

# UNIVERSITY FACULTY SENATE FORMS

## Academic Program Approval

This form is a routing document for the approval of new and revised academic programs. Proposing department should complete this form. For more information, call the Faculty Senate Office at 831-2921.

**Submitted by:** Peter Cole, Director of Undergraduate Studies, phone number: 831-6829

**Department:** Linguistics email address: pcole@udel.edu

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**Action: Add major (BS and Honors BS)**

(Example: add major/minor/concentration, delete major/minor/concentration, revise major/minor/concentration, academic unit name change, request for permanent status, policy change, etc.)

**Effective term:** 07F  
(use format 04F, 05W)

**Current degree:** Linguistics currently offers an undergraduate Minor in Linguistics, an undergraduate Minor in Cognitive Science, an MA in Linguistics & Cognitive Science and the Ph.D. in Linguistics

(Example: BA, BACH, BACJ, HBA, EDD, MA, MBA, etc.)

**Proposed change leads to the degree of: BS and Honors BS**

(Example: BA, BACH, BACJ, HBA, EDD, MA, MBA, etc.)

**Proposed name: B.S. in Cognitive Science; Honors B.S. in Cognitive Science**

Proposed new name for revised or new major / minor / concentration / academic unit (if applicable)

**Revising or Deleting:**

**Undergraduate major / Concentration:** \_\_\_\_\_  
(Example: Applied Music – Instrumental degree BMAS)

**Undergraduate minor:** \_\_\_\_\_  
(Example: African Studies, Business Administration, English, Leadership, etc.)

**Graduate Program Policy statement change:** \_\_\_\_\_  
(Must attach your Graduate Program Policy Statement)

**Graduate Program of Study:** \_\_\_\_\_  
(Example: Animal Science: MS Animal Science: PHD Economics: MA Economics: PHD)

**Graduate minor / concentration:** \_\_\_\_\_

**Note: all graduate studies proposals must include an electronic copy of the Graduate Program Policy Document, highlighting the changes made to the original policy document.**

**List new courses required for the new or revised curriculum. How do they support the overall program objectives of the major/minor/concentrations)?**

(Be aware that approval of the curriculum is dependent upon these courses successfully passing through the Course Challenge list. If there are no new courses enter "None")

None: A full explanation and justification for the new major is attached. Although new courses are referred to in this document, they are not required course for the proposed major..

**Explain, when appropriate, how this new/revised curriculum supports the 10 goals of undergraduate education: <http://www.ugs.udel.edu/gened/>**

The proposed major contributes to all of the ten goals of undergraduate education:

Goal 1, skills in communication, numerical literacy and use of technology: Numerical literacy (Bisc 104/207, CISC 105/106/181, PHIL 205). See especially speech science concentration re technology and communication. The capstone seminar requires all majors to complete a major paper.

Goal 2, critical thinking: The program includes a variety of course requiring the critical examination of research, e.g. CGSC 270, 485; LING 101; PHIL 205; PSYC 100.

Goal 3, independent and collaborative work: CGSC 270, CGSC 485, LING 101 all require both independent & collaborative work.

Goal 4, ethics and responsibility: This is specifically addressed in CGSC 270 and 485 and LING 101.

Goal 5, diverse ways of thinking: This curriculum as a whole addresses scientific and philosophical approaches to the mind.

Goal 6, intellectual curiosity: The self-designed nature of the curriculum encourages the student to develop his/her own intellectual interests.

Goal 7, integration of academic knowledge and life experiences: The program encourages and provides opportunities for internships etc. that allow the student to integrate academic knowledge and life experience.

Goal 8, expand understanding of human creativity: Cognitive science examines scientifically the source of human cognitive capabilities including artistic creativity. While not a requirement of the major, a student may choose to make this the primary emphasis of the program.

Goal 9, study of cultural diversity: A major goal of cognitive science is to examine which aspects of thought are the result of evolution and which are due to cultural factors. A student may choose to make these issues central to his or her program.

Goal 10, international perspective: The contribution of cognitive science is related to goal 9. The study of cognition in different societies requires an international perspective. Language plays a major role in the program. The study of the nature of human language is inherently an examination of both social diversity and is international in nature.

**Identify other units affected by the proposed changes:**

(Attach permission from the affected units. If no other unit is affected, enter “None”)

Anthropology

Biology

Computer and Information Science

Education

Mathematical Sciences

Program in Cognitive Science

Philosophy

Psychology

**Describe the rationale for the proposed program change(s):**

(Explain your reasons for creating, revising, or deleting the curriculum or program.)

Cognitive science studies the human mind viewed as a computational process. It lies at the confluence of computer science, educational and cognitive development, linguistics, neuroscience, neurobiology, philosophy, psychology, and certain areas of mathematics. Cognitive science has arguably been the most important development in the study of human thinking in the past twenty years; its influence can be seen across a wide variety of disciplines, from logic to communication disorders. Numerous other schools have had the foresight to establish formal programs in the area (e.g., Brown, Johns Hopkins, MIT, UCSD, UCI, Washington University, among others).

Delaware already provides opportunities for undergraduates to minor in Cognitive Science, and for graduate students to earn an MA degree emphasizing cognitive science. The goal of this BS program is to extend these opportunities to undergraduates by providing an undergraduate major. (A fuller explanation of the rationale for the degree is provided in the attached “Proposal for a B.S. in Cognitive Science.”)

**Program Requirements:**

(Show the new or revised curriculum as it should appear in the Course Catalog. If this is a revision, be sure to indicate the changes being made to the current curriculum and **include a side-by-side comparison** of the credit distribution before and after the proposed change.)

We provide a full proposal for the degree in the attached “Proposal for a B.S. in Cognitive Science.”:

1. Institutional Factors

Cognitive science studies the human mind viewed as a computational process. It lies at the confluence of computer science, educational and cognitive development, linguistics, neuroscience, neurobiology, philosophy, psychology, and certain areas of mathematics. Cognitive science has arguably been the most important development in the study of human thinking in the past twenty years; its influence can be seen across a wide variety of disciplines, from logic to communication disorders. Numerous other schools have had the foresight to establish formal programs in the area (e.g., Brown, Johns Hopkins, MIT, UCSD, UCI, Washington University, among others), and we propose to follow suit.

As a discipline, cognitive science seeks to model and explain such phenomena as language, reasoning and perception. The goal of cognitive science as a theoretical discipline is to determine those knowledge structures and processes that characterize organisms as biological information processing systems, as well as to explain how these organisms come to possess this knowledge.

Applied cognitive science takes the results of this research to such diverse areas as language technology, cognitive approaches to education, human computer interaction etc. The latter field addresses the most effective use of technology by people and includes the study of user interfaces, graphical displays, visualization of data, virtual reality, technology-based education, intelligent agents, and computer-based assistive technology for persons with disabilities.

The University of Delaware has a number of faculty with strengths in both applied and theoretical cognitive science (see section V). For years, an informal research group has met regularly to discuss recent research in Cognitive Science, and the Program in Cognitive Science has offered a stimulating program of lectures to student body, public and faculty. At present, however, there is little in the way of formal educational opportunities for undergraduate students to pursue this cross-disciplinary study. There is a minor in cognitive science (administered by the Department of Linguistics), but, as a minor, this option remains a secondary choice to students and not the focus of significant curricular development. There is no available formal program for speech science—a natural preliminary for graduate study in speech pathology as well as a natural offshoot of applied cognitive science—even as a minor area of study. While the Department of Linguistics has provided a curriculum for students interested in preparing for graduate work in speech pathology and language pathology, this has been handled in an ad hoc fashion and, therefore, has not fully met the needs of the students or of the State of Delaware. We propose to correct these problems through the creation of a new undergraduate major in cognitive science.

## 2. Student Demand and Employment Factors

A B.S. in cognitive science can have great impact at the undergraduate level, where it can feed into a variety of professional careers (e.g., cognitive engineering, user interface design) and graduate programs (e.g., computer science, education, linguistics, psychology, philosophy, speech pathology and cognitive science graduate programs). Graduate opportunities in cognitive science are already in place to a great extent. The Department of Linguistics offers an M.A. in Linguistics and Cognitive Science. The Doctoral programs of three departments, Linguistics, Psychology and Computer and Information Science offer the possibility of Doctoral programs encompassing major aspects of cognitive science. Thus, while we plan to revisit in the future the question of whether a stand-alone Doctoral program in cognitive science should be offered, our immediate concern is in providing opportunities to UD undergraduates.

The relationship between cognitive science and graduate speech pathology is particularly important for the establishment of this degree at Delaware. The need for speech pathologists in the state is evidenced by the availability of public support dollars for graduate students who agree to work in Delaware after finishing their degrees. Nonetheless, with the exception of the ad hoc program currently offered by the Department of Linguistics, the University does not currently provide any formal curriculum for students planning to enter graduate school in speech pathology. We hope to remedy that deficit with this program.

## III. Enrollment, Admissions and Financial Aid

### 1. Enrollment

There are currently about 30 students in the ad hoc pre-graduate speech pathology program organized by the Department of Linguistics. The number of students that we agree to allow into this informal program has been artificially limited, so we anticipate the demand by qualified students to be initially about 20 students per year (a conservative estimate). In addition, the Department receives about 15 inquiries a year by students not considering a career in speech science who would like to major in cognitive science. So far, most of these inquiries have been from current UD undergraduates, but with publicity there could easily be an additional 15-25

students per year applying for the program from outside the University. Thus, we estimate that within a short while the number of majors enrolling each year will be at least 35, and perhaps as many as 50.

We would like to emphasize, however, that the major reason to initiate the program is not because it will draw large numbers of students. Rather, we envisage this program as an attraction that will draw superior students to Delaware. As a discipline, cognitive science has been attractive to many of the very best students in the University. Of the students who have constructed a major in Cognitive Science as Liberal Studies majors and Dean's Scholars, a disproportionate number have received Rhodes and Marshall Scholarships, Warner and Taylor awards (best female and male student) etc. Among such students are the following:

Douglas Mauro de Lorenzo (B.A. 1998, Rhodes Scholar and Taylor Award; M.A. Linguistics; currently a Ph.D. candidate in refugee studies at Oxford)

Matt Huenerfauth (B.A. 2001, Marshall Scholarship [declined in favor of Mitchell Scholarship]; George Mitchell Scholarship; Minor in Cognitive Science, M.A. University of Dublin; currently a Ph.D. candidate in artificial intelligence at U Penn)

Thomas Pellathy (B.A. 2000, Rhodes Scholar and Taylor Award; M.A. Linguistics; currently a Ph.D. candidate at Oxford)

Katherine Wong (1999 Warner Award, RA on Linguistics NSF project & MA student in Linguistics; currently a professional musician in New York)

In addition to serving students already on campus, this program is being created to attract to Delaware students like the above and to provide exciting but structured opportunities for such students. The Department is less concerned with reaching particular enrollment goals than with maintaining the highest academic standards and attracting the most academically able students.

## 2. Admission Requirements

It is anticipated that most graduates of the program will seek postgraduate training in order to satisfy their professional aspirations. In order to ensure that students interested in cognitive science, and related fields like linguistics, speech science and speech pathology and other areas as well, will be admitted to the best graduate schools, students will only be formally admitted to the program based on their college GPA. During the freshman year students may declare a Cognitive Science Interest Major, but admission to the program as a Cognitive Science Major requires the completion of at least 30 credits of study. The minimal GPA for admission to the program will be 3.0. Once in the program, students whose current (not cumulative) GPA for required courses and courses with CGSC and LING designations falls below 3.0 will be placed on probation. If the current GPA for required courses and courses with CGSC and LING designations is not raised to 3.0 by the end of the following semester, they will be dropped from the major.

## IV. Curriculum Specifics

### 1. Institutional Factors

The Degree to be awarded is the bachelor of science (B.S.) in cognitive science. The degree will require 124 credit hours, 43 of which are in the major. Students will also have to meet University and College requirements as specified below. As is usual for B.S. degrees, the requirements are tailored to meet the needs of the curriculum.

## 2. Description of Curriculum

### a. Core requirements

At the foundation of the major is the introductory survey course in cognitive science, which has heretofore been taught within the Department of Linguistics. Further, all majors will be required to do work in the contributory subfields and methodologies of the cognitive sciences.

This is a feature of the existing minor that we bring unchanged into the major. The specific course distribution and requirements for this "core curriculum" are as follows:

### **Required Courses (25 hours/credits)**

All of the following:

CGSC 270 Introduction to Cognitive Science (foundation course)

CGSC 314 Brain and Behavior

CGSC 485 Seminar in Cognitive Science (senior seminar)

LING 101 Introduction to Linguistics

PSYC 100 General Psychology

and

One of the following:

BISC 104 Principles of Biology with Laboratory

or

BISC 207 Introductory Biology I

and

One of the following:

CISC 105 General Computer Science

or

CISC 103 Introduction To Computer Science with Web Applications

or

CISC 181 Introduction to Computer Science

or

CISC 280 Program Development Techniques

and

One of the following:

PHIL 205 Logic

or

MATH 201 Introduction to Statistical Methods I

or

MATH 205 Statistical Methods

or

PSYC 209 Measurement and Statistics

## b. Concentrations and Individualized Study

In addition to completing the required core, students will develop, with the aid of a faculty advisor, a concentration program individualized to their interests. Some students might wish to pursue the linguistic focus of speech science or linguistics; others may wish to study natural language processing and artificial intelligence and have course work in computer science etc.

The faculty advisor must be among the faculty listed in Section V of this proposal. Upon approval of the major, an up-to-date list will be maintained on the Department website. Further, the concentration program must be proposed by the student, approved by the student's faculty advisor and approved by the Undergraduate Studies Committee of the Department. All concentration programs will have at least 18 credits drawn from a list of eligible courses which will be maintained on the Department's website. The credits needed for some concentrations (e.g. Speech/Language Pathology) will exceed 18 hours because additional courses are needed to prepare students for graduate work in these specialized areas. The list of eligible courses will be updated and posted annually on the Departmental website. Substitute courses may be proposed by the student with the approval of the faculty advisor. The following list of courses is presently available in the 2006-2007 academic year or the courses have been proposed for the 2007-2008 academic year:

ANTH 102 Introduction to Biological Anthropology  
ANTH 205 Anthropology and Human Nature  
ANTH 300 Primatology  
BISC 107 Elementary Evolutionary Ecology  
BISC 195 Biological Evolution  
CGSC 327 Race, Gender and Science (existing PHIL course submitted for cross listing with CGSC))  
CGSC 330 Philosophy of Mind  
CGSC 340 Cognition  
CGSC 404 Animal Minds (new course submitted for approval)  
CGSC 421 Philosophy, Biology, Society (new course submitted for approval)  
CGSC 450 Recent Topics in Philosophy of Mind  
CGSC 4XX Audiology (new course subject to approval)  
CGSC 481 Artificial Intelligence  
CGSC496 Psycholinguistics  
CISC 220 Data Structures  
CISC 280 Program Development Techniques  
CISC 304 Logic and Programming  
CISC 409 Topics in Artificial Intelligence  
LING 102 Language, Mind and Society  
LING 203 Languages of the World  
LING 222 Language and Gender  
LING 253 Laboratory Phonetics

LING 265	Studies in Language
LING 376	Introduction to Communication Disorders
LING 377	Clinical Principles and Procedures in Speech Pathology
LING 378	Anatomy and Physiology of Speaking
LING 383	Language, Power and the Law
LING 385	Language and Law: Court Interpretation
LING 390	English Linguistics
LING 401	Historical Linguistics
LING 407	Phonology I
LING 409	Syntax I
LING 417	Language Planning
LING 433	Introduction to Acoustic Phonetics
LING 462	Language Acquisition
LING 476	Second Language Acquisition and Bilingualism
LING 477	The Structure of English
LING 480	Introduction to Sociolinguistics
LING 491	Semantics I
LING 610	Syntax II
MATH 205	Statistical Methods
MATH 210	Discrete Mathematics I
MATH 315	Discrete Mathematics II
PHIL 306	Philosophy of Science
PHIL 320	Theory of Knowledge
PHIL 330	Philosophy of the Mind
PHIL 421	Philosophy, Biology, Society (new course submitted for approval)
PHIL 450	Recent Topics in Philosophy of Mind
PSYC 207	Research Methods
PSYC 209	Measurement and Statistics
PSYC 310	Sensation and Perception
PSYC 316	Biological Basis of Behavior
PSYC 320	Introduction to Neuroscience
PSYC 344	Psychology of Language
PSYC 350	Developmental Psychology
PSYC 380	Psychopathology
PSYC 390	Social Psychology
PSYC 411	Ideas in Biopsychology
PSYC 442	Perception, Memory and Imagination

The concentrations will provide individualized learning experiences which are currently either unattainable at Delaware or obtained only in an ad hoc manner through such programs as the BALS or Dean's Scholar.

Some concentrations we envision are the following:

**Speech/Language Pathology (24/25 hours/credits):**

CGSC 496	Psycholinguistics
LING 253	Laboratory Phonetics
LING 376	Introduction to Communication Disorders



LING 377	Clinical Principles and Procedures in Speech Pathology
LING 378	Anatomy and Physiology of Speaking
LING 433	Introduction to Acoustic Phonetics
LING 462	Language Acquisition or PSYC 344 Psychology of Language
LING 480	Introduction to Sociolinguistics

The concentration in Speech/Language Pathology focuses on the scientific study of human cognition and communication. It is designed to provide a strong foundation for students wishing to pursue careers as speech/language pathologists or audiologists. Such careers require a graduate degree, and graduate programs involve an intensive course of study—as well as clinical practicum experiences—to enable their students to satisfy the requirements for professional certification.

To ensure that students are adequately prepared for graduate-level training, most graduate programs require students to have completed certain foundational prerequisites prior to accessing the graduate curriculum. The Speech/Language Pathology concentration has more core courses than do the other concentrations in order to address these prerequisites at the undergraduate level.

We also recommend the choice of certain electives. The recommended electives are courses that will also strengthen students' preparation for graduate training, but are less likely to be among the required prerequisites for graduate study. However, as the prerequisite requirements vary among graduate programs, it is recommended that students in the Speech/Language Pathology concentration investigate the prerequisite requirements associated with the graduate programs in which they have an interest so that they can better coordinate their choice of elective courses with their faculty advisor.

To maximize their chances of admission to a graduate program of their choice, it is recommended that students in the concentration consider including the following course among their electives:

Recommended Electives/Courses:

PSYC 209	Measurement and Statistics (or another statistics course)
LING 407	Phonology I
LING 477	Structure of English

These courses can be taken as electives or as part of a minor in Psychology.

**Linguistics (18 hours/credits):**

LING 407 Phonology I

LING 409 Syntax I

or

LING 477 Structure of English

LING 203 Languages of the World

LING 253 Laboratory Phonetics

Any two additional LING courses at the 300-level or above

**Human Perception (18 hours/credits):**

CGSC 330 Philosophy of Mind  
CGSC 450 Recent Topics in Philosophy of Mind  
PSYC 310 Sensation and Perception  
PSYC 320 Introduction to Neuroscience  
PSYC 412 Human Psychophysiology  
PSYC 411 Ideas in Biopsychology  
PSYC 442 Perception, Memory and Imagination

**Language Development (18/19 hours/credits):**

LING 480 Introduction to Sociolinguistics  
LING 407 Phonology I  
LING 409 Syntax I  
LING 462 Language Acquisition or PSYC 344 Psychology of Language  
LING 496 Psycholinguistics  
CGSC 340 Cognition

**Computational Modeling (18 hours/credits):**

CGSC 330 Philosophy of Mind  
CGSC450 Recent Topics in Philosophy of Mind  
CGSC 496 Psycholinguistics  
CISC 220 Data Structures  
CISC 303 Automata Theory  
CISC 304 Logic and Programming

**Mathematical and Logical Foundations of Cognitive Science (18 hours/credits):**

CISC 303 Automata Theory  
CISC 304 Logic and Programming  
MATH 210 Discrete Mathematics I  
MATH 315 Discrete Mathematics II  
PHIL 306 Philosophy of Science  
PHIL 320 Theory of Knowledge

**Animal Minds, Human Minds (18 hours/credits):**

ANTH 102 Introduction to Biological Anthropology  
ANTH 300 Primatology  
CGSC 330 Philosophy of Mind  
CGSC 404 Animal Minds  
CGSC 421 Philosophy, Biology, Society  
PSYC 316 Biological Basis of Behavior -- or -- PSYC 320, Introduction to Neuroscience

These sample concentrations are intended to be exemplary in nature. As concentrations are developed, they will be posted on the Department website to assist future students in planning their studies.

### c. First Year Experience and Discovery Learning

All first-year students in the Cognitive Science Interest major must complete a first year experience (FYE). The Department is in the process of developing an FYE tailored to students interested in Cognitive Science.

All students are required to participate in a discovery or experiential learning program. As in the case of FYE, the Department is in the process of determining which discovery experiences would be of particular value for students in Cognitive Science. The Department currently offers opportunities for study abroad and internship possibilities which could meet this requirement.

### d. Capstone Course

Senior majors will be brought together for a seminar on topics in cognitive science: CGSC 485 Seminar in Cognitive Science. This course may be team taught by a rotating group of faculty and will center around the application of the field's divergent methodologies to solving problems in the study of mind. The course will require participants to engage in a research project that demonstrates grasp of the issues in the field as a whole and in their chosen focus. The research reported on may be collaborative research with a member of the faculty of the program or research conducted in a laboratory directed by a member of the cognitive science faculty. This work may lead to an Honors Thesis for qualified students.

## 3. Curriculum Enhancements

Because the faculty associated with the major come from a range of fields, we envision that this program will provide a number of unusual opportunities for students in terms of out of classroom educational experiences. Students studying language development might get involved in ongoing research projects at the University either from an experimental vantage or from a more theoretical perspective investigating linguistic or computational issues. We also expect students in some tracks of the major to be able to find summer internships in local speech and hearing clinics, enroll in the various summer institutes in cognitive science and its contributing disciplines, such as the summer institutes of the Linguistic Society of America, the Cognitive Science Institute, and the various workshops on processing and modeling at the Association for Computational Linguistics.

There are few programs in existence which permit students to engage in such exciting interdisciplinary study. We have no doubt that students coming out of this program will have the potential to go on to the very best graduate programs in the disciplines of cognitive science, linguistics, speech pathology and audiology, or work in emerging industrial fields such as speech technology, the development of human-computer interfaces (aka human factors), and other aspects of cognitive engineering.

## 4. Sample Student Program

The following is a typical sequence of coursework taken by a student majoring in Cognitive Science with a concentration in language development. It illustrates how such a student would meet requirements for the degree.

Year 1      Fall:            CGSC 270, LING 101, CISC 105, PSYC 100 plus A&S/University

requirement

Spring: PHL 209, BISC 104, PSYC 100 plus A&S/University requirement

Year 2: Fall: CGSC 314, LING 480 plus A&S/University requirements/electives

Spring: LING 376, CGSC 340, plus A&S/University requirements/electives

Year 3: Fall: LING 462 , LING 407, plus A&S/University requirements/electives

Spring: CGSC 496, plus A&S/University requirements/electives

Summer between yrs 3&4: internship in language development lab

Year 4: Fall: LING 409, plus electives

Spring: CGSC 485 (Seminar), plus electives

## 5. University and College requirements

As is usual in the case of B.S. degrees in the College of Arts and Science, the University and College requirements are adapted to the needs of the curriculum.

### a. University Requirements

In order to receive the degree of B.S. in Cognitive Science all students must meet the University requirements for a bachelor's degree as specified in the University Catalog:

- A scholastic average of C (GPA of 2.0) in all work taken at the University.
- Completion of either 90 of the first 100 credits or 30 of the last 36 credits, full- or part-time, at the University of Delaware.
- One incoming semester of First Year Experience (FYE) completed with a passing letter grade, or a grade of P for courses graded only Pass/Fail. The number of credits will depend on the designated FYE (see FYE website: [www.ugs.udel.edu/FYE](http://www.ugs.udel.edu/FYE)).
- One semester of Freshman English (ENGL 110), completed with a minimum grade of C-.
- Three credits of Discovery Learning Experience (DLE) completed with a passing letter grade, or a grade of P for courses graded only Pass/Fail. DLE includes experiences such as internship, service learning, independent study, undergraduate research, and study abroad which are designated DLE (see DLE website: [www.ugs.udel.edu/DLE](http://www.ugs.udel.edu/DLE)).
- Three credits in an approved course or courses stressing multi-cultural, ethnic, and/or gender related content. The purpose of the multicultural requirement is to provide students with some awareness of and sensitivity to cultural pluralism—an increasing necessity for educated persons in a diverse world. This requirement may be fulfilled through a course or courses taken to complete other course requirements, but cannot be fulfilled with any course taken on a pass/fail basis. Only course sections that are designated as multicultural in the registration booklet for a specific semester can be used to fulfill this requirement.



### b. College Skills Requirements

In order to receive the degree students must meet the following skill requirements of the College of Arts and Science:

**Second Writing Requirement: (minimum grade C-) . . . . . 3 credits**

A second writing course involving significant writing experience including two papers with a combined minimum of 3,000 words to be submitted for extended faculty critique of both composition and content. This course must be taken after completion of 60 credit hours. Appropriate writing courses are designated in the semester's Registration Booklet. (See list of courses approved for second writing requirement, pages 89-91.)

**Mathematics:** . . . . . 0-4 credits

*(one of the following three options with a minimum grade of D-)*

**OPTION ONE:**

MATH 114 College Mathematics and Statistics

(designed for students who do not intend to continue the study of mathematics)

MATH 115 Pre-Calculus

(designed for students who intend to continue the study of mathematics)

**OPTION TWO:**

Successful completion of any mathematics course at or above the 200-level except MATH 201, MATH 202, MATH 205, MATH 250, MATH 251, MATH 252, MATH 253, MATH 266, MATH 300 or MATH 450.

**OPTION THREE:**

Successful performance on a proficiency test in mathematics administered by the Department of Mathematical Sciences. (0 credits awarded)

The math requirement must be completed by the time a student has earned 60 credits. Students who transfer into the College of Arts and Sciences with 45 credits or more must complete this requirement within two semesters.

**Foreign Language:** . . . . . 0-12 credits

*(with a minimum grade of D-)*

Completion of the intermediate-level course (107 or 112 or 214) in an ancient or modern language. The number of credits needed and initial placement will depend on the number of years of high school study of foreign language. Students with four or more years of high school work in a single foreign language may attempt to fulfill the requirement in that language by taking an exemption examination through the Foreign Languages and Literatures Department.

c. College Breadth Requirements

(MINIMUM GRADE OF D-)

**Group A** . . . . . 9

Analysis and appreciation of the creative arts and humanities.

Nine credits of courses representing at least two departments or appropriate instructional units.

**Group B** . . . . . 9

The study of culture and institutions over time.

Nine credits of courses representing at least two departments or appropriate instructional units.

**Group C** . . . . . 9

Empirically based study of human beings and their environment.

Nine credits of courses representing at least two departments or appropriate instructional units.

**Group D** . . . . . 9

The study of natural phenomena through experiment or analysis.

Nine credits of courses representing at least two departments or appropriate instructional units and including a minimum of one course with an associated laboratory.

If the grade earned is sufficient, a course may be applied toward more than one requirement (e.g., breadth and major requirements), but the credits are counted only once toward the total credits for graduation. If all but one course in a group has been taken in one department or program, a course cross-listed with that program will not satisfy the distribution requirement.

It should be noted that, as is usual for B.S. degrees, the number of credits required for College breadth requirements is reduced in comparison with B.A. degrees. This is due to the fact that the requirements for the major exceed those usual for a B.A.

## 6. Requirements for Honors B.S. in Cognitive Science

The recipient must complete:

### 1. All requirements for the Bachelor of Science degree in Cognitive Science:

- A cumulative GPA of at least 3.400 at the time of graduation

- At least 30 credits earned in Honors courses:

- At least 12 credits in the major department or in courses in collateral disciplines specifically required for the major;

- At least 12 credits in 300-level courses or higher, not including the first-year interdisciplinary Honors colloquium;

- Three credits in an Honors Degree seminar or Honors capstone course or comparable senior experience approved by the major and the Honors Program, to be completed in one of the last two semester of the student's degree program.

### 2. All of the University's generic requirements for the Honors Baccalaureate degree.

### 3. The student's grade point average for courses in the major must be at least 3.50 at the time of graduation.

## 7. Plans to Offer at Least 9-12 Honors Credits on a Regular Basis

The following core courses in the program have in recent years been offered with Honors sections on at least an annual basis. In the case of CGSC and LING courses, the department plans to offer these courses as Honors courses at least once a year as specified below. The major is highly individualized, so we cannot guarantee that courses offered by other departments will include honors sections, but for courses offered under the CGSC and LING rubric, the opportunity will be made available to students to take the course on an Honors basis (course to include Honors enrichment component for Honors students):

LING 101 (separate Honors section frequently offered)

CGSC 270 (separate Honors section frequently offered)

CGSC 485 (probably as individual Honors section)

CISC 105 (separate Honors section frequently offered)  
PHIL 330 (separate Honors section frequently offered)  
PSYC 100 (separate Honors section frequently offered)

#### 8. Honors Capstone Course

The Department plans to submit CGSC 485, the senior seminar required by the major, for approval as an Honors capstone course.

#### 9. 4+1 Option

Qualified undergraduate students in the in the B.S. in Cognitive Science as well as students completing a Bachelors degree in related fields like Anthropology, Computer and Information Science, Philosophy and Psychology (and other fields by application) may apply for the 4+1 option, which combines the requirements of the undergraduate and master's degree programs in Cognitive Science and Linguistics and Cognitive Science. Whereas the traditional programs for the B.S. and M.S. degrees in Cognitive Science and Linguistics and Cognitive Science involve 4 years of undergraduate work and 2 years of graduate work, the 4+1 option enables students to earn both degrees in a 5-year period. Students who complete the 4+1 program will graduate with both a Bachelor of Science degree and a Master of Science degree in Linguistics and Cognitive Science. Students who are candidates for the 4+1 option, and who complete the requirements for the B.S. but fail to complete the additional M.A. requirements, will receive the B.S. degree.

##### a. Admission into the 4+1 Program

Students may apply for admission to the 4+1 program at the end of the sophomore year. The application process requires submission of a completed graduate application form for review by the Departmental Graduate Studies Committee. Initial admission will be based upon the student's ability to meet the following recommended entrance criteria:

- Combined mathematics and verbal SAT scores of at least 1200
- An undergraduate GPA of at least 3.25
- Completion of all core courses for the B.S. other than CGSC 485
- Submission of an in-person writing sample, based on work completed in a Cognitive Science course

Admission is competitive so meeting the minimal requirements for admission does not guarantee admission nor does the failure to meet a requirement result in an automatic rejection. The GRE is not required for admission to the 4+1 program by UD undergraduates.

##### b. Maintaining Status within the Program

Upon admission into the program and prior to the start of the junior year of study, the student will meet with his graduate advisor and submit a planned program of study, including all elective courses, to the Graduate Studies Committee. Planned programs of study are due by the end of fall semester of the student's junior year.

Continuation in the 4+1 program is contingent upon maintaining a cumulative GPA of at least 3.25 in undergraduate courses with CGSC and LING designations and in graduate coursework. Satisfactory progress includes following the prescribed program of study.

Each student's progress and GPA will be evaluated at the end of each academic year by the student's advisor and the Graduate Studies Committee. Students who fail to meet the minimum

GPA requirements or fail to show progress toward the degree will be dropped from the 4+1 program. They may, however, continue in the undergraduate major unless their undergraduate progress is unsatisfactory according to the rules in effect for the B.S. program.

c. 4+1 Degree Requirements for the Master of Science in Linguistics and Cognitive Science and the B.S. in Cognitive Science

The graduate level course requirements for the 4+1 degree in Cognitive Science are the same as those for the M.A. in Linguistics and Cognitive Science. The course requirements for the degree include 30 credit hours planned in consultation with the student’s advisor and the Director of Graduate Studies, which must include at least 21 credit hours in the Linguistics Department and at least one 800-level seminar. The M.A. in Linguistics and Cognitive Science is a flexible program of study that provides training in both Linguistics and Cognitive Science. Separate tracks are provided for students whose emphasis is clearly in Cognitive Science or in Linguistics. In addition, students may propose a program of study that combines elements of the Linguistics and Cognitive Science tracks. See the Department’s Graduate Policy Statement for additional information. Students must fulfill all graduate and undergraduate course requirements for both the M.A. and their undergraduate degree.

d. Distribution of Credits in 4+1 Program

The following table illustrates a typical distribution of graduate and undergraduate credits for a student in the 4+1 program. This sample program is based on the assumption that the policy of the University is not to permit any reduction in undergraduate courses for students in the 4+1 program. Thus, students in the program complete both the full 124 credit hours of the B.S. and the full thirty credit hours of the M.A. There are a number of courses relevant to both the undergraduate and the graduate degrees that are taught as 400/600 courses, and if students taking such courses at the 600 level were permitted to count some number of the courses for both the B.S. and the M.A., students would be able to complete both the B.S. and the M.A. in five academic years without the need to participate in any special sessions. On the assumption (made in this proposal) that no such reduction in credit requirements is permitted, unless the student takes the maximal possible course load of 17 credit hours during several semesters, it may necessary for the student to participate in as many as two special sessions in order to complete the program in five calendar years.

In the sample program below, the student participates in one winter session consisting of two three credit courses and one summer session (an internship). For example, the Department of Linguistics conducts a summer and a winter session course in Italy each year that would be appropriate for many of the students. Summer session would also be an appropriate time for an internship relevant to the student’s academic interests, as in the example below.

	<b>UG Credits</b>	<b>Grad Credits</b>
<b>Freshmen Year</b>		
Fall	16	0
Winter 0		0
Spring	15	0
Summer	0	0
<b>Sophomore Year</b>		
Fall	16	0



Winter	6	0	
Spring	15		0
Summer	0		0
<b>Junior Year</b>			
Fall	16		0
Winter	0	0	
Spring	12		3
Summer	4 [e.g. internship]		0
<b>Senior Year</b>			
Fall	12		3
Winter	0	0	
Spring	12		3
<b>Year 5</b>			
Fall			12
Spring			12

**2. Revisions to Planned Program of Study in 4+1 Program**

Students who wish to make changes to their program of study must first obtain permission from their advisor. The advisor must then make a written request to the Graduate Studies Committee to revise the program of study.

**ROUTING AND AUTHORIZATION:** (Please do not remove supporting documentation.)

Department Chairperson \_\_\_\_\_ Date \_\_\_\_\_

Dean of College \_\_\_\_\_ Date \_\_\_\_\_

Chairperson, College Curriculum Committee \_\_\_\_\_ Date \_\_\_\_\_

Chairperson, Senate Com. on UG or GR Studies \_\_\_\_\_ Date \_\_\_\_\_

Chairperson, Senate Coordinating Com. \_\_\_\_\_ Date \_\_\_\_\_

Secretary, Faculty Senate \_\_\_\_\_ Date \_\_\_\_\_

Date of Senate Resolution \_\_\_\_\_ Date to be Effective \_\_\_\_\_

Registrar \_\_\_\_\_ Program Code \_\_\_\_\_ Date \_\_\_\_\_

Vice Provost for Academic Programs & Planning \_\_\_\_\_ Date \_\_\_\_\_

Provost \_\_\_\_\_ Date \_\_\_\_\_

Board of Trustee Notification \_\_\_\_\_ Date \_\_\_\_\_

# Proposal for a B.S. in Cognitive Science

## I. Introduction

This is a proposal for the establishment of an undergraduate major (B.S.) in cognitive science at the University of Delaware. The degree will be housed in the Department of Linguistics and Cognitive Science. The Department of Linguistics is currently in the process of changing its name to the Department of Linguistics and Cognitive Science. This name change is dealt with in a separate document. The Department of Linguistics is currently the academic home for the M.A. in Linguistics and Cognitive Science and for the undergraduate Minor in Cognitive Science and the Minor in Linguistics. The proposed B.S. is intended to bridge the gap between the Minor in Cognitive Science and the M.A. in Linguistics and Cognitive Science.

The major is designed to capitalize on existing faculty research and teaching strengths and to provide a formal curriculum and degree in one of the most influential new fields of study. Moreover, specialized concentrations in such sub-areas of speech science and linguistic science will meet the needs of a potentially significant number of students not currently served by an existing University curriculum.

## II. Rationale and Demand

### 1. Institutional Factors

Cognitive science studies the human mind viewed as a computational process. It lies at the confluence of computer science, educational and cognitive development, linguistics, neuroscience, neurobiology, philosophy, psychology, and certain areas of mathematics. Cognitive science has arguably been the most important development in the study of human thinking in the past twenty years; its influence can be seen across a wide variety of disciplines, from logic to communication disorders. Numerous other schools have had the foresight to establish formal programs in the area (e.g., Brown, Johns Hopkins, MIT, UCSD, UCI, Washington University, among others), and we propose to follow suit.<sup>1</sup>

As a discipline, cognitive science seeks to model and explain such phenomena as language, reasoning and perception. The goal of cognitive science as a theoretical discipline is to determine those knowledge structures and processes that characterize organisms as biological information processing systems, as well as to explain how these organisms come to possess this knowledge. Applied cognitive science takes the results of this research to such diverse areas as language technology, cognitive approaches to education, human computer interaction etc. The latter field addresses the most effective use of technology by people and includes the study of user interfaces, graphical displays, visualization of data, virtual reality, technology-based education, intelligent agents, and computer-based assistive technology for persons with disabilities.

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<sup>1</sup> Program descriptions for a number of these programs are provided to allow comparison of the proposed UD program and that at other universities.

The University of Delaware has a number of faculty members with strengths in both applied and theoretical cognitive science (see section V). For years, an informal research group has met regularly to discuss recent research in Cognitive Science, and the Program in Cognitive Science has offered a stimulating program of lectures to student body, public and faculty. At present, however, there is little in the way of formal educational opportunities for undergraduate students to pursue this cross-disciplinary study. There is a minor in cognitive science (administered by the Department of Linguistics), but, as a minor, this option remains a secondary choice to students and not the focus of significant curricular development. There is no available formal program for speech science—a natural preliminary for graduate study in speech pathology as well as a natural offshoot of applied cognitive science—even as a minor area of study. While the Department of Linguistics has provided a curriculum for students interested in preparing for graduate work in speech pathology and language pathology, this has been handled in an ad hoc fashion and, therefore, has not fully met the needs of the students or of the State of Delaware. We propose to correct these problems through the creation of a new undergraduate major in cognitive science.

## 2. Student Demand and Employment Factors

A B.S. in cognitive science can have great impact at the undergraduate level, where it can feed into a variety of professional careers (e.g., cognitive engineering, user interface design) and graduate programs (e.g., computer science, education, linguistics, psychology, philosophy, speech pathology and cognitive science graduate programs). Graduate opportunities in cognitive science are already in place to a great extent. The Department of Linguistics offers an M.A. in Linguistics and Cognitive Science. The Doctoral programs of three departments, Linguistics, Psychology and Computer and Information Science offer the possibility of Doctoral programs encompassing major aspects of cognitive science. Thus, while we plan to revisit in the future the question of whether a stand-alone Doctoral program in cognitive science should be offered, our immediate concern is in providing opportunities to UD undergraduates.

The relationship between cognitive science and graduate speech pathology is particularly important for the establishment of this degree at Delaware. The need for speech pathologists in the state is evidenced by the availability of public support dollars for graduate students who agree to work in Delaware after finishing their degrees. Nonetheless, with the exception of the ad hoc program currently offered by the Department of Linguistics, the University does not currently provide any formal curriculum for students planning to enter graduate school in speech pathology. We hope to remedy that deficit with this program.

## III. Enrollment, Admissions and Financial Aid

### 1. Enrollment

There are currently about 30 students in the ad hoc pre-graduate speech pathology program organized by the Department of Linguistics. The number of students that we agree to allow into this informal program has been artificially limited, so we anticipate the demand by qualified students to be initially about 20 students per year (a conservative estimate). In addition, the Department receives about 15 inquiries a year by students not considering a career in speech

science who would like to major in cognitive science. So far, most of these inquiries have been from current UD undergraduates, but with publicity there could easily be an additional 15-25 students per year applying for the program from outside the University. Thus, we estimate that within a short while the number of majors enrolling each year will be at least 35, and perhaps as many as 50.

We would like to emphasize, however, that the major reason to initiate the program is not because it will draw large numbers of students. Rather, we envisage this program as an attraction that will draw superior students to Delaware. As a discipline, cognitive science has been attractive to many of the very best students in the University. Of the students who have constructed a major in Cognitive Science as Liberal Studies majors and Dean's Scholars, a disproportionate number have received Rhodes and Marshall Scholarships, Warner and Taylor awards (best female and male student) etc. Among such students are the following:

Douglas Mauro de Lorenzo (B.A. 1998, Rhodes Scholar and Taylor Award; M.A. Linguistics; currently a Ph.D. candidate in refugee studies at Oxford)

Matt Huenerfauth (B.A. 2001, Marshall Scholarship [declined in favor of Mitchell Scholarship]; George Mitchell Scholarship; Minor in Cognitive Science, M.A. University of Dublin; currently a Ph.D. candidate in artificial intelligence at U Penn)

Thomas Pellathy (B.A. 2000, Rhodes Scholar and Taylor Award; M.A. Linguistics; currently a Ph.D. candidate at Oxford)

Katherine Wong (1999 Warner Award, RA on Linguistics NSF project & MA student in Linguistics; currently a professional musician in New York)

In addition to serving students already on campus, this program is being created to attract to Delaware students like the above and to provide exciting but structured opportunities for such students. The Department is less concerned with reaching particular enrollment goals than with maintaining the highest academic standards and attracting the most academically able students.

## 2. Admission Requirements

It is anticipated that most graduates of the program will seek postgraduate training in order to satisfy their professional aspirations. In order to ensure that students interested in cognitive science, and related fields like linguistics, speech science and speech pathology and other areas as well, will be admitted to the best graduate schools, students will only be formally admitted to the program based on their college GPA. During the freshman year students may declare a Cognitive Science Interest Major, but admission to the program as a Cognitive Science Major requires the completion of at least 30 credits of study. The minimal GPA for admission to the program will be 3.0. Once in the program, students whose current (not cumulative) GPA for required courses and courses with CGSC and LING designations falls below 3.0 will be placed on probation. If the current GPA for required courses and courses with CGSC and LING

designations is not raised to 3.0 by the end of the following semester, they will be dropped from the major.

#### **IV. Curriculum Specifics**

##### **1. Institutional Factors**

The Degree to be awarded is the bachelor of science (B.S.) in cognitive science. We are proposing a B.S. rather than a B.A. because, in order to achieve sufficient interdisciplinary coverage and specialization. This program requires 124 credit hours with at least 43 credits in the major. For a significant number of students it will be necessary for the major to consist of 50 credit hours or more. In contrast, the B.A. typically requires 30-35 credits in the major and no more than 45 credits are permitted. Thus, the degree of bachelor of arts is not appropriate for this major.<sup>2</sup> Students will also have to meet University and College requirements as specified below. As is usual for B.S. degrees, the requirements are tailored to meet the needs of the curriculum.

##### **2. Description of Curriculum**

###### **a. Core requirements**

At the foundation of the major is the introductory survey course in cognitive science, which has heretofore been taught within the Department of Linguistics. Further, all majors will be required to do work in the contributory subfields and methodologies of the cognitive sciences. This is a feature of the existing minor that we bring unchanged into the major. The specific course distribution and requirements for this "core curriculum" are as follows:

###### **Required Courses (25 hours/credits)**

All of the following:

CGSC 270 Introduction to Cognitive Science (foundation course)

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<sup>2</sup> At the University of Delaware the designation of "B.S." indicates that a program is highly focused rather than that it is one that is based primarily on laboratory science courses. Examples of B.S. programs at UD that do not require a large component of laboratory science courses are International Business Studies, (which focuses on advanced language skills and international area studies to accompany business courses), marketing and other business majors; Elementary teacher Education, Early Childhood Education and other education majors; Apparel Design/Fashion Merchandising, Hotel, Restaurant and Institutional Management, Human Services, Education and Public Policy, Leadership and many others (see the current catalog). What these programs have in common is that their requirements are more focused than those of B.A. programs.

While the proposed B.S. in Cognitive Science is by nature in fact more science oriented than many of the above B.S. degrees, the choice of the B.S. rather than the B.A. is motivated by the need to allow greater focus than is possible in B.A. degrees rather than by the science orientation of the degree.

CGSC 314 Brain and Behavior  
CGSC 485 Seminar in Cognitive Science (senior seminar)  
LING 101 Introduction to Linguistics  
PSYC 100 General Psychology

and

One of the following:

BISC 104 Principles of Biology with Laboratory  
or  
BISC 207 Introductory Biology I

and

One of the following:

CISC 105 General Computer Science  
or  
CISC 103 Introduction To Computer Science with Web Applications  
or  
CISC 181 Introduction to Computer Science  
or  
CISC 280 Program Development Techniques

and

One of the following:

PHIL 205 Logic  
or  
MATH 201 Introduction to Statistical Methods I  
or  
MATH 205 Statistical Methods  
or  
PSYC 209 Measurement and Statistics

#### b. Concentrations and Individualized Study

In addition to completing the required core, students will develop, with the aid of a faculty advisor, a concentration program individualized to their interests. Some students might wish to pursue the linguistic focus of speech science or linguistics; others may wish to study natural language processing and artificial intelligence and have course work in computer science etc.

The faculty advisor must be among the faculty listed in Section V of this proposal. Upon approval of the major, an up-to-date list will be maintained on the Department website. Further, the concentration program must be proposed by the student, approved by the student's faculty advisor and approved by the Undergraduate Studies Committee of the Department. All concentration programs will have at least 18 credits drawn from a list of eligible courses which will be maintained on the Department's website. The credits needed for some concentrations (e.g. Speech/Language Pathology) will exceed 18 hours because additional courses are needed to prepare students for graduate work in these specialized areas. The list of eligible courses will be updated and posted annually on the Departmental website. Substitute courses may be proposed by the student with the approval of the faculty advisor. The following list of courses is presently available in the 2006-2007 academic year or the courses have been proposed for the 2007-2008 academic year:

ANTH 102	Introduction to Biological Anthropology
ANTH 202	Human Evolution and the Fossil Record
ANTH 205	Anthropology and Human Nature
ANTH 300	Primateology
BISC 107	Elementary Evolutionary Ecology
BISC 195	Biological Evolution
CGSC 327	Race, Gender and Science (existing PHIL course submitted for cross listing with CGSC))
CGSC 330	Philosophy of Mind
CGSC 340	Cognition
CGSC 404	Animal Minds (new course submitted for approval)
CGSC 421	Philosophy, Biology, Society (new course submitted for approval)
CGSC 450	Recent Topics in Philosophy of Mind
CGSC 379	Audiology (new course subject to approval)
CGSC 481	Artificial Intelligence
CGSC496	Psycholinguistics
CISC 220	Data Structures
CISC 280	Program Development Techniques
CISC 304	Logic and Programming
CISC 409	Topics in Artificial Intelligence
LING 102	Language, Mind and Society
LING 203	Languages of the World
LING 222	Language and Gender
LING 253	Laboratory Phonetics
LING 265	Studies in Language
LING 376	Introduction to Communication Disorders
LING 377	Clinical Principles and Procedures in Speech Pathology
LING 378	Anatomy and Physiology of Speaking
LING 383	Language, Power and the Law
LING 385	Language and Law: Court Interpretation
LING 390	English Linguistics
LING 401	Historical Linguistics
LING 407	Phonology I
LING 409	Syntax I

LING 417	Language Planning
LING 433	Introduction to Acoustic Phonetics
LING 462	Language Acquisition
LING 476	Second Language Acquisition and Bilingualism
LING 477	The Structure of English
LING 480	Introduction to Sociolinguistics
LING 491	Semantics I
LING 610	Syntax II
MATH 205	Statistical Methods
MATH 210	Discrete Mathematics I
MATH 315	Discrete Mathematics II
PHIL 306	Philosophy of Science
PHIL 320	Theory of Knowledge
PHIL 330	Philosophy of the Mind
PHIL 421	Philosophy, Biology, Society (new course submitted for approval)
PHIL 450	Recent Topics in Philosophy of Mind
PSYC 207	Research Methods
PSYC 209	Measurement and Statistics
PSYC 310	Sensation and Perception
PSYC 316	Biological Basis of Behavior
PSYC 320	Introduction to Neuroscience
PSYC 344	Psychology of Language
PSYC 350	Developmental Psychology
PSYC 380	Psychopathology
PSYC 390	Social Psychology
PSYC 411	Ideas in Biopsychology
PSYC 442	Perception, Memory and Imagination

The concentrations will provide individualized learning experiences which are currently either unattainable at Delaware or obtained only in an ad hoc manner through such programs as the BALS or Dean's Scholar.

Some concentrations we envision are the following:

**Speech/Language Pathology (24/25 hours/credits):**

CGSC 496	Psycholinguistics
LING 253	Laboratory Phonetics
LING 376	Introduction to Communication Disorders
LING 377	Clinical Principles and Procedures in Speech Pathology
LING 378	Anatomy and Physiology of Speaking
LING 433	Introduction to Acoustic Phonetics
LING 462	Language Acquisition or PSYC 344 Psychology of Language
LING 480	Introduction to Sociolinguistics

The concentration in Speech/ Language Pathology focuses on the scientific study of human cognition and communication. It is designed to provide a strong foundation for students wishing to pursue careers as speech/language pathologists or audiologists. Such careers require a graduate degree, and



graduate programs involve an intensive course of study—as well as clinical practicum experiences—to enable their students to satisfy the requirements for professional certification.

To ensure that students are adequately prepared for graduate-level training, most graduate programs require students to have completed certain foundational prerequisites prior to accessing the graduate curriculum. The Speech/Language Pathology concentration has more core courses than do the other concentrations in order to address these prerequisites at the undergraduate level.

We also recommend the choice of certain electives. The recommended electives are courses that will also strengthen students' preparation for graduate training, but are less likely to be among the required prerequisites for graduate study. However, as the prerequisite requirements vary among graduate programs, it is recommended that students in the Speech/Language Pathology concentration investigate the prerequisite requirements associated with the graduate programs in which they have an interest so that they can better coordinate their choice of elective courses with their faculty advisor.

To maximize their chances of admission to a graduate program of their choice, it is recommended that students in the concentration consider including the following course among their electives:

**Recommended Electives/Courses:**

PSYC 209     Measurement and Statistics (or another statistics course)  
LING 407     Phonology I  
LING 477     Structure of English

These courses can be taken as electives or as part of a minor in Psychology.

**Linguistics (18 hours/credits):**

LING 407     Phonology I  
  
LING 409     Syntax I  
or  
LING 477     Structure of English  
  
LING 203     Languages of the World  
LING 253     Laboratory Phonetics

Any two additional LING courses at the 300-level or above

**Human Perception (18 hours/credits):**

CGSC 330     Philosophy of Mind  
CGSC 450     Recent Topics in Philosophy of Mind  
PSYC 310     Sensation and Perception

PSYC 320 Introduction to Neuroscience  
PSYC 412 Human Psychophysiology  
PSYC 411 Ideas in Biopsychology  
PSYC 442 Perception, Memory and Imagination

**Language Development (18/19 hours/credits):**

LING 480 Introduction to Sociolinguistics  
LING 407 Phonology I  
LING 409 Syntax I  
LING 462 Language Acquisition or PSYC 344 Psychology of Language  
LING 496 Psycholinguistics  
CGSC 340 Cognition

**Computational Modeling (18 hours/credits):**

CGSC 330 Philosophy of Mind  
CGSC450 Recent Topics in Philosophy of Mind  
CGSC 496 Psycholinguistics  
CISC 220 Data Structures  
CISC 303 Automata Theory  
CISC 304 Logic and Programming

**Mathematical and Logical Foundations of Cognitive Science (18 hours/credits):**

CISC 303 Automata Theory  
CISC 304 Logic and Programming  
MATH 210 Discrete Mathematics I  
MATH 315 Discrete Mathematics II  
PHIL 306 Philosophy of Science  
PHIL 320 Theory of Knowledge

**Animal Minds, Human Minds (18 hours/credits):**

ANTH 102 Introduction to Biological Anthropology  
ANTH 300 Primatology  
CGSC 330 Philosophy of Mind  
CGSC 404 Animal Minds  
CGSC 421 Philosophy, Biology, Society  
PSYC 316 Biological Basis of Behavior -- or -- PSYC 320, Introduction to Neuroscience

These sample concentrations are intended to be exemplary in nature. As concentrations are developed, they will be posted on the Department website to assist future students in planning their studies.

c. First Year Experience and Discovery Learning

All first-year students in the Cognitive Science Interest major must complete a first year experience (FYE). The Department is in the process of developing an FYE tailored to students interested in Cognitive Science.

All students are required to participate in a discovery or experiential learning program. As in the case of FYE, the Department is in the process of determining which discovery experiences would be of particular value for students in Cognitive Science. The Department currently offers opportunities for study abroad and internship possibilities which could meet this requirement.

#### d. Capstone Course

Senior majors will be brought together for a seminar on topics in cognitive science: CGSC 485 Seminar in Cognitive Science. This course may be team taught by a rotating group of faculty and will center around the application of the field's divergent methodologies to solving problems in the study of mind. The course will require participants to engage in a research project that demonstrates grasp of the issues in the field as a whole and in their chosen focus. The research reported on may be collaborative research with a member of the faculty of the program or research conducted in a laboratory directed by a member of the cognitive science faculty. This work may lead to an Honors Thesis for qualified students.

### 3. Curriculum Enhancements

Because the faculty associated with the major come from a range of fields, we envision that this program will provide a number of unusual opportunities for students in terms of out of classroom educational experiences. Students studying language development might get involved in ongoing research projects at the University either from an experimental vantage or from a more theoretical perspective investigating linguistic or computational issues. We also expect students in some tracks of the major to be able to find summer internships in local speech and hearing clinics, enroll in the various summer institutes in cognitive science and its contributing disciplines, such as the summer institutes of the Linguistic Society of America, the Cognitive Science Institute, and the various workshops on processing and modeling at the Association for Computational Linguistics.

There are few programs in existence which permit students to engage in such exciting interdisciplinary study. We have no doubt that students coming out of this program will have the potential to go on to the very best graduate programs in the disciplines of cognitive science, linguistics, speech pathology and audiology, or work in emerging industrial fields such as speech technology, the development of human-computer interfaces (aka human factors), and other aspects of cognitive engineering.

### 4. Sample Student Program

The following is a typical sequence of coursework taken by a student majoring in Cognitive Science with a concentration in language development. It illustrates

how such a student would meet requirements for the degree.

Year 1 Fall: CGSC 270, LING 101, CISC 105, PSYC 100 plus A&S/University requirement  
Spring: PHL 209, BISC 104, PSYC 100 plus A&S/University requirement

Year 2: Fall: CGSC 314, LING 480 plus A&S/University requirements/electives  
Spring: LING 376, CGSC 340, plus A&S/University requirements/electives

Year 3: Fall: LING 462, LING 407, plus A&S/University requirements/electives  
Spring: CGSC 496, plus A&S/University requirements/electives

Summer between yrs 3&4: internship in language development lab

Year 4: Fall: LING 409, plus electives  
Spring: CGSC 485 (Seminar), plus electives

## 5. University and College requirements

As is usual in the case of B.S. degrees in the College of Arts and Science, the University and College requirements are adapted to the needs of the curriculum.

### a. University Requirements

In order to receive the degree of B.S. in Cognitive Science all students must meet the University requirements for a bachelor's degree as specified in the University Catalog:

- A scholastic average of C (GPA of 2.0) in all work taken at the University.
- Completion of either 90 of the first 100 credits or 30 of the last 36 credits, full- or part-time, at the University of Delaware.
- One incoming semester of First Year Experience (FYE) completed with a passing letter grade, or a grade of P for courses graded only Pass/Fail. The number of credits will depend on the designated FYE (see FYE website: [www.ugs.udel.edu/FYE](http://www.ugs.udel.edu/FYE)).
- One semester of Freshman English (ENGL 110), completed with a minimum grade of C-.
- Three credits of Discovery Learning Experience (DLE) completed with a passing letter grade, or a grade of P for courses graded only Pass/Fail. DLE includes experiences such as internship, service learning, independent study, undergraduate research, and study abroad which are designated DLE (see DLE website: [www.ugs.udel.edu/DLE](http://www.ugs.udel.edu/DLE)).
- Three credits in an approved course or courses stressing multi-cultural, ethnic, and/or gender related content. The purpose of the multicultural requirement is to provide students with some awareness

of and sensitivity to cultural pluralism—an increasing necessity for educated persons in a diverse world. This requirement may be fulfilled through a course or courses taken to complete other course requirements, but cannot be fulfilled with any course taken on a pass/fail basis. Only course sections that are designated as multicultural in the registration booklet for a specific semester can be used to fulfill this requirement.

➤  
b. College Skills Requirements

In order to receive the degree students must meet the following skill requirements of the College of Arts and Science:

**Second Writing Requirement: (minimum grade C-) . . . . . 3 credits**

A second writing course involving significant writing experience including two papers with a combined minimum of 3,000 words to be submitted for extended faculty critique of both composition and content. This course must be taken after completion of 60 credit hours. Appropriate writing courses are designated in the semester's Registration Booklet. (See list of courses approved for second writing requirement, pages 89-91.)

**Mathematics: . . . . . 0-4 credits**

*(one of the following three options with a minimum grade of D-)*

**OPTION ONE:**

MATH 114 College Mathematics and Statistics

(designed for students who do not intend to continue the study of mathematics)

MATH 115 Pre-Calculus

(designed for students who intend to continue the study of mathematics)

**OPTION TWO:**

Successful completion of any mathematics course at or above the 200-level except MATH 201, MATH 202, MATH 205, MATH 250, MATH 251, MATH 252, MATH 253, MATH 266, MATH 300 or MATH 450.

**OPTION THREE:**

Successful performance on a proficiency test in mathematics administered by the Department of Mathematical Sciences. (0 credits awarded)

The math requirement must be completed by the time a student has earned 60 credits. Students who transfer into the College of Arts and Sciences with 45 credits

or more must complete this requirement within two semesters.

**Foreign Language: . . . . . 0-12 credits**

*(with a minimum grade of D-)*

Completion of the intermediate-level course (107 or 112 or 214) in an ancient or modern language. The number of credits needed and initial placement will depend on the number of years of high school study of foreign language.

Students with four or more years of high school work in a single foreign language may attempt to fulfill the requirement in that language by taking an exemption examination through the Foreign Languages and Literatures Department.

c. College Breadth Requirements

(MINIMUM GRADE OF D-)

**Group A** ..... 9

Analysis and appreciation of the creative arts and humanities.

Nine credits of courses representing at least two departments or appropriate instructional units.

**Group B** ..... 9

The study of culture and institutions over time.

Nine credits of courses representing at least two departments or appropriate instructional units.

**Group C** ..... 9

Empirically based study of human beings and their environment.

Nine credits of courses representing at least two departments or appropriate instructional units.

**Group D** ..... 9

The study of natural phenomena through experiment or analysis.

Nine credits of courses representing at least two departments or appropriate instructional units and including a minimum of one course with an associated laboratory.

If the grade earned is sufficient, a course may be applied toward more than one requirement (e.g., breadth and major requirements), but the credits are counted only once toward the total credits for graduation. If all but one course in a group has been taken in one department or program, a course cross-listed with that program will not satisfy the distribution requirement.

It should be noted that, as is usual for B.S. degrees, the number of credits required for College breadth requirements is reduced in comparison with B.A. degrees. This is due to the fact that the requirements for the major exceed those usual for a B.A.

## 6. Requirements for Honors B.S. in Cognitive Science

The recipient must complete:

1. All requirements for the Bachelor of Science degree in Cognitive Science:

- A cumulative GPA of at least 3.400 at the time of graduation
- At least 30 credits earned in Honors courses:
- At least 12 credits in the major department or in courses in collateral disciplines specifically required for the major;
- At least 12 credits in 300-level courses or higher, not including the first-year interdisciplinary Honors colloquium;
  - Three credits in an Honors Degree seminar or Honors capstone course or comparable senior experience approved by the major and the Honors Program, to be completed in one of the last two semester of the student's degree program.

2. All of the University's generic requirements for the Honors Baccalaureate degree.

3. The student's grade point average for courses in the major must be at least 3.50 at the time of graduation.

#### 7. Plans to Offer at Least 9-12 Honors Credits on a Regular Basis

The following core courses in the program have in recent years been offered with Honors sections on at least an annual basis. In the case of CGSC and LING courses, the department plans to offer these courses as Honors courses at least once a year as specified below. The major is highly individualized, so we cannot guarantee that courses offered by other departments will include honors sections, but for courses offered under the CGSC and LING rubric, the opportunity will be made available to students to take the course on an Honors basis (course to include Honors enrichment component for Honors students):

LING 101 (separate Honors section frequently offered)  
CGSC 270 (separate Honors section frequently offered)  
CGSC 485 (probably as individual Honors section)  
CISC 105 (separate Honors section frequently offered)  
PHIL 330 (separate Honors section frequently offered)  
PSYC 100 (separate Honors section frequently offered)

#### 8. Honors Capstone Course

The Department plans to submit CGSC 485, the senior seminar required by the major, for approval as an Honors capstone course.

#### 9. 4+1 Option

Qualified undergraduate students in the in the B.S. in Cognitive Science as well as students completing a Bachelors degree in related fields like Anthropology, Computer and Information Science, Philosophy and Psychology (and other fields by application) may apply for the 4+1 option, which combines the requirements of the undergraduate and master's degree programs in Cognitive Science and Linguistics and Cognitive Science. Whereas the traditional programs for the B.S. and M.S. degrees in Cognitive Science and Linguistics and Cognitive Science involve 4 years of undergraduate work and 2 years of graduate work, the 4+1 option enables students to earn both degrees in a 5-year period. Students who complete the 4+1 program will graduate with both a Bachelor of Science degree and a Master of Science degree in Linguistics and Cognitive Science. Students who are candidates for the 4+1 option, and who complete the requirements for the B.S. but fail to complete the additional M.A. requirements, will receive the B.S. degree.

##### a. Admission into the 4+1 Program

Students may apply for admission to the 4+1 program at the end of the sophomore year. The application process requires submission of a completed graduate application form for review by the Departmental Graduate Studies Committee. Initial admission will be based upon the student's ability to meet the following recommended entrance criteria:

- Combined mathematics and verbal SAT scores of at least 1200
- An undergraduate GPA of at least 3.25
- Completion of all core courses for the B.S. other than CGSC 485

- Submission of an in-person writing sample, based on work completed in a Cognitive Science course

Admission is competitive so meeting the minimal requirements for admission does not guarantee admission nor does the failure to meet a requirement result in an automatic rejection. The GRE is not required for admission to the 4+1 program by UD undergraduates.

#### b. Maintaining Status within the Program

Upon admission into the program and prior to the start of the junior year of study, the student will meet with his graduate advisor and submit a planned program of study, including all elective courses, to the Graduate Studies Committee. Planned programs of study are due by the end of fall semester of the student's junior year.

Continuation in the 4+1 program is contingent upon maintaining a cumulative GPA of at least 3.25 in undergraduate courses with CGSC and LING designations and in graduate coursework. Satisfactory progress includes following the prescribed program of study.

Each student's progress and GPA will be evaluated at the end of each academic year by the student's advisor and the Graduate Studies Committee. Students who fail to meet the minimum GPA requirements or fail to show progress toward the degree will be dropped from the 4+1 program. They may, however, continue in the undergraduate major unless their undergraduate progress is unsatisfactory according to the rules in effect for the B.S. program.

#### c. 4+1 Degree Requirements for the Master of Science in Linguistics and Cognitive Science and the B.S. in Cognitive Science

The graduate level course requirements for the 4+1 degree in Cognitive Science are the same as those for the M.A. in Linguistics and Cognitive Science. The course requirements for the degree include 30 credit hours planned in consultation with the student's advisor and the Director of Graduate Studies, which must include at least 21 credit hours in the Linguistics Department and at least one 800-level seminar. The M.A. in Linguistics and Cognitive Science is a flexible program of study that provides training in both Linguistics and Cognitive Science. Separate tracks are provided for students whose emphasis is clearly in Cognitive Science or in Linguistics. In addition, students may propose a program of study that combines elements of the Linguistics and Cognitive Science tracks. See the Department's Graduate Policy Statement for additional information. Students must fulfill all graduate and undergraduate course requirements for both the M.A. and their undergraduate degree.

#### d. Distribution of Credits in 4+1 Program

The following table illustrates a typical distribution of graduate and undergraduate credits for a student in the 4+1 program. This sample program is



based on the assumption that the policy of the University is not to permit any reduction in undergraduate courses for students in the 4+1 program. Thus, students in the program complete both the full 124 credit hours of the B.S. and the full thirty credit hours of the M.A. There are a number of courses relevant to both the undergraduate and the graduate degrees that are taught as 400/600 courses, and if students taking such courses at the 600 level were permitted to count some number of the courses for both the B.S. and the M.A., students would be able to complete both the B.S. and the M.A. in five academic years without the need to participate in any special sessions. On the assumption (made in this proposal) that no such reduction in credit requirements is permitted, unless the student takes the maximal possible course load of 17 credit hours during several semesters, it may necessary for the student to participate in as many as two special sessions in order to complete the program in five calendar years.

In the sample program below, the student participates in one winter session consisting of two three credit courses and one summer session (an internship). For example, the Department of Linguistics conducts a summer and a winter session course in Italy each year that would be appropriate for many of the students. Summer session would also be an appropriate time for an internship relevant to the student's academic interests, as in the example below.

	<b>UG Credits</b>	<b>Grad Credits</b>
<b>Freshmen Year</b>		
Fall	16	0
Winter	0	0
Spring	15	0
Summer	0	0
<b>Sophomore Year</b>		
Fall	16	0
Winter	6	0
Spring	15	0
Summer	0	0
<b>Junior Year</b>		
Fall	16	0
Winter	0	0
Spring	12	3
Summer	4 [e.g. internship]	0
<b>Senior Year</b>		
Fall	12	3
Winter	0	0
Spring	12	3
<b>Year 5</b>		
Fall		12
Spring		12

## ***2. Revisions to Planned Program of Study in 4+1 Program***

Students who wish to make changes to their program of study must first obtain permission from their advisor. The advisor must then make a written request to the Graduate Studies Committee to revise the program of study.

## V. Resources Available

### 1. Learning Resources

Cognitive Science has been an area of research for University faculty for at least the last 15 years. Library holdings are already excellent and are improving steadily. The Department of Linguistics has been ordering audio-visual materials in support of cognitive science as well. We do not envisage that that this degree will require an increase in the availability of learning resources.

### 2. Faculty / Administrative Resources

#### a. Administration

The degree will be housed in the Department of Linguistics and Cognitive Science. In a separate document, the Department of Linguistics has proposed a change in the name of the Department from Department of Linguistics to Department of Linguistics and Cognitive Science.

#### b. Faculty

As was mentioned previously, the Department of Linguistics is expanding to become the Department of Linguistics and Cognitive Science. Thus, it is appropriate to list both the core faculty of the Department and the membership of the program in Cognitive Science:

##### i. Core Faculty of the Department of Linguistics

Adams, Frederick R, Professor and Chair

Andreasen, Robin O, Associate Professor

Bruening, Benjamin T, Assistant Professor and Director of Graduate Studies

Cole, Peter, Professor and Director of Undergraduate Studies

Hermon, Gabriella, Professor

Hurewitz, Felicia Dawn, Assistant Professor

Poliquin, Gabriel Christopher, Assistant Professor

Schweda-Nicholson, Nancy, Professor

Tomioka, Satoshi, Associate Professor

Vogel, Irene Barrie, Professor

\*The department is currently searching to fill two positions: one in phonology / phonetics, one in computational linguistics or psycholinguistics

##### ii. Faculty with Secondary Appointments in Linguistics

Arena, Louis Anthony, Professor Emeritus

Bunnell, H Timothy, Research Associate Professor

Sandra Carberry, Professor

Chester, Daniel Leon, Associate Professor

Golinkoff, Roberta, H. Rodney Sharp Professor

Idsardi, William J, Adjunct Professor

McCoy, Kathleen F, Professor

Mineo, Beth A, Associate Professor

Papafragou, Anna, Assistant Professor

Vijay K. Shanker, Associate Professor

Tadmor, Uri, Adjunct Assoc Professor

iii. Faculty in Cognitive Science

Ackerman, Brian, Psychology, Professor

Case, John, Computer and Information Sciences, Professor

Ferretti, Ralph, Education, Professor

Ginsburg-Block, Marika, Education, Assistant Professor

Hiebert, James, Education, Robert J. Barkley Professor

Hoffman, James, Psychology, Professor

Intraub, Helene, Psychology, Professor

Jordan, Nancy, Education, Professor

Kambhamettu, Chandra, Computer and Information Sciences, Associate Professor

Lavigne, Nancy, Education, Assistant Professor

Lehrman, Alexander, Foreign Language and Literature, Associate Professor

MacArthur, Charles, Education, Professor

McLaughlin, John P, Psychology, Associate Professor

Mosberg, Ludwig, Education, Professor Emeritus

Steve Most, Psychology, Assistant Professor

Mouza, Chrystalla, Education, Assistant Professor

Murray, Frank, Education, H. Rodney Sharp Professor

Northmore, David, Psychology, Professor

Pemberton, Elizabeth, Education, Assistant Professor

Pust, Joel, Philosophy, Associate Professor

Quinn, Paul, Psychology, Professor

Rasmussen, Christopher, Computer and Information Sciences, Assistant Professor

Rocek, Tom, Anthropology, Associate Professor

Rosenberg, Karen, Anthropology, Associate Professor and Chair

Satinoff, Evelyn, Psychology, Professor

Stanton, Mark, Psychology, Associate Professor

Walpole, Sharon, Education, Assistant Professor

## **VI. Resources Required**

### **1. Learning Resources**

The University currently has excellent learning resources (e.g. library holdings) for the major.

### **2. Personnel Resources**

As an interdisciplinary program, Cognitive Science relies on courses contributed by the membership of the program as well as courses taught by faculty budgeted to the unit (i.e. those budgeted to the current Department of Linguistics, future Department of Linguistics and Cognitive Science). It is important to note that the core courses in the major are courses that are already offered on a regular basis. Thus, required courses will be available regularly. The only core course that has not been offered on a regular basis is CGSC 485, the senior seminar. This course will be offered annually as soon students reach senior status. The current faculty (including currently authorized new hires) is sufficient for these purposes.

While additional faculty are not essential for the major, the Department has been authorized to make the previously mentioned two new hires and further hires in subsequent years. These hires will further enrich the program.

### 3. Budgetary Needs

While additional funds above those already committed to the Department would enrich the major and help to produce a premiere program, current funding is sufficient for the introduction of the major.

## **VII. Implementation and Evaluation**

### 1. Implementation Plan

The implementation will consist of design of the major (06F), departmental approval (06F), college and university senate committee approvals (06F/07S), Provost, President, and BOT approvals (07S), creation or cross-listing of relevant courses (06F), co-ordination of program offerings of participating departments in the cognitive sciences (06F/07S), preparation of materials for use in admissions and publicity (07S), enrollment of new students into the major (07F).

### 2. Assessment Plan

A committee has been appointed to come up with an assessment plan for the Cognitive Science Major. The committee includes Robin Andreasen (chair) and Benjamin Bruening. The committee members will draft a plan that specifies at least three clear, concise, and measurable learning goals as well as the course(s) that ensure that our students have the opportunity to achieve these goals. The plan will also propose a method of measurement to assess whether the desired outcomes are being achieved as well as ways in which the Department of Linguistics and Cognitive Science can use the results for improving instruction and strengthen the major. The committee will consult with the Department as well as the Office of Educational Assessment in the development of this plan. We hope to have the plan completed by the end of Spring semester 2007.

## **VIII. APPENDICES**

### **Letters of Approval from Contributing Departments**