PSY 525.001 Spring 2018 Syllabus

Vision Science

PSY 525.001

About

The first scientific psychologists were physiologists fascinated by the possibility of understanding the mind by studying behavior, especially perception. In this course, we will explore some of the major topics in the field of vision science. Vision science incorporates ideas and methods from computer science, engineering, physics, and biology, and has implications for virtually every area of psychological science.

Instructor

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http://www.personal.psu.edu/rog1 http://gilmore-lab.github.io http://databrary.org

Meeting Location and Time

Monday, 2:30 pm - 5:30 pm, 350 Moore January 8 - April 27, 2018 Course 17684

Prerequisites

Undergraduate or graduate coursework in sensation and perception, neuroscience, or physiological psychology are helpful, but not required.

Text

Palmer, S. E. (1999). Vision Science: Photons to Phenomenology. MIT Press. Retrieved from https://books.google.com/books?id=mNrxCwAAQBAJ

Schedule

Week 1 • Mon Jan 8

- Topics
  - About the course
  - An introduction to vision science
  - Discussion of Barlow (1972)
- Readings

  - Palmer, chapter 1
  - Barlow, H. B. (1972). Single units and sensation: a neuron doctrine for perceptual psychology? *Perception*, *1*(4), 371–394. journals.sagepub.com. Retrieved from http://dx.doi.org/10.1068/p010371. | Link for comments |.
- Materials
  - Lecture notes. | HTML slides | PDF |.

Week 2 • Mon Jan 15 • No class

Week 3 • Mon Jan 22

- Topics
  - Methods in vision research
  - Theoretical approaches to vision
- Readings
  - Palmer, chapter 2 & Appendix A & B
  - **Optional**. Teller, D. Y. (1984). Linking propositions. *Vision Research*, *24*(10), 1233–1246. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/6395480. | Link for comments |
  - **Optional**. Read, J. C. A. (2015). The place of human psychophysics in modern neuroscience. *Neuroscience*, *296*, 116–129. Retrieved from http://dx.doi.org/10.1016/j.neuroscience.2014.05.036
  - Lecture notes. | HTML slides | PDF |.

Week 4 • Mon Jan 29

- Topics
  - The retinal image
- Readings
  - Palmer, chapter 4
  - Campbell, F. W., & Robson, J. G. (1968). Application of Fourier analysis to the visibility of gratings. *The Journal of Physiology*, *197*(3), 551–566. Wiley Online Library. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/5666169
  - Lecture notes. | HTML slides | PDF |.

Week 5 • Mon Feb 5

- Topics
  - Depth perception
  - Project proposal due by 5:00 pm
- Readings
  - Palmer, chapter 5
  - Leopold, D. A., & Logothetis, N. K. (1996). Activity changes in early visual cortex reflect monkeys' percepts during binocular rivalry. *Nature*, *379*(6565), 549–553. nature.com. Retrieved from http://dx.doi.org/10.1038/379549a0
  - Lecture notes. | HTML slides | PDF |.

Week 6 • Mon Feb 12

- Topics
  - Perceptual organization
  - Size, shape, orientation, & position
- Readings
  - Palmer, chapters 6, 7, & 8
  - Biederman, I. (1987). Recognition-by-components: a theory of human image understanding. *Psychological Review*, *94*(2), 115–147. psycnet.apa.org. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/3575582. | PDF |
  - Lecture notes. | HTML slides | PDF |.

Week 7 • Mon Feb 19

- Topics
  - Objects, scenes, faces
- Readings
  - Palmer, chapter 9
  - Schyns, P. G., & Oliva, A. (1994). From Blobs to Boundary Edges: Evidence for Time- and Spatial-Scale-Dependent Scene Recognition. *Psychological Science*, *5*(4), 195–200. SAGE Publications Inc. Retrieved from https://doi.org/10.1111/j.1467-9280.1994.tb00500.x
  - Kanwisher, N., McDermott, J., & Chun, M. M. (1997). The fusiform face area: a module in human extrastriate cortex specialized for face perception. *The Journal of Neuroscience*, *17*(11), 4302–4311. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/9151747

Week 8 • Mon Feb 26

- Topics
  - Color
- Readings
  - Palmer, chapter 3
  - Lee, T.-W., Wachtler, T., & Sejnowski, T. J. (2002). Color opponency is an efficient representation of spectral properties in natural scenes. *Vision Research*, *42*(17), 2095–2103. Elsevier. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/12169429
  - Nikolić, D., Lichti, P., & Singer, W. (2007). Color opponency in synaesthetic experiences. *Psychological Science*, *18*(6), 481–486. journals.sagepub.com. Retrieved from http://dx.doi.org/10.1111/j.1467-9280.2007.01925.x

Week 8 • Wed Feb 28

- Project proposal due by 5:00 pm

Spring Break • Mar 5-9 • No class

Week 9 • Mon Mar 12

- Topics
  - Motion
- Readings
  - Palmer, chapter 10
  - Johansson, G. (1973). Visual perception of biological motion and a model for its analysis. *Perception & Psychophysics*, *14*(2), 201–211. Springer-Verlag. Retrieved December 20, 2017, from https://link.springer.com/article/10.3758/BF03212378
  - Newsome, W. T., & Paré, E. B. (1988). A selective impairment of motion perception following lesions of the middle temporal visual area (MT). *The Journal of Neuroscience*, *8*(6), 2201–2211. Retrieved March 30, 2015, from https://www.ncbi.nlm.nih.gov/pubmed/3385495

Week 10 • Mon Mar 19

- Topics
  - Eye and head movements
- Readings
  - Palmer, Chapter 11
  - Schütz, A. C., Braun, D. I., & Gegenfurtner, K. R. (2011). Eye movements and perception: a selective review. *Journal of Vision*, *11*(5). Retrieved from http://dx.doi.org/10.1167/11.5.9

Week 11 • Mon Mar 26 • No class

- Topics
  - No class meeting; use the time to work on term projects

Week 12 • Mon Apr 2

- Topics
  - Attention
- Readings
  - Palmer, chapter 11.2
  - Treisman, A. M., & Gelade, G. (1980). A feature-integration theory of attention. *Cognitive Psychology*, *12*(1), 97–136. Elsevier. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/7351125
  - Simons, D. J., & Chabris, C. F. (1999). Gorillas in our midst: sustained inattentional blindness for dynamic events. *Perception*, *28*(9), 1059–1074. Retrieved from http://dx.doi.org/10.1068/p281059

Week 13 • Mon Apr 9

- Topics
  - Perception & action
- Readings
  - Gibson, J. J. (2014). The Ecological Approach to Visual Perception: Classic Edition. Psychology Press. Retrieved from https://market.android.com/details?id=book-8BSLBQAAQBAJ, chapters 12-14.
  - Costall, A. P. (1984). Are theories of perception necessary? A review of Gibson's The Ecological Approach to Visual Perception. Journal of the experimental analysis of behavior, 41(1), 109–115. Wiley Online Library. Retrieved from http://dx.doi.org/10.1901/jeab.1984.41-109

Week 14 • Mon Apr 16

- Student presentations/demos

Week 15 • Mon Apr 23

- Student presentations/demos

Evaluation

PSY 525 course performance will be evaluated based on the following scheme:

Component	Points	% of Grade
Class participation	4 pts/class * 15 weeks = 60	60
Term project	40 pts	40
TOTAL	**100**	**100**

Term project

Your term project will consist of two components: An in-class oral presentation or demo and a written summary. Each component is worth 20 points. I will ask you to submit a draft proposal early in the course and decide on the topic before Spring Break. As such, I expect you to be working 1-3 hours per week on the term project.

Ideas

- Build a Raspberry Pi computer for vision science and demo it.
  - e.g., using Google's AIY hardware.
- Write computer code to demonstrate a core idea or phenomenon in vision science.
- Write research proposal for a project in vision science.
- Evaluate a machine learning algorithm applied to some defined class of images or videos.
- Write a critical review of some selection of papers from the vision science literature.

- Write a persuasive piece on the topic "What X scientists should know about vision" where X is some subdiscipline you feel would benefit from knowledge about vision science.
- Carry out and report on a small-scale pilot study on some topic in vision science.
- Plan and carry out a replication study of some paper in vision science.
- Demonstrate and explain a set of compelling visual illusions.