

CSS-635: Cognitive Foundations of Computational Social Science Syllabus

Time: Thursday, 4:30-7:10pm Last day to add: Monday Feb. 1
Classroom: on-line synchronous Last day to drop: Friday, Feb. 12 (100% refund)
Class Type: Seminar
Instructor: William G. Kennedy, PhD, Captain, USN (Ret.),
 Associate Professor (Term)
 Dept. of Computational and Data Sciences, College of Science, George Mason University
e-mail: wkennedy@gmu.edu; phone: 703-993-9291
Office hours: Thursday, 3-4pm, on-line (normally Research Hall, rm 378)
Preferred method of contact: e-mail to wkennedy@gmu.edu.

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 primarily of discussions of assigned readings facilitate by the instructor or a student. There are will also be presentations and discussions of models demonstrating foundational principles.

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 listed below, but these can be waived with the instructor’s permission.

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 65 percent based on readings and discussions and 35 percent on the student projects as specified below.

Overview:		Grading Scale: (points = percentage)
readings (written reviews)	45	94-100 = A
discussion contributions	15	90-93 = A-
project prototype	5	86-89 = B+
project proposal	10	81-85 = B
project presentation	20	75-80 = B-
project submission	<u>5</u>	70-74 = C
	100	<69 = F

Readings: (worth 45 points of 100 total) Each student will prepare and submit nine reviews of specified readings, each 1-2-pages (400-800 words) and worth 5 points.

Discussion Participation: (15 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 and absence, tardiness, and early departure are evidence of nonparticipation.

Project prototype: (5 pts) Each student will modify an existing NetLogo library model to demonstrate a cognitive behavior.

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

Project Presentation: (20 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 final project report.

Project Final Submission: (5 pts) Each student will submit a report (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 24 hr. day late.

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. 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.

Texts (none required):

We will read from a variety of sources. The most frequent is Schelling's book (1979/2006) (4 chapters to be read including 1 required written review) and Dunbar's book (2004) (3 chapters to read including 1 required written review). Neither of these books are expensive.

Planned 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 28: Topic: *Introduction and overview: From Individuals to Societies & First Principle*
Week 1 Reading & due before class: nothing prior to class

February 4: Topic: *Fundamental Human Cognitive Characteristics*
Week 2 Readings: Dunbar (2004) Chapter 1 (humans wonderful)
 Schelling (1978/2006) Chapter 1 (purposeful behavior)
 Armitage (2001) Review of the theory of planned behavior
Homework due before this class: **written review (#1) of Schelling Chapter 1**

- February 11:
Week 3 Topic: *Fundamental Human Drives and Needs*
Readings: Maslow (1943) (human drives)
 Schelling (1978/2006) Chapter 2 (modeling behavior)
 Pink (2011). *Drive: The surprising truth about what motivates us*
Homework due before class: **written review (#2) of Maslow (1943)**
- February 18:
Week 4 Topic: *Emotions and Affective Behavior: Basic & Cognitive Emotions*
Readings: Izard (2010) (emotion review)
 Kahneman (2003) (System 1 System 2)
 Ekman (1999) Basic Emotions
Homework due before class: **written review (#3) of Kahneman (2003)**
- February 25:
Week 5 Topic: *Cognition and Rational Behavior I: Cognitive Architectures*
Readings: NRC (2008) Chapter 3 pg 97-104 (verbal models)
 Rao & Georgeff (1995) (BDI)
Homework due before class: **written review (#4) of Rao & Georgeff (1995)**
- March 4:
Week 6 Topic: *Cognition and Rational Behavior II: The Big 2*
Readings: Lehman, Laird, Rosenbloom (2006) (Soar)
 Anderson et al. (2004) (ACT-R)
 Laird, Lebiere, Rosenbloom (2017) Standard Model of the Mind
Homework due before class: **written review (#5) of the Soar or ACT-R reading**
- March 11:
Week 7 Topic: *Cognition and Rational Behavior III: Other Approaches to Cognition*
Readings: Hutchinson & Gigerenzer (2005) (hierarchal decision trees)
 Schmidt (2002) (PECS)
 Epstein (2014) Introduction (pp 1-10)
Homework due before class: **Project Prototype**
written review #6 Hutchinson & Gigerenzer (2005)
- March 18:
Week 8 Topic: *Designing a Cognitive Social-Simulation Project*
Reading: Epstein (2008) Why Model?
 Axtell (2000) Why Agents?
Homework due before class: **written review #7 of Epstein (2008)**
project proposal
- March 25:
Week 9 Topic: *Identity, the Self, and Abnormal Psychology*
Readings: Kopecky (2010) (Social Identity Modeling)
 Lilienfeld & Marino (1999) (Abnormal Psyc)
Homework due before class: **written review #8 of Kopecky (2010)**
Projects proposals resolved; projects due in 4 weeks
- April 1:
Week 10 Topic: *Social Behavior: The Individual within Society & Culture*
Readings: Dunbar (2004) Chapter 4 (social interactions)
 Hegselmann & Krause (2002) (opinion dynamics)
Homework due before class: **written review #9 of Dunbar Chapter 4**
- April 8:
Week 11 Topic: *Mating Behavior: The Individual Strategies to Find a Mate*
Readings: Buston and Emlen (2003) (Cognitive processes in mate choice)
 Buss and Schmitt (1993) (Sexual strategies, evolutionary perspective)
Homework due before class: **none (working on class project)**
- April 15:
Week 12 Topic: *Social Behavior: Small Groups*
Readings: Conte, Andrighetto, & Campenni (2013) (Minding Norms chapter 2)
 Dunbar (2004) Chapter 6 (culture)
 Arrow, McGrath, Berdahl (2000) Chapter 3 (Groups as Complex Systems)
Homework due before class: **working on the project**

April 22: Topic: *Social Behavior: Societies in Modeling and Simulation*
 Week 13 Readings: Schelling (1978/2006) Chapter 3 (society models)
 NRC (2008) Chapter 6 (voting & social network models)
 Homework due before class: **working on the project**

April 29: Topic: *Integrating Approaches and Issues in Modeling Humans*
 Week 14 Readings: Kennedy (2011) (how to model people)
 NRC (2008) Chapter 8 (challenges)
 Schelling (1978/2006) Chapter 7 (model interpretation)
 Homework: **prepare Project Presentations**

May 3-10: **Exam time:** In class: Project Presentations
 Week 15 Readings: none
Last day to turn in all class and project assignments.

References:

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- Buss, D.M., and Schmitt, D.P. (1993) Sexual Strategies Theory: An Evolutionary Perspective on Human Mating. *Psychological Review* **100**(2): 204-232.
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- Epstein, J.M. (2008) Why Model? *Journal of Artificial Societies and Social Simulation* **11**(4 12).
- Epstein, J.M. (2014) *Agent_Zero*. Princeton.
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- Izard, C.E., (2010) The Many Meanings/Aspects of Emotion: Definitions, functions, Activations, and Regulation. *Emotion Review* **2**(4), 363-370.
- Kahneman, D. (2003) Maps of Bounded Rationality: Psychology for Behavioral Economics. *The American Economic Review* **93**(5), 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 (available free at: http://books.nap.edu/catalog.php?record_id=12169)
- 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.
- Schelling, T. (1978/2006) "Micromotives and Macrobehavior", ISBN 978-0-393-32946-9