

Ingo Titze, Associate Editor

Some Consensus Has Been Reached On The Labeling Of Harmonics, Formants, And Resonances

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A GROUP OF 22 VOICE PROFESSIONALS engaged in vigorous debate about symbolic notation and definitions in voice acoustics for a period of about two years. The group included singing teachers, speech-language pathologists, and voice scientists from the U.S., Europe, and Australia. A forum publication resulted in the *Journal of the Acoustical Society of America* with all authors listed.¹

The first recommendation was regarding the symbol for fundamental frequency. The symbol f_o was agreed upon, written with a lower case f and a subscript “o,” not “zero.” The reason given was that a “zero” frequency does not fit into the harmonic series of the sound source. The fundamental frequency is the first harmonic, not the zero-th harmonic. The subscript “o” was appealing because it could signify “oscillation.”

The second recommendation was to write all harmonics as multiples of f_o , namely $f_o, 2f_o, 3f_o, \dots, nf_o$. This recommendation makes future use of the symbol h or H totally superfluous. Consensus was somewhat difficult to reach on this issue because a significant number of papers and textbooks have been written with h and H labels for harmonics. In conjunction with the above frequency symbols, the amplitudes of harmonics are written as $A_1, A_2, A_3, \dots, A_n$. If they are converted to decibels, the relative dB levels of the harmonics are written as $L_1, L_2, L_3, \dots, L_n$.

With regard to vocal tract resonance, much debate ensued about keeping a distinction between formants and resonances. Based on classical definitions, formants are peaks in the spectrum of the sound output from the mouth. They can be influenced by both the source and the filter (vocal tract). To the contrary, resonances of the vocal tract should (in principle) not contain source characteristics. Keeping source and filter characteristics completely separate is difficult in practice, however, because there is interaction. Recommendations were to symbolize resonance frequencies as $f_{R1}, f_{R2}, f_{R3}, \dots, f_{Rm}$ and keep traditional formant frequency symbols as $F_1, F_2, F_3, \dots, F_m$. The choice for capitol F for frequency was not without reservation, but it was argued that historical precedence is too great to reverse this convention. Relative dB levels for formant peaks are described with the symbol $L_{F1}, L_{F2}, L_{F3}, \dots, L_{Fm}$, and relative dB levels for vocal tract resonances are described with the symbols $L_{R1}, L_{R2}, L_{R3}, \dots, L_{Rm}$.

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The complete list of symbols also included formant and resonance bandwidth, but given that these are of less importance in voice pedagogy, they will not be listed here. The reader is referred to the reference given below.

NOTE

1. Ingo R. Titze, Ronald J. Baken, Kenneth W. Bozeman, Svante Granqvist, Nathalie Henrich, Christian T. Herbst, David M. Howard, Eric J. Hunter, Dean Kaelin, Raymond D. Kent, Jody Kreiman, Malte Kob, Anders Löfqvist, Scott McCoy, Donald G. Miller, Hubert Noé, Ronald C. Scherer, John R. Smith, Brad H. Story, Jan G. Švec, Sten Ternström, and Joe Wolfe, "Toward a Consensus on Symbolic Notation of Harmonics, Resonances, and Formants in Vocalization," *Journal of the Acoustical Society of America* 137, no. 5 (May 2015): 3005–3007.

Little Lamb,
 Here I am;
 Come and lick
 My white neck;
 Let me pull
 Your soft Wool;
 Let me kiss
 Your soft face:
 Merrily, Merrily, we welcome in the Year.
 William Blake, "Spring" (vs. 3)



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