Department of Criminal Justice

Simulation Modeling CJ8330

Fall 2008

Instructor: Dr. Elizabeth Groff

Days and times of course meetings: Wednesday 3:00pm - 5:30pm

Room: Gladfelter Hall, Room 553

Office Address of Instructor:
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Department of Criminal Justice
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Instructor's Office Telephone: 215-204-5164 (you will get a much faster response via email)

Instructor's E-mail address and/or website: groff@temple.edu

All email correspondence should have CJ8330 in the subject line and include your name. It is the student's obligation to contact me in the event of an emergency or other matter related to the course. In most instances, I will respond to emails within 24 hours during the week (phone calls may take longer). **As per University policy the email address used for this class will be your Temple email**. Announcements will be sent through Blackboard to that email address. I will ***respond to all emails***, so if you do not receive a response within a reasonable time, assume that I did not receive it. You should resend the email or contact me by phone or in person to discuss the situation.

Instructor's Office Hours: Wednesdays 2 - 3pm and by appointment.

Course Website: At tuportal.temple.edu – click on "Blackboard"

Prerequisites: None

Disability Statement: This course is open to all students who meet the academic requirements for participation. Any student who has a need for accommodation based on the impact of a disability should contact the instructor privately to discuss the specific situation as soon as possible. Contact Disability Resources and Services at 215-204-1280 in 100 Ritter Annex to coordinate reasonable accommodations for students with documented disabilities.

Statement on Academic Freedom: Freedom to teach and freedom to learn are inseparable facets of academic freedom. The University has adopted a policy on Student and Faculty Academic Rights and Responsibilities (Policy # 03.70.02) which can be accessed through the following link: http://policies.temple.edu/getdoc.asp?policy_no=03.70.02.

Course Description, Goals, and Methods
Welcome to Simulation Modeling.

Social problems involve complicated systems of individuals/families, organizations/institutions and places in which they are embedded. These components of society interact with one another in intricate fashions. Modeling all that complexity is a fascinating challenge. This class focuses on one approach, agent-based models (ABMs). Specifically, ABMs work by representing the components of societies as a dynamic system of interacting 'agents'. The modeler creates a virtual world for the agents by setting the initial conditions and deciding which of the components are necessary for the model. We then observe and record the interactions that take place as the society moves forward in time. The results of these virtual experiments can be used to improve the model but they can also be used to strengthen our theories and in doing so provide the foundation for more complete proposals for empirical research.

This class provides the opportunity for people interested in exploring a different approach to research under the guidance of someone who has been down that road. We will start with an overview of modeling and discuss where agent-based modeling 'fits'. Class members are encouraged to use the readings and discussion in class to form their own frameworks. While the readings will be from a variety of disciplines, the common focus is on the development and application of agent-based models.

Since application of ABM is a fairly new area, standard methodology and means of evaluating models are still under development. We will explore the existing challenges that revolve around how to explore and in some cases validate model behavior. Because simulation models are not limited by: 1) available data; 2) cost to implement programs in the form of randomized experiments; or 3) human subjects constraints they offer a relatively quick and cheap method for exploring theories and implementing programs in a virtual world.

The course will combine seminar work with hands-on modeling. While no programming or statistical experience is required, class members will thrive if they have a strong background in social science (including basic statistical analysis) and a reasonable level of computing experience or comfort. No experience with agent-based modeling is assumed. There will be both programming and non-programming options available for class members to develop their knowledge of model building. Students are encouraged to experiment with creating simple models in NetLogo. Class members with programming experience will be encouraged to design and implement their models using more sophisticated packages such as Agent Analyst or RePast.

Upon completing this course students should be able to:

- Explain the motivation for using simulation in the social sciences and what its unique contribution may be to increasing our understanding of complex phenomena
- Identify and explain the set of approaches that make up simulation modeling including their strengths and shortcomings
- Justify the choice of a particular modeling strategy based on the goals of the simulation model and the software available
- Apply these skills to develop the specification for a theory-based simulation model and the experiments necessary to test it
- Evaluate simulation models created by other researchers

This is a seminar course. Students learn by reading and reflecting on the assigned readings, listening thoughtfully to the instructor's lectures, participating in and leading class discussion, asking questions, critiquing existing models, completing an individual project and making oral presentations to the class.

Required and Optional Texts

Required:

Gilbert, Nigel, & Troitzsch, Klaus G. (2005). ***Simulation for the Social Scientist*** (Second ed.). Buckingham: Open University Press.

Schelling, Thomas C. (2006). ***Micromotives and Macrobehavior***. New York: W.W. Norton.

Optional:

Eck, John E., & Liu, Lin (Eds.). (2008). ***Artificial Crime Analysis Systems: Using Computer Simulations and Geographic Information Systems*****.** Hershey, PA: IGI Global.

*Books can easily be ordered on-line from publisher or other book vendor**.***

All other readings are available on Blackboard or from a public URL provided in the syllabus.

Schedule of Class Topics and Assignments

The following schedule is a ***tentative outline*** of the course content and readings. The order and content ***may be adjusted*** during the semester. Students are required to read the text and sources assigned ***prior to*** each class. The instructor may provide supplemental readings as needed to clarify the topic areas.

Week 1: Introduction to Simulation Modeling

(September 3)

Assignment 1: ABM websites
Due: 9/10

Week 2: Background and Fundamental Concepts

(September 10)

Assignment 1 due

Required reading

Gilbert, N., & Troitzsch, K. G. *Simulation for the Social Scientist*, Chapter 1 (pp. 1-14).

Eck, J. E., & Liu, L. (2008b). Varieties of Artificial Crime Analysis: Purpose, Structure, and Evidence in Crime Simulations. In J. E. Eck & L. Liu (Eds.), *Artificial Crime Analysis Systems: Using Computer Simulations and Geographic Information Systems* (pp. 413-417).

Eck, J. E., & Liu, L. (2008a). Contrasting Simulated and Empirical Experiments in Crime Prevention. *Journal of Experimental Criminology, 4*(3), (pp. 2-8).

Epstein, J. M., & Axtell, R. (1996). *Growing Artificial Societies*. Introduction pp. 1-20.

Schelling, T. C. (2006). *Micromotives and Macrobehavior*. Pp. 9-44.

Recommended

Ostrom, T. M. (1988). Computer Simulation: The Third Symbol System. *Journal of Experimental Psychology, 24*, 381-392.

Schelling, T. C. (2006). *Micromotives and Macrobehavior*. Pp. 44-80.

Assignment 2a: Report on two articles that document models
Due 9/17

Week 3: Types of Simulation Modeling and Examples
(September 17)

Assignment 2a due

Required reading

Auerhahn, K. (2008). Dynamic systems simulation analysis: A planning tool for the new century. *Journal of Criminal Justice, 36*, 293-300.

Gilbert, N., & Troitzsch, K. G. *Simulation for the Social Scientist*, Chapters 3, 4, 6, 7 and 8 (***skim all but chapter 8***)

Wilhite, A. (2001). *Protection and Social Order.* Paper presented at the Computational Economics and Finance Meeting, Yale University.

Assignment 2b: Report on two articles that document models
Due 9/24

Week 4: Building Simulation Models 1

(September 24) Eck, J. E., & Liu, L. (2008a). Contrasting Simulated and Empirical Experiments in Crime Prevention. *Journal of Experimental Criminology, 4*(3).

Assignment 2b due

Required reading

Epstein, J. M., Steinbruner, J. D., & Parker, M. T. (2001). *Modeling Civil Violence: An Agent-Based Computational Approach* (Working Paper). Washington DC: Center on Social and Economic Dynamics, Brookings Institution.

Gilbert, N., & Troitzsch, K. G. *Simulation for the Social Scientist*, Chapter 2 (pp. 15-26)

Gilbert, N., & Terna, P. (1999). How to Build and Use Agent-based Models in Social Science (pp. 1-13).

Groff, E. R. (2007). "Simulation for Theory Testing and Experimentation: An Example Using Routine Activity Theory and Street Robbery." Journal of Quantitative Criminology **23**(2): 75-103.

Schelling, T. C. (2006). *Micromotives and Macrobehavior*. Pp. 81-134.

Initial Idea on Proposals due October 1st

Week 5: Building Simulation Models 2
(October 1)

Initial Idea on Proposal Due

Required reading

Castle, Christian and Andrew Crooks. 2006. "Principles and Concepts of Agent-Based Modelling for Developing Geospatial Simulations." UCL Centre for Advanced Spatial Analysis, London. pp. 37-40

Eck, J. E., & Liu, L. (2008a). Contrasting Simulated and Empirical Experiments in Crime Prevention. *Journal of Experimental Criminology, 4*(3) (pp. 8-21).

Eck, J. E., & Liu, L. (2008b). Varieties of Artificial Crime Analysis: Purpose, Structure, and Evidence in Crime Simulations. In J. E. Eck & L. Liu (Eds.),

Artificial Crime Analysis Systems: Using Computer Simulations and Geographic Information Systems (pp. 417-426).

Gilbert & Troitzsch (2006). *Simulation for the Social Scientist* Chapter 9, pp. 199-216

Gilbert & Terna (1999). How to Build and Use Agent-based Models in Social Science. (pp. 13-27)

Manson. (2001). "Calibration, Verification, and Validation (Section 2.4)." Pp. 31-36 in *Agent-based Models of Land-use and Land-cover change.*

Townsley & Johnson (2008). The Need for Systematic Replication and Tests of Validity in Simulation. In J. E. Eck & L. Liu (Eds.), *Artificial Crime Analysis Systems: Using Computer Simulations and Geographic Information Systems* (pp. 1-18).

Assignment 3: Report on one ABM software package
Due 10/8

Week 6: Agent-based Modeling Implementation

(October 8)

Assignment 3 Due: Report on one ABM software package

Required reading

Castle, Christian and Andrew Crooks. 2006. "Principles and Concepts of Agent-Based Modelling for Developing Geospatial Simulations." UCL Centre for Advanced Spatial Analysis, London. pp. 22-37.

Najilis, Janssen, and Parker. 2001. "Software Tools and Communication Issues (Section 2.3)." Pp. 17-30 in *Agent-based Models of Land-use and Land-cover change*.

Week 7: Hands-on Lab Session

(October 15)

Required reading

TBA

Week 8: Presentations of Draft Projects/Models

(October 22):

Week 9: Presentations of Draft Projects/Models

(October 29):

Week 10: Integration of Space in Agent-based Models

(November 5):

Required reading

Brantingham, P. J., & Tita, G. (2008). Offender Mobility and Crime Pattern Formation from First Principles. In J. E. Eck & L. Liu (Eds.), *Artificial Crime Analysis Systems: Using Computer Simulations and Geographic Information Systems* (pp. 193-208). Hershey, PA: IGI Global.

Elffers, H., & Van Baal, P. (2008). Realistic Spatial Backcloth is not that Important in Agent Based Simulation Research: An Illustration from Simulating Perceptual Deterrence. In J. E. Eck & L. Liu (Eds.), *Artificial Crime Analysis Systems: Using Computer Simulations and Geographic Information Systems* (pp. 19-34). Hershey, PA: IGI Global. (DEBATE)

Groff, E. R. (2007). 'Situating' Simulation to Model Human Spatio-Temporal Interactions: An Example Using Crime Events. *Transactions in GIS, 11*(4), 507-530. (TECHNICAL ISSUES)

Wang, X., Liu, L., & Eck, J. E. (2008). Crime Simulation Using GIS and Artificial Intelligent Agents. In J. E. Eck & L. Liu (Eds.), *Artificial Crime Analysis Systems: Using Computer Simulations and Geographic Information Systems* (pp. 209-224). Hershey, PA: IGI Global.

Week 11: Class Cancelled (American Society of Criminology meeting)

(November 12):

Week 12: Future of Simulation Modeling

(November 19)

Required reading

Eck, J. E., & Liu, L. (2008b). Varieties of Artificial Crime Analysis: Purpose, Structure, and Evidence in Crime Simulations. In J. E. Eck & L. Liu (Eds.), *Artificial Crime Analysis Systems: Using Computer Simulations and Geographic Information Systems* (pp. 426-430).

Gilbert, N., & Troitzsch, K. G. *Simulation for the Social Scientist* pp. 22-25

Parker, Berger, and Manson. 2001. "Introduction and Conceptual Overview (Part 1). Pp. 1-12 in *Agent-based Models of Land-use and Land-cover change*.

Week 13: Project Work Day

(November 26)

No Lecture – schedule appointment to discuss project

Week 14: Presentation of Final Models

(December 3)

Project presentations

Week 15: Presentation of Final Models

(December 10):

Remaining project presentations

Final Project Due May 10

Week 16: Peer Reviews Due

December 17

Peer Reviews Due May 17

Course Policies

Note carefully the due dates for assignments as listed on this syllabus. Late assignments will lose credit (see last section of syllabus for more details). If, for any reason, you cannot hand in work when scheduled, ***you must call or e-mail me in advance of class*** for alternative arrangements.

Policy on Religious Holidays: If you will be observing any religious holidays this semester which will prevent you from attending a regularly scheduled class or interfere with fulfilling any course requirement, your instructor will offer you an opportunity to make up the class or course requirement if you make arrangements by informing your instructor of the dates of your religious holidays **within two weeks** of the beginning of the semester (or **three days** before any holidays which fall within the first two weeks of class).

Classroom Etiquette: I want the classroom experience to be positive for all students. Accordingly, try to minimize eating of fragrant food during class. Also, since it is disruptive to leave a room before the scheduled end of class, I would ask that any student that must leave early please let me know in advance of class..

Electronic Devices in the Classroom: Cell phones, Palm Pilots, pagers, and other electronic devices (including electronic music devices of any kind) **must be turned off and ear buds removed** during class except with special permission from your instructor. If by chance you forget to turn the device off, and your phone or pager rings, I expect you to turn it off immediately. If you use a phone for any reason whatsoever, I will ask you to leave the classroom and not return for the rest of the class. When you are in class, I expect you to be paying attention to what is happening in the classroom.

All class materials are copyrighted. Specifically, course materials which exist in a tangible medium such as written or recorded lectures, Power Point presentations, study materials and tests are copyright protected and the ability to copy and distribute course materials unless it is for personal use and with the instructor's permission is illegal.

Attendance Policy. As you can see from the Class Participation and Course Grading Formulas, attendance is very important to your success in this class. Students are responsible for obtaining materials and notes for any classes that are missed. Students with absences amounting to more than 20% of class hours for the semester should consider the possibility of withdrawal from the class.

Policy on Academic Honesty
The section in italics is quoted verbatim from the Temple University Bulletin for 2006-2007.

Temple University believes strongly in academic honesty and integrity. Plagiarism and academic cheating are, therefore, prohibited. Essential to intellectual growth is the development of independent thought and a respect for the thoughts of others. The prohibition against plagiarism and cheating is intended to foster this independence and respect.

Plagiarism is the unacknowledged use of another person's labor, another person's ideas, another person's words, another person's assistance. Normally, all work done for courses -- papers, examinations, homework exercises, laboratory reports, oral presentations -- is expected to be the individual effort of the student presenting the work. Any assistance must be reported to the instructor. If the work has entailed consulting other resources -- journals, books, or other media -- these resources must be cited in a manner appropriate to the course. It is the instructor's responsibility to indicate the appropriate manner of citation. Everything used from other sources -- suggestions for organization of ideas, ideas themselves, or actual language -- must be cited. Failure to cite borrowed material constitutes plagiarism. Undocumented use of materials from the World Wide Web is plagiarism.

Academic cheating is, generally, the thwarting or breaking of the general rules of academic work or the specific rules of the individual courses. It includes falsifying data; submitting, without the instructor's approval, work in one course which was done for another; helping others to plagiarize or cheat from one's own or another's work; or actually doing the work of another person.

Students must assume that all graded assignments are to be completed individually unless otherwise noted in writing in this syllabus. I reserve the right to refer any cases of suspected plagiarism or cheating to the University Disciplinary Committee; I also reserve the right to assign a grade of "F" for the given paper, quiz or test.

Course Grade consists of the following components, weighted as follows:
The course grade for this course will be determined according to the following formula:

Class Participation	30%
Proposal Reviews	20%
Project – Written and Oral portions	50%
Total	100%

Letter grades for the entire course will be assigned as follows:
A, A-, B+, B, B-, C+, C, C-, D+, D, D-, F

Attendance and Class Participation
Temple's policy is that students ***are expected to attend class regularly and participate***. I have the same expectation. Lecture, group exercises, and student participation are very important for successful class performance. Students are required to keep up with all assigned readings in advance of classroom discussions, attend all seminar meetings, and participate in class discussion. The instructor may raise or lower the base attendance and participation grade based on participation in class discussions.

In addition to routine participation, during the course of the semester each student will (full details in separate documents:

1. Report to class regarding two ABM websites (5 – 10 minutes)
2. Lead a 20 – 30 minute class discussion of four example models. The quality of the preparation will count toward the class participation grade.
3. Report to class regarding one ABM software package (10 – 15 minutes).

Proposal/Final Project Reviews
Proposal reviews should follow the guidelines provided in a separate document. These are ***due on or before the start of the final exam for the class and should be submitted in hard copy AND through Turnitin on Blackboard***.

Individual Project (including Oral Presentation)
Each student will choose one of the two final project options. There are two options available for your final project: 1) a proposal or 2) a paper. Under the proposal option the final product is a submission-quality research proposal. Under the paper option, you would develop and test a model and write up the results in a paper. While programming a model is the very best way to gain experience with simulation models, you are not required to create a model to complete the class. Further details regarding the research exercise and oral presentation will follow in a "Project Guidelines" handout.

Due dates for components of final project:

Abstract –	October 1st
Oral presentation of draft project (turn in PowerPoint)	October 22, 29
Oral presentation of final project (turn in PowerPoint)	December 3, 10
Written proposal/paper	December 10
Peer reviews	December 17

Students will present a draft version of their model near the middle of the semester (25-30 minutes) and their final project in a 25 – 30 minute PowerPoint presentation on the weeks agreed upon. Students should turn in hard copies of both presentations on the days they present to the class. The final written project is **due December 10th**. Final projects must be submitted through blackboard / turnitin.com AND in hard copy in class. Failure to submit by the deadline **both** through turnitin.com **and** in hard copy in class will constitute late submission. Final projects will be evaluated based on the substantive quality and the clarity with which they are written.

Late papers/homework policy

Late papers will be penalized 5 points for the first day late and 2 points per day up to the fourth day. Failure to be prepared to lead class discussions or make an oral presentation will result in a 10% reduction in your grade for that assignment. These guidelines will be enforced unless **prior arrangement** was negotiated because of illness, etc.