**6.542J, 24.966J, HST.712J LABORATORY ON THE PHYSIOLOGY,
ACOUSTICS, AND PERCEPTION OF SPEECH
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Part 1. Recording Speech in a Sound-Treated Room

Reference

Beranek, L.L. (1954) *Acoustics*, McGraw-Hill, New York, NY, pages 1-15; pages 92-93.

Procedure

A. Record a speech database. Recordings will be made of speech materials on the attached pages. Each lab group member will read the list of words and phrases while inside the sound-treated room. One partner will run the digitizing software from the PC and monitor for pronunciation errors or non-fluencies (these items should be repeated immediately if possible, otherwise at the end of the recording session). To make the recordings, you will need the *Recording in the Eastham Room* handout for reference.

1. Set up the computer system to make recordings. Perform the steps under the following headings on the handout: Turn on the hardware, Logon to the computer, and Configure the anti-aliasing filter. You will make all of your recordings at a sampling rate of 16 kHz.
2. At this point, you are ready to start the recording software. Follow the steps listed under the heading: Recording in Interactive Mode. You should record the list of utterances into five separate files, one each for English vowels, English consonants, Sentences, Rainbow passage, Spontaneous speech, and Prosody sentences. You will need to select a filename for each file.
3. At this point, you will transfer all of your files from the PC in the recording room to the *labc* account on the Linux systems. Follow the steps under the heading: Secure File Transfer.
4. You are now finished with the recording process in the Eastham room. The remaining analysis can be completed at one of the Linux lab computers. Login to one of the Linux

computers. On the Linux computers, you can log in as *labc*. If a window manager does not appear after entering your username and password, type *startx* to begin a window manager. Open an xterm window. Right click the mouse and select an *xterm*.

5. To get in your subdirectory after logging in, type *cd groupx*. You can create further subdirectories under *groupx* by typing *mkdir name*.

6. If you made a subdirectory to hold your data files, change to the directory where you placed your digitized files.

7. Follow the steps under the heading: File Formant Conversion. Convert your five files to the Microsoft wave format.

8. Follow the steps under the heading: Sampling Rate Conversion. Save your files in the Klatt wave format.

9. You can now use xkl to break your five long files into shorter files. For example, cut up the English vowels file into files such as: *beat.wav, bit.wav, bait.wav*, etc. And cut up the English consonants file into files such as: *putt.wav, bug.wav, tug.wav,* etc. Refer to the handout: Using *Klattools on the Unix System*, for details on how to use xkl.

The recordings you make will be used in future labs.

B. Measure the background noise. While in the sound-treated room, use the sound level meter to determine the background noise level. Measure using both the C scale (flat frequency response) and the A scale. Compare this level with that in the Speech Group seminar room. For two of the utterances (the *putt* and the *bug*) read the utterances with the speaker's lips at several different distances from the microphone: 3", 6", 12", and 3 ft.

Measure the peak sound level (C scale) for these words at each of the distances. The speaker should try to say the words with exactly the same level each time. Does the level change with distance in the expected way? Can you explain any differences from the expected change with distance?

Part 2. Spectral Analysis and Waveform Editing by Computer

The main purpose of this laboratory is to get you familiar with the various speech analysis and editing tools that are available in the Speech Group. In future labs you will use various analysis methods to examine some of the utterances that you recorded in Part 1.

In this laboratory, you will only use a few of the utterances that you recorded in Part 1. Two of these should be the utterances "the supper" and "the shutter" (supper.wav and shutter.wav). Make a spectrogram of each utterance by typing *lspecto supper* (CR). When the spectrogram is calculated, it will be in the form of a postscript (ps) file, i.e., *supper.ps* . To print the spectrogram type *lpr supper.ps*. You can delete the ps file when printing is done using the rm command, i.e. *rm supper.ps.* On the spectrogram, measure the durations of the following segments: [s], [ʃ], [ʌ], [p], and [t].

Your report on this lab can be brief. It should include spectrograms and your measurements of the peak level for different distances should be reported, with comments. You may wish to make other comments on the recording procedure.

Materials to be recorded:

A. English vowels

1.	beat	bit	i	ɪ
2.	bait	bet	e	ɛ
3.	pot	but	ɑ	ʌ
4.	boat	bought	o	ɔ
5.	put	boot	ʊ	u
6.	bat	Bert	æ	ɛʵ
7.	buy	boy	ɑɪ	ɔɪ
8.	about		ə	ɑʊ

B. English consonants

9.	the putt	the bug	p	b
10.	the tug	the duck	t	d
11.	the cut	the gut	k	g
12.	the mug	the nut	m	n
13.	the fuss	the vanilla	f	v
14.	the thug	the "the"	θ	ð
15.	the supper	the shutter	s	š
16.	the rug	the lug	r	l
17.	the wonder	the young	w	y
18.	the chump	the jump	•	ǰ

19.	the hut	sung a song	h	ŋ
20.	the /zə/	the /Zə/	z	ž

C. Sentences

21.   teacher

22.   He wanted to rebel.

23.   school

24.   high school teacher

25.   He stopped the rebel.

26.   school teacher

27.   tall school teacher

28.   Was he a high school teacher?

29.   The tall school teacher left early.

30.   teach

31.   We live in Cambridge and we study at MIT.

32.   He won those shoes.

D. Rainbow passage

When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch, with its path high above, and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond his reach, his friends say he is looking for a pot of gold at the end of the rainbow.

E. Spontaneous speech

Describe in detail the room in which you are sitting (hesitations, ah 's, etc., are normal).

F. Prosody Sentences

Please say Bray CUP again.
Please say BRAY cup again.

Please say lake EELS again.
Please say LAKE eels again.

Please say see CADS again.
Please say SEE cads again.

Please say lake ORES again.
Please say LAKE ores again.

Please say see TIES again.
Please say SEE ties again.

Please say bite INNS again.
Please say BITE ins again.

Please say my TEARS again.
Please say MY tears again.