Syllabus – Fall 2018

Excluding materials for purchase, syllabus information may be subject to change. The latest version of the syllabus will be available on HuskyCT.

Course and Instructor Information

Course Title: Special Topics in Cognitive Science: Neuroimaging Methods  
Credits: 3  
Format: lecture  
Prerequisites: Instructor consent required. A working knowledge of a Unix command line interface is strongly recommended.  
Professor: Roeland Hancock, PhD  
Location: Arjona 307  
Time: Tuesday 2:00-5:00pm

Email: For private questions, please email Roeland.Hancock@uconn.edu. Most questions should be posted on Slack so that other students can benefit from the discussion. Responses will be provided within 24 hours.  
Telephone: Office phone 860-486-4042  
Slack: @rhancock. You will be added to the course Slack discussion group.  
Office Hours/Availability: PCSB 142A. Hours by appointment, https://tinyurl.com/visitrh

Course Materials

A macOS or Linux (or Windows 10 with Ubuntu) laptop should be brought to class for in-class exercises. If this is not possible for you, please let me know as soon as possible.

Required course materials should be obtained as early as possible.

Texts are available through a local or online bookstore, such as Amazon.com. The book can be purchased in any format, e-reader, paperback, used, hardcover, etc. The UConn Co-op carries many materials that can be shipped via its online Textbooks To Go service. For more information, see Textbooks and Materials on our Enrolled Students page.

Required Materials:  

Course Description

Short description  
PSYC5171. Special Topics in Neuroimaging Methods.  
Three credits. Instructor consent required.

A hands-on introduction to the design and analysis of neuroimaging experiments.

Extended description  
Neuroimaging, particularly techniques based on magnetic resonance imaging (MRI), is a powerful technique for addressing empirical questions in cognitive neuroscience. However, MRI is also a complex technique with rapidly evolving best practices. This course will prepare you to turn theoretical questions into rigorous neuroimaging
This course addresses three themes that are critical to successful neuroimaging research:

**The origins of MRI signal.**
MRI signals are extremely noisy, indirect correlates of the neural processes that are usually of theoretical interest. This course will provide a basic introduction to the physics of MRI and the limitations of MRI as a research tool. The design of an MRI experiment involves many choices, each with their own tradeoffs, and very few universally correct choices. We will discuss the basic physics of MRI signals, the origins of design tradeoffs, and the consequences of design decisions. This will provide a foundation for making informed decisions in the design of your own experiments, and critically evaluating the methods and theoretical implications of extant MRI literature.

**Reproducibility and Computing Skills.**
There is increasing recognition that many studies in psychology, cognitive neuroscience and other fields have fallen short of scientific ideals, raising serious questions about the knowledge contributed by past findings. Addressing this issue requires multiple changes to the way science is done. This course will address one of these—the need for internal reproducibility through sound computing practice. This is particularly important for modern complex neuroimaging pipelines and the high value in reusing and sharing neuroimaging data. This course will cover the basic programming skills needed to create flexible, automated, and reproducible analysis scripts; the use of version control and software containers to preserve the reproducibility and provenance of your data and analysis. Programming, in any language, is an essential skill in modern science.

**Using MR Analysis Software.**
Through in-class exercises and homework, this course will provide a hands-on introduction to using common software packages, such as AFNI and FSL. You will create flexible, reproducible pipelines for a variety of common analysis steps (e.g. preprocessing, quality control, single subject and group statistics).

### Course Objectives

This course will prepare students to conduct cognitive neuroscience research using magnetic resonance imaging (MRI) techniques. Upon completion, students will be able to:

- understand the origins of MRI signals
- design functional MRI experiments
- use selected software packages to analyze MRI data
- develop workflows to support reproducible science

### Course Outline and Calendar

Course schedule is subject to change.

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Topic</th>
<th>Homework</th>
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<tbody>
<tr>
<td>1</td>
<td>27-Aug</td>
<td>Introduction to MR Physics</td>
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<tr>
<td>2</td>
<td>3-Sep</td>
<td>Introduction to Computing</td>
<td></td>
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<tr>
<td>3</td>
<td>10-Sep</td>
<td>Reproducibility and data management</td>
<td></td>
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<tr>
<td>4</td>
<td>17-Sep</td>
<td>fMRI Experimental Design</td>
<td>HW1 Due</td>
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<td>5</td>
<td>24-Sep</td>
<td>Design optimization</td>
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<tr>
<td>6</td>
<td>1-Oct</td>
<td>fMRI preprocessing</td>
<td></td>
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<tr>
<td>7</td>
<td>8-Oct</td>
<td>Quality control</td>
<td></td>
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<tr>
<td>8</td>
<td>15-Oct</td>
<td>Single subject statistics</td>
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<tr>
<td>9</td>
<td>22-Oct</td>
<td>Multiple comparisons</td>
<td>HW2 Due</td>
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<tr>
<td>10</td>
<td>29-Oct</td>
<td>Group analysis</td>
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<tr>
<td>11</td>
<td>5-Nov</td>
<td>Diffusion MRI</td>
<td>HW3 Due</td>
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<tr>
<td>12</td>
<td>12-Nov</td>
<td>Diffusion models</td>
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### Summary of Course Grading:

<table>
<thead>
<tr>
<th>Course Component</th>
<th>Weight</th>
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<tbody>
<tr>
<td>Participation</td>
<td>.5</td>
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<tr>
<td>Homework</td>
<td>.5</td>
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### Participation

You are expected to attend and fully participate in every class meeting unless prior arrangements have been made. A portion of your grade will be based on your engagement with in-class discussions.

### Grading

Homework assignments. Full credit will be awarded for timely, documented efforts to fully complete the assignment in accordance with directions.

### Grading Scale

- The letter “A” represents work of distinction.
- The letter “B” represents work of good quality, such as is expected of any successful graduate student.
- The letter “C” represents work below the standard expected of graduate students in their area of study.
- The letter “D” represents work of unsatisfactory quality.
- The letters “F” and “U” signify failure in the course and necessitate a recommendation by the advisory committee to the Graduate School as to whether or not the student shall be permitted to continue graduate study.

### Student Responsibilities and Resources

As a member of the University of Connecticut student community, you are held to certain standards and academic policies. In addition, there are numerous resources available to help you succeed in your academic work. This section provides a brief overview to important standards, policies and resources.

### Student Code

You are responsible for acting in accordance with the [University of Connecticut's Student Code](#). Review and become familiar with these expectations. In particular, make sure you have read the section that applies to you on Academic Integrity:

- [Academic Integrity in Undergraduate Education and Research](#)
- [Academic Integrity in Graduate Education and Research](#)

Cheating and plagiarism are taken very seriously at the University of Connecticut. As a student, it is your responsibility to avoid plagiarism. If you need more information about the subject of plagiarism, use the following resources:

- [Plagiarism: How to Recognize it and How to Avoid It](#)
- [University of Connecticut Libraries' Student Instruction](#) (includes research, citing and writing resources)

### Copyright
Copyrighted materials within the course are only for the use of students enrolled in the course for purposes associated with this course and may not be retained or further disseminated.

Adding or Dropping a Course

If you should decide to add or drop a course, there are official procedures to follow:

- Matriculated students should add or drop a course through the Student Administration System.
- Non-degree students should refer to Non-Degree Add/Drop Information located on the registrar’s website.

You must officially drop a course to avoid receiving an "F" on your permanent transcript. Simply discontinuing class or informing the instructor you want to drop does not constitute an official drop of the course. For more information, refer to the:

- Undergraduate Catalog
- Graduate Catalog

Academic Calendar

There are important dates and deadlines for each semester and session classes are offered:

- Fall and Spring Semester
- Summer Session
- Winter Session

Academic Support Resources

Technology and Academic Help provides a guide to technical and academic assistance.

Students with Disabilities

Students needing special accommodations should work with the University's Center for Students with Disabilities (CSD). You may contact CSD by calling (860) 486-2020 or by emailing csd@uconn.edu. If your request for accommodation is approved, CSD will send an accommodation letter directly to your instructor(s) so that special arrangements can be made. (Note: Student requests for accommodation must be filed each semester.)

Policy against Discrimination, Harassment and Inappropriate Romantic Relationships

The University is committed to maintaining an environment free of discrimination or discriminatory harassment directed toward any person or group within its community – students, employees, or visitors. Academic and professional excellence can flourish only when each member of our community is assured an atmosphere of mutual respect. All members of the University community are responsible for the maintenance of an academic and work environment in which people are free to learn and work without fear of discrimination or discriminatory harassment. In addition, inappropriate Romantic relationships can undermine the University’s mission when those in positions of authority abuse or appear to abuse their authority. To that end, and in accordance with federal and state law, the University prohibits discrimination and discriminatory harassment, as well as inappropriate Romantic relationships, and such behavior will be met with appropriate disciplinary action, up to and including dismissal from the University. Refer to the Policy against Discrimination, Harassment and Inappropriate Romantic Relationships for more information.

Sexual Assault Reporting Policy

To protect the campus community, all non-confidential University employees (including faculty) are required to report assaults they witness or are told about to the Office of Diversity & Equity under the Sexual Assault Response Policy. The University takes all reports with the utmost seriousness. Please be aware that while the information you provide will remain private, it will not be confidential and will be shared with University officials who can help. Refer to the Sexual Assault Reporting Policy for more information.
Students will be provided an opportunity to evaluate instruction in this course using the University's standard procedures, which are administered by the Office of Institutional Research and Effectiveness (OIRE).

Additional informal formative surveys may also be administered within the course as an optional evaluation tool.