NSCI/PSYC 433-010 Version 8/23/2018

Fall, 2018

Meeting: TR 11-12:15 122 Memorial

1. Instructor Information

Professor James E. Hoffman
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Office Hours: 11-12 MW
Class: TR 11-12:15 122 Memorial

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2. Course Information

What is Cognitive Neuroscience? Cognitive Neuroscience attempts to combine the methods and theories of cognitive psychology with neuroscience methods aimed at characterizing the structure and function of the brain. In other words, we want to know the connection between mind and brain. Topics include: perception, attention, memory, imagery, language, thought and even consciousness. This is a challenging endeavor as one needs to be a generalist with knowledge of methods and findings in several areas. It has many potential applications ranging from improving human mental abilities such as memory and thinking to helping treat various disorders such as dementia and schizophrenia.

Prerequisites. Methods (PSYC207) and Statistics (PSYC209)

Text. Banich, M. T., and Compton, R. J. ***Cognitive Neuroscience***, 4th edition. Cambridge University Press, 2018.

Additional readings from the scientific literature will be assigned for various topics.

Technology. Sakai will be used for all course activities and communication channels. All assignments will be posted through the Sakai course site unless otherwise indicated.

3. Learning Goals

My main goal for this class is to teach you to think like a cognitive neuroscientist. That means you can read a paper in the area and understand the hypotheses being considered, the ways in which they are being tested, and how data can be used to support one hypothesis over the other. Doing this will require you to know basic facts about the brain such as how neurons communicate, how the brain is divided into separate parts or areas, e.g., the parietal lobe, prefrontal cortex, etc., and how various neuroimaging methods can be used to discover what these different areas do. If you can really think like a cognitive neuroscientist by the end of the course, you will be able to generate your own hypotheses about the mind-brain connection and propose research to test them.

Each topic will involve reading a section of the text, watching an on-line video(s) and (sometimes) a paper posted on Sakai. You will then either write a short essay (max 250 words) addressing the important ideas in the reading or doing a short quiz at the beginning of class. **Essay responses are due in class at 11 am**. The purpose of these assignments is to get you to read and think about the material before class so we can use class time to discuss the material. You should do well on these assignments if you have read the material. Note, I will drop your lowest grade on these assignments. If you miss a quiz or essay, you can use your free drop to cover it. There are no make-ups except for documented illness or other unavoidable event.

It will be our job as a group to thoroughly understand the material in the text and papers and clear up any difficult concepts through discussion. Don't be intimidated by this activity. I will be there to move things along and help out if we get stuck. Just do your best on this. I don't expect you to be an instant expert in cognitive neuroscience. Your involvement during these classes will be the basis of your participation grade.

There will be two exams: a midterm and final. The final will cover material since the midterm. Exams will be take-home papers. I will provide more guidance on this later.

4. The course grade will be based on the following activities:

10% Participation

30% Quizzes and Essays

60% Two exams (equally weighted)

Letter Grades will be based on the following distribution:

Point Distributions Per Letter Grade

93-100	A
90-92	A-
87-89	B+
83-86	B
80-82	B-
77-79	C+
73-76	C
70-72	C
67-69	D+
63-66	D
60-62	D-
< 60	F

Attendance
You should be at every class. More than two unexcused absences will lower your attendance grade

Pet Peeve
Please be on time. If you arrive for class after I have started, please come up after class to let me know what happened. The use of cell phones or laptops will not be allowed in class (some exceptions for activities we will do). Be sure to turn your cell phone off before class.

Academic Integrity
I take the issue of academic honesty very seriously. All work in this class must be your own. If you are unsure about the definition of academic dishonesty or plagiarism, go the University Office of Student Conduct website http://www.udel.edu/studentconduct/ai.html. Any cases of suspected academic dishonesty in this class will be referred to that office.

Topic Schedule (1st Half of Course)

Readings are on Sakai.

Tues Aug 28 **Intro**

Thurs Aug 30 **Neurons and Brain**
Reading: Text Chap 1
Quiz

Tues Sep 4 **Imaging the Brain: MRI/fMRI**

Text, Chap. 2, pp. 62-66
Text Chap. 3 pp. 68-85

Videos:
http://nancysbraintalks.mit.edu/video/what-fmri
http://nancysbraintalks.mit.edu/video/explaining-very-simple-fmri-experiment
http://nancysbraintalks.mit.edu/video/few-tips-critically-evaluating-fmri-studies (first 16 minutes only)

Essay: What is the bold signal? Why does fMRI have the spatial and temporal resolution that it has? What is the function of control conditions in fMRI in answering the question of which areas of the brain are activated during some cognitive process? What is reverse inference? Why is it difficult?

Thurs Sep 6 **Tour of the UD Center for Biomedical and Brain Imaging**

Class meets in CBBI Lobby at 11am sharp

Directions: http://live-cbbi.pantheon.io/directions/

Tues Sep 11 **Imaging the Brain: EEG/MEG/TMS**

Reading: Text, Chap. 2 pp. 49-51; Chap. 3 pp. 85-97
Luck, S. J. (2012). Event-related potentials. In H. Cooper, P. M. Camic, D. L. Long, A. T. Panter, D. Rindskopf, & K. J. Sher (Eds.), *APA handbook of research methods in psychology, Vol. 1. Foundations, planning, measures, and psychometrics* (pp. 523-546). Washington, DC, US: American Psychological Association.

Essay: What is EEG based on? What are the necessary conditions for generating measurable ERPs? What are ERP "components and how are they named? Why are ERP components negative vs. positive? Is it possible to "localize" ERP components? Why are ERPs based on averages? Describe something that puzzled you in the Luck paper.

Hint. In essay questions, you will sometimes see questions (as above) like "Is it possible to 'localize' ERP components?" Never just give a "yes" or "no" answer to these. I am much more interested in your reasoning than the yes or no part.

Thurs Sep 13 **EEG/ERP demo (Hoffman Lab,** Directions on Sakai**)**

Reading: Most, S. B., Chun, M. M., Widders, D. M., & Zald, D. H. (2005). Attentional rubbernecking: Cognitive control and personality in emotion-induced blindness. *Psychonomic Bulletin and Review*, 12, 654–661.

Essay: Give a brief summary (in your own words) of the Most et al. paper. As part of this, describe Figure 2 in their paper (your description should include an interpretation of what the various parts of the figure mean).

Tues Sep 18 **Basic Vision**

Reading: Text Chap. 5 pp. 136-155

Essay: Describe Fig. 5.11 (p. 148). Summarize the section on whether area V4 is a specialized module for coding color (pp 150-152). Describe a general principle that characterizes how the brain does perception.

Thurs Sep 20 **Recognizing Objects and Faces Part 1**

Reading Text Chap. 6 pp. 167-182

Videos: http://nancysbraintalks.mit.edu/video/modular-design-human-brain
http://nancysbraintalks.mit.edu/video/functional-specificity-what-it-means-and-what-it-doesn%E2%80%99t

Essay: What is the main difficulty in recognizing objects? Where does this process occur in the brain? How is the brain organized to accomplish object recognition? What is the evidence for your claim (hint: single unit recording, brain damage)? What is the "grandmother cell theory"? How would you know if it was true?

Tues Sep 25 **Recognizing Objects and Faces Part 2: Are faces special?**

Reading Text Chap. 6 pp. 182-193
McKone, E., Kanwisher, N., & Duchaine, B. C. (2007). Can generic expertise explain special processing for faces? *Trends Cogn Sci,* 11(1), 8-15.

Videos: http://nancysbraintalks.mit.edu/video/discovering-face-specific-region-fmri
http://nancysbraintalks.mit.edu/video/does-stimulation-face-area-change-appearance-faces-0

Essay: What is the main difficulty in recognizing objects? Where does this process occur in the brain? How is the brain organized to accomplish object recognition? What is the evidence for your claim (hint: single unit recording, brain damage)? What is the "grandmother cell theory"? How would you know if it was true?

Thurs Sep 27 **Counter Point: James Haxby**

Reading: Haxby, J. V., Gobbini, M. I., Furey, M. L., Ishai, A., Schouten, J. L., & Pietrini, P. (2001). Distributed and overlapping representations of faces and objects in ventral temporal cortex. *Science*, 293(5539), 2425-2430. (*difficult. Do your best).*

Videos: http://nancysbraintalks.mit.edu/video/multiple-voxel-pattern-analysis
http://nancysbraintalks.mit.edu/video/important-challenge-specificity-fusiform-face-area

Essay: Summarize the gist of Haxby's argument. What is Kanwisher's take on it? What do you conclude and why? Are there any additional studies you would want to do?

Tues Oct 2 **Visual attention part 1**

Reading TBA

Thurs Oct 4 **Visual attention part 2**

Reading TBA

Tues Oct 9 **Visual attention part 3**

Reading TBA

Thurs Oct 11 **Exam 2**