

Prof. Irving Biederman  
Psychology 540 (Cross listed as NSCI 533)

University of Southern California  
Spring 2019

## **SYLLABUS: COGNITIVE NEUROSCIENCE**

IB's Office: HNB 316, Ext. 0-6094, [bieder@usc.edu](mailto:bieder@usc.edu). Email me for appointments.

**Time:** Class meets: Mon, 2:00-5:50 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.

**Room:** HNB 120F

**Required Text:** *Gazzaniga, M.S., Ivry, R. B., & Mangun, G. R. (201). Cognitive Neuroscience: The Biology of Mind. Fourth Edition. New York, N.Y.: WWNorton. [ISBN: 978-0-393-91348-4] [GIM].* \*Required chapters are preceded by an \*. There is a fifth edition that is now out but although it has some new content, the organization and clarity of exposition is wanting so we will use the fourth edition (which should be somewhat less expensive).]

Journal articles listed on the syllabus are for background edification and will not be explicitly tested. A reading or two might be added during the semester.

**Evaluation:** Evaluation will be based on two midterms (35% each) and class participation (see below). A large pool of questions will be distributed prior to each exam, a sample of which will compose the exam. There will be a choice on the exam as to what questions need be answered (e.g., 160 points of questions of which only 100 need be answered.) 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). Much of exam will consist of questions that will be covered in class lectures/discussions but some will be testing material from the text.

**Class Participation (30%):** Class comments or questions that serve to illuminate the discussion or informed criticism (but not mere attendance). On the last class (Apr. 22) there will student presentations (~20 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 a particular topic.

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

### **1. Jan 7th: Introduction. Cortical Modularity. Brain Development. Cortical visual pathways. Broadbent's Flowchart Model of Attention.**

GIM Chapters 1 Brief History. (Skim.)

GIM Chapter 2 Structure and Function of the Nervous System. (We will not cover the specifics of the molecular biology, e.g., of the cell membrane, ion channels, and neurotransmitters on pp. 28-36 but do understand the general principles).

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. Jan 14<sup>th</sup>. Sensation and Perception. Early sensory processing. How to get the world into the head. Methodologies.**

GIM Chapter 4. Methods of Cognitive Neuroscience. Rather than discuss methods devoid of substantive issues, we will consider them as they arise in particular domains.

\*GIM Chapter 5. Sensation and Perception.

**3. Jan 21<sup>nd</sup>. No Class. MLK day.**

**4. Jan 28<sup>th</sup>: Higher Level Vision I: Object Recognition. Representation. Nonaccidental Properties. Invariances.**

\*GIM Object Recognition. Chapter 6.

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

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

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.

**5. Feb 4<sup>th</sup>. Higher Level Vision II: Gabor filtering, Faces, Subordinate-Level Recognition; Scenes; Prosopagnosia vs. Phonagnosia**

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)

**6. Feb 11<sup>th</sup>. Attention & Consciousness. Automaticity. Spatial vs. verbal representations.**

\*GIM. Chapter. 7. Attention

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

**Action. Skill learning.**

GIM. Chapter 8. Action

**7. Feb 18<sup>th</sup>. President's Day. No class.**

**8. Feb 25<sup>th</sup>: Learning and Memory: Clive Wearing. Medial temporal Lobe system.**

\*GIM Chapter 9. Memory.

**10. Mar 4. First Midterm (35%)**

**11. Mar 11. Spring Recess. No Class.**

**12. Mar 18<sup>th</sup>: Emotion**

\*GIM. Chapter 10. Emotion.

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

Amir, O., Biederman, I., Wang, Z., & Xu, X. (2013). Ha Ha vs. Aha! A direct comparison of humor to non-humorous insight for determining the neural correlates of mirth. *Cerebral Cortex*, 62, 35-43. Link: <http://cercor.oxfordjournals.org/cgi/reprint/bht343?ijkey=QodzmzncQc755UY&keytype=ref>

**13. Mar 25: Language. Speech Perception. Reading. Syntax.**

\*GIM. Chapter 11. Language.

**14. April 1: Cognitive Control. Working Memory. Individual Differences: Intelligence; Behavioral Genetics.**

\*GIM. Chapter 12. Cognitive Control.

Freedman, D. J., Riesenhuber, M., Poggio, T., & Miller, E. K. (2003). A Comparison of Primate Prefrontal and Inferior Temporal Cortices during Visual Categorization. *Journal of Neuroscience*, 23, 5235–5246.

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.

**15. April 8. Social Cognition. Personality, and Morality. Evolutionary Psychology: Bonding, Love, Sex, Mother-Infant Competition, Murder, Optimal Mating Strategies.**

\*GIM. Chapter 13. Social Cognition.

Spunt, R. P., Falk, E. B., Lieberman, M. (2010). Dissociable neural systems support retrieval of *how* and *why* action knowledge. *Psychological Science*, 21, 1593-1598.

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

**16. April 15: 2<sup>nd</sup> Midterm (35%)**

**17. April 22. (Last Class). Student Presentations (30%, including general class participation).**

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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.