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Boston University, Department of Psychology

PS 525 Cognitive Science

Time: MW 11-12:30

Fall 2003

Place: Psychology Dept. Basement 53 (PSYB53)

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Course Description. Cognitive scientists share a commitment to developing theories of human cognition which can integrate findings from diverse fields (psychology, philosophy, linguistics, computer science, neuroscience). Interdisciplinary research methodology, including connectionist modeling, will be reviewed and applied to questions on human decision making, consciousness, creativity, development, social behavior and psychopathology.

Prerequisites. Any one of the following courses: Cognitive Psychology (PS 336), Physiological Psychology (PS 231) Neuropsychology (PS 338), Minds and Machines (PH 265), Mind, Brain and Self (PH 266), Philosophy of Cognitive Science (PH 468), Artificial Intelligence. Prerequisites waived for graduate students. All students should have an understanding of basic statistical concepts (e.g., background in statistics to the level of MA 116 or PS 211). Auditors and visitors welcome.

Overview of class. This will be a student-led class. During the first two weeks, class members will discuss possible topics, and come to consensus about readings and topics. Students will join forces with one other classmate to lead the class for one week.

Topics should be chosen to maximize interdisciplinary themes or those relevant to the “grand philosophical questions” which cognitive scientists began to ask in the second half of the 20th century (see section on choosing topics below).

Course Requirements

- Lead class discussion for one day (if solo) or 2 days (if with one other classmate)
- Semi-weekly Homework assignment (look up relevant info from internet) (I will distribute assignments weekly, but you can choose half of them to do, e)
- Mid-term test (Short-answer, including questions suggested by students)
- Final (covers 2nd half of course; Tues 12/16; 12:30) *OR* 8-10 page paper.

When choosing a topic, consider classic philosophical questions, and also contemporary interdisciplinary issues.

Classic philosophical questions. What is consciousness? What forces shape human behavior? How does human intelligence differ from nonhuman (animal, computer) intelligence? What is the computational architecture of the human mind? Are there common information processing characteristics across multiple levels of inquiry (neuron, individual action, society?) What fields and subfields take the “cognitive” adjective and what does perspective does “cognitive” add (e.g., cognitive ethology, cognitive sociology, cognitive linguistics, cognitive anthropology).

Contemporary interdisciplinary questions

- What is the evolutionary or adaptive basis for this behavior?
- What is its developmental time course? How do developmental factors influence the shape of this behavior or ability?
- What are the information processing or computational characteristics of this behavior?
- What is the brain basis or physiological underpinnings of the behavior?
- Is this behavior best described by multiple levels (micro/macro)?
- Does this behavior have an abnormal or pathological counterpart?
- Is this topic addressed by multiple disciplines? (Psychology, artificial intelligence, linguistics,

neuroscience, philosophy, anthropology, sociology)

- What were the important historical questions about this topic, and how have the questions changed?

Note about topic choice: A possible topic could focus more on one of these question than on the others, e.g., the topic “evolutionary psychiatry” focuses mostly on the first question.)

Course Books (at BU Bookstore)

Recommended/Supplemental: Paul Thagard, 1998. *Mind Readings: Introductory Selections on Cognitive Science*. Contains chapters on consciousness, language, mental representation, concepts, analogy, emotion, and computer models of cognition and behavior. religion and the brain.

Given the interests of members of this class, I decided not to require people to buy this book, because it has a lot of computer / robotics / artificial intelligence papers. Also, the one paper on language is not very representative of the diversity of work on cognitive science and language.

David Lodge, 2001. *Thinks: A novel*. This novel is attempt to present key issues in cognitive science in the guise of a contemporary love story between two professors, one a humanities instructor and a skeptic of attempts to study consciousness scientifically the other a champion of cognitive science. I will assign a couple chapters and provide pointers to other ones where the protagonists grapple with understanding the mind. One review is at: <http://dir.salon.com/books/review/2001/06/22/lodge/index.html> (or just google David Lodge Thinks review salon). There are other good reviews which I'm sure you can find, e.g., David Young's review for AISB Quarterly, Spring 2002.

If you like the idea of reading fiction to learn about science, I also recommend Richard Power's *Galatea 2.2*, 1995. This is easily ordered from amazon.com

First Three Weeks of Class)

Sept 8, 10 Origins of cognitive science: The cognitive revolution; artificial intelligence, connectionism

Monday

Lodge, *Thinks*, p. 49-55. Provides examples of famous cognitive science projects.

Harris, C.L. 2001. Language and cognition. Available from <http://people.bu.edu/charris/encyclopedia.html>. While focusing on language, this article reviews the three time periods we will discuss during the first week of class (the cognitive revolution, the connectionism paradigm shift, the contemporary focus on cognitive neuroscience).

Wednesday: The neural net revolution

McClelland, J.L., Rumelhart, D.E., & Hinton, G.E. (1986). The appeal of parallel distributed processing. (chapter from PDP: Explorations in the microstructure of cognition). Prof Harris will distribute.

Hinton, G.E. (1986). Learning distributed representations of concepts. Proceedings of the 1986 Cognitive Science Society Meeting. Prof. Harris will distribute this short article.

Sept 15, 17 Neural Nets: More sophisticated questions.

I'm going to additionally try to find some popular articles on these topics.

Monday

Elman, J.L. (1993). Learning and development in neural networks: The importance of starting small. *Cognition*, 48, 71-99. available from: <http://crl.ucsd.edu/~elman/>

Wednesday

Hinton, G.E., Plaut, D.C., Shallice, T. (1993). Simulating brain damage. *Scientific American*, October 1993. Prof. Harris will copy and distribute this short article.

Sept 22, 24.

Monday: The 1990s-present. Robotics, chaos theory, the rise of cognitive neuroscience

I originally assigned Chapters 1, 11-13 from *Mind Readings* (on robotics and the dynamicist approach. I think instead I will try to find a couple of “popular” articles on chaos theory, modern cognitive neuroscience, etc.

Comments on the overview

This is enough for the “overview” of cognitive science. From here on I’d like to get into specific topics, starting with language and cognition. We will review bilingualism, language acquisition, and aphasia. I will start with bilingualism as everyone has intuitions about learning (or trying to learn) a second language and thus can engage these intuitions while grappling with the topic.

Wednesday (bilingualism and emotion) This is a very “new” topic and thus fairly open and accessible (not too technical, not too controversial).

Dewaele, J-M., Foth, R. (2003). The illocutionary force of swearwords and taboo words in the speech of multilinguals. Unpublished manuscript. I will circulate an electronic version of this paper.

Harris, C.L. (2003). Bilingual speakers in the lab: Psychophysiological measures of emotional reactivity. I will circulate an electronic version of this paper.

Sept 29, Oct 1. Neuropsychology and language; aphasia. Readings TBA

Oct 6, Oct 8. Bilingualism and critical periods. Readings TBA

Topics for remainder of the semester

Neuropsychology of consciousness, sleep and dreaming, computational modeling (esp. clinical disorders and language), language development, second language acquisition (including individual differences, evolutionary explanations for language and clinical disorders), emotion (and: language, decision making, addiction), gender, religion and spirituality, neurodevelopmental disorders, categorization (especially application to stereotypes), culture-specific aspects of decision making. Other topics depending on your interests.

Leading class discussion

Students volunteer to lead class discussion on topic of their choice, and will collaborate with Prof Harris to select readings. Suggest: two class members work together to choose assessable readings, discussion topics, and activities. Either: you will both be in charge, for the Monday and Wednesday meetings, or you may each take charge of one day.

What distribution of articles to pick

When choosing readings for one week, students should aim for 4 articles/chapters. Choose articles that most of the students in the class will benefit from.

Possible distribution of articles

- one article from a popular source (e.g., Discover Magazine, Scientific American, newspaper)
- two contemporary readings, from contrasting disciplines or perspectives
- 1 additional article (such as a historical article)
- You can also suggest supplemental articles. Supplemental articles can be introductions, or advanced reading for people with a special interest in this topic.

Presenters should brainstorm with each other and Prof. Harris to find some hands-on applications or activity to do in class for one of the two days. Examples: experiments students can participate in or primary materials to review and analyze. Another idea is to organize a debate or to assign students to act

out the roles of leading theorists in a subfield.

What are your responsibilities are for leading class discussion?

- By the third week of class: Choose your topic, propose readings and presentation date. Present to the class the topic, your justification, and justification of the readings. (Readings can be modified if necessary later, at the latest, a week before your presentation date.)
- The week before your presentation date. Prepare and distribute your discussion questions. Meet with Prof. Harris to discuss ideas for the two days.
- During your presentation week. Bring relevant materials to class: outline, powerpoint presentation, primary materials for classmates to analyze, etc. After each class, the two leaders meet with Prof Harris briefly (10 minutes) to go over how the class meeting went. The following week, submit 2-4 short-answer questions for the test, with short answers. One I will distribute as a practice question.

Detailed scheduled for organizing your leading of class discussion

For each week of class, we can label Current Leaders the two class members who are leading discussion for the Monday and Wednesday of that week, and Next Leaders, the class members who are leading discussion for the following week.

- At the end of Monday's class: Current Leaders should read email and be prepared to call on students or otherwise integrate them into the discussion. End discussion at 11:15 on Mon and Wed (5 minutes before official end of class) to allow class members a chance to talk with each other or Prof Harris about any issues. I will also discuss with the Current Leaders: How did it go, were people engaged, what worked, what didn't? Review and if necessary modify plan for Wednesday class. At 12:30: Next Leaders: meet with Prof Harris to review any updates on the reading and to review your discussion questions and your plan for activities and structure for the classes you are leading. If everything is approved, email this information to the class so they can plan the reading they will do for the following week.
- At the end of Wednesdays class: Next Leaders will tell the class about their topic and the proposed reading for the next week and make sure that everyone received the discussion questions. Current Leaders: Final debriefing, draw conclusions about the two days.
- Week after you presented: Post to the courseinfo website short questions which Prof. Harris will choose from for two tests. To construct your questions, think: what material or insights from these two class days would you hope students got at the end of the class hour? What would you hope they would retain by the end of the semester? A year later? Five years later?

Assignment for Monday or Wednesday Sept 8, 10

1. In the novel *Thinks*, Ralph Messenger, head of a cognitive science institute in Great Britain, shows the institute to Helen, a literature professor. The institute features a mural describing some classic questions in the last 30 years of work. Choose one of these and find additional material to flesh out the short description that Helen receives from Ralph.

- Thomas Nagel, What is it like to be a bat?
- Prisoner's Dilemma (compare to current TV game show 'Friend or Foe') and Axelrod's Tit for Tat
- Searle's Chinese Room
- Frank Jackson's Mary, the color scientist who is color blind
- Philosophers' obsessions with "Zombies"
- Does quantum physics have the answer to consciousness?

2. In chapter 1 of *Mind Readings*, "father" Herbert Simon touches on many issues that he assumes the reader already knows about. I'm not requiring that students read this chapter, but you may already know about one of the following, and if so, bring in some ideas to share.

- p. 3 Means-ends analysis (give examples), how is this different from cell assemblies of Hebb and associative memory of Aristotle
- bring in information about classic artificial intelligence programs mentioned on p. 3: SOAR, EPAM, ISAAC, MYCIN, INTERNIST, ZBIE (p. 7)
- Why is Simon adamant that scientists must grapple with multiple levels of explanation? What are some examples where theorists have done this? (p. 8)
- What is the evidence that the brain is serial? evidence that it is parallel?
- critique: p. 12: A running program is the moment of truth
- critique: p. 13: Intuition is nothing more and nothing less than recognition
- Simon has some famous work on expertise in the pattern recognition of chess grand masters. Look this up and bring in the details.
- p. 18 Should we dissolve the boundary between cognitive psychology and social psychology?