

ACOUSTICS2008/2265 Resonance characteristics of the hypopharyngeal cavities

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The hypopharyngeal cavities are the narrow, complex parts of the lower vocal tract that include the supra-glottal laryngeal cavity and bilateral cavities of the piriform fossa. These small regions exhibit rather strong acoustic influence on vowel spectra in the higher frequencies and contribute to determining voice quality and speaker characteristics. The laryngeal cavity functions nearly as a Helmholtz resonator to generate an extra formant in the vicinity of 3 kHz, and the piriform fossa forms a pair of side-branches of the vocal tract to cause spectral zeros in the vicinity of 4-5 kHz. Vocal-tract models without employing these acoustic effects can hardly simulate natural-sounding voices of a particular speaker. Therefore, realistic acoustic models of vowel production must include the three functional components: glottal source sounds, hypopharyngeal-cavity coupling, and resonance of the vocal-tract proper. This presentation demonstrates the results from acoustic experiments on solid vocal-tract models and computer simulations of the cavities' effects based on our MRI-based visualization of the vocal tract. A possible control for singing voice qualities will be discussed based on the three-component model.