

## Thesis Abstract

# Investigations of the Acoustics of the Vocal Tract and Vocal Folds *in vivo*, *ex vivo* and *in vitro*

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The acoustic impedance of the vocal tract filter was measured *in vivo* from 10 to 4200 Hz with the glottis closed and during phonation. Frequencies, magnitudes and bandwidths were measured for the acoustic and for the mechanical resonances of the surrounding tissues. The energy losses in the vocal tract were five-fold higher than the visco-thermal losses of a dry, smooth rigid cylinder, and increase during phonation. Using a simple vocal tract model and measurements during inhalation, the resonances of the subglottal system were also estimated.

In a separate experiment excised larynges were used to investigate the control of the voice fundamental frequency by either air supply or mechanical control. All else equal, and excluding the discontinuities and hysteresis observed, the fundamental frequency was approximately proportional to the square root of subglottal pressure. Additionally, airflow through the glottis caused a narrowing of the aryepiglottic larynx in the absence of muscular control.

Finally, possible effects of the filter on the source were demonstrated using a water-filled latex vocal fold replica: changing the aero-acoustic load of the model tract by inserting a straw at the model lips, a technique used in speech therapy, changed the fundamental frequency.

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