ACOUSTICS2008/2694
Experimental analysis of the relationship between the glottal flow and glottal area waveforms

Raphael Schwarz and Dimitar Deliyski
University of South Carolina, 1621 Greene St, Williams Brice Building, 6th Fl, Columbia, SC 29208, USA

A very important but little studied aspect of human voice production is the relationship between the vocal fold vibration and the transglottal airflow. To analyze this relationship, in this study we combined high-speed videoendoscopy of the glottis for determining the glottal area waveform (GAW) with inverse filtering of the acoustic signal for estimating the glottal flow waveform (GFW). The high-speed camera system, recording at 20,000 pps, and the audio recording hardware were triggered by the same quartz oscillator to achieve synchronization with an unprecedented accuracy within 25 μs. We developed an image processing algorithm for automatic extraction of the GAW from the high-speed images. The high-speed video samples and the corresponding acoustic signals were obtained from 12 normophonic individuals (6 male, 6 female) for different voicing conditions: register (pulse, modal, falsetto); adductory adjustment (loose, normal, pressed); longitudinal tension within modal register (low, comfortable, high pitch); non-stationary phonation (variation in pitch and loudness). To compare the resulting GAWs and GFWs, the waveforms were parameterized concerning their temporal and spectral features. It is shown, that the revealed relationships between the vocal fold vibrations and the transglottal flow are comprehensible by accounting the different phonation conditions.
[Work supported by NIH.]