NEUROIMAGING
PSYC 555 Fall 2016

Time: 4:30pm-7:10pm Mon
Classroom: Research Hall 201
Instructor: **James Thompson**
2056 David King Hall
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Email: jthompsz@gmu.edu
Office Hours: 11:30am-12:30pm Thurs or by appointment

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.

Access to Computers
Students must have access to their GMU Email account. Students should feel free to communicate with me via email. Updates and notifications will be sent to the class email list using your GMU email address. If you need to use university facilities, you can find out about location and hours of university facilities at http://www.labs.gmu.edu/ or ask at the information desk at the Johnson Center. I will ONLY use your GMU Email address to contact you. Please use and check this address frequently. You may forward your GMU email to another address if you like, but please ensure that you are receiving the email to your GMU Email address.

Cancellation Policy
In case class needs to be canceled due to an unexpected event, students will be informed via email as soon as possible. Make-up sessions will be arranged for canceled classes.

Technology
Powerpoint will be used to present class materials.

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%).

Technology
Powerpoint will be used to present class materials.

Class Presentation & Opinion Paper 20%
Much 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 using data from the Human Connectome Project. 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 6th. Last day to drop Sep 30th. Labor Day Sep 5th. Thanksgiving Nov 23rd - Nov 27th.

SCHEDULE OF CLASSES

Aug 29, Sep 12 (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 19 (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 26 (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 3 (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 11 (Week 6) Columbus Day Week
fMRI Design and Analysis II
Basic fMRI designs.
Take home quiz #2

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

Oct 17 (Week 7)
fMRI Design and Analysis III
General Linear Model

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

Oct 24 (Week 8)
Special Topic Area: The Multiple Comparisons Problem

Oct 31 (Week 9)
Special Topic Area: Factorial Designs, Independent Localizers, and Circularity.

Nov 7 (Week 10)
Special Topic Area: Resting State fMRI

Nov 14 (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 21 (Week 12)
The Human Connectome Project

Nov 28 (Week 13)
EEG and Event-Related Potentials.

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

Dec 5 (Week 14)
Class Presentations