

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

University of Southern California  
Spring 2017

## **SYLLABUS: COGNITIVE NEUROSCIENCE**

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

**Time:** Class meets: Mon, 2:00-5:50 PM. **Room:** HNB 120F

**Required Text + Journal Articles (Denoted by \*).** Other articles (no \*) are for background edification and the content not covered in class will not be explicitly tested.

Text: **Gazzaniga, M.S., Ivry, R. B., & Mangun, G. R. (2014). *Cognitive Neuroscience: The Biology of Mind*. Fourth Edition.** New York, N.Y.: WWNorton. [ISBN: 978-0-393-92795-5] [GIM].

Journal articles can be downloaded from the course Blackboard site. Some readings may be added during the semester.

**Evaluation:** Evaluation will be based on two midterms (35% each) and class participation (see below). If the class stays small, then the exams will be of the short essay type (paragraph) and some fill-ins. A large pool of questions will be distributed prior to each exam from which about 70% of the questions on the exam will be sampled. There will be a choice on the exam as to what questions need be answered (e.g., 200 points of questions of which only 100 need be answered.) More than half of the exam will be composed of questions from class lectures/discussions.

**Class Participation (30%):** Class comments or questions that serve to illuminate the discussion or informed criticism (but not mere attendance). Good answers on those rare occasions when someone is called upon randomly also qualify. On the last class (Apr. 27) there will student presentations (~20 min each) in which a topic from the course material is discussed/analyzed with respect to the relations 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.* The last hour of each meeting will often be devoted to overview discussions.

### **1. Jan 9th: 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 16<sup>th</sup>. Introduction. No Class. MLK day.**

**3. Jan 23<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.

**4. Jan 30<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 6<sup>th</sup>. Higher Level Vision II: 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 13<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

**8. Feb 20<sup>th</sup>. President's Day. No class.**

**9. Feb 27<sup>th</sup>: Learning and Memory: Clive Wearing. Medial temporal Lobe system.**

\*GIM Chapter 9. Memory.

**10. Mar 6. Mar 23<sup>rd</sup> First Midterm (30%)**

**11. Mar 13. Spring Recess. No Class.**

**12. Mar 20<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 27: Language. Speech Perception. Reading. Syntax.**

\*GIM. Chapter 11. Language.

Sahin, N. T., Pinker, S., Cash, S. S., Schomer, D., Halgren, E. (2009). Sequential processing of lexical, grammatical, and phonological processing within Broca's area. *Science*, 326, 445-449.

**14. April 3: 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 10. 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.

**15. April 20: 2<sup>nd</sup> Midterm (35%)**

**16. April 27. Student Presentations (30%). Recap.**

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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.