MINDS, BRAINS, AND ROBOTICS

PHIL 3316

Monday-Friday, 1:00PM-5:00PM; Hyer Hall, Room G01.

Professor Justin Fisher
Office: Hyer Hall, room 210D.
Meetings: After class, or by appointment. I have a flexible schedule and am very happy to meet, or to talk by phone or skype.
Email: fisher@smu.edu (This is the best way to reach me.)

Course Description:

This course takes a multidisciplinary approach to the theory, methods, and current issues in cognitive science. The goal of this course is to help you think creatively and critically about integrating various approaches to the understanding and design of cognitive systems. Our readings and discussions will focus on issues such as theories of mind, computational characterizations of agents (human and machine) in complex environments, situated cognition, and interaction between cognitive systems. In tandem with this will be activities which will provide a "hands on" way of investigating some of these topics experimentally through the use of LEGO Mindstorms robot kits (provided via generous funding from the SMU President's Partners Program). These activities will provide you with an opportunity to develop, carry out, and present the results of your own ideas about cognitive systems. This course will help you to develop techniques for formal reasoning, writing, and analytical skills that will serve you well in philosophy, in other disciplines, and in your broader life.

Note for May-term students: Most meetings will involve a combination of lecture/discussion and Lego robot activities, providing welcome changes of pace in 4-hour sessions!

Humanities and Fine Arts Depth (Philosophy)

1. Students will be able to demonstrate the ability to critically reflect on or apply the theoretical methods of philosophy via a focus on a specific area or set of issues.

Technology and Mathematics

2. Students will demonstrate an understanding of how particular technologies work.

Quantitative Reasoning Proficiency

3. Students will be able to assess the strengths and limitations of quantitative models and methods.
4. Students will be able to apply symbolic systems of representation.
5. Students will be able to formulate structured and logical arguments.
6. Students will be able to test hypotheses and make recommendations or predictions based on results.

Students will learn to assess the strengths and limitations of different quantitative models and methods that have been proposed for understanding the nature of cognition. They will consider understandings of cognition as involving symbolic computational systems of representation; they will learn about and design artificial neural networks which involve quantitative representations of the spread of neural activation through a network to achieve various computational goals; they will learn about dynamical systems approaches which understand cognition as involving systems of physically coupled processes that are best understood by sets of differential equations; and they will explore game theoretic understandings of how interacting agents may compute expected payoffs and choose utility-maximizing strategies. Students will display their understanding of these issues via written homework, via exam questions, and especially via hands-on experience designing and programming LEGO Mindstorms robots (which will involve learning to make hypotheses and alter them on the basis of empirical results).

Readings:

Clark, Andy. *Mindware: An Introduction to the Philosophy of Cognitive Science*. Second edition (this is the red cover, not the first edition yellow cover!). Other readings will be made available online.

Lectures & Readings:

*You are responsible for reading any assigned material **BEFORE** the lectures.*

Evaluation:

- **Exams: Mid-term (20%) and Final (25%)**
  The exams may involve a variety of formats, including multiple choice, matching, short answer, and essay. Sample questions will be distributed prior to the exams.
- **Classroom Participation and Activities (10%)**
  You are expected to come to class prepared to talk about the assigned readings. We may use quizzes, class discussion, or other activities to help assess this. If you don't attend regularly it would be virtually impossible to do well in the course, so **if you have more than 1 unexcused absence I will significantly penalize your grade and it may be wise to drop the course.**
- **Homework / Online Discussion (15%)**
  A typical homework assignment will involve contributing two substantive paragraphs to online discussion in response to a particular prompt. At the end of the course, I will drop your lowest homework grade.
- **Lego Robot projects [group] (30%)**
  This grade will include both your robot's performance and written reports. More information will be made available on the course website. At the end of the semester, each group will submit a report regarding the division of labor within the group (e.g., that two members each did 30% of the work, and the third member did 40% of the work). These reports will be used to allocate marks to individuals for group work. Your group is encouraged to talk about your division of labor throughout the semester, and then to reach a final consensus regarding what your report will say. In the event where no consensus can be reached, individuals may submit their own reports.

Grade Appeals:

Grade appeals must be submitted in writing within two weeks of the return of graded material and within 3 weeks of the final exam, whichever comes first. Your written appeal should include a clear explanation for why what you submitted merits a higher grade. (That you have gotten high grades in other courses and/or that it would please your parents or a scholarship committee to have a higher grade are generally not reasons that your work in this course merits a higher grade.)

Academic misconduct:

Plagiarism and other forms of academic misconduct (e.g., cheating on exams) will not be tolerated. Be sure to acknowledge other people's words and ideas, whenever you use them!

Disabilities, Religious Commitments, and Extracurricular Activities:

Please let me know right away if I can help to accommodate your disabilities or religious commitments. Here are some relevant university policies:

- **Disability Accommodations:** Students needing academic accommodations for a disability must first be registered with Disability Accommodations & Success Strategies (DASS) to verify the disability and to establish eligibility for accommodations. Students may call 214-768-1470 or visit http://www.smu.edu/alec/dass.asp to begin the process. Once registered, students should then schedule an appointment with the professor to make appropriate arrangements. (See University Policy No. 2.4; an attachment describes the DASS procedures and relocated office.)

- **Religious Observance:** Religiously observant students wishing to be absent on holidays that require missing class should notify their professors in writing at the beginning of the semester, and should discuss with them, in advance, acceptable ways of making up any work missed because of the absence. (See University Policy No. 1.9.)

- **Excused Absences for University Extracurricular Activities:** Students participating in an officially sanctioned, scheduled University extracurricular activity should be given the opportunity to make up class assignments or other graded assignments missed as a result of their participation. It is the responsibility of the student to make arrangements with the instructor prior to any missed scheduled examination or other missed assignment for making up the work.

Tentative Schedule (subject to revision):

Date		Topic	Readings
THEME I. WITHIN-AGENT PROCESSING.			
Thur 16		Introduction, Mind-Body Problem.	Appendix 1.
Fri 17		Symbolic Computationalism, Begin Lab 1	Intro, Ch1-3, Braitenberg.
Mon 20		Connectionism and Neural Networks, Continue Lab 1	Ch4.
Tues 21		Symbols vs. Connections, Lab #1 Demonstration.	Ch11.
Wed 22		Marr's Three Levels, Consciousness. **(Writeup #1 due.)**	Ch5, Appendix 2.
Thur 23		**MIDTERM EXAM,** Begin Lab 2.	--

THEME II. AGENT-ENVIRONMENT INTERACTION.			
Fri 24		Challenges to Marr, Dynamicism, Continue Lab2.	Ch6,7,10
Mon 27		No Class – Happy Memorial Day!	--
Tues 28		Passive and Active Externalism, Finish Lab2.	Ch8 + Ch9
THEME III. AGENT-AGENT INTERACTION			
Wed 29		Game Theory, Begin Lab 3. **(Writeup #2 due.)**	Hofstadter.
Thur 30		Language Acquisition, Continue Lab 3	Pinker, Deacon.
Fri 31		**Final Exam,** **Lab #3 demo + Writeup due.**	--

FINAL EXAM – In class, May 31st.

Three quick tips for doing well in this course:

1. *Come to class and the labs (when you must miss, talk to a class-mate about what happened – get their lecture notes)*
2. *Do the readings ahead of time, and read 'actively' – pay attention to what you're reading, ask yourself what point(s) the author(s) is trying to make, why this matters, and so on*
3. *If you're having trouble with any of the course material, speak to the instructor right away*