

CSS-635/PSYC-768: Cognitive Foundations of Computational Social Science Syllabus

Time: Wednesday, 4:30-7:10pm Last day to add/drop freely: Jan. 27
Classroom: Innovation Hall rm 336 Last day to drop with cost: Feb. 20
Class Type: Seminar
Instructor: **William G. Kennedy**, PhD, Captain, USN (Ret.), Research Assistant Professor,
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Official Course Description: “Examines cognitive foundations and information processing in computational social agents and compares to human cognitive phenomena, including emotions, trust, and reciprocity. Emphasis on modeling project.”

Course Format: This class will consist of discussions of assigned readings and the preparation of projects. Approximately the first half of each class will be a discussion of the readings and the second half of class will be a lecture on the topic for that week.

Prerequisites: The course includes building computational social simulations incorporating foundational principles discussed in class. Therefore, some computational experience is necessary and presumed. The official prerequisites or co-requisites are:

CSS 600 Introduction to Computational Social Science, and
 CSS 610 Computational Analysis of Social Complexity

Objectives:

1. Students can thoughtfully discuss human fundamental drives, emotion/affective behavior, cognitive behavior, and social behaviors.
2. Students are able to model human behavior in computational social simulations.
3. Students understand issues associated with the plausibility of human models.

Course Expectations: As a seminar with an emphasis on a computational social simulation project, the grading is 60 percent based on readings and discussions and 40 percent on the student’s project as specified below.

Overview:		Grading Scale: (points = percentage)
readings (written reviews)	40	99-100 = A+
leading discussion	10	94-98 = A
discussion contributions	10	89-93 = A-
project prototype	10	85-88 = B+
project proposal	10	80-84 = B
project presentation	15	75-79 = B-
project submission	<u>5</u>	70-74 = C
	100	<69 = F

Readings: (worth 40 points of 100 total) Each student will prepare and submit eight reviews of specified readings, each 1-2-pages (400-800 words) and worth 5 points.

Leading the discussion: (10 pts) Each student will lead a discussion of the assigned readings in class (depending on enrollment, students may need to work in teams). Leading the discussion entails presenting a clear and concise overview of the readings, preparing 3-5 thoughtful questions for discussion related to the

readings, and facilitating the class discussion to cover the main points of the readings and how they might be addressed in a social simulation.

Discussion Participation: (10 pts) As a seminar, class contributing to the discussions is essential. Participation refers to both the content of the student's contributions as well as consideration of others' comments. Although students are not graded on attendance, students are expected to attend the class periods of the courses for which they register and absence, tardiness, and early departure are evidence of nonparticipation.

Project prototype: (10 pts) Each student will modify an existing NetLogo model to demonstrate a cognitive behavior.

Project proposal: (10 pts) One to two page summary of the research question, foundational principle, and behavior to be demonstrated by the student's project.

Project Presentation: (15 pts) Each student will make a 15-20 minute presentation of his or her research topic followed by a class discussion. The discussion of the presentation may inform the project report.

Project Final Submission: (5 pts) Each student will submit documentation describing his or her project, and include the associated code.

Late submission of class work: Homework is due at the beginning of class. Lateness reduces the possible graded points at a rate of approximately 20 percent of the original point total per day.

University Policies: The University Catalog, <http://catalog.gmu.edu/>, is the primary resource for university requirements and University policies, <http://universitypolicy.gmu.edu/> for policies affecting student and faculty conduct in university affairs.

Class communications: University policy is that all class-related communications will be made to GMU e-mail addresses. I can also send copies to other addresses. I intend to respond to all student e-mails within a couple of hours of receipt and always within 24 hrs of receipt. I have official office hours during which I will be available for drop-in discussions. Other meetings are certainly possible but should be scheduled in advanced. I will also maintain a website with class materials throughout the course. Its address will be provided in the first class.

Attendance Policy: Attendance is not graded, but as a seminar, most of the readings will be discussed in class each week and projects will be presented to the class. Therefore, attendance is expected.

Office of Disability Services: If you are a student with a disability and you need academic accommodations, please see me and contact the Disability Resource Center (DRC) at 709-993-2474. All academic accommodations must be arranged through that office.

Academic Integrity: Mason is an Honor Code university; please see the University Catalog for a full description of the code and the honor committee process. The principle of academic integrity is serious and violations must be treated gravely. Academic integrity means when you are responsible for a task, you perform that task. When you rely on someone else's work, text, or code, even if in the public domain, in any aspect of the performance of that task, you must cite the source in the proper, accepted form. Another aspect of academic integrity is the free play of ideas. Vigorous discussion and debate are encouraged in this course, with the firm expectation that all aspects of the class will be conducted with civility and respect for differing ideas, perspectives, and traditions. When in doubt (of any kind), please ask for guidance and clarification. As instructor for this course, I reserve the right to enter a failing grade to any student found guilty of an honor code violation.

Recommended Texts (none required):

Robin Dunbar (2004) "The Human Story", 2004 ISBN: 0-571-22303-6 (paperback) & ISBN 978-0-571-19133-8

National Research Council (2008) *Behavioral Modeling and Simulation: From Individuals to Societies*. Greg L. Zacharias, Jean MacMillan, & Susan Van Hemel (eds.) National Academies Press (available at: http://books.nap.edu/catalog.php?record_id=12169)

Thomas Schelling (1978/2006) "Micromotives and Macrobehavior", ISBN 978-0-393-32946-9

E.O. Wilson (1978/2004) "On human nature", ISBN 0-674-01638-6

Tentative Class Schedule: The following is the intended topics to be addressed in class and reading. Adjustments may be made during the semester based on the direction of class discussion, weather, and other events, as necessary.

- January 21: Topic: *Introduction and overview: From Individuals to Societies*
Reading & Due: none prior to class
- January 28: Topic: *Fundamental Human Cognitive Characteristics*
Readings: Dunbar (2004) Chapter 1 (humans wonderful)
Schelling (1978/2006) Chapter 1 (purposeful behavior)
Homework: **written review (#1) of Schelling Chapter 1**
- February 4: Topic: *Fundamental Human Drives and Needs*
Readings: Maslow (1943) (human drives)
Schelling (1978/2006) Chapter 2 (modeling behavior)
Homework: **written review (#2) of Maslow (1943)**
- February 11: Topic: *Emotions and Affective Behavior: Basic & Cognitive Emotions*
Readings: Izard (2010) (emotion review)
Kahneman (2003) (System 1 System 2)
Homework: **written review (#3) of Kahneman (2003)**
- February 18: Topic: *Cognition and Rational Behavior I: Cognitive Architectures*
Readings: Rao & Georgeff (1995) (BDI)
NRC (2008) Chapter 3 pg 97-104 (verbal models)
Homework: **written review (#4) of Rao & Georgeff (1995)**
- February 25: Topic: *Cognition and Rational Behavior II: The Big 2*
Readings: Lehman, Laird, Rosenbloom (2006) (Soar)
Anderson et al. (2004) (ACT-R)
Homework: **written review (#5) of the Soar or ACT-R reading**
- March 4: Topic: *Cognition and Rational Behavior III: Other Approaches to Cognition*
Readings: Hutchinson & Gigerenzer (2005) (hierarchal model)
Schmidt (2002) (PECS)
Epstein (2014) Introduction through model overview
Homework: **Project Prototype**
Homework: **written review #6 Hutchinson & Gigerenzer (2005)**
- March 11: Spring Break
- March 18: Topic: *Designing a Cognitive Social-Simulation Modeling Project*
Reading: Epstein (2008) Why Model?
Homework: **written review #7 of Epstein (2008)**
Homework: **project proposal**
- March 25: Topic: *Identity, the Self, and Abnormal Psychology*
Readings: Schwartz (2001) (Identity Theory)
Lilienfeld & Marino (1999) (Abnormal Psyc)
Projects proposals resolved; projects due in 4 weeks
- April 1: Topic: *Social Behavior: The Individual within Society & Culture*
Readings: Dunbar (2004) Chapter 4 (social interactions)
NRC (2008) Chapter 3 pg 104-121
Homework: **written review #8 of Dunbar Chapter 4**

- April 8: Topic: *Social Behavior: Small Groups*
 Readings: Sun (2006) Chapter 12 (teamwork model)
 Dunbar (2004) Chapter 6 (culture)
 Homework: **none (working on the project)**
- April 15: Topic: *Social Behavior: Societies in Modeling and Simulation*
 Readings: Schelling (1978/2006) Chapter 3 (society models)
 NRC (2008) Chapter 6 (voting & social network models)
 Homework: **none (working on the project)**
- April 22: Topic: *Integrating Approaches and Issues in Modeling Humans*
 Readings: Kennedy (2011) (how to)
 Epstein (2014) Part II (ABM)
 NRC (2008) Chapter 8 (challenges)
 Schelling (1978/2006) Chapter 7 (model interpretation)
 Homework: **Project Presentations**
- April 29: In class: Project Presentations
 Readings: none
 Homework: **Project Presentations**
- May 6: reading day (Project Presentations?)
- May 13: **Exam time:** Time used for Project Presentations (if necessary)
 Homework: project reports
Last day to turn in all class and project assignments.

References:

- Anderson, J. R., Bothell, D., Byrne, M. D., Douglas, S., Lebiere, C., and Qin, Y. 2004. An integrated theory of mind. *Psychological Review* **111**(4): 1036-1060.
- Epstein, J.M. (2008) Why Model? *Journal of Artificial Societies and Social Simulation* **11**(4 12).
- Epstein, J.M. (2014) *Agent Zero*. Princeton.
- Hill, R.A. & Dunbar, R.I.M (2002) Social Network Size in Humans. *Human Nature* **14**(1), pp 53-72.
- Izard, C.E., (2010) The Many Meanings/Aspects of Emotion: Definitions, functions, Activations, and Regulation. *Emotion Review* **2**(4), p 363-370.
- Kahneman, D. (2003) Maps of Bounded Rationality: Psychology for Behavioral Economics. *The American Economic Review* **93**(5), pp 1449-1475.
- Kennedy, W.G. (2011) Modelling Human Behavior in Agent-Based Models. *Agent-Based Models of Geographical Systems*, Part 2, pp 167-179. M. Batty, A. Heppenstall, and A. Crooks (Eds.) Springer.
- Lilienfeld, S.O. and Marino, L. (1999) Essentialism Revisited: Evolutionary Theory and the Concept of Mental Disorder. *Journal of Abnormal Psychology* **108**(3), pp 400-411.
- Maslow, A.H. (1943) A Theory of Human Motivation. *Psychological Review* **50**, pp 370-396.
- National Research Council (2008) *Behavioral Modeling and Simulation: From Individuals to Societies*. Greg L. Zacharias, Jean MacMillan, & Susan Van Hemel (eds.) National Academies Press.
- Rao A.S. and Georgeff, M.P. (1995) BDI Agents: From Theory to Practice. *Proceedings of the First International Conference on Multiagent Systems*. AAAI Press.
- Schmidt, B. (2002) Modeling of Human Behaviour: The BECS Reference Model. *Proceedings 14th European Simulation Symposium*. A. Verbraeck, W. Krug, eds.
- Schwartz, S.J. (2001) The Evolution of Eriksonian and Neo-Eriksonian Identity Theory and Research: A review and Integration. *Identity: An International Journal of Theory and Research* **1**(1), pp 7-58.
- Sun, R. (2006) *Cognition and Multi-Agent Interaction*. Cambridge University Press.