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Overtone focusing in Tuvan throat singing

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This study examines the biomechanics of a unique style of phonation, commonly referred to as “Tuvan throat singing” (Tuva is part of Russia close to Mongolia). It is characterized by overtones (i.e., harmonics) of the the source (i.e., vibrating vocal folds) being “focused” into a single concentrated formant, which can then be manipulated in frequency. The underlying biomechanical mechanisms are not well understood. Here, data were collected from a group of Tuvan singers (Huun Huur Tu) in two different forms. First, audio recordings were made in an acoustic isolation booth for detailed spectral analysis. Spectrograms revealed dynamical properties going into and out of the focused state, with relatively rapid transitions (~100-200 ms). Second, one of the singers was scanned by MRI during phonation. Images (and associated audio) of two types were made: volumetric (3-D volume scan during steady-state phonation) and dynamic (single sagittal slice with a frame rate of ~3.6 Hz). From these, area functions and articulator positions could be extracted and used in a computational model of sound production. Initial modeling efforts have successfully reproduced the steady-state condition, with a further goal to now characterize how articulator position affect the rapid transitions and frequency shifts of the focused state.

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