



# COGS3030

## Human Neuroimaging

Session 2, In person-scheduled-weekday, North Ryde 2022

*School of Psychological Sciences*

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## General Information

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Tutor

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Credit points

10

Prerequisites

130cp including (COGS2000 or COGS202) and (COGS2020 or BIOL2610 or STAT2170 or STAT2371 or PSYU2248)

Corequisites

Co-badged status

Unit description

The human brain is among the most complex and powerful information processing systems known. Since the emergence of cognitive neuroscience as a field several decades ago, an impressive range of methods have been developed to investigate the structure and function of the human brain. In this unit, students will learn key principles of a range of functional neuroimaging techniques including functional magnetic resonance imaging (fMRI), electroencephalography (EEG), magnetoencephalography (MEG), and functional near infrared spectroscopy (fNIRS). The unit focuses on conceptual and methodological issues surrounding these techniques, giving students the opportunity to think critically about the advantages and disadvantages of each technique for addressing research questions in the field of cognitive neuroscience. The unit will also cover clinical applications of neuroimaging such as its use for investigating autism and schizophrenia.

## Important Academic Dates

Information about important academic dates including deadlines for withdrawing from units are available at <https://www.mq.edu.au/study/calendar-of-dates>

## Learning Outcomes

On successful completion of this unit, you will be able to:

**ULO1:** Demonstrate advanced knowledge of neuroimaging methods and their

application to the investigation of human brain function.

**ULO2:** Explain the strengths and limitations of various neuroimaging methods and be able to identify the optimal method for a particular research question.

**ULO3:** Discuss key concepts and theories in relation to research findings obtained through different neuroimaging methods.

**ULO4:** Interpret and critically evaluate the results of neuroimaging studies.

## Assessment Tasks

Name	Weighting	Hurdle	Due
<u>Presentation</u>	10%	No	Week 4 & 6
<u>Data analysis write-up 1</u>	20%	No	Week 10
<u>Data analysis write-up 2</u>	30%	No	Week 13
<u>Final exam</u>	40%	No	Semester 2 Exam Period

### Presentation

Assessment Type <sup>1</sup>: Presentation

Indicative Time on Task <sup>2</sup>: 5 hours

Due: **Week 4 & 6**

Weighting: **10%**

Contribution to a group presentation contrasting two neuroimaging approaches to the same research question (5%) and individual written summary (5%; max. 300 words)

On successful completion you will be able to:

- Discuss key concepts and theories in relation to research findings obtained through different neuroimaging methods.
- Interpret and critically evaluate the results of neuroimaging studies.

### Data analysis write-up 1

Assessment Type <sup>1</sup>: Quantitative analysis task

Indicative Time on Task <sup>2</sup>: 15 hours

Due: **Week 10**

Weighting: **20%**

Analysis of curated dataset and write-up of methods and results (max. 1000 words)

On successful completion you will be able to:

- Demonstrate advanced knowledge of neuroimaging methods and their application to the investigation of human brain function.
- Explain the strengths and limitations of various neuroimaging methods and be able to identify the optimal method for a particular research question.

## Data analysis write-up 2

Assessment Type <sup>1</sup>: Quantitative analysis task

Indicative Time on Task <sup>2</sup>: 25 hours

Due: **Week 13**

Weighting: **30%**

Analysis of curated dataset and write-up of methods and results (max. 1500 words)

On successful completion you will be able to:

- Demonstrate advanced knowledge of neuroimaging methods and their application to the investigation of human brain function.
- Explain the strengths and limitations of various neuroimaging methods and be able to identify the optimal method for a particular research question.

## Final exam

Assessment Type <sup>1</sup>: Examination

Indicative Time on Task <sup>2</sup>: 40 hours

Due: **Semester 2 Exam Period**

Weighting: **40%**

Multiple-choice and short answer questions

On successful completion you will be able to:

- Demonstrate advanced knowledge of neuroimaging methods and their application to the investigation of human brain function.
- Explain the strengths and limitations of various neuroimaging methods and be able to identify the optimal method for a particular research question.
- Discuss key concepts and theories in relation to research findings obtained through different neuroimaging methods.
- Interpret and critically evaluate the results of neuroimaging studies.

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<sup>1</sup> If you need help with your assignment, please contact:

- the academic teaching staff in your unit for guidance in understanding or completing this type of assessment

- the [Writing Centre](#) for academic skills support.

<sup>2</sup> Indicative time-on-task is an estimate of the time required for completion of the assessment task and is subject to individual variation

## Delivery and Resources

As a student enrolled in this unit, you will engage in a range of online and face-to-face learning activities, including readings, practical laboratory activities and lectures. Details can be found on the iLearn site for this unit.

### Recommended Readings

*Introduction to Human Neuroimaging (2019)*

by Hans Op de Beeck and Chie Nakatani

### Technology Used

Active participation in the learning activities throughout the unit will require students to have access to a tablet, laptop or similar device. Students who do not own their own laptop computer may borrow one from the university library.

## Unit Schedule

	Topic/Theme	Reading	Learning Activities
Week 1	Introduction and Overview	Chapter 1, Op de Beeck (2019) <i>Introduction to Human Neuroimaging</i> . Cambridge University Press	- Overview to lab tutorial structure. - Download data and scripts ready to go for the beginning of class. - Guidance on how to get MATLAB working - Intro to MATLAB
Week 2	MRI Physics & Structural Imaging Methods	Chapter 2/3, Op de Beeck	- Tutorial exploring structural MRI data using Mango
Week 3	MRI Physics & Structural Imaging Methods	Chapter 2/3, Op de Beeck	- Critical discussion of papers for presentation
Week 4	Hemodynamic Imaging Methods, Designing a Hemodynamic Imaging Experiment	Chapter 4/5, Op de Beeck	- Group presentations for assessment task 1
Week 5	Basic and Advanced Statistical Analysis	Chapter 7/8, Op de Beeck	- fMRI pre-processing tutorial
Week 6	fNIRS	Chapter 4.4 + Luke et. al. 2021	- fMRI GLM estimation and stats tutorial

Week 7	EEG and ERPs	Chapter 9, 10 Op de Beeck	- fNIRS Group data tutorial
Week 8	Electrophysiological imaging	Chapter 9,10, Op de Beeck	- M/EEG analysis tutorial I
Week 9	MEG	Chapter 10, Op de Beeck	- M/EEG analysis tutorial II
Week 10	Advanced Data Analysis	Chapter 12, Op de Beeck	- TMS/EEG tutorial
Week 11	Causal Methods to Modulate Brain Activity	Chapter 14, Op de Beeck	
Week 12	Motor evoked responses	None	
Week 13	Review	None	

## Policies and Procedures

Macquarie University policies and procedures are accessible from [Policy Central \(https://policies.mq.edu.au\)](https://policies.mq.edu.au). Students should be aware of the following policies in particular with regard to Learning and Teaching:

- [Academic Appeals Policy](#)
- [Academic Integrity Policy](#)
- [Academic Progression Policy](#)
- [Assessment Policy](#)
- [Fitness to Practice Procedure](#)
- [Assessment Procedure](#)
- [Complaints Resolution Procedure for Students and Members of the Public](#)
- [Special Consideration Policy](#)

Students seeking more policy resources can visit [Student Policies \(https://students.mq.edu.au/support/study/policies\)](https://students.mq.edu.au/support/study/policies). It is your one-stop-shop for the key policies you need to know about throughout your undergraduate student journey.

To find other policies relating to Teaching and Learning, visit [Policy Central \(https://policies.mq.edu.au\)](https://policies.mq.edu.au) and use the [search tool](#).

## Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of

Conduct: <https://students.mq.edu.au/admin/other-resources/student-conduct>

## Results

Results published on platform other than [eStudent](#), (eg. iLearn, Coursera etc.) or released directly by your Unit Convenor, are not confirmed as they are subject to final approval by the University. Once approved, final results will be sent to your student email address and will be made available in [eStudent](#). For more information visit [ask.mq.edu.au](http://ask.mq.edu.au) or if you are a Global MBA student contact [globalmba.support@mq.edu.au](mailto:globalmba.support@mq.edu.au)

## Academic Integrity

At Macquarie, we believe [academic integrity](#) – honesty, respect, trust, responsibility, fairness and courage – is at the core of learning, teaching and research. We recognise that meeting the expectations required to complete your assessments can be challenging. So, we offer you a range of resources and services to help you reach your potential, including free [online writing and maths support](#), [academic skills development](#) and [wellbeing consultations](#).

## Student Support

Macquarie University provides a range of support services for students. For details, visit <http://students.mq.edu.au/support/>

## The Writing Centre

[The Writing Centre](#) provides resources to develop your English language proficiency, academic writing, and communication skills.

- [Workshops](#)
- [Chat with a WriteWISE peer writing leader](#)
- [Access StudyWISE](#)
- [Upload an assignment to Studiosity](#)
- [Complete the Academic Integrity Module](#)

The Library provides online and face to face support to help you find and use relevant information resources.

- [Subject and Research Guides](#)
- [Ask a Librarian](#)

## Student Services and Support

Macquarie University offers a range of [Student Support Services](#) including:

- [IT Support](#)
- [Accessibility and disability support](#) with study
- Mental health [support](#)
- [Safety support](#) to respond to bullying, harassment, sexual harassment and sexual

assault

- [Social support including information about finances, tenancy and legal issues](#)

## Student Enquiries

Got a question? Ask us via [AskMQ](#), or contact [Service Connect](#).

## IT Help

For help with University computer systems and technology, visit [http://www.mq.edu.au/about\\_us/offices\\_and\\_units/information\\_technology/help/](http://www.mq.edu.au/about_us/offices_and_units/information_technology/help/).

When using the University's IT, you must adhere to the [Acceptable Use of IT Resources Policy](#). The policy applies to all who connect to the MQ network including students.

## Inclusion and Diversity

Social inclusion at Macquarie University is about giving everyone who has the potential to benefit from higher education the opportunity to study at university, participate in campus life and flourish in their chosen field. The University has made significant moves to promote an equitable, diverse and exciting campus community for the benefit of staff and students. It is your responsibility to contribute to the development of an inclusive culture and practice in the areas of learning and teaching, research, and service orientation and delivery. As a member of the Macquarie University community, you must not discriminate against or harass others based on their sex, gender, race, marital status, carers' responsibilities, disability, sexual orientation, age, political conviction or religious belief. All staff and students are expected to display appropriate behaviour that is conducive to a healthy learning environment for everyone.

## Professionalism

In the Faculty of Medicine, Health and Human Sciences, professionalism is a key capability embedded in all our courses.

As part of developing professionalism, students are [expected to attend all small group interactive sessions](#) including clinical, practical, laboratory, work-integrated learning (e.g., PACE placements), and team-based learning activities. Some learning activities are recorded (e.g., face-to-face lectures), however you are encouraged to avoid relying upon such material as they do not recreate the whole learning experience and technical issues can and do occur. As an adult learner, we respect your decision to choose how you engage with your learning, but we would remind you that the learning opportunities we create for you have been done so to enable your success, and that by not engaging you may impact your ability to successfully complete this unit. We equally expect that you show respect for the academic staff who have worked hard to develop meaningful activities and prioritise your learning by communicating with them in advance if you are unable to attend a small group interactive session.

Another dimension of professionalism is having respect for your peers. It is the right of every student to learn in an environment that is free of disruption and distraction. Please arrive to all learning activities on time, and if you are unavoidably detained, please join activity as quietly as possible to minimise disruption. Phones and other electronic devices that produce noise and



other distractions must be turned off prior to entering class. Where your own device (e.g., laptop) is being used for class-related activities, you are asked to close down all other applications to avoid distraction to you and others. Please treat your fellow students with the utmost respect. If you are uncomfortable participating in any specific activity, please let the relevant academic know.