

Sensation and Perception

Spring 2025

(NEU 325 / PSY 345)

Time: Tues / Thurs 10-10:50am.

Location: PNI A32

Website: <http://pillowlab.princeton.edu/teaching/sp2025/>

Instructor: Dr. Jonathan Pillow (pillow @ princeton)

Office: PNI 254 Office Hours: Tues. 11-12pm and by appt.

TAs: **Connor Dunn** (cedunn @ princeton). OH: Mon 2-3p (PNI A92F)

Bichan Wu (bichanw @ princeton). OH: Thur 11a-12p (PNI 238A)

(TA office hours: 1 week before and after exams; otherwise by appt.)

Course Description

This course will provide an introduction to the scientific study of sensation and perception. We tend to think of the ability to perceive the world around us as an automatic process that happens ‘for free’ whenever we use our eyes, ears, nose, and other sense organs. But sensation-and-perception is an *active* process that relies on exquisitely sensitive receptors and powerful computational machinery housed in the brain, spinal cord, and peripheral nervous system. Our perceptual capabilities have been honed by evolution over many millions of years to arrive in their current form. The central focus of this course will be to examine how these sensory systems work and why. We will undertake a detailed study of the major senses (vision, audition, touch, smell, taste), using insights and methods from a variety of disciplines (philosophy, physics, computer science, neuroscience, psychology). We will begin with a study of the physical basis for perceptual information (e.g., light, sound waves), and proceed to the biological and psychological processes by which such information is converted to percepts in the brain.

Learning Objectives

The objective of this course is to provide a thorough introduction to the biological and psychological study of the senses, and the computational and neural mechanisms that underlie sensation and perception.

Textbook

Sensation & Perception, 6th ed. Wolfe, Kluender, et al. Sinauer 2020.

The textbook has a companion website with overviews, study aides, essays on select topics, as well as some nice demonstrations of perceptual illusions we’ll discuss in class:

https://learninglink.oup.com/access/wolfe6e-student-resources#tag_all-chapters

Readings

Additional readings from the primary scientific literature will be assigned weekly, to be discussed during precepts. List available at: <http://pillowlab.princeton.edu/teaching/sp2025/readings.html>

Ed

We encourage all students to post questions to Ed instead of sending email. This will allow others to benefit from your question, and will often result in a faster and more complete answer (since your fellow students may post answers before instructors can). Please participate on Ed, and endorse questions and answers as you see fit. Ed activity will count toward the participation grade. (More details to be provided during precept).

Course Ed page: <https://edstem.org/us/courses/73769/discussion>

Course requirements and grading

Grading elements of the course include 2 midterm exams, a cumulative final, precept participation, and an “illusions-in-the-wild” contest. Those elements will contribute to the final grade as follows:

- midterm #1: 20%
- midterm #2: 20%
- cumulative final exam: 30%
- precept participation: 20%
- illusion contest: 10%

Grades will be assigned according to the following ranges:

A	94-100	C+	77-79
A-	90-93	C	73-76
B+	87-89	C-	70-72
B	83-86	D	60-69
B-	80-82	F	<60

Precepts

Students will be expected to lead a discussion of at least one scientific paper during precept and participate in discussions of jointly-presented papers (i.e. when there is no assigned presenter). Participation grade (total 20%) will be determined by the AI in consultation with the instructor, of which 10% will depend on the precept paper presentation and review, and 10% on participation in discussions led by other students. Attendance at precepts is mandatory. Two absences will be allowed per student; for every additional absence beyond the second, 5% will be deducted from the student's participation grade.

Note also (very important!): all students must complete a *Research Participation Assignment* to receive credit for this course (see final page of syllabus).

Illusions-in-the-wild

One last element is that students will submit an illusion “discovered in the wild”, along with a half-page description of the illusion and where it was found. This can be an illusion you generate or photograph yourself. (But please note that it shouldn’t merely be an illusion you found somewhere online, or one created by another artist!). We will then have a contest, where students can view and comment on each submission and vote for their favorite.

Due date: Dean’s date.

Philosophy

Learning (like perception itself) is an active process. The more actively students engage with course materials and ideas, the more they will learn. The goal of this course is not so much to convey a set of facts as to introduce a discipline and its methods of inquiry. Our primary aims will be to dissect the ideas presented in the textbook and readings, to challenge accepted theories of perceptual phenomena, and generate new ideas and experimental hypotheses about how our percepts of the world are constructed.

Tentative schedule of topics and readings:

<u>Week</u>	<u>Lecture Topic</u>	<u>Textbook Reading</u>
(1)	Intro: Philosophy & Basic Methods Weber’s law & Psychophysics	Chap. 1
(2)	Signal Detection Theory Light, Optics, & Early Vision	Chap. 1 Chap. 1
(3)	Retina & Receptive Fields Visual Cortex & Spatial Vision I	Chap. 2 Chap. 2
(4)	Visual Cortex & Spatial Vision II Object Recognition	Chap. 3 Chap. 3
(5)	Object Recognition Color I	Chap. 4 Chap. 4
(6)	Color II Exam I	Chap. 5
(7)	<i>Spring Break</i>	

(8)	Space & Depth Perception I	Chap. 6
	Space & Depth Perception II	Chap. 6
(9)	Motion Perception	Chap. 8
	Sound & Audition I	Chap. 9
(10)	Sound & Audition II	Chap. 9
	Hearing in the Environment	Chap. 10
(11)	Music & Speech	Chap. 11
	Bayesian Theory of perception	
(12)	Somatosensation	Chap 13
	Exam #2	
(13)	Olfaction	Chap. 14
	Taste	Chap. 15

Cumulative Final Exam: Mon, May 12 07:30 pm

Research Engagement Assignment Overview

Spring 2025

Students in this course must complete a Research Engagement Assignment. There are two options: students may participate in psychology experiments for course credit or may opt to complete the Alternative Research Engagement Writing Assignment.

Four hours of experimental participation are assigned to any student in this course who has not already completed 8 hours of participation for other psychology courses in the past.

Students will have access to sign up for experiments beginning **February 13th** and must complete the required number of sessions by **April 25th** to pass the course.

Please refer to the Research Engagement Assignment document which will be posted on Canvas for complete details and instructions.

This assignment reflects the psychology department's belief that experiencing research as a participant adds greatly to a student's understanding of course material, particularly to the student's understanding of how psychologists study behavior. Your participation not only furthers your education about the nature of psychological research; it also makes a substantial, critical contribution to psychological research at Princeton and science in general.

Students may complete the Research Engagement Writing Assignment as an alternative to research participation. Each paper is worth 1 hour of credit. Four papers would be required if you choose not to participate in any experiments. Please see the Research Engagement Assignment document which will be posted on Canvas for further details.

To be clear: Completing the Research Engagement Assignment by April 25th is a requirement for passing the course.

All questions about this assignment should be directed to RoseMarie Stevenson (rosemari@princeton.edu).

January 2025