NEUROIMAGING
PSYC 555 Fall 2015

Time:	10:30pm-1:10 pm Thurs
Classroom:	Enterprise Hall 275
Instructor:	**James Thompson**
	2056 David King Hall
	Ph: 703-993-9356
	Email: jthompsz@gmu.edu
Office Hours:	2:30pm-3:30pm 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:
Huettel SA, Song AW, McCarthy G (2014). *Functional Magnetic Resonance Imaging 3rd Edition*. Sunderland, MA: Sinauer.

It is important to keep up with the reading, especially the assigned chapters from Huettel et al. This book does have a conceptual path and a quantitative path, so try at least to keep up the conceptual path. If you are struggling to keep up, make sure to let me know early!

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 consistent of discussion of papers. You will be expected to give a brief (10 minute **maximum**) presentation from the assigned readings (from the Special Topics 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 analyze a basic fMRI experiment examining the brain response to faces versus houses. Groups of three students will work together to decide on the analysis methods, 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
B: 80-83	

Important Dates: Last day to add: Sep 8th. Last day to drop Oct 2nd. Labor Day Sep 7th. Thanksgiving Nov 25th- Nov 29th.

SCHEDULE OF CLASSES

Sep 3, Sep 10 (Weeks 1 & 2)
Basics of the MR Signal
What is MRI and how does it work? Overview of topics

Huettel, Song, & McCarthy (2014) — **Chapters 2-3** (**Note:** it is important to read both these chapters before week 1, otherwise you might find it tough going. However, you can focus on the conceptual path for week 1, then dip into the quantitative path for week 2).

Sep 17 (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/

Huettel, Song, & McCarthy (2014) — **Chapters 4-5** (**Again**, focus on the conceptual path first

Sep 24 (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?

Huettel, Song, & McCarthy (2014) **Chapters 6-7**

Oct 1 (Week 5)
fMRI Design and Analysis I
Safety issues in MRI research. Sources of noise in fMRI. Preprocessing – motion correction, slice timing, etc.
Huettel, Song, & McCarthy (2014) **Chapter 8**

Oct 8 (Week 6)
fMRI Design and Analysis II
Basic fMRI designs.
Take home quiz #2

Huettel, Song, & McCarthy (2014) **Chapters 9**

Oct 15 (Week 7)
fMRI Design and Analysis III
General Linear Model

Huettel, Song, & McCarthy (2014) **Chapters 10**

Oct 22 (Week 8)
Special Topic Area: The Multiple Comparisons Problem

Oct 29 (Week 9)
Special Topic Area: Factorial Designs, Independent Localizers, and Circularity.

Nov 5 (Week 10)
Special Topic Area: Resting State fMRI

Nov 12 (Week 11)
Special Topic Area: Multivoxel Pattern Analysis

Huettel et al (2008). Chapter 11 pages 408-415

Haxby JV, Gobbini MI, Furey ML, Ishai A, Schouten JL, Pietrini P. (2001). Distributed and overlapping representations of faces and objects in ventral temporal cortex. Science. 293, 2425-30.

Nov 19 (Week 12)
EEG and Event-Related Potentials.

Luck, SJ. An Introduction to the Event-Related Potential Technique. Oxford: Oxford University Press. Ch 1

Nov 26 **THANKSGIVING**

Dec 3, Dec 10 (Weeks 13-14)
Class Presentations