Scott McCoy, Associate Editor

Nasality Deconstructed

Nicholas Perna

Nicholas Perna

"If a sound comes through the nose, and there is no voice teacher to hear it, is it nasal?"

If you are like me and spend any time at all on the varying singing or voice teaching forums on social media, you likely have come across at least one thread mentioning nasality. Inevitably many confusing terms arise in these conversations, such as nasal resonance, twang, velopharyngeal opening (VPO), and nasalance. Johan Sundberg, in his plenary address to the NATS National Conference in Las Vegas, gave mention of the fact that VPO seems to be a hot topic recently. I have previously published on nasality in this journal, demonstrating the possibility that Western classical tenors may employ more nasalance, a measurable acoustic oral and nasal signal, near their pivot pitch in *passaggio* in order to smooth their transition to full operatic head voice.[1] This was a follow up study to Birch et al.[2] The purpose of this column is to distill some of the more recent information regarding nasality and to present a foundation for the framework that nasality involves multiple issues, rather than a singularly caused event.

What nasality is does not often coincide to its perceptual characteristics. A recent study on nasality perception demonstrated that professional voice teachers did not agree on which sounds were nasal and which were not.[3] Participating teachers rated a recorded example containing one of the lowest rates of nasalance as one of the most nasal samples they heard, with over three-quarters of the listeners rating the sample between "partially nasal" and "extremely nasal." The column concluded, "The pervading issue is the manner in which the voice pedagogy community interprets a nasal sound, rather than an overall disagreement on whether or not nasality is inherently good or bad."[4] Psychoacoustics, the scientific study of how sound is perceived, may prove to be the most effective tool to determine why we perceive sounds as nasal.

TERM BY TERM: NASALITY OR NOT?

Nasal resonance is a term I find to be unclear and potentially the most divisive. Resonance itself is a challenging term, whether or not it relates to sound coming from the nose. The question is how nasal resonance is defined. Is nasal resonance meant to be the brightness of twang that comes from pharyngeal narrowing leading to increased energy in the 4–7 kHz range? Expert listeners may refer to this sound as nasal, but, physiologically, pharyngeal constriction occurs separate from the nose. It is likely that the singer previously mentioned in the recording with low nasalance, but a high degree of perceived nasality, was demonstrat-

Journal of Singing, March/April 2020
Volume 76, No. 4, pp. 429–432

ing twang. If not twang, is nasal resonance meant to be acoustic signal from the nose? Is nasal resonance meant to be airflow from the nose? There has not been sufficient evidence to suggest that acoustic signal or airflow from the nose causes perceived nasality. Since resonance can be defined as amplification and enrichment, nasal resonance may be a misnomer in any discussion of nasality. The nasal passage does little to amplify sound, and equally does little to enrich a sound because it attenuates vocal tract resonances. I would propose eliminating the term "nasal resonance" altogether.

One of the most common culprits of nasal confusion is *twang*, a term commonly used in the CCM world, particularly among those trained in Estill Voice. The Estill Voice International website lists twang as one of their "Six Voice Qualities"; interestingly, they divide the term into nasal twang and oral twang.[5] Gillyanne Kayes, an Estill trained, UK based teacher, described twang as resulting from a "tightened aryepiglottic sphincter, with high larynx and tongue."[6] Coming from a Western classical background and having previously used McKinney's *Diagnosis and Correction of Vocal Faults* as a textbook for my pedagogy courses,[7] I had been accustomed to teaching twang as a resonance fault. Thanks to many of our colleagues teaching and researching CCM styles, I now realize twang's importance in commercial voice training and performance. The Western classical teacher in me still recognizes that excess squeeze of any laryngeal musculature is less than ideal for unamplified singing. Recent work by Kerrie Obert, a Speech Language Pathologist and Estill trained singing teacher at Capitol University, who also conducts research at The Ohio State University, has demonstrated that twang voice quality may be more of a result of middle pharyngeal constrictor activation, rather than the previously thought aryepiglottic activity.[8] Obert was joined by Chadley Ballentyne in a recent NATS Chat titled "Getting the Twang of It," where they unpacked both perceptual and physiologic characteristics of twang.[9] There is more work to be done to further clarify the physiologic source of twang; however, the important point is that twang increases high frequency energy, can be produced with little or no VPO, and can have extremely low nasalance. *Twang most likely is not nasality, even though it might sound nasal to some listeners.*

Velopharyngeal opening is what the name implies, a relaxation of the velum (soft palate), which couples the nasopharynx and nasal passage with the rest of the vocal tract. The sound quality produced by a high percentage of VPO may be considered by some to be true nasality. The nasal passage is lined with moist mucous membrane. As such, sound does not fare well when passed through the nose. All spectral peaks that pass through the nose end up being attenuated to varying degrees. This type of dampening can be particularly detrimental to those frequencies in the first vocal tract resonance (fR^1) range (300–800 Hz), which singers rely on for open (3_fo or 2_fo:f R^1) and whoop (1_fo:f R^1) timbre singing as described by Kenneth Bozeman.[10] Depending on how you perceptually qualify nasality, *VPO might be nasality but may not perceptually sound nasal.*

Indulge me in a brief foray into the speech science world. Nasalance, as measured with a nasometer, is an acoustic measurement of two microphones, divided by a mask or divider plate, that becomes a ratio of the amplitude of the nasal signal divided by the oral signal added to the nose signal [$A_n/(A_o+A_n)$ x 100%]. A more accurate terminology for this is First Formant (F1) Nasalance, as described by Martin Rothenberg.[11] He termed it as such because in this resonance model there is attenuation of frequencies outside of 300–750 Hz (roughly the range of F1), and therefore sensitivity to vowels was a problem because the F1 locations of most sung vowels are found within that frequency range. The newer Glottal Enterprises OroNasal system measures nasal-to-oral airflow volume-velocity at the fundamental frequency. Rothenberg defines this measure as "flow derived F_0 nasalance." If you are attempting to measure airflow and acoustic signal coming from the nose to confirm VPO, F_0 nasalance is a better alternative. There has not been a study that demonstrated whether or not nasalance creates perceptible nasality. Birch et al. attempted to have expert listeners identify which examples demonstrated nasality, but the results were inconclusive.[12] *Nasalance might be nasality but may not perceptually sound nasal.*

VPO, NASALANCE, AND REGISTER TRANSITIONS

Subsequent research by Gill et al. suggests that utilizing VPO can be an effective strategy at smoothing register transitions.[13] Their team advocates for utilizing a narrow VPO to navigate *passaggio* because it attenuates

F1, increases the level of higher frequency partials, and reduces the risk of vocal tract instabilities, which brings us back to my 2014 *Journal of Singing* article.[14] Because the data from that study was collected in 2008, I measured only F1 nasalance, which has proven to be vowel sensitive. As such, correlations I was making to increased nasalance near pivot points such as F4 on the /a/ vowel in the tenor voice may have been false readings, caused by the boost of energy in 2_fo from its interaction with fR[1]. It is possible that there was an increase in nasalance and/or VPO in those samples, but given that the microphones were attenuating frequencies away from the fR[1] of the vowel /a/, 2_fo:fR[1], interaction might have resulted in a falsely high perception of nasalance. This latest Gill et al. study demonstrates that some professional singers do utilize VPO and that VPO is a strategy a singer has to increase energy between 2–4 kHz in relation to that of F1, leading to reduced instability and a smoother register transition.[15]

I often am contacted about whether or not I use VPO when training male students—and potentially female students—in their navigation of *passaggio*. Similar to many other pedagogic tools, the answer is, sometimes. I often have used this as a strategy with amplified singing (CCM styles), where acoustic power is not of paramount importance. While I do not dispute the Gill et al. findings, I have yet to see evidence that VPO does not lead to potential problems. Scott McCoy has warned about utilizing nasality to navigate *passaggio*, and that to do so may be to the detriment of aesthetic vocal beauty.[16] I would consider similar caution to Western classical singers who may choose to utilize VPO in lieu of finding laryngeal poise to eliminate vocal tract instabilities. When turning the voice, robust tenor, baritone, and bass voices tend to engage a higher resonance strategy such as 3_fo:fR2 or 4_fo:fR2, as has been written about extensively by Donald Miller.[17] Often when robust operatic voices achieve this resonance strategy, an increased contact quotient follows due to increased subglottal pressure as pitch rises.[18] If that resonance strategy is the goal of a singer, the VPO strategy may be counterproductive. There is potential that the coupling of the nasal cavity with the vocal tract could lower contact quotient, which may reduce the possibility for the singer to utilize the resonance strategy used by many of the great opera singers as Miller and others have documented. I have seen anecdotal evidence of this in our lab.

WHAT IS NASALITY?

The tree falling in the forest is often the beginning of the philosophic debate of perception versus reality. The nasality construct may be the finest example of this in the singing realm. Voice teachers primarily deal in the reality of perception. Voice scientists can exist more in the reality of measured results. If singing has been measured as demonstrating significant amounts of VPO or nasalance, and yet voice teachers do not agree that the sound of high or low VPO corresponds to high or low levels of perceived nasality, then the physical attributes of sound waves resonating from the nose or of increased airflow through the nose may not provide the answer to what nasality is.

The field of singing voice psychoacoustics is in its infancy. Ian Howell sought to bring the singing voice into the field of music cognition and create a framework to analyze perceptual characteristics of singing.[19] In recent correspondence about the psychoacoustic qualities of nasality, he pointed out the spectra of a nasal continuant such as /ng/ will be a strong fundamental frequency with a steep roll off of harmonics following.[20] This aligns with the idea of the nasal cavity attenuating resonances. In our discussion, Howell compared nasality to the construct of auditory roughness, a subject he has written on in *VOICEPrints*.[21] "Auditory roughness is a perceptual phenomenon that occurs when multiple conditions have been met simultaneously."[22] This best describes my own current thinking about nasality. Nasality is a percept that arises when multiple conditions, which have yet to be definitively determined, are met simultaneously. In other words, nasality is what I propose we call a voice construct. Here's to the tree falling in the forest and the voice teacher realizing that it only sounded nasal if they were there to hear it.

NOTES

1. Nicholas Perna, "Nasalance and the Tenor *Passaggio*, *Journal of Singing* 70, no. 4 (March/April 2014): 402–410.
2. Peer Birch, Bodil Gumoes, Hanne Stavad, and Johan Sundberg, "Velum Behavior in Professional Classic Operatic Singing," *Journal of Voice* 16, no. 1 (April 2002): 61–71.

3. Nicholas Perna, "Nasality: Do You Hear What I See?" *VOICEPrints* 12, no. 1 (September/October 2015): 6–7.
4. Ibid.
5. https://www.estillvoice.com/pages/about-estill.
6. Gillyanne Kayes, *Singing and the Actor* (New York: Routledge Press, 2000), 147.
7. James McKinney, *The Diagnosis and Correction of Vocal Faults* (Long Grove, IL: Waveland Press, 1994), 134.
8. K. Obert and K. Perta, "Big Twang Theory" (Paper presented at the Estill World Voice Symposium, Quebec, Canada, 2017).
9. Chadley Ballentyne and Kerrie Obert, interview by Kari Ragan, "Getting the Twang of It" (NATS Chats, January 13, 2019); https://.youtube.com/watch?v=KHjbqUYrb04 (accessed November 18, 2019).
10. Kenneth Bozeman, *Practical Vocal Acoustics* (Hillsdale, NY: Pendragon Press, 2013).
11. Martin Rothenberg, "Mask Based Nasometry: A New Method for the Measurement of Nasalance"; http://www.rothenberg.org/Naalance/Naalance.htm (accessed November 18, 2019).
12. Birch et al.
13. Brian P. Gill, Jessica Lee, Filipa M. B. Lã, and Johan Sundberg, "Spectrum Effects of a Velopharyngeal Opening in Singing," *Journal of Voice* (forthcoming) (accessed November 18, 2019).
14. Perna, "Nasalance and the Tenor *Passaggio*."
15. Gill et al.
16. Scott McCoy, "The Seduction of Nasality," *Journal of Singing* 64, no. 5 (May/June 2008): 579–582.
17. Donald G. Miller, *Resonance in Singing* (Princeton, NJ: Inside View Press, 2008).
18. Ibid., 60.
19. Ian Howell, "Parsing the Spectral Envelope: Towards a General Theory of Vocal Tone Color" (DMA thesis, New England Conservatory of Music, 2016).
20. Ian Howell, Facebook direct message with the author (July 6, 2018).
21. Ian Howell, "Necessary Roughness in the Voice Pedagogy Classroom: The Special Psychoacoustics of the Singing Voice," VOICEPrints 14, no. 5 (May/June 2017): 4–7.
22. Ibid.

Dr. Nicholas Perna is Associate Professor of Voice and Voice Pedagogy at Mississippi College. He is a Presser Music Foundation awardee and currently a voice research associate at the University of Mississippi Medical Center. His primary research areas are Laryngeal Manipulation and Singing Voice Acoustics. Perna has presented research on three continents at notable events such as the International Congress of Voice Teachers, the Voice Foundation's Annual Symposium on the Care of the Professional Voice, and the NATS National Conference. Publications include articles in *Journal of Singing, Journal of Voice*, and *VOICEPrints*. He served on the 2019 faculty of the Singing Voice Science Workshop, and he will join the faculty of the Acoustic Vocal Pedagogy Workshop at New England Conservatory in 2020.

He has appeared multiple times in recent seasons with Mississippi Opera in leading roles in *The Mikado* and *Turandot.* Perna was twice selected as a Santa Fe Opera Apprentice Artist singer. Additional operatic credits include Rodolfo, The Duke, Nemorino, Alfred, and Tamino. Symphonic appearances include Mahler's *Das Lied von der Erde*, Beethoven's Symphony no. 9, *Messiah*, and *Carmina Burana*. Perna is a 2019-2020 semi-finalist for the American Prize for men in opera. Along with Dr. Mandy Spivak, they created *The Comprehensive Britten Song Database*. http://www.brittensongdatabase.com, an open source guide to Britten's song output. Perna holds graduate degrees from the University of Miami and the University of Houston. He is the creator and co-host of the VocalFri Podcast, http://www.vocalfri.com, a weekly dash of voice science, pedagogy, and nerd pop culture.

Life has loveliness to sell,
All beautiful
and splendid things,
Blue waves
whitened on a cliff,
Soaring fire that sways and sings,
And children's faces looking up,
Holding wonder like a cup.

Life has loveliness to sell,
Music like the curve of gold,
Scent of pine trees
in the rain,
Eyes that love you, arms that hold,
And for your spirit's still delight,
Holy thoughts that star the night.

Spend all you have for loveliness,
Buy it and never count the cost;
For one white singing hour of peace
Count many a year of strife well lost,
And for a breath of ecstasy
Give all you have been, or could be.

"Barter," Sara Teasdale