PAVA
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Kristen Sullivan, Editor
Paul Patinka, Assistant Editor

Virtually PAVA 2021!

We welcome you all back to PAVA Village, our virtual town complete with theaters, restaurants (BYOE—bring your own everything), nature spaces, and more! Following Virtually PAVA 2020's success, the 2021 virtual symposium will be an experience that is as interactively engaging as any event in 3D! After a day of learning, you can grab drinks with friends at Aaron's Bar & Grill, chill out at Cool Down Café, or take a breather at Zero Hertz Spa! Come meet new friends and reconnect with familiar faces from around the world. We have re-imagined what a virtual symposium can be, so we can focus on our human connection and the knowledge-sharing we all crave, both during and in-between sessions.

The 2021 online symposium will take place August 13-15. Podium presentations will be available in Spanish, Portuguese, French, and English. We will feature live panels, live workshops, and live poster sessions. (Spanish and English only) Oral presentations are pre-recorded and can be watched at your leisure or during one of our upcoming watch parties.

Click here to see the watch party schedule. You bring the popcorn, we'll bring the movies! To register, click here, then follow one of the easy registration links.

Among the many exciting speakers at this year's symposium, we are honored to welcome Dr. Ingo Titze as our keynote speaker. Dr. Titze will be discussing "Intelligence and Information Carried with Light and Sound." Dr. J Marchand Knight will be speaking on: "Trans 101 & Inclusive Practices in the Voice Studio." Additionally, join us for a town hall discussion from the ethics committee, conversations on diversity and equity in vocology, and other relevant and timely topics. See the full schedule here.

In addition to learning opportunities, we know how important it is to get moving and stay active. What better way to get on your feet than a dance party at RippleWave Beach Club? Back by popular demand after last year's around the world dance party! And after you have worked up an appetite, you can head to the kitchen for a collective cooking party with our own Nandhu Radhakrishnan. Recipes soon to follow, so you can shop ahead! In fact, the PAVA Village city council is excited to be opening a NEW virtual restaurant for the citizens of PAVA village to dine, carouse, and network during the symposium, and you can help name it! Name nominations will be open until July 22 using this form. Information about voting will be sent out on July 23.

Finally, we would like to thank all the members of the symposium committee —D.D. Michael, Beth Falcone, Aramat Arnheim Sharon, Beth Wallace, Andrew Rethazi, Zipporah Peddle, Nandhu Radhakrishnan, and Paul Patinka, for their tireless work. We all can't wait to see you in PAVA Village!

What About Extent?: Examining Current Vibrato Metrics

Theodora Nestorova, M.M., and Joshua D. Glasner, M.M., Ph.D.

Studies involving vibrato generally reference vibrato rate and extent measurements from previous literature as normative comparisons. Many researchers use these metrics to quantify the complex phenomenon of vibrato, but conventional applications often produce differing results for identical audio samples. However, current methods of measuring vibrato rate and extent may not be consistent across platforms and software programs. Furthermore, only presenting average vibrato rate and extent may not fully characterize non-uniform vibrato. Such discrepancies in the literature may result in unreliable and non-generalizable conclusions.

Sundberg (1987) defines vibrato as a long-term “periodic modulation of the fundamental frequency.” The element of time in this definition is crucial, which is a motivating factor in studying the time-varying characteristics of vibrato. Re-examining normative vibrato metrics supports the development of novel analytical methods that consider temporal vibrato variation. Historically, vibrato has been analyzed with tools presuming a Western Classical opera aesthetic, applicable only if vibrato is uniform, consistent, and persistent over time. Analyzing the time-varying aspects of vibrato may promote a broader representation of singing genres with stylistically distinct vibrato features, and should be the subject of future inquiry.

In the Western Classical singing tradition, vibrato is typically periodic and sinusoidal, so its properties have been quantified using averages. Vibrato rate refers to the number of fundamental frequency (fo) oscillations per second, and is usually measured peak to peak. Typically, vibrato extent describes how far above and below the mean fo the frequency oscillates each cycle.

Extent is usually expressed as either full or half, the former a measure of peak to trough and the latter a measure of peak to a calculated mean fo. Extent is reported as either a percentage of fo or in cents, with 6% or 100 cents making one semitone (in equal temperament).Beyond rate and extent, other measurable acoustic characteristics of vibrato include vibrato jitter and vibrato shimmer, measures of perturbations in the fo and amplitude, respectively, and onset/offset modulation, describing the quality of the first and last several cycles of the vibrato. Recent investigations have also highlighted the interactions of airflow and intensity with frequency vibrato (Horii, 1989; Nandamudi, 2017; Nandamudi & Scherer, 2019).

Comparison of Vibrato Metrics in Current Voice Analysis Platforms

Throughout the 20th and 21st centuries, applications for spectrographic analysis have entered the mainstream of voice science and pedagogy. Many of these extract vibrato parameters as useful, practical metrics. Yet, a comprehensive comparison of vibrato metrics reported in the currently available voice analysis software does not exist.

Furthermore, several recent investigations examine vibrato differences from a historicalperspective (Rothman, Diaz, & Vincent, 2000; Ferrante, 2011; Crutchfield, 2012; Howell, 2015;Glasner & Johnson, 2020) using modern analysis techniques. In these studies, there is considerable variability in the reported vibrato measurements of historical versus modern-dayrecordings. This variability may be caused by the algorithms of each respective program used foranalysis. Therefore, it is critical to study further the commonly accepted algorithms used invarious programs to evaluate consistency of results across various platforms for vibrato analysis.

To carry out a comparative evaluation, we used three samples (Tokens 1-3) from aprofessional operatic soprano singing a messa di voce on the pitch C4 and analyzed them withfive algorithms, VoceVista 3.3.7, VoceVista 3.4.3b, VoceVista Video Pro, a custom Praat + Rcode by Nestorova, Howell, & Gilbert (2021), and a custom Python script from Herbst (2016).Table 1Resulting fundamental frequency (fo), vibrato rate (Hz), and vibrato extentmeasurements and averages from 5 algorithms. Measurements taken from6 complete cycles in the middle of a messa di voce task sung by a professional operatic soprano.

Algorithm	Sample	Reported Metrics		
		f_o (Hz)	Rate (Hz)	Extent (cents)
VoceVista 3.3.7	Token 1	538	6.3	101
	Token 2	536	6.4	109
	Token 3	531	6.3	106
	Token Avg	535	6.3	105
VoceVista 3.4.3b[1]	Token 1	537.8	6.4	169
	Token 2	535.5	6.5	180
	Token 3	530.6	6.4	194
	Token Avg	534.6	6.4	181
VoceVista Video Pro	Token 1	535.2	6.3	223
	Token 2	532.7	6.5	231
	Token 3	528.8	6.3	235
	Token Avg	532.2	6.4	230
Praat + RStudio Code	Token 1	536.4	6.3	208
	Token 2	532.1	6.4	223
	Token 3	527.4	6.3	227
	Token Avg	532.0	6.3	219
Python Code[2]		--	**Rate (Hz)**	$\overline{\Delta c}$ **(cents)**
	Token 1	--	6.28	67.76
	Token 2	--	6.51	75.18
	Token 3	--	6.40	76.52
	Token Avg	--	--	--

[1] "According to Miller & Schutte (Voce Vista developers), a minimum of three or four vibrato cycles are required to measure vibrato rate and extent, and at least 10 vibrato cycles are required to measure vibrato jitter accurately." (Guzman, et al., 2012).

[2] See Herbst, et al. (2016) for full description of algorithms and metrics used for vibrato analysis. It should be noted that there is not an extent or half extent estimate, but is “the average absolute deviation from the mean musical pitch Dc.”

Observed Discrepancies Across Algorithms

While fo and vibrato estimates remained relatively consistent, vibrato extent values varied across all five platforms. This discrepancy certainly deserves attention as it creates challenges for comparing reported vibrato extent measurements in existing literature.

Indeed, the results of this preliminary investigation revealed that comparing vibrato extent may not be straightforward across studies. First, there is the terminological issue; one must understand whether vibrato extent (as is common) refers to full vibrato extent— the amplitude between the peak and the trough of the vibrato wave, or the half extent— the absolute deviation from the mean fundamental frequency. Second, and perhaps more complex, is the question of documentation in reporting the nonuniformity of real-life fo signals that may deviate from an ideal sinusoid.

From the data reported above, it seems likely that the extent values reported in both VoceVista 3.3.7 are, in fact, half extent values rather than full. Simply doubling these values results in extent measurements that are nearly identical to the Praat + R code used in this preliminary comparison (Nestorova, et al., 2021).

It is important to note that an earlier version of VoceVista 3.4.3 included algorithmic inaccuracies that affected vibrato measurements. The creators of the software have fully disclosed this and provided an updated version of the software (VoceVista 3.4.3b). It must also be acknowledged that the differences in reported values across platforms may be attributed to variations in the discretization and the time-step function. The significance of this factor in vibrato metric calculations warrants further investigation.

Existing Half Extent Parametric Models in Previous Literature

The singing voice science community has not reached a consensus about the analysis of vibrato extent. Historically, the metric has been expressed in semitones, cents, and percentages, reporting these units somewhat inconsistently (both with +/- semitones and Hertz). While vibrato full extent is the average result of the differences of two successive peaks and troughs of a sinusoidal wave, half extent is the excursion value from a calculated mean foto top peak and from that same reference to bottom trough. While further study is still necessary to reach a conclusion, reporting half extent rather than a full extent expresses extent in a way that is readily interpretable for detailed analysis.The half extent procedure provides a solution for asymmetrical measurements in reference to vibrato, since the upper extent (peak to midline) may differ from the lower extent (trough to midline) in an imperfect, uneven sinusoid.

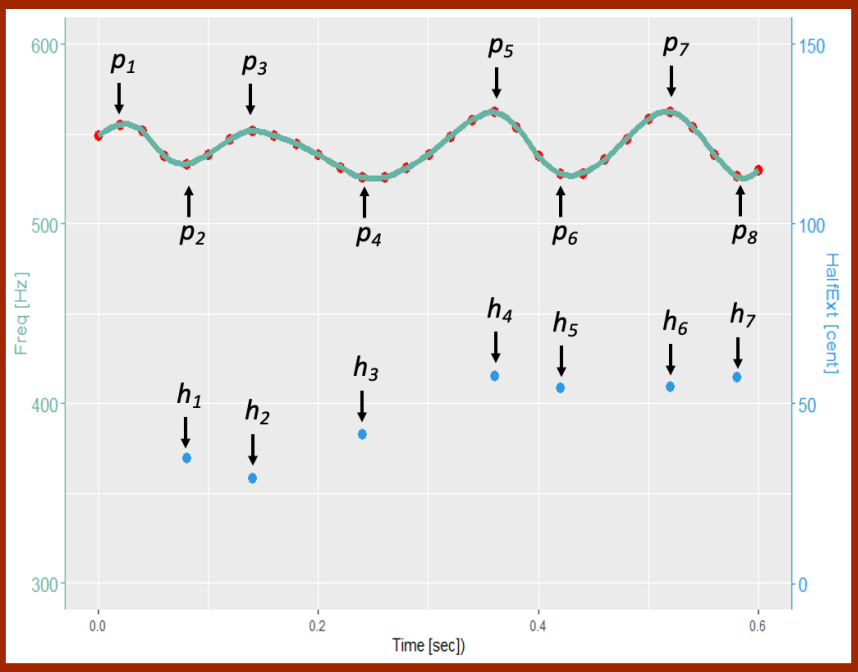

Figure A1. Illustration of the half extent calculation from the measured focontour.

Legend: Blue curve - focontour; Red dots – measured fo contour; pi points – peaks (p1, p3, p5, and p7) and troughs (p2, p4, p6, p8); blue hi points – calculated half extents in cents

Algorithm

1. Convert the measured fo contour into cents (formula found in Herbst, 2012).
2. Identify peaks (p1, p3, p5, and p7) and troughs (p2, p4, p6, p8).
3. For each successive each peak-trough pair, calculate full extent:

$ei = | pi+1 - pi |$

4. Calculate half extent:

$hi = 0.5 * ei$

A full extent is then subsequently calculated by taking the sum of each resulting half extent value and dividing by the total number of half extent pairs. Thus, a more credible extent measurement considers a distinction in half excursion values above and below a reference pitch, and is gathered in its half and full excursion versions.

Further Extent Considerations

This preliminary study reveals inconsistencies in vibrato extent values across platforms. This highlights the ambiguity surrounding algorithmically deriving and reporting vibrato extent in current and previous singing voice studies. Although such a granular investigation may seem insignificant or even “nit-picky,” discrepancies as highlighted in this report may be problematic for researchers interested in contextualizing their findings with past literature. As such, this preliminary inquiry justifies the need for transparency, specificity, and reassessment when reporting vibrato extent values in future research.

One possible solution to the issue of variance in reported vibrato extent is for investigators to report vibrato extent results by indicating both the mathematical methodology for calculation and, by including +/- before the vibrato extent value using half extent measures to indicate this measurement. Qualifying and discerning half from full vibrato extent measures in both singing voice research methodology and analysis is essential.

While the fields of singing voice science and voice pedagogy have grown significantly since the mid-20th century, it seems likely that a foundational measurement— vibrato extent— in our field has been studied and reported using inconsistent methods. Understanding each algorithm’s method for calculating singing voice measurements such as vibrato is paramount for accurately reporting normative data. It is our hope that this report highlights the discrepancies found within the literature about the measurement and analysis of vibrato in singing voices, and that it helps the fieldwork toward future consensus and better understanding of vibrato in the singing voice.

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*Editor's note: this reference was originally, incorrectly, attributed to Nix, J. The correct author is reflected here.

Hands-On Vocology

Performers Who Teacher Fitness: Is the Survival Job a Threat to the Career?

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Back in 2016, I noticed that many patients on my caseload were experiencing voice problems because of their work as group fitness instructors. Many of them came from the same studios and had the same complaints. This observation sparked my interest in wanting to understand more about the specific vocal demands involved with teaching fitness. At that time, there were some survey studies in the literature about voice complaints experienced by this population, but I didn't find much that looked at voice injuries beyond self-reports. This prompted our study at The Sean Parker Institute for the Voice, "Phonotraumatic Injury in Fitness Instructors: Risk Factors, Diagnoses, and Treatment Methods."

Since that paper was published, there have been several new studies and texts published about the topic. Clearly, it's an area of interest to many, and as we see the fitness industry growing exponentially faster than many other industries, there is a need for continued help. We know that the demands of teaching fitness place the instructor at higher risk for developing voice disorders, but something striking that came from our study was the fact that more than half of our subjects were professionally trained performers teaching fitness as a "survival job."

These were people who had elite singing voice training. One might think that they would be better equipped to handle the intense vocal demands that come with teaching fitness. Yet, they experienced injuries at the same rate as our subjects without voice training.

This highlights that occupational voice demand is not necessarily an “apples to apples” prospect. Context makes a difference. For performers who teach fitness, there is a question of whether the “survival job” may threaten the career.

Breathing

The coordination and management of breath and voice are foundational to singing technique, allowing for efficient and healthy singing that supports the emotional artistry of song. However, when teaching fitness, different styles may dictate different demands for the breath and the voice. For instance, certain genres of fitness that are more calming in nature may lead the instructor to teach with a breathy voice, potentially creating imbalance and inefficiency in the vocal instrument. Other styles of fitness may cause the instructor to shallow breathe, gasp, breath-hold, or tighten the abdominal muscles and chest wall, restricting the breath. Additional neck and shoulder tension, postural imbalance, and hyperadduction from resistance exercises and weightlifting may further compromise the sense of buoyancy necessary for singing, interfering with singing technique, and placing the instructor at risk for phonotraumatic injury.

Projection

Performers are taught healthy projection techniques, but these may not readily cross over into the fitness studio. When teaching fitness, projection is often used both as a means of delivering instruction and as a means of motivating students to push past their perceived physical limits, giving them a better workout and a feeling of success.

Voice ergonomic risk factors, such as ambient noise from music, equipment, and within-studio reverberation increase the potential for “pushing” the voice. The combination of physical exercise and projection, “pushing” more loudly than necessary, and teaching for long periods may cause patterns of muscle tension with voice use, which may then lead to phonotraumatic injury. Amplification is available in many fitness studios and may reduce the risk of phonotraumatic injury, but this is dependent upon good quality equipment that is reliable and accessible, and an awareness of the instructor to avoid unnecessary loudness. With appropriate amplification, the instructor has the potential to speak at a more conversational volume, using increased pitch variation to motivate the class, and using nonverbal cues to signal changes in activity.

The Need To Keep The Survival Job

It’s called a “survival job” for a reason. Pursuing a career as a performer is challenging, time-consuming, and costly. Survival jobs that help the performer pay for rent and food are a necessity, and jobs that provide benefits and flexibility are highly desirable. Teaching fitness often checks off all of these boxes. However, a performer may delay seeking treatment for a voice problem caused by teaching fitness. It’s not uncommon for me to meet a fitness instructor several months, or even years after they began noticing a voice problem. Much like the “show must go on” mentality, it may be difficult for a performer to consider calling out of shifts, or facing a potential voice problem that requires treatment, therefore reducing their teaching opportunities and pay. While there is a lack of epidemiological information about occupational voice injury in this population, there is a growing understanding that many occupations have a high prevalence of voice injury, yet the World Health Organization does not yet recognize dysphonia as an occupational disorder.

Role of the Teacher/Clinician-Advocate

As our theatres and fitness studios are reopening after the COVID-19 pandemic, the importance of outreach to performers and fitness professionals is as important as ever. Some of our performers may have experienced a vocal “reset” from a dramatic reduction in voice use, while others may feel the effects of deconditioning. Education on general physical health and vocal hygiene, optimizing controllable environmental work factors and amplification, managing vocal pacing, and establishing a vocal regimen that conditions and maintains the teaching voice may help our performers continue to pursue their career goals. Additional education on the roles of the laryngologist and speech-language pathologist may help performers who teach fitness understand how to seek help if they are experiencing early signs of voice injury, rather than delaying or avoiding appropriate treatment. Outreach to fitness management teams to educate on greater regulatory safeguards, workplace conditions, scheduling recommendations, and insurance coverage may be even more important, to address occupational voice injury at a higher level. As always, addressing our knowledge gaps through research about the mechanisms of voice injury, and effective prevention and treatment may provide us with our greatest tools in advocating for all occupational voice users.

References

Bureau of Labor Statistics, U.S. Department of Labor, Occupational Outlook Handbook, Fitness Trainers and Instructors, at https://www.bls.gov/ooh/personal-care-and-service/fitness-trainers-and-instructors.htm

Getting Personal

To learn more about our cross-disciplinary interests, InFormant editors will be interviewing various PAVA members so we can all learn a little more about the diverse fascinations housed in our organization. This past May, Paul Patinka had the honor of interviewing Heather Gross, a licensed voice therapist who primarily works with gender-diverse singers and speakers. Condensed answers from the conversation can be found below, and a full video and transcript can be found on our PAVA Facebook page and website.

1) Can you tell us a little about some projects you are currently working on or recently finished?

Throughout the past year, I've been putting together a monthly yoga singing mindfulness workshop where anyone of any gender identity can come and explore their authentic voice, in a way that is meaningful to them. The intention could be aligning voice with identity, it can be sort of getting out of the way of the voice, releasing tension, or releasing limiting beliefs about the voice. Through those classes, we do mindfulness, meditation, movement, and breathwork to discover where the breath is moving. I also just started working on an E-book, which is scary, but exciting. The book is called "Living Vocally." It's all about finding authenticity and vocal empowerment through mindfulness and self-acceptance. It'll have a series of mindfulness exercises, journaling, prompts, and maybe some movement and voice exercises.

2) What about vocalization fascinates or inspires you the most?

The thing about the voice that fascinates me the most is how tied it is to our identities, how it's the key to how we're feeling, and the key to who we are. If the voice doesn’t align with us, it’s a huge issue, right? What excites me the most about working with people on their voice is helping people step into not only their authentic voice, but their authentic life, so they can live as who they are. You can see the difference in my clients and the way they carry themselves with more confidence. And the increase in their quality of life when they learn to create the voice that they love and create the life that they love. The mind-body-voice connection fascinates me. How connected the voice is to our thoughts, our feelings, and the tension we're holding in our body.

3) What excites you about being a member of PAVA? How does PAVA fit into your overall career trajectory or goals?

As voice teachers, we have to hold ourselves accountable for continuing education, for our students, and our field. Also, making professional connections with other voice professionals. I think that sense of community is really important, especially when you have your practice or own voice studio. I'm getting to connect with other people who are doing the same work!

4) Do you have a mentor in your field whose work you look up to? Who is it and why?

This was the hardest question for me to answer because I have so many! Eryn Gitelis has been a mentor, a friend. She's been kind of cheering me on ever since I decided to start my voice studio and practice. She's such a good friend and coach. And then also, Dr. Aaron Ziegler has been a wonderful mentor for me in the field of clinical voice work. In the area of vocology, my time at the Summer Vocology Institute where I got to learn from the leaders and pioneers in our field, including Dr. Titze, Lynn Maxfield, Katherine Verdolini, Kate DeVore, and many more.

5) If you had unlimited resources and a year of vacation, what is something fun you would like to do with that time?

I definitely wouldn't argue with more time to spend with family and friends, and I've never been to Europe! I probably would love to travel to Europe when it's safe to do so. I know I would spend a lot of time at the pool and the beach.