Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Cycle-to-cycle analysis of jet dynamics in a scaled up vocal fold model[1] TIMOTHY WEI, Northwestern, HUNTER RINGENBERG, DYLAN ROGERS, UNL, NATHANIEL WEI, CalTech, MICHAEL KRANE, Penn State ARL — Phase-averaged and cycle-to-cycle analysis of key contributors to sound production in phonation were examined in a scaled-up vocal fold model. Simultaneous temporally and spatially resolved pressure and velocity measurements permitted examination of the streamwise integral momentum equation. Phase-averaging showed that transglottal pressure serves as a surrogate for vocal fold drag, while time traces of transglottal pressure and volume flow rate provided insight into the role of cycle-to-cycle variations on voice quality and perception. These latter findings are the focus of this talk. Experiments were conducted in a water tunnel using 2-D, 10x scaled-up vocal fold models with semi-circular ends. These were computer driven inside a square duct with constant opening and closing speeds. DPIV and time resolved pressure measurements along the duct centerline were made for Reynolds numbers from 3650 to 8100 and equivalent life frequencies from 52.5 Hz to 105 Hz. Cycle-to-cycle variations, including jet switching and modulation, were omnipresent despite their high degrees of symmetry and repeatability. The observed variations in jet motions were found to correlate with cycle-to-cycle variations of terms in the integral momentum equation related to sound production. As such, these variations may play an important role in sound quality and perception. The origins of these variations are discussed.

[1]Support from NIH 5R01 DC005642-14 is gratefully acknowledged

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Date submitted: 07 Aug 2020 Electronic form version 1.4