Modeling, Forecasting & Decisionmaking

INTA 6004A Spring 2013 T 6:05-8:55 pm Habersham G-17

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Hours: T 4-5, or by appt.

The purpose of this class is to give you an understanding of how to use computer simulations as a tool to address issues in international affairs. Computer simulations are computer programs that have at their core simplified models of our world. Different models vary in the degree and nature of their abstraction from the "real" world, but they share the goal of trying to help us better understand the complex structures and dynamics that we observe around us. Although simulations in international affairs are often used to make projections into the future, they should not be thought of as computerized "crystal balls." Their best use is to augment and improve our thinking about how the world works by performing computational tasks for which our minds are ill-suited.

One component of this class will be to examine different models or modeling systems as examples of the quite different ways to do computer simulation in international affairs. We will look primarily at what are called system dynamics models and to a lesser degree agent-based models. We will look at different aspects of these models or modeling systems such as their validation, how they relate to theory, and how they are used to support decision making.

A second aspect of the class is that we will spend time learning how to use the STELLA software you will employ to make your own simulations. STELLA is on all of the G-17 and Habersham lab computers and on the IAC virtual lab (vlab).

The true core of the class, however, is the development of your own computational (simulation) model. There is nothing like making your own simulation to understand how it should be done. You will learn how to think in terms of dynamic processes, a useful skill. You can either make your own model or make a model with one or two other students. You should think of this part of the class as very much a one-on-one (or close to that) learning experience. I am there to help you make your model.

There are few computer exercises through the progression of the class, and they can be found in the schedule below. The culmination of the class is your presentation of your final (or near final) model and a paper describing it. That final paper should be in the range of 2500-3000 words. There is also an interim version of the final paper (1000-1500 words) and a preliminary presentation of the model.

Do not be shy about making use of the librarian assigned to INTA, Mary Axford (mary.axford@library.gatech.edu). She is very helpful.

Texts

Peter Bernstein, Against the Gods.

Andrei Borschev and Alexei Filippov. "From System Dynamics and Discrete Event to Practical Agent Based Modeling: Reasons, Techniques, Tools." Paper presented at the 22nd Annual Conference of the System Dynamics Society. July 25-29, 2004. Oxford England (on T-square)

Thomas R. Cusack and Richard J. Stoll, "Collective Security and State Survival in the Interstate System." International Studies Quarterly, Vol. 38 (March 1994), pp. 33-59. (on T-square)

Richard J. Stoll, "Civil Reality? Simulation Experiments on the Impact of Civil War in a Realist World." Conflict Management and Peace Science, Vol. 22 (Spring 2005), pp. 19-38. (on T-square)

Joshua M. Epstein and Robert Axtell, Growing Artificial Societies: Social Science from the Bottom Up.

Hughes, Barry B. et al, Reducing Global Poverty. (on T-square)

Donella H. Meadows, Jorgen Randers, and Dennis Meadows. Limits to Growth: The 30-Year Update.

Sergey Paltsev (and others). The MIT Emissions Prediction and Policy Analysis (EPPA) Model: Version 4. MIT Joint Program on the Science and Policy of Global Change. Report 125. August 2005. (on T-square)

Peter Senge, The Fifth Discipline: Art and Practice of Learning Organizations.

Weart, Spencer, General Circulation Models of Climate, a webpage that can be found at: http://www.aip.org/history/climate/GCM.htm

Schedule

Jan. 8	Introduction to Class and Stella Software	
Jan. 15	Features of Stella Software and an Introduction to Models	
	Read:	Against the Gods

Jan. 22 Alternative Computational Modeling Techniques
Read: From System Dynamics and Discrete Event... paper
Due on the 22nd: *First Stella exercise*

Jan. 29 Early Models of the World
Read: Limits to Growth

Feb. 5 State of the Art Social Global Models
Read: Reducing Global Poverty
The MIT Emissions Prediction... monograph (optional)
Due on the 5th: *Second Stella exercise*

Feb. 12 What the Climate Modelers Have Done
Read: General Circulation Models of Climate

Feb. 19 Business Uses of System Dynamics Models
Read: The Fifth Discipline
Due on the 19th: *Third Stella exercise*

Feb. 26 Making Your Own Simulation Model: Designing the Model Structure
Read: What you need/want from STELLA online help/tutorials

Mar. 5 The Representation of Theories in a Model

Mar. 12 Empirical Validation of Processes Within a Model
Read: What you need/want from STELLA online help/tutorials
Due on the 12th: *1st model presentation and preliminary description of model*

Mar. 26 Troubleshooting Your Own Simulation Model
Read: What you need/want from STELLA online help/tutorials

Apr. 9 Agent-based Modeling: EARTH and Sugarscape
Read: Stoll and Cusack and Stoll articles on T-square
Growing Artificial Societies, pp. 1-178

Apr. 16 Simulating the Spread of Ideas

Apr. 23 Presentation of Models to Class

May 1 Due Date for Final Paper and Model

Determination of Final Grade

Computer exercises 10% each x3

1st model presentation	10%
Preliminary description paper	10%
Final model presentation	10%
Final paper	20%
Class participation*	20%

* Please note that class participation is more than physical presence.