

University of Florida
College of Public Health & Health Professions Syllabus
SPA 3003: Articulatory, Acoustic, and Auditory Phonetics (3 credits)
Semester: Spring 2023
Delivery Format: On-Campus

Instructor: Matthew Masapollo, Ph.D.

Office: HPNP, room 2142

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Preferred Course Communications: Canvas email

Class Meeting Times: T | Period 8 (3:00 PM - 3:50 PM) COM C1-004; R | Periods 7-8 (1:55 PM - 3:50 PM) COM C1-004

Office Hours: Wednesdays 2-3 PM, or by appointment

Prerequisites: COM 1000 (or permission of instructor)

1 Course Overview

Experimental investigations of human speech processes. Topics: measurement of speech movements; measurements of pressures and airflows in speech production; source-filter theory of speech production; computer-aided waveform analysis and spectral analysis of speech; perception of speech sounds; phonetic transcription; models for speech motor control and perception; speech development; and speech disorders.

2 Relation to Program Outcomes

The content of this course is designed to help you meet the following CCC-SLP Standard IV: Knowledge and Skills 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.

¹ Please contact me using [Canvas email](#) and include “SPA 3003” in the subject line of your messages. I will answer your emails within 48 hours (barring weekends and holidays).

² Feel free to attend my weekly office hour and email me with any questions concerning course content, but you must include your current best answer to the question, or what you have tried so far (i.e., help me help you).

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; fluency; voice and resonance, including respiration and phonation; receptive and expressive language (phonology, morphology, syntax, semantics, pragmatics, prelinguistic communication, and paralinguistic communication) in speaking, listening, reading, writing; hearing (including the impact on speech and language); swallowing (oral, pharyngeal, esophageal, and related functions, including oral function for feeding, orofacial myology); cognitive aspects of communication (attention, memory, sequencing, problem solving, executive functioning); social aspects of communication (including challenging behavior, ineffective social skills, and lack of communication opportunities); and augmentative and alternative communication modalities.

The content of this course is designed to help you meet the following **CCC-A** Standard IV: Knowledge and Skills Outcomes.

Standard IV-A: Foundations of Practice

IV-a4. Normal development of speech and language

IV-a5. Language and speech characteristics and their development across the life span

IV-a7. Effects of hearing loss on communication and educational, vocational, social, and psychological functioning

Standard IV-F: Education/Research/Administration

IV-F2. Applying research findings in the provision of patient care (evidence-based practice)

3 Course Objectives and Goals

This course introduces students to the nature of human speech production, acoustics, and perception from both a cognitive science and clinical perspective. The instructional goals are:

(1) To build an integrated understanding of the physiology, acoustics, and perception of speech. We will study the vocal tract structures capable of generating and modifying speech signals, and the underlying brain mechanisms responsible for commanding the musculature of the vocal tract. We will also study the mechanisms and processes by which listeners map the resulting acoustic signal onto phonological units (phonemes, syllables, words, gestures). Students will be able to describe and explain fundamental principles of speech articulation, acoustics, and perception, and apply that basic knowledge to the study of normal and disordered speech.

(2) To explore contemporary theories and experimental investigations of normal and disordered control of the vocal tract in the production of sound segments and syllables.

(3) To introduce students to state-of-the-art measurement tools for dynamic imaging of speech movements, including real-time magnetic resonance imaging, electromagnetic articulography, and electroglottography. Live demonstrations and mini lab experiments will provide hands-on training in measuring speech movements and their acoustic correlates, and reinforce fundamental principles about how the sounds of speech are generated.

(4) To provide intensive training in perceptually classifying sound segments and transcribing acoustic data using the International Phonetic Alphabet (IPA). Students will develop and utilize a set of phonetic transcription skills, including describing, pronouncing, and classifying sound segments using phonetic terminology; transcribing standard American English using IPA symbols at different levels of detail (broad vs. narrow) and representational levels (segmental vs. suprasegmental).

(5) To develop research-evaluation and critique-writing skills. Students will learn how to write a critique of an experimental article that deals with speech articulation and/or perception.

4 Description of Course Content

Course Schedule

Week	Date(s)	Topic(s)	Readings*
Speech Production			
1	10-Jan	Overview of the speech chain, Course goals	Gick <i>et al.</i> (2013), pp. 1-15, Shriberg <i>et al.</i> (2019), pp. 1-4
	12-Jan	Neural control of speech	Gick <i>et al.</i> (2013), pp. 15-30, 31-46
2	17-Jan	Speech production systems, dynamic imaging of the larynx & supralaryngeal vocal tract	Shriberg <i>et al.</i> (2019), pp. 15-30
	19-Jan	Respiratory control of speech	Gick <i>et al.</i> (2013), pp. 47-70
3	24-Jan	Aerodynamics: Initiation and phonation; Introduction to Praat	Gick <i>et al.</i> (2013), pp. 71-95, 96-124; Download Praat
	26-Jan	Consonantal articulations	Shriberg <i>et al.</i> (2019), pp. 5-11, Shriberg <i>et al.</i> (2019), pp. 67-92; see also Toutios <i>et al.</i> (2016) rtMRI database

Week	Date(s)	Topic(s)	Readings*
Speech Production			
4	31-Jan	Consonantal articulations, cont Vocalic articulations, Measuring VOT	Gick <i>et al.</i> (2013), pp. 125-142, 167-188, 189-204; Recordings of speech materials; see also Toutios <i>et al.</i> (2016) rtMRI database
	2-Feb	Transcription practice	
5	7-Feb	Vocalic articulations	Shriberg <i>et al.</i> (2019), pp. 31-66, Gick <i>et al.</i> (2013), pp. 143-166; see also Toutios <i>et al.</i> (2016) rtMRI database
	9-Feb	Transcription practice	
6	14-Feb	Coarticulation and coordination, speech motor sequencing	Gick <i>et al.</i> (2013), pp. 205-228
	16-Feb	Using electromagnetic articulography to track speech articulator motion	Watch articulography methods video
7	21-Feb	Suprasegmentals and prosody	Shriberg <i>et al.</i> (2019), pp. 95-110
	23-Feb	Transcription practice	
Speech Acoustics			
8	28-Feb	Basic acoustics, Acoustics of the vocal tract	Johnson (2011) pp. 7-22, 25-47
	2-Mar	Transcription practice	
9	7-Mar	Acoustics of the vocal tract, cont	
	9-Mar	Acoustics of vowels and consonants	Johnson (2011) pp. 49-77, Johnson (2011) pp. 131-149
10	14-Mar	Spring break: No class	
	16-Mar	Spring break: No class	
11	21-Mar	Acoustics of consonants	
	23-Mar	Speech production “targets”; Feedforward and feedback control mechanisms	
Speech Perception			
12	28-Mar	The task of speech perception	Johnson (2011) pp. 82-97, 100- 112
	30-Mar	Perception of vowels and consonants	Strange (1999a), Strange (1999b)
13	4-Apr	Perception of vowels and consonants, cont.	Diehl <i>et al.</i> (2004), pp. 155-159
	6-Apr	Perception of coarticulated speech	Diehl <i>et al.</i> (2004), pp. 159-167
14	11-Apr	Theories of speech perception; Eye- tracking and EEG/ERP measures	Diehl <i>et al.</i> (2004), pp. 150-155
	13-Apr	Developmental Speech Perception	Kuhl (2004)

Week	Date(s)	Topic(s)	Readings*
Speech Production			
15	18-Apr	Multisensory Speech Perception	Navarra, Yeung, Werker & Soto-Faraco (2012)
	20-Apr	Spoken Word Recognition	Jucsyzk & Luce (2002)
16	25-Apr	Peer review & feedback on term papers	
	27-Apr	Reading days: No class	
	4/1-4/5	Final Exams	

* You are responsible for monitoring and participating in the weekly discussion boards on Canvas.

Course materials and technology: The course has a website on Canvas, which is accessible from: <http://elearning.ufl.edu>. Please make sure you have access. All course material, including lectures, readings and assignments, will be posted on Canvas. There are also several active learning and discussion tools on Canvas. I encourage you to use these tools to post questions and comments concerning course material and/or assignments – this way, the whole class benefits from your questions and our answers. *It is your responsibility to monitor the course website on a regular basis.* I will also monitor the discussion boards to help ensure that misunderstandings or false views of the course content are not reinforced.

For technical support for this class, please contact the UF Help Desk at:

- Learning-support@ufl.edu
- (352) 392-HELP - select option 2
- <https://lss.at.ufl.edu/help.shtml>

Readings:

Required Texts:

Shriberg, L.D., Kent, R.D., McAllister, T., & Preston, J.L. (2019). *Clinical Phonetics*. 5th edition. Pearson.³

Gick, B., Wilson, I., & Derrick, D. (2013). *Articulatory Phonetics*, Wiley-Blackwell. (Available as an e-book through the UF library.)

Johnson, K. (2011). *Acoustic and Auditory Phonetics*. 3rd edition. Wiley-Blackwell. (Available as an e-book through the UF library.)

Supplemental resources (not required, but recommended as additional resources for students interested in more specific topics within phonetics):

Ladefoged, P., & Johnson, K. (2014). *A Course in Phonetics*, 7th Edition. Harcourt Brace Jovanovich, Publishers.

³ Note that the e-Textbook version is considerably cheaper. If you prefer a paperback version, then can probably find a cheap, second-hand version on Amazon.

(This and other editions available through the UF library.)

Guenther, F.H. (2016) *Neural Control of Speech*. MIT Press.
(Available as an e-book through the UF library.)

Stevens, K.N. (1998). *Acoustic Phonetics*. MIT Press.
(Available at the UF HSC library.)

Lieberman, P., & Blumstein, S.E. (1988). *Speech Physiology, Speech Perception, and Acoustic Phonetics*. Cambridge University Press.
(Available at the UF HSC library.)

Other readings will be drawn from a number of sources and posted on Canvas.

Software:

- [Praat](#) – Multi-platform free-ware for acoustic analysis of speech (Boersma & Weenink, 2013)
- [MATLAB](#) – Matrix calculation software used to run scripts for tracking and measuring speech movements using electromagnetic articulography.

Other links that may supplement and enrich this course are:

- BU's [collection of historical sound files and videos](#) related to speech production
- USC's database of [real-time MRI movies of IPA sounds](#) and [connected speech](#)
- York's [interactive IPA chart](#) with flash animations of the sounds and affiliated symbols
- MIT's [IPA Converter app](#)

For technical support for this class, please contact the UF Help Desk at:

- helpdesk@ufl.edu
- (352) 392-HELP - select option 2
- <https://helpdesk.ufl.edu/>

Additional Academic Resources

[Career Connections Center](#): Reitz Union Suite 1300, 352-392-1601. Career assistance and counseling services.

[Library Support](#): Various ways to receive assistance with respect to using the libraries or finding resources.

[Teaching Center](#): Broward Hall, 352-392-2010 or to make an appointment 352- 392-6420. General study skills and tutoring.

[Writing Studio](#): 2215 Turlington Hall, 352-846-1138. Help brainstorming, formatting, and writing papers.

Student Complaints On-Campus: [Visit the Student Honor Code and Student Conduct Code webpage for more information.](#)

On-Line Students Complaints: [View the Distance Learning Student Complaint Process.](#)

5 Phonetics Laboratories

UF's [Department of Speech, Language, and Hearing Sciences](#) has several state-of-the-art [laboratories](#) engaged in multidisciplinary research on speech processes. Our articulation labs house an [electromagnetic articulography system](#) for speech movement tracking in real time, and various devices for auditory feedback manipulation during ongoing speech production. Our acoustics and perception labs have multiple sound-treated booths, high-quality speech recording equipment, clinical audiometers, and software and hardware for running a wide range of perception experiments. Students are strongly encouraged to participate as subjects in research projects to learn more about how experimental studies are conducted. In addition, SLHS faculty are always interested in competent and detail-oriented students who want to supplement their formal coursework with training in a laboratory environment. Email me to set up a meeting if you are interested in this possibility.

Participate in research at UF for extra credit (optional): To encourage awareness of different aspects of speech and language research, you have the option of participating in two hours of language or communication research during the semester. A list of experiments that qualify for this credit can be found on the web at: <https://slhs.phhp.ufl.edu/research/participant-pool/>. This site will be updated throughout the semester. There are both online and in-person studies available.

A scanned copy of the consent form (if it is really long, the first and last page of the consent form) must be submitted under Assignments/Extra Credit no later than April 18, 2023 for you to receive credit, but they may be turned in earlier. Participating in research will earn you an **extra 2%** added to your course grade.

If you choose not to participate in research or do not qualify for any of the above studies, you can receive the same amount of course credit for reading a short research article and writing a 1.5 - 2-page synopsis and critique of it. Choose any additional article from those posted in the Research Participation Alternatives folder on CANVAS for this purpose. This must be turned in no later than April 18, 2023 for you to receive credit. Guidelines for writing these short papers will be provided in a separate document.

6 Academic Requirements and Grading

Note: *Grading rubrics* will be referred to when giving students feedback on dictations, lab reports, and final papers.

Readings and class discussions (10%)

- Some of the readings are in the textbooks and others will be posted on Canvas.
- The sets of readings for each week are to be read *before* class (see schedule). I will frequently provide reading guidelines on Canvas to help highlight certain concepts that students will need to derive from the readings.
- You are expected to actively participate in class discussions and in the online discussion boards to show that you have read and thought about the content

presented in the readings and lectures. This might include sharing your thoughts about the subjects during in-class discussions, or posing a question or reflecting on key concepts that you had difficulty with on the discussion boards. You will also be regularly asked open-ended questions during class about the material presented in the readings – this will provide you with the opportunity to apply what is being taught, which, in turn, will further your understanding of the topic.

Lab reports (40%)

- There will be four lab assignments (10% each). The lectures will cover the background material pertinent to each lab. These exercises are designed to stimulate student interest in exploring the science of speech and develop students' ability to engage in scientific thinking, i.e., generate hypotheses, interpret data, and actively discuss arguments dealing with speech processes.
- The data you collect and/or analyze will be compared with data reported in the speech literature and will be interpreted in terms of theories discussed in class.
- You are encouraged to collaborate (in small groups of 2 or 3) on the assignments but should submit *individual* written reports. If you do collaborate, please list your group members. This exercise is intended to help students *work in conversation with others to solve complex problems*.
- A hardcopy of each lab report is to be submitted to me in class or to my faculty mailbox (HPNP 2134) by the due date (see schedule).

Phonetic Transcription quizzes (20%)

- There will be four dictations or quizzes (5% each) that test your IPA transcription skills.

Term paper (30%)

- Students will write a short paper critiquing an experimental article that deals with speech articulation and/or perception. The topic of the paper should emerge from a phenomenon discussed in the course readings/lectures or a finding in a lab exercise. It's also possible that you're interested in a particular theoretical issue or a particular type of speech impairment (e.g., stuttering) and want to read and critique a research paper (or two) on this topic. The overall goal of this assignment is for students to hone their *deep reading*, *data analysis*, and *writing skills* by working in more depth on a topic of particular interest. Guidelines for selecting a topic and writing the paper (basic mechanics, etc.) will be provided in a separate document.
- I will provide a list of potential papers to critique and will help students search for and locate articles using the University of Florida Library System.
- You should recognize the importance of each aspect of the writing process (i.e., initial outline, drafts, final version) and allow yourself sufficient time throughout the semester to write, reflect, and revise your papers, as opposed to completing all the writing during an abbreviated period at the end of the term. You can meet with me during office hours to receive constructive feedback on any stage of the writing process (i.e., topic selection, outline, drafts, etc.).
- You should think about and structure the paper in the following way:

- *Motivation/hypothesis*: Briefly state the relevant background so that the reader understands the motivation for the study. Why is this study being conducted; what question does the author want to answer and why is this an important question?
- *Method*: What methods are used to address the hypothesis?
- *Results and the authors' interpretation*: The *main* aspects of the results should be described, especially in light of the study's goal / hypothesis (e.g., was the hypothesis supported and how do the results show—or fail to show—evidence of this?).
- If there is more than one experiment in the study you are critiquing, it is usually best to first describe the hypothesis/method/results and interpretation for Experiment 1, then do the same for Experiment 2, etc.
- A hardcopy of the paper is to be submitted to my faculty mailbox by April 29th.

Requirement	Due date	Points or % of final grade (% must sum to 100%)
Active class participation	NA	10%
Lab I	31-Jan	10%
Phonetic Dictation I	2-Feb	5%
Phonetic Dictation II	9-Feb	5%
Phonetic Dictation III	23-Feb	5%
Lab II	28-Feb	10%
Phonetic Dictation IV	2-Mar	5%
Lab III	28-Mar	10%
Lab IV	20-Apr	10%
Final Paper	29-Apr	30%

Percentage	93-100	90-92	87-89	83-86	80-82	77-79	70-76	67-69	63-66	60-62	< 60
Letter Grade**	A	A-	B+	B	B-	C+	C	D+	D	D-	E
Grade Points	4.0	3.67	3.33	3.0	2.67	2.33	2.0	1.33	1.0	0.67	0.0

** Note that the Bachelor of Health Science Program does not use C- grades.

More information on UF grading policy may be found at:

<https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/>

Class attendance: Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies that can be found

[here](#). Please note all faculty are bound by the UF policy for excused absences. For information regarding the UF Attendance Policy see the Registrar website for additional details: <https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>

Grades and grading policies: Information on current UF grading policies for assigning grade points can be found [here](#).

Make-up Work: Information on current UF grading policies for make-up work can be found [here](#) and [here](#). Please note that any requests for make-ups due to technical issues must be accompanied by the [UF Computing help desk](#) correspondence. You must e-mail me within 24 hours of the technical difficulty if you wish to request a make-up.

7 UF Policy Statements

Academic Integrity

Students are expected to act in accordance with the University of Florida policy on academic integrity. As a student at the University of Florida, you have committed yourself to uphold the [Honor Code](#), which includes the following pledge:

“We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity.”

You are expected to exhibit behavior consistent with this commitment to the UF academic community, and on all work submitted for credit at the University of Florida, the following pledge is either required or implied:

“On my honor, I have neither given nor received unauthorized aid in doing this assignment.”

It is your individual responsibility to know and comply with all university policies and procedures regarding academic integrity and the Student Honor Code. Violations of the Honor Code at the University of Florida will not be tolerated. Violations will be reported to the Dean of Students Office for consideration of disciplinary action. For additional information regarding Academic Integrity, please see Student Conduct and [Honor Code](#) or the [Graduate Student Website](#) for additional details.

Please remember cheating, lying, misrepresentation, or plagiarism in any form is unacceptable and inexcusable behavior.

Online Faculty Course Evaluation Process

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available [here](#). Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu

under GatorEvals, or [here](#). Summaries of course evaluation results are available to students [here](#).

Copyright and intellectual property: Instructor generated course materials (e.g., handouts, notes, summaries, exam questions, etc.) may not be copied, shared, or distributed in any form or in any medium without explicit permission of the instructor.

Recording Within the Course:

Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A “class lecture” is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To “publish” means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

Policy Related to Guests Attending Class:

Only registered students are permitted to attend class. However, we recognize that students who are caretakers may face occasional unexpected challenges creating attendance barriers. Therefore, by exception, a department chair or his or her designee (e.g., instructors) may grant a student permission to bring a guest(s) for a total of two class sessions per semester. This is two sessions total across all courses. No further extensions will be granted. Please note that guests are **not** permitted to attend either cadaver or wet labs. Students are responsible for course material regardless of attendance. For additional information, please review the [Classroom Guests of Students policy](#) in its entirety.

8 Support Services

Accommodations for students with disabilities: If you require classroom accommodation because of a disability, it is strongly recommended you register with the [Dean of Students Office](#) within the first week of class or as soon as you believe you might be eligible for accommodations. The Dean of Students Office will provide documentation of accommodations to you, which you must then give to me as the instructor of the course to receive accommodations. Please do this as soon as possible after you receive the letter. Students with disabilities should follow this procedure as early as possible in the semester. The College is committed to providing reasonable accommodations to assist students in their coursework.

Counseling and Student Health

Students sometimes experience stress from academic expectations and/or personal and interpersonal issues that may interfere with their academic performance. If you find yourself facing issues that have the potential to or are already negatively affecting your coursework, you are encouraged to talk with an instructor and/or seek help through University resources available to you.

U Matter, We Care: If you or someone you know is in distress, please contact umatter@ufl.edu, 352-392-1575, or visit umatter.ufl.edu/ to refer or report a concern and a team member will reach out to the student in distress.

Counseling and Wellness Center: Visit counseling.ufl.edu/ or call 352-392-1575 for information on crisis services as well as non-crisis services.

Student Health Care Center: Call 352-392-1161 for 24/7 information to help you find the care you need, or visit shcc.ufl.edu/

University Police Department: Visit police.ufl.edu/ or call 352-392-1111 (or 9-1-1 for emergencies).

UF Health Shands Emergency Room / Trauma Center: For immediate medical care call 352-733-0111 or go to the emergency room at 1515 SW Archer Road, Gainesville, FL 32608; ufhealth.org/emergency-room-trauma-center

Do not wait until you reach a crisis to come in and talk with us. We have helped many students through stressful situations impacting their academic performance. You are not alone so do not be afraid to ask for assistance.

Academic Resources:

E-learning technical support: Contact the UF Computing Help Desk at 352-392-4357 or via e-mail at helpdesk@ufl.edu

Career Connections Center: Reitz Union Suite 1300, 352-392-1601. Career assistance and counseling services career.ufl.edu/

Library Support: cms.uflib.ufl.edu/ask various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center: Broward Hall, 352-392-2010 or to make an appointment 352- 392-6420. General study skills and tutoring. teachingcenter.ufl.edu/

Writing Studio: 2215 Turlington Hall, 352-846-1138. Help brainstorming, formatting, and writing papers. writing.ufl.edu/writing-studio/

Student Complaints On-Campus: sccr.dso.ufl.edu/policies/student-honor-codestudent-conduct-code/

On-Line Students Complaints: distance.ufl.edu/student-complaint-process/

Inclusive Learning Environment

Public health and health professions are based on the belief in human dignity and on respect for the individual. As we share our personal beliefs inside or outside of the classroom, it is always with the understanding that we value and respect diversity of background, experience, and opinion, where every individual feels valued. We believe in, and promote, openness and tolerance of differences in ethnicity and culture, and we respect differing personal, spiritual, religious and political values. We further believe that celebrating such diversity enriches the quality of the educational experiences we provide our students and enhances our own personal and professional relationships. We embrace The University of Florida's Non-Discrimination Policy, which reads, "The University shall actively promote equal opportunity policies and practices conforming to laws against discrimination. The University is committed to non-discrimination with respect to race, creed, color, religion, age, disability, sex, sexual orientation, gender identity and expression, marital status, national origin, political opinions or affiliations, genetic information and veteran status as protected under the Vietnam Era Veterans' Readjustment Assistance Act." If you have questions or concerns about your rights and responsibilities for inclusive learning environment, please see your instructor or refer to the [Office of Multicultural & Diversity Affairs website](#).

9 References

Boersma, P., & Weenink, D. (2013). Praat: doing phonetics by computer. (Version 5.3.51) [Computer program]. <http://www.praat.org/>

Diehl, R.L., Lotto, A.J., & Holt, L. (2004). Speech perception. *Annual Review of Psychology*, 55, 149-179.

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- Kuhl, P.K. (2004). Early language acquisition: Cracking the speech code. *Nature Reviews Neuroscience*, 5, 831-843.
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- Strange, W. (1999b). Perception of consonants: from variance to invariance. In J.M. Pickett (Ed.), *The Acoustics of Speech Communication*, pp. 166-182. Allyn & Bacon.
- Toutios, A., Goud Lingala, S., Vaz, C., Kim, J., Esling, J., Keating, P., Gordon, M., Byrd, D., Goldstein, L., Nayak, K., & Narayanan, S. (2016). Illustrating the production of the International Phonetic Alphabet Sounds using fast real-time magnetic resonance imaging. *Interspeech*, 2428-2432, San Francisco, CA.