PSYC 60
Human Brain Mapping
Winter 2015

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Course Description:
This course will focus on how functional magnetic resonance imaging (fMRI) is used to understand human brain function. We will first examine what fMRI is, how the machine works, and how 'data' is generated and processed. Next, we will discuss how fMRI technology can be used to gain understanding of how the human brain operates, by covering topics of experimental design, analysis, and problems inherent to brain imaging research. As a class, we will collect a dataset of fMRI scans, and students will have an opportunity to operate the fMRI machine and be an experimental subject. Following data collection, we will conduct hands-on lab sessions where students will learn to analyze fMRI data, run statistical tests, and write up experimental results.

Class Periods:
Tuesday & Thursdays, 2:00-3:50
X-hour: Wednesdays, 4:15-5:05

Textbook:
Huettel, S. A., Song, A. W., & McCarthy, G. (2008). Functional Magnetic Resonance Imaging. 3rd Edition. Sinauer Associates: Sunderland, MA.

Reading from this textbook should be completed *prior to* each scheduled lecture.

Grading:
Exam 1: 30%
Exam 2: 30%
Class experiment write-up: 30%
Participation in class experiment data collection: 10%

Exams:
Exam questions will be multiple-choice, short-answer, and long-answer, based on lecture materials and the assigned reading for lecture days prior to the exam. Details on the experiment write-up will be distributed mid-course. There will *not* be a cumulative final exam.

Class experiment write-up:

During this course, we will conduct a class fMRI experiment and analyze the data. This process will culminate in the class experiment write-up. The write-up will consist of sections describing the methods we used to conduct our experiment, and the results that we found. The write-up should contain a level of detail and completeness similar to articles published in the empirical literature (we will give you examples). Write-ups will be graded based on completeness, correctness, and accuracy of data analysis results and figures.

Course schedule:

Unit 1: fMRI: What is it and how does it work?

Date	Location	Topic	Reading
Tues, Jan 6	110 Moore	Course introduction	
Thurs, Jan 8	110 Moore	fMRI safety training How MRI scanners work	Chapters 1 & 2
Tues, Jan 13	110 Moore	MRI signal generation & formation	Chapters 3 & 4 (pp. 57-68, 89-97)
Wed, Jan 14		fMRI Data Collection (1)	
Thurs, Jan 15	110 Moore	Types of MRI images Neural activity in the human brain	Chapters 5 & 6 (pp. 121-134, 147-156, 159-193)
Tues, Jan 20	110 Moore	How neural activity can be detected by the fMRI scanner	Chapter 7 (pp. 211-238)
Wed, Jan 21		fMRI Data Collection (1)	
Thurs, Jan 22	110 Moore	**UNIT 1 EXAM**	

Unit 2: fMRI experiments, class project data collection and analysis.

Unit 2 will be a mixture of lectures and hands-on labs devoted to understanding fMRI data analysis from a conceptual level. The objective of lab sessions is to provide you with rationale for the data analysis processes we will perform, as well additional tutorials on how to perform group level statistics. However, you will be expected to complete your own data analysis for your experiment write-up *on your own time*. Expect to spend additional time in the computer lab. The TA will be available to assist you during office hours and by appointment.

During X-hours and some class times, we will use the fMRI scanner to collect an fMRI data set that will be used for the remainder of the course. You will have an opportunity to be an fMRI subject (i.e., get scanned) and be an fMRI experimenter (i.e., operate the fMRI scanner). We will ask you to sign up to attend fMRI scanning for two hours (note: this is subject to change depending on course enrollment). Ideally, you will be a participant for one scan and be the experimenter for the other scan. If you are unable to participate as a subject (e.g., you have metal in your body, are claustrophobic, etc.) or choose not to be a participant, then your two hours will be used as an experimenter only. Your participation will be worth 10% of your grade. Attending and actively participating in your data collection times will earn you full credit.

For logistical reasons, the labs are self-paced. Therefore, you will not miss content while you are scanning or being scanned. Additionally, there are two major aspects of fMRI data collection and analysis that we will cover in this course: (1) What are the steps and *how* do we implement them via computers and software packages? Unit 2 covers this part. (2) Why do we do these steps (i.e., what is the purpose of motion correction, normalization, smoothing, etc)? Unit 2 also covers the rationale behind the computer magic.

Date	Location	Topic	Reading
Tues, Jan 27	110 Moore	Spatial & Temporal resolution of fMRI Signal & Noise in fMRI	Chapters 7 & 8 (pp. 238-265, 271-295)
Wed, Jan 28		fMRI Data Collection (1)	
Thurs, Jan 29	453 Moore	LAB: Introduction to Unix, Matlab, SPM fMRI Data Collection (2)	
Tues, Feb 3	453 Moore	fMRI data preprocessing I LAB: fMRI Preprocessing fMRI Data Collection (1)	Chapter 8 (pp. 295-319)
Wed, Feb 4		fMRI Data Collection (1)	

Thurs, Feb 5	453 Moore	fMRI data preprocessing II LAB: fMRI Preprocessing fMRI Data Collection (1)	
Tues, Feb 10	453 Moore	Experimental design	Chapter 9
Wed, Feb 11		fMRI Data Collection (1)	
Thurs, Feb 12	453 Moore	The general linear model LAB: General linear model	Chapter 10 (pp. 362-394)
Tues, Feb 17	453 Moore	LAB: General linear model fMRI Data Collection (2)	
Wed, Feb 18		fMRI Data Collection (1)	
Thurs, Feb 19	453 Moore	LAB: fMRI data processing	
Tues, Feb 24	453 Moore	Statistical tests & ROIs LAB: ROI analysis	Chapter 10 (pp. 394-408)
Thurs, Feb 26	453 Moore	LAB: fMRI data processing	
Tues, Mar 3	453 Moore	LAB: fMRI data processing	
Thurs, Mar 5	453 Moore	Data analysis wrap-up and help session	
Tues, Mar 10	110 Moore	**UNIT 2 EXAM and CLASS EXPERIMENT WRITE-UP DUE**	