

Syllabus: Psych 540, Cognitive Neuroscience

Prof. Irving Biederman

University of Southern California

Psychology 540 (Cross listed as NSCI 533)

Fall 2020

Reaching me: Best is email, bieder@usc.edu or my cell: 310.614.3903. (I rarely check my office phone which is 213.740.6094.)

Class meets: Mon, 2:00-5:00 PM. We will have a 10-min break at the end of each hour. Instead of the 5-5:50 hour we will have individual meetings over the course of the semester so the class will end around 5 PM but if we need more time on a given topic we will continue past 5 PM.

Room: HNB 316. (We will not meet in SOS B50.) We can also determine if the class prefers to meet in person or by zoom instruction (or some combination) as we get closer to the start of classes with consideration of Covid19 safety and University regulations. It will be a small class so safe distances can readily be maintained. I will send out an email before the start of class so that you can let me know your preference. Given the somewhat shortened semester, we can have an occasional additional short meeting if there is interest.

Text: Gazzaniga, M., Ivry, R. B., & Mangun, G. R. (2019). *Cognitive Neuroscience: The Biology of Mind*. Fifth edition). **Gazzaniga, M.S., Ivry, R. B., & Mangun, G. R. (2019). *Cognitive Neuroscience: The Biology of Mind*. Fifth Edition.** New York, N.Y.: WW Norton. [ISBN: 978-0-393-603170] [GIM]. As a money saver, you can use the **Fourth edition [ISBN: 978-0-393-92795-5]**. *Do let me know if you are using that edition.* **Journal articles listed on the syllabus are the source of some of the lectures and will not be explicitly tested.** A reading or two might be added or suggested during the semester.

At the beginning of the course I will send out a poll about your own research/personal interests and, after a brief discussion, I can select material that will provide a cognitive neuroscience perspective on those aspects of cognition.

Evaluation: Evaluation will be based on two midterms (30% each) and class participation (40% see below). A pool of questions will be distributed prior to each exam, a sample of which will comprise the exam. You will thus know the exam questions! There will be a choice on the exam as to what questions need be answered (e.g., 140 points of questions of which only 100 need be answered.) This means that you will have a choice as to which questions to answer. The exams will consist of questions that can be answered in ½ to 1 page in a large page Blue Book (which you are to bring to the exam). Most of exam will consist of questions that will be covered in class but some will be from the text.

Class Participation (40%): Participation will be judged on class comments, questions, informed contributions, or critiques that serve to illuminate the discussion (but not mere attendance). On the last class (Nov. 13) there will be student presentations (~20-30 min each) in which a topic from the course material is discussed/analyzed

with respect to the student's own research or their interest in that particular topic. Prior to that time, at least two weeks earlier, we will meet and work out an outline for your presentation.

Topics: Roughly corresponding to weeks. *There will possibly be some reordering/rescheduling of topics and possibilities of additions/subtractions of readings.*

1. Aug 17th: Introduction. Cortical Modularity. Brain Development. An animal with a maximally efficient nervous system! The best simple model for understanding how the human mind works.

GIM Chapters 1. Brief History and 2. Structure and Function of the Nervous System. (We will definitely not cover the specifics of the molecular biology, e.g., of the cell membrane, ion channels, and neurotransmitters, etc. on pp. 28-36). Do look over development of the nervous system (pp. 63-67).

Cherniak, C. (1994). Component placement optimization in the brain. *Journal of Neuroscience*, 14, 2418-2427. (For background and edification. Not explicitly tested beyond what is discussed in lecture.)

2. Aug 24th. Sensation and Perception. How to get the world into the head.

Dorsal and Ventral Visual Pathways. Incredible Case of DF. Rather than discuss methods devoid of substantive issues, we will consider them as they arise in particular domains so you can largely skip GIM Chapter 3. Methods of Cognitive Neuroscience.

*GIM Chapter 5. Sensation and Perception. Emphasize *higher* level vision and audition to understand where the processing is happening in the cortex.

3. Aug 31st: Higher Level Vision I: Object Recognition. How does the brain recognize a shape never encountered previously? Cortical visual pathways. How fast can you recognize an object or a scene? Nonaccidental Properties (Invariances). Parallels between shape and speech recognition. Gabor filtering, Faces, Subordinate-Level Recognition; Prosopagnosia vs. Phonagnosia

*GIM Object Recognition. Chapter 6.

Biederman, I. (1995). Visual object recognition. In S. M. Kosslyn and D. N. Osherson (Eds.). *An Invitation to Cognitive Science*, 2nd edition, Volume 2, *Visual Cognition*. MIT Press. Chapter 4, pp. 121-165.

Hayworth, K. J., & Biederman, I. (2006). Neural evidence for intermediate representations in object recognition. *Vision Research*, 46, 4024-4031.

Biederman, I., & Kalocsai, P. (1997). Neurocomputational bases of object and face recognition. *Philosophical Transactions of the Royal Society London: Biological Sciences*, 352, 1203-1219. (Background).

Kriegeskorte, N. et al. Matching categorical object representations in inferior temporal cortex of man and monkey. *Neuron*, 60, 1126-1141.

4. Sept 7th. No class. Labor Day.

5. Sept. 14th. Attention & Consciousness. Automaticity. Subitizing limit. Spatial vs. verbal representations. Where in the brain do we first become conscious of a visual stimulus? Why is it so difficult to know if a thermostat is conscious?

*GIM. Chapter. 7. Attention

Sheinberg, D. L., & Logothetis, N. (1997). The role of temporal cortical areas in perceptual organization. *PNAS*, 94, 3408-3413.

6. Sept 21th. First Midterm (30%).

Afterwards: Learning and Memory I: Clive Wearing. Medial temporal Lobe system. *GIM Chapter 9. Memory

7. Sept. 28th. Learning & Memory II (Continued from prior week).

Emotion. *GIM. Chapter 10. Emotion.

Biederman, I., & Vessel, E. A. (2006). Perceptual pleasure and the brain. *American Scientist*, 94, 247-253.

8. Oct. 5th. Language. Speech Perception. Reading. Syntax.

*GIM. Chapter 11. Language.

9. Oct. 12. Mar 30th: Cognitive Control. Working Memory. Judgmental Heuristics and Decision Making. How to seem (and be) smarter.

*GIM. Chapter 12. Cognitive Control.

10. Oct. 19: Individual Differences: Intelligence; Behavioral Genetics. Morality. Why can't conservatives and liberals get along?

Bouchard, T., Lykken, D.T., McGue, M., Segal, N. L., & Tellegen, A. (1990). Sources of human psychological differences: The Minnesota study of twins reared apart. *Science*, 250, 223-228.

Haidt, J. (2007). The new synthesis in moral psychology. *Science*, 316, 998-1002.

11. Oct. 26: Social Cognition. Personality. Evolutionary Psychology: Bonding, Mother-Infant Competition, Murder.

*GIM. Chapter 13. Social Cognition.

12. Nov 2: 2nd Midterm (30%). Tie up loose ends.

13. Nov. 9 (Last Class). Student Presentations.

Students requesting academic accommodations based on a disability are required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP when adequate documentation is filed. Please be sure the letter is delivered to me as early in the semester as possible. Their phone number is (213) 740-0776.