

Cognitive Psychology: Mind and Brain W2215 (Room 614)

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Office hours: Wednesday 2:00 p.m. – 3:30 p.m. (or by appointment)

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Course content: This course is concerned with the study of mind and brain, what is called “cognitive neuroscience”. Cognitive neuroscience is an inter-disciplinary area that represents an attempt by cognitive psychologists and neuroscientists to discover how mental processes are implemented in the brain. The approach focuses on human cognitive and emotional processes and relies heavily on the methods and findings of neuroscience. This is the kind of research that is currently receiving intense coverage in the media, and this course should provide you with a deeper understanding of what you might read and hear about outside of the classroom.

The topics covered are the major ones in higher-level cognition, and include: conceptual representations, long-term memory, working memory, attention, control processes, emotion learning, decision making, reasoning, and language processing. To understand the cognitive-neuroscience approach to these topics, students will be introduced to some elementary neuroanatomy, to the logic of studies with neurological patients, and to functional neuroimaging techniques, particularly Positron Emission Tomography (PET), and functional Magnetic Resonance Imaging (fMRI). The goal is to use these techniques,

along with behavioral measures, to understand the topics of interest at both a cognitive (or psychological) and neural level.

Classes: Classes meet Monday and Wednesday, 10:35 – 11:50am, and consist of lectures and a couple of review sessions. Between 2-4 classes will be devoted to the discussion of a topic (e.g., working memory). The intent is to provide a substantially deeper treatment of each topic than would be available in an introductory-level course.

Readings: The readings include (1) chapters from recently published textbook, (2) required articles and (3) suggested articles. The textbook is authored by Smith and Kosslyn (hereafter, S&K), and is entitled, “Cognitive Psychology: Mind and Brain” (the observant may notice a resemblance to the course’s title—no accident). The book has just been published by Prentice Hall and is available in the Columbia University Bookstore (in Lerner Hall).

The required articles are typically literature reviews, but sometimes critical research papers. The level of these papers is often higher than that of the book chapters. The suggested articles are usually even more advanced, and intended for students who are particularly interested in the topic.

Textbook: Smith, E. E. and Kosslyn, S. M. (2007). Cognitive Psychology: Mind and Brain. New Jersey: Prentice Hall.

Exams/Grading: Grades will depend on three factors: (1) an in-class midterm, scheduled for TBD, which covers all the material up to that point and is worth 30%; (2) a final, scheduled for TBD which covers material from the entire semester but emphasizes the material presented in the second part of the semester; and (3) a short (6-8pp.) paper on a course topic that you find of particular interest. This paper will be due near the end of the course.

SYLLABUS

Below are listed the intended topic of each lecture, along with the readings for that lecture. Please do the readings before the lecture so that you can understand what is being said in class. (Obviously, Week 1 is an exception.)

NO CLASS ON march 23RD

Week 1

1/21: Lecture 1 *Introduction to course*

Week 2

1/26: Lecture 1 *Historical overview and basics about cognitive neuroscience*

Required: S&K: Chapter 1

Brain Facts: A Primer on the Brain and Nervous System, (2005) *Society for Neuroscience*.

Nadel, L., & Piatelli-Palmarini, M. (2003). What is cognitive science? In A. Finger & L. Nadel (Eds.), *The Encyclopedia of Cognitive Science* (pp. xiii-xli). London: Macmillan.

1/28: Lecture 2 *Perceptual representations: How do we recognize objects?*

Required: S&K: Chapter 2 (Section 4: “Achieving Visual Recognition”)

S&K: Chapter 4

Suggested: TBD

Week 3

2/02 Lecture 1 *Perceptual representations: Are there specialized regions for recognizing faces and places?*

Required: Kanwisher, N., McDermott, J., & Chun, M. M. (1997). The fusiform face area: A module in human extrastriate cortex specialized for face perception. *Journal of Neuroscience*, 17, 4302-4311.

Gauthier, I. et al. (1999). Activation of the middle fusiform ‘face area’ increases with expertise in recognizing novel objects. *Nature*, 2(6), 568-573.

Suggested: Tanaka, J. W. (2005). Object categorization, expertise, and neural plasticity. In M. S. Gazzaniga (Ed.), *The Cognitive Neurosciences III* (pp. 877-887). Cambridge, MA: MIT Press.

2/04: Lecture 2 *Conceptual representations: Perceptual vs. functional features*

Required: Farah, M. J., & McClelland, J. L. (1991). A computational model of semantic memory impairment: Modality specificity and emergent category specificity. *Journal of Experimental Psychology: General*, 120, 339-357.

Smith, E. E. (1995). Concepts and Categorization. In E. E. Smith & D. Osherson (Eds.), *Thinking: An Invitation to Cognitive Science*, Second Edition, Volume 3: Chapter 1, pp. 3-33. Cambridge, MA: MIT Press.

Martin, A., Ungerleider, L. G., & Haxby, J. V. (2000). Category specificity and the brain: The sensory/motor model of semantic representations of objects. In M. Gazzaniga (Ed.), *The New Cognitive Neurosciences* (2nd ed., pp. 1023-1036). Cambridge, MA, MIT Press.

Suggested: Thompson-Schill, S. L. (2003). Neuroimaging studies of semantic memory: inferring how” from “where.” *Neuropsychologia*, 41, 280-292.

Week 4

2/09: Lecture 1 *Conceptual representations: More connections to perceptual and motor systems*

Required: Simmons, W. K., Martin, A., & Barsalou, L. W. (2005). Pictures of appetizing foods activate gustatory cortices for taste and reward. *Cerebral Cortex*, *15*, 1602-1608.

Hauk, O., Johnsrude, I., & Pulvermuller, F. (2006). (2004). Somatotopic representation of action words in human motor and premotor cortex. *Neuron*, *41*, 301-307.

Suggested: Pulvermuller, R. (2005). Brain mechanisms linking language and action. *Nature*, *6*, 576-582.

2/11: Lecture 2 *Long-term memory (LTM): Different kinds of memory systems*

Required: S&K: Chapter 5

Buckner, R. L. (2000). Neuroimaging of Memory. In M. Gazzaniga (Ed.), *The New Cognitive Neurosciences* (2nd ed., pp. 817-828). Cambridge, MA: MIT Press.

Suggested: TBD

Week 5

2/16: Lecture 1 *Explicit LTM: Input and storage*

Required: Squire, L. R., Knowlton, B. J. (2000). The Medial Temporal Lobe, the Hippocampus, and the Memory Systems of the Brain. In M. Gazzaniga (Ed.), *The New Cognitive Neurosciences* (2nd ed., pp. 765-779). Cambridge, MA: MIT Press.

Wixted, J. T. (2005). A theory about why we forget what we once knew. *Current Directions in Psychological Science*, *14*, 6-9.

Corkin, S. (2002). What's new with the amnesic H.M.? *Nature Reviews Neuroscience*, *3*, 153-160.

Suggested: TBD

2/18: Lecture 2 *Explicit LTM: Retrieval*

Required: Squire, L. R., Clark, R. E., & Bayley, P. J. (2005). Medial and temporal lobe function and memory. In M. S. Gazzaniga (Ed.), *The Cognitive Neurosciences III* (pp. 931-941). Cambridge, MA: MIT Press.

Wheeler, M. E., & Buckner, R. L. (2003). Functional dissociation among components of remembering: Control, perceived oldness, and content. *The Journal of Neuroscience*, 23, 3869-3880.

Suggested: TBD

Week 6

2/23: Lecture 1 *Explicit LTM: Role of emotion*

Required: S&K: Chapter 8

Cahill, L. et al (1994). Beta Adrenergic activation and memory for emotional events. *Nature*, 371, 702-704.

Suggested: Anderson, A. K., Wais, P. E., & Gabrieli, J. (2006). Emotion enhances remembrance of neutral events past. *Proceedings of the National Academy of Sciences*, 103, 1599-1604.

2/25: Lecture 2 *Implicit LTM: Priming and perceptual categories*

Required: Schacter, D. L. (1987). Implicit memory: History and current status. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 13(3), 501-518.

Schacter, D. L., & Buckner, R. L. (1998). Priming and the brain. *Neuron*, 20, 185-195.

Ashby, F. G., & O'Brien, J. B. (2005). Category learning and multiple memory systems. *TRENDS in Cognitive Sciences*, 9(2), 83-89.

Suggested: TBD

Week 7

3/02: Lecture 1 *Review session – no readings (Teal)*

3/04: Lecture 2 *MIDTERM*

Week 8

3/09: Lecture 1 *Implicit LTM: How it affects social behavior*

Required: Bargh, J. A., & Williams, E. L. (2006). The automaticity of social life. *Current Directions in Psychological Science*, 15, 1-4.

Lieberman, M. D. (2000). Intuition: A social cognitive neuroscience approach. *Psychological Bulletin*, 126, 109-137.

Suggested: TBD

3/11: Lecture 2 WM: *Modality specificity in storage*

Required: Baddeley, A. (1992). Working Memory. *Science*, 225 (5044), 556-559.

Jonides, J. (1995). Working Memory and Thinking. In E. E. Smith & D. Osherson (Eds.), *Thinking: An Invitation to Cognitive Science* (2nd ed., Vol. 3, Ch. 7, pp. 215-265). Cambridge, MA: MIT Press.

Davachi, L. et al. (2005). Domain specificity in cognitive systems. In M. S. Gazzaniga (Ed.), *The Cognitive Neurosciences III* (pp. 665-678). Cambridge, MA: MIT Press.

Suggested: TBD

Week 9

NO CLASS – SPRING BREAK

Week 10

3/23: NO CLASS

3/25: Lecture 1 WM: *Maintaining vs. manipulating information*

Required: S&K: Chapter 6

Smith, E. E., Jonides, J. (1999). Storage and executive processes in the frontal lobes. *Science*, 283, 1657-1661.

Suggested: TBD

Week 11

3/30: Lecture 1 WM: *Breakdowns in normal aging and pathology*

Required: Barch, D. M. (2006). What can research on schizophrenia tell us about the cognitive neuroscience of working memory? *Neuroscience*, 139, 73-84.

Reuter-Lorenz, P. A. (2002). New visions of the aging mind and brain. *Trends in Cognitive Science*, 6, 394-400.

Suggested: Goldman-Rakic, P. S. (1992). Working Memory and the Mind. *Scientific American*, 267, 111-117.

4/01: Lecture 2 *Executive processes: Attention*

Required: S&K: Chapter 7

MacDonald III, A. W. et al (2000). Dissociating the role of the dorsolateral prefrontal and anterior cingulate cortex in cognitive control. *Science*, 288, 1835-1838.

Egner, T., & Hirsch, J. (2005). Cognitive control mechanisms resolve conflict through cortical amplification of task-relevant information. *Nature Neuroscience*, 8, 1784-1790.

Suggested: S&K: Chapter 3

Humphreys, G. W., & Samson, D. (2005). Attention and the frontal lobes. In M. S. Gazzaniga (Ed.), *The Cognitive Neurosciences III* (pp. 607-617). Cambridge, MA: MIT Press.

Week 12

4/06: Lecture 1 *Executive processes: Inhibition and suppression*

Required: Banich, M. T. (1997). The Neural Bases of Mental Function. In *Neuropsychology*, Chapter 10, pp. 368-397. Boston/New York: Houghton Mifflin.

Van Veen, V., & Cartor, C. (2006). Conflict and cognitive control in the brain. *Current Directions in Psychological Science*, 15, 237-240.

Suggested: TBD

4/08: Lecture 2 *Executive Processes: Controlling emotion*

Required: Beauregard, M. Levesque, J., & Bourgouin, P. (2001). Neural correlates of conscious self-regulation of emotion. *The Journal of Neuroscience*, 21, 1-6.

Ochsner, K. N., Bunge, S. A., Gross, J. J., & Gabrieli, J. D. E. (2002). Rethinking feelings: An fMRI study of the cognitive regulation of emotion. *Journal of Cognitive Neuroscience*, 14, 1215-1229.

Suggested: Ochsner, K. N., & Gross, J. J. (2005). The cognitive control of emotion. *Trends in Cognitive Sciences*, 9 (5), 242-249.

Week 13

4/13: Lecture 1 *Decision making: Rationality?*

Required: S&K: Chapter 9

Wilson, T. D., & Schooler, J. W. (1991). Thinking too much: Introspection can reduce the quality of preferences and decisions. *Journal of Personality and Social Psychology*, 60, 181-192.

Suggested: TBD

4/15: Lecture 2 *Decision making: Role of emotion*

Required: Sanfey, A. et al. (2003). The neural basis of economic decision-making in the ultimatum game. *Science*, 300, 1755-1758.

McClure, S.M., Laibson, D.I., Loewenstein, G., & Cohen, J.D. (2005). Separate neural systems value immediate and delayed monetary rewards. *Science*, 306, 503-507.

Suggested:

Week 14

4/20: Lecture 1 *Reasoning and problem solving: Heuristics in reasoning*

Required: S&K: Chapter 10

Tversky, A. & Kahneman, D. (1974). Judgement under uncertainty: heuristics and biases. *Science*, 185, 1124-1131.

TBD

Suggested: TBD

4/22: Lecture 2 *Reasoning and problem solving: General heuristics and effects of expertise*

Required: Holyoak, K. J. (1995). Problem solving. In E. E. Smith & D. Osherson (Eds.), *Thinking: An Invitation to Cognitive Science*, Second Edition, Volume 3: Chapter 8, pp. 267-296. Cambridge, MA: MIT Press.

Parsons, L. M., & Osherson, D. (2001). New evidence for distinct right and left brain systems for deductive versus probabilistic reasoning. *Cerebral Cortex*, *11*, 954-965.

Suggested: TBD

Week 15

4/27: Lecture 1 Language processing: Overview and syntactic process

Required: S&K: Chapter 12

Pinker, S. (1994). How language works. In *The Language Instinct*. Chapter 4, pp. 83-125. New York, NY, William Morrow.

Suggested: Friederici, A. D. (2005). The neural basis of syntactic processes. In M. S. Gazzaniga (Ed.), *The Cognitive Neurosciences III* (pp. 789-801). Cambridge, MA: MIT Press.

4/29: Lecture 2 Language processing: Breakdowns

Required: Dronkers, N. F. et al (2000). The neural architecture of language disorders. In M. Gazzaniga (Ed.), *The New Cognitive Neurosciences*, Second Edition, Chapter 65, pp. 949-958. Cambridge, MA, MIT Press.

Novick, J. M., Trueswell, J. C., & Thompson-Schill, S. L. (2005). Cognitive control and parsing: Reexamining the role of Broca's area in sentence comprehension. *Cognitive, Affective, & Behavioral Neuroscience*, *5*, 263-281.

Suggested: TBD

Week 15

5/04: Lecture 1 Visit to fMRI center at Neurological Institute

Required: Chatterjee, A. (2005). A madness to the methods in cognitive neuroscience? *Journal of Cognitive Neuroscience*, *17*, 847-849.