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Proposal Word Count: 1,312

Project Proposal: What are the most effective pedagogical approaches for trans and gender queer singers to learn the concept of formant tuning in terms of gender presentation and perception?

Context:

One of the main challenges transgender singers face is being perceived as the gender they identify with, especially since the field of singing utilizes strict gender binaries to describe and cast singers in roles and voice types (Sauerland, 2022). It is a crucial time to determine ways to support trans singers in the voice studio, especially for transfemme singers, HRT does not alter fundamental pitch of their speaking voice, unlike transmasculine singers who are on testosterone, which does cause the vocal folds to thicken and therefore drop in fundamental pitch (Saureland 2022).

While fundamental frequency of pitch is the primary indicator of gender perception in the voice, there are many studies done to show that formants as well as other speech patterns and characteristics play a large role in gender perception of the voice. (Södersten et. al, 2024; Hero and Houston, 2023; Ghorshi, Vaseghi, and Yan 2008; Schmid and Bradley 2019; Manny, 2014; Houle & Levi, 2021; Kim, 2020; Martinho et. al, 2024).

HRT and gender affirming healthcare is jeopardized. This is especially important to equip trans/gender non conforming singers in a time where gender affirming care and hormone replacement therapy is jeopardized. In the United States, there are currently 711 bills being considered nationwide which would negatively impact trans/gender non conforming people, and 169 of them are putting healthcare at risk (Trans Legislation Tracker, 2026).

Justification

This artifact is a lesson plan for teachers introducing the concept of formant tuning for transgender singers who are often overwhelmed with the information they are initially presented with. This leaves many singers feeling disheartened, and unaffirmed- which is the whole point of

GAVT. My approach in the studio connects concepts the student is familiar with such as accents and different genres/styles to new concepts such as vowel modification and formant tuning. The lesson plan is designed to incorporate multiple pedagogical methods to assist the student in accomplishing the objectives, which broadens the typical approach of mimicry and modeling with just words. This approach with multiple pedagogical methods is pertinent since trans/gender non conforming people are more likely to have autism, ADHD, and other developmental/sensory issues than cisgender people (Tollit, 2024; Dattaro, 2020).

I utilize scaffolded learning by taking the concept of accents and connecting them to various genres of vocal music which are topics singers have been introduced to at some point in time, to newer concepts like formant tuning. I then ask them to reflect upon those experiences, as we build upon the acquired knowledge. This references Kolb's cycle of experiential learning. I also utilize Bloom's domains of learning and levels of learning with associated objectives (Gravells, n.d.). The theories framing this research are Kolb's cycle of experiential learning, scaffolding techniques, and sensory learning. While I cannot cater to every individual with this lesson plan, broadening the scaffolding tools and sensory learning methods to encompass cross genre singing and accents, provides extra reinforcement and connection to create a holistic perspective to formant tuning in gender affirming voice therapy/training.

The Intended Impact

The intended impact of this research is to determine effective pedagogical strategies for introducing abstract concepts such as formant tuning. While research has been done on effective methods, this project specifically is determining how to equip teachers with tools to best teach formant tuning in the context of gender affirming voice training. Testing this lesson plan and gathering feedback from participants will be crucial in assessing its viability.

While perception and presentation are influenced by many factors, such as prior experience, unintentional bias, environmental surroundings, and contextual motivation, this lesson plan is a tool in empowering transgender singers to use a voice that is most authentic to how they identify and want to present to the world. The holistic approach considers not just the objectives and goals but the human who is the student, and their journey as they go on to meet their goals, not just within the context of the studio but also as they navigate their lifelong relationship with their voice.

There is still very little research on transgender individuals, even much less so in the voice field (Graham, 2019). This research will fill a gap in knowledge about an oppressed group of people, and obtain useful information that has the potential to understand the experiences of trans and non-binary voices

The Outlined Intention

I intend to hold a group class and masterclass on 3/28 at Ripley Grier Studios in NYC, from 1:15-3:30 going through the lesson plan with a group, and then holding a masterclass for 6 students to apply what they learned in the lesson plan. I aim to utilise mixed methods for conducting this research. By employing both qualitative and quantitative approaches as well as qualitative data concerning experiences and descriptive data. I have already conducted a review of evidence and literature in Module 5. This review investigates how formants are a key part of gender perception, and how formant tuning and vowel modification are utilized in familiar concepts such as singing across genres and accents, and the best pedagogical tools to teach these concepts. I will distribute questionnaires to the masterclass participants gathering information on masterclass participants such as HRT information, age, assigned sex at birth etc. Then I will distribute surveys to gather the understanding of those in the group class and masterclass investigating the experiences of participants before and after the class. I will use a reflective journal and field notes to track my data and process of conducting this research.

March	April	May	June	July	August	September
Proposal Submitted 3/2	obtain surveys	synthesize findings	synthesize findings	write body of project	Draft submit	edit draft
Develop methods 3/6						prepare for presentation
Conduct Research 3/28						

Ethics and Insider Research

There are risks to teaching topics surrounding health and identity, and gender presentation/perception, which can be sensitive topics. Recalling potentially stressful / traumatic experiences and asking questions about private information such as healthcare can be of risk to the participants (Amir, Badour and Freese, 2009) Sensitive issues can pose a risk to one's mental health. I will list mental health resources that can assist the participants, if they feel like they need professional help such as Trans New York.

Participants will be informed of how data will be collected through surveys, questionnaires, and Video/audio recording of the class. They will know their data will be collected through google forms stored on google drive, and how the data will be about some aspects of their voice, identity, and health details. They will know they may withdraw at any time, and their data will still be protected. They will sign their consent on a form I will create and verbally confirm their consent at the beginning of their participation. When I am conducting the group class I will ensure that the wires are taped down, a clear pathway is made for participants to move in, then making sure everyone knows where fire exits are.

As an insider, I will recognize my bias, especially drawing upon my personal and professional community as potential participants, and also take into account my own experience as a neurodivergent nonbinary vocalist who works with transgender voice students. While my position lends me empathy and understanding, I will rely on my tutor for guidance to ensure there are any blind spots that are creating unethical research practices.

Expected Learning Outcomes

- Assessing the viability of utilizing the lesson plan in the studio by obtaining feedback from participant surveys
- Understand the learning needs of trans/gender non conforming individuals in the voice studio
- Ability to apply conclusions to refine and strengthen my teaching practice

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Word Count: 10,936

**Most effective pedagogical approaches for trans and gender queer singers
to learn the concept of formant tuning**

INTRODUCTION

Context:

The field of singing utilizes traditional gender binaries of male (assigned male at birth) and female (assigned female at birth) to categorize voices (Ehrick, 2015; Sauerland, 2022). The labels soprano, alto, tenor, and bass are standard in industry and education, and there are terms such as spinto, coloratura, lyric, and dramatic, to denote timbre and weight (Hagen, 2020). However, what happens when a voice does not fit into those categories?

Transgender and gender non conforming singers often struggle with their voice as it may not present and align with their gender identity. It is a crucial time to determine ways to support trans singers in the voice studio, especially for transfemme singers, since HRT does not alter fundamental pitch of their voice (Gorham-Rowan & Morris, 2006) unlike transmasculine singers who are on testosterone, which does cause the vocal folds to thicken and therefore drop in pitch (Brown et al., 2020).

While fundamental frequency of pitch is the primary indicator of gender perception in the voice, there are many studies done to show that formants as well as other speech patterns and characteristics play a large role in gender perception of the voice. (Södersten et. al, 2024; Hero and Houston, 2023; Ghorshi, Vaseghi, and Yan 2008; Schmid and Bradley 2019; Manny, 2014; Houle & Levi, 2021; Kim, 2020; Martinho et. al, 2024).

This is especially important to equip trans/gender non conforming singers in a time where gender affirming care and hormone replacement therapy is jeopardized (Redfield et al.2024). In the United States, there are 711 bills being considered nationwide which would negatively impact trans/gender non conforming people, and 169 of them are putting healthcare at risk (Trans Legislation Tracker, 2026).

Justification:

The artifact I developed is a lesson plan for teachers introducing the concept of formant tuning for transgender singers. Students are often overwhelmed with the information they are initially presented with, leaving many singers feeling disheartened and unaffirmed- which is the whole point of GAVT. The lesson plan is designed to incorporate multiple pedagogical methods to assist the student in accomplishing the objectives of gender affirmation and agency in how they choose to present their voice. This approach with multiple pedagogical methods is pertinent since trans/gender non conforming people are more likely to have autism, ADHD, and other developmental/sensory issues than cisgender people (Tollit, 2024; Dattaro, 2020).

I utilized scaffolded learning by connecting familiar concepts such as accents and various genres of vocal music to newer concepts like formant tuning, which broadens the typical approach of mimicry and modeling. I then ask them to reflect upon those experiences through a sensory lens, as we build upon the acquired knowledge. This references Kolb's (2015) cycle of experiential learning. I also utilize Bloom's domains of learning and levels of learning with associated objectives (Gravells, n.d.). The theories framing this research are Bruner's Spiral Curriculum and Vygotsky's Zone of Proximal Development in the context of sensory learning methods. While I cannot cater to every individual with this lesson plan, broadening the scaffolding tools and sensory learning methods to encompass cross genre singing and accents, provides extra reinforcement and connection to create a holistic perspective to formant tuning in gender affirming voice training.

The Intended Impact:

The intended impact of this research is to determine effective pedagogical strategies for introducing abstract concepts such as formant tuning in the context of Gender Affirming Voice Training. Gender perception and presentation are influenced by many factors, such as prior experience, unintentional bias, environmental surroundings, and contextual motivation. Pernet, Belin & Jones (2014) also concluded that gender and phoneme processing seem to be separated at the early stages of processing auditory information, since the brain relies on different acoustical cues.

Given this, the lesson plan inquires how to best equip teachers with tools to best teach formant tuning to present authentically and the feedback from this study tests its viability. This lesson plan is a tool in empowering transgender singers to use a voice that is most authentic to how they identify and want to present to the world. The holistic approach considers not just the

objectives and goals but the human who is the student, and their journey as they go on to meet their goals, not just within the context of the studio but also as they navigate their lifelong relationship with their voice.

Since there is still very little research on transgender individuals, even much less so in the voice field (Graham, 2019), this research fills a gap in knowledge about an oppressed group of people, and obtains useful information that has the potential to understand the experiences of trans and non-binary voices. I assessed the viability of this lesson plan I developed in previous modules and obtained feedback from participant surveys, to better understand the learning needs of trans/gender non conforming individuals in the voice studio and hone the ability to apply conclusions to refine and strengthen my teaching practice.

LITERATURE REVIEW

Longer vocal folds will have more mass and therefore vibrate at a lower rate. People AMAB (assigned male at birth) tend to have longer vocal cords (Gelfer and Mikos, 2005; Gelfer & Bennett, 2013) and therefore have a lower pitched voice. People AFAB (assigned female at birth) tend to have shorter vocal cords, so the folds will vibrate at a faster rate, hence why pitch is the initial indicator of biological sex assigned at birth (Babel, McGuire & King, 2014). Throughout all of these studies, the initial primary factor of gender perception tends to be the fundamental frequency (f_0), often referred to as pitch. Knowles & Little (2016) investigated how various acoustical factors, such as pitch and formants, altered a listener's perception of how cooperative the speaker is, as cooperation tends to be a quality associated with feminine traits. In the study, voices featuring a "feminine" range F_0 were rated as more cooperative than those with masculinized F_0 , regardless of the speaker's assigned sex at birth.

A study by Gelfer and Schofield (2000) also concluded that voices perceived as female averaged a higher speaking fundamental frequency (SFF) compared to those perceived as male. The upper limit of SFF and ratings of femininity were correlated in the results, suggesting that higher pitch ranges are associated with perceptions of femininity in 'Male to Female' transgender voices. Houle & Levi (2021) showed that whispered speech reduces gender clarity, indicating how significant F_0 and formants are to gender perception. Schmid and Bradley (2019) found that non-binary speakers F_0 averaged to be right in between the mean F_0 of cisgendered women and men, but the non binary speakers with more of a feminine gender identity had a higher SF_0 and those with more of a masculine gender identity had a lower SF_0 . They also

found that both masculine and feminine speech cadence and intonation patterns were used across the nonbinary participants. However, it is important to note pitch varies across cultures. Fundamental frequency does change depending on language and cultural tendencies, and perception changes due to cultural expectations and norms (Van Bezooijen, 1995; Natour and Wingate, 2009; Altenberg and Ferrand, 2006). This highlights a crucial aspect of cultural context and the voice, and also points to how gender is presented and perceived differently in various cultural and social contexts (Hancock et al., 2014).

Although F_0 can establish the initial impression of a voice in terms of gender perception, formant frequencies—the resonant frequencies of the vocal tract—can further alter and refine the perception (Donai & Lass, 2015). F_1 is associated with tongue height, and F_2 with tongue front-to-back position. If F_0 is unclear, the additional formant frequencies determine whether a voice appears masculine, feminine, or androgynous (Gelfer & Bennett, 2013; Hillenbrand & Clark, 2009). Higher vowel formants, particularly F_2 , produce a more feminine or androgynous sound (Schmid & Bradley, 2019). Many studies (Manny, 2014; Houle & Levi, 2021) have shown that when both F_0 and F_2 are higher, femininity ratings are higher. Schwarz et al. (2018) pointed out that even after having their voices feminized, the voices of transgender women often differ acoustically from those of cisgender women, particularly in terms of F_0 and resonance quality.

However, when both F_0 and F_2 values increase, the voice is perceived as more feminine over time (Mount and Salmon, 1988). This is attained through shifts in tongue placement as F_2 increased; listeners began to regard the speaker as female. Babel, McGuire, and King (2014) found that higher F_2 values in the vowel /u/ strongly predicted vocal attractiveness in female voices. In the 2018 study by Gallena, Stickels, and Stickels, the F_1 to F_3 vowel formant values of a male speaker were altered while the fundamental frequency remained unchanged. As the formants increased, listeners' perception gradually shifted from masculine to feminine.

Vowels such as /a/ and /æ/, which naturally have a high F_1 , showed that resonance patterns, rather than pitch, determine how gendered a voice is perceived. Assmann, Nearey, and Dembling (2006) used a vocoder to alter F_0 and formant frequencies and found that consistency between the two was essential for perceived naturalness. Voices with higher F_0 and higher formants were considered more feminine, while those with lower values were seen as masculine. However, in mixed configurations, the results were ambiguous, showing that both pitch and resonance determine gender perception. Hardy et al. (2020) reproduced these findings by showing that F_0 mainly determines the perceived gender but that F_2 also plays a role in the assessment of femininity in the voices of transgender women.

Shifting formant values to increase or decrease is not the only factor in gender perception, but shifting values proportionally to each other can shift how resonance is perceived. Idsardi and Zetland (2019) found formant spacing results from both vocal tract length and vowel-associated constrictions; even when tract lengths differ, similar F_1 resonances can occur in high vowels. Cartei and Reby (2015) concluded formant spacing, especially between F_1 and F_2 , contributes to gender perception in the voices of pre-pubertal children, since F_0 differs only slightly. The wider formant spacing observed in AMAB children (indicating broader tracts) was regarded as more masculine, while the narrower spacing in AFAB children was seen as more feminine. Deepawale et al. (2008) also supported the sex-related differences in spectral energy, particularly between F_2 and F_3 . Doyle et al. (2024) found that altering formant spacing during therapy did not negatively affect intelligibility, supporting the clinical feasibility of such adjustments.

Accents influence vowel formants and shape not only how a language or dialect is produced and perceived but also how others can perceive the speaker's gender (Burgering et al. 2020). Hero and Houston (2023) point out that using a range of accents in speech leads to a clearer awareness of how mouth shape and vowel resonance change. This kind of exercise is useful for trans people trying new resonance techniques. Ghorshi, Vaseghi, and Yan (2008) found that differences between accents affect dialect perception almost as much as gender differences. They conclude that F_2 is the most powerful acoustic indicator for classifying an accent, with F_1 coming next. Both Weber et al. (2001) and Babel et al. (2014) also find that variation in F_2 —particularly in the case of /u/-fronting—correlates with both the differentiation of regional accents and with the perceived attractiveness of the speaker. Chan, Hall and Assgari (2016) conducted a study in which they changed the vowel formant values in synthesized English and Spanish-accented speech. They found that different F_2 values affected comprehension and the perception of accent strength. Yan et al. (2007) compared the vowels of British, American, and Australian English and found that Australian vowels had lower F_1 and higher F_2 values, whereas British vowels exhibited intermediate values. When formants were altered to match patterns of other dialects, perceptual shifts in accent occurred, just as formant tuning affects gender perception. Therefore, accent-training techniques can provide a basis for modifying F_1 – F_2 spacing in gender-affirming contexts.

Titze, (1982) validates the significance of sensory feedback in voice production. Boysen and Hide (2024) exemplified these sensory techniques involving twang and medialisation to help participants modify vowels to alter the gender perception of their voice. In the first session,

participants were given an explanation of what twang and medialisation meant and were asked to speak at a pitch higher than their normal speaking pitch and adjust their tongue position to achieve a twangy, forward resonance. The initial aim was for participants to develop a good understanding of their own voice and its possibilities so they could carry out the resonance techniques. To achieve this, they isolated vowel sounds, then combined them into diphthongs before progressing to full words. The clinician used sensory learning methods to stress the importance of feeling and being able to tell the difference between the sympathetic resonance vibrations in the lips, teeth, nostrils, and hard palate. Participants were asked to listen to the recordings, identify the different sounds, and link them to the kinesthetic sensations.

Laird (1985) found that while kinesthetic and auditory sensory learning are important in singing, 75% of an adult's knowledge comes from sight, 13% from hearing, and the remaining 12% comes from a combination of touch, smell, and taste. However, Mayer (1998) examined whether recall improved when instructions were delivered both visually and aurally, and found that integrating both methods led to better recall than relying on visual information alone. The results show that multisensory learning is even more effective.

Other sensory learning tools also support visual learning, such as automation and biofeedback technologies with promising uses in gender-affirming voice therapy. Kumar et al. (2011) and Deepawale et al. (2008) explain that classifying pitch and formant data can support therapy by providing real-time visual feedback. In their study, Kawitzky and McAllister (2018) used visual-acoustic biofeedback to help transgender women train their resonance strategies to raise F_2 values and blind listeners judged higher F_2 values as more feminine.

Different musical genres involve different resonance strategies, which can shift F_1 and F_2 values (Bozeman, 2013; Sundberg & Thalen, 2015). There are differences in pharyngeal width and laryngeal height among genres (Wilson, 1997; Latimerlo & Popeil, (2012). In the case of classical and R&B, the pharyngeal space is wider, with country and rock using a narrower and more constricted space, and pop or musical theatre showing a degree of neutrality. Since the space of the vocal tract changes, this shifts the formant values.

Vowel modification, a conventional method for balancing resonance across registers (O'Connor, 2022), can also influence gender perception by shifting formant values. Closed vowels, such as /u/ and /i/, have a low F_1 , whereas open vowels such as /a/ have a high F_1 . Fronted vowels, like /i/ and /æ/, produce high F_2 values and are perceived as brighter or more feminine; back vowels such as /a/ and /u/ produce lower F_2 values and a darker sound. By altering laryngeal height and

pharyngeal width, singers can modify these spectral characteristics. (Moisik et. al., 2019; Ragan and Popeil, 2017; Emmons, n.d.)

Vocal tract shapes can be linked to perceived gender characteristics—low, wide configurations mirror a darker, "masculine" timbre, which while higher, narrower ones sound brighter or more "feminine". In classical singing, darker vowels and a lowered larynx enhance "scuro" resonance, associated with masculine qualities (Moisik et al., 2019). Transmasculine singers may therefore benefit from classical repertoire emphasizing rounded vowels such as /o/, which lowers F_1 and F_2 , deepening perceived resonance. Conversely, musical-theatre belting emphasizes brightness and forward resonance: vowels like /æ/ raise F_2 , and the "molar mouth" technique widens oral space for a brassy, feminine sound (Popeil & Latimerlo, 2012; Cardon, 2021). Encouraging transfeminine singers to perform such repertoire can provide a sensory and acoustic framework for achieving higher F_2 resonance and thus greater vocal femininity.

Teaching these concepts with sensory learning is extremely useful in pedagogy, because it connects the students' experience to new concepts, which is termed "scaffolding." Gregory (2023) describes various types of scaffolding (such as procedural, conceptual, strategic and metacognitive) which accomplish different aims to help the student become well versed and competent in a subject. Blummer (2014) notes that meta cognitive learning can be done with a variety of reflective tools and prompts rather than attempting trial and error, which can be inefficient.

While the literature I used in previous modules draws fairly consistent conclusions, it must be acknowledged that perception is subjective, students have individual learning styles and needs, and these conclusions from literature will vary across different manners of speech and languages (Zimman, 2017; Van Bezooijen, 1995; Altenberg and Ferrand, 2006). This approach with multiple pedagogical methods is pertinent since trans/gender non conforming people are more likely to have autism, ADHD, and other developmental/sensory issues than cisgender people and therefore have different learning needs (Tollit, 2024; Dattaro, 2020).

METHODOLOGY

This project is grounded in the framework of gender perception- and perception cannot be controlled, it can only be constructed (Johnson and Sjerps, 2017). Perception can be altered by how the subject presents, and is inherently subjective. While that does remain to be true, in my work in the last module I discovered how perception can correlate with positivism - the numbers

and data will often correlate with subjective findings. Many find positivist and constructivist perspectives to be irreconcilable (Lincoln and Guba, 2000). However, Cupchik (2001) argues that the quantitative methodologies correlating with positivism and qualitative methodologies correlating with constructivism can be bridged by the term he coined- constructivist realism. This term *“acknowledges a social world (or worlds) that is reflected in the natural attitude of daily life and exists prior to and independent of either positivist or constructivist analysis; hence realism.”*

Therefore, I position myself within this constructivist realist ontology. I utilize and position myself in the constructivist theory which claims that learners acquire new skills and knowledge not just by direct instruction but also experiences, interaction, and integration (Williams, 2021). There are advantages and disadvantages of constructivism within pedagogy, but the disadvantages are often only present in large classroom settings, and with standardized objectives (Gleeson, 2017).

The advantages are highlighted in the voice studio application, where the setting for teaching voice in a musical context is one on one or small group learning. This ontological stance informs my methodology by building upon the research that I began in module 4 and synthesizing that literature to create this artifact, which consisted of mostly quantitative data surrounding formants. However, perception is a topic which is inherently subjective so I drew upon some findings from my module 3 work which delved into the perspective of trans women/femmes, which would work with data from empirical testing, as well as drawing upon my own experiences teaching in the studio. Utilizing both white and grey literature is informed by constructivist realism because it acknowledges the social world which *“exists outside of positivist and constructivist analysis.”* Therefore, I use grey literature from forums and websites which add valuable insight to the social aspects of this area of research, lending to Vygotsky’s perspective that learning is a co-created experience, as well using reliable sources which represent this under-researched population.

This study also adopts an interpretivist-constructivist epistemology. Knowledge about effective gender-affirming vocal pedagogy is understood as being co-constructed through interactions between researcher, participants and the educational context. This is informed by theoretical frameworks that support social co-constructed learning, such as Vygotsky’s zone of proximal development (Shabani, Khatib and Ebadi, 2010). The Participants' experiences of learning, voice and gender perception are therefore viewed as valuable sources of knowledge. At the

same time, quantitative evidence, including findings from acoustic research and participant questionnaires, is used to supplement these interpretations, resulting in a mixed-methods approach. The methods utilized in the design are literature reviews, artefact development, questionnaires, pre/post surveys, reflective journals, field notes on the class recording, qualitative coding and descriptive quantitative analysis.

Artefact development:

In order to discuss how the lesson plan is applied, a short explanation of how it was intentionally developed is necessary. Since accent training techniques can serve as frameworks for modifying F_1 – F_2 spacing in gender-affirming contexts, I utilized accents as an introduction to formant tuning (Chan et al. 2016). Various accents and dialects are concepts most people are aware of, even if they do not know the intricacies of accents or how to accurately utilize them in speech and singing. Building upon this familiar concept can be effective to introduce vowel modification through conceptual scaffolding as outlined in Bruner's model of the spiral curriculum (Johnston, 2012). The lesson plan prompts the teacher to ask the student to mimic an accent and repeat after the instructor. This modeling approach allows the student to observe an example before introducing the main topics of the lesson. It also establishes trust in the student-teacher relationship, where the teacher leads and the student follows. Once they receive affirmation that they accomplished the mimicry, the student can feel empowered to try new things, lending to Bruner's theories of learning through discovery (Johnston, 2012).

I utilized Bloom's levels of learning objectives alongside Kolb's reflective model. First, I ask students to recall what they previously knew and their concrete experience of how the introduction felt in their body. This reflective kinesthetic prompt helps the student become aware of how their body is incorporated into the abstract concepts introduced next (Quinn, 2000). A visual aid is then used to explain how vowels are formed in the mouth and shaped with the tongue and lips. This visual aid is introduced first since seventy-five percent of the information adults obtain is visual (Laird, 1985). The graphic shows examples of words because the student may not be familiar with the International Phonetic Alphabet, which is how the vowel cone graph is typically displayed.

For the next stage of Kolb's experiential learning, I introduce kinesthetic sensory mapping by making physical adjustments and becoming aware of how they feel in the body. Singers can often become "stuck in their head" when taught with abstract concepts. Kilpatrick (2020) notes the importance of movement in voice pedagogy, requiring awareness of the body and the parts

utilized to attain the task at hand. Identifying the tongue and lips, which shape the vowels and vocal tract, is crucial so the student understands the physical tools at their disposal. I also incorporate Bloom's next level by prompting students to describe where and how they felt changes in their body and where they experienced sympathetic resonance. This combines direct instructions on tongue and lip movement with modeling through mimicry.

The vocal warm-ups provide trans-femme and trans-masc singers with a framework for incorporating vowel shapes before introducing formant tuning. Allowing the brightest, most forward vowel [i] helps trans-femme students modify subsequent vowels to be brighter, an example of medialisation described by Boysen and Hide (2024). Lip rounding in the trans-masculine exercise lowers the fourth formant, elongates the vocal tract, and produces a darker quality associated with masculine voices (Mount and Salmon, 1988; Zimman, 2017).

The next stage in Kolb's reflective cycle is abstract conceptualization, where I introduce formants. Formants can be confusing, so establishing a proper framework beforehand is paramount. Explaining how formants can be of value for transgender students, as students can disengage when taught complex concepts without comprehending the subject's relevance (Nicholson and Putwain, 2015). Since pitch is often assumed to be the only means of altering gender perception, explaining how formant spacing can influence gender perception even when F_0 values don't change demonstrates why this concept is important for gender-affirming voice training (Gelfer & Bennett, 2013; Hillenbrand & Clark, 2009; Schmid & Bradley, 2019; Manny, 2014; Houle & Levi, 2022; Babel, McGuire, and King, 2014; Assmann, Nearey, and Dembling, 2006). The lesson then builds on the earlier sympathetic resonance mapping exercise to introduce vowel modification.

The next stage in Kolb's reflective cycle is active experimentation, which corresponds with Bloom's next level of application. The student first observes another singer applying these concepts in a video, demonstrating that performances, videos, and everyday speech or singing can all be connected to studio work (Amir et al., 2009). The student then applies these discoveries to a vocalise or piece. Sauerland (2022) notes the importance of student agency in repertoire selection, particularly because repertoire often exists within a strict gender binary. I have found that giving students agency strengthens confidence and their "inner voice," which also strengthens their physical vocal apparatus (Cardon, 2021). This is especially important for transgender singers, who may have a complex relationship with identity, gender presentation, and how they are perceived. Songs can be transposed to suit the student's vocal register, with

application guided by the instructor (Vala, 2021). Selecting repertoire appropriate to the student's level remains important, making song suggestions or working within the student's preferred genres proves to be beneficial.

At the end of the lesson, I address Bloom's remaining learning objectives of analysis, synthesis, and evaluation. I ask students to compare how they felt at the beginning and end of the lesson, summarize the concepts they learned, and evaluate how the application supports their personal goals. These reflective questions are an example of metacognitive scaffolding (Warwick, 2007). Students and teachers can then assess together how to move forward establishing communication.

I incorporate multiple forms of sensory learning in the lesson plan so instructors can adapt if a student struggles with one approach (Pernet et al., 2014). Challenges may arise if a student is unfamiliar with accents or uninterested in certain musical genres. In those cases, the teacher can adapt by connecting the concepts to songs or artists the student already enjoys and highlighting the speech or singing characteristics they are familiar with.

Methods:

I applied this lesson plan in the context of a group class and masterclass on 3/28 at Ripley Grier Studios in NYC, from 1:15-3:30. I taught the lesson plan with a group, and then taught a masterclass for 6 students to apply what they learned in the lesson plan. I employed both qualitative and quantitative approaches as well as qualitative data concerning experiences and descriptive data. The entrance and exit surveys were designed to measure the observer and masterclass participants' perceived understanding and ability to apply concepts of formant tuning to their singing practice as gender queer singers. I distributed questionnaires to the masterclass participants gathering information on masterclass participants such as any pronouns and gender identifiers. While I initially wanted to ask about age or HRT information, I realized how that does not portray how they will apply concepts of formant tuning and could be seen as unnecessary and invasive. Instead I asked how I could best work with them during the masterclass and what song they would like to sing.

I distributed surveys to gather the understanding of those in the group class and masterclass investigating the experiences of participants before and after the class. The entrance survey had participants note if they identified as neurodivergent, selecting all the sensory ways in which they learn best (visual, auditory, kinesthetic) and scaling their understanding of formant tuning

and vowel modification on a scale of 1-5 (1 being not familiar at all, 5 being very familiar). The exit survey contained the following questions scaled from 1-5 (1 being not familiar at all, 5 being very familiar).

- What is your understanding of formant tuning now after the class?
- What is your understanding of vowel modification now after the class?
- Do you feel confident in applying these concepts to affirm your gender presentation
- What portion of class was most effective for you?

A Introduction using accents

B Visual Charts

C Listening to various genres and artists

D Call and response / mimicking

E Identifying sympathetic resonance

I gave the participants and observers room to add additional comments. This quantitative methodology with scaled surveys ensured I have a framework for the qualitative data to breathe within. I tracked my data and process of conducting this research with reflective journal and field notes.

Ethics and Bias:

As an insider, I recognized my bias, especially as I drew upon my personal and professional community as potential participants. I also accounted for my own experience as a non binary vocalist who works with transgender voice students. Using my place of employment (Singing Lessons NYC by Eleonor England) to advertise the group/master class made it easy to find participants, as a few of my current and former clients and former students signed up. I also drew upon my network by advertising the class on social media, and I had two friends, and three community members join the class as well. In order to ensure that recruiting through my employer was ethical, I verbally reiterated to my clients multiple times that participating or withdrawing from the study would not impact their regular lessons with me, or our working relationship. As I sifted through the data, I used interpretive phenomenological and thematic analysis to draw conclusions from the class recording, and had to be conscious of my bias personally knowing all but one of the participants professionally/personally, and the person I did not know is very connected in my local artistic network.

FINDINGS

Various themes emerged before the class even began. I taught a lesson earlier that day with one of the participants, where she expressed how her American Southern accent came with a lot of assumptions and prejudices, so I chose not to use that one in a demonstration. I prompted the class to speak in a British accent, and asked what they felt. They noticed a dropped jaw, taller vowels, a “bubble” in the back of the mouth. I prompted the class to speak in an Australian accent, and they felt it was wider and brighter. The back of the throat was diminished. They noted the lips were spread wider than how they typically would speak. I noted that while there might be assumptions and associations based on accents and how one speaks, there is no morality on how the voice is used, there are just different resonance and articulation strategies associated with different languages and dialects. I justified using accents (Hero and Houston, 2023) to the class as a way to scaffold with a familiar concept and mimicry as a way to introduce formants. This showed how perception of dialect and accent carries associations and potential prejudice, which closely parallels how gender presentation in the voice also holds prejudice, discrimination, and violence. I investigated the impact of said violence in prior modules, which concluded that violence leads transfemme people to be more cautious to use their voices. Throughout the past few years of working with individuals and groups who have experienced trauma, this violence leads to self silencing as a means of protection and survival, often showing up as jaw clenching. I noticed jaw clenching particularly with Participants A, C, and E later in the class.

After the introduction to the class with accents, I incorporated the concept of vowel modification and its influence on gender presentation (Boysen and Hide, 2024; Moisik et al, 2019). I displayed the vowel cone and used other sensory methods to reinforce the visual chart with mimicking and correlating where sensations can be kinesthetically felt in the mouth with the visual aid. Then, I introduced the concept of vowel height and depth. The chart I used did not have any IPA symbols, but words in English to depict the vowel sounds which made it more accessible. This is a scaffolding technique to not alienate the class and potentially confuse them with very new concepts of IPA symbols. From this visual aid, I prompted the class to mimic me by repeating vowels [a] [E] [i] in order from most open to most closed. I asked “What changes?” The class responded that the tongue had to shift higher, and they also associated that with the jaw closing. Then, I prompted the class to mimic me by repeating vowels [a] [o] [u] in order from most open to most closed. Again, I asked “what changes?” and the class noted that the lips had to round more as the vowels progressed. Participants also noticed that the [i] vowel widened the

lips, and the [u] vowel felt more back. I did make the distinction in speech, the jaw will close the space of the mouth as we use closed vowels, however, when we are sustaining on the vowel in singing, that might not always be the case. I also gave a tactic to reduce nasality but keep brightness. Pinching the nose, and speaking behind the nasality by raising the soft palate, exhibited another manner in which one can shape the vocal tract.

Another theme I coded was additional ways to prompt vowel modification such as utilizing glides to encourage tongue height or lip rounding in a more subtle way. This is effective for students who take an instruction and fixate on the direction resulting in unnecessary tension. For example in **Warm up 1**, there is a [j] glide when the singer shifts from the [i] to the [E] [o] and [a] vowels. This glide helps keep the tongue higher, but I did not mention this. I just prompted the group to shift the second vowels closer to the [i] tongue position. I instructed the singers to sing a vigorous fricative [v] to engage the diaphragm and ensure enough breath energy for the ascending fourths. Participant C noted that there was more connection and consistency in forward resonance. Others said it felt clearer and brighter. I asked if they noticed their tongues moved lower than necessary when they switched vowels from [i] to the other following vowels. They agreed that they felt that. Singers need to ensure we do not overspread and clench the jaw. I said “while we don’t want to completely unhinge the jaw to get space, if we unclench the jaw, there is room for the tongue to take up, and therefore, utilize a brighter resonance without merely using spreading of the lips for brightness.” I added that brightening the vowel by modifying towards the [i] tends to be associated with more of a feminine vocal quality (Manny, 2014; Houle & Levi, 2021).

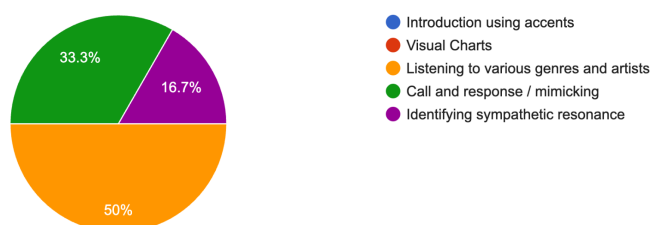
Another example of a glide used to achieve vowel modification is in **Warm up 2**. I directed everyone to sing the next warm up and lean into the roundness using the [w] glide to set up the roundness. An observer noticed that there was a lot of ease, and laryngeal relaxation, as opposed to the previous exercise. Another noticed that they felt less laryngeal clench and less tongue tension. I note that rounding the lips creates a wider pharyngeal space and a lowered larynx which can help ease any clenching. Another observer noticed that they were able to sing lower, but also saw the impulse to put effort into rounding. This showed how emphasizing a certain factor can cause unnecessary fixation and tension. I explained how the vocal folds' primary vibration does not actually sound like our voice, but that vibration reverberating in our vocal tract makes our voices all sound unique. I noted how we shape the vocal tract with voluntary muscle movements, such as tongue and lip shape, which impact the pharyngeal shape. This was a segway into the concept of formants.

Then, I introduced another visual aid, an EQ spectrum to visualize how pitch can remain constant, but formant values can shift depending on vowels. I sang [i, E, a, o, u] on a single pitch and pointed out the shifting frequency values on the Tonal Energy app on my iPad. Participant B mimicked me and we noticed the significant visual differences in the formant frequency values between our voices. I said that while fundamental frequency is the primary predictor in gender perception, the next strongest predictor is formant frequencies (Gelfer & Bennett, 2013; Hillenbrand & Clark, 2009; Schmid & Bradley, 2019). I did note that speech habits and phonation patterns also influence gender perception (Knowles & Little, 2016; Gelfer & Mikos, 2005; Hillenbrand & Clark, 2009; Zimman, 2017). I noted that using vowel modification and resonance strategies give us the tools and agency to present in the way which we want, in various contexts. I gave an example and we modified vowels from [tu] to [tju] and noticed the shift in sound and sensation while not completely changing the vowel. Using associative scaffolding, I gave the analogy that vowels are like watercolors, we can saturate them to be brighter or darker. Participants had heard of the term *chiaroscuro* in a variety of contexts including painting, so the analogy proved to be effective.

Demonstration was also effective when I sang a line from The Trees on the Mountains from Susanna by Carlisle Floyd to exemplify “darker” vowels and Someone Like You, from Jekyll and Hyde by Frank Wildhorn exemplifying bright vowels. I noted that pop singing tends to sit more neutral in the mouth, similar to how speech sits in the mouth. I presented the chart from Sing Anything, by Lisa Pompeil and Gina Latreimo, and explained the various factors that go into singing in different genres, from nasality, laryngeal tilt, pharyngeal shape, and resonator space. These factors are flexible and vowel modification in various genres is a base framework, not a rigid fixed rule. Resonance strategies can communicate and express the music and emotion, which I reiterated is the whole point of singing.

The listening portion of the class was given a 50% most effective rating from the survey. The key takeaways from listening to the songs that the participants would sing in the masterclass was how vowels modify for the genre and how that translates into gender presentation strategies.

What portion of class was most effective for you?
6 responses



For example, [In Darkness Let Me Dwell](#), I point out that the mouth shape of the singer in the video stays more neutral to round, the height on the [a] is very tall, [i] vowels are given more height. I noted how the more tall/round mouth shape lends itself to a widened pharyngeal space, lowering the fourth formant (Mount and Salmon, 1988; Zimman, 2017; Mainka et al., 2015) which is associated with more masculine qualities of singing due to the larger vocal tracts of people assigned male at birth and go through male puberty. While we cannot actually increase the size of the singer's vocal tract, we can widen the space that is there, rather than constrict it, which can influence the formant tuning and therefore the shift in how the voice is presented in scale. Another example I used was [nomoreroses](#) by Holding Absence. I asked the class what they noticed about the vowel shape and they noticed that the mouth shape is open but is also wide. For screamo-punk vocals that require aryepiglottic fold engagement, that vowel modification strategy correlates with the phonation. I reiterated the connection to articulators and phonation later in the Masterclass.

Another theme that emerged is vowel modification and formant tuning is important not just for genre but also the setting the song was performed, giving more dimension to the application as Bruner's spiral curriculum outlines. A recorded performance can require different vowels and phonation than singing live. I used the example of I'm No Good by Amy Winehouse: [Studio version](#) vs [Live](#). [u] in "good" is much brighter, in general everything is placed very forward, which I likened to the [ɲɛə] sound. The live performance has darker vowels. I show how her "mix" phonation is the same but the vowels have more depth, even on the [i] vowel on "cheated myself." Participant C asked if vowels change if you do it in a recording booth vs live, and I said when recording contemporary commercial music we do not want to manipulate our vowels too much ourselves, so we can give a mixing engineer a blank slate to work with.

Age also impacts hormones and the voice as well. The [original studio version](#) of Madonna's Borderline had much brighter vowels boosting the second formant which lent itself to the 80s synth pop soundscape. A [live pop rock version](#) had vowels in a more neutral, conversational place. Another version of Madonna [singing live at 59 years old](#) had a different arrangement with a slower tempo. I noted that she is now older, she needs to not just transpose to work with a voice in menopause with decreased estrogen, but also needs to anchor phonation with taller vowels given the less pliable and thicker vocal folds. To conclude this portion of the class, I reiterated that genre can help as a framework to modify vowels seeing the different resonance strategies needed for each genre and that gender perception is culturally contextual.

THE MASTERCLASS

Some of the themes that emerged from the masterclass were various strategies to achieve a brighter vowel while releasing tension. As discussed prior, trans people are often silenced, and this shows up as subconscious jaw clenching. Participants A, C, and E utilized jaw tension and clenching, which may have been a protective mechanism, and I found that when the jaw was unclenched, the tongue wanted to depress or detract. I used mimicry and kinesthetic sensory tools to set an intention for the singers to align their tongue in an [i] tongue position. With these three participants, I utilized scaffolding to methods to close the zone of Vygotsky's proximal development (Shabani, Khatib and Ebadi, 2010).

Participant A (any/all pronouns) sang *Nomoreroses* by Holding Absence. I noted excellent vowel modification on the word "me" on the pitch Eb5, by opening up the [i] vowel by singing [mE]. We worked on sustaining through a fast syllabic section with the lyrics: *"I've been kneeling on my barebones, speaking with my eyes closed, Keeping both my knuckles pressing my nose, But nothing that I ever do, Will close this hole inside of me."* Opening the jaw allowed for more sustain especially through the plosive consonants. I compared the jaw movement to the wrist, letting the joint release as if we were dropping a feather or tissue from our hand and to aim for a similar release in the jaw. Then if the jaw opens, we need to negotiate more brightness, so the tongue raises towards the [i] vowel. I asked if the [i] vowel is shaped by the tongue or lips and they correctly responded tongue. Given they were releasing the jaw, I challenged them to sing the passage up the octave, since the scaffolding methods were closing the zone of proximal development. The key takeaway was to allow space for the vowel, and utilize the tongue to maintain brightness and raise the second formant.

Participant C (she/her) was preparing for a choral audition in a piece by Atlas A. Lee-Reid. The text is: "Now everything has come to rest, the end has come and I am not afraid." We spoke about choral singing and blending vowels with more height and depth, but since this is a solo, I encouraged her to not modify it with an intention to blend with other singers. This reiterates that vowel modification depends on the setting and context. We tried the kinesthetic release paralleling wrist and jaw movement, resulting in a notable difference in vowel clarity and legato. We also used the unvoiced dental fricative [θ] in "everything" and "the" can be used to propel breath energy and using [ŋ] to align phonation between registers.

Participant E (she/her) sang “You know I’m No Good,” by Amy Winehouse. I noticed jaw clenching and lip spreading on high notes. I noted how this narrows the pharyngeal space and raises the larynx, restricting agility between registers. I prompted her to relax the jaw, and keep the tip of the tongue resting at the bottom teeth and releasing clenching of the tongue on the [i] vowels on “Sweet reunion, Jamaica and Spain, We’re like how we were again.” I noticed spreading on “can’t get joy” so I directed her to continually release the jaw, but use the tongue to take up that space to obtain brightness. She is a regular client of mine, and in lessons she has had intense, unwanted responses to tall round “choir boy” vowel sounds. While she needed to release the jaw clenching and spreading, I needed to prioritize strategies for her to raise the second formant and obtain brightness in the quality. Many vocal coaches emphasize spreading for brightness, however, I likened the spreading of the lips to salt on dinner, we do not need a lot of it. The foundation requires a relaxed flexible larynx and an unclenched jaw to sustain on various vowels. If we want to spread for brightness, it can be incorporated contextually on top of the foundation of laryngeal flexibility.

Another theme that emerged were additional methods to achieve brightness in conjunction with tongue height. I used nasal consonants [n] and [m] with brighter vowels such as [i] [ae] or [ei] to place the vowel in a brighter place with Participants B and D. This tapped into the kinesthetic sensory method shifts the sympathetic resonance forward with a nasal consonant. Participant B (he/they) sang *Borderline* by Madonna in the key of Dmaj. I had him watch in the mirror while singing “Something in the way you love me won’t let me be,” and then he did not over widen the lips which gave more laryngeal flexibility in the higher parts of his range. He wanted to keep the brightness in the quality, so I prompted him to sing on a [nae] but keep the lips rounded and “pouty.” The rounded lips widened the pharyngeal space and kept the larynx slightly lower to help navigate the transition between registers. The [n] kept the resonance bright, and he kept his tongue in the [ae] shape to maintain the brightness. I chose [nae] to model the diphthong in the lyric “playing.” I also prompted him to get a tighter “mix” phonation by leaning into the [n] in order to get more vocal fold closure and keeping more rib expansion on the exhale to manage breath pressure. Methods to shape brightness also impact phonation, building upon the concept of resonance to address phonation and fold closure, exemplifying the application of Bruner’s spiral curriculum (Johnston, 2012).

When the tongue needed additional shaping, I used the [j] glide, since it proved effective in warm ups done prior. I used both nasal consonants and the [j] glide with Participant D (she/her) who sang “Say the Word” from the musical ‘*The Mad Ones*’ by Bree Lowdermilk, Kait Kerrigan,

and Kate Kerrigan. We began with the lyrics, “Meanwhile there are so many things...” I used associative scaffolding and related this example to the fast and text dense chorus of Tracy Chapman’s Fast Car. I prompted her to use the nasal [m] consonant to place some more forward resonance with the [mi] in “meanwhile” and use that as a framework to put the following vowels in. I noted how that brought clarity to the text and how musical theater is different from pop because it is text focused, whereas if a pop singer like Ariana Grande wants to execute agile runs, she needs more pharyngeal width and laryngeal flexibility. Then, we focused on the phrase “I didn’t know how to love you until you swept me away.” since her tongue pulled back on the higher sustained syllable a-“way.” I had her sing the phrase on [jei] because the [j] glide keeps the tongue higher, and the glide opens up to the more open vowel. This kept the tongue and vowel forward, raised the second formant, and obtained more brightness and clarity (Popeil & Latimerlo, 2012; Cardon, 2021) in the following words to propel her into the key change.

The final theme that emerged from the class was breath, phonation, articulation/resonance all influenced each other to varying degrees, which I had initially touched upon with the listening portion of the class. I pointed this out to the class when I was working with Participant F (he/him) who sang “In Darkness Let Me Dwell,” by John Dowland. He did not want to sing it in a traditional classical style with vibrato and dark vowels. His vowels and diction were very clear, lending to the lovely “tenor” quality of the voice. I noticed he was over emphasizing each syllable, so I challenged him to find legato by prompting him to give taller space for the vowel by opening the jaw. I utilized associative scaffolding and likened singing legato to how string is consistent through beads on a necklace- like how the vowels and breath are consistent through the consonants. The legato flowed so much more freely and he noted it felt easier in terms of breath energy to manage.

SURVEY RESULTS

While it is valuable to view the overall results of each question, I found it to be most valuable to discuss the before and after results of each individual profile and then incorporate the overall survey findings. This lends itself to the constructivist realist positioning of reconciling the reality of the quantitative information such as formant tuning values, and the constructivist understanding of qualitative data where the participants perspective is constructed through their discovery based, lived experience interacting with me and the others present in the class.

Participant A gained familiarity and understanding with formant tuning, and vowel modification, and noted they do have neurodivergence/sensory processing issues. They selected they learn best through visual, auditory, and kinesthetic learning methods but responded that listening to various genres and artists was the most effective part of the class. Their familiarity with both vowel modification and formant tuning increased by a value of 2 and scaled comfortability with application for gender affirmation as a 4/5. They said, “I felt the tonal shifts from allowing my tongue to ‘take up space’. I’m now going to be more cognizant of where I place my tongue whilst singing because I have a history of allowing my tongue to pull to the back of my mouth.”

Participant B was already fairly familiar with formant tuning, and vowel modification, and after the class was confident in understanding and application and noted on the entrance survey he might have neurodivergence/sensory processing issues, but not formally diagnosed. He increased familiarity with vowel modification and formants from 4 to 5 and comfortability in application in terms of gender affirmation as 4/5. He noted that listening to various genres and artists was the most effective part of the class correlating with his response he learns best through auditory and kinesthetic learning methods. The most effective thing he learned was, “Singing on “nyah” and then singing the lyrics in that space” and also gave feedback that hearing the different versions of Borderline was insightful on how he can alter the way he sings his own tunes. He had mentioned to me in the past about how he wants to incorporate more brightness and femininity back into his voice prior to when he was on HRT and have that option, which was why I focused more on obtaining that brightness through the nasal/bright [nja].

Participant C grew in some understanding and familiarity with the concepts as her responses increased by 1 on both formant tuning and vowel modification. She selected she learns best through visual, auditory, and kinesthetic learning methods but noted listening to various genres and artists was the most effective part of the class. She scaled comfortability in application in terms of gender affirmation as a 5/5. The most effective thing in the masterclass for her was, “Using hand gestures to loosen my jaw and allow the space necessary for formant tuning.” This indicates she responded well to the kinesthetic method I applied in having her mirror deliberate releasing of a joint in the wrist and using that as a scaffolding point to also apply to releasing the joint of the jaw.

Participant D noted on the entrance survey she does have neurodivergence/sensory processing issues and learns best through visual, auditory, and kinesthetic learning methods. She

responded 4 on the scale of 1-5 on familiarity with formants and familiarity with vowel modification. Participant D did not fill out the exit survey.

Participant E grew in understanding of the concepts of formant tuning and vowel modification and does have neurodivergence/sensory processing issues. She selected she learns best through visual learning methods but noted that the call and response/mimicking was the most effective part of the class. She increased familiarity with formants by one value, and two on familiarity with vowel modification, and scaled comfortability for implementation in gender presentation as a 4/5. She filled out the exit survey a few weeks after the masterclass and noted that “I honestly don’t remember very clearly, but I think it [the key concept she learned in the class] was along the lines of reminders about physicality (avoiding tension) and intention (like, the emotional posture I was singing from).”

Participant F is a trans man on HRT (which I was verbally informed of). He noted on the entrance survey he has neurodivergence/sensory processing issues. He selected he learns best through visual, auditory, and kinesthetic learning methods but call and response/mimicking was the most effective part of the class for him. He increased the value of familiarity with formants by 2, and vowel modification by 1. He scaled his comfortability implementing concepts for gender affirmation as a 3/5. Since trans men/masc people on HRT often rely on the effects of testosterone to lower the fundamental frequency of their voice (Saurland, 2022) which is the primary indicator of gender perception (Södersten et. al, 2024; Hero and Houston, 2023) rather than formant tuning, I can understand why he would mark the formant tuning application for gender affirmation a 3/5.

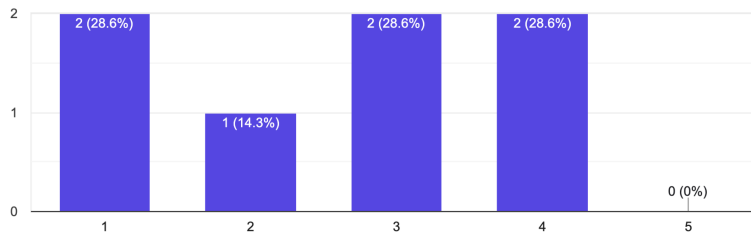
One observer took the entrance and exit survey and stated they do not have neurodivergence/sensory processing issues. They selected they learn best through visual and auditory learning methods and identifying sympathetic resonance was most effective for them. They increased familiarity with formants by 3, and familiarity with vowel modification by 1, and rated comfortability in implementing concepts for gender affirmation a 4/5.

Overall the participants gained understanding of formant tuning, vowel modification, and gender affirmation. However, it is important to note that one participant did not fill out the exit survey, so while I was given verbal feedback about the success of the class from this participant, I cannot formally conclude there is overall improvement across all participants. It is expected to see a

wide array of responses in familiarity with formants in the entrance survey, as formants are not discussed as widely as vowel modification, especially for beginning singers.

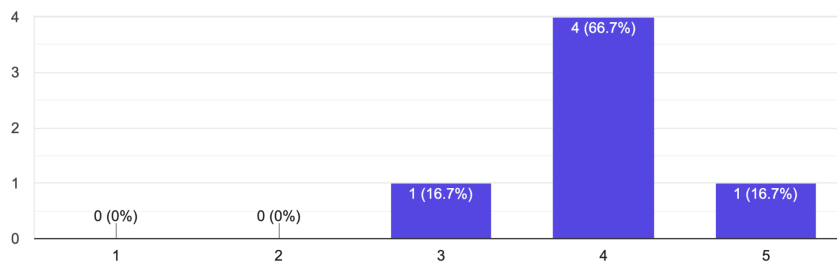
Current Understanding of Formants

7 responses



What is your understanding of formant tuning now after the class?

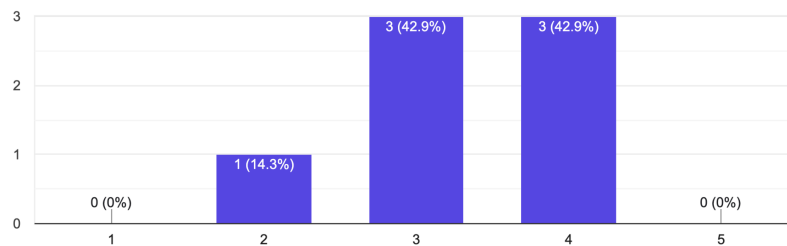
6 responses



Vowel modification is used across a wide variety of singing contexts with a vast array of purposes and outcomes, so I was not surprised to see how that was a more familiar concept to the participants.

Current Understanding of Vowel Modification

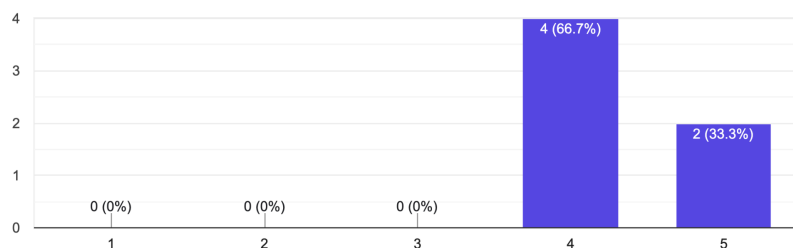
7 responses



I was pleased to see how much more familiar they were with the concept and application after the class. After reflection, I credit this to the scaffolding and sensory learning methods I utilized. By connecting and applying vowel modification to songs the singers were familiar with and would be singing, they could hear differences and strategies in a variety of contexts. They also had visual, auditory, and kinesthetic means to sense the modifications in real time. I was pleased to see there were overall higher scores on the gender affirmation survey question, as I did not review the extensive studies in the class to prove how brighter vowels are associated with more perceived feminine qualities and darker vowels are correlated with more perceived masculine qualities. Bruner's spiral curriculum proved effective as I reiterated bright/dark vowels throughout the class, increasing the means of application.

What is your understanding of vowel modification now after the class?

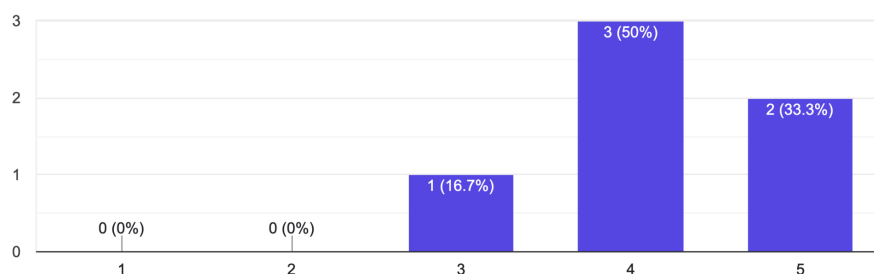
6 responses



It must be acknowledged that while formant values are measurable objective data that can alter how a voice presents, gender perception is also co-created by the person using their voice and the others perceiving it, justifying the constructivist realist ontology. The literature and findings conclude that formant values do play a role in how gender is perceived in the voice, but it is not a singular truth that can address individual perception or wide scale systemic bias.

Do you feel confident in applying these concepts to affirm your gender presentation

6 responses



While the survey results indicate the participants feel confident in applying these methods to affirm the gender presentation of their voices, perception is a variable that can be influenced, but not controlled, due to factors beyond the participant's control.

FUTURE RECOMMENDATIONS:

Based on this research, I aim to make adjustments to my pedagogical methods. As a singer, I was told to modify my vowels many times through the years, but I did not understand its significant impacts on phonation and resonance, leading to a frustrating journey from instrumentalist to vocalist. I hope that teachers can utilize some of these methods in the studio to strengthen understanding of abstract concepts like formant tuning and its practical application in the studio. These methods can also be applied outside the context of gender presentation to teach vowel modification as a general concept.

The improvement in the participants' understanding and knowing what was most effective showed that my lesson plan was effective but it also showed some places where I can improve my teaching. In hindsight, it would have been wise if I had taken time before the class to settle in and gather myself. I was teaching lessons right up until 15 minutes before the class began, and while I tend to ride the adrenaline of rushing about and multi-tasking, I see where I could have taken a more balanced approach, ate a meal, reviewed my notes, and mentally prepared myself.

As the lesson plan outlined, I gave the formal definition of formants: a peak of acoustic energy in the sound spectrum of vocal sounds, particularly vowels. Formants are resonant frequencies of the vocal tract, including the nasal cavities, throat, and mouth, which shapes the sound and creates distinction between the sounds. When participant C had asked a question regarding overtones, I should have made the distinction between how overtones are generated by sound source, and formants are shaped by resonating containers (Irene & Harris, n.d.). At the moment I did not know how to explain it concisely and in hindsight that would have clarified the concept. Also, there are more streamlined explanations of linking formants to F1 with vowel height, F2 with forward/back axis, F3 is associated with rounding, and how F3-5 are considered the 'singer's' formant (Kayes, 2015). Outlining the correlations in a more organized manner would be beneficial for future explanations.

Unfortunately, the studio did not provide the TV I had requested to display the charts so I used my iPad and laptop to show my device screen to the participants. Due to this circumstance, it's difficult to assess if visual learning methods were an effective way of teaching formant tuning, especially since the entrance survey indicated that 85.7% of participants learned best with visual aids. There was a significant live reaction in the class about the EQ values which visually indicated shifting formant values. The option on the exit survey "Visual Charts" was not specific enough to clarify that also meant the EQ graph I showed on my iPad screen with the Tonal Energy App. Specifying that tool in future surveys would be helpful to gain more insight in participant's learning preferences.

Specificity in my approaches, such as using recordings of the participants' songs that they were going to sing, did involve risk, as it could have resulted in the singers feeling self conscious. I wanted to point out vowel modification in a variety of different contexts such as age, environment, and setting, not just genre, and correlate it directly to something they could apply for themselves. This was very effective since half of the people who took the exit survey said this portion of the group class was most effective for them, whereas two people noted that call and response/mimicry was most effective for them, and one person reported identifying sympathetic resonance.

While I did ask in the entrance survey to denote any neurodivergence or sensory processing issues, there were not enough participants to draw any meaningful correlations of neurodivergence with specific sensory learning methods within this study. A design change in the study, such as interviews to gain insight on the participants' experiences with sensory processing would have lent itself to correlating learning methods to their specific sensory processing needs. This would require a larger sample of participants to draw a meaningful conclusion or a comparison group to compare various methods and people with certain learning preferences and needs.

Further investigation on how to best teach these concepts might include not just a sensory based approach, but focus more on integrating the gender affirming aspects and its applications in speaking, not just singing. I found in module 3 that trans femme people are at risk of violence and discrimination when they speak, and those who hear their voice can conclude they are trans. This indicates a need for speaking applications as well as singing. Future research to amplify the experiences of trans and gender non conforming voices is paramount in today's socio-political climate. Methods of gender affirming voice training that do not rely on Hormone

Replacement Therapy are necessary as access to HRT is jeopardized. HRT impacts not just fundamental frequency for individuals on testosterone, but also phonation for individuals taking estrogen (Sauerland, 2022). Teaching singers how vowel modification also impacts phonation, pharyngeal space, and laryngeal tilt can give them applicable tools and the agency to choose when and how they want to present their voice in a variety of contexts.

CONCLUSIONS

I set out to test the best pedagogical sensory methods to teach formant tuning and vowel modification in the context of Gender Affirming Voice Training. This project tested a lesson plan I developed using evidence from literature, and the data I drew from the class and surveys shows that the lesson plan and its methods were generally effective as we saw overall improvement in comprehension and application. Now I better understand the learning needs of trans/gender non conforming individuals in the voice studio and can hone the ability to apply these conclusions to strengthen my teaching practice.

Vowel Modification has many functions which influence each other to varying degrees, such as negotiating register shifts, style in genre, environment, melodic and rhythmic context (O'Connor, 2022). I noted lots of clenched jaws and overspreading, so making space without over opening the jaw, (and therefore closing off the back space) is a necessary distinction to make. Giving space in the mouth means the tongue can take up that space raising second formant values. I used the model of [i] and [ae] to use as a framework goal to modify rounder vowels to keep a more raised tongue. Vowel modification and articulation influences phonation especially in various settings and genres, since it impacts laryngeal and pharyngeal positioning, which also influences breath pressure and strategy. These methods of vowel modification can help in formant tuning (Titze, Maxfield, & Walker, 2017) which influence gender presentation, by correlating how brightness is associated with feminine speech qualities, and creating vowel depth is associated with masculine qualities (Södersten et. al, 2024; Hero and Houston, 2023; Ghorshi, Vaseghi, and Yan 2008; Schmid and Bradley 2019; Manny, 2014; Houle & Levi, 2021; Kim, 2020; Martinho et. al, 2024).

Different pedagogical methods need to be applied individually in the voice studio and different methods for classroom settings. The group class consisted of a broad overview with a variety of methods. It requires empathy for a teacher to discern how to apply them and close the zone of proximal development (Shabani, Khatib and Ebadi, 2010), and then build upon the concepts in

the framework of Bruner's spiral curriculum (Johnston, 2012). It is crucial to ask students to reflect on how they feel and communicate that to the teacher when to apply a different method (Kolb, 2015). An overall multi sensory approach works best (Laird, 1985), especially since multiple participants noted 2-3 manners of sensory learning methods were effective, not just one. This is evidence how learning is so specific to each individual's experience and sensory processing. Using scaffolding between these sensory methods only strengthens the intern-sensory connections, and solidifies comprehension and implementing effective application. A repeated fix "cookie cutter" method of applying brightness will not be effective for everyone, such as giving different methods for participant B versus participant E. Given this individuality, it became evident how pedagogically sensitive different methods are in teaching technique to singers.

The title of the class, 'Seen and Heard,' describes this sensory pedagogical lens for teaching vowel modification. At the end of the class I praised everyone for supporting each other for we have to see each other, witness each other, and hear each other through growth which is a very vulnerable process. A key takeaway I shared with all 6 participants:

"We need to make space for the vowel like we need to make space for each other. We need to let the tongue take up space and not shrink back, as we also should take up space as well and be witnessed by each other. When we close down and pull back it is often a result of shame. Our body's biological response to shame is making ourselves smaller and quieter for self preservation and safety, resulting in a clenched jaw, which constricts the vocal apparatus. The beautiful thing about singing is showing us how to live life. We can thank our body for its responses. We don't need to be silenced by fear, guilt, and shame. We can be free, seen and heard and hopefully they will be equipped with flexible tools to apply to their voices to show up as authentically as they can."

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