MSc in Computational Cognitive Neuroscience

Programme Specification

Awarding Institution:
University of London (Interim Exit Awards made by Goldsmiths' College)
Teaching Institution: Goldsmiths, University of London
Final Award: MSc in Computational Cognitive Neuroscience
Programme Name: MSc in Computational Cognitive Neuroscience
Total credit value for programme: 180
Name of Interim Exit Award(s):
Postgraduate Diploma in Computational Cognitive Neuroscience
Duration of Programme: 1 year (full-time) or 2 years (part-time)
UCAS Code(s): Not applicable
HECoS Code(s):
(100497) Psychology
(100359) Artificial Intelligence
QAA Benchmark Group: Computing
FHEQ Level of Award: Level 7
Programme accredited by: N/A
Date Programme Specification last updated/approved: February 2023
Home Department: Computing
Department(s) which will also be involved in teaching part of the programme:
Psychology

Programme overview

The programme is concerned with theory and practice of computational cognitive neuroscience. Its core contents include (i) fundamentals of cognitive neuroscience (cortical and subcortical mechanisms and structures underlying cognition and behaviour, plus experimental and neuroimaging techniques), and (ii) concepts and methods of computational modelling of biological neurons, simple neuronal circuits, and higher brain functions. In fact, one of the distinctive features of the Master is precisely that it includes the study of biologically-constrained models of cognitive functions (including language). This sets this programme apart from many other existing computational neuroscience ones, which focus predominantly on modelling "low-level" aspects of brain function. In addition, the programme offers several courses that teach programming skills, thereby increasing the

career options available to students who complete the MSc course. In sum, this uniquely interdisciplinary Master combines, in a single programme, contents that are typically covered by separate courses, i.e., theory and experimental methods in cognitive neuroscience, neural modelling, and programming.

The final research project, a crucial component of the course, enables students to apply newly learned techniques in practice and develop real world and transferable skills that employers look for: understanding user needs, planning their time, presenting their work and evaluating their projects. It is also an excellent opportunity to combine computational modelling with empirical research in human participants. Our experiments in the Psychology or Computing labs can focus on healthy or clinical populations. Informed consent remains the cornerstone of the ethics of neuroscience research; our studies in human participants adhere to the declaration of Helsinki, which establishes the ethical principles regarding human experimentation. In addition, our studies require evaluation and approval by the Psychology Research Ethics Committee.

Finally, to support students in their careers and search for post-Master employment, the joint directors have established collaborative links with a number of industrialists active in areas closely aligned with the programme's themes. This attains two goals: first, by means of research projects carried out in collaboration with an industry partner, students are given the opportunity to develop relationships with leaders in the field, creating a direct route to post-MSc internships and job opportunities; second, feedback from the partners to the programme directors ensures the relevance of the course to current and future needs of employers. Taken together, this degree will help students become fully rounded computational cognitive neuroscientists with a deep knowledge of theory, cutting-edge methods and technologies, and the contexts in which they are created and used.

Programme entry requirements

First or upper second-class honours degree (or equivalent undergraduate degree) in a relevant discipline (including computer science, engineering, physics, mathematics, statistics, biology, psychology, medicine) or closely related field. Applicants might also be considered if they aren't a graduate, or their degree is in an unrelated field but have relevant experience and can demonstrate the ability to work at postgraduate level. Students who have not had any prior exposure to programming techniques will be required to attend at least one pre-sessional course on MATLAB (offered by the Computing Department). Similarly, students who do not possess an adequate level of maths (or statistics) knowledge might be required to take a pre-sessional course on mathematical methods for computational neuroscience (organised by Computing), or statistics (offered by Psychology or Computing), as appropriate. Students from a technical background not familiar with neuroscience will be asked to attend a pre-sessional course on Neuroscience (offered by

Psychology). Non-native English students should normally have a minimum IELTS score of 6.5 overall or equivalent.

Programme learning outcomes

This programme aims to provide a basis for independent research in computational cognitive neuroscience, prepare students for employment both in academia and industry, as well as widen access to higher education (see point “Programme entry requirements” above). It targets two main categories of students, namely: (*i*) graduates of a “technical” degree, i.e., who come equipped with computer science or programming skills but little or no prior exposure to neuroscience and experimental methods, and (*ii*) students with a background in life sciences (e.g., from Psychology, Biology, Neuroscience or Medicine), who have knowledge of human neuroscience but lack programming and computational modelling skills. Importantly, by virtue of the complementary sets of skills and knowledge taught during the programme (see below), students from both categories will have acquired, by the end of this programme, equivalent (advanced) level of expertise in both cognitive neuroscience and computational modelling, making them equally competitive on the job market.

PGDip

Students who successfully complete the Post Graduate Diploma in Computational Cognitive Neuroscience will be able to:

Knowledge and understanding

Code	Learning outcome	Taught by the following module(s)
A1	Demonstrate knowledge and understanding of fundamental concepts and methods in computational neuroscience.	Cortical Modelling.
A2	Demonstrate knowledge and understanding of the neural processes underlying some of the key cognitive functions.	Cognitive Neuroscience, Modelling Cognitive Functions, Foundations of Neuroscience.
A3	Describe the main computational mechanisms and assumptions underlying some of the existing brain-inspired computational models of cognitive functions.	Cortical Modelling, Modelling Cognitive Functions.

Code	Learning outcome	Taught by the following module(s)
A4	Demonstrate knowledge of the main brain structures and major phases of brain development.	Foundations of Neuroscience.

Cognitive and thinking skills

Code	Learning outcome	Taught by the following module(s)
B1	Critically discuss open issues in the field of cortical and brain-inspired cognitive modelling and possible approaches to tackle them in practice.	Modelling Cognitive Functions.
B2	Demonstrate critical thinking skills about research in the area of computational cognitive neuroscience.	Cognitive Neuroscience, Modelling Cognitive Functions.
B3	Discuss theoretical issues that arise when trying to relate mental function to brain function.	Cognitive Neuroscience.
B4	Apply the principles of good statistical analysis.	Statistical Methods.

Subject specific skills and professional behaviours and attitudes

Code	Learning outcome	Taught by the following module(s)
C1	Implement simple models of cortical circuits that exhibit learning (i.e., synaptic plasticity).	Cortical Modelling.
C2	Critically evaluate a given modelling approach or neuro-computational architecture.	Cortical Modelling, Modelling Cognitive Functions.
C3	Being able to analyse a data set obtained from a cognitive neuroscience study in a creative way and draw conclusions on the results.	Cognitive Neuroscience, Advanced Quantitative Methods, Multivariate Statistical Methods.
C4	Write code to implement neural models that mimic structure and function of the human cortex.	Cortical modelling, Introduction to Coding with MATLAB and R, Data Programming, Cognitive Neuroscience.
C5	Critically argue for the interdependence of theory, modelling, and experiment in research.	Cognitive Neuroscience, Cortical modelling, Modelling Cognitive Functions, Multivariate Statistical

Code	Learning outcome	Taught by the following module(s)
		Methods, Advanced Quantitative Methods.

Transferable skills (Elements)

Code	Learning outcome	Taught by the following module(s)
D1	Present themselves and their work.	This will be taught throughout the programme.
D2	Be able to reflect on and critically evaluate their work.	This will be taught throughout the programme.
D3	Be proactive, plan their activity in advance, and exercise personal responsibility in their work	This will be taught in throughout the programme.
D4	Write scripts / code for generic data processing	Introduction to Coding with MATLAB and R, Data Programming, Advanced Quantitative Methods.

MSc

In addition to the above outcomes, students who complete the MSc in Computational Cognitive Neuroscience will be able to:

Knowledge and understanding

Code	Learning outcome	Taught by the following module(s)
A5	Apply a sound understanding of modern computational cognitive neuroscience techniques in the implementation of a research project	Research Project

Cognitive and Thinking Skills

Code	Learning outcome	Taught by the following module(s)
B5	Propose, plan, execute and critically self-evaluate a significant piece of original work	Research Project

Subject Specific Skills and Professional Behaviours and Attitudes

Code	Learning outcome	Taught by the following module(s)
C6	Identify a suitable level of modelling abstraction for a given (cognitive neuroscience) research question.	Research Project

Transferable Skills

Code	Learning outcome	Taught by the following module(s)
D5	Carry out academic research and writing	Research Project

Marking Criteria

Mark	Descriptor	Specific Marking Criteria
80-100%	Distinction (Outstanding/Exceptional)	A grade in the range of 80-100% will be awarded in the case of really accomplished work that demonstrates high levels of scholarship and originality. This grade will reflect the overall achievement of the appropriate learning outcomes to an exceptionally accomplished level. In particular a grade in the 90s should be reserved for work deemed to be outstanding, and of publishable quality.
70-79%	Distinction	A grade in the range of 70-79% will be awarded when candidates show evidence of an excellent application of appropriate knowledge, understanding and skills as specified in the module learning outcomes. Demonstration of a thorough grasp of relevant concepts, methodology and content appropriate to the subject discipline; indication of originality in application of ideas, in synthesis of material or in performance; insight reflects depth and confidence of understanding of the material.
60-69%	Merit	Demonstration of a deep level of understanding based on a competent grasp of relevant concepts, methodology and content; display of skill in applying interpreting complex material; organization of material at a high level of competence. Students should be able to demonstrate the ability to work independently to

		research and implement state of the art technologies.
50-59%	Pass	Demonstration of a sound level of understanding based on a competent grasp of relevant concepts, methodology and content; display of skill in organizing, discussing and applying complex material. Students should be able to implement state of the art technologies under guidance.
30-49%	Fail	Represents an overall failure to achieve the appropriate learning outcomes. Students achieve some of the aims but were unable to demonstrate independence and originality beyond what would be expected at undergraduate level.
10-29%	Bad fail	Represents a significant overall failure to achieve the appropriate learning outcomes.
1-9%	Very bad fail	A submission that does not attempt to address the modules specified learning outcomes. It will be considered a non-valid attempt and the module must be re-sat.
0%	Non submission or plagiarised	Work was not submitted or it was plagiarised.

Mode of study

On campus full-time or part-time

Programme structure

Students will complete the MSc programme in one (full-time) or two (part-time) calendar years. The core of the programme is based on four taught modules (Term 2) and a research project with dissertation (Term 3). The compulsory modules in Term 1 are specifically aimed at bringing all students “up to speed”, i.e., to a sufficient level of programming proficiency, knowledge of basic statistical methods, and fundamentals of neuroscience, so that they can successfully complete the core parts of the programme (delivered in Terms 2 and 3). Where appropriate, students will be required to attend pre-sessional courses on programming, statistics, maths, neuroscience or a combination of these (refer to section “Programme entry requirements” on page 1). These pre-sessional courses are free for offer holders who later enrol on the MSc programme.

The programme’s structure comprises 180 module credits, (as described below), each credit is equivalent to 10 notational hours of study which includes lecturing, practical work, tutorials

and workshops, and allocation for independent study. The total credit value of each module indicates the overall notional learning hours. In addition to the taught modules listed below, students are encouraged to attend Psychology and Computing Departmental Invited Speaker Series and the Whitehead Lecture (jointly organised by Computing and Psychology).

All students will take the following modules:

Term 1

- Foundations of Neuroscience (15 CATS)
- Multivariate Statistical Methods (15 CATS)

Term 2

- Cortical Modelling (15 CATS)
- Advanced Quantitative Methods (15 CATS)
- Modelling Cognitive Functions (15 CATS)
- Cognitive Neuroscience (15 CATS)

Term 3

- Research project in Computational Cognitive Neuroscience (60 CATS)

In addition, students are to choose two modules (in Term 1 and/or Term 2) from a list of optional modules published annually by the programme staff (and subject to prerequisites), one of which must be “Introduction to Coding with MATLAB and R” or “Data Programming” (students can take both), for a total of 30 CATS.

Full-time mode

[*] Students must choose at least one of these two options.

Module Name	Module Code	Credits	Level	Module Type	Term
Foundations of Neuroscience	PS74005D	15	7	Compulsory	1
Multivariate Statistical Methods	PS71020E	15	7	Compulsory	1
Cortical Modelling	IS71088A	15	7	Compulsory	2
Modelling Cognitive Functions	IS71087A	15	7	Compulsory	2
Cognitive Neuroscience	PS71092A	15	7	Compulsory	2
Advanced Quantitative Methods	PS71082A	15	7	Compulsory	2

Research Project in Computational Cognitive Neuroscience	IS71089A	60	7	Compulsory	3
Introduction to Coding with MATLAB and R, OR Data Programming [*]	PS71089A / IS71068A	15	7	Optional [*]	1
Optional module from a list annually published and approved		15	7	Optional	1 or 2

Part-time mode

[*] Students must choose at least one of these two options.

Academic year of study 1

Module Name	Module Code	Credits	Level	Module Type	Term
Foundations of Neuroscience	PS74005D	15	7	Compulsory	1
Data Programming, OR Introduction to Coding with MATLAB and R [*]	IS71068A / PS71089A	15	7	Optional [*]	1
Cortical Modelling	IS71088A	15	7	Compulsory	2
Cognitive Neuroscience	PS71092A	15	7	Compulsory	2

Academic year of study 2

Module Name	Module Code	Credits	Level	Module Type	Term
Multivariate Statistical Methods	PS71020E	15	7	Compulsory	1
Optional module from a list annually published and approved		15	7	Optional	1 or 2
Modelling Cognitive Functions	IS71087A	15	7	Compulsory	2
Advanced Quantitative Methods	PS71082A	15	7	Compulsory	2
Research Project in Computational Cognitive Neuroscience	IS71089A	60	7	Compulsory	3

Progression Requirements

Part-time students will normally be required to have passed all assessments in the first year before progressing to year two.

Academic support

Support for learning and wellbeing is provided in several ways by departments and College support services who work collaboratively to ensure students get the right help to reach their best potential both academically and personally.

All students are allocated a Personal Tutor (one in each department for joint programmes) who has overall responsibility for their individual progress and welfare. Personal Tutors meet with their student at least three a year either face-to-face, as part of a group and/or electronically. The first meeting normally takes place within the first few weeks of the autumn term. Personal Tutors are also available to students throughout the year of study. These meetings aim to discuss progress on modules, discussion of the academic discipline and reports from previous years if available (for continuing students). This provides an opportunity for progress, attendance and assessment marks to be reviewed and an informed discussion to take place about how to strengthen individual learning and success.

All students also have access to a Senior Tutor to enable them to speak to an experienced academic member of staff about any issues which are negatively impacting their academic study and which are beyond the normal scope of issues handled by Programme Convenors and Personal Tutors.

Students are provided with information about learning resources, the Library and information available on Learn.gold (VLE) so that they have access to department/ programme handbooks, programme information and support related information and guidance.

Taught sessions and lectures provide overviews of themes, which students are encouraged to complement with intensive reading for presentation and discussion with peers at seminars. Assessments build on lectures and seminars so students are expected to attend all taught sessions to build knowledge and their own understanding of their chosen discipline.

All assessed work is accompanied by some form of feedback to ensure that students' work is on the right track. It may come in a variety of forms ranging from written comments on a marked essay to oral and written feedback on developing projects and practice as they attend workshops.

Students may be referred to specialist student services by department staff or they may access support services independently. Information about support services is provided on the Goldsmiths website and for new students through new starter information and induction/Welcome Week. Any support recommendations that are made are agreed with the student and communicated to the department so that adjustments to learning and teaching can be implemented at a department level and students can be reassured that arrangements are in place. Opportunities are provided for students to review their support arrangements should their circumstances change. The Disability and Wellbeing Services maintain caseloads of students and provide on-going support.

The Careers Service provides central support for skills enhancement, running The Gold Award scheme and other co-curricular activities that are accredited via the Higher Education Achievement Report (HEAR).

The Centre for Academic Language and Literacies works with academic departments offering bespoke academic literacy sessions. It also provides a programme of academic skills workshops and one-to-one provision for students throughout the year

Placement opportunities

Currently there are no official placement opportunities for students enrolled in this MSc programme. However, the MSc joint directors have established collaborative links with a number of industry partners who regularly offer to jointly supervise MSc projects, or, occasionally, an internship after graduation.

Employability and potential career opportunities

Students will acquire knowledge of cutting-edge computational cognitive neuroscience techniques and a cross-disciplinary profile which will make them particularly competitive on the job market (especially for positions that require expertise and skills from different areas, e.g., international projects and research institutes). While the programming skills acquired during the programme will increase students' opportunities to work in big-data companies, their knowledge of computational modelling and cognitive neuroscience will be beneficial in both academia as well as in industry (e.g., in large enterprises with a focus on developing systems exhibiting human-like behaviour and AI technologies). The MSc directors have also established collaborative links with high-profile international industry partners (based in Japan, USA, and Europe). Through joint final projects carried out in collaboration with these partners, students are granted a direct route towards post-Master's internships and employment. Examples of jobs and positions suited to graduates of this programme include

Data Analyst, Lead Platform Engineer, AI Resident, Data Scientists, Machine Learning Engineer, Data Engineer, Research Assistant and PhD candidate.

Students are supported from the start to the finish of this programme to understand the different potential career journeys they can follow and to build a portfolio of work to demonstrate their capability to gain employment or freelance work in that area. Assessment has been designed to facilitate this process through the development of transferable or soft skills listed in the section above. Regular guest lectures from industry support the development of sector knowledge and awareness of different career paths.

The Department's External Advisory Board ensures relevance of all our programmes to the current and future needs of employers. All programmes are designed in consultation with employers to make sure students develop transferable skills to improve their career opportunities and they will be applying their skills to real-world problems through live project briefs and group projects. The board and other employers attend showcase events where students can present their ideas, get feedback and build important connections.

We have dedicated employability resource within the department to build employer relations and manage additional initiatives to support their future career opportunities, including regular communication of external opportunities for mentoring and work experience and an annual Career week (a focussed week of career support every June in the department where students can access alumni panels by programme and a range of industry talks).

Programme-specific requirements

Not applicable.

Tuition fee costs

Information on tuition fee costs is available at: https://www.gold.ac.uk/students/fee-support/ .

Specific programme costs

Not applicable.