

SLHS 1301W The Physics and Biology of the Spoken Language

Spring Semester 2014

Lectures: MWF 9:05 am – 9:55 am (20 Shevlin)

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Office Hours: WF 10:00-10:50 and by appointment (49 Shevlin Hall)

Teaching Assistants

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Labs Sections (Ford Hall B53)

003, 11:15 A.M. - 12:45 P.M., Tu

006, 02:15 P.M. - 03:45 P.M., Th

002, 01:30 P.M. - 03:00 P.M., M

004, 10:15 A.M. - 11:45 A.M., W

Office Hours (Shevlin Hall 16)

Tuesday 1-2 pm

Wednesday 12 -2 pm

COURSE DESCRIPTION

This is a 4-credit course, which satisfies two liberal education requirements: (1) the Diversified Core Curriculum as a physical science course with laboratory, and (2) a writing intensive course.

The goals of this course are to provide students with a background to the core concepts in physics by describing in depth the physical properties of spoken language. Some of the physics topics that we will cover in this course include the following:

This course talks about the **acoustics** of speech. Speech is a waveform that travels from a person producing a sound to a person hearing a sound. We will explore the nature of those waveforms—what they look like, how to best describe and analyze them, and how our auditory system reacts when it encounters these waves.

This course talks about **energy transfer**. Waves transfer energy. When a wave hits the ear, the energy is transmitted from a gaseous medium—the air—to a solid medium—the bones of the middle ear—to a liquid medium—the lymph in the inner ear. By learning about this, you will learn about general principles that govern how energy is transferred in physical systems.

This course talks about basic principles related to **matter**. Speech is produced with a variety of organs: our larynx, our tongues, our lips, and our teeth and travels through the air around us. Each of these has different properties. We will explore how those properties shape the speech that we produce and perceive.

Rather than being a course on speech or language per se, this is a course that uses speech and language as phenomena for understanding broad concepts in the physical sciences. As part of this endeavor, we will briefly touch on other concepts relevant to speech, including its biological and cognitive basis, but at its core, this course is about the physics of speech. We will examine the aerodynamic and acoustic principles that underlie sound production. We will examine how to relate characteristics of speech waveforms back to the different processes used to produce it. We will study how to transmit, store, and recreate speech waveforms with

computers. We will study how the human auditory system and nervous system convert different aspects of waveforms into signals that our brains recognize as sounds. It is through this focus on the physical sciences that this course satisfies the university's physical sciences with laboratory liberal education requirement. This course has a heavy focus on analysis and hypothesis-testing using the scientific method. What constitutes a testable hypothesis about the physical characteristics of sound, and what are appropriate types of evidence to examine these? Here, we will contrast the kinds of information that you can learn from studying speech and language from a physical-science perspective with the kinds of information that you can learn studying it other ways. By the end of the course, we hope you will have an expanded appreciation for how physical-sciences inquiries can complement the other kinds of inquiries about speech and language that you might make.

This course also satisfies the university's writing-intensive requirement. Students will meet this requirement through numerous opportunities to summarize their laboratory work in written documents. These will include a mix of technical-writing assignments and expository writing.

The objectives of this course are as follows:

To provide students who have a general science background with an introduction to the core concepts in the physical sciences. These are presented in the context of discussing the physical characteristics of spoken language signals. Students are also given the opportunity to apply these concepts in laboratory sessions, many of which allow students to collect and analyze data on the physical characteristics of speech.

To introduce students to the traditional and emerging modes of inquiry in the discipline of speech-language-hearing sciences.

To inform students of the recent technological advances associated with spoken language such as digital processing systems and speech-recognition systems.

To give students the opportunity to write about technical topics in speech-language-hearing sciences, both using technical language and using lay language.

ORGANIZATION OF COURSE

Class Time: 60% lecture, 15% discussion, 25% laboratory

Work Load: 15 pages of reading per week, 30 pages of writing per semester. Papers are typically 3-5 pages each

Grade: 25% exam #1, 25% exam #2, 25% final exam (#3), 25% lab work

Exam format: true-or-false, multiple choice, short answer

Class sessions will be devoted primarily to lectures and demonstrations (See LABORATORY ASSIGNMENTS for additional information). *Students are expected to attend all lectures and to participate actively in discussion. Each student is responsible for information presented in class and for any announcements that are made in class and by Email regarding examinations, laboratory assignments, and so forth.*

Course Materials

1. Denes, P.B. and Pinson, E.N. (1993, Second Edition). *The Speech Chain: The Physics and Biology of Spoken Language*. New York: W.H. Freeman and Company. (See reading assignments on Page 5.)
2. Laboratory manual, lecture slides, study guides and practice tests are provided online at the Moodle course web site, which requires login with your UMN ID and password at <http://myu.umn.edu> There will also be Email announcements for the course.

Examinations will be heavily weighted on materials presented in class.

EXPECTATIONS FOR STUDENTS

University of Minnesota Senate Policy states that for undergraduate students, the average student in an average week should expect to devote 3 hours per week for each credit hour of registration. This is a four-credit course. Thus, the average student in an average week should expect to devote 12 hours per week, including the three lecture hours and the two laboratory hours per week. Students who then devote the balance of 7 hour per week to quality studying should expect to do well in the course.

GRADING

A	93 -100	Achievement that is outstanding relative to the level necessary to meet course requirements
A-	90 - 92	
B+	87 - 89	
B	83 - 86	Achievement that is significantly above the level necessary to meet course requirements
B-	80 - 82	
C+	74 - 79	
C	66 - 73	Achievement that meets the course requirements in every respect
C-	60 - 65	
D+	57 - 59	
D	50 - 56	Achievement that is worthy of credit even though it fails to meet fully the course requirements
F	<50	Represents failure and signifies that the work was either 1) Completed, but at a level of achievement that is not worthy of credit, or 2) Not completed and there was no agreement between the instructor and the student for the student to be awarded an I
S		Achievement that is satisfactory, which is equivalent to a C- or higher
N	<60	No credit
I		Assigned at the discretion of the instructor when, <i>due to extraordinary circumstances, e.g., hospitalization or family emergency, a student is prevented from completing the work of the course on time. The awarding of an "I" requires a written agreement between the instructor and the student.</i> Failure to complete assignments or examinations that is not attributable to "extraordinary circumstances" does not justify the assignment of an "I" grade.

Academic Conduct

Academic dishonesty in any portion of the academic work for a course shall be grounds for awarding a grade of F or N for the entire course.

Please familiarize yourself with university policy regarding academic conduct and misconduct, by reading the following links:

http://www1.umn.edu/regents/policies/academic/Student_Conduct_Code.html

http://www1.umn.edu/regents/policies/humanresources/Academic_Misconduct.html

If you have any questions about what constitutes academic misconduct, please ask your TA or the class Instructor. It is better to ask and be sure than to risk unintentionally committing academic misconduct.

➤ Classroom Conduct

1. All students are expected to behave as scholars at a leading research university. This includes arriving on time, not talking during lecture (unless addressing the instructor or in group discussions), and not leaving the classroom before the end of the lecture.

2. The use of cell phones, PDAs, and the Internet is not allowed in class. This prohibition is consistent with the university senate's policy on electronic devices in the classroom. Use of laptop computers in class is prohibited except in cases where the student has explicit permission from Dr. Munson to do so.
3. Please consult with the Instructor regarding permission and accommodations for special needs.
4. Students who disrupt class or violate class rules will be warned. Students who repeatedly disrupt or violate class rules will be dismissed from the classroom.

➤ Use of Email

In accordance with Academic/Administrative Policy 2.2.3, “A University assigned student email account shall be the University’s official means of communication with all students on the Twin Cities campus. *Students are responsible for all information sent to them via their University assigned email account.* If a student chooses to forward their University email account, he or she is responsible for all information, including attachments, sent to any other email account.” As a matter of good practice, *students are urged to check their Email at least once daily and also at least once over the weekend.* Remember, if we receive an E-Mail from a non-university account, we have no way of knowing whether the E-Mail was sent by your or is fraudulent. Moreover, the instructors will only send E-Mail to the students' University of Minnesota accounts.

Please also be aware of E-Mail etiquette. Many a potentially good relationship has been soured (at least temporarily) because of a miscommunication over E-Mail. Following good E-Mail etiquette will reduce that possibility. Two very good resource for this are:

<http://owl.english.purdue.edu/owl/resource/636/01/>

http://email.about.com/od/emailnetiquette/tp/core_netiquette.htm

POLICY CONCERNING LABORATORIES

Laboratory Sessions will be held in Room B053 Ford.

*Students are required to attend Laboratory Sessions, and to attend only the session for which you are **registered**. Failure to attend a laboratory and/or to submit a satisfactory laboratory report will result in a score of 0% for that laboratory assignment.*

Laboratory reports must be turned in **to your TA** by no later than the start time of your scheduled laboratory the following week. ***The percentage grade for each laboratory report will be decreased by 20 percentage points for every 24 hour period***— exclusive of Saturdays, Sundays, and official University holidays — that the report is late. Reports received more than 5 days late, exclusive of Saturdays, Sundays, and official University holidays, will receive a grade of 0%. Your TA will return your laboratory reports one week later at the time of your next scheduled laboratory.

Lab 12 Auditory Assessment Lab:

Please note the special requirements for the laboratory entitled, “Auditory Assessment.” This is a laboratory arranged separately for each student. ***It is the only one out-of-class lab.*** You will have an opportunity to register for the day and time of this laboratory. Remember to pick the time that won’t conflict with the regular lab schedule. Students are encouraged to submit this laboratory report in **to your TA** as soon as possible after you have attended the laboratory. Specific instructions regarding how to complete the lab will be given during lab hours.

There will be 12 required laboratory sessions. A separate document describes the laboratory schedule.

All 12 laboratories will be graded. Failure to attend and to turn in a report will result in a grade of 0% for that laboratory. In total, laboratories and reports constitute 25% of your course grade. The two lowest scores for the labs will be dropped in the calculation for your final grade. There are no make-up labs. **If a student misses a laboratory assignment, this is graded zero and is (presumably) one of the two labs dropped in the calculation of your final grade.**

Students may bring a calculator to class, particularly for lectures associated with 1) The Physics of Sound, 2) Hearing, and 3) Acoustic Characteristics of Speech. The calculator should have the following functions, at minimum: Log ; 10^x ; \square ; and X^2 . Students will be permitted to use calculators during examinations and during laboratories.

• LABORATORY ASSIGNMENTS

1. There are 12 scheduled laboratory activities throughout the semester. Among the assignments you turn in, only **ten** highest grades will contribute to the lab portion of your total grade.
2. Weekly laboratory material will be posted on Moodle throughout the semester. **It is imperative that you bring a copy of the lab material to each laboratory session.** We recommend that you should print out the lab handout and have it with you. It is much easier to follow the steps that are printed on pieces of paper and work on experiments on computer without having the window minimize and maximize all the time. Note: There is a printer in the B053 Ford. However, you should not expect its availability each time. Prepare your lab material beforehand.
3. Laboratory reports will be graded with respect to both *content and style*. The report should reflect carefully crafted prose with special attention to proper grammar, correct spelling, and a careful, logical progression of thought. The report should be textual, not just a listing of thoughts, ideas, and observations. **Specific grading rubric** for each lab report will be posted on the Moodle site ahead of time. In almost all cases, it is unwise to submit the first draft of your laboratory report. Draft the report, edit it, and modify it until your submission reflects your best possible exposition. Please take advantage of TA office hours to help you during this process.
4. **Except for the first three labs, the fifth and the eighth, all other laboratory assignments must be typed.** If that requirement presents a hardship, please contact your TA in advance of the first scheduled laboratory.
5. There is **no requirement of typed report for Labs 1-3, Lab 5, and Lab 8.** However, you will **answer all listed math questions and finish data interpretation activities** to get the grade for the specific lab assignment.
6. **Typed laboratory reports (Labs 4, 6-7, 9-12)** are to be **submitted online to the designated dropboxes via Moodle website** before the next scheduled laboratory session. You are responsible for your work should something happen. If the Moodle server “goes down,” **you are still responsible for completing the assignment on time and submitting your report to your TA via your university email account.**

EXAMINATIONS

1. Examinations will cover material in the textbook *and additional material that is presented in class, with particular emphasis on material presented in class.*
2. There will be two midterm examinations and one final examination.
3. Each examination will focus *principally* on material covered from the time of the last examination.

GRADING:

1. The final course grade will be weighted as follows:

1 st Midterm	25%	Chapters 1,2,3
2 nd Midterm	25%	Chapters 9,4,5
Final Examination	25%	Chapters 6,7,8,10, 11
Laboratories and Reports	25%	

2. Grading problems should be resolved with the TA for your lab section.
3. This course will use the +/- grading system. For students who register S/N, letter grades of C- or higher will be recorded as an S. Letter grades lower than C- will be recorded as an N.
4. *Incompletes*: To receive an incomplete, the two midterm examinations must have been completed with an average passing grade prior to the scheduled time for the final examination, all laboratories and laboratory reports must have been completed with a composite passing grade prior to the scheduled time for the final examination, the reason for missing the final examination must have been explained to the Instructor, not the TAs, by the scheduled time for the final examination, and the student and the Instructor must have signed an agreement. To remove an **I** from your transcript, a make-up final must have been completed *before the end of the fourth week of the subsequent semester*. Please see the special notes about qualifications for receiving an **I** on page 2 of this syllabus.
5. *Make-up Examinations*: Make-up examinations will be administered only under extremely compelling circumstances. If you must miss the examination, you must contact the Instructor, not the TAs, prior to the examination and present a satisfactory documented explanation for your intended absence to avoid penalty. The percentage grade for each makeup exam will be decreased by 20 percentage points for every 24 hour period — exclusive of Saturdays, Sundays, and official University holidays— that the exam is late.
6. Students shall not be penalized for absence due to unavoidable or legitimate circumstances. However, students are responsible for providing documentation to the TA or the instructor to verify the reason for their absence. For example, if you represent the university in intercollegiate sports, you can get an authorized letter from your sports program to prove your legitimacy for missing an exam or lab on a given day. The documentation should provide the specific number of dates on which a student cannot attend the class/lab. A grace period for the maximum of three days after the justified absence period (exclusive of Saturdays, Sundays, and official University holidays) will be permitted. After the grace period, the 20% deduction rule will apply.

THIS PUBLICATION/MATERIAL IS AVAILABLE IN ALTERNATIVE FORMATS ON REQUEST. PLEASE CONTACT THE INSTRUCTOR IF YOU REQUIRE AN ALTERNATIVE FORMAT.

The University of Minnesota is committed to the policy that all persons shall have equal access to its programs, facilities, and employment without regard to race, color, creed, religion, national origin, age, marital status, disability, public assistance status, veteran status, or sexual orientation.

Week	Date	Cum.	Topic (tentative schedule)	Reading	Labs
1	Jan 22	1	Ch 1: The Speech Chain	P 1-16	No Lab
	Jan 24	2			
2	Jan 27	3	Ch 2: Linguistic Organization	P 17-30	Lab 1: Unit Conversion
	Jan 29	4			
	Jan 31	5		P 30-40	
3	Feb 3	6	Ch 3: Physics of Sound	P 40-45	Lab 2: Unit Conversion (Continued)
	Feb 5	7			
	Feb 7	8		Final date to register for Audiological Assessment Lab (Lab 12)	
4	Feb 10	9	Ch 3: Physics of Sound		Lab 3: Logarithms & Decibels
	Feb 12	10			
	Feb 14	11			
5	Feb 17	12	Ch 9: Digital Signal Processing	P 185-202	Lab 4: A Scientific Report
	Feb 19	13			
	Feb 21	14			
6	Feb 24	15	Ch 4: Speech Production	P 47-64	Lab 5: Sound Level Measurements
	Feb 26	16			
	Feb 28	17			
7	Mar 3	18	Ch 5: Hearing	P 64-78	Lab 6: Digital Acoustic Analysis
	Mar 5	19			
	Mar 7	20			
8	Mar 10	21	Ch 5: Hearing	P 79-93	Lab 7: Digital Acoustic Analysis (Continued)
	Mar 12	22			
	Mar 14	23			
9	Mar 17-21		SPRING BREAK NO CLASSES		
10	Mar 24	24			Lab 8: Speech Perception & Production
	Mar 26	25			
	Mar 28	26			
11	Mar 31	27	Ch 6: Nerves, Brain, Speech Chain	P 111-128	Lab 9: BrainVoyager Brain Tutor
	Apr 2	28			
	Apr 4	29		P 128-137	
12	Apr 7	30	Ch 7: Acoustic Char. of Speech	P 139-151	Lab 10: Categorical Perception
	Apr 9	31			
	Apr 11	32			
13	Apr 14	33	Ch 8: Speech Perception	P 153-162	Lab 11: Speech Intelligibility
	Apr 16	34			
	Apr 18	35			
14	Apr 21	35	Ch 8: Speech Perception	P 162-183	No Lab
	Apr 23	36			
	Apr 25	37			
15	Apr 28	38	Chapter 10: Speech Synthesis	P 203-218	
	Apr 30	39			
	May 2	40			
16	May 5	41	Chapter 11: Auto. Speech Recogn.	P 219-239	No Lab
	May 7	42			
	May 9	43			
17	Exam#3 (Chapters 6, 7, 8, 10, 11) 1:30 p.m.-3:30 p.m., Thursday, May 15 (20 Shevlin).				