Research Methods of Cognitive Neuroscience Syllabus

Department of Psychology and Neuroscience

PSYO/NESC 3137 Fall 2026

Dalhousie University operates in the unceded territories of the Mi'kmaw, Wolastoqey, and Peskotomuhkati Peoples. These sovereign nations hold inherent rights as the original peoples of these lands, and we each carry collective obligations under the Peace and Friendship Treaties. Section 35 of the Constitution Act, 1982, recognizes and affirms Aboriginal and Treaty rights in Canada.

We recognize that African Nova Scotians are a distinct people whose histories, legacies, and contributions have enriched the part of Mi'kma'ki known as Nova Scotia for over 400 years.

Course Instructor(s)

Name Job Title	Email	Office Hours
Dr. Jennika Veinot Course Instructor	Jennika.Veinot@dal.ca	Email me to book office hours using "3137 office hours request" in subject line.
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Course Description

An overview of neuroimaging and other techniques of cognitive neuroscience (including fMRI, ERP, and others) focusing on how they work, how they are applied, and their inherent limitations. Labs include experience collecting and analyzing ERP data and fNIRS data.

Course Prerequisites

- PSYO/NESC 2000 (Methods in Experimental Psychology and Neuroscience)
- PSYO/NESC 2130 (Introduction to Cognitive Psychology)

Course Exclusions

None

Course Structure

Course Delivery

Lectures will be Tuesdays and Thursdays, 2:35pm-3:25pm in LSC Psychology wing, room P5208. Labs are Wednesdays 1:05pm-2:55pm in LSC Oceans Wing, room O2660 (SURGE Classroom).

Lectures

I believe that interactive class formats are optimal for learning, and this is reflected in how I run the course. I will provide the material I expect you to learn in written format, and expect that you read it on your own time outside of class. This way you can absorb information at your own rate and on your own time, and re-read sections that you don't fully understand. Then in lecture/discussion classes, I will review key points in the material I expected you to learn—however, the lectures do not provide all the detailed information that the readings do. For labs and assignments/exams I expect you to demonstrate learning of all the material in the readings, not just what we had time to cover in class.

Lab Sessions

The lab sessions will be used in a variety of ways, all aimed at providing hands-on experience with cognitive neuroscience experiments. In the first part of the term, these will be devoted to learning how to collect and analyze EEG/ERP data. In the latter part of the term, the lab sessions will be devoted to fNIRS data acquisition and analysis.

Course Materials

Required text:

- Newman, Aaron J. (2019). ***Research Methods for Cognitive Neuroscience.*** Sage Publications, London.

As well, the ERP Lab Report is expected to be written in APA 7 style. Adherence to this style will be graded quite strictly, so it is highly recommended that you own the official style guide. Yes, you can find brief summaries of APA style basics on line, but APA style is a lot more than reference formatting, and we expect full adherence to the style:

- American Psychological Association. (2020). ***Publication manual of the American Psychological Association, Seventh Edition.*** Washington, D.C.: American Psychological Association.

I also highly recommend this short book on writing habits and style:

- Silvia, Paul. J. (2007). ***How to write a lot.*** APA Life Tools.

Learning Objectives

As a laboratory course, there are both "content" and "process" objectives. The primary content objective is that you acquire a basic understanding of the imaging and stimulation techniques most commonly used in cognitive neuroscience: what is measured and/or influenced (physiologically and/or behaviourally), the technical aspects of how it is measured and/or influenced, and its strengths and limitations. The primary process objectives of this course are that you develop the skills to collect and analyze EEG and fNIRS data. At the end of this course, you should be able to:

- Explain, for each technique covered, its
    - technical basis
    - physiological basis
    - applications
    - strengths
    - limitations
- Critically evaluate the methods used, and conclusions drawn from, published cognitive neuroscience studies
- Apply an EEG cap and collect high-quality data, as well as being able to identify common sources of noise in EEG data and know how to minimize these
- Process and analyze EEG/ERP data, and explain the rationale for each step
- Apply fNIRS sensors and collect high-quality data, as well as being able to identify common sources of noise in fNIRS data and know how to minimize these
- Process and analyze fNIRS data, and explain the rationale for each step
- Execute a cognitive neuroscience experiment using information from lectures and text.

Assessment

Due dates for all assessment components are described below or in the schedule. The final exam will be scheduled by the university and posted.

Laboratory Techniques (10%)

In this course you will be taught how to use EEG and fNIRS technologies to record functional data from the human brain. You will be assessed on your understanding of the steps involved in acquiring each type of data, and your performance in conducting them. These assessments will occur during the final data collection session for each technique (week 3 for EEG and week 10 for fNIRS), and will involve the teaching team observing you as well as asking questions about what you are doing.

- EEG: 5%
- fNIRS: 5%

ERP Lab Report (15%)

You will collect data from your classmates in an EEG experiment during the lab component of the course, analyze it, and write it up in a lab report.

fNIRS Lab Report (15%)

You will collect data from your classmates in an fNIRS experiment during the lab component of the course, analyze it, and write it up in a lab report.

Exams (60%)

- Exam 1 (15%) will cover the material in chapters 1-5 of the textbook.
- Exam 2 (15%) will cover the material in chapters 6-9 of the textbook.
- Exam 3 (30%) will be a cumulative final exam covering material from all textbook chapters, as well as the labs.

Bonus Points (3%)

- You may earn a bonus worth 1% of your final grade for participating in a university-run "self improvement" class. Please ask the instructor of the class to email me confirmation of your attendance. Email is preferred because I can't verify written notes easily; it is your job to ensure the instructor follows up with the email to me. Options for these workshops include the following, but others may be possible — feel free to ask the instructor if an idea you have will count:
    - Studying for Success Program (time management, note-taking, study skills)
    - University Writing Centre (help on choosing a topic, organizing ideas, clear and accurate written expression, proper referencing and citation)
    - Counselling Services (Speak Easy program for public speaking, Exam Anxiety program)
- You may earn an additional 2% for participating in research studies offered by the Department of Psychology & Neuroscience through the SONA system.

Conversion of numerical grades to final letter grades follows the Dalhousie Grade Scale

A+ (90-100)	B+ (77-79)	C+ (65-69)	D (50-54)
A (85-89)	B (73-76)	C (60-64)	F (0-49)
A- (80-84)	B- (70-72)	C- (55-59)	

Course Policies on Missed or Late Academic Requirements

Attendance/Declaration of Absence

If you have to miss class or another class-related commitment for reasons including short-term physical or mental health conditions, or other extenuating circumstances (such as caregiving duties; immediate family illness, injury or death; involvement in an accident; legal proceedings; being a victim of a crime, domestic or intimate partner violence.) that may affect their ability to

complete required graded academic requirements. you may submit a ***Student Declaration of Absence (SDA)*** form. You may submit a maximum of two separate SDA forms per course during a term. These can be submitted online through the class Brightspace page. Since a significant portion of your final grade is based on participation, failure to attend classes regularly will adversely affect your grade. If you need to miss a significant number of classes (3 or more), please discuss this with the instructor, ideally beforehand. In most cases some form of documentation supporting your request (e.g., doctor's note) will be required for consideration. Requests made after due dates have passed are unlikely to be granted except in exceptional circumstances. For major and chronic physical or mental health conditions, or other long-term or recurring absences, you should refer to the University's Missed or Late Academic Requirements due to Student Absence regulation and the Accommodation Policy.

Late Work

Time management is one of the many life skills you are expected to demonstrate (and/or develop) in this course. Due dates are firm, and ***10% per day will be deducted from your maximum possible mark on any assignment that is turned in late.*** Deadlines are specified on Brightspace to the minute, and the margin of error is 5 minutes. If you are having technical difficulties submitting, email the instructor (and cc the TA) within 5 minutes of the deadline. You are given ample time to complete the assignments, so waiting until the last minute, then having your computer crash or getting sick etc. is not an excuse. **All hard drives fail, usually with no warning, and usually very soon before some deadline. In this day and age, there is no excuse for losing work due to a computer failure.** Dalhousie provides you with free cloud storage via OneDrive. You should set up OneDrive on your computer and use that folder as the place where you save all your school-related files. Then, things are automatically backed up to the cloud every time you save a file, and will be accessible from other computers or via my.dal.ca if and when disaster strikes. There are many other, also-free options like Dropbox, Google Drive, and iCloud, but OneDrive is Dal's officially-supported one. Late work may be accepted by prior arrangement (preferred), or after the fact under exceptional circumstances. You must provide documentation from a physician or other person qualified to judge your inability to work on the assignment for a significant portion of the period that you were given to work on it. The Teaching Assistant does not have the authority to consider such requests, so please direct them to the instructor.

Use of Generative Artificial Intelligence

The use of generative AI in writing lab reports or exams is *not permitted* for this course. Your written work submitted for evaluation should not include text produced by generative AI.

You *are* permitted to use AI coding assistants (such as GitHub Copilot), or more general-purpose tools like ChatGPT, to help you understand and modify the code provided for data analysis, to analyze data collected in this class for the lab reports.

Course Accessibility

If you require additional accommodations, please refer to the Student Accommodation Policy.

- You are eligible for accommodations based on protected characteristics such as religion. If you have religious, cultural, or community-significant observances that conflict with course requirements, reach out to me to collaboratively find alternatives for completing the course requirements.
- To begin the process of requesting a formal academic accommodation, contact the Student Accessibility Centre

Course Content

The below schedule Is subject to change. Check Brightspace regularly for any announcements posted regarding schedule changes.

Week	Date	Lesson Topic(s)	Reading/Assessment
1	Tues, Sept 8	Introduction to the course	Chapters 1-2
	Wed, Sept 9	NO LAB	
	Thurs, Sept 10	EEG/ERP	Chapter 3
2	Tues, Sept 15	EEG/ERP	
	Wed, Sept 16	Lab: Introduction to EEG	
	Thurs, Sept 17	EEG/ERP	Chapter 4
3	Tues, Sept 22	MEG	Chapter 5
	Wed, Sept 23	Lab: Our EEG Experiment	
	Thurs, Sept 24	MEG	
4	Tues, Sept 29	Exam Review	
	Wed, Sept 30	Lab: EEG Data Collection	
	Thurs, Oct 1	Exam 1	
	Tues, Oct 6	MRI	Chapter 6

5	Wed, Oct 7	Lab: EEG Data Collection	
	Thurs, Oct 8	fMRI	Chapter 7
6	Tues, Oct 13	fMRI	
	Wed, Oct 14	Lab: EEG Data Preprocessing	
	Thurs, Oct 15	fMRI	Chapter 8
7	Tues, Oct 20	Structural MRI	Chapter 9
	Wed, Oct 21	Lab: EEG Data Analysis	
	Thurs, Oct 22	Connectomics	Chapter 10
8	Tues, Oct 27	Connectomics	
	Wed, Oct 28	**Lab Tour**	
	Thurs, Oct 29	Exam Review	
9	Tues, Nov 3	Exam 2	
	Wed, Nov 4	**Lab Tour**	
	Thurs, Nov 5	fNIRS	Chapter 12
Reading Week			
10	Tues, Nov 17	fNIRS	
	Wed, Nov 18	Lab: Introduction to fNIRS	
	Thurs, Nov 19	PET	Chapter 11
11	Tues, Nov 24	TMS	Chapter 13
	Wed, Nov 25	Lab: fNIRS Data Collection	
	Thurs, Nov 26	TMS	
	Tues, Dec 1	TES	Chapter 14

12	Wed, Dec 2	Lab: fNIRS Data Analysis	
	Thurs, Dec 3	***Cancellation Make-Up Day***	
13	Tues, Dec 8	**Lieu Day: Monday Schedule**	
	Wed, Dec 9	**Exam Review**	

Syllabus Appendix

Syllabus Appendix: Student Supports & University Statements, Policies, and Guidelines

Student Resources and Support

1. UNIVERSITY POLICIES AND PROGRAMS

1A. Important Dates in the Academic Year (including add/drop dates)

https://www.dal.ca/academics/important_dates.html

1B. Classroom Recording Protocol

https://www.dal.ca/content/dam/www/about/leadership-and-governance/university-policies/class-recording-protocol.pdf

1C. Dalhousie Grading Practices Policies

https://www.dal.ca/content/dam/www/about/leadership-and-governance/university-policies/grading-practices-policy.pdf

1D. Grade Appeal Process

https://www.dal.ca/campus_life/academic-support/grades-and-student-records/appealing-a-grade.html

1E. Sexualized Violence Policy

https://www.dal.ca/content/dam/www/about/leadership-and-governance/university-policies/sexualized-violence-policy.pdf

1F. Scent-Free Program

https://www.dal.ca/dept/safety/programs-services/occupational-safety/scent-free.html

2. LEARNING AND SUPPORT RESOURCES

2A. General Academic Support – Advising (Halifax)

https://www.dal.ca/campus_life/academic-support/advising.html

2B. General Academic Support – Advising (Truro)

https://www.dal.ca/campus_life/ssc/academic-support/advising/academic-advisors.html

2C. Faculty of Science Advising Support

https://www.dal.ca/faculty/science/current-students/undergrad-students/degree-planning.html

2D. Writing Centre

https://www.dal.ca/campus_life/academic-support/writing-and-study-skills.html

2E. Study Skills/Tutoring

http://www.dal.ca/campus_life/academic-support/study-skills-and-tutoring.html

2F. Student Health & Wellness Centre

https://www.dal.ca/campus_life/health-and-wellness.html

2G. On Track

https://www.dal.ca/campus_life/ssc/academic-support/on-track.html

2H. Indigenous Student Centre

https://www.dal.ca/campus_life/communities/indigenous.html

2I. Mi'kmaq and Indigenous Relations

https://www.dal.ca/about-dal/indigenous-connection.html

2J. Elders-in-Residence

https://www.dal.ca/about/mission-vision-values/mikmaq-indigenous-relations/elders-in-residence-and-traditional-knowledge-keepers.html

2K. Black Student Advising Centre

https://www.dal.ca/campus_life/communities/black-student-advising.html

2L. International Centre

https://www.dal.ca/campus_life/international-centre.html

2M. South House Sexual and Gender Resource Centre

https://www.dsu.ca/ratified-societies/2023/7/5/x48ixck9n12fx3t9aau7nnq5e6d7rl-tasl4-8c37h-bc2xj

2N. LGBTQ2SIA+ Collaborative:

https://www.dal.ca/about/mission-vision-values/equity-diversity-inclusion-and-accessibility/about-office-equity-inclusion/community-specific-groups/lgbtq2sia-collaborative.html

2O. Dalhousie Libraries

https://libraries.dal.ca/

2P. Copyright Office

https://libraries.dal.ca/services/copyright-office.html

2Q. Dalhousie Student Advocacy Services

https://www.dsu.ca/dsas?rq=student%20advocacy

2R. Dalhousie Ombudsperson

https://www.dal.ca/campus_life/safety-respect/ombudsperson.html

2S. Human Rights and Equity Services

https://www.dal.ca/about/mission-vision-values/equity-diversity-inclusion-and-accessibility/about-office-equity-inclusion/human-rights-and-equity-services.html

3. SAFETY INFORMATION

3A. Biosafety

https://www.dal.ca/dept/safety/programs-services/biosafety.html

3B. Chemical Safety

https://www.dal.ca/dept/safety/programs-services/chemical-safety.html

3C. Radiation Safety

https://www.dal.ca/dept/safety/programs-services/radiation-safety.html

3D. Laser Safety

https://www.dal.ca/dept/safety/programs-services/radiation-safety/laser-safety.html