

2019 MidWinter Meeting  
Association for Research in Otolaryngology (ARO)

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Title:  
Overtone Focusing in Tuvan Throat Singing

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Abstract:  
"Throat singers" from central Asia are well known for their unique song vocalizations. In particular, singers from Tuva (a federal subject of Russia) have become popularized in part due to the exploits of the late physicist Richard Feynman. A salient example is "Khoomei", a style that creates an otherworldly yet organic sound. Deeply steeped in folk tradition, Tuvan "overtone singing" is achieved without the aid of external apparatus (e.g., a lamellophone). However, the underlying vocal tract biomechanics required for throat singing are not well understood. To elucidate such mechanisms, this study combines several approaches: detailed spectral analysis of a variety of song from several Tuvans, dynamic and volumetric structural MRI of a Tuvan singer, and computational airway modulation modeling. Preliminary results indicate that singers produce source patterns that give rise to a dense array of harmonics (i.e., "overtones"), which are kept relatively stable across time. Singers simultaneously modify their vocal tract to create narrowly "focused" filter states [i.e., highly accentuated formant(s)] that can be modulated independent of the source and other focused states (if present). Model results suggest a focused state arises from a singer's ability to merge two formants to (greatly) enhance the amplitude of one or two harmonics. Tongue tip position and inclusion of the piriform cavities appear important to help produce a focused state, while position of the back of the tongue controls aspects of "pitch". Comparisons are also explored with "Western" singers, who produce overtone focused song that has both significant similarities and differences relative to the Tuvans.