

GOVERNMENT 90RS: TOPICS IN AGENT-BASED MODELING  
SPRING 2008

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**Course description**

This is a discussion and project-based course that will provide you with a hands-on introduction to the field of agent-based modeling. An agent-based model is a tool used by social scientists to study how large-scale social dynamics result from micro-level individual behavior. In its basic form, a collection of individuals, or agents, are programmed into a computer, along with a simple behavioral algorithm describing how they act. The computer then allows the agents to interact (possibly in both space and time), and ultimately generates a social dynamic that can then be analyzed in terms of the behavioral rules.

In the social sciences many problems we are interested in involve group phenomena that may seem perplexing when viewed in the aggregate. Examples include fads, norms, segregation, stereotyping, and network formation. The goal of an agent-based model is to look at the micro-level decisions that people make – the decision to live close to a friend, slow down to take a look at an accident, arrive early to the theater to get a good seat, or return a phone call – and to study how these “small” decisions may have large and unintended consequences for society as a whole.

## **How the course will work**

In the first two months our time will be divided into two parts: discussing the week's readings and working on various projects in the computer lab. The readings are drawn from different fields and genres. I chose them in part to familiarize you with how agent-based models are done, but also to give you inspiration for the sorts of problems you may be interested in tackling in your own final projects. I expect everyone to do the readings every week and to be prepared to comment on them.

I have structured each week's lab project to loosely correspond with the topics we have discussed in class. During our lab time you will work on bits of code and learn how to implement your own models. John Gasper and I will be available to help you one-on-one with any problems you might run into. This time is meant to be fun – the individual projects I assign will not count for a very large portion of your grade, but are more intended to help you get your feet wet. You're welcome to brainstorm and work with your classmates on these problems, but also remember that in order to ever learn how to program you will need to write your own code. You'll be required to type your results and ideas up in two to three pages and these pages will be due the following week, along with your code. I'll be looking for you to explicitly and clearly state your model, to summarize your results, and to suggest potential modifications of the model.

The ultimate goal of the class is for you to produce your own model. You'll spend the last month of the class working on this project almost exclusively. Class time will be set aside for you to present your preliminary ideas and results to your classmates. On the last day of class (or thereabouts, depending on when I can reserve a room large enough to hold everyone) we will hold a poster session for you to present your model to the Institute for Quantitative Social Science community and the department. A 20-page term paper will be due before the final exam period.

## **Grades**

I realize that students may enter this course with very different levels of programming experience. When grading your group and individual projects I'll be looking for creativity and thoughtfulness as much as execution. Your final grade will be based on the following three criteria:

Participation (25%), Lab Projects (25%) and Final Project (50%).

## Weekly readings and lab projects

- Feb 5: Introduction
  - “The Standing Ovation Problem,” John Miller and Scott Page, 2004.\*
  - Chapter 1 in Micromotives and Macrobehavior, Thomas Schelling, 1978.
  - Introduction and Chapter 1 in The Tipping Point, Malcolm Gladwell, 2000.
  - **Lab Project: Introducing Mathematica using the ovation problem**
- Feb 12: Patterns in the social sciences
  - Chapters 2 & 3, Micromotives and Macrobehavior.
  - **Lab Project: Generating and displaying data using a simple random walk**
- Feb 19: Sorting, moving and mixing
  - Chapters 4 & 5, Micromotives and Macrobehavior.
  - “Institutions and Sorting in a Model of Metropolitan Fragmentation,” Elizabeth Penn, 2004.\*
  - **Lab Project: Schelling’s segregation model**
- Feb 26: Political and social culture
  - “Dictatorship, Democracy and Development,” Mancur Olson, 1993.\*
  - “Changing Social Norms,” (article and attached comments), Jean Ensminger and Jack Knight, 1997.\*
  - Chapter 5 in The Tipping Point.
  - **Lab Project: Modeling voting institutions**
- Mar 4: Culture, cont’d.
  - Chapters 4 & 7, The Tipping Point.
  - **Lab Project: A simple cascade**

- Mar 11: Modeling “choice”
  - Chapters 1 & 2 in A Logic of Expressive Choice, Alexander Schuessler, 2000.\*
  - “The Market for ‘Lemons’,” George Akerlof, 1970.\*
  - “The Evolution of Cooperation,” Robert Axelrod and William Hamilton, 1981.\*
  - “The Tragedy of the Commons,” Garrett Hardin, 1968.\*
  - **Lab Project: Turnout with expressive and instrumental voters**
- Mar 18: More on choice
  - Chapters 6 & 7 in Micromotives and Macrobehavior.
  - **Begin independent project in lab**
- Mar 25: No class – Spring Break
- Apr 1: Guest lecture (readings to be announced)
- Apr 8: Class presentations / critique
  - **Independent work, 5-page introduction due today**
- Apr 15: Class presentations / critique
  - **Independent work, 5-page model & data description due today**
- Apr 22: Class presentations / critique
  - **Independent work, 3-page progress report due today**
- Apr 29: Poster session
- May 9: Final papers due

Readings with a (\*) are posted on the course website.