

## INVESTIGATION OF PULMONIC ACTIVITY IN SPEECH

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Although it has been known since ancient days that the pulmonic system provides the air under pressure required by almost all speech sounds, there is still considerable controversy surrounding the question of whether there is any active short-term pulmonic involvement in the production of specific speech segments (e.g., aspirated stops) or of stressed syllables. Since the only way the pulmonic system can actively contribute to speech production is by varying the volume of the chest cavity, we sought to shed some light on these issues by recording, in three adult male speakers of English, lung volume (as transduced by a whole-body pressure plethysmograph) along with (combined) oral and nasal airflow and the voice signal during a variety of utterance types. Fundamental frequency was extracted and averages formed of all parameters. Figure 1 shows a sample of the averaged data. The lung volume function was characterized by a momentary slowing of the rate of decrement (in comparison to an estimated 'normal' or background rate) during the production of stop closures (upward arrow) and a quickening of the rate of decrement during fricatives, [h], aspirated stop release, and the production of heavily stressed syllables (downward arrow). In all cases but the last, the variation in lung volume could be interpreted as passive reactions to changing lung pressure occasioned by changes in glottal and/or supraglottal impedance. Only heavily stressed syllables were invariably accompanied by active changes in lung volume. (Work supported by the National Science Foundation and the National Institutes of Health.)

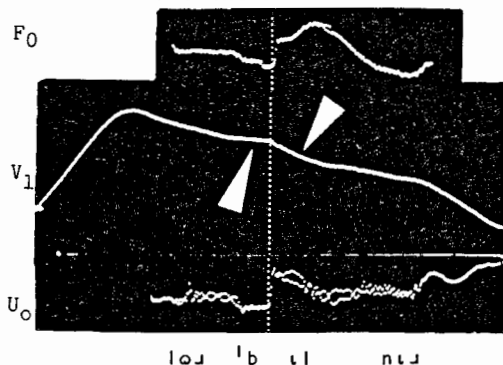


Figure 1. Averaged fundamental frequency ( $F_0$ ), lung volume ( $V_1$ ), and oral airflow ( $U_0$ ) during the utterance 'Lure Bill near', [l<sup>h</sup>o<sup>h</sup> 'b<sup>h</sup>il n<sup>h</sup>i:] as produced by an adult male speaker of English. The dotted vertical line marks the synchronization point used to form the averages.