On the vowel source spectrum

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along similar lines from a more comprehensive material in order to gain a broader understanding of stress contours and temporal organization in speech.

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Reference:


B. ON THE VOWEL SOURCE SPECTRUM

Two different methods have been developed for investigating vowel source spectra:

a) Analysis by synthesis

b) Inverse filtering

The analysis by synthesis method was based on spectrum sampling with our 51-channel spectrum analyzer and synthesis by means of a digital computer. This frequency domain method is described in more detail by Tappert, Mártony, and Fant (1).

The inverse filter is described by Fant (2) and Lindqvist (3). It operated in the time-domain providing an output similar to the glottal waveform. The transform of the output to a spectrum was also made with the 51-channel analyzer.

The speech material used in the present study are different steady state vowels produced by a single speaker with normal voice effort.

F.M. recordings were made for the inverse filtering analysis in order to avoid phase distortion when studying wave forms. The F.M. system had a high frequency cutoff of 2.5 k/s.

Fig. 1-5 shows the deviations of the source spectra from a reference 12 dB/oct falling source. The solid lines
Fig. 1-5. Source spectra of subject O.F., normalized with respect to -12 dB/octave. Solid curves from harmonic spectrum matching, broken curves from inverse filter analysis.

Fig. 1-6. Mean source spectrum normalized with respect to -12 dB/oct, speaker O.F. from harmonic spectrum matching.
pertain to the analysis by synthesis method, the dotted line to the inverse filter methods.

Both methods show similar results; with the inverse filter method the high frequency limitation is in part due to the frequency-modulated tape-recording system, in part to the lower signal to noise at higher frequencies.

In the analysis by synthesis method the accuracy at higher frequencies (over 2.5 kc/s) is impeded by possible errors of the higher pole correction. We used a correction correlated to the frequency of the fourth pole (formant 4).

Fig. 1-6 shows the mean normalized spectrum for the same speaker. Similar source spectra for other speakers have been reported earlier (1). For speaker O.F. the source spectrum is falling more than 12 dB/oct and the 800 c/s zero commonly observed is not so pronounced here in conformity with a relative smooth glottal wave shape.

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References: