Psychology 376 / 3.0
Functional Neuroimaging the Human Brain and Mind
Winter 2022

Course Instructor: Jason Gallivan, PhD
Office: Botterell Hall 239
E-mail: gallivan@queensu.ca
Office Hours: By appointment

Teaching Assistants (TA):
Qasem Niksefat
Email: m.niksefat@queensu.ca
Office Hours: By Appointment

Class Days/Times: Wednesdays: 10 – 11:30am
Fridays: 8:30 am – 10am

Location: Kingston Hall, rm 101

Course Description:
Brain imaging, and functional magnetic resonance imaging (fMRI) in particular, has become a revolutionary tool in the study of human brain function and organization. This course will cover brain imaging technology, current tools and techniques for experimental design and analysis, as well as delve into details about brain areas, connectivity and topography. Throughout, the course will highlight the prominent role of fMRI in the burgeoning field of cognitive neuroscience and review, using specific examples, what human neuroimaging has revealed about the functional organization of the mechanisms underlying goal-directed behaviour (e.g., perception, planning, memory, language, decision-making, etc.). In addition, we will discuss the merits and limitations of fMRI as a tool for cognitive neuroscientists and the ways in which it can be combined with other techniques.

Intended Student Learning Outcomes:
Upon completion of this course, a successful student should be able to:
1. Understand how fMRI works and how it is commonly used to investigate cognitive processes in the brain
2. Understand, in principle, both basic and advanced fMRI analyses and how corresponding results should be interpreted
3. Understand some basic human functional neuroanatomy and topography
4. Critically read and scrutinize an fMRI paper and understand the strengths and weaknesses of the presented findings (i.e., appreciate what a research paper *does* and *does not* show)
5. Understand the merits and limitations of fMRI as it compares to other methodologies used in cognitive neuroscience
6. Apply active learning, critical thinking and problem-solving to the study of human cognitive neuroscience

Relevance of Course: Information taught in this course is highly relevant for students interested in the human brain and behaviour, cognitive and systems neuroscience, neurobiology, computer science, philosophy, medicine, clinical psychology, research and teaching.

Textbook &/or Courseware Package: There is no required textbook for this course. Required readings will be made available for download through OnQ. Students are responsible for all assigned readings as they contain more material than can be covered directly in lecture. Similarly, some material covered in lectures will not appear in the assigned readings. ***Students are responsible for this material as it will appear on exams.***

Course Notes: Lecture slides will be provided for this course (you will need to attend/watch lectures to fill in some of the gaps).

Contacting Me: Students requiring assistance are encouraged to speak with me either before or after lectures. I will arrive/leave lectures approximately 10 minutes before/after lecture and will be more than happy to answer any questions during this time. Should you wish to meet with me outside of this time, please email me (or the class TA) to make an appointment. Email, while commonly used, does limit the effectiveness of communications and may not be the best way for me to answer your question(s). In such instances, I may suggest a personal meeting at a mutually agreed upon time (in-person or via Zoom). I will do my very best to answer emails as soon as possible; however, emails can be expected to be replied to within 2 working days (i.e., a reply to a 1 am Saturday night email may not arrive before Tuesday). To facilitate my responses, please include the course ID (i.e., "PSYC 376") in the subject line of the email. Thanks.

Course Content: Tentative lecture schedule (*Subject to modification*)

Date	Lecture Topics
Week 1: Jan 10 -14	Introduction to Course and Instructor Go over course syllabus **Lecture 1:** General introduction to fMRI
Week 2: Jan 17 - 21	**Lecture 2:** MR Physics and Safety **Lecture 3:** Origins of the BOLD Response
Week 3: Jan 24 - 28	**Lecture 4:** fMRI Preprocessing and Design Principles **Lecture 5:** Block- and Event-Related Designs
Week 4: Jan 31 – Feb 4	**Lecture 6:** fMRI Statistics and Brain Normalization **Lecture 7:** Analysis Approaches and Advanced Designs
Week 5: Feb 7 - 11	**Lecture 8:** Repetition Suppression and Multivoxel Pattern Analysis **Lecture 9:** Brain Networks and Connectivity
Week 6: Feb 14 - 18	**Lecture 10:** Brain Areas and Topography **Lecture 11:** Combining fMRI with Other Techniques
Week 7: Feb 21 - 25	**READING WEEK**
Week 8: Feb 28 – March 4	****Midterm**** **Lecture 12:** Vision & Perception
Week 9: March 7 - 11	**Lecture 13:** Motor Systems & Action Control **Lecture 14:** Memory
Week 10: March 14 - 18	**Lecture 15:** Audition & Language **Lecture 16:** Executive Functions & Decision-making
Week 11: March 21 - 25	**Research Seminars on special topics (TBA)**

Week 12: March 28 – April 1	**Research Seminars on special topics (TBA)** **Team Video Presentations:** Vision & Perception **/** Motor Systems
Week 13: April 4 - 8	**Team Video Presentations:** Memory / Auditory & Language **Team Video Presentations:** Executive Functions & Decision-making
Date to be determined	****Final Exam****

Evaluation Scheme

Description	Value	Date
Midterm Exam (in-class)	25%	See above
Research Proposal	25%	TBA
Final Exam	25%	TBA
Team Video Presentations	20%	TBA
Weekly MC Questions (20 in total)	5%	at least 1 per lecture

Midterm and Final Exams **(25% each; 50% of final mark combined):**
The midterm and final exam will each consist of multiple choice questions only and will be assessing a combination of factual and conceptual issues related to the content of the course. There will be <u>no</u> overlap in content between the Midterm and Final Exams. Because of the structure of the course, you will need the content/knowledge acquired in the first half of the course to succeed in the second half and thus, there is no need to overlap content in the two exams. [*As an aside, I always hated it when Professors would make you go back and re-study all the material from the midterm for the final exam*].

Timing of Final Examinations
The exam dates for each Term are listed on the Faculty of Arts and Science webpage under <u>Important Dates</u>. Student exam schedules for the Fall Term are posted via SOLUS immediately prior to the Thanksgiving holiday; they are posted on the Friday before Reading Week for the Winter Term and for the summer term, they are individually noted on the Arts and Science Online syllabi. **Students should delay finalizing any travel plans until <u>after</u> the examination schedule has been posted. Exams will <u>not</u> be moved or deferred to accommodate employment, travel/holiday plans or flight reservations.**

Weekly Multiple Choice (MC) Questions **(5% of final mark):**
You will be required to create, for each lecture, at least one potential multiple choice question that could, in principle, be used on an exam (Midterm or Final). You must upload these questions, along with the corresponding **correct** response to these questions, using OnQ, prior to every Wednesday lecture (and corresponding to the material covered in the previous week). Each question will have a value of 0.25% on your final mark (note that although they carry a small percentage, they can often determine whether you end the course with an 89% versus a 90%, or a 79% versus 80% grade). Students must produce 20 of these questions over the term, and at least <u>one</u> question per lecture. Because we have 16 lectures in total, 4 of these 20 MC will need to overlap in content with another submitted MC question (with a maximum of 2 MC questions per lecture; this overlap can be done at the student's discretion).

Students will receive a 0.25% grade for producing a viable question (with correct answer) that could be used in an exam (i.e., it must require that one knows the course material to answer it correctly and it must be of average difficulty). Otherwise, students will receive a 0% grade for that particular question.

To up the ante, particularly thoughtful and well-formed MC questions may actually be used on either the Midterm or Final Exam. Thus, not only will the student who creates these questions receive a 0.25% grade, but they will know the answer to that particular question on the exam, and thus also receive additional benefit! *LATE MCs WILL NOT BE ACCEPTED.*

Team Video Presentations (20% of final mark):
For this project, you will self-assemble into small groups of individuals (e.g., 2 or 3; this number is subject to change depending on total course enrollment). For this project, you and your team will choose a research article in a particular content area (a list of potential articles will be provided with each of Lectures 12-16). *Research articles cannot be duplicated between groups. Therefore, topics will be selected on a first-come first-serve basis and must be approved by me.* This project will challenge you to think critically and apply the knowledge you have acquired from the entire course in an applied context. Such a task is highly relevant to many of the possible career paths associated with a university degree in Psychology, the Life Sciences, and related disciplines.

You and your team will be required to complete this project outside of class time.

1. **Video Content:** Your team will be required to read one of the research articles provided and produce a (hopefully) creative video presentation that addresses each of the following (this is not meant to be an exhaustive list of aspects you can include):
    *   What was known before your selected research article and what particular gap in knowledge did the experiment(s) address? (note that providing this adequate background for the viewer may require you to read a few key papers from previous work cited in the article)
    *   What was the specific research question asked and why (at the time) was it important, timely or novel?
    *   What specific task and analysis methods were used?
    *   What did the authors find?
    *   Why are these results important in this particular research area? How do they fit within the larger literature on this topic?
    *   What are some of the limitations in the methods used and/or conclusions drawn?

    Note that visual aids, including diagrams, article figures, and/or animations etc. should be incorporated into your video so as to effectively convey your understanding of the article. You will also be graded on your ability to take complex ideas, research questions and approaches, and distill them so that they are easy-to-follow and readily comprehendible to non-experts in this area (this will require some thought on your part). You should also strive for your video presentation to be entertaining and engaging.

2. **Format Guidelines:** Each video should be 8-10 minutes in length (no shorter or longer) and *all groups members must talk in the video at least once.* There are lots of free video editing programs to allow you to finalize your video presentation (most computers include a program capable of doing this) and most of you, I am assuming, have smart phones with video recording capability.

3. **Submission Guidelines:** Each team's video presentation will need to be uploaded to Youtube on a date that is to be announced and the link to be provided. Failure to do so will result in a late penalty.

4. **Grading:** Your total grade (20%) for this team project will determined by the TA and me, based on how well the criteria in #1 are met. Note that content derived from the video presentations is fair game for the Final Exam and thus, attending the video presentations of your peers will prove to be in your benefit (*Hint Hint!*).

Research Proposal (25% of final mark):
You will be required to read one of the articles provided (note that these are a separate set of articles from the Video presentation articles) and design a follow-up experiment to the study that builds on those previous findings but which could, in principle, provide its own novel contribution to the literature. In only 2 pages, you will be expected to:

- Briefly convey your selected article's findings and provide motivation/justification for your own, follow-up experiment (in the context of the previous literature). You must demonstrate why your <u>own</u> experiment is important, novel and/or addresses a key research question in the field.
- Briefly outline your experimental task and how the data will be analyzed
- Outline your hypothesis (as well as hypothetical results) and indicate what, if confirmed, your findings would demonstrate
- Include no more than one figure (which can be multi-paneled) in your proposal

Note that <u>all</u> the text should fit onto both pages (¾ margins, minimum 11 pt font, single-spaced max)! The single figure (with associated figure caption, of no more than 300 words) is to be included on a separate page. Other than these criteria, there are no formatting requirements. However, you will probably find it beneficial to use subheadings, underlining and boldface throughout to direct the reader's attention to your key points and sections. Also, note that this 2-page research summary proposal **is worth 25% of your final mark (!!!) and so it should be thoughtfully constructed, easy-to-follow and heavily edited (underline <u>heavily</u>). Being able to write a concise and engaging 2-page summary that nearly anyone can understand (perhaps even your grandmother) is one of the most important (yet poorly emphasized) skills one can acquire in the sciences (and, indeed, in most other career paths). It takes a great deal of thought and effort to do well. The purpose of this exercise, in addition to applying the course knowledge and forcing you to think creatively, is to help you further develop this critical skill. Due to the space limitations, you will need to think carefully about what details to include versus exclude, such that your reader has all the necessary content information to understand the scientific details of your proposal while, at the same time, appreciating why your proposal is novel and important. Your proposal will be evaluated by the TA, and so it should be written at a level for someone who has working knowledge of fMRI (e.g., there will be no need to describe a GLM, etc.)

Grading system – Numbers In, Letters Out: All components of this course will receive numerical percentage marks. The final grade you receive for the course will be derived by converting your numerical course average to a letter grade according to Queen's Official Grade Conversion Scale as shown below:

Grade	Numerical Course Average (Range)	Descriptor
A+	90-100	Truly Exceptional
A	85-89	Outstanding
A-	80-84	Excellent
B+	77-79	Very Good
B	73-76	Good
B-	70-72	Reasonably Good
C+	67-69	Acceptable
C	63-66	Minimally Acceptable (Hons.)
C-	60-62	Minimally Acceptable (Gen.)
D+	57-59	Unsatisfactory Pass
D	53-56	Unsatisfactory Pass
D-	50-52	Unsatisfactory Pass
F	49 and below	Failure. No course credit

Late Policy: Unless otherwise stated, late submissions will be penalized by 5% per day it is late (e.g., a submission earning a grade of 85% will receive a 80% if submitted one day late).

Students are responsible for keeping back-up copies of all written work and assignments. Invalid or corrupt files submitted electronically will be subject to the course late penalty and computer, disk, and/or other hardware related problems will not be accepted as an excuse to hand in late hard-copy assignments.

REGULATIONS AND POLICIES

Accommodations for Disabilities

Queen's University is committed to achieving full accessibility for people with disabilities. Part of this commitment includes arranging academic accommodations for students with disabilities to ensure they have an equitable opportunity to participate in all their academic activities. The Senate Policy for Accommodations for Students with Disabilities was approved at Senate in November 2016. If you are a student with a disability and think you may need academic accommodations, you are strongly encouraged to contact the **Queen's Student Accessibility Services (QSAS)** and register as early as possible. For more information, including important deadlines, please visit the QSAS website.

Academic Consideration for Students in Extenuating Circumstances

Academic consideration is a process for the university community to provide a compassionate response to assist students experiencing unforeseen, short-term extenuating circumstances that may impact or impede a student's ability to complete their academics. This may include but is not limited to:

- Short-term physical or mental health issues (e.g., stomach flu, pneumonia, COVID diagnosis, vaccination, etc.)
- Responses to traumatic events (e.g., Death of a loved one, divorce, sexual assault, social injustice, etc.)
- Requirements by law or public health authorities (e.g., court date, isolation due to COVID exposure, etc.)

Queen's University is committed to providing academic consideration to students experiencing extenuating circumstances. For more information, please see the Senate Policy on Academic Consideration for Students in Extenuating Circumstances.

Each Faculty has developed a protocol to provide a consistent and equitable approach in dealing with requests for academic consideration for students facing extenuating circumstances. Arts and Science undergraduate students can find the Faculty of Arts and Science protocol and the portal where a request can be submitted. Students in other Faculties and Schools who are enrolled in this course should refer to the protocol for their home Faculty.

If you need to request academic consideration for this course, you will be required to provide the name and email address of the instructor/coordinator. Please use the following contact information:

     Instructor/Course Coordinator Name: Jason Gallivan
     Instructor/Course Coordinator email address: gallivan@queensu.ca

Students are encouraged to submit requests as soon as the need becomes apparent and to contact their Professors/Course Coordinators as soon as possible once Consideration has been granted. Any delay in contact may limit the Consideration options available.

[**Optional:** Your Professor/Course Coordinator requests email/onQ/phone communication to 613-123-4567 or abc@queensu.ca within X days of receiving verification of your Consideration request.]

For more information on the Academic Consideration process, what is and is not an extenuating circumstance, and to submit an Academic Consideration request, please see our website.

Academic Integrity

Copyright of Course Materials
Unless otherwise stated, the material on the course website is copyrighted and is for the sole use of students registered in PSYC 376. The material on the website may be downloaded for a registered student's personal use but shall not be distributed or disseminated to anyone other than students registered in this course.

Technology Requirements

Turnitin Statement
This course uses Turnitin, a third-party application that helps maintain standards of excellence in academic integrity. Normally, students will be required to submit their course assignments through onQ to Turnitin. In doing so, students' work will be included as source documents in the Turnitin reference database, where they will be used solely to detect plagiarism.
Turnitin is a suite of tools that provide instructors with information about the authenticity of submitted work and facilitates the process of grading. Turnitin compares submitted files against its extensive database of content, and produces a similarity report and a similarity score for each assignment. A similarity score is the percentage of a document that is similar to content held within the database. Turnitin does not determine if an instance of plagiarism has occurred. Instead, it gives instructors the information they need to select the authenticity of work as a part of a larger process.

Please read Turnitin's Privacy Pledge, Privacy Policy, and Terms of Service, which govern users' relationship with Turnitin. Also, please note that Turnitin uses cookies and other tracking technologies; however, in its service contract with Queen's, Turnitin has agreed that neither Turnitin nor its third-party partners will use data collected through cookies or other tracking technologies for marketing or advertising purposes. For further information about how you can exercise control over cookies, see Turnitin's Privacy Policy

Turnitin may provide other services that are not connected to the purpose for which Queen's University has engaged Turnitin. Your independent use of Turnitin's other services is subject solely to Turnitin's Terms of Service and Privacy Policy, and Queen's University has no liability for any independent interaction you choose to have with Turnitin.

Remote Proctoring Statement
Selected assessments in this course will use remote proctoring provided by Examity, which is a third-party, cloud-based service that enables the completion of a proctored exam or test from an off-campus location, through onQ. This cloud-based proctoring solution was chosen as part of the approach to maintaining academic integrity when remote proctoring is required. Precise details about how remote proctoring will be used in this course will be provided by the instructor.

Queen's has conducted an extensive privacy and security review of Examity and has entered into a binding agreement with terms that address the appropriate collection, use and disclosure of personal information in accordance with Ontario's privacy legislation. You should also take measures yourself to protect your information by keeping your NetID password and challenge questions private, closing all applications prior to starting an exam/test, and ensuring your device is updated and safeguarded

against malware. For more information about remote proctoring, please see
http://www.queensu.ca/registrar/students/examinations/exams-office-services/remote-proctoring