

Dept. for Speech, Music and Hearing  
**Quarterly Progress and  
Status Report**

**Studies of voice pathology by  
means of inverse filtering**

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journal: STL-QPSR  
volume: 3  
number: 1  
year: 1962  
pages: 006-006



**KTH Computer Science  
and Communication**

<http://www.speech.kth.se/qpsr>



### C. STUDIES OF VOICE PATHOLOGY BY MEANS OF INVERSE FILTERING

The field of research indicated by the title above has not yet been subjected to a thorough investigation. The data presented here are merely intended to exemplify analysis techniques.

During a visit of Mr. B. Briess of the State University of New York, Upstate Medical Center, Syracuse, we made tape-recordings of sustained vowel sounds most of which were intended to exemplify a voice production with extreme muscle dysfunction as well as sub-glottic over-compression. A frequency modulation technique was used in the tape-recordings for preserving a frequency response down to DC.

Results for a hoarse voice characterized by "complete absence of cricothyroid function during phonation" are given in Fig. I-3 which contains spectrograms, sections, oscillograms, and the inverse filter curve run synchronously with the oscillograms. The oscillogram and the inverse filter curve were recorded on the Mingograph ink recorder. These two time functions are presented with a highly expanded time scale and represent the last 400 msec of the sustained passage.

The inverse filtering technique is not finally established and there remains several difficulties, e.g. the shifts in DC static pressure level and possible ringing effects in the filter unit. There can be seen, however, a clear tendency of a highly irregular vocal frequency and double excitation within a natural voice period. The double excitation is especially apparent in the inverse filtering curve. It appears as if the subjective pitch as sensed by the particular speaker corresponded closer to the number of glottal excitations per second than to the number of complete vocal periods per second and is thus higher than the basic periodicity pitch.

B. Briess, G. Fant

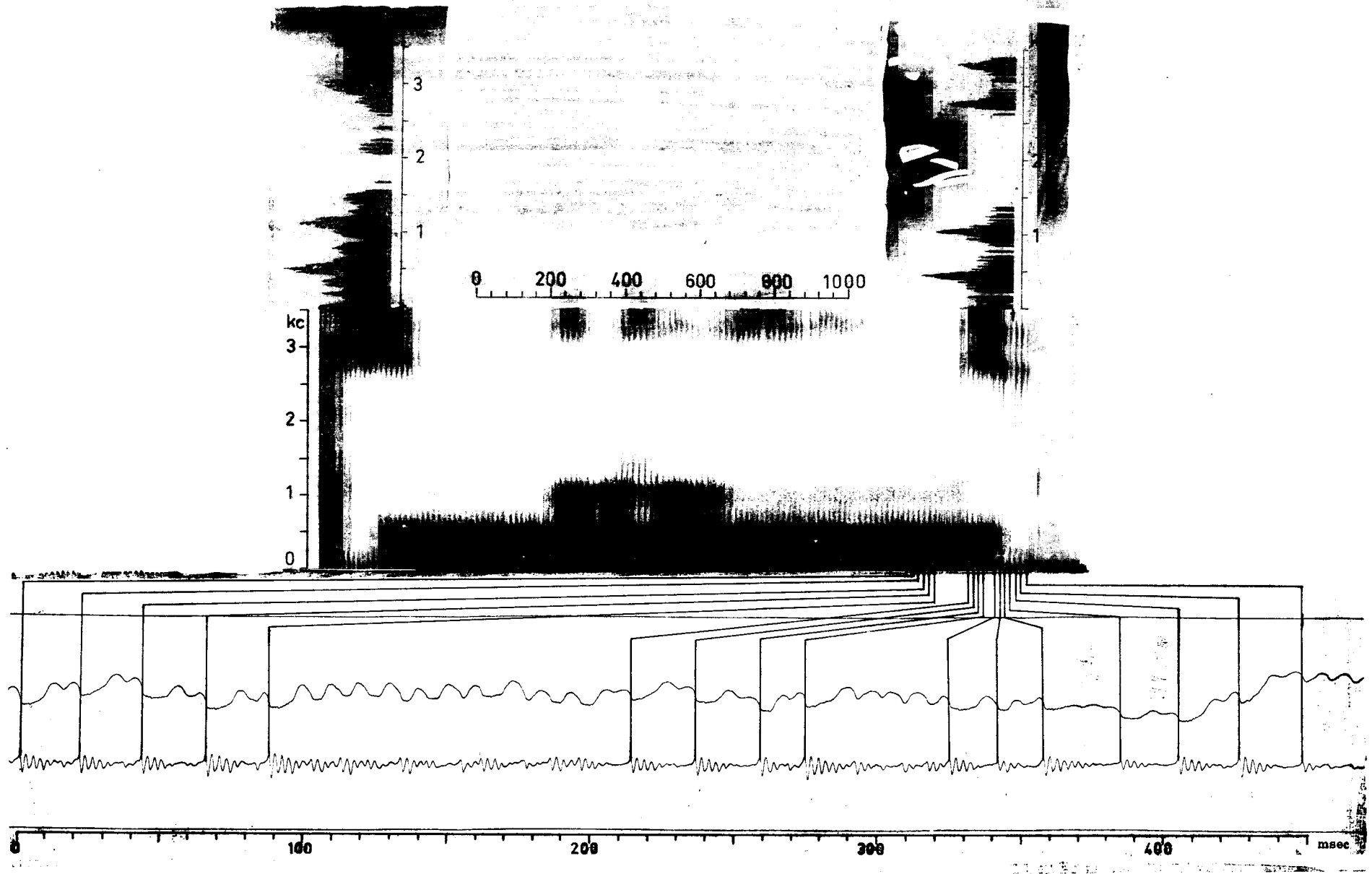


Fig. I-3. Section, spectrogram, inverse filter curve, and oscillogram of sustained vowel. Corresponding glottal pulses on spectrogram and oscillogram are indicated.