

CD 411

Introduction to Speech Science

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Course Description

Prerequisite to the study of normal and impaired human communication is an understanding of the fundamental principles of the production, acoustics, and perception of speech. This course builds on students' basic knowledge of speech articulation and offers a more in-depth study of speech anatomy, physiology, and production. The course also introduces students to the acoustic theory of speech production. We will study the characteristics of the complex sound waves produced by vocal cord vibration and the filtering properties of the human vocal tract. We will analyze the acoustic characteristics of vowels and consonants and will assess how listeners interpret the input acoustic signal as linguistic information. Speech sounds are not produced — or heard — in isolation, but rather occur in a fluent, continuous stream. The course emphasizes the dynamics of speech articulation, acoustics, and perception. We will explore how speakers coordinate multiple articulators (such as the lips, tongue, jaw, and velum) to produce fluent speech and how listeners use time-varying acoustic information about articulatory coordination to determine what speakers are saying.

Course Objectives

At the end of the course, students will be able to:

- Understand and explain the difference between language and speech, and the anatomical and physiological mechanisms are involved in each.
- Define key concepts in acoustics and compute related problems involving simple and complex waves, frequency, and intensity.

- Identify and explain the functions of the anatomical and physiological correlates of speech production and perception.
- Understand and explain the acoustical and articulatory properties of speech, and apply these understandings to analyze real and synthesized speech, waveforms, spectra, and spectrograms.
- Compare and contrast diverse theories/models of speech perception.
- Critically engage with current technology and research in the field of speech science.

ASHA Knowledge Outcomes

- Standard IV-A - The applicant must have demonstrated knowledge of the biological sciences, **physical sciences**, statistics, and the social/behavioral sciences.
- Standard IV-B - The applicant must have demonstrated knowledge of **basic human communication** and swallowing processes, including the appropriate **biological, neurological, acoustic**, psychological, developmental, and linguistic and cultural bases. The applicant must have demonstrated the ability to integrate information pertaining to normal and abnormal human development across the life span.
- Standard IV-C - The applicant must have demonstrated knowledge of **communication** and swallowing disorders and differences, including the appropriate etiologies, characteristics, **anatomical/physiological, acoustic**, psychological, developmental, and linguistic and cultural correlates in the following areas:
 - **articulation;**
 - ...
 - **voice and resonance, including respiration and phonation;**
 - ...

The course will be a combination of assigned readings, lectures, exercises, small group discussions and individual projects. No prior knowledge of linguistics or language description is assumed.

Required Text

- Raphael, L.J., Borden, G.J., and Harris, K. 2011. *Speech science primer: Physiology, acoustics, and perception of speech*. 6th ed. Baltimore, MD: Lippincott, Williams, and Wilkins.

Course Readings

Additional readings will be provided on the course website (or on the teaching page of my website)

Course Policies

- **Attendance and punctuality** — Attendance is a requirement in this course. Although there is no specific penalty for missing a class, you will be held responsible for the content of every lecture and for knowing about assignments. If you should need to miss a class, be certain to check with me to ascertain what you will be missing. If you should miss a class or arrive late, be sure to find out what you missed. It is very important that you come to class **on time**. Failure to do so is disruptive and impacts negatively on the rest of class.
- **Electronic distractions** — Laptops, tablets, and smart phones are almost becoming like extended parts of our bodies; however, please respect the institution of the University, the instructor, and yourself by using electronic devices appropriately. You may use your laptop/tablet to take notes and participate in class activities, but you are required to be responsible with respect to sites visited during class. Further, please silence your cell phones before entering the classroom. Use of any technological devices during exams will result in a zero on that exam. Failure to adhere to these policies may result in dismissal from class.
- **Grading of homework assignments** — Grading criteria vary according to the assignment (rubrics for each assignment will be provided on the class website or the teaching tab of my website), though you should always aim for originality, relevance (use proper citation methods), style, grammar, and well-crafted presentation of arguments and counter-arguments. It is your responsibility, whether you are present or not, to be aware of due dates and times for assignments ('It's in the syllabus'). Late assignments (when accepted) will be lowered one letter grade (10%) for each day late (including weekend days).
 - No make-up exams will be given.

Grading Policy

- 10% Active participation in class discussions.
- 30% Graded homework/lab assignments.
- 15% Speech physiology and articulation exam.
- 15% Acoustics exam.
- 10% 3-page Critique of research article.
- 20% Comprehensive final exam

Grading Scale

A	91.5-100.0	excellent, exceptional
B+	87.5-91.49	very good, admirable
B	81.5-87.49	good, commendable
C+	77.5-81.49	adequate, passable
C	71.5-77.49	marginal
D+	67.5-71.49	unsatisfactory
D	61.5-67.49	more unsatisfactory
F	< 61.49	über unsatisfactory

Course Requirements

- **Participation:** Please read and come prepared to discuss the readings. Much of the class will be spent putting the reading into practice.
- **Homework:** There will be 5 homework assignments designed to allow you to practice the concepts covered in readings and lectures. They will be posted on the class website and/or on the teaching tab at my academic website at least one week prior to the due date. All assignments are due at the beginning of class on the specified date.
- **Exams:** The course is roughly divided into thirds. The Speech Physiology and Articulation exam will cover the material from the first third, the Acoustics exam from the middle third, and the final exam will be cumulative for the entire semester, but weighted toward the final third.
- **Short Critique of research article:** The goal of this assignment is for students to work in a bit more depth on a topic of particular interest. Many possibilities are open to you! Perhaps the topic will emerge from a finding in a homework exercise or perhaps you've always been interested in certain consonants or vowels of a language you've studied and want to conduct a small-scale original acoustic analysis of these speech sounds. It's also possible that you're interested in a particular theoretical issue and want to read and critique a research paper on this topic.

Academic Dishonesty Policy

You are encouraged to work together, but are expected to do your own work and acknowledge use of anyone else's work or ideas. Academic dishonesty includes: (a) copying another student's work or letting another student copy your work and (b) copying passages or ideas directly from another source and passing them off as your own; that is, without properly referencing them. If you have been academically dishonest, and violated the Honor Pledge and Code (<https://goo.gl/6j2E2F>), I will be required to report you to the Office of Academic Affairs. Each student must write up her/his assignment independently; copying and pasting is not allowed.

If you decide to collaborate with others, please describe the nature of this collaboration, whether in the capacity of having your assignment proofread, receiving assistance with the analysis, or simply 'throwing around ideas'. A brief sentence at the top of your assignment will be sufficient. You will not be 'marked down' if you received assistance, but it is important to acknowledge those who have directly helped you develop your ideas.

Statement on Accommodation

In keeping with the University of Alabama's commitment to non-discrimination and providing program accessibility for qualified students with disabilities, I am happy to provide reasonable accommodation in collaboration and guidance with the Office of Disability Services. Students wishing to make such arrangements should contact the Office at 348-4285.

Tentative Schedule

Week 01, 08/28 - 09/01: Course Overview

- **Reading:** None

Week 02, 09/04 - 09/08:

- **Reading:** Anatomy and Respiration: *SSP* Chapter 3
- **Reading:** Airstream: Ladefoged and Johnson Chapter 6 (on website)

Week 03, 09/11 - 09/15:

- **Reading:** Phonation and laryngeal function *SSP* Chapter 4
- **Reading:** Timing of laryngeal and articulatory gestures Reetz and Jongman Chapter 6 (on website)

Week 04, 09/18 - 09/22:

- **Reading:** Articulation of consonants *SSP* Chapter 6
- **Reading:** Catford Chapters 4 and 5 (on website)
- **Homework:** Homework 1 due

Week 05, 09/25 - 09/29:

- **Reading:** Articulation of vowels *SSP* Chapter 5

Week 06, 10/02 - 10/06:

- **Reading:** Articulatory dynamics/gestures *SSP* Chapter 8
- **Reading:** Theories of speech production *SSP* Chapter 8
- **Homework:** Homework 2 due

Week 07, 10/09 - 10/13: Review and Articulation Exam

Week 08, 10/16 - 10/20:

- **Reading:** Basic acoustics *SSP* Chapter 2
- **Reading:** Acoustics of the vocal tract *SSP* Chapter 5

Week 09, 10/23 - 10/27:

- **Reading:** Vowel acoustics *SSP* Chapter 5

Week 10, 10/30 - 11/03:

- **Reading:** Consonant acoustics *SSP* Chapter 6
- **Homework:** Homework 3 due

Week 11, 11/06 - 11/10:

- **Reading:** Articulation of prosody *SSP* Chapter 2
- **Reading:** Digital Signal Processing Johnson Chapter 3 (on website)
- **Homework:** Homework 4 due

Week 12, 11/13 - 11/17: Review and Acoustics Exam

Week 13, 11/20 - 11/24:

- **Reading:** Basic audition *SSP* Chapter 1
- **Reading:** Perception of acoustic variation *SSP* Chapter 10

Week 14, 11/27 - 12/01:

- **Reading:** Dynamics of speech perception *SSP* Chapter 11
- **Reading:** Theories of speech perception *SSP* Chapter 11
- **Homework:** Homework 5 due

Week 15, 12/04 - 12/08: Review

- **Homework:** Research Critique due

Final Exam TBD, 12/11 - 12/15: