MNGT0783 Simulation in the Social Sciences

Doctoral programme, early Session 2, 2009.
(3 hours/week over 5 weeks, from July)

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Course web page: www.agsm.edu.au/bobm/teaching/SimSS.html

1. Rationale for the Course

The purpose of the course is to introduce research students to tools of simulation in the social sciences and some applications, in economics, in strategy, in applied psychology, and in policy.

Goals: To acquaint doctoral students with some of the many approaches to simulation in the social sciences, their strengths and weaknesses, and their appropriateness for particular kinds and areas of research.

"'Simulation means driving a model of a system with suitable inputs and observing the corresponding outputs.' (Bratley, Fox & Schrage 1987, ix). While this definition is useful, it does not suggest the diverse purposes to which simulation can be put. These purposes include: prediction, performance, training, entertainment, education, proof and discovery."

"Simulation is a third way of doing science. Like deduction, it starts with a set of explicit assumptions. But unlike deduction, it does not prove theorems. Instead, a simulation generates data that can be analyzed inductively. Unlike typical induction, however, the simulated data comes from a rigorously specified set of rules rather than direct measurement of the real world. While induction can be used to find patterns in data, and deduction can be used to find consequences of assumptions, simulation modeling can be used as an aid in intuition."

"Simulation is a way of doing thought experiments. While the assumptions may be simple, the consequences may not be at all obvious. The large-scale effects of locally interacting agents are called "emergent properties" of the system. Emergent properties are often surprising because it can be hard to anticipate the full consequences of even simple forms of interaction." (Axelrod, 2003)

2. Units of credit:

2 units (15 hours of class contact time).

3. Pre-requisites, Co-requisites, Exclusions:

None.

4. Learning objectives

The primary aim of the course is to expose students to the use of simulation in the social sciences as a "third way of doing science, in contrast to both induction and deduction" (Axelrod 2003). "Simulation can be an effective tool for discovering surprising consequences of simple assumptions."

Although programming will not be required or assessed, students will be encouraged to get their hands dirty, using one of the several simple simulation platforms

— the easy-to-use and recently updated NetLogo platform is recommended (see the course web page). Students will also learn how to describe what they plan to do by writing a grant proposal to obtain funding to pursue a simulation approach to gaining understanding of a problem in their field of research.

This half-unit course is to critically acquaint doctoral students with some of the many approaches to simulation in the social sciences, their strengths and weaknesses, and their appropriateness for particular kinds and areas of research. Simulation can be thought of as a third way of doing science, in contrast to both induction and deduction. By the end of the course, students will be able to:

- contrast such simulation techniques as system dynamics, microsimulation (including Monte Carlo), multi-level simulation, cellular automata, distributed AI (including genetic algorithms), and learning models;
- understand how to go about performing computer experiments on the simulation model of the phenomenon being studied;
- understand how to analyse the results and present them in a way others can readily understand;
- critique simulation studies in areas that might include: strategy, economics, planning, law, organization theory, political science, applied psychology, and public policy.

5. Assessment:

Grading is based on the clarity, rigour, and appropriate research designs and analysis of four written deliverables.

1. A one-page pre-proposal describing a Computer Laboratory research project that could be completed in less than a year. (10%)
2. A draft of a full 10–15-page single-spaced grant proposal describing your project. I shall give guidance to the proposals. (See example of an NSF grant proposal under Other Links on the web page.)
3. An *individual* review of two research proposals per student (not your own, of course). I shall provide guidance on the reviews. *Grades for this componenr are based on the quality and clarity of your comments as a reviewer,* ***not*** *on the comments your proposal receives.* (40%)
4. A final version of the research proposal, incorporating suggestions from the reviewers (50%)

Assessment grades to be used: A B C F

6. Textbook

The required text will be:

Nigel Gilbert and K. G. Troitzsch, *Simulation for the Social Scientist,* Open University Press, 2nd edition, 2005.

and also see:

John H. Miller and Scott E. Page, *Complex Adaptive Systems: An Introduction to Computational Models of Social Life* (Princeton Studies in Complexity), Princeton Uni. Press, 2007.

7. Readings

Consult the web page for the week's readings.

8. Course Organisation

The course is divided between lecture and discussion. Lectures emphasize latest computational techniques, modelling, examples, and computational laboratory methodological issues. Discussions emphasize student projects and ideas, the development and appropriate use of simulation techniques.

I shall distribute a list of readings for discussion in the next class (with some handouts). I welcome suggestions for discussion from you.

Lecture Topics

Week	*Date*	*Lecture Topics*
1	July 28	Introduction to Computer Laboratories and simulation. Simulation: basic concepts, grand challenges. G&T: Ch 1, 2
2	August 3	Micro-analysis and Cellular automata G&T: Ch 4, 7
3	August 17	Agent-based models G&T: Ch 8, 9
4	August 24	Space and Networks
5	September 1	Learning and evolutionary models: neural nets and the Genetic Algorithm. G&T: Ch 10 Conclusion.

(No class on August 10.)