

Lab assignment 2: Acoustic cues for place of articulation in stop consonants

1. Read the background papers:

- a) Blumstein SE, Stevens KN. (1979). Acoustic invariance in speech production: evidence from measurements of the spectral characteristics of stop consonants. J Acoust Soc Am. 66(4):1001-17.

http://www.utdallas.edu/~assmann/hcs7367/blumstein_stevens79.pdf

- b) Sussman HM, McCaffrey, HA, Matthews SA (1991). An investigation of locus equations as a source of relational invariance for stop place categorization. J Acoust Soc Am. 1991 90(3):1309-1325.

<http://www.utdallas.edu/~assmann/hcs7367/sussman91.pdf>

2. Download the recordings: Download the recordings of the CV syllables, /ba/, /da/, /ga/, /pa/, /ta/, /ka/ from the class web page:

<http://www.utdallas.edu/~assmann/hcs7367/cvc.zip>

Use these recordings to get started with the measurements.

3. Make recordings of your own productions:

Syllable-initial stops			Intervocalic stops			Syllable-final stops		
/bi/	/ba/	/bu/	/ ibi/	/aba/	/ubu/	/ ib/	/ab/	/ub/
/di/	/da/	/du/	/ idi/	/ada/	/udu/	/ id/	/ad/	/ud/
/gi/	/ga/	/gu/	/ igi/	/aga/	/ugu/	/ ig/	/ag/	/ug/
/pi/	/pa/	/pu/	/ ipi/	/apa/	/upu/	/ ip/	/ap/	/up/
/ti/	/ta/	/tu/	/ iti/	/ata/	/utu/	/ it/	/at/	/ut/
/ki/	/ka/	/ku/	/ iki/	/aka/	/uku/	/ ik/	/ak/	/uk/

2. Static spectral shape model: Use these recordings to investigate the hypothesis that the shape of the spectrum – sampled at the time of burst release – provides invariant cues specifying the place of articulation for the English stop consonants. Use FFT and LPC analysis (see links below) to generate spectral plots for each of the recordings. Classify these as diffuse falling, diffuse rising or compact. Can you think of potential problems for this theory?

<http://www.utdallas.edu/~assmann/hcs7367/fp.m>

<http://www.utdallas.edu/~assmann/hcs7367/lpcp.m>

3. Locus equation model: Locus equations describe the relationship between the frequency of F2 at burst onset and in the vowel. Use TrackDraw (specsynth.m) to estimate the F2 frequency at burst onset and F2 in the vowel for each of the recorded syllables. Make a plot of the locus equations published by Sussman et al. 1991 and superimpose your measured values. How well do the observed data match the predictions of the model?