

LING 413: SPEECH SCIENCE  
WINTER 2022

Professor: Patrice (Pam) Beddor  
Office Hours: Tuesday 1:00-2:00 and by appointment  
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Canvas Course Site: LING 413 001 WN 2022

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. Building on students' basic knowledge of speech articulation, this course provides a more in-depth study of speech production, especially from the perspective of how speakers coordinate multiple, overlapping articulatory gestures in the production of continuous speech. 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 investigate how listeners interpret the input acoustic signal as linguistic information. We will also explore selected aspects of articulatory and perceptual development, and speech impairments.

Throughout, the course will emphasize the dynamic nature of producing and perceiving speech. Basic phonetic principles will be reinforced through laboratory work, which will provide training in articulatory timing, acoustic analysis, and perceptual testing.

This course is primarily intended for students with interests in the speech and hearing sciences. Prerequisite: LING 313. (Students who take LING 413 may not also take LING 512 for credit.)

READINGS

- Text: *Speech Science Primer: Physiology, Acoustics, and Perception of Speech*. 2011. L. J. Raphael, G. J. Borden, & K. S. Harris. Lippincott Williams & Wilkins.
- Other readings on Canvas site: chapters from other textbooks (e.g., Ladefoged & Johnson's *A Course in Phonetics*; Johnson's *Acoustic and Auditory Phonetics*) and journal articles that connect our study of articulation, acoustics, and perception to specific speech impairments.

COURSE REQUIREMENTS

- Lab exercises (40%)
- Speech physiology and articulation exam (15%), acoustic exam (15%), perception quiz (7.5%)
- Short (roughly 4- to 5-page) paper (12.5%)
- Active participation in discussions that demonstrates understanding of material (10%)

SHORT PAPER OR 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 lab 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 or a particular type of speech or hearing impairment and want to read and critique one or two research papers on this topic. (A set of research articles will be posted on the Canvas site.)

#### COURSE-RELATED TOOLS

- Course website. The Canvas site for the course will be used for posting readings, announcements, handouts, copies of lecture notes, discussions, and more. Students should consult the website frequently.
- Praat. The freeware acoustic analysis and stimulus presentation program that we'll be using, Praat, is downloadable from <http://www.fon.hum.uva.nl/praat/>.

#### PHONETICS LABORATORY

The department has a [state-of-the-art phonetics laboratory](#). It will be difficult to visit the lab and maintain social distancing, so it's likely that we won't do that, but I will introduce you to some of the ongoing research projects of our phonetics faculty and graduate students.

#### OUR DISCUSSION FORMAT

We want to create an atmosphere of mutual respect in which we recognize that we all bring relevant expertise and experiences to the course and are learning from each other. In our discussions, different viewpoints will arise. We will want to respect others' rights to hold opinions and beliefs that differ from our own, to listen carefully to what they are saying, and to comment in ways that reflect that we have paid attention to the speaker's comments. When we disagree, let's take care to challenge the idea, not the person. In this course, we are also honing our skills as scientists, making it especially important to support our statements with evidence and to provide a rationale for our position.

Although we all have a responsibility to come to class prepared and willing to share, we also have different comfort levels with sharing our ideas. Please be aware of different communication styles, look for ways to expand your communication tool kit, and try to share responsibility for including all voices in the discussion.

#### OTHER IMPORTANT INFORMATION

- You are expected to adhere to the required safety measures and guidelines of the State of Michigan and U-M. These include wearing a face covering that covers the mouth and nose in class, and not coming to class when ill or in quarantine. Students seeking to request an accommodation related to the face covering requirement under the Americans with Disabilities Act should contact the [Office for Institutional Equity](#).
- I am committed to providing equal opportunity for participation in all aspects of this course. If you think you need an accommodation for a disability, please let me know at your earliest convenience. Also, requests for accommodations may be made by contacting the Services for Students with Disabilities (SSD) Office located at G664 Haven Hall (734-763-3000). The SSD Office typically recommends accommodation through a Verified Individualized Services and Accommodations (VISA) form.
- Students may experience stressors that can impact both their academic experience and their personal well-being. These may include academic pressures and challenges associated with relationships, mental health, alcohol or other drugs, identities, finances, etc. If you are experiencing concerns, seeking help is a courageous thing to do. If the source of your stressors is academic, please contact me so that we can find solutions together. For personal concerns, U-M offers a variety of resources, many which are listed on the [Resources for Student Well-being](#) webpage. You can also search for additional well-being resources [here](#).
- All students are expected to be aware of the College of LSA's standards of academic integrity. If you have any questions, please talk to me. <https://lsa.umich.edu/lsa/academics/academic-integrity.html>  
<https://www.lib.umich.edu/academic-integrity>

## SYLLABUS

SSP = Speech Science Primer

Date	Topic	Readings	Lab Exercises
Th 1/6	Introduction		
Tu 1/11	Speech anatomy and respiration	SSP Ch 3 especially pp. 55-67	
Th 1/13	Initiation and phonation	SSP Ch 4; Ladefoged & Johnson Ch 6	
Tu 1/18	Consonant articulation / Timing of laryngeal and supralaryngeal gestures	Ladefoged & Johnson Ch 7	Ex 1 assigned
Th 1/20			
Tu 1/25	Vowel articulation	Ladefoged & Maddieson pp.281-306	Ex 1 due
Th 1/27			Ex 2 assigned
Tu 2/1	Articulatory dynamics and gestural coordination (including in apraxic speech)	<i>Optional:</i> Hagedorn et al. 2017 (read only pp. 877-885)	
Th 2/3			Ex 2 due
Tu 2/8	Articulation review		
Th 2/10	<b>Articulation exam</b>		
Tu 2/15	Acoustics of the vocal tract	SSP Ch 2	
Th 2/17		SSP Ch 5	
Tu 2/22	Vowel acoustics	SSP Ch 5	
Th 2/24			Ex 3 assigned
Mid-term Break			
Tu 3/8	Digital signal processing	Johnson pp. 49-64; 77-79	
Th 3/10	Consonant acoustics	SSP Ch 6	Ex 3 due
Tu 3/15			Ex 4 assigned
Th 3/17	Acoustics of prosody / Prosody in autism spectrum disorders	SSP Ch 7; <i>Optional:</i> Lehnert-LeHouillier et al. 2020	Ex 4 due
Tu 3/22	Acoustics review		
Th 3/24	<b>Acoustics exam</b>		
Tu 3/29	Hearing and psychoacoustics	SSP Ch 9	
Th 3/31	Speech perception	SSP Ch 10; SSP Ch 11 pp. 222-229; 243-252	Ex 5 assigned
Tu 4/5			
Th 4/7	Perceptual development	SSP Ch 11, pp. 229-238	Ex 5 due
Tu 4/12	Audiovisual speech perception by children with autism spectrum disorders	Irwin & Brancazio 2014	
Th 4/14	<i>Topic of our choice!</i>	Reading TBD	Perception quiz due
Tu 4/19	Pulling it all together		
Tu 4/26	<b>Short paper due by 5:00 pm</b>		