AGENT BASED MODELING TRACK SYLLABUS

June 11-15, 2010
Institute for Systems Science and Health
Washington University in St. Louis, MO

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Group Emails: issh-2012-abm-track@googlegroups.com goes to all course participants
and instructors.

Track Objectives: The goal of this course is to introduce the field of agent-based
modeling and its applications to health and the social sciences. Specifically, we will
address the following questions:

1) What is agent-based modeling?
2) What kinds of questions is ABM useful for answering?
3) How are agent-based models constructed?
4) What are the best practices in model design and testing?
5) How can ABM be incorporated into an empirical research program?

Models presented in this course will be programmed exclusively in NetLogo (see
ccl.northwestern.edu/netlogo/ for downloads, sample models, and tutorial). Course
participants will pursue independent projects in which they will design a conceptual
sketch for an ABM pertaining to their area of research. For additional Netlogo
resources, see the ISSH 2009 NetLogo tutorial materials at:
http://obssr.od.nih.gov/training_and_education/issh/2009/files/ISSH2009_ABM_Track_
NetlogoQuickGuide.pdf
http://obssr.od.nih.gov/training_and_education/issh/2009/files/ISSH2009_ABM_Track_
NetlogoCodeSnippets.pdf

AGENT-BASED MODELING TRACK SYLLABUS

Monday (6/11):

Afternoon

1:30 – 2:45pm: Introduction

- Overview of the week, introduction of participants, track leader, and assistants
- Modeling and its many potential roles in research

2:45-3:15pm Break

• Individual help with Netlogo installation available

3:15 – 4:00pm: Introduction to ABM

- Agent-based Modeling: What, when, and why?

<u>Readings</u>

Epstein, Joshua (2008). "Why Model?" *Journal of Artificial Societies and Social Simulation* (http://jasss.soc.surrey.ac.uk/11/4/12.html)

Schelling, Thomas (1978). *Micromotives and Macrobehavior*, Chapter 1. New York: Norton and Company.
http://obssr.od.nih.gov/training_and_education/issh/2010/files/track_abmt/Schelling_Micromotives_Ch1.pdf

Tuesday (6/12):

Morning

9:00 – 10:15am: The Building Blocks of ABM

- Introduction to the components of an agent-based model
- Best practices in ABM design

10:15 – 10:45 Break

- Individual help with Netlogo available

10:45 – 12:00pm: Guest Speaker, Elizabeth Bruch (Univ of Michigan)

- Models in sociology and public health research
- Agent-based models of segregation

Afternoon

1:30 – 3:00pm: Introduction to NetLogo

- Overview of programming language, user interface
- Implementing an ABM in NetLogo – a simple example model

Evening (on your own)

Begin work on Independent Projects

- Outline components and design for original model

Readings

Axelrod, Robert (2005). Advancing the Art of Simulation in the Social Sciences. *Handbook of Research on Nature Inspired by Computing for Economy and Management*, Jean-Philippe Rennard (Ed.) Hersey, PA: Idea Group.

Bruch, Elizabeth and Robert Mare (2006). Neighborhood Choice and Neighborhood Change. *American Journal of Sociology* 112:667-709.

Bruch, Elizabeth (2011). Neighborhood sorting by race and income. *Sociology, Complex Systems, & Population Studies*.

Sterman, John. 2006. "Learning from Evidence in a Complex World." *American Journal of Public Health* 96:505-14.

Wilensky, U., and Rand, W. (in press). An introduction to agent-based modeling: Modeling natural, social and engineered complex systems with NetLogo. Cambridge, MA: MIT Press.

Wednesday (6/13):

Morning

9:00 – 10:15am: Components of ABM in Detail

- Agent properties, rules, and behavior
- Spatio-temporal complexity

10:15 – 10:45 Break

10:45 – 12:00pm: Lab Time

- Developing more complete properties, rules, behavior, and environment: building complexity onto the base example model in two different directions

Afternoon

1:30 – 3:15pm: Guest Speaker, David Shoham (Loyola)

- Spatial complexity and networks in agent-based models
- Network effects and obesity, chronic disease prevention

3:15 – 3:45 Break

3:45 – 5:30pm: Lab time (continued)

- Adding complexity to example models (cont'd)
- Modeling policy interventions in the expanded example model(s)

Evening (on your own)

Continue work on individual projects

- Refine designs for individual model sketches

Readings

Bahr, David B., et al (2009). Exploiting Social Networks to Mitigate the Obesity Epidemic, *Obesity* doi:10.1038/oby.2008.615

Hammond, Ross (2009). Complex Systems Modeling for Obesity Research. *Preventing Chronic Disease* 6:1-10.

Epstein Josh, et al (2008). Coupled Contagion Dynamics of Fear and Disease: Mathematical and Computational Explorations. PLoS ONE 3(12): e3955.

Shoham David, et al (2005). Chronic kidney disease and life course socio-economic status [review]. Advances Chronic Kidney Disease. January 2005.

Thursday (6/14):

Morning

9:00 – 10:15am: Guest Speaker, Stephen Eubank (VBI)

- Empirically-calibrated ABM as a policy tool

10:15 – 10:45 Break

10:45 – 12:00pm: Lab Time

- Presentation of Best practices for
  - Parameter sweeps and statistical analysis
  - Comparing model output to data
  - Drawing appropriate conclusions from models

Afternoon

2:30 – 3:15pm: Model Testing and Evaluation Lab

- Testing and analyzing example models: sensitivity analysis, empirical testing and calibration

3:15 – 3:45pm Break

3:45 – 5:30pm: Presentations on Independent Projects

- Consider how to incorporate model into broader research program

Reading

Centola, Damon and Macy, Michael (2007). Complex Contagions and the Weakness of Long Ties. *American Journal of Sociology* 113(3): 702-734.

Epstein, Joshua. 2009. "Modeling to Contain Pandemics." *Nature* 460:687.

Eubank Stephen, et al (2004). Modeling disease outbreaks in realistic urban social networks. *Nature* 429:180-184.

Friday (6/15):

      9:00 – 10:00am: Wrap-up, resources, next steps, questions….