

**PROPOSAL FOR A GRADUATE CERTIFICATE PROGRAM IN  
COGNITIVE SCIENCE AT THE UNIVERSITY OF  
MASSACHUSETTS/AMHERST**

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**MISSION STATEMENT**

Graduate programs usually train students in the theories, findings, methods and modes of argumentation of a single traditional discipline. A researcher's orientation to a particular problem can often be predicted if one knows in which department the researcher was trained. How a problem is approached, which questions are of interest, what method of analysis is applied and the context in which a problem is placed differ across disciplines.

Cognitive Science, the study of cognitive systems, is a topic of study that cuts across a variety of traditional disciplines. At the University of Massachusetts, the Departments of Communication Disorders, Computer Science, Linguistics, Philosophy, and Psychology have been the most visible players in cognitive science. They have shared Sloan Foundation funding in cognitive science, their faculty share several Federal research and training grants, they host the ongoing Five College Faculty Seminar in Cognitive Science, and their graduate students frequently cross departmental boundaries to take courses and do research. Other schools in the Five Colleges also have a rich variety of offerings in cognitive science, and their faculty often participate in the training of UMass graduate students.

A number of other universities (see the attached list of some 40 prominent ones in the United States) have chosen to establish graduate programs or departments of cognitive science in an attempt to encourage cross-disciplinary training. The departments at the University of Massachusetts that are most involved in cognitive science have chosen not to relinquish their degree-granting autonomy in favor of establishing a new graduate degree in cognitive science. Nonetheless, these departments recognize that pioneering work in cognitive science depends on identifying new questions and approaching them in novel ways. While this can be done within the bounds of a traditional discipline, contact with related disciplines may serve as a catalyst. It may equip a researcher with the skills needed to take on deeper issues than would otherwise be possible and to approach questions that are not highlighted within a traditional discipline, and contact with faculty and students in a department other than one's own often has unforeseen benefits to all involved.

The mission of the Cognitive Science Certificate Program is to promote such contact in a self-designed flexible but coherent program which draws on the unique strength of the resources at the University of Massachusetts and the individual interests and talents of particular students. The Certificate Program would encourage graduate students to study outside the bounds of their home department and recognize the achievements of those who do so.

## PROPOSED PROGRAM STRUCTURE AND REQUIREMENTS

Matriculated graduate students (PhD or Masters level) in the Departments of Communication Disorders, Computer Science, Linguistics, Philosophy, and Psychology at the University of Massachusetts/Amherst can complete the requirements of the Graduate Certificate Program in Cognitive Science and receive formal recognition of such completion. Matriculated graduate students in other departments may petition the Cognitive Science Certificate Steering Committee for admission to the Program. The requirements for the Certificate are:

A) The student must take 15 credits of approved graduate courses in one or more departments other than his/her major degree department, selected from the offerings of the Departments of Communication Disorders, Computer Science, Linguistics, Philosophy, and Psychology listed below. A student may appeal to the Cognitive Science Certificate Steering Committee to substitute up to six credits of courses for courses on this list. Such appeal must be accompanied by a persuasive rationale for the substitution and must be approved by a majority of the Steering Committee.

B) Up to six of the 15 credits may be earned for conducting original research outside the student's major department.

C) A student must submit a plan of study to the Cognitive Science Certificate Steering Committee as early as possible in the student's graduate career. The student must have completed no more than nine credits of coursework toward the Certificate when the plan of study is submitted. The plan of study must specify a cohesive package of courses to be taken and provide a rationale for the particular selection of courses by demonstrating how the courses constitute a coherent approach to cognitive science. The plan of study must also designate a member of the graduate faculty as a Certificate Advisor, and the advisor must indicate his or her approval of the plan of study.

D) The Cognitive Science Certificate Steering Committee must review each student's accomplishments at or before the time that the student receives his or her terminal degree and, if the student has fulfilled the requirements of the Certificate, vote to award the certificate.

E) The courses listed below can be chosen to fulfill the requirements of the Certificate Program. In each case, the student should consult the course instructor prior to registering in the course to determine whether he or she has the necessary background knowledge for the course.

### COMMUNICATION DISORDERS

ComDis 580	Cognitive Bases of Language	3 cr
ComDis 610	Phonological Disorders	3 cr
ComDis 613	Language Disorders in Adults I	3 cr
ComDis 614	Language Disorders in Adults II	3 cr
ComDis 631	Language Disorders in Children I	3 cr
ComDis 632	Language Disorders in Children II	3 cr
ComDis 645	Theories of Hearing	3 cr
ComDis 896	Independent Study	Variable

### COMPUTER SCIENCE

Cmpsci 503 (591C)	Embedded Systems	3 cr
Cmpsci 572	Neurobiology	3 cr
Cmpsci 585	Natural Language Processing	3 cr
Cmpsci 587 (591B)	Computing with Artificial Neural Networks	3 cr
Cmpsci 589	Machine Learning	3 cr
Cmpsci 603	Robotics	3 cr
Cmpsci 646	Information Systems	3 cr
Cmpsci 670	Computer Vision	3 cr
Cmpsci 681	Multi-agent Problem Solving	3 cr
Cmpsci 683/383	Artificial Intelligence	3 cr
Cmpsci 691O	Tools for Exploratory and Tutoring Systems	3 cr

#### LINGUISTICS

Ling 501 (591A)	Linguistic Theory and Grammar of English	3 cr
Ling 601	Introduction to Transformational Grammar	4 cr
Ling 603	Generative Phonology	4 cr
Ling 610	Semantics and Generative Grammar	4 cr
Ling 611	Psychological Background to Linguistic Theory	3 cr
Ling 614	Introduction to Phonetic Theory	3 cr
Ling 620	Formal Semantics	3 cr
Ling 705	Diachronic Linguistics	3 cr
Ling 711	Language Acquisition	3 cr
Ling 712	Perception of Linguistic Form	3 cr
Ling 740-748	Structure of Language Courses (Field Methods)	3 cr

#### PHILOSOPHY

Phil 550	Epistemology	3 cr
Phil 751	Theory of Knowledge	3 cr
Phil 783 (or 584)	Philosophy of Language	3 cr
Phil 784 (or 582)	Philosophy of Science	3 cr
Phil 785	Philosophy of Mind	3 cr
Phil 791-795 Seminars (when topic is appropriate; e.g., in Spring 2000 Jay Garfield taught a seminar in Foundations of Cognitive Science)		

#### PSYCHOLOGY

Psych 530	Human Neuropsychology	3 cr
Psych 617	Applied and Basic Cognition and its Development I	3 cr
Psych 618	Applied and Basic Cognition and its Development II	3 cr
Psych 650	Brain Development and Behavior	3 cr
Psych 750	Learning and Memory Processes in Children	3 cr
Psych 751	Cognitive Processes in Children	3 cr
Psych 752	Perceptual Development in Children	3 cr
Psych 891-3	Seminar (when appropriate to Cognitive Science)	3 cr
Psych 896-7	Independent Study, Special Topics	variable

## **ADMINISTRATIVE STRUCTURE**

The Cognitive Science Certificate Program is administered by a Cognitive Science Certificate Steering Committee. This Committee consists of one faculty representative of each of the departments involved in the program (Communication Disorders, Computer Science, Linguistics, Philosophy, and Psychology). Each department will choose its representative for a two-year term, using whatever selection procedures the department deems appropriate. The same representative may be selected for consecutive terms. Terms will be staggered, with three departments normally selecting representatives in even-numbered academic years and two departments in odd-numbered years. The Steering Committee will elect a Coordinator each year, for a one-year term. The Coordinator will serve as the person for students to contact and will convene meetings of the Committee as necessary. Departments not included in the list above who wish to participate in the Cognitive Science Certificate Program may petition the Steering Committee for inclusion, submitting a list of courses to be included in the list of approved courses and evidence that their graduate students have been participating in cognitive science activities. If the Steering Committee approves the petition, it will initiate a program revision request following procedures described in the Faculty Senate Course Approval Procedure Guide. If the revision is approved, the petitioning department will be asked to provide a representative to the Committee.

## **SOME DETAILS**

- A. The proposed Cognitive Science Certificate Program will require no new resources. All courses are regularly taught at the present time, and no added staffing is required.
- B. We anticipate that between three and ten students will receive the Certificate each year.
- C. We will advertise the Program on a web page to make certain that graduate students at the University of Massachusetts are aware of it. We will also use it to attract prospective graduate students to the University of Massachusetts.

## **AMENDMENTS ADDED AT REQUEST OF DEPARTMENTS: DECEMBER 3, 2000**

1. The Cognitive Science Certificate will be awarded only at the time the student receives his or her terminal degree is his or her major department.
2. The policies that have been established in each department for course registration and enrollment remain in effect for those courses that contribute to the Cognitive Science Certificate. A student's participation in the Cognitive Science Certificate program does not guarantee admission to a course.
3. An attachment illustrating possible coherent sets of courses now appears at the end of this document.

**PLAN OF STUDY TOWARDS A CERTIFICATE IN COGNITIVE  
SCIENCE, UNIVERSITY OF MASSACHUSETTS/AMHERST**

Student name: \_\_\_\_\_

Major department: \_\_\_\_\_ Application date: \_\_\_\_\_

Expected date of receipt of terminal degree (indicate masters or doctoral): \_\_\_\_\_

Proposed courses from list of approved courses:

Dept	Number	Title	If already taken:	
			Semester taken	Grade
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

Proposed courses not from list of approved courses:

Dept	Number	Title	If already taken:	
			Semester taken	Grade
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

**Rationale:** Provide a rationale for the proposed courses, describing how they constitute a coherent approach to cognitive science. Provide descriptions of and justifications for courses not on approved list. Use continuation page as needed.

Certificate Advisor: \_\_\_\_\_

Department: \_\_\_\_\_

\_\_\_\_\_  
(Signature of advisor)

\_\_\_\_\_  
(Signature of applicant)

## **Illustrative course programs for the Graduate Certificate in Cognitive Science**

I. A student in Psychology who is interested in memory and conceptual behavior could take the following courses:

CmpSci 587, Computing with artificial neural networks

CmpSci 589, Machine learning

Ling 501, Linguistic theory and grammar of English

Phil 784, Philosophy of science

Phil 785, Philosophy of mind

This program would give the student a broad overview of cognitive science approaches to knowledge and the representation of knowledge, which is fundamental to the student's specialization in memory and conceptual behavior

II. A student in Psychology who is interested in computational approaches to vision, visual reasoning, and visual form learning might take the following courses:

Cmpsci 572, Neurobiology

Cmpsci 587, Computing with artificial neural networks

Cmpsci 589, Machine learning

Cmpsci 670, Computer vision

Plus one course not in current list, added at the request of the student who argues that the specific computational principles covered in this course have particular relevance to psychological approaches to computer vision: Cmpsci 687, Reinforcement Learning.

This program is sharply focused on computational approaches. It would provide the student with tools to do research on the psychology of vision that few psychologists enjoy.

III. A student in Linguistics who is interested in language processing in normal adults and in adults with language disorders might take the following courses:

Cmpsci 585, Natural language processing

Psychology 530, Human neuropsychology

Psychology 617, Applied and basic cognition and its development I

ComDis 580, Cognitive bases of language

ComDis 613, Language disorders in adults I

This program would provide the student with a broad overview of experimental and clinical approaches to language and language disorders.

IV. A student in Communication Disorders who is interested in normal and disordered phonological development might take the following courses:

Linguistics 601, Introduction to transformational grammar

Linguistics 603, Generative phonology

Linguistics 614, Introduction to phonetic theory

Psychology 617, Applied and basic cognition and its development

Psychology 752, Perceptual development in children

This program would give the student a substantial and integrated foundation of linguistic approaches to language, focused on phonology and phonetics, as well as a solid introduction to experimental approaches to the psychology of perception, including auditory perception.