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**Advanced Topics in CogSci: Cognitive Neuroscience**

**The Cognitive Neuroscience of Sound**

**Class: Monday/Thursday, 08:40 to 10:00am, BU, SEC, 220**

Index Number: 27956

Instructor: Mimi Phan, PhD

**Overview**

A simple sound - air-pressure waves striking our eardrums - conveys a lot of information that our brain readily, easily, and effortlessly transform into a percept that we can remember, identify, and assign a value to. This course is an exploration of how sound is processed in the brain, providing an introduction to the stages of information processing from the ears to auditory cortex and beyond. Methods of data acquisition (e.g., fMRI, electrophysiology, psychoacoustics) are introduced along with their advantages and pitfalls. Sound and auditory perception are discussed, starting with the basic properties such as frequency, loudness, pitch, and timbre, progressing to human speech and music. We will explore what parts of the brain are necessary and sufficient to understand spoken, seen, or imagined words, jam to music, or recognize even your friend's voice. We will investigate how our brain processes the perceptual constancies of sound despite variations in acoustic features (e.g., your roommate's voice here, there, and everywhere throughout last semester). We will touch upon how congenital or acquired diseases (deafness, aphasia, dyslexia, and amusia) alter the underlying molecular substrates and neural circuitry of sound perception and coding. The class format will be mixed (enrollment size determined): lectures, journal-club-like presentation of papers, and group oral and written presentations.

Students are expected to have a basic understanding of psychobiology and topics covered in general psychology before taking this class.

**Learning Objectives**

The objective of this course is to provide a thorough introduction to the biological and psychological study of sound, and the computational and neural mechanisms that underlie its sensation and perception. After participation in the course, the students will have developed a familiarity and appreciation of the behavioral and neuronal dynamics associated with the cognitive neuroscience of sound.

**Required book**

Schnupp, Nelken, and King (2012). *Auditory Neuroscience - Making Sense of Sound*. Cambridge: MIT Press. Also see the **associated web site**: <http://auditoryneuroscience.com/>

**Course requirements**

There will be weekly quizzes on the first day of class of each week (typically on Mondays). Each quiz will cover the material from the previous week or based on the additional readings from the primary scientific literature. Each student will give an individual journal club presentation. In addition, each student must complete a final group presentation and a final report on the presentation. No provision will be made to "make-up" missed quizzes and final presentations. There will be no mid-term or final exams.

**Weekly quizzes**

The first 10-15 minutes of the first class of each week, there will be a multiple-choice / brief answer quiz on the material covered in the previous week or based on additional readings from the primary scientific literature. This quiz will be closed book. Anyone who is not present for the quiz will receive a zero (no exceptions). The lowest 2 (of a planned 10) quiz grades will be automatically dropped and the remaining grades averaged to determine the final weekly quiz grade.

**Journal Article Presentations**

The ability to read, understand, interpret, synthesize, and present the scientific literature is important for both scholar and layman. Throughout your academic career and beyond, you will be expected to read and interpret journal articles/data/reports, and summarize their content for

colleagues and collaborators, in presentations, proposals, and publications. Students will be required to give an oral presentation of a scientific journal article. The presentation should be 20 mins long and include at least 5-10 PowerPoint slides. This may include a title slide, outline slide, and questions slide. The journal article topic will either supplement lectures or be related to the student's group project.

**Final presentations and Written Report** *Each student must participate in a final project that culminates in an oral presentation to the class on the final few meeting days of the semester.* Each group must be 3-4 students. Each group must select a topic, either from the suggestions in a handout, or of their own choosing (in consultation with the instructor). Groups are responsible for researching this topic on their own throughout the semester, developing a reading list covering the topic, creating an outline of the final presentation, and then presenting their material to the class (see handout for due dates for each). Grading of the final presentations will be determined by the instructor, the average peer grade assigned by classmates, and individual contributions to the group.

*A written report is also part of the evaluation.* Reports should be typed, single-spaced, using 12 point Times New Roman font with 1 1/2 -inch margins and no more than 3 pages. Please include a cover page with your paper's title, your name and ID#, my name, the date, and course (this should be the only page of the report showing your name). Every page of the term paper should be numbered at the bottom right-hand corner and have your *student ID# only* in the top right-hand corner. I will give specific guidelines about the structure and format of the paper in a separate handout, but in essence, it will follow your class presentation/lecture.

### **Grading scale and policy**

Final grades will be determined by a weighted average of the following grades:

10% Weekly quizzes

20% Journal Article Presentations

30% Final report

40% Final presentations: see below for grade breakdown

Each group will receive a letter grade for the final presentations; however, individual grades will also depend on the contributions of each person to the group effort and peer evaluations.

**Group Effort (10%):** Specifically, each group participant must allocate points to members of the group to reflect the contributions of that member. Each group member will be given 100 points that they can assign amongst the group members (excluding themselves).

**Instructor Evaluations (10%):** Points will be tallied in a rubric (created by me) that will outline all the essential components of an effective presentation (i.e., for effective communication of your content) like speaking style, slide organization, slide appearance, pace, use of technology (like laser pointers, slide animations, etc.) in addition to the content of your talk. Part of this assessment will be based on the timeliness of adherence to deadlines (see schedule).

**Peer Evaluations (20%):** The peer evaluation will be anonymous and determined from the total number of points allocated to you by 3 of your classmates (randomly selected). Points will be tallied in a rubric (created by me) that will outline all the essential components of an effective presentation (i.e., for

effective communication of your content) like speaking style, slide organization, slide appearance, pace, use of technology (like laser pointers, slide animations, etc.) in addition to the content of your talk. I will review each and every peer evaluation to verify that all assessments are fair and balanced.

### Grade Conversion

Your instructor may use one of the following scales of numerical equivalents to letter grades:

90% or above	A
85- 89%	B+
80- 84%	B
75- 79%	C+
70- 74%	C
60-69%	D
Below 60%	F

**Academic Integrity** Each student in this course is expected to abide by the Rutgers University Code of Student Conduct and Academic Integrity Policy. Any work submitted by a student in this course for academic credit will be the student's own work. For this course, collaboration is allowed in the following instances: *research strategies, peer-review of assignments or other instances based upon special requests and my approval.*

Of course, you are encouraged to study together and to discuss information and concepts covered in lecture and the sections with other students, even to give ideas of which historical figures to select for your term paper. You can give "consulting" help to or receive "consulting" help from such students. However, this permissible cooperation should never involve one student having possession of a copy of all or part of work done by someone else, in the form of an e-mail, an e-mail attachment file, online forums, a flash drive, or a hard paper copy.

*Please ask me if you are writing something and would like assistance in appropriate ways to cite previously published work. That's one great reason to schedule an office hour appointment!*

For info and useful links, visit: **[academicintegrity.rutgers.edu](https://academicintegrity.rutgers.edu)**

Should copying occur, both the student who copied work from another student and the student who gave material to be copied could both automatically receive a zero for the assignment. Penalty for violation of the University Code of Student Conduct can also be extended to include failure of the course and University disciplinary action. The risk really isn't worth it.

During examinations, you must do your own work. Talking or discussion is not permitted during the examinations, nor may you compare papers, copy from others, or collaborate in any way. Any collaborative behavior during the examination will result in failure of the exam, and may lead to failure of the course and University disciplinary action.

**Accommodations for students with disabilities:** In compliance with the Rutgers University policy and equal access laws, I am available to discuss appropriate academic accommodations that may be required for student with disabilities. Requests for academic accommodations are to be made during the first two weeks of the semester, except for unusual circumstances, so arrangements can be made. Students are encouraged to register with the RU Office of Disability Services to verify their eligibility for appropriate accommodations and provide me with appropriate documentation.

<https://ods.rutgers.edu/>  
<http://health.rutgers.edu/>

**Inclusivity Statement:** We understand that our members represent a rich variety of backgrounds and perspectives. The Psychology Department is committed to providing an atmosphere for learning that respects diversity. While working together to build this community we ask all members to:

- share their unique experiences, values and beliefs
- be open to the views of others
- honor the uniqueness of their colleagues
- appreciate the opportunity that we have to learn from each other in this community
- value each other’s opinions and communicate in a respectful manner
- use this opportunity together to discuss ways in which we can create an inclusive environment in this course and across the Rutgers U. community

**Policy on attendance** Students are expected to attend class lectures and final presentations. Failure to attend the final presentation series will negatively affect your grade. In the case of a medical emergency or other extreme circumstances, it is the student’s responsibility to **contact another student**, determine what material / announcements they missed, and take appropriate action to catch up, as necessary. It is not the instructor’s responsibility to provide make-up materials to the student.

**Policy on collaboration** As discussed above, much of the work for the class will be done in groups; in general, cooperation is encouraged. The exception to this rule are the weekly quizzes, which should reflect each student’s knowledge and understanding of the course materials.

**SCHEDULE OF LECTURES (subject to change)**

		<b>Topics</b>	<b>Scheduling notes</b>
<b>week1</b>	Monday, January 20, 2020	Why Things Sound the Way They Do.	
<b>week2</b>	Monday, January 27, 2020	Do We Need to Pay Attention?	
<b>week3</b>	Monday, February 3, 2020	The Ear.	weekly quizzes begin
<b>week4</b>	Monday, February 10, 2020	Subcortical coding.	project groups & topic requests due
<b>week5</b>	Monday, February 17, 2020	Periodicity and Pitch Perception: Physics, Psychophysics, and Neural Mechanisms.	journal article presentations begin
<b>week6</b>	Monday, February 24, 2020	Hearing Speech.	
<b>week7</b>	Monday, March 2, 2020	Neural Basis of Sound Localization.	project reading list due

<b>week8</b>	Monday, March 9, 2020	Auditory Scene Analysis.	
<b>week9</b>	Monday, March 16, 2020	Spring Recess: Saturday, March 14 - Sunday, March 22	
<b>week10</b>	Monday, March 23, 2020	Development, Learning, and Plasticity.	project presentation outline due
<b>week11</b>	Monday, March 30, 2020	Cortical processing; Attention Part 2.	
<b>week12</b>	Monday, April 6, 2020	Sound Perception Across the Senses.	project draft slides due
<b>week13</b>	Monday, April 13, 2020	Auditory Prostheses: From the Lab to the Clinic and Back Again.	
<b>week14</b>	Monday, April 20, 2020	Final Presentations	
<b>week15</b>	Monday, April 27, 2020	Final Presentations	
<b>week15</b>	Monday, May 4, 2020	Final Presentations	Regular Classes End Monday, May 4
<b>Exam</b>		May 12, 2020: 8:00 PM - 11:00 PM	Final Reports Due at 8 am