Seminar in Cognitive Neuroscience

Psychology 435
Spring 2012
Cudahy Hall 301
Wed 7:00-9:30p

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Course Description and Goals

The way that information is represented and processed in the brain is central to a broad range of topics in psychological science. In this course we will consider how the methods of cognitive neuroscience including brain imaging (e.g., EEG/ERP/ERO, fMRI, fNIRS, MEG, VBM) and dissociation-based techniques such as neuropsychology, TMS, or neurogenetics have revolutionized the exploration of these topics. We will pay particular attention to how these techniques can be used to understand higher-level cognition during development and in questions related to social psychology and psychopathology. Class participants will be introduced to these techniques, read, present, and discuss results from the primary literature, and also have an opportunity to develop an idea relating to their own research incorporating one or more of these methods.

Prerequisites

While there are no formal prerequisites for this course a strong background in research methods, cognitive psychology, and or neuroscience will help.

Materials

There is no required text for this course. Instead we will be reading articles from the primary literature and several edited book chapters. I will make these available on Blackboard.

Expectations

1. I expect you to be an intellectual partner in this class, being responsible for your own learning as well as that of others (including ME!). This includes thoroughly reading the assigned articles or chapters before class. I expect that when it is your turn to present you will seek my help in preparation and will make good use of the classes' time.
2. I expect you to come to class and be there the whole time. When you can't be in class I expect you to communicate that to me before your absence. When you are in class I expect you to be focused on class. No cell phones, texting, or emailing during class. Believe me, this hurts me even more than it hurts you and I will behave so I expect you to as well.
3. I expect academic honesty. Do your own work and cite other people's ideas correctly.
4. I expect us to laugh and have fun in each and every class!

Assignments & Assessment

1. ***Participation (10 pts).*** I expect you to be at class, have read the assigned readings prior to class, and actively participate in class discussion. There will be a sign up sheet to indicate your presence, it is your responsibility to initial this each and every time your are present.
2. ***Paper Discussion (30 pts).*** You will be responsible for leading discussion on two papers during the first 11 weeks of class. You should be prepared to take about 20-30 minutes to introduce the pape and lead a class discussion. This includes covering the authors' motivations including relevant background literature. You will also want to make sure the hypotheses and methods are clear and briefly summarize the results and what they mean. Remember, not everyone studies what you do, so make sure to communicate to the whole class. I think you will be most successful if you organize your remarks with a few PowerPoint slides. Lastly, you will lead a discussion of the paper with me, so it would be a good idea to have a couple of questions to ask the class to get things started. As a part of this you should plan to come to office hours *THE WEEK BEFORE* your week to go over your paper with me. If you can't come during my scheduled office hour (Tuesday 1-3p) we will find another time before the weekend. This can also be done via Skype for those not regularly on campus, but we still need to

schedule a time. Also, when you come in to discuss your second paper try to have some idea of what you will do for your final project.

3. ***Project Presentation (20 pts)***. As a part of the class you will be developing an idea related to your own research or interests that uses a Cognitive Neuroscience method. Ultimately you will work this idea into a NRSA Research Plan, but this presentation is for you to try out your idea on the class before you get too far along in writing. You should organize your remarks with a few PowerPoint slides much like in the paper discussion and cover similar topics; however, I don't see this presentation as a "speech", rather it should be an informal discussion for your to get good feedback. As a part of this you should plan to come to office hours *THE WEEK BEFORE* your week to go over your idea with me. If you can't come during my scheduled office hour we will find another time before the weekend.
4. ***Research Proposal (30pts).*** The single best thing you can do during your graduate school experience is to develop a research idea and obtain funding for the resulting project. The "Gold Standard" for this is the National Research Service Award (NRSA; http://grants.nih.gov/training/nrsa.htm) funded by many of the Institutes funded by the National Institute of Health (NIH). These awards are available at both the pre- and post-doctoral level. Typically people apply for the pre-doctoral award after their second year once they have an idea of where their research is headed. The post-doctoral award is usually applied for in your last year of graduate school once you have identified a potential post-doc mentor. Regardless of type, both are focused on *research* and *training*. Just like a non-training grant application you argue for why a particular problem is important and how you intend to address the problem with a set of studies. But you also describe what you will learn working on this project with the particular mentor at the specific institution.

   For this class I would like you to develop a project idea based on your research interests that uses a cognitive neuroscience method. The full NRSA application is quite involved, but for this class I just want you to develop the research plan, which is up to ten single-spaced pages. The plan includes: Specific Aims, Background and Significance, Research Design and Methods including a description of Preliminary Studies. You will also want to include a Literature Cited section (not included in the ten pages). The plan should be written in APA style including Literature Cited. The full instructions for an NRSA application may be found on Blackboard under assignments; however, you should pay particular attention to Part I. I will also provide you with several examples of research plans during the next couple of weeks.

   Given where you are at in your academic career it may more sense for you to develop some other type of proposal (e.g., National Science Foundation Graduate Research Fellowship; http://www.nsfgrfp.org/). If you think this is the case please speak with me.

Grading. Final Grades will be assigned as follows:

A:	93-100%
A-:	90-92.9%
B+:	87-89.9%
B:	83-86.9%
B-:	80-82.9%
C+:	77-79.9%
C:	73-76.9%
C-:	70-72.9%
D+:	67-69.9%
D:	60-66.9%
F:	less than 60%

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* Discussion to be lead by student

Focus on the introductions of the method-specific papers (e.g., Pascual-Leone et al., 1999), but these papers may aid you in understanding the methods used in the specific papers you are discussing in class.

WEEK DATE READINGS

1 1/18 Introduction to Cognitive Neuroscience

Morrison, R.G., & Knowlton, B.J. (2012). Cognitive neuroscience in higher cognition. In K.J. Holyoak & R.G. Morrison (eds.). *The Oxford Handbook of Thinking and Reasoning* (pp. 67-89). New York: Oxford University Press.

2 1/25 Neuroanatomy

Taber, K.H., & Hurley, R.A. (2012). Neuroanatomy for the psychiatrist. In *Textbook of Psychiatry. New York:* American Psychiatric Association, Inc./DOI: 10.1176/appi.books.9781585623402.338161

Mesulam, M. – M. (2000). Behavioral neuroanatomy: Largescale networks, association cortex, frontal syndromes, the limbic system, and hemispheric specialization. In M-Marsel Mesulam (Ed.), *Principles of behavioral and cognitive neurology (*pp. 1-120). New York, NY: Oxford University Press.

3 2/1 Cognitive Neuropsychology

Feinberg T.E., & Farah M.J. (1997). The development of modern behavioral neurology and neuropsychology. In T.E. Feinberg & M.J. Farah (Eds.), *Behavioral Neurology and Neuropsychology*. (pp. 3-23). New York, NY: McGraw-Hill.

Damasio, H., & Damasio, A.R. (2000). The lesion method in cognitive neuroscience. In T.E. Feinberg & M.J. Farah (Eds*.), Patient-based approaches to Cognitive Neuroscience.* (pp. 21-34). Cambridge, MA: MIT Press.

*Anderson, A, Phelps, E.A. (2001). Lesions of the human amygdala impair enhanced perception of emotionally salient events. *Nature, 411,* 305-9.

*Morrison, R.G., Krawczyk, D., Holyoak, K.J., Hummel, J.E., Chow, T., Miller, B., & Knowlton, B.J. (2004). A neurocomputational model of analogical reasoning and its breakdown in frontotemporal lobar degeneration. *Journal of Cognitive Neuroscience, 16,* 260

4 2/8 Virtual Lesion Methods & Structural Brain Imaging (VBM & DTI)

Pascual-Leone, A., Bartres-Faz, D., & Keenan, J. P. (1999). Transcranial magnetic stimulation: Studying the brain-behaviour relationship by induction of 'virtual lesions'. Philosophical Transactions of the Royal Society of London.Series B, Biological Sciences, 354(1387), 1229-1238. doi:10.1098/rstb.1999.0476

Ashburner, J., & Friston, K. J. (2000). Voxel-based morphometry—the methods. *NeuroImage, 11*(6 Pt 1), 805-821. doi:10.1006/nimg.2000.0582

Filler, A. (2009). Magnetic resonance neurography and diffusion tensor imaging: Origins, history, and clinical impact of the first 50,000 cases with an assessment of efficacy and utility in a prospective 5000-patient study group. Neurosurgery, 65(4 Suppl), A29-43. doi:10.1227/01.NEU.0000351279.78110.00

*Tsujii, T., Masuda, S., Akiyama, T., & Watanabe, S. (2010). The role of inferior frontal cortex in belief-bias reasoning: An rTMS study. *Neuropsychologia, 48*(7), 2005-2008. doi:10.1016/j.neuropsychologia.2010.03.021

*Dumontheil, I., Houlton, R., Christoff, K., & Blakemore, S. J. (2010). Development of relational reasoning during adolescence. *Developmental Science, 13*(6), F15-24. doi:10.1111/j.1467-7687.2010.01014.x; 10.1111/j.1467-7687.2010.01014.x

*Rogalski E J; Murphy C M; deToledo-Morrell L; Shah R C; Moseley M E; Bammer R; Stebbins G T (2009). Changes in parahippocampal white matter integrity in amnestic mild cognitive impairment: a diffusion tensor imaging study. *Behavioural neurology, 21,* 51-61.

5 2/15 Behavioral and Cognitive Neurogenetics

Green, A., & Dunbar, L. (2012). Mental function as genetic expression: Emerging insights from cognitive neurogenetics. In K.J. Holyoak & R.G. Morrison (eds.). *The Oxford Handbook of Thinking and Reasoning* (pp. 90-111). New York: Oxford University Press.

Tsankova, N., Renthal, W., Kumar, A., & Nestler, E. J. (2007). Epigenetic regulation in psychiatric disorders. *Nature Review Neuroscience, 8*(5), 355-367.

*Amir, R. E. Ruthie E. Amir, Van den Veyver, I.B., Wan, M., Tran, C.Q., Francke, U., & Zoghbi, H.Y. (1999). Rett syndrome is caused by mutations in X-linked MECP2, encoding methyl-CpG-binding protein 2. *Nature Genetics, 23,* 185−188.

*Tan, H. Y., Chen, Q., Sust, S., Buckholtz, J. W., Meyers, J. D., Egan, M. F., et al. (2007). Epistasis between catechol-O-methyltransferase and type II metabotropic glutamate receptor 3 genes on working memory brain function. *Proceedings of the National Academy of Sciences USA, 104*(30), 12536–12541.

6 2/22 Functional Brain Imaging: PET/fMRI/fNIRS

Raichle, M.E. (2000). Functional Imaging in cognitive neuroscience. In T.E. Feinberg & M.J. Farah (Eds.), *Patient-based approaches to Cognitive Neuroscience.* (pp. 21-34). Cambridge, MA: MIT Press.

Brown, G. G., Perthen, J. E., Liu, T. T., & Buxton, R. B. (2007). A primer on functional magnetic resonance imaging. *Neuropsychology Review*, *17*(2), 107–125. doi:10.1007/s11065–007-9028–8

Villringer, A., & Chance, B. (1997). Non-invasive optical spectroscopy and imaging of human brain function. *Trends in Neurosciences, 20*(10), 435-442.

*Kroger, J. K., Sabb, F. W., Fales, C. L., Bookheimer, S. Y., Cohen, M. S., & Holyoak, K. J. (2002). Recruitment of anterior dorsolateral prefrontal cortex in human reasoning: A parametric study of relational complexity. *Cerebral Cortex, 12,* 477-485.

*Tsujii, T., & Watanabe, S. (2010). Neural correlates of belief-bias reasoning under time pressure: A near-infrared spectroscopy study. *NeuroImage, 50*(3), 1320-1326. doi:10.1016/j.neuroimage.2010.01.026

7 2/29 Functional Brain Imaging: EEG/ERP/MEG

Luck, S. J. (2005). An introduction to the event-related potentials and their neural origins. In S.J. Luck, *An Introduction to the Event-Related Potential Technique.* (pp. 1-50). Cambridge, MA: MIT Press. Pay particular attention to pages 3-34.

Sauseng, P., & Klimesch, W. (2008). What does phase information of oscillatory brain activity tell us about cognitive processes? *Neuroscience and Biobehavioral Reviews, 32*(5), 1001-1013. doi:10.1016/j.neubiorev.2008.03.014

Baillet, S., Mosher, J. C., & Leahy, R. (2001). Electromagnetic brain mapping. *IEEE Signal processing magazine, 18*(6), 14-30.

*Vogel, E. K., McCollough, A. W., & Machizawa, M. G. (2005). Neural measures reveal individual differences in controlling access to working memory. *Nature, 438*(7067), 500-503. doi:10.1038/nature04171

*Voss, J. L., & Paller, K. A. (2009). An electrophysiological signature of unconscious recognition memory. *Nature Neuroscience, 12,* 349-355.

8 3/7 SPRING BREAK – NO CLASS

9 3/14 Social Cognitive Neuroscience

*Amodio, D.M., Master, S.L., Yee, C.M., Taylor, S.E. (2008). Neurocognitive components of the behavioral inhibition and activation systems: implications for theories of self-regulation. *Psychophysiology, 45,* 11-9.

*Saxe, R & Kanwisher, N. (2003). People thinking about thinking people: fMRI studies of theory of mind. *Neuroimage, 19,* 1835-42.

*Correll, J., Urland, G. L., & Ito, T. A. (2006). Event-related potentials and the decision to shoot: The role of threat perception and cognitive control. *Journal of Experimental Social Psychology, 42,* 120-128.

10 3/21 Developmental Cognitive Neuroscience

*Wright, S.B., Matlen, B.J., Baym, C.L., Ferrer, E., & Bunge, S.A. (2008). Neural correlates of fluid reasoning in children and adults. *Frontiers in Human Neuroscience,1.*

*Mills, D. L., Coffey-Corina, S., & Neville, H. J. (1997). Language comprehension and cerebral specialization from 13 to 20 months. *Developmental Neuropsychology, 13,* 397-445.

*Imada, T., Zhang, Y., Cheour, M., Taulu, S., Ahonen, A. & Kuhl, P. K. (2006). Infant speech perception activates Broca's area: a developmental magnetoencephalography study. *NeuroReport, 17,* 957-962.

11 3/28 Clinical Neuroscience

*Cannon, T. D. Thompson, P. M. van Erp, T. G. Toga, A. W. Poutanen, V. P. Huttunen, M. Lonnqvist, J. Standerskjold-Nordenstam, C. G. Narr, K. L. Khaledy, M. Zoumalan, C. I. Dail, R. Kaprio, J. (2002). Cortex mapping reveals regionally specific patterns of genetic and disease-specific gray-matter deficits in twins discordant for schizophrenia. *Proc Natl Acad Sci USA, 99,* 3228-33.

*Sonty, S. P., Mesulam, M. - M., Weintraub, S., Johnson, N. A., Parrish, T. B., & Gitelman, D. R. (2007). Altered effective connectivity within the language network in primary progressive aphasia. *The Journal of Neuroscience, 27*, 1334-1345.

*Bachman, P., Kim, J., Yee, C. M., Therman, S., Manninen, M., Lönnqvist, J., Kaprio, J., Huttunen, M. O., Näätänen, R., & Cannon, T. D. (2008). Abnormally high EEG alpha synchrony during working memory maintenance in twins discordant for schizophrenia. *Schizophrenia Research, 103*, 293-297.

12 4/4 Project Presentations

13 4/11 Project Presentations

14 4/18 Project Presentations

15 4/25 Project Presentations

16 5/2 A Moody Final

DATES ARE TENTATIVE. ASSIGNMENT DUE DATES MAY CHANGE DURING THE SEMESTER! I will communicate changes both in class and also on Blackboard.

16 January 2012