

Cognitive Science

- M. Cognitive Science
- Ph.D. Cognitive Science

M. Cognitive Science

About the Program

Cognitive Science is an interdisciplinary approach to the study of human and artificial cognition. It integrates research from experimental psychology, theoretical and computational linguistics, artificial intelligence, philosophy of mind, and other related areas to address questions about learning, knowing, and thinking. The researchers who are involved in Carleton's programs in Cognitive Science have strengths in areas such as consciousness, cognitive development, mathematical cognition, cognitive and computational modelling, human performance, applied cognition, syntax, semantics, pragmatics, philosophy of mind and language, symbolic and computational logic, intelligent information systems, knowledge representation, natural language understanding, swarm and collective intelligence, evolutionary computing, and some areas of neuroscience. The program also involves researchers from industry, government agencies, and other post-secondary institutions.

Academic Regulations

See the General Regulations section of this Calendar.

Program Requirements

Admission Requirements

The requirement for admission into the M.Cog.Sc. program is an Honours degree with an average of at least B+.

Applicants whose first language is not English must demonstrate a fluent knowledge of English. This is normally done in one of the following ways:

1. An overall score of 70 on the Canadian Academic English Language (CAEL) Assessment
2. A TOEFL score of 230 CBT (computer-based test) or 580; or 86 IBT overall with a minimum score in each component of writing (22), speaking (22), reading (20) and listening (20).
3. An overall IELTS score of 6.5, with a minimum of 6.0 in each band score; or
4. An acceptable certification that the language of instruction in your most recently completed undergraduate or graduate degree was English.

To be admitted, a candidate must submit a description of his or her research interests in the area of Cognitive Science.

M. Cog. Sc. - Research Project option (5.0 credits)

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|---|-----|
| 1. 0.5 credit in: | 0.5 |
| CGSC 5100 [0.5] Issues in Cognitive Science | |
| 2. 0.5 credit in: | 0.5 |

CGSC 5101 [0.5] Experimental Methods and Statistics

or CGSC 5103 [0.5] Formal Methods

3. 1.5 credits from: 1.5

CGSC 5001 [0.5] Cognition and Artificial Cognitive Systems

CGSC 5002 [0.5] Experimental Research in Cognition

CGSC 5003 [0.5] Cognition and Language

CGSC 5004 [0.5] Cognition and Conceptual Issues

CGSC 5005 [0.5] Cognition and Neuroscience

4. 1.0 credit in: 1.0

CGSC 5908 [1.0] Research Project

5. 1.5 credits in cognitive science or other approved courses selected in consultation with the graduate supervisor 1.5

6. Preparation of research for presentation at the Cognitive Science Spring Conference.

Total Credits 5.0

M. Cog. Sc. - Thesis option (5.0 credits)

1. 0.5 credit in: 0.5

CGSC 5100 [0.5] Issues in Cognitive Science

2. 0.5 credit from: 0.5

CGSC 5101 [0.5] Experimental Methods and Statistics

or CGSC 5103 [0.5] Formal Methods

3. 1.5 credits in cognitive science or other approved courses, from at least two different cognitive disciplines, selected in consultation with the graduate supervisor 1.5

4. 2.5 credits in: 2.5

CGSC 5909 [2.5] M. Cog. Thesis

5. Preparation of research for presentation at the Carleton Cognitive Science Graduate Conference.

Total Credits 5.0

Guidelines for Completion of the M.Cog.Sc. Degree

The degree is expected to take no more than four (4) terms to complete. Students will enroll in courses while also conducting research. While all students will take some core courses, the specific balance of the remaining credits (coursework and research) will vary by student. Credit selection will be determined in consultation with either the Graduate Supervisor or the student's faculty advisor.

Ph.D. Cognitive Science

About the Program

Cognitive Science is an interdisciplinary approach to the study of human and artificial cognition. It integrates research from experimental psychology, theoretical and computational linguistics, artificial intelligence, philosophy of mind, and other related areas to address questions about learning, knowing, and thinking. The researchers who are involved in Carleton's programs in Cognitive Science have strengths in areas such as

- consciousness
- cognitive development
- mathematical cognition

- cognitive and computational modelling
- human performance
- applied cognition
- syntax
- semantics
- pragmatics
- philosophy of mind and language
- symbolic and computational logic
- intelligent information systems
- knowledge representation
- natural language understanding
- swarm and collective intelligence
- evolutionary computing
- some areas of neuroscience

The program also involves researchers from industry, government agencies, and other post-secondary institutions.

Academic Regulations

See the General Regulations section of this Calendar.

Admission Requirements

- Master's degree (or the equivalent) from one of the participating disciplines. An average of at least A- in courses in cognition is normally required.
- Applicants with a master's degree in one of the participating disciplines are normally admitted to a 10.0-credit program.
- Students eligible for admission to the 10.0 -credit program but with deficiencies may be required to take additional courses or may be directed to apply for the M. Cog.Sc.
- An overall score of 70 on the Canadian Academic English Language (CAEL) Assessment
- A TOEFL score of 230 CBT (computer-based test) or 580; or 86 IBT overall with a minimum score in each component of writing (22), speaking (22), reading (20) and listening (20).
- An overall IELTS score of 6.5, with a minimum of 6.0 in each band score; or
- An acceptable certification that the language of instruction in your most recently completed undergraduate or graduate degree was English.
- To be admitted, a candidate must submit a description of his or her proposed area of thesis research and a member of the core faculty must indicate in writing that he or she is willing to supervise the student.

Program Requirements

The requirements of the Ph.D. in Cognitive Science are:

Ph.D. Cognitive Science (10.0 credits)

1. 0.5 credit in:		0.5
	CGSC 6001 [0.5] Theory and Methods of Cognitive Science	
2. 0.5 credit in:		0.5
	CGSC 5100 [0.5] Issues in Cognitive Science	
3. 0.5 credit in:		0.5

	CGSC 6801 [0.5] Proseminar in Cognitive Science	
4. 0.5 credit in:		0.5
	CGSC 6002 [0.5] Methodology Rotation I	
5. 0.5 credit in:		0.5
	CGSC 6003 [0.5] Methodology Rotation II	
6. 5.0 credits in:		5.0
	CGSC 6909 [5.0] Ph.D. Thesis (The prospectus must be defended at an oral comprehensive examination on the subject-matter of the thesis. The thesis must also be defended at an oral examination.)	
7. 2.5 credits in	cognition from three different cognitive disciplines, including at least 0.5 credit in neuroscience if not already completed.	2.5
Total Credits		10.0

- Each year, students are required to present a research paper or poster at the Cognitive Science Spring Conference.
- Program to be selected in consultation with the Graduate Supervisor of Cognitive Science.
- Any student planning a dissertation with an applied cognitive emphasis is required to work for at least one term at a facility approved by the student's research supervisor and the Director of the Cognitive Science Program. Such a facility may include any institution, governmental laboratory, corporation, hospital or educational centre conducting research in the area of the student's specialization. Students should complete this work while registered in either option:

Methodology Rotation

CGSC 6002 [0.5]	Methodology Rotation I
CGSC 6003 [0.5]	Methodology Rotation II

Ph.D. Thesis

CGSC 6909 [5.0]	Ph.D. Thesis
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Methodology Rotation

The methodology rotation consists of two parts. Students spend one term in each of two laboratories or other research venues using two different methods for studying cognition (behavioural, linguistic-theoretic, computational, conceptual, neuroscientific).

The purpose of the methodology rotation is to give students sufficient background in two different approaches to cognition to allow the student to use work from these approaches in his or her own research.

Assignments will be as specified by each rotation supervisor. Each rotation will be graded separately by the supervisor, Passed with Distinction (PWD)/Satisfactory(S)/Unsatisfactory (U). In the event of a grade of U the student may repeat a rotation only once.

Prospectus, Comprehensive Examination, Thesis and Defense

When a student is ready to begin work on a thesis (dissertation), the Graduate Supervisor approves a dissertation committee which must have at least three members from two different approaches to cognition, including the advisor or co-advisors plus the Director of the

Cognitive Science doctoral program ex officio. Preparation of the thesis has two stages. First the student prepares a prospectus, which is examined at a comprehensive examination on the subject matter of the thesis. Then the student prepares the thesis, which is defended at a public oral examination. Specifically:

Prospectus

The prospectus must describe the proposed research and review the relevant literature in the field of the research. The research proposal must be sufficiently detailed to allow the examining committee to judge the likelihood of a successful dissertation ensuing from it. Preparation of the prospectus will follow the practices common in the advisor's area of research. The committee may add further requirements.

Comprehensive Examination

The prospectus is examined orally by a board consisting of the members of the dissertation committee. The committee may add further examiners. The examination is a comprehensive examination of the thesis subject matter, to ensure that the student has a sound understanding of the context of his or her proposed research, and of appropriate methods, ethical considerations, and so on. The examining board will also consider the research that the student is proposing, which must be of sufficiently high quality and described in sufficient detail to allow the committee to judge whether, if completed successfully, it would be likely that the student would be awarded the degree. Should a student fail the comprehensive exam or his or her prospectus is unacceptable, the student may resubmit the prospectus and be reexamined once.

Thesis

The completed thesis is examined orally by an examining board consisting at minimum of the dissertation committee, an examiner at arm's length to the project from within Carleton (the "internal external") and an examiner from another university who is at arm's length to the student and the committee and who is a recognized expert in the area of the dissertation. All university regulations apply.

Residence Requirement

All Ph.D. candidates must be registered full-time in a minimum of six terms to satisfy the residence requirement.

Language Requirement

A second language is required when relevant to the student's program of research. Whether a second language is required and the level of proficiency expected is determined at the time of admission, based on the student's description of his or her proposed area of thesis research.

Milestones for Completion of the Ph.D. Degree

To assist all Ph.D. students to progress through their program in a timely manner, the Ph.D. Cognitive Science Program has milestones in place to mark students' progress. In the first year, the students are expected to complete CGSC 6801 and make substantial progress in their coursework. Students are expected to complete CGSC 6001 in their first two years (it is offered in alternate

years). During second year, students are expected to complete their coursework and to begin their two methodology rotations (CGSC 6002 and CGSC 6003). The methodology rotations must be completed by the beginning of the third year. The research requirements in first and second year apply to all students. The third year is devoted to research and preparing your Prospectus and defending it (this is the Comprehensive requirement). The prospectus is to be defended by the end of third year. The fourth year and, if necessary fifth year, are to be spent completing your research, completing the dissertation, and defending it.

First year

Proseminar, Theory and Methods (if available), coursework, presentation at Spring Conference

Second year

Theory and Methods (if available), coursework and methodology rotations, presentation at Spring Conference

Third year

Prospectus and comprehensive exam, presentation at Spring Conference

Fourth-fifth year

Thesis and thesis defence

CGSC 5001 [0.5 credit]

Cognition and Artificial Cognitive Systems

An introduction to the contribution of artificial intelligence and computer modeling of cognitive processes to cognitive science.

CGSC 5002 [0.5 credit]

Experimental Research in Cognition

An introduction to the contribution of experimental psychology and neuroscience to cognitive science.

CGSC 5003 [0.5 credit]

Cognition and Language

An introduction to the contribution of theoretical linguistics and linguistic research to cognitive science.

CGSC 5004 [0.5 credit]

Cognition and Conceptual Issues

An introduction to the contribution of philosophy of mind, philosophy of language, and other conceptual investigations to cognitive science.

CGSC 5005 [0.5 credit]

Cognition and Neuroscience

An introduction to the contribution of neuroscience to cognitive science.

CGSC 5100 [0.5 credit]

Issues in Cognitive Science

A survey of the central problems and issues of cognitive research to start the process of acquiring the interdisciplinary breadth required to understand research in cognitive science.

CGSC 5101 [0.5 credit]**Experimental Methods and Statistics**

An introduction to the design of experiments and the statistics needed to interpret data in cognitive science. Also offered at the undergraduate level, with different requirements, as HCIN 5400, for which additional credit is precluded.

CGSC 5103 [0.5 credit]**Formal Methods**

The class introduces students to various formal methods relevant to cognitive science, possibly including (but not limited to) formal logic, the theory of computation, probability theory, decision theory.

Precludes additional credit for CGSC 5102.

Prerequisite(s): permission of the department.

Seminar.

CGSC 5303 [0.5 credit]**Linguistic Analysis, Culture and Cognition**

Universals of language from a cross-cultural perspective. Study of lesser-known languages leading to critical understanding of universal human concepts and communication practices in culture-specific configurations. Cross-linguistic analysis as a means to general understanding of diversity and universality in human cognition.

CGSC 5901 [0.5 credit]**Special Topics in Cognitive Science**

Seminar on current, important issues related to Cognition and Neuroscience, Philosophy, Computer Science, Linguistics and/or Psychology. Topics will vary from year to year.

CGSC 5907 [0.5 credit]**Independent Research**

Permission to register and approval of research plan must be obtained from the graduate supervisor. A final research report must be filed in the departmental office prior to submission of course grade. The course may be repeated for credit.

CGSC 5908 [1.0 credit]**Research Project**

Students may enroll in multiple sections of this course (as necessary) to complete their Research credits.

CGSC 5909 [2.5 credits]**M. Cog. Thesis****CGSC 6001 [0.5 credit]****Theory and Methods of Cognitive Science**

Introduction to the main epistemological issues in cognitive science and to the diverse methods that researchers use to study cognition.

CGSC 6002 [0.5 credit]**Methodology Rotation I**

Students spend one term in a laboratory or other research venue using a method for studying cognition (behavioural, linguistic-theoretic, computational, conceptual, neuroscientific). Assignments will be as specified by each rotation supervisor.

CGSC 6003 [0.5 credit]**Methodology Rotation II**

Students spend one term in a laboratory or other research venue using a different method for studying cognition (behavioural, linguistic-theoretic, computational, conceptual, neuroscientific). Assignments will be as specified by each rotation supervisor.

CGSC 6004 [0.5 credit]**Cognitive Modelling for Cognitive Science**

Introduction to the field of cognitive modelling. Different modelling systems and how to evaluate them against human data; how to create cognitive models using the ACT-R cognitive architecture.

Lectures three hours per week.

CGSC 6501 [0.5 credit]**Special Topics in Cognitive Science**

Seminar course on a topic of interest to students in Cognitive Science. Topics will vary from year to year.

Lectures three hours per week.

CGSC 6801 [0.5 credit]**Proseminar in Cognitive Science**

A survey of the central problems and issues of natural and artificial cognition and a brief examination of contemporary neuroscience. Compulsory in the first year of registration.

Precludes additional credit for CGSC 6801 (no longer offered).

CGSC 6901 [0.5 credit]**Directed Studies in Cognitive Science I****CGSC 6902 [0.5 credit]****Directed Studies in Cognitive Science II****CGSC 6909 [5.0 credits]****Ph.D. Thesis**

Summer session: some of the courses listed in this Calendar are offered during the summer. Hours and scheduling for summer session courses will differ significantly from those reported in the fall/winter Calendar. To determine the scheduling and hours for summer session classes, consult the class schedule at central.carleton.ca

Not all courses listed are offered in a given year. For an up-to-date statement of course offerings for the current session and to determine the term of offering, consult the class schedule at central.carleton.ca