SPECTRUM

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NHCA Annual Conference News

by **Madison Saunders**, *Program Chair and* **Laura Kauth**, *Director of Education*

Hello to all our fellow NHCA members! The Conference Program Task Force continues to work hard and is making great strides to ensure that this year's 47th annual NHCA conference will be the place to be from February 9-11, 2023. Jacksonville will be the perfect winter escape for all those passionate about hearing conservation.

REGISTRATION IS NOW OPEN!!! The abstracts have been reviewed, acceptance letters have been sent, and the agenda is set ... the only thing missing is you!

Sessions:

If you are looking for mental stimulation, swap Netflix for a binge of what's new in the field of hearing conservation science. With the impressive quantity and quality of submissions, we were able to create a jam-packed program agenda you are sure to enjoy. With 32 sessions, 18 posters, and 8 full- and half-day workshops, NHCA 2023 is lining up to be an event not to be missed. Especially with great breakout tracks like: HPD Advances, Beyond Occupational Noise Exposures, and Fit Testing Updates. We are also pleased to announce our keynote speaker for this year's conference is Dr. David Zapala, who will be discussing the impact of noise exposure on the vestibular system.

Social:

If the long-awaited social aspect of conference is what you are truly after, then look no further than the Friday Fiesta at Top Golf Jacksonville, where you can relax with your best hearing conservation friends over fajitas and libations, get a few swings in at the tee, and even compete for best(?) dressed in the golf-themed costume contest. No matter how you partake, it's going to be a good time. Don't forget to let us know you (and any guests) are coming by selecting the Friday night event during registration.

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Spectrum is available without charge to NHCA members in all categories. Anyone interested in publishing in Spectrum should contact Ashley Montoya at the NHCA office.

NHCA provides leadership, expertise, and education on hearing loss prevention strategies and services to the broader professional community and empowers and supports members through networking and advocacy.

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presidential pEARspective

Enrich and Engage

by Gayla L. Poling
NHCA President

> *Alone we can do so little;*
> *together we can do so much.*
>
> *– Helen Keller*

At the core of our NHCA vision is the prevention of hearing loss and other auditory disorders. From initial education on prevention, to persevering and protecting remaining hearing, to advancing critical research, our NHCA members contribute to and champion this in all sectors of society. Advances in hearing health care and hearing conservation are increasing in public awareness. This provides opportunities in our broader communities to "enrich and engage" as experts in preventing hearing loss, while enhancing and leveraging our NHCA partnerships.

Below are some ways we are extending our reach and empowering our engagement as advocates for hearing health.

Enrich

- Utilize the website and resources. We continue our steadfast commitment to supporting education and advocacy of hearing loss prevention strategies and services to our members and the broader community. Check out our NHCA website for the latest resources, quick access to our educational webinars, and much more!

- Join the conversation. As part of our enhanced partnership discussions, we are engaged in coordinated outreach efforts to highlight hearing conservation and the important role of hearing health across the life course. Some recent announcements in hearing health care have been part of the coordinated conversations. For example:

    - The U.S. Food and Drug Administration (FDA) announced on August 16, 2022, the final rule on over the counter (OTC) hearing aids, enabling direct-to-consumer purchasing of hearing aids. The ruling is effective October 15, 2022.

    - On September 20, 2022, the FDA approved sodium thiosulfate to reduce the risk of ototoxicity associated with cisplatin, in pediatric patients one month and older with localized, non-metastatic solid tumors.

Engage

- Expand and leverage partnerships. There are several organizational outreach opportunities to enhance member value and expand our advocacy reach. In addition to our formal liaisons/representatives, there are various opportunities for contributing YOUR EXPERTISE. Volunteering to represent the NHCA perspective or serving as a champion for NHCA are a few examples. Please consider learning more about how you can share your unique perspective by contacting nhcaoffice@hearingconservation.org.

- Connect with NHCA. Networking opportunities within NHCA and across partnering organizations throughout the year provide important advocacy for hearing loss prevention and ensure representation of the full scope of perspectives.

    - Support our **social media engagement** efforts and share your ideas. Mark your calendars to attend our virtual Town Hall IGNITE session, November 8, 2022, for the latest from our sponsors and a "sneak peek" of our 47th NHCA Annual Conference, February 9-11, 2023, in Jacksonville, Florida.

While the individual contributions of our members are robust, it is inspiring to see all that is accomplished together! I ask you to enrich NHCA by sharing your expertise and contributing to our partnership engagement efforts. Thank YOU for your continued commitment to NHCA.

NHCA Annual Conference News

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Service:

Are you looking to get even more out of your conference experience than an extensive amount of CEUs and memories to last a lifetime with your favorite noise nerds? Be a volunteer! We are always seeking individuals who are interested in getting involved and would happily find a task worthy of your efforts, from moderating to assisting with AV … you may even get to don a red apron filled with 50/50 tickets. Look for the volunteer sign up in your registration!

While we cannot wait to reunite in person after two long years away, we simply cannot ignore the possible need for safety precautions or protocols. The task force team expects our highly anticipated return to in-person to be a fun-filled extravaganza just like the good old days. However, should COVID-19 cases peak in Jacksonville during our expected time together, the use of masks will be asked of our members in attendance. While we don't expect this to be the case, we want to set reasonable expectations and hope for understanding from our group of well-intended professionals who are also passionate about prevention in our own way.

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Peeling the Speech Banana

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Abstract

The speech banana is ubiquitous in the classroom and the clinic, but what nutritional value does it hold for understanding the effect of hearing loss on speech perception? The speech banana is used to illustrate the frequencies of speech sounds (phonemes) and how hearing loss may therefore result in difficulty perceiving certain phonemes. The typical speech banana provides an overly simplistic representation of the speech frequencies. However, in reality each phoneme encompasses a frequency range, not a single frequency, so attempting to map hearing loss to perception of individual phonemes is not as straightforward as we might think. Further, not all speech bananas are the same. A close examination of various speech bananas shows that some have greater nutritional value than others. This paper provides a review of phoneme acoustic characteristics as well as an historical overview of the speech banana so that we can better understand (and interpret) the nutritional value that it holds.

The speech banana is ubiquitous in audiology and speech-language pathology clinics, but what nutritional value does it truly provide? Given the name, it must have something to do with speech, but why is a banana involved? As it turns out, the "banana" isn't critically important (it's only roughly the shape of a banana, after all), but the speech part certainly is. Perhaps you've seen it called the "familiar sounds audiogram" or the "audiogram of everyday sounds" as well, but they're all essentially the same concept. The speech banana is a graphic illustration of the frequency and intensity of the phonemes (and perhaps everyday environmental sounds) as plotted on an audiogram (Figure 1).

The speech banana is typically used to counsel patients about how hearing loss might affect speech perception abilities based on how much of a loss is evident at specific audiometric frequencies. It's certainly true that hearing loss can negatively affect speech perception abilities, as severity and pattern of loss are related to the degree of decrease in speech perception.

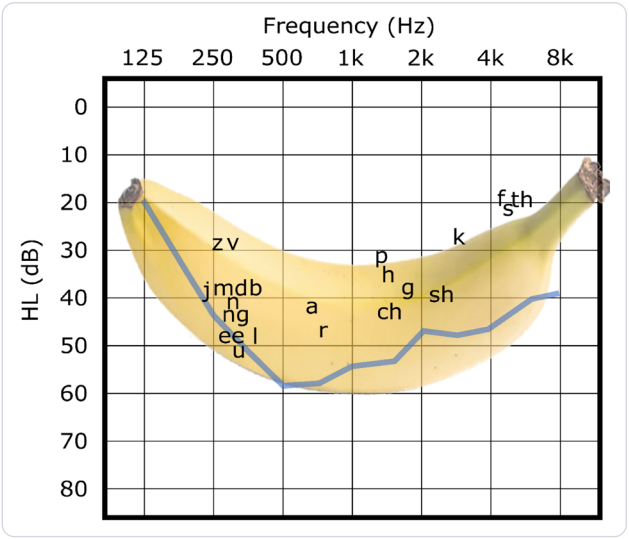

Figure 1: Typical speech banana. The blue line shows a representative long-term average spectrum of speech for male speakers (adapted from Cox and Moore, 1988).

If you're familiar with the Count-the-Dots Audiogram (Killion and Mueller, 2010), you've probably noticed a commonality with the speech banana. Yes, the area that encompasses the "dots" in the Count-the-Dots Audiogram is roughly banana shaped! And for good reason: that banana shape corresponds (roughly) to the frequencies and intensities of the phonemes. However, while the speech banana and the Count-the-Dots Audiogram are indeed related, they are not exactly the same thing. For example, the speech banana displays specific phonemes on the audiogram, while the Count-the-Dots Audiogram instead is used to estimate the Articulation Index and its relationship to overall speech intelligibility in various contexts.

Are all bananas the same?

Let's consider what the speech banana can tell us. To start with, perhaps we should take a look at what's inside the speech banana – let's slice some open! Us-

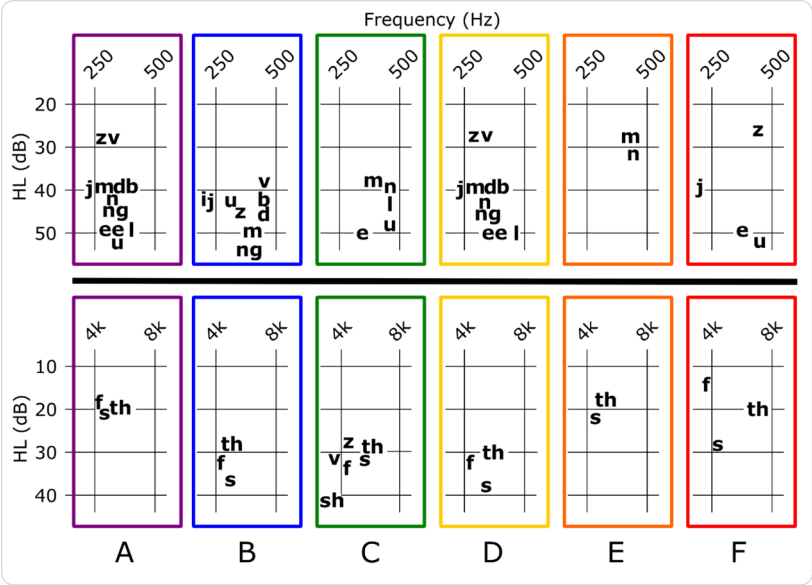

Figure 2: Slices from six speech bananas obtained online. Data have been redrawn on identical frequency and amplitude scales for comparison.

ing a convenience sample of speech bananas that were obtained from various websites, we can compare and contrast. As it turns out, not all speech bananas are the same. Inspecting the low frequencies for a number of speech bananas shows some commonalities and some differences (Figure 2, top panel). While many of the bananas display a number of the same phonemes in the range of 250-500 Hz, the specific phonemes displayed are clearly not universal. For example, consider the lowly consonant "m". For six of the seven speech bananas illustrated, "m" is displayed. However, "m" is not shown on the speech banana in the top panel, slice F on Figure 2. Upon close inspection, it's clear that some of the speech bananas do display most of the same phonemes (e.g., top panel slices A and D), however some bananas display many more phonemes than others do. In top panel slice E, for example, only the phonemes "m" and "n" are present at the 250-500 Hz range. For the higher frequencies in the 4 kHz to 8 kHz range (Figure 2, bottom panel), a similar pattern is evident. Some bananas display the same phonemes, while others appear to be missing quite a few (again, see slice E).

Even when the same phonemes are displayed on these representative speech bananas, there are discrepancies regarding the placement of specific phonemes with respect to both frequency and amplitude. Once again, consider "m." The frequency that is identified for "m" varies from just over 250 Hz to nearly 500 Hz, and the amplitude for "m" is shown at locations from less than 30 dB HL to 50 dB HL on different speech bananas (Figure 2). At the high frequencies, "th" varies from just over 4 kHz to just under 8 kHz. And when we consider the phoneme "z," all bets are off! Notice that "z" is displayed between 250-500 Hz for four of the six speech bananas (with varying amplitude), but the banana slice C shows "z" at over 4 kHz. A similar discrepancy across the banana slices can be found for "v" and a number of vowels (including phonemes at frequencies not illustrated in Figure 2).

A further discrepancy exists regarding labeling. Some speech bananas appear to be using International Phonetic Alphabet (IPA) symbols (e.g., /i/ for the long "e" vowel sound in top panel slice B for Figure 2) while others seem to be labeling phonemes via common spelling in words (e.g., "ee" for the long "e" sound) and others are doing something different (see slices C and F that display just "e," for example). This can lead to confusion. If the assumption is that "ee" means a long "e" sound (as in the word "see"), then what does "e" stand for? The symbol "e" might indicate the long "e" sound, however the IPA /e/ vowel is pronounced as in the word "bait" or "bet", depending on the language. Further, does the "i" symbol in top panel slice B indicate a short "i" sound as in the word "bit" or should it be read as an IPA /i/ symbol indicating a long "e" sound as in the word "beet"?

If you had originally thought that all bananas were the same, perhaps you've overlooked the plantain and red bananas and so many other varieties. While we might have expected speech bananas to be nearly identical as well, it turns out that there are also many varieties. So, which banana holds the most nutritional value? They can't all be correct, considering that there are so many discrepancies in terms of which phonemes are displayed, what symbols are used to display them, as well as the frequency and amplitude of each phoneme. Perhaps it would be helpful to explore the history of the speech banana.

Discovery of the first speech banana

Let's consider the speciation of the speech banana. The emergence of the speech banana can be traced back to Steinberg (1928), Fant (1959), and Tyler (1979) among others. These rudimentary speech bananas typically displayed phonetic features such as sibilance, the formant frequencies, or vocal fundamental frequency (Fletcher, 1970; Liden, 1954; Steinberg,

1928) instead of individual phonemes. However, Tyler (1979) used phonetic groupings based on manner of production, displaying the frequency and amplitude ranges of nasals, fricatives, vowels, and stops.

Most of these early, uncultivated species of speech bananas displayed these phonetic features on a frequency by amplitude graph, with amplitude typically displayed in dB HL as per an audiogram (see Figure 1). Commonly used speech bananas display individual phonemes instead of phonetic features on an audiogram plot (Northern and Downs, 2014). The individualized placement of phoneme symbols suggests a relationship of a specific frequency to each phoneme. Further, placement of the phonemes on the y-axis also suggests a specific amplitude for each phoneme; however, speech (and even individual phoneme) amplitude is related to many factors such as the speaker's vocal intensity (whispered, conversational speech level, or shouting, for example) as well as the placement of the recording microphone that was used to capture the speech waveform. Nonetheless, it is likely that the amplitude levels represented on the typical speech banana are reflective of conversational speech intensity.

To begin exploring the nutritional value of the common speech banana, we need to first consider the sound intensity of the various phonemes as measured in decibels Sound Pressure Level (dB SPL). While this can be measured for each individual phoneme, we can also look at speech as a whole by observing the long-term average spectrum (LTAS). This analysis shows the average spectral energy over a lengthy speech sample that would (optimally) contain all of the phonemes. When converted from dB SPL to decibels hearing level (dB HL), the resulting data roughly corresponds to the familiar curved shape of the speech banana. Figure 1 displays a composite LTAS data curve calculated as an average from three datasets overlaid on the speech banana (data adapted from Cox and Moore, 1988; also see Olsen, Hawkins, and Van Tasell, 1987 for additional detail on the LTAS).

Acoustic characteristics of the phonemes

While the LTAS does provide us with the stereotypical banana shape, placement of the individual phonemes on the speech banana plot requires knowledge of the specific frequency and amplitude components of each phoneme. Although the typical speech banana displays discrete phonemes placed in specific, defined locations relative to an audiogram graph, in reality all phonemes encompass a wide range of frequencies and amplitudes. Therefore, mapping hearing loss to individual phoneme perception is not straightforward. Considering the numerous factors that may impact speech and individual phoneme intensity, let's focus instead on the frequency components of the phonemes. On a typical speech banana, each phoneme is displayed at a specific frequency. For example, in the speech banana shown in Figure 1, the phonemes "z" and "v" are located near 250 Hz as are "m", "d", and even "ee" and "u" (although each is shown at different amplitudes). Clearly, the frequency content of "z" and "v" cannot be the same as for "ee" and "u," right? Right. While each of those phonemes does have frequency energy near 250 Hz, there are significant differences between phonemes that are evident when considering their respective amplitude spectrums.

Let's review some of the broad acoustic features of the phonemes. To begin with, we typically separate the phonemes into two categories: vowel and consonant. While convenient, this binary categorization can be misleading, as some consonants are better termed "semivowels" (see below), as they share acoustic characteristics with the vowels. Further, nasal phonemes such as "m," "n," and "ng" (as in ring) also share these defining acoustic characteristics. Specifically, the vowels are defined as voiced (i.e., using phonation as the primary source of sound) continuant phonemes produced without strong constriction in the vocal tract. Semivowels such as "y" (as in "yellow"), "w," "l," and "r" as well as the nasal phonemes are produced in a similar fashion, although they are used differently than vowels for linguistic structure (Ladefoged and Maddieson, 1996). High intensity frequency bands, or formants, generated due to vocal tract resonance differentiate between the various vowels, semivowels, and nasal phonemes.

On a speech banana, we would need to consider at least three formant frequencies for each vowel or semivowel. Vowel formants range from less than 350 Hz to well over 3000 Hz for the third formant (Hillenbrand et al., 1995). However, much of the differentiation between vowels lies in the first and second formant frequencies. We see similar formant patterns for the semivowels; however, the nasal phonemes show a strong difference. Using the nasal cavity for resonance yields antiformants (i.e., antiresonance) as well as formant frequencies. For the nasal phonemes, the strong influence of the antiformants, as well as strong damping due to nasal tissue properties, yields attenuation of nearly all acoustic energy except for a low frequency first formant (at approximately

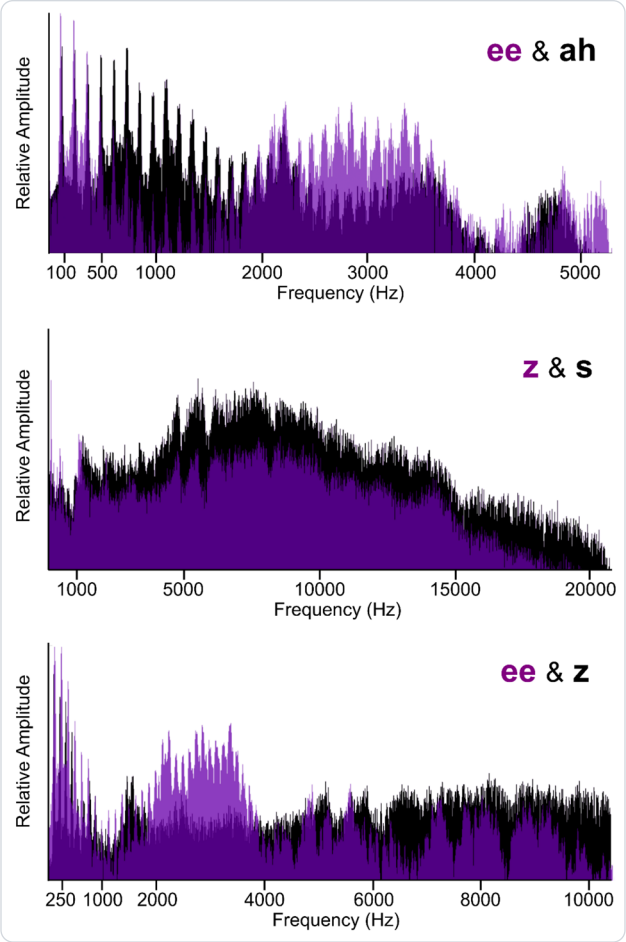

Figure 3: Amplitude spectrum plots comparing "ee" and "ah" vowels (top panel), "z" and "s" consonants (middle panel), and "ee" and "z" phonemes (bottom panel). Note that the frequency range displayed is different for each phoneme comparison panel.

300 Hz) called the "nasal murmur." This band of energy encompasses the fundamental frequency and associated harmonics below approximately 500 Hz (Harrington, 1994). Differentiation between the nasals is largely due to the formant transitions from preceding or following phonemes.

The remaining consonants, the obstruents, are largely produced with the controlled release of air under pressure passing through a narrow constriction. This yields turbulent airflow, which we hear as wideband frication noise. Consider the phonemes "s" and "f," for example. While there are many features that differentiate the obstruent phonemes, let's simplify by just considering the presence and characteristics of frication noise and the presence or absence of voicing (phonation). While all obstruents are produced with some level of frication noise, vocal tract resonance yields amplification of a range of frequencies within that noise, depending on the particular phoneme produced. If we use "z" and "sh" as an example, while both phonemes are produced with frication noise, the resonant frequency of that frication noise is substantially lower for the "sh" than for the "z" (Bjorndahl, 2022; Ladefoged and Maddieson, 1996). Further, the "z" phoneme is produced with phonation as a second sound source (i.e., it is "voiced"), thus it will also demonstrate a low-frequency fundamental and a series of related harmonics.

Let's consider the acoustic characteristics of some of the phonemes that we've previously examined. Figure 3 illustrates the spectral characteristics of a number of phonemes, with overlays providing direct comparisons. In the top panel, it is evident that the vowels "ee" and "ah" share characteristics of a fundamental frequency and harmonically related energy across a wide frequency range, however the amplitude of those harmonics is strongly different across these vowels due to the influence of vocal tract resonance (the formants). Specifically, "ee" is characterized by a relatively low-frequency first formant and a relatively high-frequency second formant that is only slightly lower in frequency than the third formant. The vowel "ah," on the other hand, is characterized by relatively even spacing of frequency between the three formants, with the first formant being substantially higher in frequency than is seen for the "ee." In the typical speech banana (see Figure 1), the positions of the "ee" and "ah" vowel markings thus appear to be related to the frequency of the first formant, as "ee" is placed at a lower frequency than "ah."

In the middle panel of Figure 3, we see striking similarities between the spectra of "s" and "z," as they both have large amounts of aperiodic frication noise at high frequencies, with the greatest amplitude between approximately 5 to 10 kHz for both phonemes in this example. However, "z" being a voiced phoneme also shows a fundamental frequency at approximately 110 Hz and a series of additional harmonics visible below 1 kHz in this example. In some speech bananas, the "z" phoneme is represented with a location near 250 Hz, while others position the "z" near 500 Hz or even higher than 4 kHz (Figure 2). The lower frequency representation of "z" on the speech banana is related to the presence of voicing (i.e., the fundamental frequency and associated harmonics). The "s" phoneme is often displayed at around 5 kHz on the speech banana. However, the spectral centroid (the center of mass of the spectrum) frequency of the frication noise for both "s" and "z" typically

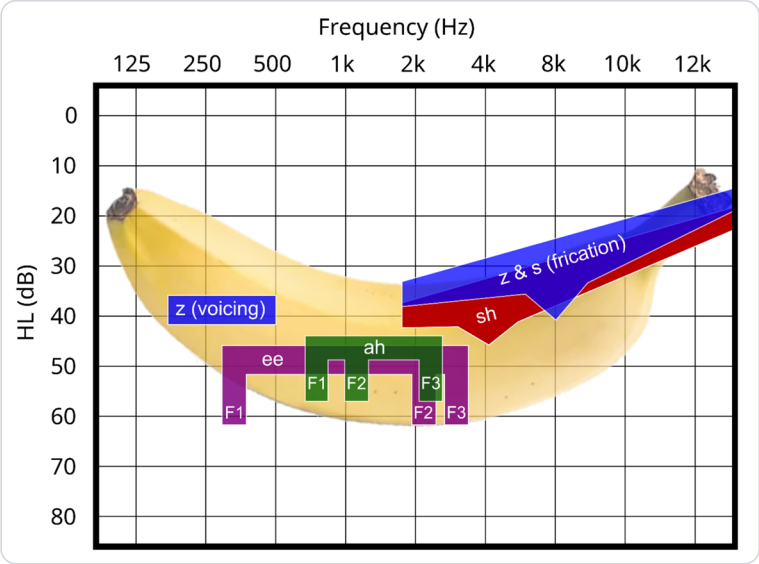

Figure 4: Speech banana illustrating the relative frequency ranges of selected phonemes. The effect of resonance (three formants for the vowels "ee" and "ah" and the spectral centroid frequency of "z," "s," and "sh" are illustrated by the downward deflection of the ranges to indicate frequencies of greater amplitude.

falls within 7 to 8 kHz for adult speakers (Holliday et al, 2015), and the range of frication noise extends higher than 15 kHz. Differentiation of the "s" and "z" phonemes therefore relies heavily on the presence or absence of voicing.

The bottom panel of Figure 3 compares the vowel "ee" and the voiced consonant "z." Although both have a fundamental frequency and associated harmonics, it is the higher frequency components (including the high-frequency frication noise for the "z" and the harmonics that are strongly amplified at the formants for the "ee" between 2-3.5 kHz) that clearly differentiate between these two phonemes. Indeed, there is evidence that spectral energy above 8 kHz may aid in speech perception (Hunter et. al, 2020).

The nutritional value of the speech banana

We could certainly closely examine the acoustic characteristics of all of the phonemes, but we'll soon discover that each encompasses a wide range of frequencies, unlike how phonemes are typically represented on the speech banana. Which of those frequencies differentiate between phonemes is related to many factors, including the manner of production (e.g., continuant vs. occlusive phonemes, voiced vs. voiceless phonemes, etc.). A more accurate speech banana would illustrate the wide range of frequencies that encompass each phoneme, how those ranges may overlap, and distinguishing characteristic features of each phoneme, such as formant frequencies. Extending the frequency range beyond 8 kHz would further yield a more accurate speech banana in terms of actual phonemic acoustic characteristics. Figure 4 provides such a representation for a number of selected phonemes, including comparison of "s" vs "sh" where the spectral centroid frequency for "sh" is lower (at approximately 4 kHz) than for the "s" (at approximately 8 kHz).

A different way to consider the speech banana is to represent broad phonetic features instead of individual phonemes, in a manner reminiscent of Fant (1959) among others (see Olson, Hawkins, and Van Tasell, 1987) (Figure 5). While this type of display is more accurate regarding phoneme frequency ranges, interpretation does require knowledge of the acoustic characteristics of the phonemes. For example, while both "s" and "z" are fricative consonants, voiced consonant "z" contains a fundamental frequency and associated harmonics besides frication noise. Or, while the vowels have overlap in the ranges of the formant frequencies, there are distinct patterns to those formants (in terms of separation by frequency) that relate to perceptual differentiation.

In broad terms, the frequencies that differentiate the vowels and the semivowels encompass approximately 300 Hz to 3 kHz. Hearing loss within that frequency range may yield difficulty differentiating between the various vowels and semivowels. For obstruent pho-

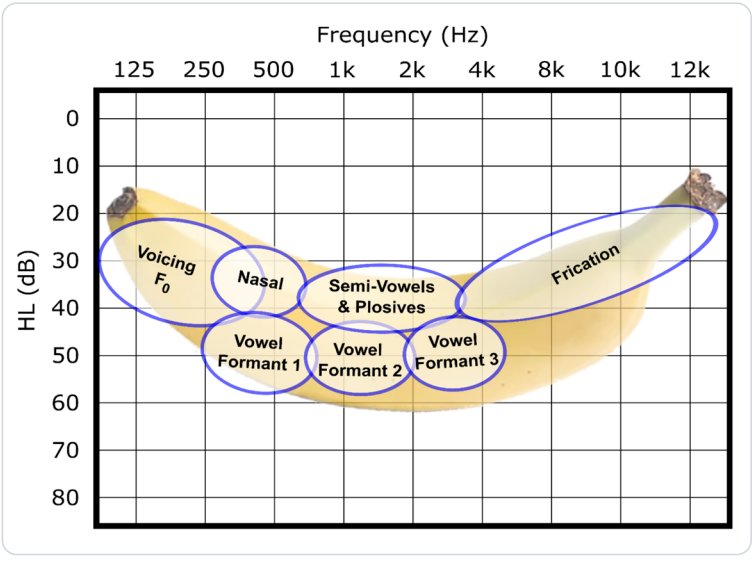

Figure 5: Speech banana with phonetic features.

nemes that rely on frication noise, the frequency range that differentiates these phonemes encompasses approximately 2 kHz to well over 15 kHz, but phonemes such as "s," "z," "sh," and "zh" show the effects of amplification due to resonance (i.e., the spectral centroid frequency) at frequencies typically less than 8 kHz. The "weak" fricatives (e.g., "f," "v," "th," etc.) do not show clear effects of resonance, but they are characterized by wide-band frication noise as are all the fricatives. For both obstruent and continuant phoneme categories, the "voiced" phonemes will include frequency energy at a fundamental frequency and associated harmonics. The average fundamental frequency may be lower than 100 Hz for some adult male speakers, approximately 230 Hz for adult female speakers, and as high as 300 to 400 Hz in children. The presence and frequency of the fundamental provide information to the listener regarding voiced vs voiceless phonemes as well as the perception of femininity/masculinity.

When considered at face value, the typical speech banana does provide some nutrition in the form of a generalized (yet not terribly accurate) representation of selected phonemes in relation to the range of hearing. It is evident that all speech bananas are not the same, and some provide a more accurate representation of the phonemes than others. However, adding to our knowledge base regarding the acoustic characteristics of the phonemes and of speech in general can yield an even more satisfying and nutritious speech banana.

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Meet Ashley Montoya
New Executive Director

At a meeting of the NHCA Executive Council on June 20, 2022, Ashley Montoya's appointment as Executive Director of NHCA was unanimously approved, effective July 1, 2022.

NHCA first contracted with Denver-based Civica Management in 2018 and has twice renewed. Civica's agreement includes a provision to designate a key employee who, with the approval of the Executive Council, serves as NHCA's Executive Director. Ashley Montoya is now taking over for Kim Gill, who was named President of Civica last year.

Ashley has graciously agreed to introduce herself in this publication of the NHCA Spectrum.

Hello NHCA members! I am honored to step into my new role as Executive Director of NHCA. By the time you read this article, I will have participated in a series of briefings that significantly add to my understanding of hearing conservation, and how the steadfast commitments of the Association and its members are achieving the objectives of preventing noise-induced hearing loss. This includes a pre-arranged ride-along where I will learn from observing the proceedings of mobile on-site hearing testing and training.

I am excited to immerse myself into the world of hearing loss prevention. I immediately associate loss of hearing with my grandfather. He owned his own construction business prior to the introduction of hearing conservation programs in the workplace. It was so heartbreaking for me to see how frustrating it was for him to communicate with his loved ones in the final years of his life.

I have learned to appreciate so many things about my ability to hear. Communication, laughter, music, awareness, and connection are on my list of personal values. I can't begin to imagine the experiences associated with having to live a hearing-impaired lifestyle.

About Me

I come to NHCA with over five years' experience in association management. Prior to joining Civica in 2021, I worked for another association management company in which I managed four associations from A-Z, including: board and committee management, conference and event planning, sponsor relations, marketing, client communications, managing membership databases and websites, and overseeing budget and accounting functions.

I am involved in several professional associations myself. I serve as Director of Communication on the Board of Directors for Professional Convention Management Association Rocky Mountain Chapter and am a member of both Association Management Companies Institute and Colorado Society of Association Executives.

I am very proud to say that I plan to graduate from Regis University in May of 2023, with my B.A. in Business Administration. Being a first-generation college student, I've taken a rather untraditional path to obtain my degree. I've worked full time while taking online courses for the past 10 years. The combination of gaining skills in the workforce, while also learning curriculum that directly applies to my day-to-day job, has served me well.

I'd like to thank you for the opportunity to serve your organization and the hearing conversation community. I look forward to what the future holds for NHCA. It will be a personal privilege to connect each member's name with the corresponding smiling face as we assemble in Jacksonville for our next Annual Conference in February. Please don't hesitate to reach out via the channels below with any ideas, questions, or concerns.

Warm Regards, Ashley Montoya

How to connect with me

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Phone: 720-674-6773
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Student Spotlight

Taylor Paige

by Hannah Formella Zdroik
NHCA Student Member Delegate

Major Taylor Paige is an active duty USAF audiologist, currently pursuing a PhD in Communication Sciences and Disorders at the University of South Alabama in Mobile, Alabama. She commissioned with the USAF in 2017 after graduating from Nova Southeastern University with her Au.D. She completed her B.S. in Communication Sciences and Disorders from James Madison University in 2013. Maj Paige's research interests have been focused on noise-induced hearing loss and extended high-frequency audiometry. Taylor is also a 2022 recipient of our NHCA Scholarship Foundation Student Research Award.

What brought you into the field of Audiology and where you are now?

I knew I wanted to be a specialist in the medical field, and I stumbled upon audiology and gerontology in undergrad. These two complemented one another and felt like a good match for me. It was while pursuing my Au.D., that I attended a military presentation at a national audiology conference. This sparked an interest for me and set me on the path of working in the VA and later commissioning in the USAF.

Who was the most influential person(s) in your career?

There are so many; it takes a village! One of my first major influences was Dr. Fred Rahe. I worked at the front desk of his private practice audiology clinic, and he was also my hearing conservation professor. We were able to do sound level measurements at a local factory to learn hearing conservation hands on. He always made learning audiology and working in the clinic fun.

What do you think is the most important challenge facing hearing conservation?

Education! People don't know what they don't know.

What can be done to address this?

Audiologists and hearing health professionals advocating for hearing conservation. If we continue to push for opportunities to educate and spread awareness, then we can make a difference. Having people "buy-in" to hearing conservation may influence them to actively protect their hearing.

How has the COVID-19 pandemic affected you professionally, and how have you handled it?

I am more physically separated from colleagues due to COVID-19, which is tough for me. I enjoy having social interactions at work. Now, I make sure I enjoy my time with colleagues and friends whenever given the opportunity.

Of what accomplishment are you most proud, professionally?

I'm really proud of building good working relationships with other professionals. I went from being in my externship to running my own audiology clinic, and it was because of those peers that that lent an ear (pun intended) and a helping hand that I made it.

Of what accomplishment are you most proud, personally?

Living in and traveling to different parts of the country and world and learning about new cultures; it has helped me grow so much as a person.

When you aren't preventing hearing loss, what do you do for fun?

Study for comps :) ...but, really, spin classes, playing golf, and catching up on my favorite shows.

Lightning Round:

Best place you have ever traveled: Iceland or Thailand
Place you want to visit the most: I want to go back to Europe! - hopping around Scandinavia
Favorite color: green
Favorite animal: cat 😺
Favorite food: Mac & cheese or chocolate cake
Favorite book: I've read the Harry Potter series several times, so I have to go with that :)
Favorite movie: National Lampoon's Christmas Vacation
Favorite sound: my cat's little "mews"

NHCA Narrative:
Jim Schultz

by Jim Schultz
NHCA Member

I trace the origin of my NHCA story to one of the most important homework assignments of my academic career, which I failed.

In 2007, I was an undergrad in the Audio Arts and Acoustics department at Columbia College Chicago. Part of the curriculum was a fascinating auditory anatomy and physiology course taught by Benj Kanters. One of the assignments was getting a hearing test at a local clinic that worked with musicians, called Sensaphonics. For most of my peers, it was an easy "A".

In full honesty, I never scheduled an appointment and did not complete the assignment. For the record, it was the last assignment I ever skipped. Feeling guilt from my negligence, I figured the least I could do was hop on the Sensaphonics website to learn more about them. It was my first, independent exploration into audiology and, as the cliché goes, it was a lightbulb moment. I was drawn to this obscure healthcare discipline that revolved around care for our precious sense of hearing. At the time, pursuing a doctorate seemed an insurmountable task, so the idea went to the back burner.

In 2015, I was a second-year audiology student at Arizona State University and attended my first AudiologyNow! conference. The one session on the top of my list addressed hearing healthcare for musicians. The speakers were Mike Santucci and Heather Malyuk of Sensaphonics. I had continued following the company over the years and their conservation-dominant approach put them on my personal "Mount Rushmore of Audiology".

Throughout the talk, a voice in my head started shouting to find a way to get a rotation at Sensaphonics. I lived on the other side of the country and already had my academic rotations booked, but I didn't care. An opportunity to learn hands-on from industry heroes and achieve personal redemption from the bungled Columbia assignment was too important. After the talk, I introduced myself to Dr. Malyuk and blurted a plea for an off-the-record rotation squeezed in between the summer and fall sessions. She generously offered to work with me and see what we could whip up.

A few months later, I was back in Chicago, shadowing Dr. Malyuk at the Sensaphonics Musician's Hearing Clinic. The impact of my time there is beyond the scope of this story, but the experience was transformative.

Before returning to Arizona, Heather plugged the NHCA as a professional collection of "our people" and strongly recommended attending the annual meeting as someone interested in conservation. Heeding her advice, I went to the following NHCA conference and was sold.

Today, I'm an NHCA member and work on the Noise Outcomes in Servicemember Epidemiology (NOISE) study, exploring the effects of military exposures on hearing health in our Service members and Veterans. In 2022, I had the privilege of speaking at the NHCA annual conference on behalf of our team and it was quickly cemented as one of my favorite professional accomplishments.

I've enjoyed reflecting on the past fifteen years to attempt a cohesive NHCA narrative. In hindsight, it was intertwined in a happenstance chain of events that, ultimately, led me to audiology. As we hear more from our peers, I wouldn't be surprised to see timely interjections from "our people" emerge as a common theme of paths to the NHCA. That was certainly my experience and I hope to pay it forward to others moving into the future.

NHCA Narrative:
Frank Wartinger, Au.D.

by Merlyn Lubiens
NHCA Emeritus Member

There's a crack, a crack in everything.
THAT'S HOW THE LIGHT COMES IN!

– lyrics lifted from "Anthem",
as written and sung by Leonard Cohen

Maybe you've already noticed. There's a movement afoot and the momentum is building. "Light is coming in" at ear level as more and more big-name musicians are tuning in to the "How To" that prevents noise-induced hearing loss. But we're getting ahead of this story.

There are those who are gifted with both a brilliant mind and an inherent capacity to care.

Frank was born into a family of ever-excelling musicians. He was no exception, as he grew into the pleasures of improvising in jam sessions and onstage performances. It came as no surprise that Frank's path included earning a Bachelor of Music degree at Purchase Conservatory of Music in the Studio Production Program. What may have come as a surprise to Frank was the evolution of what became the rest of his story, in parallel with being an accomplished musician.

Frank recounts how, as he progressed through middle school and into high school, he was increasingly aware of the onset of tinnitus, an untimely distraction that became constant and always audible. Eventually, the persistent nature of this condition peaked Frank's curiosity and concern, prompting him to, of all things, purchase several audiology textbooks.

Fast forward. As if responding to a calling, this very active composer, producer, recordist, mixing engineer, and multi-instrumentalist strategically added a graduate degree in Audiology to his professional repertoire of understanding.

Thereafter, Frank began to envision launching Earmark Hearing Conservation; the "crack" that would "let the light come in" to benefit a very deserving sector of society. Ultimately, it was Frank's desire that it would become a destination where he could combine his love and appreciation for music with his knowledge and professional ability to administer hearing healthcare.

Earmark now serves musicians and music lovers with customized solutions for listening, monitoring, and performance needs. Understandably, the protocol and primary focus for almost every patient begins with the administration of a comprehensive hearing evaluation that objectively dictates the professional counsel and recommendations that follow, whether it be hearing conservation consultation, custom hearing protection options, and/or in-ear monitors - always with an "ear" for the trickle-down availability of new technologies.

Frank has also come to recognize the importance of grassroots endeavors. As a guest instructor, he often stands before a select classroom of university students, where he is given the opportunity to tie an appreciation for all types and styles of music with an introductory course regarding the effects of noise on hearing, which generally leads right into something akin to, "There's no cure for a noise-induced hearing loss. But here's the good news! A noise-induced hearing loss is preventable!" The Q&A session that follows is always rewarding for its spontaneity of having been such a teachable moment.

Here's an update to Frank's lifetime of listening through his tinnitus condition. Quote: "I have completely habituated and no longer have a negative reaction or find tinnitus bothersome. In fact, I now see this as a positive in my life, as it has guided my path into music school, into audiology school, and into my work with patients who are still in the early reactive stages of tinnitus perception."

In April 2022, Earmark introduced and produced the first in a series of "Talking Ears" podcasts. "Talking Ears" is an unscripted Q&A format, very interactive and personalized, with the goal of providing a space for music creators to discuss their hearing needs and issues. Or, simply stated, the guests are primarily music creators speaking on the subject of their ears.

Frank hosts each podcast in the background, focusing "the incoming light" on each guest. Still, it is his warm and casual manner that has already established his reputation for drawing the listening audience to sense, "it's as if we're all in the same room."

Frank readily credits fellow NHCA member, Michael Santucci of Sensaphonics, for having pioneered audiology services in the music industry which has, by extension, resulted in Frank's very fulfilling vocation. Frank states, "We are increasingly delighted to witness and welcome a steady increase in the number of clinical settings where audiologists are learning (just like I did) about hearing protector products specifically designed for musicians and, subsequently, adding this feature to their service capabilities. It's truly a niche of hearing conservation – where there are no compliance regulations - that has proven to prevent noise-induced hearing loss." To which Frank adds, "There's a great deal of satisfaction in being able to report that this new awareness is actively spreading to benefit our nation's population of musicians at every level."

When asked, "To what do you most attribute Earmark's day-to-day success?" Frank's immediate response was, "The unsolicited power inherent in word of mouth." Most business-minded people, when hearing this, will assess this response as being the obvious outcome of having combined business longevity with a stellar reputation for delivering what has been promoted and promised. In this case, being so genuinely authentic is a big plus!

Prepare to be impressed as you visit and read the more detailed commentary presented at earmarkhc.com. The home page accommodates easy access to the podcast and previous "Talking Ears" presentations. Then, you may want to take note of the calendar that lists when virtually taught CAOHC certification and recertification training courses are scheduled.

Oh, yes! Being married with two young children has conditioned Frank to work only half-days as he strives to manage getting everything done in no more than 12 hours every day.

"There's a crack, a crack in everything.
THAT'S HOW THE LIGHT COMES IN!"

Author's footnote: What a personal privilege to interview and become better acquainted with Frank Wartinger. As one of many Past Presidents of NHCA, it is reassuring to realize that Frank represents an emerging generation of hearing conservation professionals who are so fully committed to Our Vision and Our Mission.

Remote and Hybrid Workers in the White-Collar Sector: New Data Highlights the Modern Workplace's Toll on Hearing

Heather Malyuk
Owner, Soundcheck Audiology
heather@soundcheckaudiology.com

The term "hearing conservation" often conjures up images of bright vests, foam earplugs, and protective eyewear. In 2022, however, audiologists are finding that noise-exposed workers are not limited to factories, construction sites, or other "hazardous" venues. On the contrary. A budding population in need of hearing conservationists seems to be white collar, work-from-home (WFH), and hybrid workers. The World Health Organization's "2021 World Report On Hearing" estimated that approximately half of the global population is at risk of acquiring hearing loss from hazardous listening practices both at work and home. While it is important to reach the entire world with the message of conservation, it is essential to first collect data to inform recommendations. WFH and hybrid workers have very little evidence-based literature centered on their auditory experiences. However, anecdotal evidence suggests that workers are experiencing increased rates of auditory fatigue and tinnitus from increased use of ear-level devices. Tuned, a teleaudiology company focused on providing hearing care as a health benefit, sought to collect data from this population.

Using SurveyMonkey®, Tuned collected responses from 353 workers, ranging from 20 to 65 years in age, to determine access to hearing health via their employer and their own hearing experiences. These individuals spanned the entirety of the United States, with 28% identifying as non-white, and with a variety of job titles *(figure 1)*.

Of the respondents, 80% were employed by an organization on a full-time basis, with all such respondents either working remotely or in a hybrid fashion. Of the full-time employees, 83% receive health benefits from their employer, with only 46% of those receiving hearing benefits.

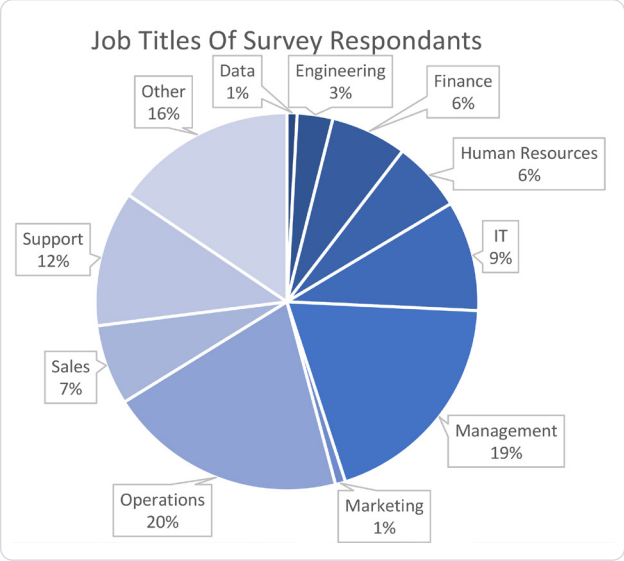

Figure 1

When focusing solely on the 233 full-time workers who have employer-provided health benefits, Tuned's study found that 60% experience listening fatigue at the end of their workday (figure 2), with 52% admitting to taking added workday breaks due to listening fatigue. Additionally, 49% of those individuals wear earphones/headphones for more than 5 hours per day (figure 3) with 43% reporting that 5 or more hours are for work-related use only.

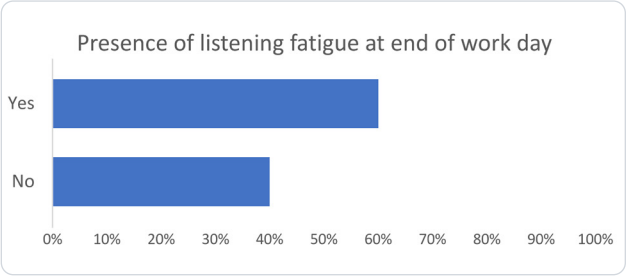

Figure 2

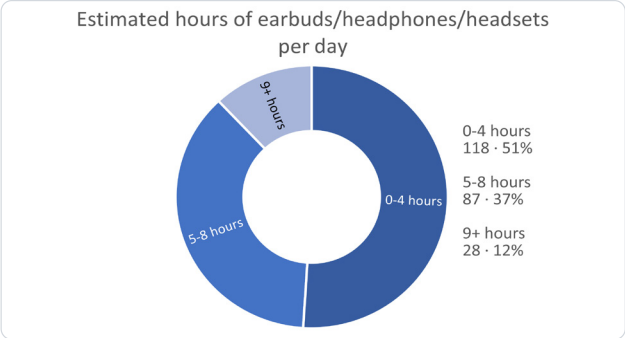

Figure 3

These workers also experience hearing disorders, with 43% disclosing having tinnitus (ringing in the ears) within the past year, and 26% experiencing an increase in tinnitus and/or other hearing issues since the pandemic.

These data imply a need for hearing conservation education, hearing screenings, and recommendations. As more data is collected, hearing conservationists will be able to offer this population as much evidence-based care as their industrial counterparts.

Reference: World Health Organization. (2021). World report on hearing.

Aage Møller, a Father of Tinnitus Research, beloved colleague, mentor, and friend passed away August 19, at the age of 90.

https://news.utdallas.edu/faculty-staff/aage-moller-tribute-2022/

Margareta and Aage Møller

Robert J. (Bob) Oliveira, biochemist, inventor, and founder and CEO of Hearing Components, Inc., passed away Sept 5, at the age of 79.

https://m.startribune.com/obituaries/detail/0000436565/?fullname=robert-j-oliveira

Bob Oliveira