

### **Course Description:**

This course presents, in a combined lecture/laboratory format, basic knowledge about speech acoustics, production, and (to a lesser extent) perception. Laboratories are to be completed outside of class (approximately 2 hrs/week on average). This is good preparation for the Speech Science First Exam, phonetics-related Qualifying Papers, or for courses in phonology. Students will write several short papers on various topics in speech science and acoustic phonetics (e.g., source-filter theory; myoelastic/aerodynamic theory of phonation, speech sound sources, among others), acoustic cues for vowels and for consonant manner, place, and voicing; perceptual processes. At the end of the semester, participants will submit a proposal for a research study (an experimental or corpus-based investigation) that makes use of the tools and/or concepts addressed in the course. Co-authored proposals among students are encouraged.

**Note:** This course is being taught entirely online and synchronously; as per the course schedule, we will be meeting on Mondays from 11:45am until 1:45pm (with some exceptions, noted on the preliminary schedule), with all meetings taking place on Zoom.

### **Course Learning Goals:**

*Students in this course will gain specialized knowledge related to the study of speech production, including source-filter theory and the acoustic analysis of vowels and constants. Students will also learn to communicate experimental designs and results in a concise (but informative) way, in both written and oral forms.*

**Texts:** Please purchase **the first two books**. I will provide you with the necessary readings from the other texts, although you will likely want to own them in the long run (Baken & Orlikoff in particular is the kind of book you pull down from the shelf on a regular basis for years). See also the other readings (and optional follow-up readings) on the last page of the syllabus.

1. Kent, R.D., & Read, C. (1<sup>st</sup> or 2<sup>nd</sup> edition). The Acoustic Analysis of Speech. San Diego: CA: Singular. (Chapters listed on this syllabus are from the first edition, but the ordering of chapters should be the same for both 1<sup>st</sup> and 2<sup>nd</sup>).
  2. Raphael, L. J., Borden, G. J. & Harris, K. S. [4<sup>th</sup>, 5<sup>th</sup>, or 6<sup>th</sup> Ed.] Speech Science Primer: Physiology, Acoustics, and Perception of Speech. Baltimore, MD: Lippincott Williams and Wilkins. (The readings I list in the syllabus are from the 5<sup>th</sup> edition; if you have the 4<sup>th</sup> or 6<sup>th</sup>, the chapters are a little different, so contact me to determine the equivalent if you're using one of those editions).
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3. Pickett, J. M. (1999) The Acoustics of Speech Communication: Fundamentals, Speech Perception Theory and Technology. Needham Heights, MA: Allen & Bacon (ISBN 0-205-19887-2).
  4. Baken, R. J. & Orlikoff, R. F. (2000). Clinical Measurement of Speech and Voice. San Diego, CA: Singular. (ISBN 1-5659-3869-0)
  5. Ladefoged, P. (2006) A Course in Phonetics (Fifth Edition). Fort Worth, TX: Harcourt. (ISBN 0-15-507319-2). (Other editions are fine, although the ones co-authored by Keith Johnson are considerably different than the ones prior to that).
  6. Gick, B., Wilson, I., & Derrick, D. (2013). *Articulatory phonetics*. Chichester, UK: Wiley-Blackwell.

**IPA sites:**

You are expected to know, or learn, the International Phonetic Alphabet (IPA). If you don't know it already, please begin learning it. These are two interactive sites for hearing examples of the sounds of the IPA:

<http://www.phonetics.ucla.edu/course/chapter1/chapter1.html>

<http://www.yorku.ca/earmstro/ipa/>

<https://tanakayu.doshisha.ac.jp/teaching.html>

The following site has the sounds along with either ultrasound or MRI images of the tongue:

<http://www.seeingspeech.arts.gla.ac.uk/display.php?chart=1&datatype=2&speaker=4>

You can download an app here:

<https://www.uvic.ca/humanities/linguistics/resources/software/ipaphonetics/index.php>

**Bases for Evaluation of Students**

Your grade will be based on performance on papers, laboratory reports and a proposal for a study (one which you will hopefully be able to execute after the class). 46% of the grade will come from the average of six lab reports, 46% from the average of papers 1 through 4, and 8% from your grade on Paper 5 (which is your written proposal). Grades will be on an A-F scale (A = 4; B = 3, etc.). Late papers and reports receive a one-grade deduction.

SPCH 70500/LING 79200: Speech Science, Spring 2021, instructor: Jason Bishop

**Date & Time: Mon, 11:45am – 1:45pm, Fully Online and Synchronous (on Zoom)** (*schedule subject to change slightly as the semester progresses*)

Wk	ClassDate	Topic	Assignments/Readings due start of each class
1	1 Feb	Introduction and overview (and assessment of everyone's previous work in phonetics). Review of articulatory phonetics and the IPA, phonetic inventory	
2	8 Feb	Source-Filter Theory of Speech Production, sound sources & resonators, quasi-periodic sources, quarter-wave resonators and 2-tube models	<b>Lab 1:</b> Praat Exercise ( <i>no report required</i> ) <i>Reading: Kent and Read (Ch1-2)</i>
×	(15 Feb)	<i>Happy Presidents Day! No Class Meeting</i>	
3	22 Feb	(More) Source-Filter Theory; Vowel Acoustics/Articulation; (More) speaker differences, temporal characteristics	<b>Paper 1:</b> Source-Filter Theory/Vowel Production <i>Reading: Kent &amp; Read (Ch3-4)</i>
4	1 March	Generation of Sound Sources: Respiration & Phonation Speech breathing & laryngeal control, speaker differences; f <sub>0</sub>	<b>Lab 2:</b> Analysis of vowels I <i>Reading: Garellek (2019)</i>
5	8 March	Consonant Acoustics/Articulation: Voicing in fricatives and stops, spectral and temporal cues; phonotactic variation, VOT, closure cues, release cues, preceding vowel duration	<b>Lab 3:</b> Analysis of vowels II <i>Readings: Raphael et al. (Ch6); Baken &amp; Orlikoff (Ch7, pp.274-277)</i>
6	15 March	Consonant Acoustics/Articulation: Manner of articulation, noise duration, silence, nasal murmur, transition and closure duration	<b>Lab 4:</b> Voicing in fricatives and stops <i>Reading: Davidson (2016)</i>
7	22 March	Manual and automatic methods for measuring segmental durations; other tools for processing phonetic data	<b>Paper 2:</b> The voice source <i>Readings: Turk, Nakai &amp; Sugahara (2006); Gonzalez, Grama &amp; Travis (2020)</i>
×	(29 March)	<i>Spring Break (No Class Meeting)</i>	
8	5 April	Consonant Acoustics/Articulation: Place in approximants, formant transitions & loci; Place in fricatives, noise spectra, spectral peaks, coarticulatory effects	<b>Lab 5:</b> Place of articulation in consonants <i>Reading: Kent &amp; Read (Ch6)</i>
9	12 April	Lexical stress, sentence stress and intonation; segmental durations in relation to prosodic structure	<b>Paper 3:</b> Measuring segmental durations <i>Readings: Raphael (Ch7, pp.159–163); Keating (2006); Turk lecture ("Timing in Talking")</i>
10	19 April	Phrasing/grouping, pausing & disfluency; prosody in relation to speech production planning	<i>Reading: Shattuck-Hufnagel (2019)</i>
11	26 April	[Special Topics] Speech intelligibility: acoustic correlates of "clear speech" (with applications to bilingualism and disordered speech)	<b>Paper 4:</b> Prosody, timing & planning <i>Reading: Smiljanić &amp; Bradlow (2009)</i>
12	3 May	[Special Topics] Top-down Speech Perception	<b>Lab 6:</b> Stop place perception <i>Reading: Dupoux et al. (1999)</i>
13	10 May	Presentations of project proposals	
14	17 May	<i>Reading Day (No Class Meeting)</i>	
15	24 May	Exam Week; Submit proposals via email by end of day 5/28	<b>Paper 5:</b> Written project proposals

## Papers listed on the Weekly Schedule

### Week 4

- Garellek, M. (2019). The phonetics of voice. In W. F. Katz & P. F. Assmann (Eds): *The Routledge Handbook of Phonetics*. pp. 75-106.

#### **Optional follow-ups for those interested:**

- Gerratt, B. R., J. Kreiman, & M. Garellek. (2016). Comparing measures of voice quality from sustained phonation and continuous speech. *Journal of Speech, Language, and Hearing Research* 59, 994-1001.
- Bishop, J. & Keating, P. (2012). Perception of pitch location within a speaker's range: Fundamental frequency, voice quality and speaker sex. *Journal of the Acoustical Society of America* 132(2), 1100-1112.

### Week 6:

- Davidson, L. (2016). Variability in the implementation of voicing in American English obstruents. *Journal of Phonetics* 54, 35–50.

#### **Optional follow-ups for those interested:**

- Cho, T., Whalen, D., Docherty, G. (2019). Voice onset time and beyond: Exploring laryngeal contrast in 19 languages. *Journal of Phonetics* 72, 52-65.
- Kakadelis, S. & Whalen, D. (2018). Place of articulation effects on voice onset time and phonation bleed persist in languages with no voicing distinction. *The Journal of the Acoustical Society of America* 143 (3), 1968-1968
- Dmitrieva, O., Llanos, F., Shultz, A. A., and Francis, A. L. (2015). Phonological status, not voice onset time, determines the acoustic realization of onset f0 as a secondary voicing cue in Spanish and English. *Journal of Phonetics* 49, 77–95.

### Week 7:

- Turk, A., Nakai, S., & Sugahara, M. (2006). Acoustic segment durations in prosodic research: A practical guide. In S. Sudhoff, D. Lenertova, R. Meyer, S. Pappert, P. Augurzyk, I. Mleinek, N. Richter, & J. Schliesser (Eds.), *Methods in Empirical Prosody Research* (pp. 1-27). Berlin: Walter de Gruyter.
- Gonzalez, S., Grama, J., Travis, C. (2020). Comparing the performance of forced aligners used in sociophonetic research. *Linguistics Vanguard*, 6(1), 20190058.

#### **Optional follow-ups for those interested:**

- Turk, A. & Shattuck-Hufnagel, S. (2007). Multiple targets of phrase-final lengthening in American English words. *Journal of Phonetics* 35(4), 445-472.

### Week 8:

- Keating, P. (2006). Phonetic encoding of prosodic structure. In J. Harrington & M. Tabain (Eds): *Speech production: Models, phonetic processes, and techniques*. (pp. 167-186). New York & Hove, UK: Psychology Press.

#### **Optional follow-ups for those interested:**

- Byrd, D. & Saltzman, E. (2003). The elastic phrase: Modeling the dynamics of boundary-adjacent lengthening. *Journal of Phonetics* 31 (2), 149-180.
- Cho, T. (2005). Prosodic strengthening and featural enhancement: Evidence from acoustic and articulatory realizations of /a, i/ in English. *The Journal of the Acoustical Society of America* 117 (6), 3867-3878.

**Week 9:**

- Shattuck-Hufnagel, S. (2019). Toward an (even) more comprehensive model of speech production planning. *Language, Cognition and Neuroscience* 34(9), 1202-1213

**Optional follow-ups for those interested:**

- Whalen, D. Kinsella-Shaw, J. (1997). Exploring the relationship of inspiration duration to utterance duration. *Phonetica* 54 (3-4), 138-152.
- Whalen, D. (1990). Coarticulation is largely planned. *Journal of Phonetics* 18 (1), 3-35.
- Keating, P. & Shattuck-Hufnagel, S. (2002). A prosodic view of word form encoding for speech production. *UCLA Working Papers in Phonetics* #101, pp. 112-156.
- J. Krivokapić. (2007). Prosodic planning: Effects of phrasal length and complexity on pause duration. *Journal of Phonetics* 35, 162-179.
- Tilsen, S. (2013). A dynamical model of hierarchical selection and coordination in speech planning. *PLoS ONE* 8(4): e62800. doi:10.1371/journal.pone.0062800

**Week 11:**

- Rajka Smiljanic, & Bradlow, A. (2009). Speaking and Hearing Clearly: Talker and Listener Factors in Speaking Style Changes. *Language and Linguistics Compass* 3(1), 236–264.

**Optional follow-ups for those interested:**

- Carl, M. Kent, R., Levy, Ek., Whalen, D. (2020). Vowel Acoustics and Speech Intelligibility in Young Adults With Down Syndrome. *Journal of Speech, Language, and Hearing Research* 63 (3), 674-687
- Baese-Berk, M., Walker, K. & Bradlow, A. (2018). Variability in speaking rate of native and non-native speakers. *The Journal of the Acoustical Society of America* 144 (3), 1717-1717.
- Ferguson, S. & Morgan (2018). Talker differences in clear and conversational speech: Perceived sentence clarity for young adults with normal hearing and older adults with hearing loss. *Journal of Speech, Language, and Hearing Research* 61(1): 159–173.

**Week 12:**

- Dupoux, E., Kakehi, K., Hirose, Y., Pallier, C., & Mehler, J. (1999). Epenthetic vowels in Japanese: A perceptual illusion? *Journal of experimental psychology: human perception and performance* 25(6), 1568–1578.

**Optional follow-ups for those interested:**

- Davidson, L., & Shaw, J. (2012). Sources of illusion in consonant cluster perception. *Journal of Phonetics* 40(2), 234-248.
- Kingston, J., Levy, J., Rysling, A., & Staub, A. (2016). Eye movement evidence for an immediate Ganong effect. *Journal of experimental psychology: Human perception and performance* 42(12), 1969-1988.