Cognitive Science (BS)

Cognitive Science is the study of complex information processing in humans and machines and includes the multidisciplinary study of biological and artificial systems. Important components of cognitive science include areas of research such as: cognitive-neuroscience, brain-imaging studies of perceptual and cognitive processing, Human-Computer Interaction (HCI), Artificial Intelligence (AI) and machine learning, computational neuroscience, and mathematical psychology. The field of cognitive science draws from diverse approaches to understanding complex information processing systems, including research from experimental psychology, neuroscience, linguistics, philosophy, computer science, mathematics, and engineering.

The Cognitive Science program in the School of Behavioral and Brain Sciences at UT Dallas consists of three concentration areas: (1) Psychology/HCI, (2) Neuroscience, and (3) Intelligent Systems (AI) /Computational Modeling.

Cognitive Science Majors select core upper-division coursework from 2 of these 3 concentration areas to generate multidisciplinary areas of focus. In addition to providing a sound preparation for graduate work in Cognitive Science and related areas, the Cognitive Science major is an ideal choice for students pursuing careers that combine interests in neuroscience, cognition, mathematics, and computer science. There are exciting career prospects in both industry and academics for the Cognitive Science major.

Cognitive-Neuroscience Careers. Students whose focus area is cognitive-neuroscience will be well prepared for the pursuit of graduate degrees and careers associated with: medicine, clinical neuropsychology, brain-imaging technology, intraoperative neurophysiological monitoring, and evaluation of bionic/prosthetic technology (e.g., cochlear implants and artificial limbs). Students interested in Cognitive-Neuroscience career opportunities typically choose their coursework from the specialization areas of both Psychology/HCI and Neuroscience.

Artificial Intelligence and Machine Learning Careers. The areas of Artificial Intelligence and Machine Learning are concerned with the problem of the design and evaluation of artificially intelligent systems. Examples of artificially intelligent systems include: web search engines, speech recognition algorithms, computer-based natural language understanding, robotics, computer vision, smart algorithms which support automated data mining, the design of intelligent entities in computer games, as well as bionic and prosthetic technology development and evaluation (such as cochlear implant technology). Students interested in career opportunities in this area should choose their core coursework from the AI/Computational Modeling specialization area.

Computational Neuroscience and Mathematical Psychology Careers. Computational neuroscience and mathematical psychology are areas of study concerned with the development of mathematical and simulation models for the purpose of advancing theory in the behavioral and brain sciences. Students interested in careers in computational neuroscience would choose their core coursework from the specialization areas of both Neuroscience and AI/Computational Modeling. Students interested in the area of mathematical psychology would choose their core coursework from the specialization areas of Psychology/HCI and AI/Computational Modeling.
**Usability Engineering and User Experience (UX) Careers.** Students whose focus area is Human-Computer Interaction (HCI), are prepared to pursue careers in the areas of usability engineering and user-experience (UX) design. Such careers involve the evaluation and design of human-computer interfaces such as website and software graphical user interfaces (GUIs), smartphone interfaces, and voice-user interfaces (VUIs). Students interested in Usability Engineering opportunities should choose their core coursework from the Psychology/HCI specialization area and include one or more HCI courses. Students interested in the area of user-experience (UX) design typically choose their core coursework from both the specialization areas of Psychology/HCI and Artificial Intelligence/Computational Modeling.

**Medical and Dental School Career Paths.** The Cognitive Science major is an excellent choice for students interested in preparation for medical or dental graduate study. Cognitive science students receive training in areas such as biology, chemistry, psychology, and mathematics. Freshman and sophomore students interested in pre-med careers should identify basic, required, and recommended subject requirements for their top choices in medical schools. This information should then be used to design an appropriate cognitive science curriculum with their undergraduate Cognitive Science advisor. Permission to take relevant advanced coursework in biology, chemistry, and neuroscience can, in some cases, be used to satisfy the neuroscience specialization area requirements with approval from the Cognitive Science program head. Students interested in Health Services career paths should choose Neuroscience as one of their two specialization areas.

**Bachelor of Science in Cognitive Science**

**Degree Requirements** *(120 semester credit hours)*

*View an Example of Degree Requirements by Semester*

**Faculty**


**Associate Professors:** Chandramallika Basak, Kristen Kennedy, Sven Kroener, Mandy J. Maguire, Christa McIntyre Rodriguez, Jonathan E. Ploski, Karen Rodrigue, Lucien (Tres) Thompson, Gagan Wig

**Assistant Professors:** Michael Burton, Kendra Seaman, Catherine Thorn

**Professors of Instruction:** Salena Brody, Karen Huxtable-Jester, Nancy Juhn

**Associate Professors of Instruction:** Meridith Grant, Steven McWilliams, Gayle Schwark

**Assistant Professors of Instruction:** Siham Raboune, Anna Taylor

**Senior Lecturer:** Rukhsana Sultana

**Affiliated Faculty:** Robert Ackerman, Shayla C. Holub, Heidi Kane, Candice M. Mills, Jackie Nelson, Amy Pinkham, Karen J. Prager, Raúl Rojas, Pamela R. Rollins, John W. Santrock, Noah J. Sasson, Melanie J. Spence, Linda M. Thibodeau, Hanna K. Ulatowska, Andrea Warner-Czyz
I. Core Curriculum Requirements: 42 semester credit hours

Communication: 6 semester credit hours

**COMM 1311** Survey of Oral and Technology-based Communication

**COMM 1315** Public Speaking

**RHET 1302** Rhetoric

Or select any 6 semester credit hours from **Communication Core** courses (see advisor)

Mathematics: 3 semester credit hours

**MATH 2417** Calculus I

or **MATH 2413** Differential Calculus (Note: **MATH 2417** is recommended)

Or select any 3 semester credit hours from **Mathematics Core** courses (see advisor)

Life and Physical Sciences: 6 semester credit hours

Select 6 semester credit hours from **Life and Physical Sciences Core** courses (see CGS advisor)

Language, Philosophy and Culture: 3 semester credit hours

Select 3 semester credit hours from **Language, Philosophy and Culture Core** courses

Creative Arts: 3 semester credit hours

Select 3 semester credit hours from **Creative Arts Core** courses

American History: 6 semester credit hours

Select 6 semester credit hours from **American History Core** courses

Government/Political Science: 6 semester credit hours

Select 6 semester credit hours from **Government/Political Science Core** courses

Social and Behavioral Sciences: 3 semester credit hours

**PSY 2301** Introduction to Psychology

Or select any 3 semester credit hours from **Social and Behavioral Sciences Core** courses (see advisor)

Component Area Option: 6 semester credit hours

**MATH 2419** Calculus II

or **MATH 2414** Integral Calculus (Note: **MATH 2419** is recommended)
II. Major Requirements: 48-54 semester credit hours (12 semester credit hours beyond Core Curriculum)

Major Preparatory Courses

The following are required for all concentration areas: (24 semester credit hours)

- CGS 2301 Cognitive Science\(^3\)
- CS 1337 Computer Science I
- MATH 2417 Calculus I\(^3\)
  - or MATH 2413 Differential Calculus\(^3\)
- MATH 2419 Calculus II\(^3\)
  - or MATH 2414 Integral Calculus\(^3\)
- MATH 2418 Linear Algebra
- PSY 2301 Introduction to Psychology\(^3\)
- PSY 2317 Statistics for Psychology
  - or CS 3341 Probability and Statistics in Computer Science and Software Engineering

Additional Preparatory Courses for AI/Computational Modeling Area (6 semester credit hours)

The courses listed below are not required for all students specializing in the AI/Computational Modeling area but are prerequisites for some courses in this area.

- CS 2305 Discrete Mathematics for Computing I
- CS 2336 Computer Science II

Additional Preparatory Courses for Neuroscience Area (21 semester credit hours)

The courses listed below are not required for all students specializing in the Neuroscience area but are prerequisites for some courses in this area.

- BIOL 2111 Introduction to Modern Biology Workshop I
- BIOL 2281 Introductory Biology Laboratory
- BIOL 2311 Introduction to Modern Biology \(^3\)
- CHEM 1111 General Chemistry Laboratory I
- CHEM 1311 General Chemistry \(^3\)
- CHEM 1112 General Chemistry Laboratory II
CHEM 1312 General Chemistry II

Major Core Courses required for all concentration areas: 12 semester credit hours

CGS 3361 Cognitive Psychology
NSC 3361 Introduction to Neuroscience
PSY 3392 Research Design and Analysis
CGS 3340 Experimental Projects in Cognitive Science
or PSY 3393 Experimental Projects in Psychology

Major Related Courses: 24 semester credit hours

Select 4 courses each from 2 of the following 3 Concentration Areas:

Core Courses for Psychology/HCI Concentration Area

Select 12 semester credit hours from the list of courses below:

CGS 3325 Historical Perspectives on Psychology: Mind and Machines since 1600
CGS 4359 Cognitive Neuroscience
CGS 4362 Perception
CGS 4352 Human-Computer Interaction I
CGS 4353 Human-Computer Interaction II
PSY 3331 Social Psychology
PSY 4343 Abnormal Psychology
PSY 2314 Lifespan Development
PSY 3310 Child Development
PSY 3362 Cognitive Development
PSY 3339 Educational Psychology
PSY 4364 Attention and Memory
NSC 4385 Neuropsychology
CGS 4320 Psychology of Reasoning

Core Courses required for Neuroscience Concentration Area

Select 12 semester credit hours from the list of courses below:

NSC 4352 Cellular Neuroscience
NSC 4354 Integrative Neuroscience
NSC 4356  Neurophysiology
NSC 4366  Neuroanatomy
NSC 4363  Neuropharmacology
NSC 4367  Developmental Neurobiology
NSC 4359  Cognitive Neuroscience
NSC 4353  Neuroscience Laboratory Methods
NSC 4357  Neurobiology of Learning and Memory
NSC 4362  Molecular Neuroscience
NSC 4371  Neural Plasticity
NSC 4373  Sensory Neuroscience
NSC 4385  Neuropsychology
NSC 4351  Medical Neuroscience
NSC 4358  Neuroscience of Pain
NSC 4372  Neuroimmunology
NSC 4350  Medical Neuropathology

**Core Courses required for Intelligent Systems (AI)/Computational Modeling Concentration Area**

Select 12 semester credit hours from the list of courses below:

- **CS 3341** or **SE 3341** Probability and Statistics in Computer Science and Software Engineering
- **CGS 3342** Cognitive and Neural Modeling Laboratory
- **CGS 4314** Intelligent Systems Analysis
- **CGS 4315** Intelligent Systems Design
- **CS 3345** Data Structures and Introduction to Algorithmic Analysis
- **CS 4365** Artificial Intelligence
- **CS 4375** Introduction to Machine Learning
- **CS 4391** Introduction to Computer Vision
- **CS 4395** Human Language Technologies
- **CS 4372** Computational Methods for Data Scientists
- **CGS 4352** Human-Computer Interaction I
- **CGS 4353** Human-Computer Interaction II

**III. Elective Requirements: 24-30 semester credit hours**
Free Electives:

- 24 semester credit hours for Intelligent Systems (AI)/Computational Modeling Concentration Area
- 30 semester credit hours for the other two concentrations

Students are encouraged to explore areas of concentration in Cognitive Science, Psychology, and Neuroscience as well as explore interests outside the field. Be aware that at least 51 semester credit hours of upper-division semester credit hours are required for graduation. In addition, advanced CGS students in good academic standing may request permission from the Cognitive Science Program Head to take graduate Applied Cognition and Neuroscience coursework (ACN prefix) to fulfill some of the elective course requirements.

Incoming freshmen must enroll and complete requirements of **BBSU 1100**.

Fast Track Baccalaureate/Master's Degrees

UT Dallas undergraduate students with strong academic records who intend to pursue a master's degree in Applied Cognition and Neuroscience at UT Dallas may consider an accelerated undergraduate-graduate plan of study. If accepted into the program, students may take up to 15 semester credit hours of graduate courses that may be used to complete the bachelor's degree and also to satisfy requirements for the Master's degree. Students must maintain a 3.000 grade point average and earn grades of B or better in the graduate courses taken.

Students should apply for Fast Track admission in the semester they reach 90 semester credit hours. To qualify for application, undergraduate students must have completed at least 18 semester credit hours in major core courses at UT Dallas. To be eligible for Fast Track admission, students must have completed at least 90 semester credit hours toward a baccalaureate degree, completed a minimum of 36 hours of general education core curriculum classes, and meet program admission requirements. Apply to the Fast Track program through the Applied Cognition and Neuroscience Program Office. Students should consult with a graduate advisor regarding admissions criteria and plans of study at the beginning of their junior year.

Minor in Cognitive Science: 18 semester credit hours

Students who are not majoring in Cognitive Science may minor in Cognitive Science by completing 18 semester credit hours. Students who take a minor will be expected to meet the normal prerequisites in courses making up the minor, and should maintain a minimum GPA of 2.000 on a 4.00 scale (C average). At least 12 of the 18 semester credit hours required by the minor in Cognitive Science must be satisfied by completing two upper-division courses from each of two different Cognitive Science specialization areas. In addition, 9 of the 18 semester credit hours required for the minor in Cognitive Science must have a Cognitive Science (CGS), Psychology (PSY), or Neuroscience (NSC) prefix and be upper-division courses. No semester credit hours may be used to satisfy both major and minor requirements; however, free elective semester credit hours or major preparatory classes may be used to satisfy the minor. At least one-third of the semester credit hours for a minor must be taken at UT Dallas.

1. Incoming freshmen must enroll and complete requirements of UNIV 1010 and the corresponding
school-related freshman seminar course. Students, including transfer students, who complete their core curriculum at UT Dallas must take UNIV 2020.

2. Curriculum Requirements can be fulfilled by other approved courses from institutions of higher education. The courses listed are recommended as the most efficient way to satisfy both Core Curriculum and Major Requirements at UT Dallas.

3. A required Preparatory course that also fulfills a Core Curriculum requirement. Fourteen semester credit hours (14) are counted in Core Curriculum.

4. Note that either SE 3341 or STAT 3341 may be used as an equivalent course for CS 3341 for all Cognitive Science program requirements as well as all Cognitive Science course prerequisites.

5. Taught only once every other year.