

PSYCH 891 – Cognitive Neuroscience of High-Level Vision and Memory Spring 2020

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Class times: Mondays 4 – 6.30 pm
Location: Tobin Hall 504
Moodle Page: <https://moodle.umass.edu/course/view.php?id=63051>
(please check Moodle Regularly)

Course Description and Objectives

This course will examine the neural mechanisms of higher-level vision and memory, and how they are studied using the methods of cognitive neuroscience. Topics will include object recognition and face processing, mechanisms of declarative memory in the brain, and non-mnemonic functions of the hippocampus and medial temporal lobe. We will examine these topics by reading primary research articles covering a range of methods, including neuroimaging, formal models of cognition and neuropsychology (i.e., lesion studies). The objectives are:

- *To provide an in-depth introduction to the research literature on the brain mechanisms of object recognition and declarative memory.*
- *To develop critical analytical skills for evaluating primary research articles*
- *To provide a thorough grounding in cognitive neuroscience methods, including (1) neuroimaging and recent techniques for analyzing neuroimaging data, (2) formal process models for building brain-based theories of cognition, and (3) the intersection of modeling with neuroimaging and other methods (e.g., neuropsychology, electrophysiology) to build concrete theories that account for convergent evidence from multiple methods and make testable predictions.*
- *To develop oral presentation skills and academic writing skills*

Course Requirements

Class Participation (30%)

This class is heavily discussion based. Each week we will read and discuss 2-3 primary research articles (depending on length and difficulty); some weeks one of the readings might be more lighthearted or you may be assigned a video to watch. Students are expected to contribute to the discussion in every class, with oral contributions reflecting that you have read the papers closely.

Weekly Written Comments or Summaries (20%)

There is a discussion forum on the Moodle page. By 8pm on the day before (Sunday), students should post either (1) a summary of each article (200-300 words), or (2) a comment/question relating to each article. Your comment could be a question asking for clarification on something you didn't understand, or a criticism (a problem with the method, or an alternative explanation for the results), or a suggestion about the relationship of the article to other research. Your comment could also be a response to someone else's question. The only stipulation is that your comments should demonstrate that you have read the papers closely. *If you choose to write summaries, you may send them to me by email* instead of posting on the forum, if you prefer.

In-Class Presentation (20%)

Each student will be required to present two primary research articles, one in each of two separate classes. Dates and articles will be assigned at the start of the semester. You may prepare a PowerPoint presentation or use other visual aids. If you do not use a pre-prepared visual display, it is expected that you will need to draw diagrams on the whiteboard/blackboard as you speak. The presentation should last ~20 minutes and include a summary of the motivation, methods and results of the paper, and a critical discussion/appraisal of the authors' interpretations. Your presentation may address questions posted by others on the Moodle page the night before, but you are not obliged to cover them all.

Final Paper (30%)

Students will write a final term paper on a topic that relates to material we have covered in class. The paper may take the form of a literature review, a plan for a novel experiment, or a grant proposal. The work you submit must be novel: it cannot closely resemble any document you have written prior to this class for another purpose (e.g., a previous NSF grant application or a paper for another class). Further details will be forthcoming during the semester. Papers are due on **Friday May 1st**, at 5pm, to be submitted electronically via Moodle.

Attendance Policy

Please do not text, surf the web, check email or work on other projects during class. I plan to keep the workload reasonable and the grading fair. I hope very much that the class will be interesting and useful to you. Respecting the class by not texting/web-surfing etc. is ***the most important thing that you can do*** to help me achieve this goal! No phones in the classroom, please.

If you know you are going to miss a class, please tell me in advance. Sometimes people get sick or have other emergencies, and if this happens once during the semester that's fine. However, more than one absence (unless you have good reason for your absences) will affect your participation grade. We have only 12 meetings. If you miss a day when you were supposed to lead the discussion, this will result in a zero for that presentation, unless you provide a university-sanctioned excuse.

Obtaining Reading Material

The articles for the class will be posted electronically on Moodle for you to download. Please have a copy of the articles available during class discussions, whether this means printing them out or bringing a laptop to class. Readings will be available a week ahead of time. Some material is listed as to be announced (TBA) on the syllabus; this will be filled in as the semester progresses. Some readings listed currently on the schedule may change. Moodle will have the finalized reading assignments for each class – please check it regularly.

Grading Scale

A	A-	B+	B	B-	C+	C	C-	D+	D	F
93-100	90-92.5	85-89.5	80-84.5	75-79.5	70-74.5	65-69.5	60-64.5	55-59.5	50-54.5	0-49.5

Scores will be rounded to the nearest whole number, ***after*** aggregating across assignments and ***before*** translating to a letter.

Policy on Grading for Class Participation and Written Comments

For both the *Written Comments* and the *Class Participation* part of your grade, I will drop the lowest score before averaging your scores (so if you miss one class due to illness, this absence won't count and you don't need to bring a doctor's note). If you miss more than one class, you'll need to account for your absences if you want to avoid a zero that cannot be dropped. If your Forum Comments are late but not too late (8pm Sunday - 12 noon Monday) your grade will be marked down by 5% (maximum score will be 9.5/10). If they are very late (after 12 noon Monday) your grade will be marked down by 10% (maximum score will be 9/10). If you don't make comments at all before class, you will score zero, or if you comment on only one of the two papers you can score only 5/10. No need to comment on the paper that you are presenting on the date you present.

Academic Honesty

Since the integrity of the academic enterprise of any institution of higher education requires honesty in scholarship and research, academic honesty is required of all students at the University of Massachusetts Amherst. Academic dishonesty is prohibited in all programs of the University. Academic dishonesty includes but is not limited to: cheating, fabrication, plagiarism, and facilitating dishonesty. Appropriate sanctions may be imposed on any student who has committed an act of academic dishonesty. Instructors should take reasonable steps to address academic misconduct. Any person who has reason to believe that a student has committed academic dishonesty should bring such information to the attention of the appropriate course instructor as soon as possible. Instances of academic dishonesty not related to a specific course should be brought to the attention of the appropriate department Head or Chair. Since students are expected to be familiar with this policy and the commonly accepted standards of academic integrity, ignorance of such standards is not normally sufficient evidence of lack of intent. The policy can be found here: http://www.umass.edu/dean_students/codeofconduct/acadhonesty/.

Pay special attention to plagiarism. Many students do not understand the extent to which "paraphrasing" the text in another author's work is **unacceptable** in academic assignments. This website from Indiana University explains plagiarism and how to avoid it: <http://www.indiana.edu/~wts/pamphlets/plagiarism.shtml>.

Accommodation Statement

The University of Massachusetts Amherst is committed to providing an equal educational opportunity for all students. If you have a documented physical, psychological, or learning disability on file with Disability Services (DS), you may be eligible for reasonable academic accommodations to help you succeed in this course. If you have a documented disability that requires an accommodation, please notify me within the first two weeks of the semester (by Tuesday 4th Feb) so that we can make appropriate arrangements.

SCHEDULE AND READINGS ON PAGES 4 - 6.

Tentative Schedule

Exact dates for specific topics may change.

Please ***check Moodle regularly*** for updates or changes, and to download the readings.

<u>Class</u>	<u>Date</u>	<u>Topic</u>	<u>Reading</u>
2	Mon 3 Feb	Gestalt Theory versus Encapsulated Perception	#thedress Michael Bach's website Firestone & Scholl (2016)
3	Mon 10 Feb	Representation of Object Form in Visual Cortex	Visual Agnosia Video (for context) Malach et al. (1995) Freud, Plaut & Behrmann (2016)
-	Mon 17 Feb	No Class, Presidents' Day	see next row
4	Tue 18 Feb <i>UMass Mon.</i>	Probing the Information Content of Visual Cortex	Haxby, Gobbini et al. (2001) Kay, Naselaris et al. (2008)
5	Mon 24 Feb	Object Recognition: Categories and Semantics	Sacks, O. (1985) <i>The Man Who Mistook His Wife for a Hat</i> Warrington and Shallice (1984) Farah et al. (1995)
6	Mon 2 Mar	Hyperalignment	Haxby, Guntupalli et al. (2011)
7	Mon 9 Mar	Models of Visual Object Recognition	Krizhevsky et al. (2012) Güçlü and Van Gerven (2015)
Spring Break			
8	Mon 23 Mar	Memory and the Medial Temporal Lobe	Video of Clive Wearing Scoville and Milner (1957) Squire & Zola-Morgan (1991)
9	Mon 30 Mar	Complementary Learning Systems / Dual-Process Memory Theories	McClelland et al. (1995) Diana et al. (2007)

10	Mon 6 Apr	Computational Models of Memory in the Medial Temporal Lobe	Norman and O'Reilly (2003) Cowell et al. (2006)
11	Mon 13 Apr	The Medial Temporal Lobe and Perception	Buckley, Booth et al. (2001) Barense, Groen et al. (2012)
	Mon 20 Apr	NO CLASS – Patriots' Day	see next row
12	Wed 22 Apr <i>UMass Mon</i>	Non-Mnemonic Functions of the Hippocampus	Hindy et al. (2016) Palombo et al. (2018)
13	Mon 27 Apr	Memory Function Outside of the MTL/Hippocampus	Ross et al. (2018) Cooke et al. (2015)

Reference List

(for readings listed so far)

Barense, M.D., Groen, I.I.A., Lee, A.C.H., Yeung, L.K., Brady, S.M., Gregori, M., et al. (2012) Intact memory for irrelevant information impairs perception in amnesia. *Neuron*, 75: 157–167.

Buckley, M.J., Booth, M.C., Rolls, E.T., & Gaffan, D. (2001). Selective perceptual impairments after perirhinal cortex ablation. *Journal of Neuroscience*, 21: 9824–9836.

Cooke SF, Komorowski RW, Kaplan ES, Gavnornik JP, Bear MF (2015) Visual recognition memory, manifested as long-term habituation, requires synaptic plasticity in V1. *Nat Neurosci*. Feb; 18(2): 262-71. doi: 10.1038/nn.3920.

<https://www.ncbi.nlm.nih.gov/pubmed/25599221>

Cowell RA, Bussey TJ, Saksida LM. (2006) Why does brain damage impair memory? A connectionist model of object recognition memory in perirhinal cortex. *J Neurosci*. 26(47):12186-97.

Diana, R.A., Yonelinas, A.P. and Ranganath, C. (2007) Adaptation to cognitive context and item information in the medial temporal lobes. *Neuropsychologia*. Nov; 50(13): 3062-9. doi: 10.1016/j.neuropsychologia.2012.07.035.

Farah MJ, Levinson KL, Klein KL. (1995) Face perception and within-category discrimination in prosopagnosia. *Neuropsychologia*, Jun; 33(6): 661-74.

Firestone, C. & Scholl, B. (2016) Cognition does not affect perception: Evaluating the evidence for "top-down" effects. *Behav Brain Sci*. Jan; 39: e229. doi: 10.1017/S0140525X15000965. [Only pages 1-19; the Open Peer Commentary is very much optional].

- Freud, E. Plaut, D.C. & Behrmann, M. (2015) 'What' Is Happening in the Dorsal Visual Pathway. *Trends Cogn Sci.* Oct; 20(10): 773-784. doi: 10.1016/j.tics.2016.08.003.
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- Hindy, N., Ng, F. & Turk-Browne, N. Linking pattern completion in the hippocampus to predictive coding in visual cortex. *Nat Neurosci* **19**, 665–667 (2016). <https://doi.org/10.1038/nn.4284>
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- Krizhevsky, Sutskever, Hinton, G (2012) ImageNet Classification with Deep Convolutional Neural Networks. *Advances in Neural Information Processing Systems* 25, 2012.
- Malach R, Reppas JB, Benson RR, Kwong KK, Jiang H, Kennedy WA, Ledden PJ, Brady TJ, Rosen BR and Tootell RB (1995). Object-related activity revealed by functional magnetic resonance imaging in human occipital cortex. *Proc Natl Acad Sci USA.* 92(18):8135-9.
- McClelland JL, McNaughton BL, O'Reilly RC (1995) Why there are complementary learning systems in the hippocampus and neocortex: insights from the successes and failures of connectionist models of learning and memory. *Psychol Rev.* 1995 Jul;102(3):419-457. doi: 10.1037/0033-295X.102.3.419.
- Norman KA, O'Reilly RC. (2003) Modeling hippocampal and neocortical contributions to recognition memory: a complementary-learning-systems approach. *Psychol Rev.* 110(4):611-46.
- D J Palombo, S M Hayes, K M Peterson, M M Keane, M Verfaellie, Medial Temporal Lobe Contributions to Episodic Future Thinking: Scene Construction or Future Projection?, *Cerebral Cortex*, 28 (2) February 2018, Pages 447–458, <https://doi.org/10.1093/cercor/bhw381>
- Ross, D.A., Sadil, P.S., Wilson, D.M. and Cowell, R.A. (2018) Hippocampal Engagement during Recall depends on Memory Content. *Cerebral Cortex*, 28(8): 2685–2698.
- Sacks, O. (1985) *The Man Who Mistook His Wife for a Hat.* (December 1985). ISBN 0-671-55471-9. Chapter 1.
- Scoville, WB, Milner, B (1957). Loss of recent memory after bilateral hippocampal lesions. *J Neurol Neurosurg Psychiatry.* 20(1):11-21.
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- Squire LR, Zola-Morgan S. (1991) The medial temporal lobe memory system. *Science.* 253(5026):1380-6.

Warrington & Shallice (1984) Category specific semantic impairments. *Brain*. 107 (Pt 3):829-54.