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Boston University, Department of Psychology

**PS 525 Cognitive Science**

**Time:** MW 11-12:30

**Spring 2004**

**Place:** Psychology Dept. Basement 41 (PSYB41)

**Instructor:** Catherine Harris

**Office:** Psychology Department 123

**Phone:** 353-2956

**Office Hours:** M 1-2, T 4-5

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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.** Much of this class will be student-led. During the first three 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 or can lead one day on their own. Students can choose any presentation day, beginning the week of Feb 2. I have listed tentative readings and topics through March 22. I will modify topics and readings depending on student interests. Also, if your topic could fit into one of the topics I have listed for February and March, it is best to present then, and I will adjust the schedule.

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

- Readings for each class meeting: Read and be prepared to participate in class
- Weekly written comments: email to the class or bring copies to class
- Lead class discussion for one day (if solo) or 2 days (if with one other classmate)
- Mid-term test (Short-answer, including questions suggested by students)
- Final (covers 2nd half of course; Wed May 5, 2pm) *OR* 8-10 page paper.

There is no textbook for this class. Readings are articles which can be downloaded from [sciencedirect.com](http://sciencedirect.com) or other sites, as noted in the list of readings. You can obtain texts for your own background reading (see list at next page).

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.)

### **Cognitive Science Books for Background Reading**

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.

Patricia Churchland, *Mindwise*. Takes a philosophical perspective: how does cognitive science shed light on classic questions about the mind?

I suggest browsing titles with key words “cognitive science introduction”. The MIT Press bookstore (small shop in Kendall Square) and cognitive science section of Barnes and Nobles are good places for looking at books.

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.

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.

### **More on Course Requirements**

**Weekly email.** Discussion leaders will distribute discussion questions about the reading. If we have two separate topics in a week, you only need to provide a written comment on one topic. You can distribute your comments by responding to this email. Send your email before Monday, so students can read it for Monday class, or on Tuesday, so students can read it for Wednesday class. If you were unable to circulate your comment ahead of time, bring 3 or 4 copies to class and students can read at the beginning of class. I expect students to read each other’s comments and will call on you to ask you to discuss the comments.

Comments do not need to be elaborate and can be as short as a few sentences giving your opinion on the topic. You can raise a question that was unanswered by the reading (something that could be addressed as a group). You could mention related work that you know of from other classes or other reading.

### **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 an experiment or provide 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 (if possible; we do have flexibility): 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.
- 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. 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?

## **Schedule of Readings and Topics**

### **Wed Jan 14 Origins: The cognitive revolution; artificial intelligence**

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).

-->Browse an on-line site dedicated to cognitive science. Do your own search or try this one: <http://cscs.umich.edu/~crshalizi/notebooks/cognitive-science.html>

### **Jan 19 (no class Monday) Wed The mid-80s Connectionist Revolution “Brain-style computer modeling”**

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., Plaut, D.C., Shallice, T. (1993). Simulating brain damage. *Scientific American*, October 1993. Available from: <http://www.cnbc.cmu.edu/~plaut/papers/abstracts/HintonPlautShallice93SciAm.simBrainDam.html>

If He Only Had a Brain: Right now it's floating in a dish in Japan. Someday it may be offering you advice. By David H. Freedman DISCOVER Vol. 13 No. 08 | August 1992 | Biology & Medicine <http://www.discover.com/issues/aug-92/features/ifheonlyhadabrai88/>

On-line introductions: Public lecture from Jaap Murre, University of Amsterdam: <http://>

[www.neuromod.org/courses/public.html](http://www.neuromod.org/courses/public.html)

<http://www.cs.ucd.ie/staff/fcummins/home/CogModels/connectionism.html>: Tutorials with java application, by Fred Cummins of University College, Dublin.

## **Jan 26 Continue connectionism; Wed: Chaos Theory, Complexity, Robotics**

### *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*

Brooks, R.A. (1991). New approaches to Robotics. *Science* (253), September 1991, pp. 1227–1232. Available from: <http://www.ai.mit.edu/people/brooks/papers/new-approaches.pdf> (This paper prints out in very small type; you may want to try to cut and paste it from the screen into some other word processor where you can enlarge the font.)

Gregory Rae, Introduction to chaos theory. Available from: <http://www.imho.com/grae/chaos/index.html>

Skarda, C.A., Freeman WJ (1987). How brains make chaos in order to make sense of the world. *Behavioral and Brain Sciences* 10: 161-195. Available from:

<http://sulcus.berkeley.edu/FreemanWWW/manuscripts/IC8/87.html>

Fire in the Brain: Can programmable implants help epileptics detect the onset of seizures? By Kathy A. Svitil DISCOVER Vol. 23 No. 05 | May 2002 <http://www.discover.com/issues/may-02/features/featfire/>

## **Feb 2 Language, Developmental Flexibility, Critical periods**

### *Language and brain development*

Birdsong, D., & Molis, M. (2001). On the evidence for maturational constraints in second language acquisition. *Journal of Memory and Language*, 44, 235-249.

Bates, E. (1999). Plasticity, localization and language development. (216 KB) In S. Broman & J.M. Fletcher (Eds.), *The changing nervous system: Neurobehavioral consequences of early brain disorders* (pp. 214-253). New York: Oxford University Press. Available <http://crl.ucsd.edu/~bates/papers.html>

Bates, E., & Dick, F. (2000). Beyond phrenology: Brain and language in the next millennium. *Brain and Language*, 71, 18-21.

Bates, E., Elman, J., Johnson, M., Karmiloff-Smith, A., Parisi, D., & Plunkett, K. (1998). Innateness and emergentism. In W. Bechtel & G. Graham (Eds.), *A companion to cognitive science* (pp. 590-601). Oxford: Basil Blackwell. Available from <http://crl.ucsd.edu/~bates/papers.html>

Kim, K.H.S., Relkin, N.R., Lee, K-M., Hirsh, J. (1997). Distinct cortical areas associated with native and second languages. *Nature*, 388, 171-4.

### *Critical periods*

Pallier, C., Dehaene, S., Poline, J.-B., LeBihan, D. Argenti, A.-M., Dupoux, E., & Mehler, J. (2003). Brain imaging of language plasticity in adopted adults: can a second language replace the first? *Cerebral Cortex*, 13, 155-161. Available from: <http://www.ehess.fr/centres/lscp/persons/pallier/papers/index.html>

Oh, J.S., Jun, S.-A., Knightly, L.M., & Au, T.K. Holding on to childhood language memory, *Cognition*, 86, B53-B64

Grimshaw, G.M., Adelstein, A., Bryden, M.P., & MacKinnon, G.E. (1998). First-language acquisition in adolescence: Evidence for a critical period for verbal language development. *Brain and Language*, 63, 237-255.

Bailey, D. B. (2002). Are critical periods critical for early childhood education?: The role of timing in early childhood pedagogy. *Early Childhood Research Quarterly*, 17, 281-294.

## **Feb 9 Savantism / Developmental Disorders**

### *Savantism*

Tsimpli, I-M., & Smith, N. (1998). Modules and quasi-modules: Language and theory of mind in a polyglot savant. *Learning and Individual differences*, 10, 193-215.

Bates, E. (1997). On language savants and the structure of the mind: A review of Neil Smith and Ianthi-Maria Tsimpli, "The mind of a savant: Language learning and modularity. *International Journal of Bilingualism* 1(2), 163-179. Available from: Bates' homepage: <http://crl.ucsd.edu/~bates/papers.html>

### *Williams Syndrome*

Johnson, S.C., & Carey, S. (1998). Knowledge enrichment and conceptual change in folk biology: Evidence from Williams syndrome. *Cognitive psychology*, 437, 156-200.

Tager-Flusberg, H., & Sullivan, K. (2000). A componential view of theory of mind: Evidence from Williams syndrome. *Cognition* 76, 59-89.

For genetic analysis of Williams syndrome, if you are interested, see Bellugi et al, *From cognition to brain to gene* (can borrow from Prof. Harris)

## **Tues Feb 17, Wed 18 Primate cognition**

Depending on student interests, we can modify readings to include evolution of human language, and animal cognition generally.

Michael T. (2000). Primate cognition: introduction to the issue. *Cognitive Science*, 24, 351-361.

Gallup, G.G. (1998) Self-awareness and the evolution of social intelligence. *Behavioural Processes*, 42, 239-247.

Povinelli, D.J., Bering, J.M., & Giambrone, S. (2000). Toward a science of other minds: escaping the argument by analogy. *Cognitive Science*, 24, 509-541.

Heyes, C. M. (1998) Theory of mind in nonhuman primates. *Behavioral and Brain Sciences*. Available from the BBS website, <http://www.bbsonline.org>

Primate Cognition at Emory University -- Click on video and field observation; there is also an overview of primate cognition and a bibliography <http://www.learnlink.emory.edu/~npatel2/>

Shanker, S., & King, B. J. (forthcoming). The emergence of a new paradigm in ape language research. *Behavioral and Brain Sciences*. <http://www.bbsonline.org/Preprints/Shanker/Referees/>

Boysen, S.T., & Hallberg, K.I. (2000). Primate numerical competence: contributions toward understanding nonhuman cognition, *Cognitive Science*, 24, 423-443.

Whiten, A. (2000). Primate culture and social learning. *Cognitive Science*, 24, 477-508.

Byrne, R.W. (2000). Evolution of primate cognition. *Cognitive Science*, 24, 543-570.

## **Feb 23 Evolutionary Psychology/Psychiatry**

Mealey, L. (1995). The sociobiology of sociopathy: An integrated evolutionary model. *Behavioral and Brain Sciences* 18 (3): 523-599. [bbsonline.org/Preprints/OldArchive/bbs.mealey.html](http://www.bbsonline.org/Preprints/OldArchive/bbs.mealey.html)

Abed, R.T. (1998). The sexual competition hypothesis for eating disorders. *British Journal of Medical Psychology* 71(, 525-547. <http://cogprints.ecs.soton.ac.uk/archive/00000800/>. Proposes that eating disorder and pursuit of thinness are manifestations of female intrasexual competition.

Evans, Dylan (1999) From moods to modules: preliminary remarks for an evolutionary theory of mood phenomena. In *Proceedings Naturalism, Evolution and Mind*, Edinburgh.<http://>

cogprints.ecs.soton.ac.uk/archive/00000814/ An Evolutionary look at emotions and discussion of the modularity debate.

### *Supplementary articles*

Smith, E.A. et al. Controversies in the evolutionary social sciences: a guide for the perplexed. *Trends in Ecology and Evolution*. Short history of evolutionary arguments applied to social sciences.

### **Mar 1 Emotion; Neurobiology of social attachment Wed Mar 3 Test 1**

Panksepp, J. (2003). Feeling the pain of social loss. *Science*, 302, 237-239.

Johnson, S. (2003). The brain and emotions. *Discover*, May issue. Prof. Harris will circulate electronically.

Carter, C.S. (1998). Neuroendocrine perspectives on social attachment and love. *Psychoneuroendocrinology*, 23, 779-818.

### **March 8 Enjoy Spring Break**

### **March 15 Change blindness and Consciousness**

#### *Change blindness*

Simons, D.J., & Levin, D.T. (1997). Change blindness. *Trends in Cognitive Sciences*, 1, 261-267.

Rensink, R. When good observers go bad: Change blindness, inattention blindness, and visual experience. *Psyche*, 6. Available from: <http://psyche.cs.monash.edu.au/v6/psyche-6-09-rensink.html>

Levin, D.T., Drivdahl, S.B., Momen, N., & Beck, M.R. (2002). False predictions about the detectability of visual changes: The role of beliefs about attention, memory, and the continuity of attended objects in causing change blindness. *Consciousness and Cognition*, 11, 507-527.

#### *Consciousness*

Spence, S.A. (1996). Free will in the light of neuropsychiatry. *Philosophy, Psychiatry and Psychology*, 3, 75-90. Available from: [http://muse.jhu.edu/journals/philosophy\\_psychiatry\\_and\\_psychology/v003/3.2spence01.html](http://muse.jhu.edu/journals/philosophy_psychiatry_and_psychology/v003/3.2spence01.html)

Wegner, D.M. (2003). The mind's best trick: How we experience conscious will. *Trends in Cognitive Sciences*, 7, 65-69.

Wegner, D.M. (2002). *The illusion of conscious will*. Cambridge, MA: MIT Press. Precis available on [www.bbsonline.org](http://www.bbsonline.org).

Libet, B. (1985). Unconscious cerebral initiative and the role of conscious will in voluntary actions. *The Behavioral and Brain Sciences*, 8, 529-566. May be available on [www.bbsonline.org](http://www.bbsonline.org).

### **March 22 Genes, Memes and the Biology of Religion**

*Memes are cultural concepts* which have unusual fitness, having survived the marketplace (or the battleground) of competing ideas. Memes are a big idea. They straddle genes and culture. They are controversial. Some people say they are nothing more than what anthropologists have always studied. Others say they are a new concept and have the potential for revolutionizing how we think.

Blackmore, S. (2000). The power of memes. *Scientific American*, 283(4), 52--61. Available from: <http://www.susanblackmore.co.uk/SciAm00.html>

For additional reading, browse these websites:

Blackmore's webpage for links to other papers: <http://www.susanblackmore.co.uk/publicat.htm> see also: <http://www.memes.org.uk/> and [http://members.tripod.com/~Drahcir/memes/meme\\_read.html](http://members.tripod.com/~Drahcir/memes/meme_read.html)

#### *Biology of Religion*

Grinde, B. (1998). The biology of religion: A Darwinian gospel. *Journal of Social and Evolutionary*

*Systems*, 21, 19-28.

Arbib, M.A. (1998). Self and society: between God and brain. *Trends in Cognitive Sciences*, 10.

Atran, S., & Norenzayan, A. (in press). Religion's evolutionary landscape: Counterintuition, commitment, compassion, communion. *Behavioral and Brain Sciences*. Available from [bbsonline.org](http://bbsonline.org).

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As students decide their presentation dates/topics, the schedule above will be revised, with some topics being assigned to dates below, if a student's topic will fit best into a February or March topic.

**April 5**

**April 12**

**Wed April 21**

**April 26** (Last day of instruction: Wed April 28)

**Wed May 5: Test 2** (or turn in paper)

### **Other Topics**

Many other topics which could be pursued, depending on student interests. The following have generated a lot of interest in prior years: Emotion, decision making, cognition of literature, racial perception, social cognition, implicit attitudes and stereotyping, brain, visual imagery, and advertizing, computational models of mental disorders, sleep/dreaming, pain perception. A very new topic is the genetics underlying disorders, and the genetics of human evolution.

### **Discussion Questions for Wednesday Jan 19**

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?