

Ingo Titze, Associate Editor

# Mixed Registration

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IT IS WELL ACCEPTED that there are two anchors in voice registration, assuming that vocal fry and whistle voice are not included but treated as separate register categories. The two anchors have various names. One is called chest voice, full voice, or modal voice, which is described by a vibratory mechanism that some have labeled M1.<sup>1</sup> Acoustically, harmonic energy above the fundamental dominates the sound spectrum in this register. The other anchor is called falsetto or light head voice, which is described by a vibratory mechanism labeled M2. In this register, energy in the fundamental frequency dominates the spectrum acoustically. Much debate is still ongoing about registrations between these two anchors, all of which fall into the category of mix, mixed registration, or *voix mixte*.<sup>2</sup>

Disagreement exists about the gradual nature in which mixed registration can be achieved. Is there a continuous progression of mixed registrations, or are there stair-steps that deserve special names or categories? One argument is that the two mechanisms (M1 and M2) are distinct and cannot be mixed.<sup>3</sup> Thus, there would be a chest (M1) mix and there would be a falsetto or head voice (M2) mix. In their argument, the mixing is not mechanical in terms of vocal fold vibration, but rather acoustic and perceptual. One can perceive a smooth register transition, but a quantal shift always takes place in the mechanism of vibration. The sudden register shift is simply camouflaged by vowel modification or compensatory adjustments in adduction or lung pressure. Evidence for this argument comes from electroglottography (EGG), which often shows a discontinuity in vocal fold contact area in a perceptually smooth pitch glide through the *zona di passaggio*.<sup>4</sup>

A competing argument is that the two mechanisms of vibration can merge to become themselves continuous. Tensions in the tissue layers of the vocal fold (ligament and TA muscle), as well as the medial surface shape, can be balanced so that a smooth transition occurs in the vibratory pattern.<sup>5</sup> A bi-stable system can become stable anywhere, but it may require much practice to achieve stability in the mixed configuration, particularly for people who have been habilitated in one of the anchor registrations. For example, if a person's speaking voice has been driven toward chest registration in normal development, cultivating and maintaining the mix may be a life-long struggle. Less often, but also possible, if falsetto voice has been the model in development, obtaining the mix may also be a struggle. Contrary to both of these examples, if mixed registration has been the default in one's speaking voice for many years, little practice is needed to maintain stability in mix for singing. It is only a matter of shading the mechanism in one direction or the other.

Research is still ongoing to settle on one or the other explanations of mix. If voice registration were only a laryngeal phenomenon, as it was once thought to be, the answer would clear today. However, now that we understand that the sound source and the airway resonator (the filter) cannot be separated in singing, sudden shifts in the sound output spectrum resulting from harmonic-resonance interaction can be perceived as a registration.<sup>6</sup> This is particularly the case with the many versions of mix. A vowel change can be perceived as a register change even if the source is stable. More importantly, a vowel change can trigger a change in the source mechanism.<sup>7</sup> Thus, with multiple harmonics interacting with multiple resonances on multiple pitches, a simple explanation of mixed registration is not likely to be forthcoming soon. Perhaps the best we will be able to say is something like this: “On this note, there is a 30% mix on the continuum between chest voice and falsetto (laryngeally), with a reinforcement of specific harmonics in the series  $1f_0, 2f_0, 3f_0, \dots$  by resonances (formants) in the series  $F_1, F_2, \dots$ ” Such an explanation, however cumbersome, would be consistent with musical acoustic descriptions of orchestral instruments. However, perceptual labels such as chest-mix and head-mix will be difficult to avoid, mainly because singing teachers rely on perception more than the underlying physics, and rightfully so.

## NOTES

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5. I. R. Titze, “Bi-stable vocal fold adduction: A mechanism of modal-falsetto register shifts and mixed registration,” *Journal of the Acoustical Society of America* 135, no. 4 (April 2014): 2091–2101.
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**Ingo R. Titze** is Distinguished Professor of Speech Science and Voice at the University of Iowa and Executive Director of the National Center for Voice and Speech at the University of Utah. His formal education is in physics and electrical engineering, but he has devoted much of his studies to vocal music and speech. Dr. Titze has published more than 400 articles in scientific and educational journals, coedited two books titled *Vocal Fold Physiology*, and now has three books in print: *Principles of Voice Production*, *The Myoelastic Aerodynamic Theory of Phonation*, and *Fascinations with the Human Voice*. He has lectured throughout the world and has appeared on such educational television series as *Innovation*, *Quantum*, and *Beyond 2000*. He is a recipient of the William and Harriott Gould Award for laryngeal physiology, the Jacob Javits Neuroscience Investigation Award, the Claude Pepper Award, the Quintana Award, and the American Laryngological Association Award. He is a Fellow and a Silver Medalist of the Acoustical Society of America, and a Fellow of the American Speech-Language-Hearing Association. Dr. Titze has served on a number of national advisory boards and scientific review groups, including the Scientific Advisory Board of the Voice Foundation and the Division of Research Grants of the National Institutes of Health. In addition to his scientific endeavors, Dr. Titze continues to be active as a singer. He is married to Kathy Titze and has four children and eight grandchildren. Mail should be addressed to Ingo R. Titze, National Center for Voice and Speech, 330 WJSHC, Iowa City, IA 52242. Telephone (319) 335-6600.

## ANNIVERSARY FACTOID

NATS was born on March 23, 1944. The Association’s first publication appeared in October of that year. It was called *The Bulletin*, and the editor was Homer Mowe.