COGS 269: Cognitive Neuroscience, Spring 2018

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Meeting times: Tuesdays 10-1
Location: COB 262
Office hours: by appointment @ SSM 259A
Prerequisites: Some knowledge of basic neurophysiology and brain function.

Course Description:

This course is designed to give a comprehensive overview of human cognitive neuroscience research. The goal of this course is to prepare the student for conducting research in the cognitive and psychological sciences with a thorough overview of the literature, methodologies and debates in the field. Applications of cognitive neuroscience and their broad relationship to general principles of human cognition will also be discussed.

Specific topics that will be covered include measurement, perception, action, learning, memory language, and plasticity. Examples will be drawn from various pathologies to explain the function of the intact brain in cognition. A strong emphasis will be placed on using laboratory tools and techniques including EEG and TMS.

Specific Educational objectives:

- To provide a framework for the scientific study of human cognitive neuroscience.
- To expose the student to the latest developments and debates in the field.
- To apply this fundamental knowledge towards the study of specific functional behaviors using lab techniques learned during the semester.

Format of the course:

Although, bulk of the content of this course will be delivered through lectures, I am aiming for a fairly intimate atmosphere with lots of open discussions and debates. All course material will be made available on the web ahead of time.

- We will have lectures/tutorials in Jan/Feb.
- Following this (March-April) we will have intensive discussions/presentations on hotly contested topics in the area (worth 40% of your grade)
- The classes in April will be laboratory-centric and involve hand-on training on brain measurement and manipulation using EEG and TMS.
- Finally, you will do a comprehensive literature review of a topic in human cognitive neuroscience that is relevant to your own research. The review paper should be approximately 20 double-spaced pages + reference (worth 60%). The topic will be arrived at in consultation with the instructor.

Content:

There will be no official textbook for the course.
The following books are highly recommended for reference.

1) **Gazzaniga M, Ivry RB, Mangun, RM (2013) Cognitive Neuroscience: The biology of mind (Chapters 3,4,8)**

2) **Kandel, ER, Schwartz, J, Jessell, T (2000) Principles of Neural Science, 4th edition. http://www.amazon.com/Principles-Neural-Science-Eric-Kandel/dp/0838577016**

We will be following the structure of the following readings. You will be expected to read these ahead of the lectures/tutorials.

PHASE 1

Week 1 - 3

KEY PROBLEMS & BASIC NEUROPHYSIOLOGY

Background readings:

Gazzaniga MS, Ivry RB, Mangun R (2013). Cognitive Neuroscience: The biology of mind (Chapters 3,4,8)

General questions in Cognitive Neuroscience and Brain Anatomy, with a detailed introduction to human cognition, perception & action.

PHASE 2 (Student driven)

Week 4-5

ACTION NETWORKS IN THE BRAIN:

Background readings:

•   Rizzolatti, G., & Craighero, L. (2004). The mirror neuron system. Annual Reviews of Neuroscience, 27, 169-192.

•   Pulvermuller, F (2005) Brain mechanisms linking language and action. Nature Reviews Neuroscience. 6: 576-82.

Critical readings:

•   Hickok, G. (2009). Eight problems for the mirror neuron theory of action understanding in monkeys and humans. Journal of Cognitive Neuroscience, 21, 1229–1243.
•   Graziano, M. (2006). The organization of behavioral repertoire in motor cortex.

Annual Review of Neuroscience, 29, 105-134.
- Milner, AD & Goodale MA (2008). Two visual systems re-viewed. Neuropsychologia, 46(3),774-85.
- Hickok, G. & Poeppel, D. (2004). Dorsal and ventral streams: A framework for understanding aspects of the functional anatomy of language. Cognition, 92, 67-99.

Week 6,7

BRAIN and LANGUAGE

Gazzaniga textbook Chapter on Language (to be presented by students).

Week 8

Review

PHASE THREE
LABORATORY TRAINING

Week 9

TRANSCRANIAL MAGNETIC STIMULATION

- Hallett, M (2007). Transcranial Magnetic Stimulation: A Primer. *Neuron* 55: 187-99.
- Fadiga L, Craighero L, Olivier E. (2005) Human motor cortex excitability during the perception of others' action. *Current Opinion in Neurobiology*. 2005 15: 213-8.

Week 10

ELECTROPHYSIOLOGY AND BRAIN MEASUREMENT

- Teplan M (2002) Fundamentals of EEG measurement. *Measurement Science* review, volume 2, section 2, 2002.
- Delorme A, Makeig S. EEGLAB: an open source toolbox for analysis of single-trial EEG dynamics (557kB, .pdf) *J Neurosci Methods*, 134:9-21, 2004.
- Makeig S, Debener S, Onton J, Delorme A, Mining event-related brain dynamics, *Trends in Cognitive Science*, 8(5):204-210, 2004.

    Followed by EEG LAB and tutorial on EEG measurement.
    Plus lots of practical guides/Manuals to be posted on course website.

FINAL PAPER due on May 1, 2018.