

SPEECH COMMUNICATION
6.541J-24.968J-HST710J
Spring 2004

Problem Set 5

Assigned: 03/09/04

Due: 03/16/04

Problem 1

On the server terminal there are waveforms of a sentence spoken by four speakers --- two female, two male. The sentence is: **The box would contain just a few cookies.**

You are asked to select two of these utterances (one female, one male), and to make several measurements on these sentences.

- a) What are the two shortest vowels in the sentences and what are the two longest vowels? Tabulate these eight durations (4 vowels, 2 sentences).
- b) There are four versions of the consonant /k/ in each sentence. Using a 6.4-millisecond window, display the spectrum just at the time of the release of each of these consonants. The window should be centered just at the release. For each /k/, tabulate the frequency of the major peak, representing the front-cavity resonance for the consonant. Note that these frequencies are different for the different /k/'s and the different speakers. Discuss reasons for these differences in terms of vocal-tract size and tongue-body position.
- c) The sentence contains two versions of /s/, one of /z/, and one of /f/. Display the spectrum of each of these fricatives in turn. Use a 6.4-millisecond window, and calculate an average spectrum over a time interval of 40-80 ms, depending on the duration of fricative. There should be no preemphasis (d=0).

In the case of /s/'s and /z/, make the following measurements:

- (i) frequency and amplitude (in dB) of the peak at high frequencies (above 3500 Hz).
- (ii) maximum amplitude (in dB) in the range of the second and third formants (usually 1300 to 3000 Hz).
- (iii) Calculate difference between (i) and (ii). Discuss your answer. See discussion in text, pp. 398-403.

Do the same measurements for /f/. In this case, there is probably no peak at high frequencies, so just take the maximum amplitude in the frequency range 3500-6000 Hz, corresponding to (i) above for /s/. Discuss the difference in spectrum shape for /f/ and /s/.