EXPERIMENTS WITH SHARP FILTERING OF DANISH AND GERMAN VOWELS.

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Some three years ago we started some experiments with sharp highpass filtering of vowels. These experiments were first undertaken in order to throw light on a problem that had arisen in spectrographic measurements, viz. the difficulty in determining the exact F1 peak in spectrograms of vowels with a pronounced "subformant", i.e. an intensity concentration below the first formant pole (perhaps due to nasal coupling or the like). This low-frequency peak, which is often found in German lax vowels, may or may not merge with the F1 envelope, partly depending on the F1 location, and thus raises a methodical problem in sound spectrography. In cases where the F1 envelope is just broadened we face the problem whether to try to determine the actual pole frequency (which cannot in principle be done in any simple fashion with our present methods) or whether to take the centre of gravity observed on the spectrogram (which will be inconsistent with the principles followed in all cases where the subformant is distinguishable from F1).*)

The error that can be introduced when F1 is measured in the presence of a merging subformant, is appreciable. It has, however, been generally claimed that the ear is not very sensitive to differences in the low-frequency region of the speech signal. In order to evaluate whether the contribution of low-frequency energy to the vowel quality is negligible, we have prepared a rather extensive material consisting of Danish and German vowels, long and short, occurring in contexts and isolated, with sharp highpass filtering at different frequencies. The cutoff frequencies used for each vowel

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*) A comparison with standard spectrum envelopes for different types of vowels suggests itself in such cases. - A number of precision analyses of vowels synthesized by JR on OVE II and analysed with the 51 channel analyser were recorded at the Speech Transmission Laboratory in Stockholm in 1965, see STL-QPSR-3/1965, pp. 25f. Envelopes drawn from these spectrograms and provided with indications of the actual pole frequencies will probably be useful in defining the shape of F1 proper in our natural vowel spectra.

are (approximately) 200, 250, 340, 400, 500, 630, 800, and 1000 c/s. (With narrow vowels we did not use the highest cutoff frequencies, since the experiment was to throw light on phenomena associated with the F1 region only.)

A preliminary listening made by ourselves clearly indicated that the distribution of spectral energy below some 200 c/s does indeed not contribute to define the phonetic quality of the sound. Certain other results concerning the quality of vowels with removal of a greater or lesser portion of the F1 region are suggested.