

## SYLLABUS

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Monday - September 11, 2006  
Session 1

**Topic:**

SYLLABUS

**Class Plan:**

**PSYC W3265 Auditory Perception Fall 2006**

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### Introduction

How does the human brain make sense of the acoustic world? What properties of sound are important for the discrimination and recognition of sounds with specific meaning? What aspects of auditory perception do humans share with other animals? How does the brain perform the computations necessary for skills such as sound localization? How do we focus our auditory attention on one voice in a crowd? What acoustic cues are important for speech perception? What's special about music? We will address these questions and more by studying the basics of auditory perception in a textbook, and reading classic and current literature to understand the scientific progress in the field today. Our reading of the literature will be critical, with a focus on good scientific design.

This course will systematically review the main topics of auditory perception such as: 1) the physics of sound; 2) the anatomy and physiological functioning of the auditory system; 3) perception of loudness; 4) frequency selectivity and discrimination; 5) perceptual phenomena such as forward and backward masking; 6) temporal processing; 7) pitch and timbre perception in simple and complex sounds; 8) auditory attention; 9) scene analysis; 10) speech and music perception. We will examine the current literature on such topics as sound localization in humans and other animals, how the brain forms a map of auditory space, acoustic communication in humans, birds and other mammals, and how the brain may be specialized to encode the unique communication sounds of individual species. We will analyze the studies demonstrating categorical perception and lateralization of the brain for language processing. And we will study how people perceive and process music.

### The reading list and weekly schedule

**Textbook:** Moore, B. C. J. (2003) An Introduction to the Psychology of Hearing. (5<sup>th</sup> edition) Academic Press Inc. San Diego, CA.

#### Week 1 – Sept 11

The physical properties of sound, the ear, and the auditory system

**Reading**

Moore, chapter 1

Students select presentation topics this week

#### Week 2 – Sept 18

Sound Intensity and Loudness Perception

Presenters: Adam, Nick, Rahul

**Reading**

Moore, chapters 2 and 4

Hellman, R, Miskiewicz, A, Scharf, B (1997) Loudness adaptation and excitation patterns: Effects of frequency and level. *JASA* **101**:2176-2185.

Dean, I, Harper, NS, McAlpine, D (2005) Neural population coding of sound level adapts to stimulus statistics. *Nature Neurosci* **8**:1684-1689.

#### Week 3 – Sept 25

### Frequency Selectivity, Discrimination

Presenters: Mike and Darcy

#### Reading

Moore, chapter 3 and 6 (sections 1-3)

Yan, W, Suga, N (1998) Corticofugal modulation of the midbrain frequency map in the bat auditory system. *Nature Neurosci* **1**: 54-58.

Bendor, D, Wang, X (2005) The neuronal representation of pitch in primate auditory cortex. *Nature* **436**: 1161-1165.

### Week 4 – Oct 2

#### Temporal Information and Processing, Masking

Presenters: David and Nick

#### Reading

Moore, chapter 5

Lu, T, Liang, L, Wang, X (2001) Temporal and rate representations of time-varying signals in the auditory cortex of awake primates. *Nature Neurosci* **4**:1131-1138

Woolley, SMN, Fremouw, TE, Hsu, A, and Theunissen, FE (2005) Spectro-temporal Modulation Tuning as a Mechanism for Auditory Discrimination of Natural Sounds. *Nat Neurosci* **8**:1371-1379.

Woolley, SMN, Gill, P, and Theunissen, FE (2006) Stimulus-dependent auditory tuning results in synchronized population coding of vocalizations in the songbird midbrain. *J Neurosci* **26**:2499-2512.

### Week 5 – Oct 9

#### Sound Localization

Presenters: Katie and Kibby

#### Reading

Moore, chapter 7

Konishi, M (2003) Coding of auditory space. *Annu Rev Neurosci* **26**:31-55.

Bergan, JF, Ro, P, Ro, D, Knudsen, EI (2005) Hunting increases adaptive auditory map plasticity in adult barn owls. *J Neurosci* **25**: 9816-9820.

McAlpine, D (2005) Creating a sense of auditory space. *J Physiol* **566**: 21-28.

### Week 6 – Oct 16

Society for Neuroscience Meeting – no class

### Week 7 – Oct 23

#### Midterm Exam

### Week 8 – Oct 30

#### Auditory Attention

Presenters: Jen and Hal

#### Reading

Carlyon, RP (2004) How the brain separates sounds. *Trends Cog Sci* **8**:465-471.

Haykin, S, Chen, Z (2005) The cocktail party problem. *Neural Comput* **17**:1875-1902.

Suga, N, Xiao, Z, Ma, X, Ji, W. (2002) Plasticity and Corticofugal Modulation for Hearing in Adult Animals. *Neuron* **36**: 9-18.

### Week 9 – Nov 6

Academic Holiday

## **Week 10 – Nov 13**

### **Complex Sounds, Streaming and Scene Analysis**

Presenters: David and Jen

#### **Reading**

Moore, chapters 6 and 8

Micheyl, C, Tian, B, Carlyon, RP, Rauschecker, JP (2005) Perceptual Organization of Tone Sequences in the Auditory Cortex of Awake Macaques. *Neuron* **48**:139-148.

DeWeese, MR, Zador, AM (2005) Neural Gallops across Auditory Streams. *Neuron* **48**: 5-7.

Gutschalk, A, Micheyl, C, Melcher, JR, Rupp, A, Scherg, M, Oxenham, AJ (2005) Neuromagnetic Correlates of Streaming in Human Auditory Cortex. *J Neurosci* **25**:5382-5388.

## **Week 11 – Nov 20**

### **Speech and Categorical Perception**

Presenters: Rachael and Kim

#### **Reading**

Moore, chapter 9

Pardo, J, Remez, R. (2006) The Perception of Speech. In: *The Handbook of Psycholinguistics* (2<sup>nd</sup> edition), Elsevier, New York.

PK Kuhl, KA Williams, F Lacerda, KN Stevens, and B Lindblom (1992) Linguistic experience alters phonetic perception in infants by 6 months of age. *Science* **255**: 606-608.

## **Week 12 – Nov 27**

### **Neural Basis of Speech Perception**

Presenters: Rachael and Adam

#### **Reading**

Golestani, N, Paus, T, Zatorre, RJ. (2002) Anatomical Correlates of Learning Novel Speech Sounds. *Neuron* **35**:997-1010.

Dehaene-Lambertz, G, Hertz-Pannier, L, Dubois, J (2006) Nature and nurture in language acquisition: anatomical and functional brain imaging studies in infants. *Trends Neurosci* **29**: 367-373.

Gentner, TQ, et al. (2006) Recursive syntactic pattern learning by songbirds. *Nature* **440**: 1204-7.

Marcus, GF (2006) Language: startling starlings. *Nature* **440**: 1117-8.

## **Week 13 – Dec 4**

### **Communication in nonhuman animals**

Presenters: Tara and Mike

#### **Reading**

Doupe, AJ, and Kuhl, PK (1999) Birdsong and human speech: common themes and mechanisms. *Annu Rev Neurosci* **22**: 567-631.

Braaten, RF, Reynolds, K (1999) Auditory preference for conspecific song in isolation-reared zebra finches. *Animal Behaviour* **58**: 105-111.

King, AP, West, MJ et al (2003) Female Cowbird Song Perception: Evidence for Plasticity of Preference. *Ethology* **109**: 865-77.

Egnor, SER, Iguina, CG, Hauser, MD (2006) Perturbation of auditory feedback causes systematic perturbation in vocal structure in adult cotton-top tamarins. *J Exp Biol* **209**: 3652-63.

Poulet, JFA, Hedwig, B (2005) Auditory orientation in crickets: pattern recognition controls reactive steering. *PNAS* **102**: 15665-69.

## **Week 14 – Dec 11**

Presenters: Hal and Joe

## Music Perception

### Reading

Tervaniemi, M (2001) Musical Sound Processing in the Human Brain: Evidence from Electric and Magnetic Recordings. *Ann N Y Acad Sci* **930**:259-272. (currently unavailable)

Peretz, I, Zatorre, R (2005) Brain organization for music processing. *Ann Rev Psychol* **56**: 89-114.

Zatorre, RJ, Halpern, AR (2005) Mental Concerts: Musical Imagery and Auditory Cortex. *Neuron* **47**:9-12.

### **Course requirements**

Each week, students will attend a two-hour seminar. Class time will be devoted to the presentation and discussion of book chapters and journal articles. The reading is intended to provide background knowledge on the relevant topics, to cover the current and most exciting research on those topics, and to serve as a stimulus for discussion. Two students sign up to lead the discussion each week.

The students take a written midterm exam with essay questions covering the material in the textbook, the papers and the class discussions. During the second half of the semester, the students write a term paper due on the Monday of Reading Week. The 10-15 page paper should take the form of a critical review paper that addresses a specific question related to the topics of the seminar.

Grading is allocated as follows:

Midterm exam	20%
Term paper	30%
Participation and Presentations	50%