Stevens Institute of Technology

Howe School of Technology Management

Syllabus

Design Science

*Graduate Seminar*

|  |  |
| --- | --- |
| MGT 726A, fall semester 2008, starting August 26. | Day of Week: Tuesday  Room: Babbio 110  Time: 6:15-8:45 pm |
| Jeffrey Nickerson (jnickerson@stevens.edu) | |

**Overview**

|  |
| --- |
| In a graduate seminar, we will actively explore design science. We will read the existing literature and write our own papers. As part of this, we will run simulations and design new mechanisms and interfaces. The end result of the course will be models – and one or several papers, authored individually or jointly, suitable for publication. |

**Introduction to Course**

|  |
| --- |
| In his book Sciences of the Artificial, Herbert Simon wrote:  *Design… is the core of all professional training; it is the principal mark that distinguishes the professions from the sciences. Schools of engineering, as well as schools of architecture, business, education, law, and medicine, are all centrally concerned with the process of design…The professional schools can reassume their professional responsibilities just to the degree that they discover and teach a science of design, a body of intellectually tough, analytic, partly formalizable, partly empirical, teachable doctrine about the design process.*  We will follow the above path. Specifically, we will look at two related topics:   1. The use of simulation to analyze social processes. We will see how simple individual behaviors lead to the emergence of complex global behaviors. 2. The design of new processes. How can we design new mechanisms that will encourage the emergence of new behavior?   In the seminar, we will discuss many topics, including:   * Models of social networks, starting from Simon’s ideas about preferential attachment * The Garbage Can Model: modeling the problems of university administration * Simulation as a research technique * Visualization and decision making |

**Relationship of Course to Rest of Curriculum**

|  |
| --- |
| The course is intended for Ph.D. students. The focus will be on topics primarily of interest to management school students – that is, the modeling of management processes, information systems, and social processes. The content may also be of interest to those in other computing, engineering, and social science disciplines. |

**Learning Goals**

|  |
| --- |
| By the end of this course:   * You will be able to use computational techniques to analyze social processes * You will be able to create new mechanisms/processes/interfaces that will be useful for individuals or groups making decisions |

**Pedagogy**

|  |
| --- |
| This is a learn-by-doing course. You will create and demonstrate models every week. Once you become familiar with the general ideas of the course, you are encouraged to begin research on a topic that interests you. You can learn additional methods of analysis from the sources in the recommended reading. |

**Resources**

|  |
| --- |
| Please the interlibrary loan system (go to WorldCat off the Stevens Library website and click on ILL for any book yo want) to find the books in the list in the last section.  Several computational tools will be useful to you:  NetLogo  free: <http://ccl.northwestern.edu/netlogo/docs/>  Mathematica  Available on Storage01 for all students and faculty  Processing  free: http://processing.org/  R  free: http://www.r-project.org/ |

**Lectures**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Date** | **#** | Modules | **Assignments Due** | Reading |
| 8/26/2008 | 1 | **Overview** |  |  |
| 09/02/2006 | 2 | **Garbage Can Model** | install Netlogo, run  http://ccl.northwestern.edu/netlogo/models/community/GarbageCan | Cohen, Fioretti  Read the Netlogo manual |
| 09/09/2006 | 3 | **Garbage Can Model 2** | Modify the model | Simon, Ch 1 and 5  suggested: Resnick |
| 09/16/2006 | 4 | **Preferential Attachment 1** | Run Wilensky, U. (2005). NetLogo Preferential Attachment model, at: http://ccl.northwestern.edu/netlogo/models/PreferentialAttachment | Barabasi, Grannovetter |
| 09/23/2006 | 5 | **Preferential Attachment 2** | Modify the model |  |
| 09/30/2006 | 6 | **Ideas about Simulation** | Read and think | Cederman  Gilbert, ch 1, 2 |
| 10/07/2006 | 7 | **Guest Lecture** | Read and think | To be determined |
| 10/14/2006 |  | **no class – monday schedule** | Read and think | Start research for a project |
| 10/21/2006 | 8 | **Ideas II** | Read and think, collect data for your project | Epstein, ch 1, 2 |
| 10/28/2006 | 9 | **Design Science** | start prototyping your project | Hevner 2004a |
| 11/04/2006 | 10 | **Bayesian approaches vs. Distributed Cognition** | Project discussions | suggested: Tenenbaum, Hollan |
| 11/11/2006 | 11 | **Project idea discussions** | Project proposals due |  |
| 11/18/2006 | 12 | **Project presentations** | Project presentations |  |
| 11/25/2006 | 13 | **Project presentations** | Project presentations |  |
| 12/02/2006 | 14 | **Project presentations** | **Papers/Projects due** |  |

**Recommended Reading**

Albert, Jim. 2007. *Bayesian Computation With R*. New York: Springer.

Barabasi, AL and R Albert. 1999. Emergence of Scaling in Random Networks. *SCIENCE* 286:509-512.

Cederman, LE. 2005. Computational Models of Social Forms: Advancing Generative Process Theory. *AMERICAN JOURNAL OF SOCIOLOGY* 110:864-893.

Clark, Andy. 2003. *Natural-Born Cyborgs : Minds, Technologies, and the Future of Human Intelligence*. Oxford ; New York: Oxford University Press.

Cohen, MD, JG March and JP Olsen. 1972. Garbage Can Model of Organizational Choice. *ADMINISTRATIVE SCIENCE QUARTERLY* 17:1-25.

Epstein, Joshua M. 2006. *Generative Social Science : Studies in Agent-Based Computational Modeling*. Princeton: Princeton University Press.

Fioretti, Guido and Alessandro Lomi. 2008. The Garbage Can Model of Organizational Choice: An Agent-Based Reconstruction. *SIMULATION MODELLING PRACTICE AND THEORY* 16:192-217.

Fry, Ben. 2008. *Visualizing Data*. Sebastopol, CA: O'Reilly Media, Inc.

Gaylord, Richard J, and Louis J D’Andria. 1998. *Simulating Society : A Mathematica Toolkit for Modeling Socioeconomic Behavior*. New York: Springer.

Gilbert, G. Nigel, and Klaus G Troitzsch. 2005. *Simulation for the Social Scientist*. Maidenhead, England ; New York, NY: Open University Press.

Grannovetter, M. (1973). The strength of weak ties. American Journal of Sociology 78: 1360-1380

Greenberg, Ira. 2007. *Processing : Creative Coding and Computational Art*. Berkeley, CA New York: Friends of Ed Distributed to the book trade worldwide by Springer-Verlag.

Hevner, AR, ST March, J Park and S Ram. 2004a. Design Science in Information Systems Research. *MIS QUARTERLY* 28:75-105.

Hollan, J., Hutchins, E., Kirsh, D. (2000) ‘Distributed cognition: toward a new foundation for human-computer interaction research’. ACM transactions on computer-human interaction, 7(2), 174-196.

Hungerford, BC, AR Hevner and RW Collins. 2004b. Reviewing Software Diagrams: A Cognitive Study. *IEEE TRANSACTIONS ON SOFTWARE ENGINEERING* 30:82-96.

Pearl, Judea. 2000. *Causality : Models, Reasoning, and Inference*. Cambridge, U.K. ; New York: Cambridge University Press.

Resnick, Mitchel. 1994. *Turtles, Termites, and Traffic Jams : Explorations in Massively Parallel Microworlds*. Cambridge, Mass: MIT Press.

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

Simon, Herbert A. 1996. *The Sciences of the Artificial*. Cambridge, Mass: MIT Press.

Tenenbaum, J. B., Griffiths, T. L., and Kemp, C. (2006). Theory-based Bayesian models of inductive learning and reasoning. Trends in Cognitive Sciences, 10(7), 309-318.