

## FORMANT FREQUENCY VARIATION AND VOWEL QUALITY

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Two sources of within-phoneme variation have been of major interest to experimental phonetics: 1) context-dependent and 2) speaker-dependent. The relative importance of these sources of variation is examined in the light of natural data and synthetic speech experiments. It is argued that speaker variation is both greater in magnitude and more systematic than context variation. The phonetic import of physical variation must be carefully considered in evaluating this question.

Mermelstein (1978) provides evidence that much of the contextual variation observed thus far is below threshold, and hence perceptually irrelevant. Lindblom's undershoot model for formant variation has been seriously weakened by recent results reported by Gay (1978). Although limited evidence exists for a perceptual mechanism that could compensate for some contextual variation, (Lindblom and Studdert-Kennedy 1967), the degree of complementarity between natural context variation and perception is not clear.

The magnitude of speaker variation is several times larger than that of context variation. Nearey (1977) provides evidence for a detailed complementarity between natural speaker variation and perception in synthetic stimuli. A "constant ratio hypothesis" (CRH) is shown to provide an excellent fit to natural data. Furthermore, an important perceptual implication of CRH is supported in a synthetic vowel experiment: the change in the formant frequencies of a single context vowel is sufficient to produce a global monotonic shift in categorization boundaries of a vowel continuum that covers F1-F2 space.

#### References

- Gay, T. (1978): "Effect of speaking rate on vowel formant movements", *JASA* 63, 223-230.
- Lindblom, B. and M. Studdert-Kennedy (1967): "On the role of formant frequency transitions in vowel recognition", *JASA* 42, 830-843.
- Mermelstein, P. (1978): "Difference limens for formant frequencies of steady-state and consonant-bounded vowels", *JASA* 63, 572-580.
- Nearey, T. (1977). Phonetic feature systems for vowels. Dissertation, University of Connecticut.