Introduction to Cognitive Science

COGST 1101/CS 1710/LING 1170/PHIL 1910/PSYCH 1102
Fall 2023
Uris Hall G01
Tuesdays and Thursdays, 1:25pm-2:40pm

Instructor:
Shaun Nichols
326 Goldwin Smith Hall
Email: sbn44@cornell.edu
Office hours: Tuesday 11-12, and by appointment

Graduate student TAs:
*
Email:
Office hours: ***, and by appointment
Office location: ***

Pardis Rostami
Email: pr475@cornell.edu
Office hours: ***, and by appointment
Office location: ***

Migdalia Valenzuela
Email: ma776@cornell.edu
Office hours: ***, and by appointment
Office location:

Lisa Zhao
Email: fz227@cornell.edu
Office hours: ***, and by appointment
Office location: ***

WiM graduate student TA
Bryan West
Email: sbw78@cornell.edu
Office hours: ***, and by appointment
Office location: ***

Contact:
If you have questions about the syllabus, canvas, or other administrative matters, please email ***

Course description: This course is an introduction to central issues and themes in cognitive science. We will begin by reviewing work on cognitive architecture and the foundations of cognitive science. Then we

will consider several contemporary research domains, including categorization, learning, decision making, memory, and object perception.

Readings:

All readings will be available on canvas or linked through the canvas site.
The required readings will contain information that is not presented in the lecture. You are responsible for knowing the content from both.

Course requirements and grading:

Quizzes: 20%

> Each week there will be a short quiz (administered via Canvas) consisting of multiple choice and T/F questions about material presented in the lectures during that week. You will have a 24-hour window to complete the exam outside of class.
> Typically, the quiz will be posted at 5 PM on Thursday and due by 5 PM on Friday.
> These are to be done privately without communicating with other students in the course. You may, however, use whatever materials you have available, including lecture slides and videos.
> Some weeks, there will be more than one quiz, but this will be rare.
>
> We will automatically drop your two lowest quiz scores.

Discussion posts: 20%

Each week there will typically be at least one discussion post. The post should be 250-500 words.

The discussion posts will be about the required reading or viewing for one of the classes. Each student will be required to post a comment on the discussion board, and reply to a comment by at least one other student.
NOTE that your original post should include some kind of response to the ideas, not just a summary.

The discussion posts themselves will be due at 5PM the day after the lecture to which they correspond. Responses to the posts are due at midnight the next day (but it will probably be easiest to try to do it around the same time that you do the original post).

Discussion posts will be graded lightly using the following scale:
> 0 = Not Submitted
> 1 (85) = Below the Bar; missing something significant
> 2 (91) = On Track
> 3 (96) = Exceptional

In most cases, you will only receive comments from the TA if you get below a 2. If you are getting 2's on all these responses, then you are in good standing (equivalent to an A-) in the "Discussion posts" portion of the grade.

We will automatically drop your lowest score as a way to accommodate any emergency situations, illnesses, or just a rough week.

Exams: 60%

There will be 3 exams (each worth 20%), covering material from lectures during the relevant portion of the course. the exams will consist mostly of multiple choice and T/F questions, with a few short answer questions. Exams will be online during class time (1:25-2:40).

Exam 1: Sept 26
Exam 2: Oct 26
Exam 3: Nov 30 (noncumulative)

The exams will be in class. No notes or devices may be used during the exams.

Extra Credit: 2%

There will be opportunities for extra credit. Extra credit can add as much as
(and no more than) 2% to your final grade. For example, if at the end of the semester you have earned a final grade of 92% and you complete the maximum amount of extra credit (2%) then you will receive an A in the course (95%). You can earn extra credit (2% maximum) by writing a brief report on either of the following (1 report = up to 1% added to your final grade):

> a. a cogsci colloquium talk (these will be announced in class). The report should be 1 page, double-spaced. These should be sent to sbn44@cornell.edu
> b. the discussion that follows a Sprocket film (see http://cogsci.cornell.edu for the schedule). The report should be 1 page, double-spaced. These should be sent to ***Adam Broitman <awb99@cornell.edu>, who is facilitating the series.

Grading scheme:

For A-F: …80-82=B-; 83-86=B; 87-89=B+; 90-92=A-; 93-96=A; 97-100=A+.
For S/U, S = 70% or more

Notes on Academic Integrity

> 1. Each student in this course is required to adhere to Cornell's Academic Integrity Code: http://cuinfo.cornell.edu/aic.cfm
> It is your responsibility to familiarize yourself with the Code, and what constitutes a violation of it. All work submitted must be the student's own, and all sources must be properly cited.
> 2. Students are not permitted to buy or sell any course materials, online or otherwise. This includes handouts, quiz questions, discussion posts, etc. Such behavior constitutes academic misconduct.

Late Work:

Except for lateness due to documented emergencies, late work will be penalized by 1/3 letter grade per day (this is in the interest of fairness to all students).

Use of Canvas Software

> You will be automatically enrolled in the Canvas site when you enroll in the course. I will use it to post assignments and send occasional announcements, and you will use it to submit your discussion posts. Finally, your TA might use it to assign homework questions or online discussions. If you have trouble with Canvas, go here first: https://canvas.cornell.edu/courses/1848/pages/student-resources

Students with Disabilities:

Cornell University is committed to ensuring access to learning opportunities for all students. Student Disability Services (SDS) is the campus office that collaborates with students who have disabilities to provide and/or arrange reasonable accommodations.

- If you are registered with SDS and have a faculty notification letter dated for this semester, please contact me early in the semester to review how the accommodations will be applied in the course. If you have an immediate access need, please see me after class.
- If you have, or think you have, a disability in any area such as, mental health, attention, learning, chronic health, sensory, or physical, please contact the SDS office to arrange a confidential discussion regarding equitable access and reasonable accommodations.
- Students with short-term disabilities, such as a broken arm, can often work with instructors to minimize classroom barriers. In situations where additional assistance is needed, students should contact the SDS as noted above.
- If you are registered with SDS and have questions or concerns about your accommodations please contact your SDS Counselor.

Student Disability Services is located at Cornell Health Level 5, 110 Ho Plaza, 607-254-4545, sds.cornell.edu.

Financial Hardship: https://dos.cornell.edu/first-generation-low-income-student-support/access-fund

Tentative Schedule

The required reading/viewing will not duplicate the material presented in lecture. (Often the optional reading will do that.)
The required reading/viewing will typically be some extension or elaboration on what gets covered in lectures.
The reading/viewing should typically be done after seeing the lecture.

First day (August 22)

Reductionism (Aug 24)
Required reading:
Carandini, M. (2012). From circuits to behavior: a bridge too far?. *Nature neuroscience*, *15*(4), 507-509.
Humphreys, P. (2018). https://aeon.co/essays/atomism-is-basic-emergence-explains-complexity-in-the-universe

#Discussion topic:
to what extent do Carandini or Humphreys seriously challenge reductionism? (You can just pick one for your post.)

Optional reading:
Churchland, P. (2013). Section on functionalism in "The ontological problem (the mind-body problem)." Ch. 2 of Matter and Consciousness, 3rd Ed. (pp. 63-72). MIT Press.
Kincaid, H. (1990). Molecular biology and the unity of science. *Philosophy of Science*, 57(4), 575-593.

Computational Theory of Mind (Aug 29)
Required reading: None
Optional reading:

> Pinker, S. 1997. *How the Mind Works*. New York, Norton, pp. 64-77.
>
> Bringsjord, S. 2008. Declarative/Logic-based cognitive modeling. In R. Sun (ed.), *Handbook of Computational Psychology*, **Sections 1, 3 through 3.1.3 (skip 3.1.2), 5 up to 5.1.3, 6**

Neural networks (Aug 31)
Optional viewing:
> https://www.youtube.com/watch?v=aircAruvnKk

Required reading: None
Optional reading:

> Thomas, M, & McClelland, J. 2008. Connectionist Models of Cognition. In R. Sun (ed.), *Handbook of Computational Psychology*, **pp. 22-27 and section 3.1**

Modularity; Levels and Evolution (Sept 5 & 7)
Sept 5
Required reading:

> Firestone, C., & Scholl, B. J. (2016). Cognition does not affect perception: Evaluating the evidence for "top-down" effects. *Behavioral and brain sciences*, *39*.
> *Read Section 1 and the first paragraph of section 2. (Skip rest of 2 and all of 3.)
> Review Fig 2. Read Sections 4&5.

#Discussion topic:
what are the ways that a defender of top-down effects might respond to Firestone & Scholl? To what extent are those responses convincing?

> Optional reading:
>
> Fodor, J. (1985). Precis to *Modularity of Mind, Behavioral and Brain Sciences,* 8, 1-5.
> Quilty-Dunn, J. (2020). Attention and encapsulation. *Mind & Language*, 35(3), 335-349.

Sept 7
Required reading: None
Optional reading:

> Marr, D. 1982. *Vision*. MIT Press, chapter 1.
> Cosmides, L., and Tooby, J. (1994) Beyond intuition and instinct blindness: Toward an evolutionarily rigorous cognitive science. *Cognition*, 1-14.

Innateness and the Poverty of the Stimulus (Sept 12)
Required reading:

> Friedmann & Rusou (2015). Critical period for first language: the crucial role of language input during the first year of life. *Current Opinion in Neurobiology, 35*: 27-34.

#Discussion topic:
to what extent does the evidence reported in this paper (F&R) provide support for the thesis that humans have an innate language acquisition device?

> Optional reading:

Laurence, S. & Margolis, E. 2001. The Poverty of the Stimulus Argument. *British Journal for the Philosophy of Science, Sections 3, 7.2*

Hannagan, T., Amedi, A., Cohen, L., Dehaene-Lambertz, G., & Dehaene, S. (2015). Origins of the specialization for letters and numbers in ventral occipitotemporal cortex. Trends in cognitive sciences, 19(7), 374-382.

Learning (Sept 14; Sept 19)

Required reading: None
Optional reading:
Mandelbaum, E. (2020) Associationist Theories of Thought, SEP section 3, 9.4
Cushman: Action, Outcome and Value, 273-278.
Perfors, A., Tenenbaum, J., Griffiths, T. & Xu, F. 2011. A tutorial introduction to Bayesian models of cognitive development. *Cognition* 120, *Sections 1,2,4*

Memory (Sept 21)

Required viewing: Elizabeth Loftus
https://www.ted.com/talks/elizabeth_loftus_how_reliable_is_your_memory?utm_campaign=tedspread&utm_medium=referral&utm_source=tedcomshare

#Discussion topic:

to what extent should the research reported by Loftus make us generally skeptical of our memories?

Required reading: None
Optional reading:
Gazzaniga et al. (2018). Memory, from *Cognitive neuroscience: the biology of the mind.*
Oliver Sacks, "The Abyss", New Yorker,
https://www.newyorker.com/magazine/2007/09/24/the-abyss

Exam 1 (Sept 26)

Perception (Sept 28)

Required reading:
Gandhi, T., Kalia, A., Ganesh, S., & Sinha, P. (2015). Immediate susceptibility to visual illusions after sight onset. *Current Biology*, *25*(9), R358-R359.
Vallortigara, G., Regolin, L., & Marconato, F. (2005). Visually inexperienced chicks exhibit spontaneous preference for biological motion patterns. *PLoS biology*, *3*(7), e208.

#Discussion topic:

to what extent do the studies in these papers show that some visual experiences are innately specified? Does an evolutionary explanation support the innateness hypothesis? (You can just pick one for your post)

Optional reading:
Palmer, S. (1999), *Vision science*, ch. 1
Optional viewing:
Visual agnosia
https://www.youtube.com/watch?v=ze8VVtBgK7A

Visual Cognition: Object Perception (Oct 3)

Optional reading:

Green, E. J., & Quilty-Dunn, J. (2020). What is an object file?. *The British Journal for the Philosophy of Science*.

Scholl, B. 2007. Object persistence in philosophy and psychology. *Mind & Language*, 22: 563-591, **Sections 1-4**

Concepts and Categorization (Oct 5)

Required reading: None
Optional reading:

Laurence, S. & Margolis, E. 2019. "Concepts" *Stanford Encyclopedia of Philosophy*, http://plato.stanford.edu/entries/concepts/ *section 2*

Language understanding (Oct 12)

Required Reading:

Searle, J. R. (1980). Minds, brains, and programs. *Behavioral and brain sciences*, *3*(3), 417-418.

#Discussion topic:

to what extent does Searle's challenge show that computers can't or won't understand the meaning of language

Optional reading:

Pinker, *The Language Instinct*, chapter 4
Traxler, M. *Introduction to Psycholinguistics.* Chapter 3: Word Processing, **pp. 79-87**

Causal cognition (Oct 17)

Optional Reading:

Gopnik et al. (2001). "Causal learning mechanisms in very young children." *Dev. Psych.* **pp. 620-624; 626-629**

Saxe & Carey 2006. "The Perception of Causality in Infancy" *Acta Psychologica* **sections 1-4**

Optional viewing:

https://www.ted.com/talks/alison_gopnik_what_do_babies_think#t-309763

Theory of mind (Oct 19)

Optional Reading:

Johnson, S. 2003. Detecting Agents, **sections 1-5**
Gray, H., Gray, K. and Wegner, D. 2007: Dimensions of mind perception. *Science*, 315, 619.

Emotion (Oct 24)

Optional reading:

Griffiths, P. E. (1997). *What emotions really are*. University of Chicago Press. Chapter 4.
Frank, R. (1988). *Passions within reason*. Norton. Chapter 3.

Exam 2 (Oct 26)

Decision theory (Oct 31)

Required reading: None
Optional reading:

Stanovich, K. Decision Making, **pp. 8-15**

Rilling & Sanfey 2011. Neuroscience of social decision-making. *Annual Review of Psychology* 62, 23-48.

Reasoning (Nov 2)
Required reading:
Groopman, J. (2007). Mental malpractice. *New York Times*, 7/2/07.
#Discussion topic:
consider the examples offered in this article and whether this is a more general worry about contemporary society. Try to come up with examples of your own where this might apply.

Optional reading:
Kahneman, *Thinking fast and slow*, chap 26, Prospect theory

Game theory and experimental economics (Nov 7)
Optional Reading:
Fehr, E., & Gächter, S. (2002). Altruistic punishment in humans. Nature, 415(6868), 137-140.

Nov 9: No class

Moral judgment (Nov 14)
Required reading:
Greene, J. D. (2008). The secret joke of Kant's soul. *Moral psychology*, *3*, 59-66
#Discussion topic:
to what extent does the argument in this paper succeed in showing that the right thing to do in Footbridge is to push the guy off the bridge?

Optional reading:
Koenigs, M., Young, L., Adolphs, R., Tranel, D., Cushman, F., Hauser, M. D., & Damasio, A. 2007. Damage to the prefrontal cortex increases utilitarian moral judgments. *Nature*, 446 (7138), 908–911.

Social learning and normative cognition (Nov 16)
Optional reading:
Laland (2017) *Darwin's Unfinished Symphony*, Chapter 4 "A tale of two fishes" 77-98.
Henrich *Secret of our success*, Chapter 11, pp. 185-196

Culture (Nov 21)
Required reading:
Henrich, J., Heine, S. J., & Norenzayan, A. (2010). The weirdest people in the world?. Behavioral and brain sciences, 33(2-3), 61-83, sections 1 and 2.
#Discussion topic:
to what extent does the argument in section 2 undermine results in cognitive science? In particular, are there some areas of cognitive science that are less vulnerable to this critique? Are there ways that extant results can be preserved in light of the cultural critique?

Consciousness (Nov 28)
Required reading:
Owen, A. M., Coleman, M. R., Boly, M., Davis, M. H., Laureys, S., & Pickard, J. D. (2006). Detecting awareness in the vegetative state. *Science*, 313(5792), 1402.

#Discussion topic:

to what extent does this study show that the patient has phenomenal consciousness?

> Optional reading:
>> Chalmers, D. J. (1995). Facing up to the problem of consciousness. *Journal of consciousness studies*, *2*(3), 200-219.

Exam 3 (Nov 30)

Leftovers:

The Self and Free will
> Optional reading:
>> Roskies, A. (2006). Neuroscientific challenges to free will and responsibility. *Trends in cognitive sciences*, *10*(9), 419-423.

> Required reading/viewing:
>> New & Scholl (2008) "Perceptual Scotomas: A Functional Account of Motion-Induced Blindness"
>> Watch the demos for this paper: https://perception.yale.edu/Brian/demos/MIB-PercScotoma.html

#Discussion topic:

how do the studies in this paper support the idea that (1) MIB is produced by unconscious inference and (2) that this inference is adaptive (i.e., serves a function)?