

Semester**Psychology/Cognitive Science 127: Cognitive Neuroscience****Time and Place:**

Lecture: TBD

Sections: TBD

GSI TBD

Instructor: TBD

Office:

email:

Office Hours:

GSIs:**Website:**

The bCourse website will include

Lecture slides (provided in advance of class and then updated)

Links to the Webcast of each lecture (audio w/ slides)

Assignments

Old exams

Textbook:

Gazzaniga, Ivry, and Mangun

Cognitive Neuroscience: The Biology of the Mind, 4th Edition

Available at ASUC Bookstore

** Copies of the text will be on 2-hour reserve in the Biosciences Library, VLSB.

Reader:

Available electronically on bcourse website.

Important dates:

Exam 1: TBD

Exam 2: TBD

Exam 3: TBD

Anatomy Quiz: TBD

Literature Critique TBD

Research Proposals Sections, Week of TBD

Coure Description:

Cognitive neuroscience involves the study of the brain and behavior. It reflects an interdisciplinary effort to understand how the mind works, drawing on research in psychology, neurology, and the neurosciences. The course will explore various topics in cognition including perception, memory, language, attention, action, and cognitive control. The course material will be based on various methodologies such as: 1) the study of patients who have localized brain damage from strokes or tumors, or suffer from neurological disorders such as Alzheimer's Disease and Parkinson's Disease; 2) neuroimaging techniques used to obtain structural and functional measures of the brain and brain activity in healthy people while engaged in various cognitive tasks; 3) studies in non-human species that allow physiological measurements or manipulations of neural activity.

Program Learning Goals:

As part of a campus-wide project to improve undergraduate education, the Department of Psychology has identified a number of program-level goals for our curriculum. Through the mixture of lectures, readings, section exercises and discussions, as well as the assessments, this course aims to address facets of seven core program-level goals.

1. Understand basic concepts that characterize psychology/neuroscience as a field of scientific inquiry, and appreciate the various subfields that form the discipline. As will be emphasized throughout the course, and in particular, emphasized in the initial set of lectures, cognitive neuroscience is an interdisciplinary field, one that draws on diverse methodologies.
2. Develop an understanding of the central questions/issues in contemporary psychology/neuroscience as well as a historical perspective of theories and key empirical data. The course will examine classic problems in cognitive psychology, using neuroscientific evidence to evaluate models of mental function.
3. Develop a thorough understanding of one of the major content areas of psychology (i.e., Social/Personality, Developmental, Clinical, Cognitive, Biological). The focus here will be on the cognitive and biological areas, although the material will also touch on developmental and clinical issues.
4. Develop skills to critically evaluate the presentation of scientific ideas and research in original scientific papers as well as in the popular media. This goal is at the heart of the teaching philosophy used in this course. The sections are designed to help students develop skills to read and evaluate the primary literature.
5. Become familiar with research methods used in psychological research, and become proficient in basic concepts of statistical analyses and familiar with more advanced methods in data analyses and modeling. The discussion of the Reader articles will focus on the methods and results sections of the papers, allowing the students to critically evaluate how scientists test and evaluate hypotheses.
6. Learn to develop, articulate, and communicate, both orally and in written form, a testable hypothesis, or an argument drawing from an existing body of literature. These skills will be developed in sections through the discussion of the Reader articles and group project. In addition, one section of each exam requires that the students propose an experiment and present expected results. Moreover, the questions usually require that the students graph two distinct sets of results, an exercise designed to encourage consideration of multiple outcomes.
7. Apply a psychological principle to an everyday problem, or take an everyday problem and identify the relevant psychological mechanisms/issues. Understanding cognition is intrinsically interesting to everyone. In addition, the course will address some of the major challenges to cognition that come about from disease and aging.

Course grading:

The exams and paper will be weighted as follows:

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|------------------------------|-----|
| First Midterm: | 22% |
| Second Midterm: | 22% |
| Third Midterm: | 22% |
| Anatomy Quiz: | 4% |
| Research Proposals | 7% |
| Literature Critique: | 14% |
| Class Participation (TopHat) | 3% |
| Section Participation/RPP | 6% |

All assignments will be graded on a 100-point scale and then weighted by the above formula in the determination of final grades. Grading will most likely be on a straight curve (e.g., B's between 80-89.9), but grades will be curved up if the median of the final distribution is below 80. Under no circumstances will grades be curved down. Concerns with a grade on any assignment must be addressed within two weeks of the return of that assignment. No exceptions.

Exams:

There will be three midterm exams. Each exam will be composed of three parts: 1) multiple choice; 2) short identifications; 3) one essay. There will be a choice for both the identifications and essays (e.g., choose 1 of 2 essays). The third midterm will be given during the final exam slot, although only the first two hours will be available for the exam. There will not be a cumulative final.

Make-up exams are not given except under emergency situations. In such circumstances, the student is responsible for notifying the instructor prior to the exam or as soon thereafter as possible. I will not offer make-ups when there is a delay in notification.

Literature Critique:

The goal of the critique is to get students to read original research articles with a focus on the methods used to investigate the question under consideration. Students must review two articles that address a common topic, but use two different methods (e.g., patient study and functional imaging study; single cell recording and patient study). The paper will be a maximum of 3-pages (double-spaced). Late papers will be penalized. A detailed description of the assignment will be provided later in the semester.

Anatomy Quiz:

This will be a short quiz given in section, designed to ensure you have the essential brain basics.

Research Proposals:

This is a group project, performed in section. Each group will make an oral presentation in section of a research proposal.

Class Participation via TopHat:

I am experimenting with in-class interactive technology this semester, using the Tophat platform. Interaction will be via your cell phone (alternative options available upon request). I anticipate using Tophat input a couple of times each class. Grading of this component will be based on Tophat registration for attendance and participation in interactive prompts. There are 25 lectures and let's assume there will be two interactive prompts per class. This would produce a total of 75 Tophat prompts. Your grade for this component will be determined as:

of actual prompts/# of total responses X 100

Section Participation and RPP/Alternative Assignment:

There are two components to the participation grade. The first is based on your attendance and involvement in section. The second is based on your completion of the research participation program (RPP) requirement or an alternative assignment. Your GSI will provide a grade for participation based on the following guidelines:

PART 1: Section Participation

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|--|---------|
| Someone who came almost every week, was prepared, and participated: | 65 - 70 |
| Someone who came almost every week, was prepared, but minimal participation: | 60 - 65 |
| Someone who attended most sections and participated when they came: | 50 - 60 |
| Someone who attended most sections, but minimal participation: | 40 - 50 |
| Someone who attended half and participated when they came: | 30 - 40 |
| Someone who attended half with minimal participation: | 20 - 30 |
| Someone who rarely attended: | 0 - 20 |

PART 2: RPP Participation or Alternative Assignment

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|---|---------------|
| Completion of RPP 3-credit requirement | 10 pts/credit |
| Or | OR |
| Satisfactory Completion of Alternative Assignment | 30 pts |

Research Participation (or alternative assignment):

Students must complete EITHER the Research Participation Program requirement or an alternative assignment.

The RPP program

- serves as a source of voluntary participants for psychology department and other approved researchers
- respects participant rights and ethical considerations
- provides an educational and positive experience for participants

To learn how to create an RPP account and start participating in experiments, please go to the link: <http://psychology.berkeley.edu/students/undergraduate-program/research-participation-program>

Please read the document, "RPP Information for students". Then, set up a Sona account as instructed. We recommend doing this as soon as possible. If you have any questions, you can contact RPP at rpp@berkeley.edu.

The RPP requirement for the class is three credits. The RPP credits must be completed by end of the RPP period, TBD . Consider completing earlier rather than later since demand is sometimes very high near the end of the term.

Alternative Assignment: Students who prefer to complete an alternative assignment can provide a short research proposal. For this assignment, you would propose a follow-up study to a published study. You would submit a 3-page paper in which you, a) review the goals and key findings of the published study, b) discuss a follow-up experiment to that study, c) describe the methods and show your predicted results (with at least one graph or table). Papers must be posted to the bCourse folder as a single pdf that includes the 3-page paper and the published study. The file should be named Lastname_FirstInitial_127AA.pdf and is due TBD . No late papers will be accepted.

Sections:

Most of the sections will provide an opportunity to review material presented in class and discuss the readings. For the latter, the emphasis is on learning to read and evaluate original research reports. These can be quite dense and intimidating. With practice you should develop the skill to understand the goal of the study, evaluate the methods and results, and identify questions for future study. To facilitate this skill development and discussion, the GSIs will call on students (sometimes at random). Be prepared! You don't need to get it "right" -- just demonstrate a willingness to think about the material.

In addition, two assignments will be completed in section (the anatomy quiz and the research proposal). These assignments will be described in handouts to be provided later in the semester.

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| Week of TBD | Section Topics NO SECTIONS Orientation, Reader #1 Review of anatomy/physiology, Reader #2 Anatomy quiz, Reader #3 Reader #4 Reader #5 Overview of critique, Pubmed review, Reader #6 Final approval of topics/articles for critique, Reader #7 Reader #8 Reader #9 Form Proposal Groups, Reader #10 Work on Proposals, Reader #11 Present research proposals NO SECTIONS (Thanksgiving) Reader #14 |
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Lectures and Readings (Prepare Reader articles for indicated week)

| Date | Lect | Topic | Textbook | Reader (for sections) |
|------|---|----------------------------------|----------------|-----------------------|
| TBD | 1 | What is cognitive neuroscience? | GAZ 1 | |
| TBD | 2 | Principles of Neuroscience | GAZ 2: 23-39 | Reader #1 |
| TBD | 3 | Mapping the Brain | GAZ 2: 40-69 | |
| | | NO Class: Labor Day | | Reader #2 |
| TBD | 4 | Principles of Cognition | GAZ 3: 71-78 | |
| | ***** Week of TBD: Anatomy Quiz in Sections | | | |
| TBD | 5 | Studying the Dysfunctional Brain | GAZ 3: 78-86 | Reader #3 |
| TBD | 6 | Perturbing the Brain | GAZ 3: 86-104 | |
| TBD | 7 | Functional Imaging I | GAZ 3: 104-119 | Reader #4 |
| TBD | 8 | Functional Imaging II | | |
| | | Exam 1 | | Reader #5 |
| TBD | 9 | Perception: The visual system | GAZ 5 | |
| TBD | 10 | Perception: Object recognition | GAZ 6: 219-246 | Reader #6 |

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| TBD | 11 | Guest lecture: “Encoding in the brain” | GAZ 6: 246-271 | |
| TBD | 12 | Motor control: Pathways and disorders | GAZ 8: 327-341 | Reader #7 |
| TBD | 13 | Motor control: Representation of action | GAZ 8: 342-351 | |
| TBD | 14 | Motor control: Component analysis | GAZ 7: 352-377 | Reader #8 |
| TBD | 15 | Memory: Pathways and disorders | GAZ 9: 379-394 | |
| ***** Literature Critique Due at beginning of lecture, Monday, October 23 | | | | |
| TBD | 16 | Memory: Functional dissociations | GAZ 9: 394-423 | Reader #9 |
| TBD | 17 | Guest lecture: “Why sleep?” | | |
| TBD | | Exam 2 | | Reader #10 |
| TBD | 18 | Language: Pathways and disorders | GAZ 11: 469-495 | |
| TBD | 19 | Language: Functional analysis | GAZ 11: 495-505 | Reader #11 |
| TBD | 20 | Language: Sounds, symbols, and concepts | | |
| ***** Week of TBD: Research Proposals in Section | | | | |
| TBD | 21 | Guest lecture: Attention disorders | GAZ 7: 272-285 | Reader #12 (on own) |
| TBD | 22 | Attention: Component analysis | GAZ 7: 285-324 | |
| TBD | 23 | Consciousness: Perception and awareness | GAZ 14: 605-643 | Reader #13 (on own) |
| TBD | | NO Class: (pre)Thanksgiving holiday | | |
| TBD | 24 | Cognitive Control: Working memory | GAZ 12: 507-539 | Reader #14 |
| TBD | 25 | Cognitive Control: Staying on Task | GAZ 12: 539-557 | |
| TBD | | Review Session (in normal class time and place) | | |
| TBD | | Exam 3, 3:00 – 4:30 (first half of regular exam time) | | |

Reader:

- 1: Gonzalez-Rosa JJ, Soto-Leon V, Real P, Carrasco-Lopez C, Foffani G, Strange BA, Oliviero A. Static Magnetic Field Stimulation over the Visual Cortex Increases Alpha Oscillations and Slows Visual Search in Humans. *J Neurosci*. 2015 Jun 17;35(24):9182-93.
- 2: Méndez-Bértolo C, Moratti S, Toledano R, Lopez-Sosa F, Martínez-Alvarez R, Mah YH, Vuilleumier P, Gil-Nagel A, Strange BA. A fast pathway for fear in human amygdala. *Nat Neurosci*. 2016 Aug;19(8):1041-9.
- 3: Moisa M, Polania R, Grueschow M, Ruff CC. Brain Network Mechanisms Underlying Motor Enhancement by Transcranial Entrainment of Gamma Oscillations. *J Neurosci*. 2016 Nov 23;36(47):12053-12065.
- 4: Carhart-Harris RL, Muthukumaraswamy S, et al. Neural correlates of the LSD experience revealed by multimodal neuroimaging. *Proc Natl Acad Sci U S A*. 2016 Apr 26;113(17):4853-8.
- 5: Wang X, Peelen MV, Han Z, He C, Caramazza A, Bi Y. How Visual Is the Visual Cortex? Comparing Connectional and Functional Fingerprints between Congenitally Blind and Sighted Individuals. *J Neurosci*. 2015 Sep 9;35(36):12545-59.
- 6: Moeller S, Crapse T, Chang L, Tsao DY. The effect of face patch microstimulation on perception of faces and objects. *Nat Neurosci*. 2017 May;20(5):743-752.
- 7: Waters S, Wiestler T, Diedrichsen J. Cooperation Not Competition: Bihemispheric tDCS and fMRI Show Role for Ipsilateral Hemisphere in Motor Learning. *J Neurosci*. 2017 Aug 2;37(31):7500-7512.
- 8: Marks SM, Lockhart SN, Baker SL, Jagust WJ. Tau and β -Amyloid Are Associated with Medial Temporal Lobe Structure, Function, and Memory Encoding in Normal Aging. *J Neurosci*. 2017 Mar 22;37(12):3192-3201.
- 9: Nabavi S, Fox R, Proulx CD, Lin JY, Tsien RY, Malinow R. Engineering a memory with LTD and LTP. *Nature*. 2014 Jul 17;511(7509):348-52.
- 10: Siuda-Krzywicka K, Bola Ł, et al. Massive cortical reorganization in sighted Braille readers. *Elife*. 2016 Mar 15;5:e10762. doi: 10.7554/eLife.10762.
- 11: Huth AG, de Heer WA, Griffiths TL, Theunissen FE, Gallant JL. Natural speech reveals the semantic maps that tile human cerebral cortex. *Nature*. 2016 Apr 28;532(7600):453-8.
- 12: O'Shea, J., Revol, et al. Induced sensorimotor cortex plasticity remediates chronic treatment-resistant visual neglects. *eLife*. 2017. Preprint
- 13: Pinto Y, Neville DA, Otten M, Corballis PM, Lamme VA, de Haan EH, Foschi N, Fabri M. Split brain: divided perception but undivided consciousness. *Brain*. 2017 Jan 24. pii: aww358. doi: 10.1093/brain/aww358.
- 14: Cogan GB, Iyer A, Melloni L, Thesen T, Friedman D, Doyle W, Devinsky O, Pesaran B. Manipulating stored phonological input during verbal working memory. *Nat Neurosci*. 2017 Feb;20(2):279-286.