School of Behavioral and Brain Sciences

Cognitive Science (B.S.)

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, situated cognition, Human-Computer-Interactions (HCI), computational modeling, and Artificial Intelligence (AI). The field of cognitive science draws from diverse approaches to understanding these processes, including research from experimental psychology, neuroscience, linguistics, 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) Cognitive-Neuroscience, and (3) AI/Computational Modeling. Cognitive Science Majors select the majority of their upper-division coursework from 2 of these 3 concentration areas in order 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 core coursework from both the specialization areas of Psychology/HCI and Neuroscience.

Human-Computer-Interaction Careers. Students whose focus area is Human-Computer-Interactions (also known as HCI or usability engineering), will be prepared for the pursuit of careers involving the evaluation and design of user-friendly software interfaces which arise, for example, in website development. Students interested in HCI career opportunities should choose their core coursework from the Psychology/HCI specialization area and take one or more of the HCI courses available.

AI/Computational Modeling Careers. Students whose focus area is AI/computational modeling will be prepared for the pursuit of careers associated with the development and evaluation of Artificial Intelligence (AI) technology (e.g., web search engines, speech recognition, robotics, computer vision, and computer games), bionic and prosthetic technology development and evaluation (such as cochlear implant technology), as well as the development of computational models to support theory development in the behavioral and brain sciences. Students interested in career opportunities in this area should choose their core coursework from the AI/Computational Modeling specialization area.
Bachelor of Science in Cognitive Science

Degree Requirements (120 hours)

I. Core Curriculum Requirements\(^1\): 42 hours

**Communication (6 hours)**
- 3 hours Communication (RHET 1302)
- 3 hours Communication Elective (CGS 3340 or PSY 3393)\(^2\)

**Social and Behavioral Sciences (15 hours)**
- 6 hours Government (GOVT 2301 and GOVT 2302)
- 6 hours American History
- 3 hours Social and Behavioral Science Elective (PSY 2301)\(^2\)

**Humanities and Fine Arts (6 hours)**
- 3 hours Fine Arts (ARTS 1301)
- 3 hours Humanities (HUMA 1301)

**Mathematics and Quantitative Reasoning (6 hours)**
- 6 hours Calculus (MATH 2417 and MATH 2419)\(^3\)

**Science (9 hours)**
- 6 hours Science (NSC 3361 and CGS 2301)\(^2\)
- 3 hours Science Electives (including at least one course with a substantial laboratory component)

II. Major Requirements: 60 hours (15 hours beyond Core Curriculum)\(^4\)

**Major Preparatory Courses**

The following are required for all concentration areas: (24 hours)
- **CGS 2301** Cognitive Science\(^4\)
- **CS 1337** Computer Science I
- **MATH 2417** Calculus I\(^3\)
- **MATH 2419** Calculus II\(^5\) (prerequisite: MATH 2417)
MATH 2418 Linear Algebra (prerequisite: MATH 2419)
PSY 2301 Introduction to Psychology
PSY 2317 Statistics for Psychology
   or CS/SE 3341 Probability and Statistics in Computer Science and Software Engineering (prerequisite: MATH 2419 and CS 2305)
   or STAT 4351 Probability (prerequisite: MATH 2451)

Additional Preparatory Courses for AI/Computational Modeling Area (10 hours)
   CS 2305 Discrete Mathematics for Computing I (prerequisite: MATH 2417)
   CS 2336 Computer Science II (prerequisite: CS 1337)
   MATH 2451 Multivariable Calculus with Applications (prerequisite: MATH 2419)

Major Core Courses required for all concentration areas (12 hours)
   CGS 3361 Cognitive Psychology
   NSC 3361 Behavioral 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 hours)
Select 4 courses each from 2 of the following 3 Concentration Areas

Core Courses for Psychology/HCI Concentration Area (select 12 hours from list of courses below)
   CGS 3325 Historical Perspectives on Psychology: Mind and Machines Since 1600
   CGS 4359 Cognitive Neuroscience (prerequisite: PSY 2301)
   CGS 4362 Perception
   CGS 4352 Human Computer Interactions I
   CGS 4353 Human Computer Interactions II
   CGS 4355 Human Computer Interactions Lab
   PSY 4374 Human Judgment and Decision Making
   PSY 3331 Social Psychology
   PSY 4343 Abnormal Psychology
**Core Courses required for Cognitive-Neuroscience Concentration Area** (select 12 hours from list of courses below)

- **NSC 4352** Cellular Neuroscience (prerequisite: **NSC 3361**)
- **NSC 4354** Integrative Neuroscience (pre- or corequisite: **NSC 3361**)
- **NSC 4356** Neurophysiology (prerequisite: **NSC 4352**)
- **NSC 4366** Neuroanatomy (prerequisite: **NSC 3361**)
- **NSC 4363** Neuropharmacology (prerequisite: **NSC 4352** or **NSC 4354**)
- **NSC 4367** Developmental Neurobiology (prerequisite: **NSC 4352** or **NSC 4354**)
- **NSC 4359** Cognitive Neuroscience (prerequisite **PSY 2301**)
- **NSC 4353** Neuroscience Laboratory Methods

**Core Courses required for AI/Computational Modeling Concentration Area** (select 12 hours from list of courses below)

- **CGS 3342** Cognitive and Neural Modeling Lab (prerequisite: **MATH 2418**)
- **CGS 4312** Computational Modeling Methods for Language Understanding
- **CGS 4313** Neural Net Mathematics (prerequisites: **MATH 2451** and **MATH 2418**; or instructor consent required)
- **CGS 4314** Intelligent Systems Analysis (prerequisites: **CGS 4313** or instructor consent required)
- **CGS 4315** Intelligent Systems Design (prerequisites: **CGS 4314** or instructor consent required)
- **CS 3305** Discrete Mathematics for Computing II (prerequisite: **CS 2305**)
- **CS 3345** Data Structures and Introduction to Algorithmic Analysis (prerequisite: **CS 2336** and **CS 3305**)
- **CS 4365** Artificial Intelligence (prerequisite: **CS 3345**)
- **CS 4375** Introduction to Machine Learning (prerequisites: **CS 3345** and **CS 3341**)
- **CS 4391** Introduction to Computer Vision (prerequisite: **CS 3345**)

**III. Elective Requirements: 18 hours**

**Breadth Electives**
(6 hours of upper-division courses, or lower-division courses that have prerequisites, that are outside of Psychology and not cross-listed with Cognitive Science).

**Free Electives (3-13 hours)**

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 hours of upper division 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.

**Minor in Cognitive Science**

Students who are not majoring in Cognitive Science may minor in Cognitive Science by completing 18 semester credit hours. At least 12 of the 18 semester credit hours required by the minor in Cognitive Science must be upper-division courses from either the Psychology/HCI, Neuroscience, or Computational Modeling/AI 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 credit hours may be used to satisfy both major and minor requirements; however, free elective hours or major preparatory classes may be used to satisfy the minor. At least one-third of the hours for a minor must be taken at UT Dallas.

**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. When accepted into the program, students may take up to 15 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. The Fast Track makes it possible for students to complete upper-division undergraduate education and graduate training in three years. Students must have completed at least 90 semester credit hours toward a baccalaureate degree before beginning Fast Track course work. Students should apply to admissions one semester before they reach 90 hours. To qualify for application, undergraduate students must have completed at least 18-semester credit hours in major core courses at UT Dallas. Apply to the Fast Track program through the Cognitive Science Program Office. Students should consult with a graduate advisor regarding admissions criteria and plans of study at the beginning of their junior year.

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

2. A required Major course that also fulfills a Core Curriculum requirement. Hours are counted in Core Curriculum.
3. Six hours of Calculus are counted to fulfill the Mathematics Core Requirement. MATH 2413, MATH 2414, and MATH 2415 can substitute for MATH 2417 and MATH 2419.

4. This course is a Major requirement that also fulfills a Core Curriculum requirement. Fifteen hours (15) are counted in Core Curriculum.

5. Six hours of Calculus are counted to fulfill the Mathematics Core Requirement. MATH 2413, MATH 2414, and MATH 2415 can substitute for MATH 2417, and MATH 2419.

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