NEUROIMAGING
PSYC 555 Spring 2013

Time: 4:30pm-7:10 pm Thurs
Classroom: David King Hall 2073
Instructor: James Thompson
2056 David King Hall
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Email: jthompsz@gmu.edu
Office Hours: 3:30pm-4:30pm Thurs

Objectives:
Brain imaging methods, particularly functional magnetic resonance imaging (fMRI), structural MRI, and event-related potentials (ERPs), are becoming common tools to study specialized human brain regions involved in cognitive functions. This course will cover: a brief overview of fMRI methods, experimental design and analysis issues in fMRI, structural MRI techniques and how they can contribute to cognitive neuroscience, and an overview of ERP methods. Throughout the course we will discuss the merits and limitations of neuroimaging as a tool for cognitive neuroscientists. By the end of the class, students should be able to read, understand and critique papers in brain imaging, and have a reasonable understanding on how to successfully design and analyze a neuroimaging study.

Required Readings:

Additional papers for presentations/discussion will be available via the course website.

Format:
This course will consist of a few lectures that cover particular technical areas, but the majority of the course will consist of discussion driven by students presenting papers. As many of the concepts that will be covered may be new to most of you, I expect everyone to have read the assigned papers before the class. Prerequisites for the course are: basic (undergraduate level) knowledge of cognitive psychology and neuroscience (or physiological psychology), or willingness to cover this ground through your own reading. A willingness and ability to do extensive research outside the assigned reading, seek assistance if you are finding any area difficult, and participate in class discussion, is essential.

Attendance Policy:
Although you will not be graded on attendance, this is a graduate level course and I expect to see you in class each week.

GMU Honor Code:
George Mason University has a code of Honor that each of you accepts by enrolling as a student. You should read and become familiar with this code at http://mason.gmu.edu/%7Emontecin/plagiarism.htm. The expectation is that all of the work you do for this class will be the work of one individual. However, you are fully encouraged to discuss the readings and topics raised in this class with your fellow students.

Disabilities:
If you are a student with a disability and you need academic accommodations, please see me and contact the Disability Resource Center (DRC) at 703-993-2474. All academic accommodations must be arranged through that office.

Assessment: Assessment will consist of two take-home quizzes (20%), a class presentation and opinion paper (20%), class participation (20%), and a group project (40%).

Class Presentation & Opinion Paper 20%
Most of this class will consist of discussion of papers. You will be expected to give a brief (10 minute maximum) presentation from the assigned readings (either from the Special Topics or the Neuroimaging Controversy sections) and then lead the discussion. I have chosen each of the readings with a specific goal in mind, and many of the readings may contain information that is unfamiliar to you, so it is essential that you briefly discuss with me your paper before your presentation.

Along with your presentation you will be required to write a brief (1000 words maximum) opinion paper about the topic of your presentation.

Class Participation 20%
Keep in mind, if you are not presenting a paper that week make sure you come to class with opinions about the papers we will discuss!

Take-home Quizzes 20%
The take home quizzes will consist of short answer items based on material covered in the classes.

Group Project 40%
During the course of the semester you will design, conduct, and analyze a basic fMRI experiment examining the brain response to faces versus houses. Groups of three students will work together to decide on the study design, analyze the data, and present the results to the class. Each team member will then prepare their own written report of the project.

Grades:
Total 100 points, letter grades as follows:
A: 90-100    B-: 77-79
A-: 87-89    C: 70-76
B+: 84-86    F: 0-69
**Important Dates**
Last day to drop without penalty Sep 2; Last day to drop Sep 26; Thanksgiving Nov 26-30.

**SCHEDULE OF CLASSES**

**Weeks 1 & 2:**
**Basics of the MR Signal**
What is MRI and how does it work? Overview of topics, assignment of presentations.

[ Lecture Notes for Weeks 1&2 ]

**Week 3**
**From MR Signal to Images**
What is k-space? Slices, Volumes, Voxels.
Take home quiz #1

http://www.revisemri.com/tutorials/what_is_k_space/
http://www.revisemri.com/tutorials/how_k_space_works/

[Lecture Notes]

**Week 4:**
**Physiology & Metabolics of fMRI**
What is the Blood Oxygen Level Dependent (BOLD) response? What is the contribution of neuronal spiking vs local field potentials?

**Week 5:**
**fMRI Design and Analysis I**
Safety issues in MRI research. Sources of noise in fMRI. Preprocessing – motion correction, slice timing, etc.

**Week 6:**
**fMRI Design and Analysis II**
Basic fMRI designs.
Take home quiz #2

**Week 7:**
**fMRI Design and Analysis III**
GLM and multiple comparisons.
Week 8:
**Neuroimaging Controversy: Voxel-wise Factorial Models vs Independently Identified Regions of Interest.**
What is the best strategy for the analysis of fMRI data?


Week 9:
**Special Topic Area: Retinotopic/Spatiotopic mapping.**
Phase-encoding imaging


Week 10:
**Special Topic Area: fMRI Adaptation and Repetition Effects**
Am I ever going to see your face again?


Week 11:
Special Topic Area: Multivoxel Pattern Analysis
Decoding stimuli from neural signals


Week 12:
Event-Related Potentials.
How do we measure event-related potentials and what do they mean?


Weeks 13-14:
Class Presentations