

FEEDBACK AND FEEDFORWARD MECHANISMS USED BY SPEAKERS PRODUCING FAMILIAR AND NOVEL SPEECH PATTERNS

G.J. Borden, K.S. Harris, H. Yoshioka, and H. Fitch

Haskins Laboratories, New Haven, Connecticut U. S. A.

Speech has been shown to be remarkably stable despite attempts to interrupt sensory feedback. The present study indicates that speech production control operates somewhat differently when the task involves imitation of unfamiliar utterances. Data were collected on two normal subjects imitating a phonetician producing syllable patterns. Some of the syllables were familiar to the subjects /pi/, pe^t/, /fi/, and /zi/, while others were less familiar /py/, /pø/, /xi/, and /yi/. Subjects repeated the imitations under various combinations of abnormal speaking conditions: nerve block anesthesia, auditory masking, and an artificial extension of the alveolar ridge.

Analysis of the data includes sound spectrograms, EMG recordings of pertinent articulatory muscles, and a test made for listener judgments of the imitations produced under the various conditions.

Results from the first subject show novel utterances to vary more than familiar utterances in vocal tract resonances and in EMG patterns. When the vocal tract area alteration was added to the nerve block plus masking condition, listeners judged the imitations to be worse, as speakers are presumably forced to change positional goals to come close to their auditory perceptual goals. The condition in which the speaker could hear himself despite loss of tactile sensation resulted in higher front cavity resonances and more accurate imitations, indicating that self hearing sharpens the match between vocal tract shape and perceptual goals. Results of the study will be interpreted within the framework of a model of speech production regulation, which operates differently for speech acquisition than for production of skilled speech.

References

- Borden, G.J., K.S. Harris, and L. Catena (1973): "Oral feedback II. An electromyographic study of speech under nerve-block anesthesia", JPh 1, 297-308.
- Borden, G.J. (1976): "The effect of mandibular nerve block upon the speech of four-year-old boys", L&S 19, 173-178.