PSYC 60
Human Brain Imaging
Fall 2012

Professor:

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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. Second Edition. Sinauer Associates: Sunderland, MA.

When possible 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 and/or short-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 8	150 Moore	Course introduction	
Thurs, Jan 10	150 Moore	How MRI scanners work MRI Safety Training	Chapters 1 & 2
Tues, Jan 15	150 Moore	MRI signal generation & formation	Chapters 3 & 4 pp. 57-67, 89-97
Thurs, Jan 17	150 Moore	Types of MRI images Neural activity in the human brain	Chapters 5 & 6 pp. 121-132, 138-142, 147-156, & all of Chpt. 6
Tues, Jan 22		How neural activity can be detected by the fMRI scanner	Chapters 6 & 7
Thurs, Jan 24	150 Moore	**UNIT 1 EXAM**	

Unit 2: Class project data collection.

During this section of the course, 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).

During class times from January 29 – Feb 12, and possibly during some additional daytime and evening hours, you will participate in the data collection process. We will ask you to sign up to attend fMRI scanning for a total of four 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 other scans. 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 four hours will be used as an experimenter only.

During Unit 2, there will be no exams. However, your participation will be worth 10% of your grade. Attending and actively participating in your data collection times will earn you full credit.

Date	Location	Topic	Reading
Tues, Jan 29	Scanner 453 Moore	fMRI Data collection LAB 1: Introduction to Unix, Matlab, SPM	
Thurs, Jan 31	453 Moore	fMRI Data collection LAB 1: Introduction to Unix, Matlab, SPM	
Tues, Feb 5	150 Moore	Preprocessing	Chapter 10
Thurs, Feb 7	453 Moore	fMRI Data Collection LAB 2: fMRI preprocessing	
Tues, Feb 12	453 Moore	fMRI Data Collection LAB 2: fMRI preprocessing	

For logistical reasons, the labs are duplicated. 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 3 covers the rationale behind the computer magic.

Unit 3: fMRI experiments, data analysis & class project data analysis

Unit 3 will be a mixture of lectures and hands-on labs devoted to understanding fMRI data and how it is processed. The objective of lab sessions is to provide you with rationale for the data analysis processes we will perform, as well as a tutorial on how to execute these processes. 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 all X-hours and by appointment.

Date	Location	Topic	Reading
Thurs, Feb 14	150 Moore	Spatial & Temporal resolution of fMRI Signal & Noise in fMRI	Chapters 8 & 9
Tues, Feb 19	150 Moore	Experimental design	Chapter 11
Wed, Feb 20		Optional: Make-up LABS 1-2	
Thurs, Feb 21	150 Moore	The general linear model	Chapter 12 p. 336-342
Tues, Feb 26	453 Moore	LAB 3: General linear model	Chapter 12 p. 323-336, p. 343-357
Thurs, Feb 28	453 Moore	LAB 4: Statistical tests & Contrasts	
Tues, March 5	453 Moore	LAB 5: Group Analyses	
Wed, March 6	453 Moore	Optional: Make-up LABS 3-5	
Thurs, March 7	150 Moore	**UNIT 3 EXAM and CLASS EXPERIMENT WRITE-UP DUE**	