MSc Computational Cognitive Neuroscience

Programme Specification

Awarding Institution:
University of London (Interim Exit Awards made by Goldsmiths' College)
Teaching Institution: Goldsmiths, University of London
Name of Final Award and Programme Title:
MSc Computational Cognitive Neuroscience
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):
(100366) Computer Science 50%
(101381) Cognitive Neuroscience 50%
QAA Benchmark Group: Computing
FHEQ Level of Award: Level 7
Programme accredited by: Not applicable
Date Programme Specification last updated/approved: December 2020
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 compulsory 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 conveyed in separate courses, i.e., theory and experimental methods in cognitive neuroscience, neural modelling, and programming.

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, Python or R, offered by the Computing Department. Similarly, students who do not possess an adequate level of maths (or statistic) knowledge for the Programme might be required to take a pre-sessional course on mathematical methods for computational neuroscience (to be co-organised by Psychology and Computing), or statistics (existing, offered by Psychology), as appropriate. Non-native English students should normally have a minimum IELTS score of 6.5 or equivalent.

Aims of the programme

This programme aims to provide a basis for independent research in the area of 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.

What you will be expected to achieve

Students who successfully complete the Postgraduate 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
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	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 and draw conclusions on the results	Cognitive Neuroscience, Advanced Quantitative Methods, 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, Data Programming, Cognitive Neuroscience
C5	Critically argue for the interdependence of theory, modelling and experiment in research	Cognitive Neuroscience, Cortical modelling, Modelling Cognitive Functions, Statistical Methods, Advanced Quantitative Methods

Transferable skills

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 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, Data Programming, Advanced Quantitative Methods

In addition to the above outcomes, students who complete the MSc 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

How you will learn

The Departments of Computing and Psychology are committed to a diverse and stimulating range of learning and teaching methods that ensure the programme outcomes are addressed rigorously and effectively. Learning emphasises a close synthesis between theoretical understanding and practical application that helps students develop an advanced, critical approach to the subjects of Computing or Psychology in general and to Computational Cognitive Neuroscience in particular.

The teaching and learning methods to which you will be exposed have been designed in recognition of: (a) the different background expertise; (b) the learning requirements of different types of information and skills; and (c) the need for you to engage in a complementary range of learning activities leading to the synthesis of academic knowledge and professional skills/competencies.

Learning and assessment strategies

To achieve the learning outcomes a range of teaching/learning methods will be adopted, including formal lectures, workshops, computer labs, seminars, module work (essays), and the conduct of an independent research project. Professional competencies are integral to teaching throughout the programme, during which you will be provided with many opportunities for discussion and debate. This learning strategy is designed to challenge your preconceptions, facilitate your independent thought, and enable you to develop subject-specific critical abilities. You will attend lectures in order to gain the necessary background knowledge, and computer lab sessions to acquire the required level of programming skills. Both the background knowledge and the programming skills will then be used in the compulsory modules of the programme to leverage the acquisition of more advanced expertise required for the development, and application of, neurobiologically realistic models of cortical and cognitive function.

These teaching/learning methods are integral to the acquisition of subject specific skills and understanding, but also provide the opportunity for discussion and debate. An aim of the programme is to facilitate independent thought and enable you to develop a critical perspective. You will receive feedback on written work (essays and coursework) in the form of structured numerical feedback, relating to the logic of arguments, their coherence, references, coverage of background literature, as well as in the form of written constructive criticism, highlighting the major strengths and weaknesses sufficient to allow you to know how to improve your work.

An additional aim of the programme is to provide you with the programming skills and theoretical background necessary to implement simple models of cortical circuits (see C1). Accordingly, you will receive feedback on the correctness of the code that you produce as part of relevant taught modules (such as “Data Programming” and “Cortical Modelling”). All materials associated with each module (teaching slides and additional resources, such as articles, code) will be made available on the corresponding “learn.gold” (VLE – “Virtual Learning Environment”) site.

During meetings with programme teaching staff, you will have a further opportunity to receive feedback and academic guidance. The reliability and validity of these forms of assessments are assured by group meetings between teaching staff. In addition, all written work is either second marked or moderated. Detailed criteria for marking bands are provided for students in the Programme Handbook.

Students are expected to engage in considerable independent reading and practical work for all modules culminating in the research project. This independent work will be supported by library resources, access to lab space and computing cluster facilities, and supervision from teaching staff.

Finally, you will be invited to attend the Departmental Talk series at the Department of Computing and Psychology, and the Whitehead lectures, jointly organised by both departments. These series of talks, covering the broader areas of Computing, Psychology, and Neuroscience, will expose you to module researchers and to contemporary ideas and practices in these fields. This may help you with decisions concerning your future career.

How you will be assessed

The Departments of Computing and Psychology are committed to providing diverse types of assessment. Our methods of assessment are designed to reflect research-relevant and professional activities and to encourage independent as well as collaborative work. In particular, our assessment integrates different kinds of written work (essays, coursework), oral presentation work (poster, slides), hands-on practical work including software development and computational modelling, data analysis design and implementation, and individual or group work. Students will be required to present their work in a number of different ways including posters, traditional reports and essays, oral presentations, and software and computational modelling scripts.

The following learning outcomes are associated with each type of assessment:

- Oral presentation (A2, A3, B1, B2, D1, D2, D3)
- Poster presentation (B4, D1, D2, D3)
- Report e.g., reports or weekly homework (A1, A2, A3, B1, B2, B3, C2, C3, C5, D1, D2, D3)
- Code or script writing (C1, C3, C4, D3, D4)
- Project (A3, A5, B4, C3, C4, C5, C6, D1, D2, D3, D4, D5)
- Exam (A4, B4, C3, C5)

Feedback is very important to the learning process, and shows students how to improve their work, and provides suggestions on how to learn more effectively in the future. Therefore the Department is committed to providing timely and full feedback on all assessed assignments.

Final research projects will be assessed based on the submission of a final report and a presentation in a viva. Guidance on the structure and writing of the report will be given in the module handbook. Moreover, general guidance on writing scientific work will specifically be provided in the “Research Project” module section in the programme handbook. Projects will be marked by a panel composed of two members of academic staff.

Students who are unable to submit an assessment on time due to illness or other unavoidable circumstances, must provide documentary evidence to their personal tutor in

order to be allowed a late submission. Evidence must also be supplied for students to apply for consideration of mitigating circumstances in assessment.

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; organisation 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 organising, 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.

Mark	Descriptor	Specific Marking Criteria
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.

How the programme is structured

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 compulsory parts of the programme (delivered in Terms 2 and 3). Within the limits set out below, students on the part-time pathway can choose which modules they take in Terms 1 and 2 of Years 1 and 2. However, dependent on a student’s particular background, it may be recommended that they are taken in a specific order. Where appropriate, students will be required to attend pre-sessional courses on programming, statistics, maths, 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).

Full-time mode

Module Title	Module Code	Credits	Level	Module Status	Term
Foundations of Neuroscience	PS74005D	15	7	Compulsory	1
Statistical Methods	PS71020D	15	7	Compulsory	1
Cortical Modelling	IS71088A	15	7	Compulsory	2
Modelling Cognitive Functions	IS71087A	15	7	Compulsory	2

Module Title	Module Code	Credits	Level	Module Status	Term
Cognitive Neuroscience	PS71092A	15	7	Compulsory	2
Advanced Quantitative Methods	PS71082A	15	7	Compulsory	2
Research Project	IS71089A	60	7	Compulsory	3
EITHER: Introduction to Coding with MATLAB [1]	PS71089A	15	7	Optional	1
OR: Data Programming [1]	IS71068A	15	7	Optional	1
Optional module from a list annually published and approved	Various	15	7	Optional	1 or 2

[1] Students should choose at least one of these two options.

The following is an indicative example of such a list of optional modules (some may be subject to prerequisites):

- Introduction to Coding with MATLAB (15 CATS)
- Data Programming (15 CATS)
- Artificial Intelligence (15 CATS)
- Research Design and Analysis (15 CATS)
- Neural Networks (15 CATS)
- Machine Learning (15 CATS)
- Critical Analysis (15 CATS)
- Physical Computing (15 CATS)
- Behavioural Genetics (15 CATS)

(Note that Machine Learning and Artificial Intelligence are available only to students who have significant experience of programming practice – e.g., graduates of computer science, engineering, maths, statistics, or physics programmes or equivalent previous experience).

Part-time mode

Academic Year of Study 1

Technical stream: Aimed at students who come already equipped with maths and programming skills, e.g. graduates of a technical discipline such as Computer Science, Physics, Mathematics, Engineering, etc.

Module Title	Module Code	Credits	Level	Module Status	Term
Foundations of Neuroscience	PS74005D	15	7	Compulsory	1
Statistical Methods	PS71020D	15	7	Compulsory	1
Cortical Modelling	IS71088A	15	7	Compulsory	2
Cognitive Neuroscience	PS71092A	15	7	Compulsory	2

Life Sciences stream: Aimed at students who come already equipped with neuroscientific and statistical skills, e.g. graduates of a life-science discipline, such as Psychology, Biology, Medicine, Neuroscience, etc.

Module Title	Module Code	Credits	Level	Module Status	Term
EITHER: Introduction to Coding with MATLAB [1]	PS71089A	15	7	Optional	1
OR: Data Programming [1]	IS71068A	15	7	Optional	1
Optional module from a list annually published and approved	Various	15	7	Optional	1 or 2
Cortical Modelling	IS71088A	15	7	Compulsory	2
Cognitive Neuroscience	PS71092A	15	7	Compulsory	2

Academic Year of Study 2

Technical stream

Module Title	Module Code	Credits	Level	Module Status	Term
EITHER: Introduction to Coding with MATLAB [1]	PS71089A	15	7	Optional*	1
OR: Data Programming [1]	IS71068A	15	7	Optional*	1
Optional module from a list annually published and approved	Various	15	7	Optional	1 or 2
Modelling Cognitive Functions	IS71087A	15	7	Compulsory	2
Advanced Quantitative Methods	PS71082A	15	7	Compulsory	2
Research Project	IS71089A	60	7	Compulsory	3

Life Sciences stream

Module Title	Module Code	Credits	Level	Module Status	Term
Foundations of Neuroscience	PS74005D	15	7	Compulsory	1
Statistical Methods	PS71020D	15	7	Compulsory	1
Modelling Cognitive Functions	IS71087A	15	7	Compulsory	2
Advanced Quantitative Methods	PS71082A	15	7	Compulsory	2
Research Project	IS71089A	60	7	Compulsory	3

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 a number of 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 twice 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 are also allocated 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 are able to 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 Academic Skills Centre 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.

Links with employers, placement opportunities and career prospects

Based on existing collaborative links between the two co-programme leaders with different labs and research institutes in the UK and EU (e.g., the University of Cambridge and University of Plymouth, the Neurospin Research Center in Paris, and the Bernstein Center for Computational Neuroscience in Germany, involving a number of participating Universities), we will promote student visits at these international labs once the MSc project is completed, as part of (optional) follow-up research projects. We are also currently developing links with employers to explore potential placement opportunities taking place after the MSc is completed.

Career prospects:

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 programme team have established collaborations with high-profile international industry partners (Japan, USA, and Europe), who may offer joint research projects for the dissertation, as well as internships.

The requirements of a Goldsmiths degree

All taught postgraduate degrees have a minimum total value of 180 credits and involve one calendar year of full-time study. Some programmes may extend over more than one calendar year and, when this is the case, they have a higher total credit value. Programmes are composed of individual modules, each of which has its own credit value. Part-time students normally take modules to the value of 90 credits each year. If a programme has a part-time pathway, the structure will be set out in the section "How the programme is structured" above. Normally, all modules are at level 7 of the Framework for Higher Education Qualifications.

More detailed information about the structure and requirements of a Goldsmiths degree is provided in the Goldsmiths Qualifications and Credit Framework.

Modules

Modules are defined as:

- "Optional" – which can be chosen from a group of modules
- "Compulsory" – which must be taken as part of the degree

Progression

Some programmes may require students to pass specific modules prior to completion of the dissertation/major project (or equivalent). Additionally, where a programme of study extends beyond one calendar year, students may be required to pass specific modules in their first year of study before progressing to the second year. Where this is the case, these requirements will be set out in this Programme Specification.

Award of the degree

In order to graduate, students must successfully complete all modules specified for the programme, as set out within the section “How the programme is structured” above.

Classification

Final degree classification is calculated on the basis of a student’s mean average mark (based on credit value) across all modules on the programme.

Masters degrees are awarded with the following classifications:

Distinction – 70%+
Merit – 60-69%
Pass – 50-59%

More detail on the calculation of the final classification is on our website.

Interim exit awards

Some programmes incorporate interim exit points of Postgraduate Certificate and/or Postgraduate Diploma, which may be awarded on the successful completion of modules to the minimum value of 60 credits or 120 credits respectively. The awards are made without classification.

When these awards are incorporated within the programme, the relevant learning outcomes and module requirements will be set out within the “What you will be expected to achieve” section above.

The above information is intended as a guide, with more detailed information available in the Goldsmiths Academic Manual.

Programme-specific rules and facts

General programme costs

In addition to your tuition fees, you will be responsible for meeting standard costs associated with your study. Find out more information at gold.ac.uk/programme-costs.

Specific programme costs

Not applicable.

How teaching quality will be monitored

Goldsmiths employs a number of methods to ensure and enhance the quality of learning and teaching on its programmes.

Programmes and modules are formally approved against national standards and are monitored throughout the year, such as in departmental committees, a variety of student feedback mechanisms and through the completion of module evaluation questionnaires. Every programme has at least one External Examiner who reviews comments annually on the standards of awards and student achievement. External Examiner(s) attend Boards of Examiners meetings and submit an annual written report.

Modules, programmes and/or departments are also subject to annual and periodic review internally, as well as periodic external scrutiny.

Quality assurance processes aim to ensure Goldsmiths' academic provision remains current, that the procedures to maintain the standards of the awards are working effectively and the quality of the learning opportunities and information provided to students and applicants is appropriate.

Detailed information on all these procedures are published on the Quality Office web pages.