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CS 6795: Cognitive Science
Summer 2024
Keith McGregor
Course Description and Syllabus

Description: CS 6795 is a 3-credit graduate introductory course on cognitive science. Cognitive science is an interdisciplinary study of mind and intelligence. The core question is *how does mind work? That is, how does mind produce intelligent behavior?*

Cognitive science lies at the intersection of computer science (especially artificial intelligence), psychology, biology (especially neurobiology), education, linguistics, anthropology, and philosophy, as indicated by this logo of the Cognitive Science Society (<https://cognitivesciencesociety.org/>):



From the Georgia Tech course catalog: “Multidisciplinary perspectives on cognitive science. Interdisciplinary approaches to issues in cognition, including memory, language, problem solving, learning, perception, and action.”

Like the in-person version (CS 6795), this course is heavily project-based including both guided and self-directed projects. It will consist of series of twenty-nine video lessons; thirty-two reading assignments; twelve quizzes; six small individual exercises; and one self-directed term project. Unlike the on-campus class, this (OMSCS 6795) class is fully online and asynchronous, with the video lessons and the online discussion forum replacing the in-person classes. However, the professor will hold optional fireside chats at specific times throughout the semester.

Prerequisites: An open and inquisitive mind! An aptitude for reading! An aptitude for self-directed, project-based and collaborative learning. Also, some background in basic computer science and programming such as data structures and algorithms. Note again that this course requires substantial reading and writing, as well as considerable investment of time.

Learning Goals: The main learning goal of the course is an introduction to the basic concepts, hypotheses, models, methods, issues and debates in cognitive science. Specific objectives include: (1) Introduction to the main information-processing paradigms in cognitive science as well as the main critiques of the paradigms, (2) Introduction to the central questions, topics, themes and perspectives that drive the study of cognitive science, including their historical development as well as the state of the art, (3) Understanding the variety of methodologies used to explore cognitive science, including the capabilities and limitations of different research methods, and (4) Learning about the relationship between cognitive science and computing, including human-centered computing, design, and educational technology.

Learning Outcomes: By the end of the course, the typical student should know enough about cognitive science to: (1) Understand and participate in scholarly conversations on cognitive science, (2) read and understand the cognitive science literature, (3) take advanced courses in cognitive science, (4) take the cognitive science specialization in the Georgia Tech Ph.D. qualifying examination in human-centered computing, (5) analyze and address problems in human-centered computing from a cognitive science perspective, and (6) conduct research into cognitive science.

Learning Strategies: We will use a wide range of learning strategies to accomplish the above learning goals and outcomes, including learning by example, learning by doing, authentic learning, project-based learning, personalized learning, collaborative learning, peer-to-peer learning, learning by teaching, learning by reflection, and immersion in a community of interest. Much of the learning in this class will be self-directed.

Learning Assessments: We will use a wide variety of learning assessments to evaluate the learning outcomes in this class, including quizzes, small group exercises, two guided projects, and one self-directed project. The various projects will involve writing of project reports.

Instructor:

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Teaching Assistants:

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Office Hours:

There will not be any formal office hours held during the semester, but students may request meetings with the teaching assistants as needed. Otherwise, please direct all questions to the course discussion forum.

Textbooks: The primary textbook is:

MIND, An Introduction to Cognitive Science, Paul Thagard, MIT Press, 2nd edition, 2005.

This is an easy to read book that offers a light but very useful introduction. It will provide a shared basis for our more advanced readings on selected topics. This book is provided in the “Readings and Additional Resources” section on Canvas.

Here are a few other general resources for cognitive science:

<http://plato.stanford.edu/entries/cognitive-science/>

http://en.wikibooks.org/wiki/Cognitive_Psychology_and_Cognitive_Neuroscience

Cognitive Science, Jay Freidenberg and Gordon Silverman, SAGE, 2016.

An earlier edition of this book is available online

http://www2.fiit.stuba.sk/~kvasnicka/CognitiveScience/Friedenberg_Cognitive%20science.pdf

The MIT Encyclopedia of the Cognitive Sciences

Robert Wilson and Frank Keil (editors)

MIT Press, 1999

<http://www.aii.ed.ac.uk/project/oplan/documents/1999/1999-MITECS.pdf>

Readings: The accompanying class schedule specifies a series of reading assignments. We will provide digital copies of all readings. We expect that each student will have read at least the primary readings in the week they are assigned.

Reading a research paper is not easy and can take several hours. To make the process easier and more efficient, you want to read a paper in multiple passes. In the first pass, read only the title, abstract, the introduction, and the conclusions. This should be easy and fast and will give you a gist of the paper. In the second pass, also read the section and subsection headings, the illustrations (figures, tables, and their captions), the discussion section, and browse through the list of references. This should give you a better understanding of the paper. In a third pass, if needed and/or if you want to, you can read the full paper. Here are some more tips on how to read a research paper:

<https://web.stanford.edu/class/ee384m/Handouts/HowtoReadPaper.pdf>

<https://www.elsevier.com/connect/infographic-how-to-read-a-scientific-paper>

Writing: Each student in the class will engage in six individual exercises and a semester-long self-directed project. The project will entail the writing of a paper: the length of the paper will vary depending on the project. Here are two tutorials on how to write a term paper:

<http://www.wikihow.com/Write-a-Term-Paper>

<http://www.collegeonline.org/library/online-assignments/termpaper-writing.html>

We encourage all students to think of the semester-long self-directed term project as potentially leading to a paper worthy of publication. Here is the IEEE template for writing papers:

<https://www.ieee.org/conferences/publishing/templates.html>

Generative AI: Use of ChatGPT and other LLMs: If you wish, you are permitted to use ChatGPT and other LLMs to support your writing for any assignment. However, if you do so, you must do both of the following:

1. You must properly cite each and every section within which the tool was used, even if you have rephrased the generated information. See the IEEE guidelines for proper citation methods.
2. In each submission that used such a tool, you must include an appendix of no less than 500 words within which you reflect on the effect of using that tool in your own writing (style, voice, emphasis, etc.).

Canvas site: The Head TA will maintain a Canvas site for the class that will provide information about the course, assessments, and grades. The Head TA will also maintain the discussion forum.

Class Participation: This class requires participation in the class through the completion of class surveys. Participation in the Ed discussion forum is optional, but highly encouraged since that is the main form of communication between the staff and students.

Quizzes: We will have a quiz almost every week for a total of ten quizzes. Each quiz will consist of multiple-choice questions. The quizzes will be directly from the primary readings and are intended to make sure that all students are doing the readings. Two attempts are permitted per quiz, and the highest score will be recorded. The lowest overall quiz grade will be dropped, so your total quiz score will be based off your highest 9 out of 10 quizzes.

Individual Exercises: We will have five individual exercises. Each of the five exercises will also pertain to the readings in the class. Each exercise will result in a short report on the exercise.

Term Project: The semester-long term project will unfold over 9 weeks. Students may choose to investigate a topic of their choice. We expect each student to spend at least 100 person hours on the project. Hours will be tracked via a task list that is included with your initial project milestone. The project itself includes a detailed analysis of a problem from the perspective of cognitive science and survey of the related literature. The TAs will work with the students in helping them with their term projects. To keep track of students' progress, we will have 3 required milestones with one optional check-in milestone. We will provide details as part of the project release. We expect some of the term

project reports to be of a quality that can be submitted to professional workshops for potential publication.

Examinations: There are no examinations in this class.

Assignment Due Dates: All assignments are due at 11:59pm [Anywhere on Earth time](#), unless otherwise noted. We will not accept assignments submitted late due to time zone issues. You should update your Canvas to reflect your time zone. **There are no exceptions;** sorry.

Late and Make-up Work Policy: There will be no make-up work provided for missed assignments. Of course, emergencies (illness, family emergencies) will happen. In those instances, [please contact the Dean of Students office](#). The Dean of Students is equipped to verify emergencies and pass confirmation on to all your classes. For consistency, we ask all students to do this in the event of an emergency.

Communication Policy:

You are responsible for knowing the following information:

1. Anything posted to this syllabus
2. Anything emailed directly to you by the teaching team (including announcements via Canvas and Ed Discussions), 24 hours after receiving such an email or post.

Because Canvas and Ed Discussions announcements are emailed to you as well, you need only to check your Georgia Tech email once every 24 hours to remain up to date on new information during the semester. Georgia Tech generally recommends students to check their Georgia Tech email once every 24 hours. So, if an announcement or message is time sensitive, you will not be responsible for the contents of the announcement until 24 hours after it has been sent.

Grades: Here is a distribution of weights for different activities for calculating the final grade.

Class surveys: 5%

Quizzes (Q1-Q10): 20%

Individual Exercises (IE1-IE5): 30%

Self-directed term project (M1-M4): 45%

We will assign extra credit to exemplary exercises and projects and post them on Canvas. Thus, it is possible to get a score higher than 100% in this class.

The final grades may be normalized (or curved).

Proctoring Information: In order to verify the identity of all GT online students, all online students are required to complete the onboarding quiz that uses Honorlock. Honorlock is utilized for student identity verification and to ensure academic integrity. Honorlock provides student identity verification via facial and ID photos. You may also be asked to scan the room around you. The onboarding quiz will be a practice quiz that will not affect your grade in the course. You can take the onboarding quiz as many times as you want. All potential violations are reviewed by a human. The Honorlock support team is available 24/7. While Honorlock will not require you to create an account, download software, or schedule an appointment in advance, you will need Google Chrome and download the Honorlock Chrome Extension. Information on how to access Honorlock and additional resources are provided below. You can also access Honorlock support at <https://honorlock.com/support/>.

Honor Code: Learning is a social process. This is why encourage class participation. Thus, on one hand, we strongly encourage collaboration in this class. On the other, we will abide by the Georgia Tech's honor code of academic conduct. This means that any work submitted by a student must be his or her own. With the advent of the internet, it has become easy to take materials from various resources available on the web. But please remember that it has also become easy to check for it: the TA can and will enter an arbitrary sentence from a paper into a search engine and find out if the sentence has been taken from elsewhere. Students are encouraged to consult resources available on the web and elsewhere. However, any material taken from any resource must be properly attributed. The paper must reflect the student's own design and analysis, work and writing.

Georgia Tech Counseling: The COVID-19 global pandemic has caused many problems related to health, including mental health. Georgia Tech offers counseling services to all students, staff and faculty (<https://counseling.gatech.edu/content/services>). It also offers emergency counseling services (<https://counseling.gatech.edu/content/students-crisis>). It is for all of us to take care of one another as well as ourselves.

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Class Schedule

This is a day-by-day schedule for our class. The schedule specifies a series of video lessons and corresponding reading assignments. All readings are listed by the last names of the first author. All readings are available on Canvas in a digital form. We expect that each student will have watched the video lessons and read at least the primary readings on each topic in the assigned week.

The schedule also specifies the activities and assessments for each week: surveys, quizzes, exercises, and self-directed projects. Note also that all assessments are due on Sunday midnight AOE, which translates to Monday 8 am in Atlanta.

There will be three class surveys in all, including the final CIOS survey administered by Georgia Tech.

The quizzes are multiple-choice and based on the reading assignments. All twelve quizzes will be based on the primary readings.

The individual exercises too will be based on the primary readings. There will be six exercises in total.

In the self-directed term project, students will work on a theme/problem on their choice. The term project will unfold over 9 weeks, with 3 required milestones and 1 optional milestone.

Part A of the course: Basics of Cognitive Science

Week of 5/13

Videos	Lesson 1 Lesson 2 Lesson 3	
Readings	Representation Logic, probability Rules	Thagard Ch. 1 Thagard Ch. 2 Thagard Ch. 3
Activities	Onboarding quiz assigned 5/13, due 5/19 Start-of-Course survey assigned 5/13, due 5/19	

Week of 5/20

Videos	Lesson 4 Lesson 5 Lesson 6	
Readings	Concepts Analogies Images Connections	Thagard Ch. 4 Thagard Ch. 5 Thagard Ch. 6 Thagard Ch. 7
Activities	Quiz 1 assigned 5/20, due 5/26 Individual Exercise 1 assigned 5/20, due 5/26 Milestone 1 assigned 5/20, due 6/2	

Week of 5/27

Videos	Lesson 7 Lesson 8 Lesson 9	
Readings	Review of CogSci Brains Emotions Consciousness Body	Thagard Ch. 8 Thagard Ch. 9 Thagard Ch. 10 Thagard Ch. 11 Thagard Ch. 12
Activities	Quiz 2 assigned 5/27, due 6/2 Milestone 1 due 6/2	

Part B of the course: Computational Cognitive Science

Week of 6/3

Videos	Lesson 10 Lesson 11 Lesson 12		
Readings	Culture Review Explanations Information-processing levels	Thagard Ch. 13 Thagard Ch. 14 Simon – Ch.1 Marr	Simon Ch. 5 Newell
Activities	Quiz 3 assigned 6/3, due 6/9 Individual Exercise 2 assigned 6/3, due 6/9 Optional Milestone 2 assigned 6/3, due 6/23		

Week of 6/10

Videos	Lesson 13 Lesson 14		
Readings	Representation – 2 Concepts - 2	Markman Schank	Bechtel Nersessian
Activities	Quiz 4 assigned 6/10, due 6/16 Individual Exercise 3 assigned 6/10, due 6/16		

Week of 6/17

Videos	Lesson 15 Lesson 16 Lesson 17		
Readings	Analogies - 2 Images - 2 Cognitive Architectures	Kolodner Larkin Laird, Libere, Rosenbloom	Centner Dehaene Langley
Activities	Quiz 5 assigned 6/17, due 6/23 Optional Milestone 2 due 6/23		

Week of 6/24

Videos	Lesson 18 Lesson 19 Lesson 20		
Readings	Neural Networks Embodied Cognition Distributed Cognition	Rogers Brooks Hutchins	Bengio Grosz
Activities	Quiz 6 assigned 6/24, due 7/1 Individual Exercise 4 assigned 6/24, due 7/1 Milestone 3 assigned 6/24, due 7/14		

Part C of the course: Cognitive Science and Human-Centered Computing

Week of 7/1

Videos Lesson 21
 Lesson 22
 Lesson 23

Readings	Culture	Tomasello	Shore
	Relationship to AI	Langley	Goel
	Relationship to Learning	Bransford	Lave

Activities Quiz 7 assigned 7/1, due 7/7
 Individual Exercise 5 assigned 7/1, due 7/7
 Milestone 4 assigned 7/1, due 7/21

Week of 7/8

Videos Lesson 24
 Lesson 25
 Lesson 26

Readings	Relationship to Design	Norman	Simon
	Relationship to Human-Computer Interaction		Baron-Cohen
	Relationship to Robotics	Cakmak	Fitzgerald

Activities Quiz 8 assigned 7/8, due 7/14
 Milestone 3 due 7/14

Week of 7/15

Videos Lesson 27
 Lesson 28

Readings Relationship to Creativity Boden

Activities Quiz 9 assigned 7/15, due 7/21
 Milestone 4 due 7/21

Week of 7/22

Videos None

Readings None

Activities Quiz 10 assigned 7/22, due 7/28
 End-of-Course survey assigned 7/22, due 7/28
 CIOS survey due 7/28