



# COGS2020

## Experimental Design and Data Analysis for the Cognitive and Brain Sciences

Session 1, In person-scheduled-weekday, North Ryde 2025

*School of Psychological Sciences*

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#### **Disclaimer**

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## General Information

Unit convenor and teaching staff

Matthew Crossley

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Credit points

10

Prerequisites

STAT1103 or STAT1170 or STAT170

Corequisites

Co-badged status

Unit description

In this unit, students will learn essential principles of experimental design and data analysis skills for research in the cognitive and brain sciences. Students will gain first-hand experience applying these skills by analysing real-life behavioural and neural data sets such as those from fMRI, MEG, and EEG. Students will learn the R programming language, which is widely used throughout the statistics and data science communities in academia and private industry. Topics covered include programming statistical analyses and visualising data in R, effective experimental design for hypothesis testing, and critically examining the results of statistical analyses in the cognitive and brain sciences.

## 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 proficiency in programming and executing statistical analyses using the R programming language.

**ULO2:** Create and evaluate data visualisations and publication-quality figures using the R programming language to communicate insights from data effectively.

**ULO3:** Design experiments and apply appropriate statistical methods to formulate, test, and critically evaluate hypotheses in the cognitive and brain sciences.

**ULO4:** Draw evidence-based conclusions and identify potential limitations in analyses by

interpreting and critically evaluating statistical concepts and results.

## General Assessment Information

Grade descriptors and other information concerning grading are contained in the [Macquarie University Assessment Policy](#).

All final grades are determined by a grading committee, in accordance with the Macquarie University Assessment Policy, and are not the sole responsibility of the Unit Convenor.

Students will be awarded a final grade and a mark which must correspond to the grade descriptors specified in the [Assessment Procedure](#) (clause 128).

To pass this unit, you must demonstrate sufficient evidence of achievement of the learning outcomes, meet any ungraded requirements, and achieve a final mark of 50 or better.

Further details for each assessment task will be available on iLearn.

## Late Submissions

Unless a Special Consideration request has been submitted and approved, a 5% penalty (OF THE TOTAL POSSIBLE MARK) will be applied each day a written assessment is not submitted, up until the 7th day (including weekends). After the 7th day, a grade of '0' will be awarded even if the assessment is submitted. Submission time for all written assessments is set at 11.55pm. A 1-hour grace period is provided to students who experience a technical concern.

For example:

Number of days (hours) late	Total Possible Marks	Deduction	Raw mark	Final mark
1 day (1-24 hours)	100	5	75	70
2 days (24-48 hours)	100	10	75	65
3 days (48-72 hours)	100	15	75	60
7 days (144-168 hours)	100	35	75	40
>7 days (>168 hours)	100	-	75	0

For any late submissions of time-sensitive tasks, such as scheduled tests/exams, performance assessments/presentations, and/or scheduled practical assessments/labs, students need to submit an application for Special Consideration.

## Assessment Tasks

Name	Weighting	Hurdle	Due
<a href="#">Weekly online problem sets</a>	50%	No	Approximately one every 3 to 4 weeks.
<a href="#">Final project and oral presentation</a>	50%	No	End of week 13

### Weekly online problem sets

Assessment Type <sup>1</sup>: Problem set

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

Due: **Approximately one every 3 to 4 weeks.**

Weighting: **50%**

Graded weekly online problem sets designed to assess student comprehension of lecture content, including both theoretical questions and routine exercises to reinforce skills in R programming and statistical theory.

On successful completion you will be able to:

- Demonstrate proficiency in programming and executing statistical analyses using the R programming language.
- Create and evaluate data visualisations and publication-quality figures using the R programming language to communicate insights from data effectively.
- Design experiments and apply appropriate statistical methods to formulate, test, and critically evaluate hypotheses in the cognitive and brain sciences.
- Draw evidence-based conclusions and identify potential limitations in analyses by interpreting and critically evaluating statistical concepts and results.

### Final project and oral presentation

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

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

Due: **End of week 13**

Weighting: **50%**

Students will analyse data from a cognitive science experiment and submit a recording of an oral

presentation demonstrating their statistical analysis, data visualisation, and interpretation of results. The presentation will feature live coding, a justification of methods, effective visualisations, and a clear explanation of findings. Students will also submit all source code and a PDF copy of their slides.

On successful completion you will be able to:

- Demonstrate proficiency in programming and executing statistical analyses using the R programming language.
- Create and evaluate data visualisations and publication-quality figures using the R programming language to communicate insights from data effectively.
- Design experiments and apply appropriate statistical methods to formulate, test, and critically evaluate hypotheses in the cognitive and brain sciences.
- Draw evidence-based conclusions and identify potential limitations in analyses by interpreting and critically evaluating statistical concepts and results.

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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, videos and lectures etc. Details can be found on the iLearn site for this unit.

### Recommended Readings

For recommended readings, please consult the iLearn site for this unit.

### Technology Used

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

## 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 [connect.mq.edu.au](https://connect.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/>

## Academic Success

[Academic Success](#) 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 Advocacy](#) provides independent advice on MQ policies, procedures, and processes

## Student Enquiries

Got a question? Ask us via the [Service Connect Portal](#), 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 towards 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.

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Unit information based on version 2025.02 of the [Handbook](#)