

Introduction to Cognitive Science

Lecture

T Th 2:40-3:55 pm
202 Altschul Hall

Instructors

Christopher Baldassano
Assistant Professor, Psychology Department
Columbia University
Office hours: Thursday mornings on Zoom by [appointment](#)

John Morrison
Professor and Chair, Philosophy Department
Director, Cognitive Science Program
Barnard College
Office hours: Monday at 3:00 and Friday at 4:00 on Zoom [by appointment](#)

Teaching Assistants

Always contact your Primary TA. This includes requests for extensions, questions about grades, and concerns about extenuating circumstances. Please cc the course email address (IntroductionCogSci@gmail.com) whenever you email your TA.

Abby Wood (Head TA) (Students: A - L Chen)
PhD Student, Neurobiology and Behavior Program
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Office hour: Tuesday at 9am [on Zoom](#)

Ines Aitsahalia (Students: S Chen – Figueroa)
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Office hour: Thursday at 11:30 at [Dear Mama Cafe](#)

Justin Buck (Students: Flynn – Jing)
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Office hour: Mondays from 10-11 AM [on Zoom](#)

Hannah Chen (Students: Kamal – Lloyd)
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Valeria Fascianelli (Students: Magee – Park)
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Office hour: Fridays, 2-3pm [on Zoom](#)

Francisco Salema Oom de Sacadura (Students: Peabody – Speer)
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Office hour: Monday 8- 9AM [on Zoom](#)

Erfan Zabeh (Students: Sperling – Wadhwa)
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Office hour: Wednesday 5-6pm, [on Zoom](#)

Yizi Zhang (Students: Whi – Zhu)
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Office hour: Friday 1:30-2:30 [on Zoom](#)

Description

The goal of cognitive science — and of this course — is to understand how the mind works. Trying to understand our own minds is perhaps the most ambitious and exciting (and difficult) project in all of science, and this project requires tools drawn from fields including experimental psychology, computer science and artificial intelligence, linguistics, vision science, philosophy, anthropology, behavioral economics, and several varieties of neuroscience (among others). This course will introduce you to the major tools and theories from these areas, as they relate to the study of the mind. We will employ these perspectives while exploring the nature of mental processes such as perception, reasoning, memory, attention, imagery, language, intelligence, decision-making, and consciousness. In sum, this course will expose you to cognitive science, the assumptions on which it rests, and many of the most important and fascinating results obtained so far.

Learning Outcome

To develop a broad understanding of cognitive science by introducing students to many of its contributing disciplines, including psychology, philosophy, computer science, neuroscience, linguistics, and economics. To write focused essays analyzing the key arguments, concepts, and issues or questions in assigned readings. To use writing as a way of crystalizing thought, and improve writing clarity and precision through a multi-step drafting process.

Assessments

1. (15%) Daily Quizzes

To get the most out of this course, it is essential that you complete the readings. To encourage this, there will be a quiz at the start of each lecture. It will consist of 4-5 multiple choice questions

and the answers should be obvious to anyone who completed the readings. There will be 22 quizzes in total, but we will count only your 18 highest scores to allow for sickness, religious observance, family emergencies, and other events of that nature. There will be no make-ups. All quizzes will be posted to CourseWorks at the start of class. You can take the quiz even if you're attending remotely.

For students registered with Disability Services (DS or CARDS) who are eligible for testing accommodations: If your final quiz grade is equal to or higher than your final exam grade, your quiz grade will be factored into your final grade. But if it is lower, we will use your final exam grade as your quiz grade. In short, should you do poorly on the quizzes due to not having appropriate testing accommodations, you will not be penalized.

2. (10%) In-person attendance

We will take attendance using Codific, an app on your phone. For a link and instruction video, visit <https://codific.com/student-attendance-radar/> Please register using your school email address. We will start using the app the second week (Sept 12th). If you can't use your phone to mark yourself present, you can check in with one of the professors. While you can take the quiz and watch the lectures remotely, you cannot "attend" remotely. For each lecture, you will receive a grade of 1 for attending in person, and 0 otherwise. We will count only your highest 19 scores, allowing you to miss four in person lectures without any impact on your attendance grade. This is intended to cover sickness, religious observance, family emergencies, and other events of that nature. If truly exceptional circumstances lead you to miss more than four lectures (after the first week), get in touch with your TA as soon as possible.

3. (30%) Midterm and Final Exams

Exams will be multiple choice and we will focus on the material covered in lecture. The exam on which you do the best will count for 20% of your grade; the other will count for 10%.

4. (45%) Three Short Papers (5 pages each, 15% each)

For each paper, you can choose a topic from a list we will provide, or come up with your own topic. You are required to submit a one paragraph proposal in advance so that your TA can provide feedback before you start writing the paper. In some cases, the feedback might be as simple as, "looks good." But in other cases, your TA might suggest substantial changes.

Your final paper should cite a limited amount of outside research (at least 2 papers), and also cite relevant papers/chapters from the course readings. Late submissions will incur a 1 point (out of 50 total points) penalty per day, up to a maximum penalty of 20 points. If you need to request an extension on a paper, contact your Primary TA as soon as possible.

You are not allowed to use Large Language Models (LLMs) such as GPT-3 while writing your proposal. But you are allowed to use them when writing the paper as long as you acknowledge their role at the end of the paper.

Paper 1: Proposal due 9/29, paper due 10/12

Paper 2: Proposal due 11/3, paper due 11/16

Paper 3: Proposal due 12/6, paper due 12/14

5. Extra credit

To earn extra credit, you can attend a talk in the cognitive science lunch series and submit a one paragraph summary of an interesting idea from the talk. The talks are all on Fridays from 12-1pm. The first is on Friday, 9/22 (Brian Scholl on perception), the second is on Friday, 10/20 (Lisa Margulis on music cognition), and the third is on Friday, 11/17 (Ann Senghas on language development). You will receive an extra point on your final exam (out of 50 points). Summaries should be submitted through CourseWorks by the following Monday (three days later). You cannot get extra credit for more than one talk summary, and there is no partial credit for summaries submitted late.

Grading

Grades will be rounded only to the nearest 0.1%, and assigned letter grades as follows:

A+: 98-100%	B+: 87-89.9%	C+: 77-79.9%	D: 60-69.9%
A: 93-97.9%	B: 83-86.9%	C: 73-76.9%	F: 0-59.9%
A-: 90-92.9%	B-: 80-82.9%	C-: 70-72.9%	

Schedule

Part 1: Basic Elements

Tuesday 9/5: What is Cognitive Science? (JM & CB)

Thursday 9/7: The Cognitive Approach (JM)

Required: Stillings et al. (1995), “What is Cognitive Science?”

Tuesday 9/12: Explanation (CB)

Required: Marr (1982), “The Philosophy and the Approach”

Required: Pylyshyn (1999), “What’s In Your Mind?”

Further: von Neumann (1958), selection from *The Computer and the Brain*

Thursday 9/14: Computation (CB)

Required: Jones (2014), “The Learning Machines”

Further: Bengio and Marcus (2020), “The best way forward for AI” (Debate)

<https://www.youtube.com/watch?v=EeqwFjqFvJA>

Tuesday 9/19: Representation (JM)

Required: Koslyn, Thompson, Ganis (2006) *The Case for Mental Imagery*, Ch 1

Further: Koslyn, Thompson, Ganis (2006) *The Case for Mental Imagery*, Ch 2

Part 2: Basic Questions

Thursday 9/21: Modularity (JM)

Required: Firestone and Scholl (2016), “Cognition does not affect perception: Evaluating the evidence for ‘top-down’ effects” (Sections 1-3, pages 1-7)

Required: Kanwisher and Yovel (2006), “The fusiform face area” (Sections 1-2, pages 1-4)

Tuesday 9/26: Development (CB)

Required: Wynn (1992), “Addition and Subtraction by Human Infants”

Required: Gershman (2021), Chapter 4 of *What Makes Us Smart*

Further: Marcus et al. (1992), Chapters 1-2 of *Overregularization in Language Acquisition*

Thursday 9/28: Nature and Nurture (CB)

Required: Bouchard (2008), “Genes and Human Psychological Traits”

Required: Gandhi et al. (2015), “Immediate Susceptibility to Visual Illusions After Sight Onset”

Further: NPR (2021), “The Legacy of Trauma: Can Experiences Leave A Biological Imprint?”

<https://www.npr.org/2020/12/16/947232031/the-legacy-of-trauma-can-experiences-leave-a-biological-imprint>

Further: Arcaro et al. (2017), “Seeing faces is necessary for face-domain formation”

Tuesday 10/3: Evolution (JM)

Required: Darwin (1871), *Descent of Man*, Ch 21 (selection)

Required: Cosmides and Tooby (1997), “Evolutionary Psychology: A Primer”

Further: Gould (1997), “Darwinian Fundamentalism” (Section 1)

Part 3: Linguistics

Thursday 10/5: Basic Principles of Linguistics (Craig Roberts guest lecture)

Required: Pinker (1994), *The Language Instinct*, Ch 1 and 2

Tuesday 10/10: Language learning (CB)

Required: Jackendoff (1994), Chapters 3 and 10 of *Patterns in the Mind*

Required: Stephen King (2010), “What Writing Is”

Further: Gershman (2021), Chapter 11 of *What Makes Us Smart*

Further: Piantadosi (2023), *Modern language models refute Chomsky’s approach to language*

Part 4: Neuroscience

Thursday 10/12: The Brain (CB)

Required: Churchland (2013), selection from Chapter 7 of *Matter and Consciousness* (3rd Ed.)

Required: Churchland and Sejnowski (1988), “Perspectives on Cognitive Neuroscience”

Further: Huttenburg et al. (2017), “Large-Scale Gradients in Human Cortical Organization”

Tuesday 10/17: Studying the Mind by Measuring the Brain (CB)

Required: Coltheart (2013), “How Can Functional Neuroimaging Inform Cognitive Theories?”

Required: Fodor (1999), “Why the Brain?”

Further: Falk (2012), “From Neural Responses to Population Behavior: Neural Focus Group Predicts Population-Level Media Effects”

Further: Niv (2021), “The Primacy of Behavioral Research for Understanding the Brain”

Thursday 10/19: Review for midterm (JM & CB)

Tuesday 10/24: MIDTERM

Part 5: Psychology

Thursday 10/26: Attention (CB)

Required: Simons & Levin (1998), “Failure To Detect Changes to People in a Real-World Interaction”

Required: Jiang et al. (2006), “A Gender- and Sexual Orientation-Dependent Spatial Attentional Effect of Invisible Images”

Further: Most et al. (2001), “How Not to Be Seen”

Further: Smith (2012), “The Attentional Theory of Cinematic Continuity”

Tuesday 10/31: Memory (JM)

Required: Proust (1913), *Remembrance of Things Past* (excerpt)

Required: Averbach and Sperling (1961), “Short Term Storage of Information in Vision” (excerpt)

Required: Baddeley (1992), “Working Memory”

Thursday 11/2: Memory (JM)

Required: Gallistel and King (2009), *Memory and the Computational Brain* (excerpt)

Required: Godden and Baddeley (1975), “Context-Dependent Memory in Two Natural Experiments”

Tuesday 11/7: Election holiday

Part 6: Problem solving

Thursday 11/9: Probabilistic Reasoning (JM)

Required: Tversky and Kahneman (1993), “Probabilistic Reasoning”

Tuesday 11/14: Robotics and Embodied Cognition (CB)

Required: Clark (1999), “An embodied cognitive science”

Further: Cross and Ramsey (2021), “Mind Meets Machine: Towards a Cognitive Science of Human–Machine Interactions”

Thursday 11/16: Reinforcement Learning (CB)

Required: Holyoak (1998), “Problem Solving”

Required: Botvinick et al. (2019), “Reinforcement Learning, Fast and Slow”

Further: Deepmind (2020), “MuZero: Mastering Go, chess, shogi and Atari without rules”

Part 7: Philosophy

Tuesday 11/21: Consciousness (JM)

Required: Jackson (1982), “Epiphenomenal Qualia”

Thursday 11/23: Thanksgiving break

Tuesday 11/28: Belief (JM)

Required: Gendler (2010), “Belief and Alief”

Thursday 11/30: Challenges to Cognitive Science (JM)

Required: Searle (1980), “Minds, Brains, and Computers”

Further: van Gelder (1995), “What Might Cognition Be If Not Computation?”

Part 8: Artificial Intelligence

Tuesday 12/5: Artificial Intelligence (JM & CB)

Required: Russell and Norvig, Chapter 1 of “Artificial Intelligence”

Required: Wolchover (2020), “[Artificial Intelligence Will Do What We Ask. That’s a Problem.](#)”

Further: Buranyi (2017), “[Rise of the racist robots – how AI is learning all our worst impulses](#)”

Further: Talty (2018), “[What Will Our Society Look Like When Artificial Intelligence Is Everywhere?](#)”

Thursday 12/7: Review for final (JM & CB)

TBD FINAL EXAM (12/15-21)

Honor Code

Approved by the student body in 1912 and updated in 2016, the Code states:

We, the students of Barnard College, resolve to uphold the honor of the College by engaging with integrity in all of our academic pursuits. We affirm that academic integrity is the honorable creation and presentation of our own work. We acknowledge that it is our responsibility to seek clarification of proper forms of collaboration and use of academic resources in all assignments or exams. We consider academic integrity to include the proper use and care for all print, electronic, or other academic resources. We will respect the rights of others to engage in pursuit of learning in order to uphold our commitment to honor. We pledge to do all that is in our power to create a spirit of honesty and honor for its own sake.

Wellness Statement

It is important for undergraduates to recognize and identify the different pressures, burdens, and stressors you may be facing, whether personal, emotional, physical, financial, mental, or academic. We as a community urge you to make yourself--your own health, sanity, and wellness--your priority throughout this term and your career here. Sleep, exercise, and eating well can all be a part of a healthy regimen to cope with stress. Resources exist to support you in several sectors of your life, and we encourage you to make use of them. Should you have any questions about navigating these resources, please visit these sites:

- <http://barnard.edu/primarycare>
- <https://barnard.edu/about-counseling>
- <http://barnard.edu/wellwoman/about>

Center for Accessibility Resources & Disability Services Statement

If you believe you may encounter barriers to the academic environment due to a documented disability or emerging health challenges, please feel free to contact me and/or the Center for Accessibility Resources & Disability Services (CARDS). Any student with approved academic accommodations is encouraged to contact me during office hours or via email. If you have questions regarding registering a disability or receiving accommodations for the semester, please contact CARDS at (212) 854-4634, cards@barnard.edu, or learn more at barnard.edu/disabilityservices. CARDS is located in 101 Altschul Hall.

Affordable Access to Course Texts and Materials Statement

All students deserve to be able to study and make use of course texts and materials regardless of cost. Barnard librarians have partnered with students, faculty, and staff to find ways to increase student access to textbooks. By the first day of advance registration for each term, faculty will have provided information about required texts for each course on CourseWorks (including ISBN or author, title, publisher, copyright date, and price), which can be viewed by students. A number of cost-free or low-cost methods for accessing some types of courses texts are detailed on the Barnard Library Textbook Affordability guide (library.barnard.edu/textbook-affordability). Undergraduate students who identify as first-generation and/or low-income students may check out items from the FLIP lending libraries in the Barnard Library (library.barnard.edu/flip) and in Butler Library for an entire semester. Students may also consult with their professors, the Dean of Studies, and the Financial Aid Office about additional affordable alternatives for having access to course texts. Visit the guide and talk to your professors and your librarian for more details.