PNP Intro to Cognitive Science

L64 PNP 200
Spring 2024

Section 01: Tuesday/Thursday, ---
Section 02: Tuesday/Thursday, ---
Location: ---

Instructor:
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Office: ---
Office Hours: Tuesday/Thursday, ---

Course Description

Cognitive science is the interdisciplinary study of the mind, drawing upon and integrating findings from psychology, neuroscience, linguistics, computer science, and philosophy, among other disciplines. This course begins with a historical overview of some of the principal landmarks in the history of cognitive science. It then uses detailed case studies to introduce the basic techniques and theoretical frameworks used by cognitive scientists. Prerequisites: completion of at least one of the following courses: MBB 120A, Psych 100B, Phil 100, Phil 120F, Phil 125C, Biol 2960, or Ling 170D.

Learning Objectives

This is a lecture-based, introductory survey course of cognitive science. In addition to lectures, there will also be hands-on demos and in-class discussion. The course will:

(1) Introduce you to the seminal **theories** and **findings** which form the foundation of more advanced studies in cognitive sciences (e.g., in psychology, neuroscience, philosophy, and computer science). All scientific and philosophical study is an **ongoing discussion and collaboration between people**. This course will catch you up on that collaborative conversation to this point.
(2) Develop an **integrated framework which connects very different approaches to the mind**, e.g., connecting behavioral studies on human problem solving in psychology to single-cell recording studies of visual neurons in cats.
(3) Introduce you to the role of **introspection and conceptual analysis** in the study of the mind.
(4) Teach you to **appreciate the interplay between the three components to the study of the mind**: (i) *objective observations*, (ii) *subjective introspection*, and (iii) *conceptual analysis*. Almost all interesting work in any cognitive science draws on all three components. Often, the weakness of a theory, or the weakness of some interpretation of a finding, comes down to ignoring or oversimplifying one of these three components. You will be able, by the end of this course, to identify these three components in a scientific study or philosophical argument and evaluate that study or argument on that basis.

Graded Work

Attendance and Participation (20%): Absences will be excused (not counted against you) in line with university policy, **if you email me before the start of class**. Note that I will usually fully and automatically credit everyone who comes to class. However, if I notice a sustained pattern of coming to class unprepared or not contributing, I will first speak to you about it, then (if the pattern continues) cease crediting you for attendance (or reduce attendance credit) until you come more prepared and participate.

Module Quizzes (30%): **11 total, lowest 2 scores dropped.** These will be **timed, multiple choice** and will be **taken at home over Canvas.** They will open at the start of the last day of the module and close at the end of the first day of the next module. (For the last module, the quiz will close the following Tuesday.) They will be **open book**, meaning you can use your notes, the textbook, slides, and any material provided by me over Canvas. However, you **cannot use Google, ChatGPT, or any other internet resource**.

Component Analysis (CA) Paper (30%): You will write on a scientific study from four options (select a single paper). **You will write both a draft and a revision, highest score of the two submissions counted**. The paper should be **between 1000 and 2000 words**. You will **submit through Canvas**; use a file format that I can open in either Word or a pdf reader. If I can't open it, it's late. If you accidentally submit the wrong file, it's late. Unexcused **late assignments** will be **dropped 10%**. Extensions will be granted in line with university policy, **if requested by email at least 24 hours before the deadline.** Papers are to be done on your own; you **may not work with a fellow classmate**. ChatGPT and similar tools may be used, but see the policy below. **Due by the end of the scheduled day.** Instructions will be provided.

Component Analysis (CA) Presentation (20%): You will present on the scientific study of your choice (select a single paper). You cannot do a presentation on one of the four studies assigned as possibilities for the component analysis paper. Slots for presentations will be open starting in Module 3, with **two open slots each class** (making forty-six possible open slots). You are allowed to **work with a partner** on the presentation – please do! Partners will receive the same grade and are expected to make **equal (even if different) contributions**. (Working alone is fine too.) These presentations will not be typical science presentations broken down by Intro / Methods / Results / Discussion. You will have plenty of time to learn that stuff in your discipline-specific classes. Instead, **the presentation will give a component analysis (to be explained in the instructions)**. Think of it as a presentation version of the paper assignment. **You must sign up for a presentation slot by the beginning of Module 3. Slots will be first come, first served.**

Textbook

Cognitive Science: An Introduction to the Science of the Mind, 4th edition, by José Luis Bermúdez.

See: https://www.cambridge.org/core/resources/cognitive-science-4/

Available in the bookstore. **Please purchase.**

Meetings

Our class will meet in-person on the scheduled days/times, at the scheduled location. Although this is a lecture-based class, you should come prepared to ask and answer questions. Please **read the textbook chapters** listed on the schedule for each day. The **journal articles** listed on the schedule are **optional reading**, except for whichever one you select for your component analysis paper (of course). Please be mindful of each other's health; **if you are sick, stay home and rest**.

Technology. Laptops and tablets may be used to take notes. Phones should be kept away. If I notice you are not using your computer for an appropriate purpose during class, I reserve the right to ask you to put it away or use it properly. If you have a disability accommodation, let me know.

Grade Scale and Academic Integrity

The usual: 97-100% A+ // 93-96% A // 90-92% A- // 87-89 B+ // 83-86 B // 80-82 B- // 77-79 C+ // 73-76 C // 70-72 C- // 67-69 D+ // 63-66 D // 60-62 D- // 0-59 F // Passing (for Pass/Fail): C- (70%) or better.

Academic Integrity: Effective learning, teaching and research all depend upon the ability of members of the academic community to trust one another and to trust the integrity of work that is submitted for academic credit or conducted in the wider arena of scholarly research. Such an atmosphere of mutual trust fosters the free exchange of ideas and enables all members of the community to achieve their highest potential.

In all academic work, the ideas and contributions of others (including generative artificial intelligence) must be appropriately acknowledged and work that is presented as original must be, in fact, original. Faculty, students and administrative staff all share the responsibility of ensuring the honesty and fairness of the intellectual environment at Washington University in St. Louis.

For additional details on the university-wide Undergraduate Academic Integrity policy, please see: https://wustl.edu/about/compliance-policies/academic-policies/undergraduate-student-academic-integrity-policy/

Generative AI: You are free to use tools such as ChatGPT for working through any aspect of this course, except the quizzes. However, if do you so, you must also turn in the raw output which you edited into your final submission. Attach it at the end under some heading like "Raw ChatGPT Output". You must also, of course, note all aids and resources used (e.g., ChatGPT, Grammarly, etc.). Improper use of aids like ChatGPT without proper acknowledgement will count as academic dishonesty. You're responsible for the accuracy and quality of your work. Know the limits of these tools.

Help

I am available during my office hours to answer questions about the topics we're discussing, answer questions about course policies, questions about your grades, and to help with completing the assignments. I'm also happy to make appointments at other times if you're unable to attend my regular office hours. You can also reach me by email at barkasi@wustl.edu.

Disability Resources

WashU supports the right of all enrolled students to an equitable educational opportunity, and strives to create an inclusive learning environment. In the event the physical or online environment results in barriers to the inclusion of a student due to a disability, they should notify the instructor as soon as possible.

Disabled students requiring adjustments to equitably complete expectations in this course should contact WashU's Disability Resources (DR), and engage in a process for determining and communicating reasonable accommodations. Because accommodations are not applied retroactively, DR recommends initiating requests prior to, or at the beginning of, the academic term to avoid delays in accessing accommodations once classes begin. Once established, responsibility for disability-related accommodations and access is shared by Disability Resources, faculty, and the student.

Disability Resources: http://www.disability.wustl.edu/; 3147-935-5970

Other WashU Policies

For information on COVID, reporting sexual assault and harassment, military service leave, preferred names and personal pronouns, emergency preparedness, and the resources available to students at WashU, please see: WashU policies

Schedule

All dates listed below are approximate and may be adjusted as we go. Textbook chapters are **required** reading. Papers listed are **optional** readings (unless you are doing a component analysis on the paper). **Canvas will be the definitive source for all due dates!**

Module 1: The Mind as Information Processor

- T, 1/16: Introduction to cognitive science // Demo 1: Pencil-sharpening introspection
- R, 1/18: What rats in mazes teach us about the mind // Textbook, chapter 1; Ramirez et al 2013
- T, 1/23: The nature of cognitive information processing: Three seminal studies // Textbook, chapter 2

Module 2: Early Work on the Brain

- R, 1/25: The turn to the brain // Textbook, chapter 3 // Module 1 Quiz Due
- T, 1/30: Recording cat neurons and electrically induced hallucinations: Early studies // Hubel and Wiesel 1968; Penfield and Perot 1963

Module 3: The Mind as Digital Computer?

- R, 2/1: Analogies with digital computers: Physical symbol systems and the language of thought // Demo 2: PSS for the river-crossing problem // Textbook, chapter 4.1 and 4.2 // Module 2 Quiz Due // Presentation Sign-ups Due
- T, 2/6: The Russian room argument and the Turing test // Textbook, chapter 4.3

Module 4: The Mind as Neural Network?

- R, 2/8: The brain itself: Neural networks // Demo 3: Single-neuron simulation // Textbook, chapter 5 // Module 3 Quiz Due
- T, 2/13: Modern deep neural networks // Demo 4: Deep neural network for sentiment analysis
- R, 2/15: Demos continued

Module 5: Alternative Models of Cognition

- T, 2/20: The mind as dynamic system? // Textbook, chapter 6 // Module 4 Quiz Due
- R, 2/22: The mind as Bayesian computation // Demo 5: Binocular rivalry // Textbook, chapter 7
- T, 2/27: The weird reality of dreams: A case study in predictive coding // Windt 2018

Module 6: Mapping the Architecture of the Mind

- R, 2/29: Is information processing modular? // Textbook, chapter 8.1—8.3 (skip 8.4) // Module 5 Quiz Due
- T, 3/5: Strategies for brain mapping // Textbook, chapter 9
- R, 3/7: Predicting visual activity from convolutional neural networks: A case study in modern brain mapping // Yamins et al 2014; Yamins and DiCarlo 2016 // Component Analysis Paper Draft Due

Spring Break

- T, 3/12: Spring Break (no class)
- R, 3/14: Spring Break (no class)

Module 7: (More on) The Format of Mental Representation

- T, 3/19: Dreams and waking perception: The same neural representations? // Haxby et al 2001; Horikawa et al 2013 // Module 6 Quiz Due
- R, 3/21: Is neural decoding really mind reading? // de-Wit et al 2016; Ritchie et al 2017

Module 8: Applications: Language, Object Perception, and Machine Learning (Abstraction)

- T, 3/26: Models of language learning // Textbook, chapter 10 // Module 7 Quiz Due
- R, 3/28: Object perception and folk physics // Textbook, chapter 11
- T, 4/2: Machine learning and more on deep neural networks // Textbook, chapter 12

Module 9: Consciousness

- R, 4/4: Consciousness: Introduction // Textbook, chapter 15.1 // Module 8 Quiz Due
- T, 4/9: Consciousness: Functions and the "hard problem" // Textbook, chapter 15.2—15.5

Module 10: Nonhuman Animal and Plant Minds

- R, 4/11: Nonhuman animal consciousness // Allen 2004 // Module 9 Quiz Due
- T, 4/16: Nonhuman animal cognition // Andrews 2016
- R, 4/18: Do plants have minds? // Li and Zhang 2008; Gagliano et al 2014; Gagliano et al 2016

Module 11: The Cognitive Approach and Free Will

- T, 4/23: Free will: The conceptual landscape // Module 10 Quiz Due
- R, 4/25: The Libet Paradigm: An empirical test of free will? // Libet et al. 1983; Libet 1999; Bredikhin et al. 2023 // Component Analysis Paper Revision Due
- T, 4/30: No Class, but Module 11 Quiz Due

No Final