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The Hybrid Teacher: Expanding the Vocal Pedagogy Regime

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THE HYBRID TEACHER:
EXPANDING THE VOCAL PEDAGOGY REGIME

DMA PROJECT

A DMA Project submitted in partial fulfillment of the
requirements for the degree of Doctor of Musical Arts in the
College of Fine Arts
at the University of Kentucky

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ABSTRACT OF DMA PROJECT

THE HYBRID TEACHER:
EXPANDING THE VOCAL PEDAGOGY REGIME

The world of professional vocal training is becoming more and more eclectic and demanding in the United States. Academic music programs, and subsequently, vocal and vocal pedagogy programs are still predominantly classical in 2022, due to the American university system's historical roots. In the 21st century, the commercial music industry is at an all-time high. However, in contemporary academia, vocal and vocal pedagogy degree programs remain primarily classical. In recent years, voice professionals have been discussing the implications of academic programs updating their programs and pedagogy in order to include professional CCM and hybrid training. Classical, CCM and hybrid singers need assured long-term vocal health, proficiency, and artistry via pedagogically-sound vocal training. The question is, "How will more voice teachers will be trained in hybrid techniques to meet this need?"

Changes to academic courses and requirements are necessary to ensure that hybrid (classical and nonclassical) vocal pedagogy is offered more broadly to all voice-teachers-in-training. Collegiate vocal pedagogy must make a greater effort to meet industry standards for singers of every musical style, moving away from predominantly classical styles to a hybrid system which acknowledges classical and nonclassical styles as equally valid and challenging. The hybrid voice teacher understands classical and nonclassical singing and can modify teaching techniques to suit the interests and abilities of their voice students. Training for the hybrid voice teacher must begin in academia. Academic training for the hybrid teacher ensures that more voice teachers are working, a broader range of future voice professionals have solid technical foundations, and industry standards for all styles of singing are acknowledged, respected, and upheld by professional voice teachers.

This DMA project will look at the understanding of scientific function as being of prime importance in teaching healthy singing. In studying classical and belted vocal techniques functionally, many differences are noticeable in voice science. The first part of this paper will focus on current research and theory related to functional belting and functional classical singing techniques, and their application to various sung musical styles. By comparing functional singing during classical versus belted technique, one can

denote any differences in posture, breath, registration, resonance, and acoustics. The second part of the paper offers applied exercises and explanations for in-studio application of the information offered in Part I. These exercises mirror the pedagogical areas explored in Part I (posture and breathing, registration, resonance, and acoustics), offering training techniques that acknowledge technical differences between classical and belted singing inside the hybrid studio. To close Part II, vocal cross-training will be explored.

KEYWORDS: vocal pedagogy, CCM, functional singing, vocal technique, hybrid singing, vocal cross-training

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01/12/2022

Date

THE HYBRID TEACHER:
EXPANDING THE VOCAL PEDAGOGY REGIME

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01/12/2022
Date

DEDICATION

For Mom and Dad, who put music in my heart before I could sing.
For my aunties, who cheered me and cheered for me.
For my friends, who believed in me and brought me food.
For my teachers, who helped me to find myself.
For my students, who inspire and teach me every day.

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Thank you to my family and friends who gladly accepted my "I can't talk now – writing" moments, encouraging me to stay focused and to keep going. To my grandparents, who passed the teaching of music down generationally to my parents in such a way that, I guess I just couldn't escape it! To my siblings, with whom making music was always my joy, the joy of our household. To my parents, who love and nurture me, accepting me despite flaws and failures, always seeing me as higher than I see myself, and inspiring me to reach for what you know, and therefore I believe, I can attain. I could not have asked for two more nurturing or loving humans to have raised me. You have always given wings to my dreams, and you have always wanted what is best for me. I am so thankful for your patience, encouragement, and pride in me.

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Mostly, I thank the Lord Jesus, for being my constant companion and friend; For allowing me to overcome every barrier, no matter how great. Whatever You have in store next, I know it's going to be good.

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INTRODUCTION

A. Introduction

The world of professional vocal training is becoming more and more eclectic and demanding in the United States. Academic music programs, and subsequently, vocal and vocal pedagogy programs are still predominantly classical in 2022, due to the American university system's historical roots. Vocal pedagogy emerged in the 19th century when parents sent their students to university in order to develop a "cultured voice;" one that would elevate lower- and middle-class citizens to a higher social status. Still somewhat tied to European roots, music in 19th century academia was supported by wealthy upper-class citizens who wished to support classical, and often sacred, musical output.

In the 21st century, the commercial music industry is at an all-time high. Commercial music grossed $7.3 billion in live concert sales in 2016, according to the Recording Industry Association of America. Classical music accounted for only 1 percent of these sales. The Neilson report of recorded music consumption (2016) reports that 1% of people listen to jazz, classical, and children's music, while 29% of people listen to rock, 22% listen to R&B and hip hop, 13% listen to pop, and 10% listen to country. In contemporary academia, vocal performance majors are decreasing, while musical theatre and contemporary commercial vocal programs are on the rise, according to the Higher Education Arts Data Services Project. Matthew Edwards provides statistics and elaborates on this problem in his chapter entitled "Why It's Time to Add CCM to Your Studio" (*So You Want to Sing CCM (Contemporary Commercial Music): A Guide for Performers*, p. 264-286).

Currently, there is an imbalance in academia. Vocal and voice pedagogy degree programs are primarily classical. Meanwhile, music the America population is listening to, practicing, performing, and purchasing is predominantly nonclassical. The music

industry offers a broad range of opportunities for future nonclassical (CCM) and hybrid (classical and CCM) singers. These singers will require reliable vocal technique for the longevity of their careers. In recent years, voice professionals have been discussing the implications of academic programs updating their programs and pedagogy in order to include professional CCM and hybrid training. Classical, CCM and hybrid singers need assured long-term vocal health, proficiency, and artistry via pedagogically-sound vocal training. The question is, "How will more voice teachers will be trained in hybrid techniques to meet this need?" There are currently no doctoral degree programs in the United States solely dedicated to musical theatre or commercial music. Students wishing to train to teach these styles must be able to sing very well classically in order to receive a doctoral degree in voice. Matthew Edwards suggests (in his chapter referenced above) that qualified CCM performers should be able to teach in academia. However, as there is no way to ensure that professional CCM singers have a pedagogical background for teaching advanced vocal technique, it may also be necessary to offer certificate or degree programs to CCM professionals. These programs would ensure that CCM professionals wishing to become voice teachers have a grounding knowledge of functional voice science.

Changes to academic courses and requirements are necessary to ensure that hybrid (classical and nonclassical) vocal pedagogy is offered more broadly to all voice-teachers-in-training. Collegiate vocal pedagogy must make a greater effort to meet industry standards for singers of every musical style, moving away from predominantly classical styles to a hybrid system which acknowledges classical and nonclassical styles as equally valid and challenging. The hybrid voice teacher understands classical and

nonclassical singing and can modify their teaching techniques to suit the interests and abilities of their voice students. Training for the hybrid voice teacher must begin in academia. Academic training for the hybrid teacher ensures that more voice teachers are working, a broader range of future voice professionals have solid technical foundations, and industry standards for all styles of singing are acknowledged, respected, and upheld by professional voice teachers.

B. Literature

Texts and resources that offer voice science knowledge and training techniques for the CCM singer have become more abundant recently. The "So You Want to Sing" series, a project of the National Association of Teachers of Singing, are helpful resources featuring various chapters by voice experts in their fields. *So You Want to Sing CCM* and *So You Want to Sing Rock* have been the most referenced in this paper. *Vocal Technique* by Julia Davids and Stephen LaTour, offers an overview of general principles related to classical and contemporary styles for conductors, teachers, and singers. The *Vocal Athlete,* a text with companion training techniques book, is by far the weightiest resource, offering a section on the structure and function of the voice, a second on vocal health and fitness, and a third on vocal pedagogy for the 21st-Century Vocal Athlete. In the third section, *The Vocal Athlete* acknowledges the history of classical voice training, as well as offering various perspectives on belting pedagogy, followed by theory and research related specifically to belted singing. Mary Saunders Barton and Norman Spivey's book *Cross-training in the Voice Studio* provides a wealth of practical application for vocal cross-training and is an invaluable training tool for voice teachers.

In a collegiate vocal pedagogy class, the above resources, partnered with functional voice science textbooks (ie. Scott McCoy's *Your Voice: An Inside View*) could serve as a foundation for vocal pedagogy study for the hybrid teacher. Drawing on these resources and many more, it is my wish to develop a single resource that provides a comparison of classical and CCM singing, both from a voice science, and an applied teaching perspective. This resource could bring together classically trained vocalists and professional contemporary vocalists, offering each the insights and knowledge they need to become successful hybrid voice teachers.

This paper aims to define the hybrid teacher and hybrid training techniques by comparing the techniques associated with classical versus belted sound production. As bookends in the vocal sound spectrum, these two different ways of singing allow the human voice to produce diverse sounds. By studying both classical and belted singing as technical singing systems, voice teachers and teachers-in-training can feel confident in the methods they use to help students create specific vocal sound qualities. Knowledge of these specific methods empowers voice teachers to delineate vocal style, preparing their voice students for diverse professional venues.

The Hybrid Teacher: Expanding the Vocal Pedagogy Regime offers an overview of what pedagogical knowledge might be offered to a hybrid voice teacher studying in academia. This discussion could lead to a more expanded pedagogical resource for the hybrid voice teacher; a textbook designed to provide an overview of hybrid vocal training in the university setting, specifically for vocal pedagogy courses.

C. Rationale

The professional voice industry places a growing demand on voice teachers to have knowledge of a wide variety of vocal styles. In order to help students to accomplish various styles of singing, professional voice teachers need technical knowledge that allows them to:

A. Connect their knowledge of classical singing technique to other teaching other styles of singing, comparing their classical academic training with what contemporary styles demand.

AND

B. Build an overall knowledge of how to connect voice science and research with applied, technical training in the studio.

AND

C. Improve their participation in, understanding of, and appreciation for many styles of singing, assisting their students in producing industry-standard timbre, skill, and expression.

The hybrid teacher takes an eclectic, well-rounded approach to training singers, offering classical and nonclassical repertoire and training techniques. Even when a student shows a stronger interest in a particular style, the hybrid teacher recognizes that techniques associated with classical singing can assist a nonclassical singer to develop a more well-rounded instrument and visa versa.

This paper seeks to lay out the pedagogical and practical considerations of the hybrid voice teacher. In Part I of the paper, I will compare belted and classical singing functionally, considering the following areas: posture and breath, registration, resonance, and acoustics. I will also examine belting and mixing as terms, defining them according

to their past and contemporary semantics. In Part II, I will explore each pedagogical area as it applies to private voice teaching, offering practical, applied knowledge and exercises. These sections will mirror one another in order to offer a rendering of voice science knowledge into its immediate in-studio application.

D. Methodology

This paper is laid out in two large sections. Part one is a comparison of belted and classical singing functionally. Part two offers in-studio application concepts for the hybrid voice teacher, including exercises that focus on each functional area of singing: breath, registration, resonance, and acoustics. (As postural concepts are basically the same for both classical and belted singing, they are not included in detail in either section. An excellent resource for postural-focused training of singers is Andrew Byrne's *The Singing Athlete: Brain-Based Training for Your Voice*.) Part two finishes with some cross training connections and techniques, offering examples of areas where singers who have mastered classical techniques can benefit from studying belting and visa versa. In this paper, the diagrams J-M are my original depictions.

Keeping in mind that the term "classical" has association with style and technique, and "belt" has association with styles (musical theatre, rock, and other CCM styles to various degrees,) and technique, for the purposes of this paper, it should be assumed that the term "classical" refers to a specific method of technical voice training, and the term "belt" refers to another specific method of technical voice training, unless specified otherwise. To create strong connections between function and sound, I offer side by side comparisons of the two very different ways of singing, both of which can be accomplished by the same singer. I do so in the hope that more teachers will develop a

hybrid approach in their studio, which could serve to elevate both classical and nonclassical singing styles in the professional voice world.

PART I.

ANALYSIS: Comparing Classical and Belted Singing Functionally

Introduction

Teaching various styles of singing can create a versatile singer. Compare this concept to dance training. It is beneficial that stage performers should have technical dance training in order to promote posture, balance, strength, poise, form, and physical confidence on stage. This is especially true for musical theatre performers, who are required to study multiple styles of dance to prepare for a performance career. Styles of dance are not "techniques" but rather technique in dance is the underlying conditioning and form of the body, as well as how the body is used while dancing. Good technique in dance creates beautiful lines, pointed toes, stretched/fully extended limbs, flexibility, fluidity of movement, correctly executed steps, rhythmic and musical connection, and overall beauty and balance of form. It is expected that dancers bring good technique, including a well-conditioned body, to every style of dance. Each style of dance has its own set of movements and technical requirements. In response to the demands of style, a dancer trains their body technically in order to be responsive, agile, and versatile for each dance style, in order to create the shapes and movements required.

It is similar for singing. Singers work hard to build their vocal technique to allow them to use their voice with flexibility, versatility, and strength, sometimes for long and intense durations. Like dancers, some singers focus on a single style of singing, while others become proficient in multiple styles. In order to perform multiple styles of singing, vocalists need an underlying understanding of functional vocal technique that allows them to use their voice healthily in a variety of ways.

Voice science research has led to many helpful insights into what comprises a healthful, efficient vocal technique. Based on current research, I wish to examine functional vocal technique in belted singing from all areas of pedagogical study,

including posture, breath, registration, resonance, acoustics, and performance practice, and to compare the techniques of belting to classical singing, noting the functional differences of each technical method. The term "classical" is also associated with a style of music, and belting is associated with multiple styles of music. For clarity, it is important to specify that these terms refer to specific technical methods of training unless otherwise indicated.

Chapter 1: Posture and Breath

1.1 Posture Comparisons

In general, the principles of aligning the body for efficient use of the vocal instrument are the same in classical and belted singing. Singers who wish to improve their postural efficiency may study Alexander Technique, Feldenkrais, Body Mapping, or another method (ie. Andrew Byrne) which allows them to improve body awareness coupled with efficiency and fluidity of movement. There are only a few notable changes in postural requirements for healthy singing in a classical versus belted technique. In general, belters may use a more lifted head position to accommodate a neutral, speech-like larynx, which is generally higher than what is used for classical singing. A lifted head position may also afford the singer the opportunity to open their mouth, jaw, and throat in a manner that is acoustically effective for belting, especially when singing high notes. However, overall, the principles of healthful, efficient posture are the same in both manners of singing.

1.2 Breath – The Power Source

Singing in general requires a deeper, more extended inhalation phase than speech as well as a longer and more controlled exhalation phase. The singing voice relies on the body to increase and decrease both air flow and air pressure, depending on the pitch being produced, and how close the singer is to the end of a phrase. High pitches tend to require more pressure and less flow, and visa versa. In healthy singing technique, the exhale is slow and controlled while maintaining rib expansion. The slow, controlled exhale creates either air flow (low and middle range) or air pressure (high range) to maintain appropriate vocal fold vibration (Doscher, 1994, MT p. 65-66).

Because the vocal folds often adduct more firmly and squarely in belted singing, there are two main differences in breathing for classical versus belted styles: immediacy, and force.

1.3 Immediacy

In Classical singing, there may be greater time taken to extend the ribs and fill the lungs than in belting. The breath phase for belting is shorter in order to produce a more immediate, visceral sound. Most vocal specialists think of belting as being more closely related to a primitive cry or call. Primitive man would have used a called vocal sound to cry for help, or to frighten away a dangerous animal. One does not take time to fill their lungs with a long, extended breath before this type of utterance. If you take a moment to yell "hey," you will feel that your ribs engage quickly and immediately. There seems to be an immediate engagement of the internal intercostals pulling down and inward, and a natural counterbalance of the external intercostals, which also engage during called sound. The sound is intense, the support immediate. Even on extended passages which require belted singing, the performer seems to use less air more efficiently. Classical singers are more likely to "float" the sound, setting up with a slower inhalation phase that allows them to stay in a more expanded position in the ribcage for longer. Classical singers use greater external intercostal expansion at inhalation. However, both classical singers and belters must strengthen their external intercostals to slow the process of rib collapse during phonation/exhalation.

1.4 Air Force (Air Pressure and Air Flow)

In general, Classical singing uses thin vocal folds which touch at the ligament only, so air pressure will be lesser, while air flowing through the vocal folds will be

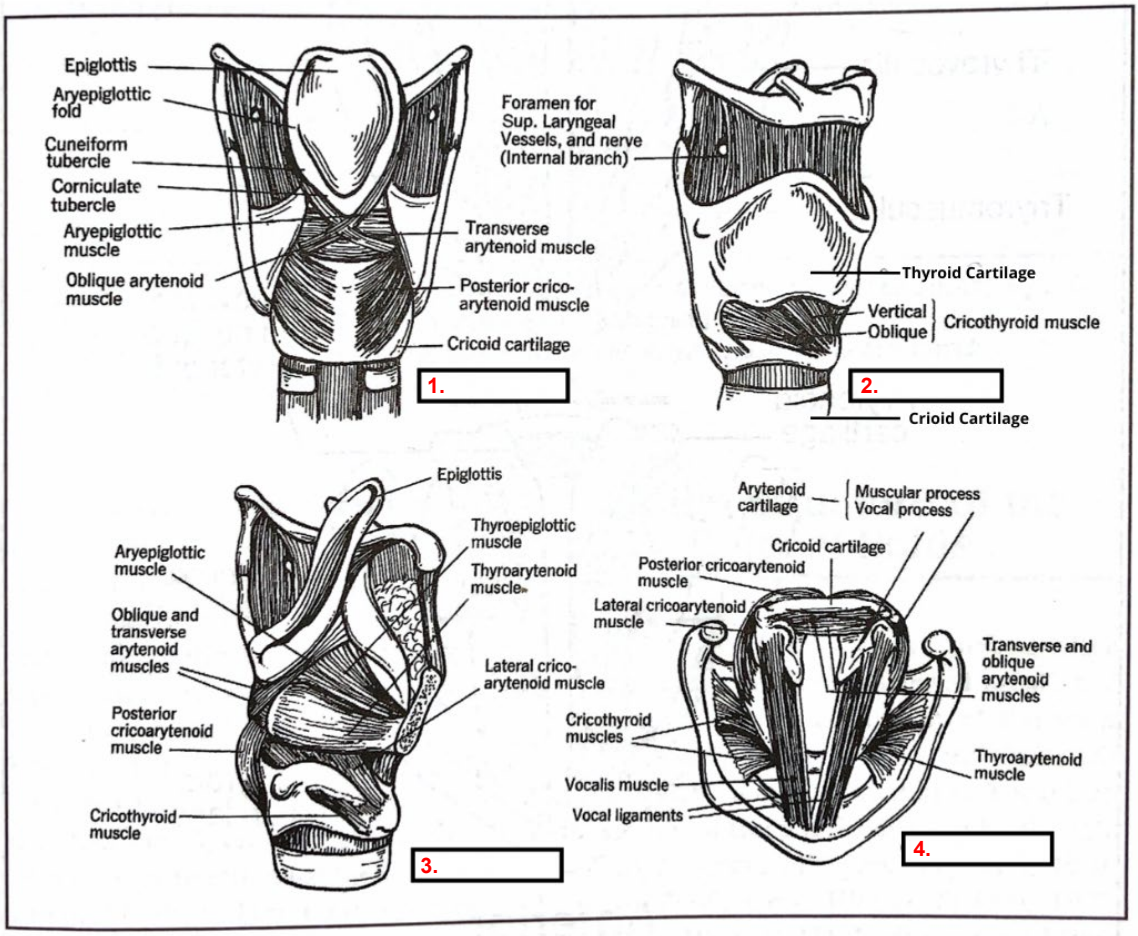
greater. More resistance from thicker, more squarely adducted vocal folds (see Registration) in belting means slightly more air pressure and less flow. When Matthew Edwards discusses breath support in his online course *How Your Voice Works*, he explains that singers can support exhalation by engaging their external intercostals only, or by using abdominal support, or by using a combination of abdominal and intercostal support. He notes that belters are likely to prefer to add abdominal support. In the spring of 2019, I attended a masterclass with Kimberly Shively and Brian Kremer at the South Eastern Theatre Conference. These faculty members from Elon University's Musical Theatre Department program emphasized the connection between emoting honestly and body-breath connection. Professor Kremer taught a helpful technical concept for belting, asserting that the singer he was working with should use abdominal support in a manner that leans down toward the pelvic floor, (using the same muscles used in calling out, picking up heavy objects, childbirth or flatulating!) I have found this method of support quite successful to aid belters in engaging support for intense singing without overly tightening their throat and neck muscles. However, I tried it for intense passages in classical singing and found it helpful for more CT-dominant singing as well. In fact, I have observed in my studio that whenever a singer needs to maintain steady air pressure for intense singing, this method of support has proven very helpful.

Chapter 2: Registration – Sound Source/Phonation

2.1 Registration Comparisons

To begin a discussion about registration differences in belting and classical singing, some pedagogical background is necessary. Firstly, a picture of how the vocal folds function will help offer a better understanding of vocal registration.

The vocal folds attach to the backside of the thyroid cartilage, the notch of which is the "adam's apple" in a singer. The thyroid cartilage is shaped like a shield (See Figures 2 and 4) and it sits atop of the cricoid cartilage, which is shaped like a signet ring (See Figures 1 and 3). The cricoid cartilage attaches to the trachea (See Figure 1) which connects to the lungs. So, the larynx (or "voice box") has access to its source of power (breath exhaled from the lungs) and phonation occurs when air moves through the adducted vocal folds (or "vocal cords.") Forming an opening shaped like a "v," the two vocal folds open to the back of the throat. (See Figure 4). Each vocal fold is connected fully from the front of the thyroid cartilage across sides of the thyroid cartilage (the image depicts the sides as open to show muscles below, but Figure 5 shows a photo of the complete vocal folds.) Each end of the vocal fold attaches to a conical cartilage called the arytenoid (see Figure 4). The arytenoid attachments allow the vocal folds to be opened and closed (adducted) from the back.



Figures 1-4. The intrinsic muscles of the larynx.
From *Vocal Health and Pedagogy: Science and Assessment, Second Edition,* by R. Sataloff. Copyright 2006. Plural Publishing. P. 55 of *The Vocal Athlete*

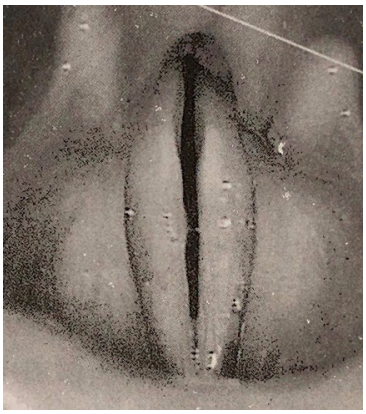


Figure 5. A photograph of the vocal folds.
From *Your Voice: An Inside View, Second Edition,* by Scott McCoy. Copyright 2012. Scott McCoy and Inside View Press. P. 28

The vocal fold is scientifically called the thyroarytenoid muscle because it attaches from the thyroid cartilage to the arytenoid cartilage. The thyroarytenoid muscle can shorten and thicken itself, which it does to create lower pitches, or to stretch and thin itself to create higher pitches. The thyroarytenoid muscle maximally thins itself to the highest pitch achievable in first mode of registration. In order to achieve higher pitches, a secondary muscle is needed to further stretch and thin the vocal folds. The muscle responsible for further stretching the vocal folds is called the cricothyroid muscle, and its action defines the second mode of registration. It is located on the outside of the thyroid cartilage, and functionally, it tilts the thyroid cartilage forward by pulling the bottom of the cartilage down toward the cricoid cartilage. This tilting action further stretches and thins the vocal folds, allowing them to create higher pitches. Figure 6 (A) shows the cricothyroid muscle connecting the thyroid and cricoid cartilages. Figure 6 (B) demonstrates the motion of the cricothyroid joint, which can rock and slide forward when the cricothyroid muscle is contracted. Melissa Largent provides a helpful visual of motion capabilities of the cricothyroid joint when the cricothyroid muscle is adducted here: https://www.youtube.com/watch?v=HczwMpcyXSs.

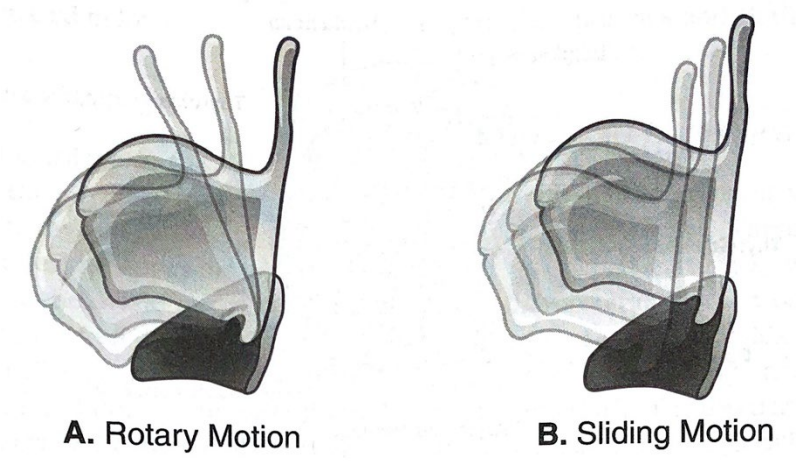


Figure 6. Movement of the cricothyroid joint A. Rotary and B. Sliding.
From *Speech and Voice Science, 2E* (Figure 5-19, 1st ed, p. 134) by A. Behrman, 2013, Plural Publishing. P. 48 *The Vocal Athlete*

The cricothyroid muscle (CT) and the thyroarytenoid muscle (TA) are an agonist/antagonistic pair. However, this does not mean they are pulling on each other in a parallel manner, like biceps and triceps. The TA muscle forms the body of the vocal folds themselves and is inside the larynx. It is capable of both shortening/relaxing and elongating/stretching the vocal forms and because more minute motions of the vocalis muscle, it is capable of making the smallest adjustments in pitch and tone. An excellent visual of this motion is provided by this Kenhub Human Anatomy video: https://www.youtube.com/watch?v=Bh9cDldOIPE. (Watch at 22:42-24:12 for an explanation of the TA muscle including the vocalis muscle.) The CT muscle attaches on the posterior side of the larynx and pulls the vocal folds as a result of the thyroid cartilage being pulled forward and down. The arytenoids provide an anchor for the posterior part of the vocal folds, so that the CT muscle can be the active stretcher of the vocal folds.

At the most basic level of understanding of registration, voice teachers have acknowledged the two main modes of singing as "chest voice" and "head voice," each of which is defined by this muscle pair. Chest voice can also be referred to as Mode 1 or

thyroarytenoid (TA) dominant singing. Head voice can also be referred to as Mode 2 or cricothyroid (CT) dominant singing. The other modes of registration are vocal fry (extreme low) and whistle tone in female voices (extreme high).

While singing teachers are likely to continue to refer to the two main modes of registration for singing as head voice and chest voice, the terms "Mode 1 and Mode 2" are used by voice scientists. These terms offer voice teachers a more functional definition of registration, but I will use both sets of terms in this paper. The terms are interchangeable, and I prefer training singers to recognize both scientific function and industry standards. Industry singers are very likely to be asked to sing with more "head" or "chest" voice.

In Mode 1 singing, the shortened thyroarytenoid muscle is brought together thickly and squarely. In Mode 2 singing, the vocal folds are elongated and come together thinly, with only the upper margins making contact (See Figure 7). While the length of the vocal folds primarily determines pitch, the thickness of the vocal folds determines tone qualities associated with registration. In very general terms, thicker vocal folds are associated with contemporary musical theatre and belted vocal sounds. Thinner vocal folds in general are associated with classical and traditional musical theatre vocal sounds. Since the vocal folds can phonate on the same pitch with varying degrees of thickness, a variety of timbres are available to the vocalist, simply by understanding how to more thickly or thinly adduct their vocal folds.

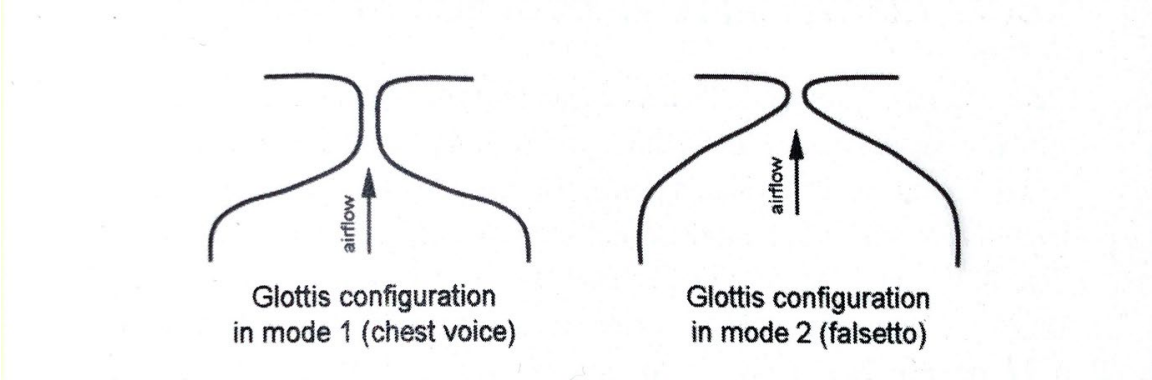


Figure 7. Primary Modes of Vocal Fold Vibration.
From *So You Want to Sing Music Theatre: A Guide for Professionals*. (Figure 2.6, 1st ed, pg. 33) by Karen Hall, Copyright 2014. Rowman & Littlefield. All photos courtesy of Dr. Scott McCoy

Matthew Edwards gives an excellent analogy which I often use to help singers understand vocal cord thickness.

> "To visualize the differences in vocal fold thickness, put the palms of your two hands together in front of you with all four fingers touching. Separate your fingers from each other one at a time, stating with the pinky, then the ring finger, then the middle, then the index. When all of your fingers are separated, bring your pinkies back together, then the ring fingers, then the middle fingers, and finally the index fingers. As soon as the index fingers touch, repeat the movement. This hand motions simulates the movement of the vocal folds when vibrating. When all four fingers are touching (thick vocal fold vibration/mode 1), the tone quality will have a lot of buzz and very little airflow. This is chest voice, which is produced by contraction of the thyroarytenoid muscle. Repeat the finger motion without allowing the pinkies to come together. This is like chest-mix. The resulting tone quality will have a little less buzz than chest voice. Next repeat this hand motion with only the middle and index finger touching. This is like head-mix. There is only a little buzz left in the voice at this point. Finally, repeat the motion with only your index fingers touching, this is pure head voice (thin vocal fold vibration/mode 2). There is little if any buzz in head voice and a lot of excess air might escape as you phonate. No matter what register you are singing in, both the TA [thyroarytenoid muscle] and CT [cricothyroid muscle] are involved. Therefore, it is extremely important to train both registers equally. Doing [otherwise] will leave you with an unbalanced voice." (*So You Want to Sing Rock N' Roll*, p. 103-104)

With the understanding that the vocal folds function three-dimensionally and with the ability to shorten and thicken themselves and vice versa, the singer has many options for sound determined primarily by registration. While both classical and musical theatre styles require the use of both chest voice and head voice, the degree to which each are used varies in the two styles. Classical singers tend to favor CT dominant singing, with thinner vocal folds and subsequently more air flowing through. When belting, musical theatre singers tend to favor more TA dominant singing, with thicker vocal folds, and subsequently less air flowing through.

It is important to note that these concepts of registration as they relate to belted and classical singing styles are generalized, overall observations. For example, overall, belted singing uses more TA dominance. However, opera singers can and do engage TA activity, even into their upper registration. A more dramatic operatic voice type may engage a heavier "mixed" color, but they do not sound like they are belting because of other resonance and acoustical factors. It is the combination of the registration factors discussed, factors yet to be discussed, and possibly factors yet to be discovered which work together to create a vocal sound that aurally identified as classical or belted.

2.2 Vibratory Cycle of the Vocal Folds

In order to examine the differences between vocal fold oscillation in belting and classical singing, a brief description of the vibratory cycle of the vocal folds is needed. During a single vibratory cycle of the vocal folds:

1. The vocal folds close by muscular forces within the larynx.
2. Air pressure increases beneath the glottis.

3. Increasing air pressure causes the glottis to open from the bottom (lower layers) to the top.
4. As air escapes and flows through the glottis, it increases in velocity and decreases in pressure.
5. Negative pressure and vocal fold elasticity (the "spring-like" quality of the vocal folds) cause the vocal folds to return to a closed position from bottom to top.
6. As soon as the glottis is fully closed, the process begins again.

This cycle repeats as many times per second as the frequency of the pitch being sung.

2.3 Open and Closed Quotient

Through Electroglottograpy [EGG] and inverse filtering, voice scientists can discover how long the vocal folds are open and closed during a vibratory cycle, as well as how quickly they come together. Multiple studies have shown a longer closed quotient (CQ) for belted singing than for classical singing. Some conclusions that may be drawn from these studies include (The Vocal Athlete, p. 230):

- Belted singing had over a 50% closed phase in a study by Schutte and Miller, 1993. In a study by Bourne and Garnier (2012,) six singers produced each of the following qualities: chest belt, mix, twangy belt, and legit singing. Legit singing had the longest open quotient (OQ) with twangy and chest belt showing similarly shorter OQ and longer CQ. Mixed voice production had varying results, with all six subjects demonstrating different strategies.

- The degree of CQ increases as frequency increases and vowels do not influence the closed quotient when belting. (Besterbreurtje and Schutte, 2000)
- Heavier belt (ie. “brassy) using a greater degree of chest voice production resulted in the longest closed quotient. (Bjorkner et al, 2005)

The belted voice also showed higher subglottal pressures than classical singing. Subglottal pressure is the amount of air pressure needed to set the vocal folds in motion. It makes sense that singers using a greater degree of chest voice would be engaging thicker vocal folds, therefore subglottal pressure would be higher (ie. More air force would be needed.)

Finally, the belted voice also shows a higher speed quotient or SQ (Lebowitz and Baken, 2011). The speed quotient describes how quickly the vocal folds come together to begin the vibratory cycle. This factor seems to correlate to the greater immediacy of breath needed for belting, as described in the breath section.

That belted singing seems to have a longer closed quotient than classical and legit singing seems to relate to registration factors, such as the use of thicker vocal folds, and that more subglottal pressure is needed to phonate in belted singing. As voice science learns more about the physical properties of vocal fold oscillation, more may be discovered as to why belted singing results in a longer closed phase and a higher speed quotient in the vibratory cycle of the vocal folds than classical singing.

2.4 A Note About Vocal Fold Oscillation

Voice science is still discovering the intricacies of how the vocal folds phonate in a sustained manner. Inge Titze’s Three-Mass Model is often the theory used to best describe vocal fold oscillation. According to this theory, during a single cycle of

vibration, the glottis opens and closes "asymmetrically with vertical phase difference from bottom to top. Air pressure is also asymmetrical, increasing when the glottis is in a convergent shape (bottoms of the two folds are farther apart from each other) and decreasing when the glottis is divergent (tops of the two folds are farther apart. This asymmetry of air pressure, combined with the impact of pressure changes above the glottis caused by inertia, is sufficient to sustain vocal fold oscillation." (Scott McCoy, p. 107). However, the National Center for Voice and Speech reports that researchers at the University of Iowa now base their computer simulations of vocal fold oscillation on 16-mass models.

Chen Gia Tsai conducted experiments wherein he used ultrasonic imaging to discover an oscillation cycle that differs from the Three Mass Model. Tsai discovered that the deeper layers of his vocal folds vibrated bottom to top, but the upper layers vibrated top to bottom, creating a pattern that more closely resembles sea waves. He states that this theory needs more experimental evidence, but that it points to the vocal folds functioning as an energy-saving spring, and that similar oscillation systems can be found in animals. (http://homepage.ntu.edu.tw/~tsaichengia/vf_vibration.html).

Voice science is still making discoveries about the physics of vocal fold oscillation. Future findings in this area may aid voice scientists in discovering more about what is happening during belted singing that causes the vocal folds to have a longer closed quotient than in classical singing. Additionally, new findings regarding how our vocal fold "springs" function may have implications in vocal health and vocal efficiency for belted singing.

Chapter 3: Resonance

3.1 Resonant Spaces

The voice has seven resonant spaces that influence the color and amplitude of the source sound from the vocal folds. There are two resonant spaces below the larynx (subglottic), and five resonant spaces above the larynx (supraglottic).

Below the larynx, the chest cavity and the trachea are viable resonance sources. However, I will not cover research on how these resonance spaces influence source sound here. It is sufficient to state that sympathetic resonance which amplifies the fundamental is helpful to the singer, and that these sources could be further investigated in another paper as viable resonant spaces; It is likely that greater freedom and dimension of sound are available to the singer through knowledge of how supraglottic spaces influence source coupling.

The five supraglottic resonators are: the laryngopharynx (containing the laryngeal vestibule), the oropharynx, the oral cavity, the nasal cavity, and the frontal sinus cavity. It should be noted that the oropharynx is an extension of the laryngopharynx above the epiglottis, and that the oral cavity is an extension of the oropharynx from the hump of the tongue to the lips. Together, the three malleable supraglottic spaces form a single tube, which extends vertically from the larynx (laryngopharynx) to the palate, curving at the palate and tongue (oropharynx) to extend horizontally from the tongue to the lips (oral cavity). This unique shape of the vocal tract, as well as its malleability, provide a complex system of resonance and acoustical possibilities for the singing instrument. Nonmalleable spaces play a secondary role in vocal resonance, as they cannot be altered by the singer.

The sinus cavity and nasal cavity are the supraglottic, nonmalleable resonant spaces of the body. While singers often feel resonance sensations in the sinus cavity, this space is not known to be a primary filtration source, but likely does amplify singing sound secondarily. The nasal cavity also provides sympathetic vibration feedback to the singer while phonating but is not considered a primary resonator. (See Figure 8. The large cavity is the nasal cavity, the smaller frontal cavity is the sinus cavity). Resonance sensations in the nasal area are not to be confused with nasality, which results when the velopharyngeal port does not close completely (due to a low palate.) The opening of the velopharyngeal port while singing allows the nasal cavity to produce resonant frequencies separately from the oral cavity. Most voice teachers find nasal resonance to be an undesirable vocal quality in all styles of singing, while some teachers find a slight opening of the velopharyngeal port desirable for certain styles and effects in CCM singing.

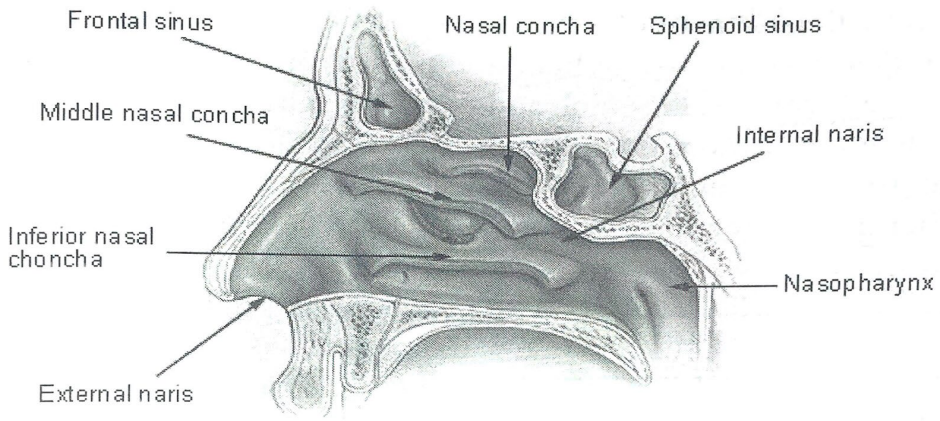


Figure 8. Nose, nasal and sinus cavities.
From *Wikimedia Commons.* Lateral view of the nose and nasal cavities, P. 89 *The Vocal Athlete*

Supraglottic influencers that are malleable by the singer play a more significant role in timbre and amplitude of vocal frequencies. The bulk of research and vocal

pedagogy commentary seems to relate to these tractile supraglottic resonators. The resonation areas that can be adjusted by the singer are:

i. the laryngopharynx (containing the laryngeal vestibule) and

ii. the oropharynx as the extended vertical portion of the vocal tract and

iii. the oropharynx and the oral cavity as the horizontal portion of the vocal tract

Note that the oropharynx is a resonance space that intermingles sound coming from the larynx, and sound coming back into the vocal tract from the lips, teeth and hump/lifted area of the tongue.

3.2 Laryngopharynx (containing The Laryngeal Ventricle)

The laryngopharynx extends from the vocal folds to the tip of the epiglottis and contains the laryngeal ventricle, the cavity immediately above the vocal folds (See Figure 9.) The Laryngeal vestibule is wide and triangular, with its base or anterior wall presenting. It is the inlet to the laryngeal ventricle cavity. This space is responsible for the singer's formant, a "ringing" quality in the classical voice (especially used by lower voices) that allows the singer's voice to carry over an orchestra. In general, it provides "ring" by pairing with the very high upper harmonics of the source sound. Many CCM pedagogues believe that the singer's formant is not used by belters, who use microphones and have no need to amplify harmonics of the voice higher in frequency than a violin for example. However, LeBorgne (2021), discovered that elite belters presented with a clustering of energy around 4000 Hz. (*The Vocal Athlete*, p. 96.) More research is needed to determine if the singer's formant is used in belted singing. The larynx sits in a sling of muscles, allowing it to be bouncy and flexible in a neutral position. Contraction

of laryngeal elevators can elevate the larynx which shortens the laryngopharynx as a resonant space. Contraction of laryngeal depressors can anchor or depress the larynx. Lowering the larynx creates a longer laryngopharyngeal resonant space. In addition, the laryngopharynx can be narrowed to varying degrees and in various locations. For example, it has been shown that the general area just above the larynx (the aryepiglottic area) can be adjusted to create "twang," a vocal color used prominently by belters.

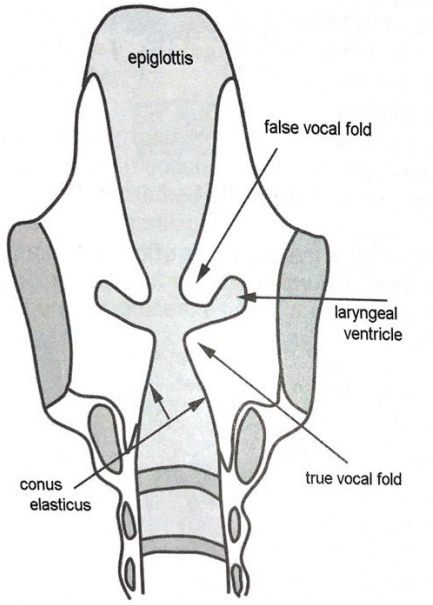


Figure 9. Coronal cross section of larynx.
From *Your Voice: An Inside View* (Figure 8-11, 2nd Ed, p. 112) by Scott McCoy, Copyright 2012. Scott McCoy and Inside View Press.

3.3 The Aryepiglottic Sphincter and Twang

When singers narrow the area just above the larynx, it produces a sound voice professionals call "twang." This sound is associated with the sound of a baby crying ("waaaa!"), the cackle of a witch, or the quack of a duck. The aryepiglottic sphincter is narrowed when the epiglottis closes (ie when we swallow.) Closing the epiglottis minutely while singing (via muscles in the laryngopharynx) causes the narrowing of the

aryepiglottic sphincter, producing the vocal color we call "twang." The following video from the vocalzone.com shows a singer demonstrating twang: https://www.vocalzone.com/the-record-blog/v-team-vocal-care/teachers-secret-weapon-method-never-got-told-end-vocal-strain-forever/

Twang is used by belters to strengthen their mixed sound. Employing twang, belters maintain strength of tone as they ascend to higher and higher pitches in a mixed belt. As the belter ascends in pitch, greater CT engagement requires them to contract the TA muscle less and less as the vocal folds are stretched thinner and longer. The use of twang helps blend mode 1 and mode 2, creating the illusion of an extension of mode 1 into the upper register. Twang raises the first formant by narrowing and shortening the vocal tract in a manner that does not need to create unnecessary tension in the surrounding laryngeal muscles. (Formants will be discussed further in the formant section of the paper). Twang also increases the closed quotient of the vocal folds.

3.4 The Oropharynx (Or Pharynx)

The oropharynx continues from the epiglottis to the soft palate. It is the space which connects the laryngopharynx to the oral cavity. Highly complex acoustical interactions are possible in the oropharynx because it is the section of vocal tract that receives and amplifies sound traveling out of and back into the vocal tract. The oropharynx is primarily adjustable via the epiglottis, the soft palate and the back of the tongue.

3.5 The Oral Cavity

The oral cavity is the third malleable supraglottic space. It is primarily associated with vowel formation. The movement of the jaw, tongue, palate, and lips all influence

the sound filtration possibilities of this resonant space. The oral cavity can act as an extension of the full vocal tract, influencing its other areas. For example, the lips when narrowed at the corners with a rounded extension, can naturally and instinctively cause a subsequent lengthening of the vocal tract in the laryngopharynx via lowering of the larynx.

The vocal tract contains the malleable resonance spaces of the voice, and is a quarter-length tube (closed at one end, open at the other,) giving it specific acoustic properties. Lengthening a quarter wave tube will lower the pitch of the tube. Shortening the quarter wave tube will raise the pitch of the tube. These acoustic factors, in addition to the malleability of each resonant space within the vocal tract, make it the most interesting and complex source of resonance for the vocal instrument. For the purpose of clarity, the term "pharynx" will be used to denote the portion of the vocal tract which contains both the laryngopharynx and the oropharynx.

3.6 Vocal Tract Differences

There are many differences in the way the vocal tract is used for classical versus belted singing. Table 1 offers a comparison of these factors.

Table 1. Comparing Vocal Tract Differences in Classical and Belted Singing

Vocal Tract Differences	Classical Singing	Belted Singing
Laryngeal position	Generally, a low, stable laryngeal position is preferred	Most research points to a higher or more elevated larynx, although research demonstrates that some elite belters use a lower laryngeal position (Ch 14 of *Vocal Athlete*)*
Vowel tuning	Involves tuning each vowel to the first harmonic of the frequency being sung for maximum beauty and amplitude.	Involves singing in speech range as well as bringing speech level vowels up into higher ranges, finding the vowel shape that is closest to vernacular speech for each pitch sung. Vowel tuning favors the amplification of higher harmonics using higher formants/brighter vowels.
Vowel shapes	Round, tall, vertical vowel shapes are preferred, mouth in a long [ɔ] position, jaw relaxed and moderately open, opening more as pitches ascend.	Wider vowels with trumpet or bell-shaped embouchure; mouth in [e], [ɛ], [æ], or [a] position, jaw dropped and more open; closed vowels [i] and [u] are not preferred. Opening as pitch ascends
Vocal tract shape	Inverted megaphone (See Figures 10, 11) Mouth is more rounded/closed, Larynx is lower, pharynx more open, Palate may be higher.	Megaphone (See Figures 12, 13) Mouth is open and wider, pharynx, especially aryepiglottic sphincter are narrower, larynx may be higher or neutral/bouncy.
Vowel modification	Uses more vowel modification, favoring moving all vowels toward a rounder shape ie. [a] [o] or [u]. As voice ascends, singer modifies toward [a] for females, [u] then [a] for males to favor first harmonic amplification.	Uses less or more minimal vowel modification; tendency to modify toward bright, open vowels as one ascends, modifying to [æ] or bright [a] which favor the amplification of the 1st and 2nd harmonics.

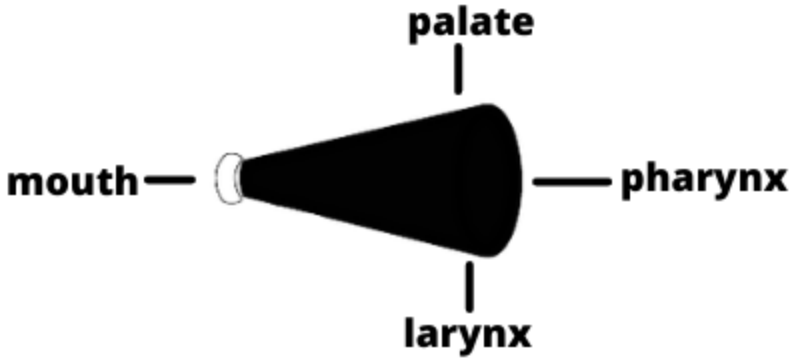


Figure 10. Inverted Megaphone Vocal Tract Shape (as envisioned by its name/description).

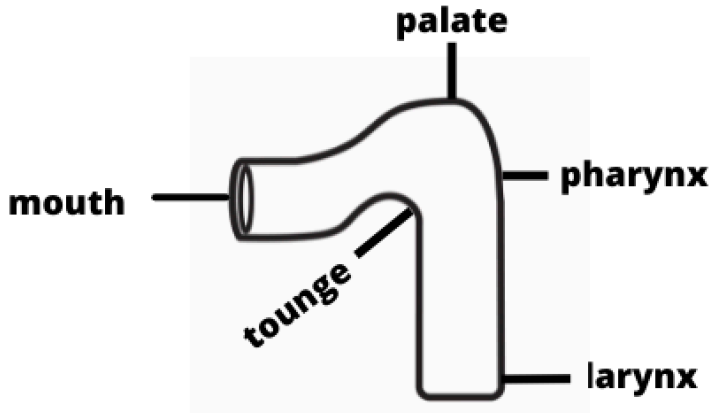


Figure 11. Inverted Megaphone Vocal Tract Shape (more biologically correct depiction).

Figure 12. Megaphone Vocal Tract Shape (as envisioned by its name/description).

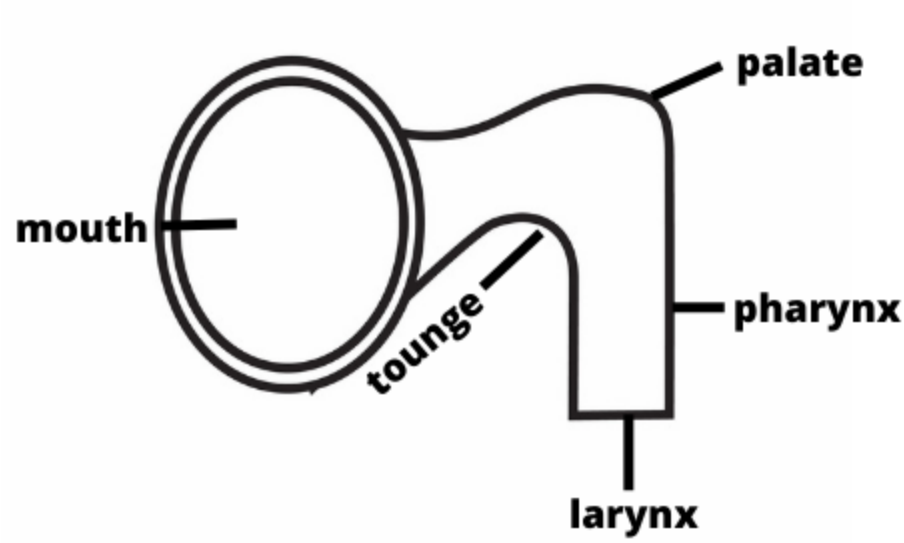


Figure 13. Megaphone Vocal Tract Shape (more biologically correct depiction).

Chapter 4: Acoustics

4.1 Acoustic Principles at Work: Formants

The Acoustical Society of America (1994) defines formant thus: "Of a complex sound, a range of frequencies in which there is an absolute or relative maximum in the sound spectrum." (http://www.phys.unsw.edu.au/jw/formant.html). In voice science and other scientific areas which focus on the human voice (i.e., speech science), a formant is defined as an acoustic resonance of the human vocal tract, as identified by the concentration of acoustic energy around a particular frequency in the vocal sound wave.

Formant concepts can be difficult to grasp and subsequently apply to vocal teaching. In addition to standard vocal pedagogy books, such as Scott McCoy's *Your Voice: An Inside View*, I found the website voicescienceworks.org to be very helpful in explaining formants, providing helpful diagrams as well.

4.2 Formant 1 and Formant 2 Explained

In singing, we have two basic containers of air:

Formant 1 (F1): The vertical container - the air container behind the tongue (from the top of the larynx to the hump of the tongue), and

Formant 2 (F2): The horizontal container - the air container above and in front of the tongue (from the hump of the tongue to the tip of the lips.)

A formant is a resonance of the vocal tract, or more specifically, a formant can be described as the pitch of the air in each container. Formant 1 is the pitch of the air that vibrates in the vertical container. Formant 2 is the pitch of the air that vibrates in the horizontal container.

The singer's vocal tract is their primary source of resonance. The vocal tract is capable of many shapes, and all these shapes make tubes for different pitches. The pitch being vibrated by the vocal folds is called the fundamental frequency. If the pitch of the fundamental frequency (or any of its overtones) matches the pitch of the filtration source (ie. vocal tract,) that pitch will be amplified. This is the definition of formant resonance. Scott McCoy explains (*So You Want to Sing Music Theatre*, p. 36):

> "When an echo from the vocal tract arrives back at the glottis at the precise moment a new pulse of sound is created, the two elements synchronize, resulting in a significant increase in energy. These resonant frequencies in which strong amplification has occurred are called formants."

Formants change the raw, buzzing sound of the vocal folds into the sounds we associate with speech and singing. In general, we associate the vertical tube of the voice (the pharynx) with the first formant, and the more horizontal tube of the voice (the oropharynx and oral cavity) with the second formant. Formants are labelled sequentially as they ascend in pitch. (See Figure 14).

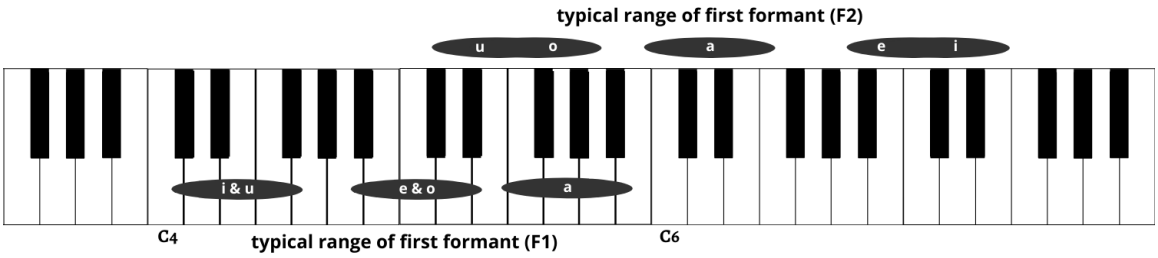


Figure 14. Typical range of first and second formants for primary vowels.
From *So You Want to Sing Rock N' Roll* (Figure 2.8, 1st Ed, p. 53) by Matthew Edwards., Copyright 2014. Rowman & Littlefield

For First Formant, [i] and [u] are lowest in pitch (around C4-G4), [e] and [o] are moderate in pitch (around A5-E5) and [a] is highest in pitch (around F5-C6 and above. If one would like to hear their vocal tract's first formant pitches ascend, flicking one's

throat (vertical container) gently while whispering the vowels in order will produce a series of ascending pitches.

Second Formants are higher in pitch than first formants, beginning around D5-E5 on the [u] vowel and moving to around F5-G5 on the [o] vowel. The middle second formant is [a] at C6-D6. The highest second formants are [e] at approximately A7-C7 and [i] at approximately C7-E7. To hear one's second formant pitches, flicking one's cheek while whispering the vowels in order will produce a series of ascending pitches. One will note that second formant pitches are a good deal higher than first formant pitches.

4.3 Formants in Belting Vs. Classical Singing

4.3.1 Brighter vs. Darker Tone – General Adjustments

The way formants influence vocal tone is one of the key differences in aural perception between belting and classical singing. In general, belted singing is considered "brighter." Dr. Karen Hall (*So You Want to Sing Music Theatre)* simply states that vowels in belting are more "forward." This term is usually used by voice teachers to describe resonance sensations in front of the lift of the tongue, up toward the palate, sinus, and nasal resonators. However, there is more to know about how brighter and darker tones are accomplished using vocal tract adjustments. Table 2 describes changes that can be made in the first and second formant areas in order to brighten or darken vocal tone.

Table 2. Formant Adjustments that Brighten and Darken Vocal Tone

Adjustment/Tone Quality	Darker Tone/Lowered* Formants	Brighter Tone/Raised* Formants
Lips	Elongated/Vertical	Spread/Horizontal
Lips	Rounded	Bell-shaped, Trumpet-shaped, Triangular, or Boxy
Pharynx/Larynx	Elongated/Lowered larynx	Shortened/Raised larynx
Pharynx	Opened/Widened	Narrowed
Tongue Hump	Lowered	Raised
Palate	Lifted	Lowered
Head/chin position	Retracted	Lifted/Extended

Darker tone colors are the result of the pitch of the vocal tract formants [F1 and/or F2] being lowered. Conversely, brighter tones are the result of raised or higher formants.

4.4 Harmonics Explained

A harmonic is a soundwave whose frequency is an integral (whole number) multiple of the frequency of the selfsame soundwave (source sound). Unlike formants, harmonics are a part of the source sound, or fundamental pitch produced by the vocal folds. If one changes the pitch of the fundamental tone by changing the length of the vocal folds, the harmonic pitches will also change. The fundamental pitch is the slowest and strongest vibration of the vocal folds. The faster vibrations that occur within the fundamental are called overtones or harmonics. The higher the harmonic, the softer the vibration. In other words, if the vocal folds were vibrating without the filter of the vocal tract, the fundamental frequency would be the strongest vibration and loudest pitch heard,

and the upper harmonics would be barely heard, with the first harmonic being the next strongest, etc.

4.5 The Harmonic Series

The harmonic series of pitches occurs only when the fundamental vibration is periodic, occurring in a regular pattern. This regular, periodic pattern is possible because the vocal tract is a quarter wave tube. Within this pattern, the number of air molecules displaced by the vibration must be equal to the number of air molecules that come back together. This periodic vibration of the fundamental pitch (H0) produces harmonic frequencies that are integer multiples of the fundamental as follows:

The second harmonic (H1) vibrates 2x as fast as the fundamental

The third harmonic (H2) vibrates 3x as fast as the fundamental

Etc.

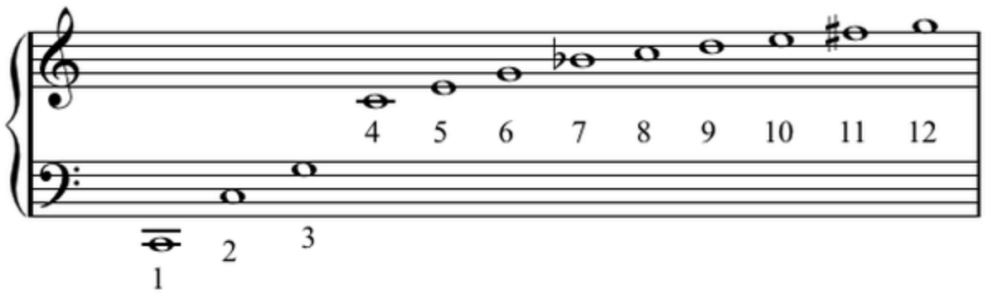


Figure 15. The harmonic series beginning on C2.
From https://www.voicescienceworks.org/harmonics-vs-formants.html

4.6 Acoustic Principles: Harmonics and Formant Tuning

As discussed in the registration section, belting engages the thyroarytenoid muscle along with the cricothyroid muscle while singing higher and higher pitches. In classical singing, the cricothyroid muscle engages more actively while the thyroarytenoid

muscle disengages while singing higher and higher pitches. Singing with more TA muscle engagement in belting creates more vocal fold closure, which creates stronger, higher frequency harmonics. However, too much TA engagement on high pitches can create unwanted tension in the laryngeal muscles. This unwanted tension happens when the TA works too intensely against the CT's function of stretching the vocal folds to higher pitches.

Therefore, in order to decrease vocal trauma when singing in a belt or mixed production, formant tuning is used. Belters take advantage of the fact that raising formant pitches will brighten the vowel being sung to create an environment where both the first and second harmonic can be amplified. Recall the definition of F1 and F2 on p. 33. When belting, singers may use a more raised larynx, shortening the vocal tract in order to raise F1 in pitch, allowing it to be closer to the second harmonic of the fundamental pitch. A shortened vocal tract means the singer can ascend in pitch without a lot of timbre or articulatory changes, creating an evenness in tone. Belters also open their jaw to raise F2. This phenomenon is seen often while watching Broadway singers belt out their phenomenal climactic high notes. Sometimes I call this shape "belt mouth." To sing an E5, for example, a female belter uses approximately the same amount of jaw opening as when classically singing a C6. Elite belters can reinforce (or amplify) multiple harmonics in the harmonic series of the fundamental pitch using formant tuning.

Belting tends to more aptly amplify both H1 and H2, which creates a different acoustic than in classical singing, where H1 is primarily amplified. When the singer amplifies higher harmonics by raising F1 via vocal tract shortening, and F2 via jaw

opening, a brassy, bright tone is the result. This tone is often more associated with speech colors ("called" or "cried" sounds).

The belted singing acoustic is a strong, visceral, emotional sound that is reliant on thicker vocal folds, more breath pressure/force, and a longer closed quotient of the vibratory cycle. In addition to these alterations, the belted sound is strengthened acoustically by formant tuning, favoring raised (ie. higher pitched) formants to amplify higher harmonics of the fundamental pitch.

4.7 Vowel Modification – What is It?

Singers learn to find the space in which maximal acoustical boost is reached from the pairing of the fundamental tone (and its overtones), and the pitch of the tube through which it flows. Vowel modification is the singer's intentional shaping of formants in order to best track the frequency being sung.

Classical singers tend to prefer open vowels that create an inverted megaphone shape. The inverted megaphone shape is defined by rounded, closed lips and an open, vertical space behind the hump of the tongue. This vertical space can be created by lowering the larynx and raising the soft palate. Vowels such as [o] [a] or a dark [u] exemplify the inverted megaphone shape and therefore, classical singers tend to modify all their vowels towards these shapes. The inverted megaphone shape allows the singer to lower F1 and F2 in order to track the first harmonic of the pitch being sung. In a study by Lebowitz and Baken in 2011, (*The Vocal Athlete*, p. 233), it was discovered that a Classical singer's first harmonics have higher amplitudes than their second harmonics. Like classical singers, belters were shown to have higher H1 amplitude than H2 also, but only 70% of the time. Belters had second harmonics with higher amplitude than first

harmonics 30% of the time. This is a special acoustical phenomenon. [Recall the first harmonic is usually quieter than the fundamental and the 2nd harmonic is usually quieter than the first harmonic in the overtone series.] I believe, in part, that this phenomenon may occur because belted singing favors the megaphone shape. The megaphone shape is defined by an open jaw and lips that are lifted from the teeth to create an open, square mouth shape in front of the tongue. Belters narrow their vocal tract by using twang and lift their tongue into a bright vowel like [ae] or [e] to create a narrower space behind the hump of the tongue. These factors create a shape that is more likely to boost H2 than the factors that create the inverted megaphone shape. Using this shape, classical singing modifies vowels to track H1. Belted singing, favoring a megaphone shape, often tracks the higher harmonic in the series (H2). Interestingly, studies show that elite belters still sing with a relatively low larynx, although it is more mobile and may sit more neutrally (as in speech) in belting than in classical singing. In relation to tracking H1 or H2, I would be curious to know if pitch and vowel play a part in influencing when the belter is more likely to amplify the second harmonic in a manner which overtakes H1 in volume. (Another study for another day!)

4.8 Vowel Modification Used by Belters

Mastering ideal formant configurations allows the singer to create a belted sound acoustically. To favor a brighter, brassier acoustic that more closely resembles speech, belters tend to modify toward different vowels than classical singers do. Vowels that raise either F1, F2, or both are [æ], [e], [ɛ], bright [a], and [Y]. Belters tend to modify their vowels on high notes toward these vowels in order to formant tune. Formant tuning happens when a singer adjusts their vocal tract configuration, favoring shapes which

boost amplification of certain harmonics of the sound source. For belters, it is desirable to boost higher harmonics than for classical singers. The worst vowels for high belting are [u], [i], [I], and [o] because they are produced with a closed jaw position (which lowers formant pitch). These vowels especially require modification: [i] is typically modified to [e], [o] is typically modified to [œ], and [I] is typically modified to [ɛ], and [u] is typically modified to [Y]. A great aural example of these vowel modifications is found at the end of the song "I'd Rather Be Me" from the Broadway musical *Mean Girls*. Barrett Wilbert Weed sings "I'd rather be me [me] than be [be] with [wɛð], you [IɛY]". Note that the vowels tilt toward these modifications, so that the slight alteration can be recognized. The vowels still come out sounding like the correct vowel phonetically, and the words are completely intelligible, being modified to vowels that closely resemble the spoken vowels (not toward open vowels like [a] and [o] which work well in classical singing but would sound effected in this style.)

4.9 Harmonics and Registration

In *The Vocal Athlete*, in a portion of the book entitled "The Science Behind Singing," Marcy Rosenberg and Wendy Leborgne discuss many scientific studies on voice science and the conclusions that can be drawn from them. Rosenberg and Leborgne discuss the interaction between the changes of the vocal tract and the sound source: in other words, how the vocal folds and the formant spaces interact. They identify three ways to modify the vocal tract that allow it to remain stable while the primary source sound vibrates through it:

- Adjust the length of the vocal tract
- Adjust the shape of the vocal tract

- Narrow the epilaryngeal area

They assert that finding the correct adjustment in each area creates an interaction between the sound source and vocal tract which promotes stability of vocal fold vibration during pitch and vowel changes. And visa versa, they propose that an incorrect adjustment in one or more areas can cause abrupt disturbances in vocal fold vibration.

Ingo Titze tested this theory in his study of nonlinear source-filter coupling (2008, *The Vocal Athlete*, p. 236). His theory asserted that the chest register will flip to head register as the voice ascends if H2 is not reinforced while belting. For belted singing, [ae] and [a] have the highest F1 pitches. These vowels help tune the first formant to acoustically boost H2 for higher pitches, creating a reinforced acoustic that sounds like the belted voice is being carried higher and higher. These vowels are directly related to the narrowing of the epilaryngeal area (or using twang). When a singer uses twang, they can raise F1, often without significantly raising the larynx. [This may explain why elite belters are often found to maintain a relatively low larynx while singing. Although it is generally agreed by voice scientists that belting often uses a higher laryngeal position overall, I train singers to use a neutral laryngeal position, as in normal speech patterns. Often, a lower, more relaxed laryngeal position can be accomplished while belting if the singer trains to do so over time. However, it should not be viewed as harmful if the larynx rises while belting, provided that the laryngeal constrictors and other neck and pharyngeal elevators are not overly engaged or obstructive.]

For Classical singers, the ability to sing smoothly from chest register to head register is accomplished by lowering F1 in order to amplify H1 (the lower harmonic) instead. Lower F1 is accomplished by lowering the laryngeal space, rounding and

elongating the lips, opening the pharynx, and raising the palate. According to Titze's theory, the harmonic being reinforced must remain stable throughout registration transitions. Therefore, Classical singers would avoid a chest to head flip by maintaining a low F1, ensuring that formant tracking takes place for H1 through the passaggio and into the head voice as the voice ascends in pitch.

Speaking in terms of overall configuration of F1 and F2 (or mouth and vocal tract shape), a singer who wishes to ascend in pitch evenly from chest to head registrations must choose either the "inverted megaphone," which tracks H1, or the regular megaphone shape, which tracks H2. All vowels will modify toward the megaphone or inverted megaphone shape as represented by the following vowel shapes: [u] [o] [c] for inverted megaphone, and [e][ae][a][ɛ] in regular megaphone. If Titze's theory is correct, singing a vowel that is incompatible with the overall megaphone or inverted megaphone shape will lead to a break in registration when ascending from chest into head voice and visa versa.

Rosenberg and Leborgne conclude that the ability to make these minute vowel adjustments successfully are what makes an elite singer. Matthew Edwards explains it very simply this way: "Narrowing and expanding the various parts of your vocal tract will enhance bass, mid, and treble tone qualities." (*So You Want to Sing Rock and Roll*, p. 127). He calls this "micromanaging" vowel shapes.

Chapter 5: What is Belting?

5.1 What Belting Used to Mean

Belting is singing in a chest-dominant manner that is true to speech patterns but is sustained. When someone is belting, they are using closer to the thickest vocal folds they can use before the voice breaks on any given pitch. This means, the higher one sings, the less they can actually "belt," as thyro-arytenoid activity (which shortens and thickens the vocal folds) must give way to more and more cricothyroid activity (which lengthens and stretches the vocal folds) as the vocal folds ascend in pitch. True belting, then, can only happen up to the pitch where the vocal folds can adjust pitches internally, with TA activity only. Once the voice employs the use of the cricothyroid "stretcher," it is no longer belting, but mixing, using both TA and CT activity to achieve its tone color and pitch. For women, the belt threshold, or belt passaggio is usually up to B4/Bb4. A trip through the repertoire of early belters (pre-1965), such as Ethel Merman, Liza Minelli, and Mary Martin seems to support this idea. It was less common in traditional musical theatre for female belters to venture much higher than a B4 or Bb4 in a heavy chest voice, although there are some examples of singers using a more chest-based vocal quality up to C5, C#5 or even D5. For men, the belt threshold is usually at F4/F#4.

In contemporary musical theatre, the demand for higher and higher sounds that match the quality of a belt has increased dramatically. For females, a "belted quality" could be required up to A6 and beyond. For males, this quality could be required up to B4/Bb4 and beyond.

5.2 What Belting Means Now

However, based on the knowledge that it is impossible to "belt" (sing without the use of the CT muscle) as high as contemporary musical theatre demands, one must question what singers are actually doing when they are "belting" above the belt passaggio. It may sound like they are carrying the quality and strength of their chest voice higher and higher, without a break in the voice, or even a strained tone. But biologically, it is impossible that they are belting beyond the point where their CT muscle must be used to stretch to higher pitches. At least, in the true sense of the word. What these singers are doing is mixing, using acoustical principles that allow them to maintain both the speech quality, strength, and ring of their heavier mechanism. And so, when one hears the term belting, as in, "Man, s/he can really belt high!" what is really meant is "Man, s/he can really maintain the ring of that bright vowel on that high pitch while creating an acoustically dynamic and powerful sound with a called quality which uses some TA activity." In general, when a singer is asked to belt more, or to use more "belt," they are being asked to increase the amount of TA activity they are using on a pitch, but this may also not be necessary (or possible.) The singer instead should seek to employ the acoustical principals that allow them to raise the pitches of their formant spaces, allowing them to amplify the second harmonic, creating a brassy, open tone that resembles a trumpet or a person crying or calling out.

In this paper, the terms belt or belted singing are used to describe a style or manner of singing that employs a specific technical process, resulting in a specific kind of sound. The defining interrelated qualities of belt technique are:

- TA activity beyond the belt passaggio

- Megaphone vocal tract position
- Raised formants and “brighter” vowels
- Called speech, vowels identified as being closer or true to speech, keeping in mind that modifications toward [e], [æ] and [a] help to raise formants/brighten vowels for the mixed belt as the voice ascends.
- A neutral, free larynx that is neither elevated to the point of constriction, nor depressed, and which may or may not be anchored by laryngeal depressors

Although I use the term belt/belting/belted singing to refer to what in practice, is in fact defined as mixing, most voice professionals mean “mixing,” when they use the term “belting.” An explanation of mixed singing and how the term belt and mix related and intermingle with one another is below.

5.3 What Is Mixing?

Mixing is about as illusive of a term as is the term “support.” Singers and teachers know it needs to happen, but the functional application is not innate in the term, and very different methods can be used by teachers to teach or achieve a “mix.” I define mix by several factors, all of which have been discussed above. A coordinated effort of multiple technical skills is required in order to achieve a “mixed” singing approach for CCM styles. It is important to note that although Classical singers do use “voix mixte,” this term is associated more with the middle to low voice, used in a head-dominant manner. “Mixed singing” as a sound quality, and as a technical method of sound production is required in contemporary musical theatre and other CCM styles. If a music director asks a Broadway singer to use “more mix,” it means they are belting too heavily in that section of song. The music director is asking the singer to use more CT activity,

or head voice quality, in their singing sound without altering their speech-like approach to the vowels. The music director may also be asking the singer to use more acoustic and aerodynamic power, and less muscle power to create clarity, vibrance, and resonance in the voice. The following factors play a part in creating a mixed (or medium) belt:

1. Both head voice (Cricothyroid activity) and chest voice (Thyroarytenoid activity) must be used to varying degrees.
2. Formant pitches (F1 and F2) must be raised to facilitate mixing, especially to bridge through the passaggio that connects the chest and head voice. Formant pitches can be raised by using varying degrees of twang, raising the larynx and/or narrowing the vocal tract. Some other ways to raise formant pitches are: to open the jaw, raise the tongue hump, move the tongue forward, lowering the palate (without too much opening of the naso-pharyngeal port,) widening the palate, and protracting the lips.
3. Vowels must remain close to speech as one ascends. While I believe vowel modification does take place while mixing, and that the mix requires that singers favor modification to brighter vowels in order to achieve the favorable acoustic described in #2, the character of the vowel should be discernable and heard as being true to the vowel in the spoken word.

Mixing has been described by musical theatre pedagogues as the coordinated and balanced effort of using both the thyro-arytenoid muscle and the cricothyroid muscle while singing. In other words, when someone is “mixing” or singing with a mixed approach, their head voice and chest voice mechanisms are operating together,

simultaneously. This coordinated effort provides a basic, if not complete description of mixed voice, as it is an important factor in achieving a mixed sound.

Mixing comes from the speaking voice, which naturally favors some thyro-arytenoid activity. We tend to speak in our modal or chest voice, with higher voice types favoring slightly higher speaking tones than lower voice types. When training a singer to mix, the voice teacher will use a bottom-up approach, teaching the singer first to speak and then to sustain speech tones (ie. sing) on pitches nearest to their natural speaking range. From the spoken approach, the singer can be trained to produce higher and higher pitches without modifying too much away from the spoken vowel shape and quality, and without shifting into a fully head-dominant tone. Teaching singers to belt and mix involves working toward speaking and singing on higher and higher pitches while maintaining some TA activity. Crying and calling are the most effective approach because these sounds are "up and over" and not too aggressive. Yelling has a "smack" to the sound that tends to initiate with a glottal onset and create too much tension. (Recall that the voice is already making an intense sound with a quicker speed quotient in a belted onset). Singers can also be trained to speak with genuine vowels in their head voice, achieving a 'head mix' that can often develop into a heavier belted mix as the singer continues in the following goals:

- To extend their ability to speak and sing higher pitches through "bottom up" training.
- To learn to reinforce higher harmonics in their upper register.

- To sing with healthy, confidant vocal technique, including posture efficacy, breath support, flexibility of the vocal tract, and dexterity of the articulators (tongue and jaw).

Chapter 6: Part I Conclusion

Although there are minor adjustments between classical and belted singing in the areas of breathing and posture, most technical goals remain the same for each, and classically trained singers will find their training crosses over well to belting in these areas. However, one notes more outstanding differences in registration and acoustics when comparing belted and classical singing. In the area of registration, the main difference noted is how the cricothyroid and the thyroarytenoid muscles engage during phonation. Belted singing in general seems to have a greater degree of thyro-arytenoid dominance compared to cricothyroid dominance, but since both styles require masterful use of both sets of phonation muscles, cross training a singer seems to make sense overall. In the area of acoustics, we note differences in the shapes used in all areas of the vocal tract, and how that influences resonance and amplification of the voice. As teachers, we also need to acknowledge the sounds we are hearing. It is easy to decipher styles of singing when we are invited to listen to someone belt "O mio babbino caro" or to sing "Big Spender" in a classical head voice. Any singing teacher (and most people in general) would say, upon listening, "that's not right!" Every style of singing has its own spectrum of vocal sounds which define it, and one of our jobs as vocal educators is to identify how to most healthily produce the sounds that are appropriate to each style of music, in order to support professional singers in a vast, competitive industry. Not that every singer needs to sing every style, or that every teacher needs to teach every style, but that there should be a knowledgeable teacher for every singer and every style of singing. Most importantly, the more versatile a singer's training, the more thorough their understanding of their voice will be, allowing them to masterfully create a full spectrum of sounds healthily and expressively, potentially for very different styles.

A dramatic example of this kind of versatility is found in the voice of Broadway performer Jessie Mueller. Listen to her sing "What's the Use of Wonderin'" from *Carousel* (2018 Broadway Cast Recording), and "She Used to Be Mine" from Waitress (2016 Broadway Cast Recording). These recordings demonstrate how the same voice, produced healthily, within industry standard aesthetics, can sing using two completely different vocal styles at an elite level.

PART II.

APPLICATION: Practical Implications for the Private Voice Studio

Part II Introduction

A. My background and training

I grew up in a small town in Saskatchewan, Canada. During my school-aged years, my musical training was primarily classical. I studied piano and voice classically up through the 12th grade and was deeply influenced to enjoy classical music. My mother plays classical piano and teaches classical piano and voice, and my father plays both jazz and classical music on the trumpet. In Canada, two systematic celebrations of the study of classical music deeply influenced my participation during my formative years. The first influence was the Royal Conservatory of Music, which offers graded examinations in every musical instrument imaginable. I studied piano up through grade 10 and voice to the level of an associate vocal performance degree (ARCT), earning the gold medal for the highest mark in Canada on that exam. The second influence toward high-level classical music making was the Music Festival Association. Music Festivals take place in small and large centers throughout Canada. In these festivals, young musicians can perform for aural and written feedback from an adjudicator and may even receive awards and scholarships for outstanding performance. Classical music was the strong base and emphasis in my early music-making opportunities, although both the RCM examinations and Music Festivals offered to an increasing degree the opportunity to explore musical theatre repertoire additionally.

In college, I studied first a BMusEd degree and then a MMus in vocal performance. My academic training and singing experiences in college were primarily classical and choral in nature. Due to my exposure to jazz and some contemporary Christian music, my interest in finding other ways of using my singing voice was peaked in my formative years. I participated in my first fully produced musical in high school

when I entered a performing arts high school my senior year, and prior to that I had won a provincial Music Festival scholarship in a musical theatre class. In college, I began learning and teaching all things musical theatre, reading, observing, and training in every way possible. As a performing arts teacher, I began working with musical theatre students from every angle – as a singing teacher, a vocal director, a musical director, an audition coach, a director, a producer. The broad applications of vocal training became more and more evident. Doors opened for me to work with professional voice students of many ages. In doing so, I saw that it is vital for young artists to be competitive and versatile in an expanding performing arts market. Professional singing is present on the stage, on tv, in movies, in commercials, in voiceover work, and the list goes on. The implications of healthy singing and speech were of salient interest to me. As an academically trained classical (opera) singer, I had believed that teaching voice from a classical perspective would benefit all voices. Although that belief has not proved to be untrue, it is only a partial look at the big picture of the voice. Classical singing is thought of as a style of singing, but it is a more importantly a technique of singing. Classical technique emphasizes certain aspects of functional singing. It is one way the voice can be used. However, in working with professional singers of every age in many genres, I've concluded that classical singing is not a holistic foundation for technically training musical theatre belting and mixing, nor for most other CCM styles. Moreover, a highly versatile hybrid singer, the singer who has become the standard in my studio, needs both classical and nonclassical singing technique. The two techniques are used to varying degrees, depending on student interest. Students who prefer classical singing always get a little bit of speech-based belting and mixing training in order to help them audition for

their contemporary school musical, for example. Students who love to belt always receive top-down training which develops and strengthens the functional head voice. These students must also learn to master a lyrical line, in a Roger's and Hammerstein ballad, for example. Techniques for pop, rock, R&B, gospel, jazz, folk, and beyond require combinations of classical and belted/speech-based techniques, as well as other style-based skills (riffing, growling, intentional flipping/cracking, etc). My aim as a voice teacher is to help each student develop a broad technique that allows them to explore their preferred vocal sounds, and their preferred musical styles, with effortless skill and technical training that supports healthy singing for their lifetime.

B. Using pedagogical knowledge in the private voice studio

Although it must be done with discretion, teaching vocal function and pedagogy to voice students is effective. Not to say that a voice student needs to learn every aspect of their breath mechanism before they are allowed to utter a note. Quite contrarily, students should be invited to enjoy their singing voices at every stage of learning. The analogy I use that of driving a car. When a 16-year-old gets their learner's permit, they just want to drive. They don't know everything, and frequently need guidance just to drive safely. I see beginner singers in the same way. Just starting with the basics of making sound and healthy sound exploration without self-judgement is enough. The beginner singer just wants to sing in their singing lessons. As a student progresses, they become proficient at some of the basic "rules" of singing and are ready to get their license. They are ready to drive on their own; The need for the voice teacher at every turn lessens as students learn to practice and apply singing principles safely and sufficiently on their own. Teaching pedagogy in the voice studio is like teaching a driver

how their car functions. It creates an elite driver – one who can tinker under the hood. Teaching vocal function allows the singer to put the pieces together in terms of how their voice works and that can be very empowering for them. Not only can they drive, but they can also work towards a more souped-up engine. Systematically teaching voice function allows voice students to progressively improve and intentionally engage their vocal sounds. Once a student has studied for a year or more, I like to ask them to share their personal concepts of various areas of vocal technique to investigate how much they understand. For example, I might say, "Pretend you are teaching a friend his first singing lesson. How would you describe breathing for singing to him?" When a student has a strong awareness of voice function, they can address independently many of the challenges encountered in weekly practice, building and then maintaining their instrument, potentially for long careers. Once the student reaches this level of knowledge of the function of their instrument, they may only need lessons sporadically for maintenance or problems they can't figure out on their own. They may also become voice teachers themselves.

C. How to use this section to train singers, including exercises

Part I of this paper is set up to discuss and compare voice science research and its implications on voice function for classical and belted singing. Part II is intended to be correlational and applied. The reader may wish to reach each section in full to incrementally consider each area of vocal pedagogy, from breathing to acoustics. I do not elaborate on postural considerations or offer any posture exercises, as posture for classical and belt singing technique is basically the same and is therefore only mentioned in the scope of this paper. The reader may also wish to jump back and forth from the

applied section (Part II) to the correlational section on voice function, immediately applying voice science to vocal techniques that can be used in the teaching studio. Exercises can be used individually or incrementally, starting with breath work. Voice teachers should feel free to modify exercises, seeking out the best method of practical application for each concept and area of technical training.

Chapter 7: Application of Breath Concepts

7.1 Breath Goals Defined

It has become invaluable to ensure that each student I work with is connected to their breathing system in a manner that allows their voice to be free and supported. Support is a word that voice teachers use frequently but that is very rarely defined. I believe that support really means creating a system of pressurized air that flows at a rate that engages the vocal folds aerodynamically. Breathing efficiently and dynamically is a lifelong pursuit for career singers and requires constant monitoring. Breath technique for belting and for classical singing is the same from a bird's eye view, but the minor differences are noted in the exercise descriptions below.

7.2 Factors That Affect the Singer's Breath

The singer's breathing mechanism can be affected by many factors, including but not limited to the following:

- The condition of the muscles of inspiration and expiration. Sometimes dancers find these muscles need to be stretched to loosen them before singing. Very physically high-strung students may also need this type of stretching.
- The condition of the lungs. Allergies, illness, and substance abuse can cause it to be difficult to get a full breath.
- The general energy level of the body. Lack of sleep, nutrition, hydration, or physical exhaustion can influence how well the singer is able to breath and support sustained sound.

A singer does not breath "naturally," as normal breathing is passive and autonomic. Instead, they must prepare their breathing system to "support" sustained

sound over time. A singer's exhalation phase must be much longer than their inhalation phase, and within a given phrase, singers encounter numerous vowels and consonant sounds, musical articulations, dynamic changes, and other vocal effects. Singers need time at the beginning of a lesson to focus on their breathing, settling into a pattern of released (low, slow) inhalation wherein their diaphragm is allowed to descend, filling their lungs deeply. The singer's exhalation phase should be pressurized, extended and controlled.

7.3 Exercise 1 - The Pool Floaty

Creating a pressurized system of air can be accomplished using what I call the "pool floaty" method. The singer sits on a chair and leans forward, focusing on inhaling into the back between the bottom of the ribs and the top of the (back) hips. Once this breath is taken fully, the singer will feel like a balloon or a "pool floaty" toy. In order to pressurize this air and make it even more dynamic, the singer leans on the breath creating a similar effect inside their body to what happens inside the pool floaty toy when someone sits on it. (I often use the expression "lean down and out," but "up and out" may also work). We know the air in the pool floaty toy is more pressurized because when you undo the nozzle, the air in the pool toy that someone is sitting on comes out with greater intensity than if you undid the nozzle without someone sitting on it. After establishing the sensation of air pressure in the body in between inhalation and exhalation, the student should then exhale to a count of 5. Repeat the exercise exhaling to a count of 8, then 10, then 12, etc. Then the student can repeat the exercise speaking the counts out loud with a supported speaking voice. Thirdly, the student can sing a

simple pattern, starting in their speaking range (i.e., 54321), singing the numbers they spoke, starting with "1, 2, 3, 4, 5."

Many teachers make the mistake of overemphasizing breath intake or breath flow. Taking in too much breath results in the vocal folds functioning as a valve to hold back the excessive air that is coming through them. Vocal folds cannot function as a valve for holding breath and phonate functionally at the same time. Taking a clavicular (high) breath creates the same problem. One does not want to attempt to prepare their vocal folds to hold back breath and to vibrate at the same time. It is a confusing message and creates unwanted tension during phonation. Overemphasizing air flow usually results in breathy singing, and sometimes also results in strident, sharp or forced vocal colors. Air flow must be offered to the vocal folds at a rate that allows them to aptly vibrate, creating sound waves that do not have a lot of excess air driving or running through them. The sound waves created by phonation can be amplified by the resonators (spaces above and below the folds) more effectively if there is not a lot of excess air escaping the vocal folds and interfering with wave patterns during phonation. If you find that a student is holding air in the clavicular region during the pool floaty exercise, advise them to exhale the "extra breath" sitting in their upper chest before they start counting, using only the pressurized air in their lower body to complete the exercise.

7.4 Why this exercise?

This breathing exercise is both foundational and versatile. It is a variation of a breathing exercise taught to me by a wonderful voice teacher and Juilliard graduate, Steven Schnurman, during my lessons with him in New Jersey. The act of bending over and focusing on breathing into the back where the largest part of the lung resides makes a

lot of sense. This type of breath seems to be more effective also for dancers and mesomorph body types, who may struggle to find a low, relaxed breath by focusing on the front of their body (ie. Abs and "diaphragm"). The reason this exercise is so valuable is because it helps the singer ground and pressurize their air stream. This manner of breathing allows the singer to move the air out gradually with a "floaty" approach for classical and legit/legit mix singing. It also establishes a sense of breath pressure in the part of the body where belters would lean "down and out" into the pelvic floor, as in picking up something heavy or calling out. Recall that belting engages the vocal folds more quickly at the onset of sound than classical singing does, and this manner of breathing seems to facilitate this technical need for immediacy as well. This breathing exercise prepares the singer to manage the phrase with their intent at inhalation, and they have control of breath pressure and flow options. This allows them to manage the breath over the phrase as they express text in any technical style.

7.5 Exercise 2 - Wall Push Ups

Singers often struggle on the second half of the phrase. They run out of breath and need to take another one in the middle of a phrase, or they continue to sing on "fumes" and end up in glottal fry as the voice runs out of fuel. Singers run out of breath in the second half of the phrase because at some point in time, the singer loses enough air that the pressure in their lungs begins to be negative. The autonomic brain is signaling the body to take a breath at this point, which can cause the singer to panic and breath before they had planned to in the phrase. In order to continue to provide the vocal folds with a steady stream of pressurized air, the body needs to resist the collapse of the ribcage, often with some abdominal contraction as well. Wall push-ups can help all

singers to strengthen their external intercostals, the rib muscles responsible for lifting the ribs up and out. These muscles are generally not very strong because they are only used for inhalation and a few other circumstances (i.e. lifting heavy objects.) Trained classical dancers especially have trouble accessing these muscles at first because their internal intercostals, the muscles that close the ribs, are used constantly.

To do a wall push-up, stand 2-3 feet from a wall and extend your elbows 3-4 inches from the bottom of your ribs. Keeping your elbows in line with your ribcage and with hands out in front of you, lean forward until your hands are on the wall ahead of you. Do a push up on the wall, extending both your elbows and your ribs laterally, as though a string is attached to your elbows and is pulling your ribs toward it. Repeat 5-10 times at first, then increase repetitions. Try speaking a repeated sentence or singing a sustained note while doing a wall push up. This exercise often improves a singer's ability to sing sustained, high and high sustained sounds without tension, or with more TA engagement without tension.

7.6 Why this exercise?

Both classical singers and belters need strong external intercostals. Improving intercostal strength will allow the singer to get to the end of a phrase without running out of breath or losing tone. It will also improve belted singing which requires more subglottic pressure, and therefore more strength in the muscles of inspiration, which act as a counterbalance when the air pressure in the lungs decreases during a sung phrase.

Chapter 8: Application of Registration Concepts

8.1 Registration and Registration Goals Defined

Warmups in a classical and legit musical theatre vocal style are usually the first sung warm-ups used in a lesson. When warming up a voice for classical singing, I find the best way is to start is with exercises that encourage aerodynamic sound and CT dominant singing. I may begin with lip trills or a semi-occluded exercise, then move toward open, round vowels, such as [u] [o] and [a]. A 54321-pattern beginning mid-range and working down and then beginning mid-range and working up with a light approach and plenty of airflow (not to be confused with "breathiness") is generally an effective second exercise. I encourage mixing into the lower register, keeping the CT activated as long as possible while descending to lower pitches where mode 1 becomes more active. These types of warm-ups establish easily produced sound in all registrations, with breath as the fuel source for the sound, and without the use of excessive tension in the throat.

Warming up for mixing and belting (a more TA dominant approach to singing) happens only after:

1. Warming up a student's breath to ensure they are connected to a low, secure, pressurized breath.
2. Singing legato on the breath in a CT dominant manner, warming up from the middle of the voice upwards, and then from mid-voice downwards in a top-down (54321) approach.

Contemporary musical theatre singing requires singers to carry a more TA-dominant sound above the second passaggio (for females, this is usually anything above B4,) but the CT muscle must be activated to allow mixing to happen. To mix, a singer

must engage both the CT muscle and the TA muscle simultaneously. Mixing happens on a sliding scale; Keep in mind that "belted" singing is really mixing. If you think of singing in mode 1 as black and singing in mode 2 as white, mixing is a sliding scale of grey. In general, shades grow lighter functionally as the voice ascends to remain functionally healthy and easy. It is also possible to darken shades as the voice descends, but for any given pitch, there are varying shades of mixing possible. In the middle voice, almost any shade of mix is possible. Mary Saunders Barton's Vocal Arch provides a visual of the registration areas for the female belter.

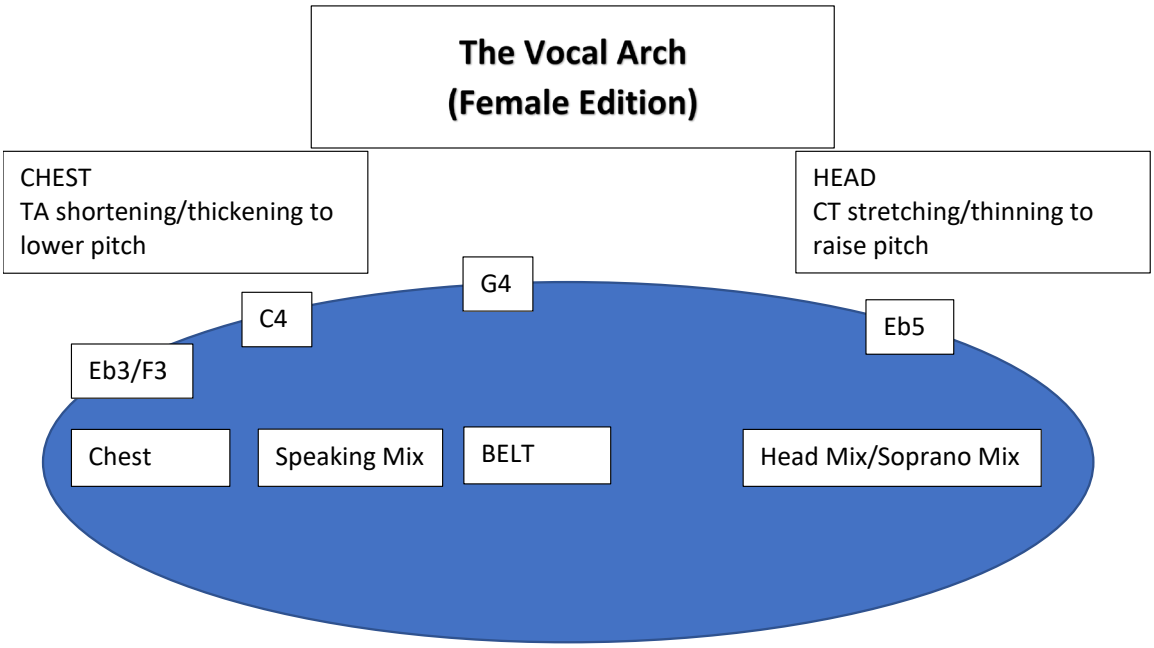


Figure 16. The Vocal Arch.
From *Bel Canto Can Belto* (Female Training Video). Copyright 2007. Penn State University Publishing. Mary Saunders Barton

Both male and female voices experience registration shifts, called passaggi. The first, or primo passaggio is where the lowest chest voice moves into the lower middle voice or speaking mix for females, and where the chest voice moves into head voice (before falsetto) for males. For females, this occurs between C4 (middle C) and G4. For

males, this occurs between A4 and D4. The second passaggio occurs where the upper middle voice bridges into the head voice for females, and where the head voice bridges into the falsetto for males. Mixing is necessary above the second passaggio, which Mary Saunders Barton does not include in the Vocal Arch chart. In female singers, the TA muscle has maximally stretched at approximately B4/Bb4 (second passaggio) and must give way to CT stretching at C4. (C4 is said to be where the mixed belt "opens" for females). Singers must learn to maintain a little TA thickness while primarily relying on CT stretching and acoustical principals in order to achieve a belted sound beyond the second passaggio. For males, the second passaggio occurs between E4 and G4 (F/F# are common transition pitches) and bridges the head voice into falsetto. It is easy to be too heavy with TA dominant singing as the voice ascends through the second passaggio, so that the singer becomes too shouty in their approach and struggles to sing higher pitches. There are two methods of warming up that I have found to be helpful in preventing this problem from occurring.

8.2 Step 1 – Calling on Pitch (Top Down/Arched) to Engage Mix

After CT dominant warmups, begin warming the student up from a pitch that is moderate for them, moving upward first to encourage a balanced mix of CT and TA engagement. Have the student call a phrase or word using an engaged speaking voice and an "up and over," siren-like approach. "Wow," "That's amazing," "Stop," and "Come back here," are phrases with bright [a] and [e] vowels that work well for mixed sounds. Then, the singer sings the approximate pitch that they called. Establish the pitch and have the student call out in their speaking voice, approximately on that pitch. Then have the student sing that pitch, usually in a 5-1 pattern, sliding between notes. An "up

and over" approach mimics the "top-down" approach of classical training and helps the student to maintain enough CT engagement to sustain the pitch easy while calling in their upper register. Specifically, C4 and above for females, and approximately E3 and above for males are good pitches to ascend to before descending downward with this called approach. On a second pass through the exercise, try starting mid-voice and going higher.

8.3 Spoken Phrases to Capture Mix

Bel Canto Can Belto video booklet. Copyright 2007 Mary Sauders Barton.
Oh, no you don't
May I Come in? (try with British inflection)
NO way!
Never, never, no!
Where are you going? (accusatory)
Holy Cow!
Yikes!
Wowee!
Hey guys!
Damn Cat!
How dare you!
Let me go!
Hello-o (duh)
Hello, boys and girls! (a la Mickey Mouse for establishing CT dominant sound/head voice, then try a speaking mix which engages mid-low pitches)

Additionally, I use:

Stop that!
Come back here!
Why are you doing that?
Stay here!
Calling your dog ie. "Hopper, come back here!"
Mom! (or any person's name called)
Wow!
Hey! Stay! Or any one-syllable "ay" word
Waaaaaa! (baby crying) or "Let me call the waaaambulance for you!"

8.4 Step 2 – Bringing the low voice up in a limited interval: Engaging Belt

Another way to strengthen TA dominant singing is to bring the registration quality of a lower note up to a higher note. Some teachers use octave leaps to achieve this, and I will do so with an advanced student, but for warmups early in the lesson, and for singers who have not mastered their mixed voice, I use the interval of a perfect 5^{th} or smaller. Again, in a called approach, the student will sing "how dare you," "oh, no you don't!" "Hey taxi," or "why say that?" in a 1-5-1 pattern, again sliding between notes. Encourage the singer to bring the same quality of registration from the first pitch up to the second pitch, thus increasing their ability (and tolerance) to create a more intense, buzzy, TA-influenced sound.

Chapter 9: Application of Resonance and Acoustic Concepts

9.1 Resonance Goals Defined

The hybrid voice teacher trains students to be aware and knowledgeable of their resonant spaces. The way resonant spaces are addressed has specific acoustical implications for the singer. Understanding that malleable resonant spaces can be adjusted to create specific sounds allows a student to intentionally sing classically, and to intentionally belt and mix. Keeping in mind that the term "classical" has association with style and technique, and "belt" has association with styles (musical theatre, rock, and other CCM styles to various degrees,) and technique, students may explore a variety of vocal colors associated with various styles of music as they develop greater awareness of how to adjust their resonant spaces. Within this awareness, students can create specific sounds associated with specific styles of singing with the only limitation for singing sound being that which can be produced healthily (or without pathology) long-term.

9.2 Factors that Influence Resonance

9.2.1 Resonance – Sound Filters

The concept of "space" for the singer is both simple and complex, because every singer knows that the way they use their "spaces" (mouth and throat) effects their singing sound, but there are a lot of factors to consider regarding these spaces. Primary vibration of the vocal folds without filtration sounds like a simple buzz. I often think of it as being like the sound a full balloon makes when its neck vibrates as it is released. It is the resonant spaces of the body above and below the vocal folds that amplify the fundamental buzz tone created by the vocal folds, in order to create a fully dimensional

and unique timbre. A singer's sound is determined by many ever-changing filter factors including:

- Resonant spaces above and below the vocal folds.

*The singer's biological make-up changes during puberty and there are successive vocal fold and resonant space changes into mid adulthood.

- Vocal tract configuration/shape.

*Malleable by the singer

- Vowel shapes and adjustments - lips, jaw, and tongue

*Malleable by the singer

- Acoustical principles at work in relation to vowel shapes and vocal tract configurations (ie. Backflow, harmonics amplified, and harmonics cancelled.).

*Malleable and Perceptible to the trained singer. Often heard as buzz, feedback, ring, overtones, or as one of my soprano students described it: "small rodents fighting in my head." Tracking resonance requires patience and intuition. The singer must learn to sense acoustic coupling. Often, I simply say: "Find the ring!" Note that not all singers like the feedback of good acoustics initially because they perceive it differently from inside their head. A good remedy to this problem is to have them record lessons and practice sessions and to play back their singing. They usually hear that good acoustics are pleasant to the listening ear, and that these acoustics help to amplify and give color to the overall tone spectrum.

- Degree of tension or slack of the vocal folds

*Somewhat Malleable, somewhat determined by pitch.

Although these factors work together, the next set of exercises will address each area individually. My goal will be to focus on each area in order to build a picture of the resonant system surrounding the vocal folds, and how each area can have an influence on the fundamental tone being sung. These warmup methods should also allow a comparison of the resonance and acoustical factors involved in belting versus classical singing.

9.3 Palate Exercises Overview

Both classical singers and belters need to learn to isolate and raise their palate. Raising the palate creates an acoustic space that is more favorable for harmonic coupling, removes nasality from the singing tone, and encourages a counterbalance of space and relaxation in the pharynx. Most singers need to learn to lift and stretch their palate through vocal training, as it is a learned, physical skill.

9.4 A Note About Placement

Many voice teachers use the concept of placement to help students find ideal resonance sensations. I also use this concept to help establish with voice students that:

- The soft palate is large, covering all the space above the pharynx and some of the space above the tongue.
- The soft palate is flexible. It can be lifted front to back and side to side, with varying degrees of elevation in its distinct areas.
- The pressurized airflow they are sustaining should be aimed at their palate for the purpose of lifting it throughout the spoken and sung phrase.
- The palate changes shape, and the sensation of where you might aim to lift your palate also changes depending on what pitch you are singing. Adjusting

your “aim” may allow you to find better resonance for the pitch and vowel you are singing. To provide a visual for how placement is perceived, see the chart below. Placement for the high voice can be found by using such a guide, although every singer is an individual and must find what feels right for them.

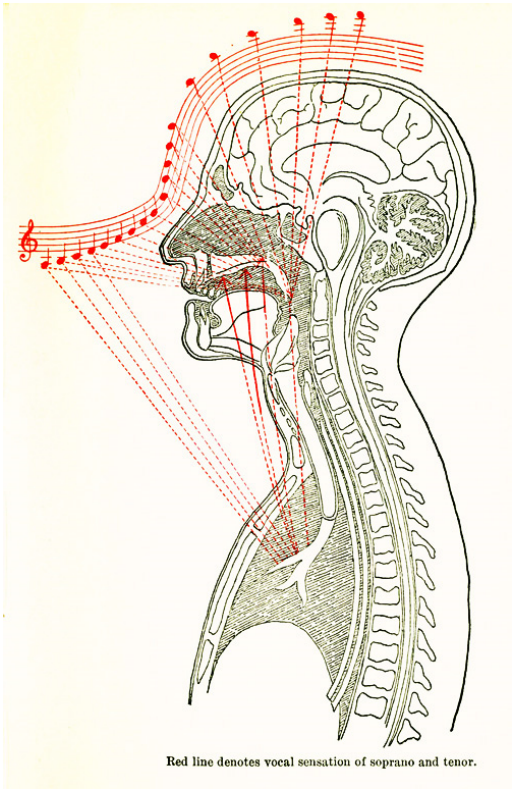


Figure 17. Placement chart for the soprano and tenor voice. https://edwardsvoice.wordpress.com/2019/09/30/mix-it-up-monday-allow-placement-to-reveal-itself-dont-force-it/

To begin, the teacher can help the singer identify a low/dropped palate and a lifted palate. A lowered palate can be found using the syllable “ung.” A lifted palate can be found on an open “ah” in head voice. To check if the palate is lifted or dropped, have the student hold their nose and practice going back and forth between the two sounds. It is impossible to sustain sound with a fully dropped palate (ie. with one’s nose plugged on

"ung.") Moving from this extreme to a sustained nasalized sound to an open [a] will help the student establish varying degrees of palatal lift.

9.5 Palate Lifting and Lowering Exercise

Kind, kind, kind (5—3---1)

It is very common for vernacular American English speakers to have a low palate, especially if they are from the southern states. I teach in Kentucky, and most of my beginner students have no concept of lifting or opening the palate (unless they have sung in a traditional choir.) This exercise helps the student feel their palate lifting into the [a] vowel, with special help from the breath force of the [k]. The palate then lowers as the student sings [nd], because [n] is a nasal consonant. However, the student should be encouraged not to drop into heavy nasality, maintaining as much [a] space behind the closed [n] as possible.

9.6 Palate Lowering and Lifting Exercise

Ng-a (5-5-4-4-3-3-2-2-1-1).

Have the student sing [ng] and [a] on each pitch in a descending five-note scale. Establish the feeling of lowering the palate on [ng] and lifting/opening the palate on [a]. In a mixed voice, this exercise will involve a subtler palate lift, with less change between the nasal consonant and the vowel. In a classical approach, more vertical space will be used in the embouchure and vocal tract, the perceived placement will be further back on the palate, and there will be a stronger sensation of lift (dome, parachute) on the [a]. In cross training a student, venture toward a classical approach for a MT student who is having difficulty lifting their palate, then work backward for a mixed approach. For a classical student, work for a more [ng]-influenced [a] to aid in the development of twang.

(Recall that twang does not mean nasality in the tone. However, lowering the palate or using a broader palate can help encourage easier narrowing of the aryepiglottic sphincter.)

Some students drop their palate too low when singing voiced consonants, especially nasal consonants like [n] [m] and [ng]. Begin correcting this fault by having the student say or sing a sustained tone from consonant to vowel. Ie. Mmmmmmaaaaaaa. Address palate height while sustaining the nasal consonant and encourage that a higher and higher palate is possible on a nasal consonant. Graduate to exercises with nasal consonant and vowel combinations. (ie. 543211 “mine yours a long time”.)

9.7 Laryngeal Positioning Exercises

Singers who develop an awareness of laryngeal positioning tend to more quickly produce both classical and mixed belt sounds. Acoustically, laryngeal positioning allows the singer to control whether the vocal tract is set up to couple with lower or higher harmonics of the fundamental tone. Technically, developing a flexibility and mobility in the larynx allows the singer to create desirable tone colors and resonant spaces without undesired tension of the extrinsic laryngeal and neck muscles. Freedom and flexibility of muscles that connect the jaw and tongue to the larynx must be developed as well.

The larynx cartilages sit in a cradle of muscles that attach above and below. Muscles that attach upward and can elevate the larynx are the laryngeal elevators. The thyrohyoid muscles are attached to the hyoid bone which attaches to the jaw and tongue. Other muscles which can elevate the larynx are the constrictor muscles, used to swallow and constrict the vocal tract above the vocal folds.

The sternothyroid muscles are attached to the sternum and are the main depressors of the larynx. In addition, the sternohyoid muscles connect the hyoid bone to the sternum, and the omohyoid muscles connect the hyoid bone to the scapula (shoulder blade) passing through the tendinous loops around the jugular veins. Both the sternohyoid and the omohyoid counterbalance the hyoid elevator muscles.

9.8 Neutral Larynx

Begin by having the student speak with a neutral larynx. I use simple, common phrases like, "How are you today?" "Hello my name is _____" or "Would you like to go for a walk with me?" Address whether the larynx is free and neutral when the student speaks.

Healthy speaking voice markers:

- An "up and out" quality
- Ample, resonant tone
- Healthy onsets and offsets (glottal onsets of words that start with vowels is very common in contemporary speech and must be corrected)
- Utilizing pitches that are neither too low (glottal fry,) or too high (breathy, "off the voice" alla Marilyn Monroe)
- Energized from start to finish, but without run-on sentences (speaker takes regularly metered breaths rather than running on fumes because of abnormally long phrases)
- Clear, correctly formed consonants and vowel sounds

If the student needs to address bad habits in their speaking voice, spend several weeks working with them on correcting these for a healthier speaking sound. I have

several children's books on my piano for these purposes. I have a student read a portion of the book at the start of the lesson to address how they are doing with speaking voice health. The flow, pitch, range, freedom, flexibility, resonance, clarity, articulation, and inflection of the students speaking voice will define them as an actor and as a singer. Since all forms of professional singing require a synthesis of text and music in a manner that communicates or tells a story to an audience, the speaking voice should be given due weight as you work to train each student.

9.9 Lowered Larynx

Now that we have established that the larynx generally sits in a neutral, relaxed position for speech, it is valuable to address laryngeal positions that are higher or lower than neutral for singing. Firstly, remember that the larynx is attached to elevator and depressor muscles, and that excessive tension in any of the following areas will prevent the student from moving their larynx flexibly: jaw, neck, tongue, shoulders, chest. Taking time to help the student find alignment, and to stretch each area listed, will prevent frustration when working with laryngeal positioning. Andrew Byrne book *The Singing Athlete* provides many useful exercises to this end. It is also important to note that the student's goal is not to force or push the larynx down. Scott McCoy defines a lowered laryngeal position this way: "The ultimate goal is to release in the muscles that can elevate the larynx, leaving the depressors free to anchor the larynx gently in place without actively pulling it down." (*Your Voice: An Inside View*, p. 120).

9.10 Exercises for Finding a Lower Laryngeal Position

A lower laryngeal position can be found by using the guide vowels [o] and [u]. To begin speaking in a lower laryngeal position, I ask the student to speak in their

"grandpa voice," or to say the giant lines from Jack and the Beanstalk: "Fi Fy Fo Fum, I smell the blood of an Englishman." Another sound that seems to work is "boo-boo-boo" or "bo-bo-bo" (spoken from higher to lower pitches in modal voice). This can be extended into a 54321 exercise. I also use the consonant-vowel combination [lu] and the words "open," "almond," and "amen" in a slidy 5-1 or 8-1 approach. Other factors that can help the student find a healthy lower laryngeal position are:

- Protruding the lips using the corner muscles but leaving the top and bottom of the lip relaxed. [u] and [o] are the obvious vowel shapes here. Student can develop more lip coordination by doing "lip push-ups," placing their finger in front of their lips (as in "shhh") and pushing their lips toward their finger using their lip corner muscles only.
- Freedom and flexibility of the tongue (massage the tongue under the chin with your thumb, training the tongue not to push down at this location during inhalation, speech or phonation; stick the tongue out and stretch it all ways, sing with tongue out; wiggle center of the tongue while tip is rooted behind the bottom teeth; wiggle the jaw, not tongue and visa versa). In general, a tongue arch that stays in a "humped" shaped, similar to its position when neutral (not singing or speaking) is desired. Find neutral position of the tongue by swallowing, then relaxing with the mouth closed. Open the mouth with a similar tongue position.
- Freedom and flexibility of the jaw. Lowering the jaw while relaxing the tongue (allowing the hump to raise up for classical singing with the option to

move slightly forward for belting) will release the muscles that elevate the larynx.

- Lifting the palate. When classical singers use the inverted megaphone shape, the lifted palate creates the second half of the open/broader part of the megaphone. (Refer back to Images J and K).
- Relaxing the pharyngeal constrictors. (aka "Opening the throat")

9.11 Higher/Narrowed Larynx – Twang

Recall that narrowing the pharynx (as in swallowing/closing epiglottis) raises the larynx via the constrictor muscles.

Choose a top-down pattern (ie. 5 sliding to 1, 5-3-1, or 54321) and have your singer engage twang using vowel/vowel-consonant combinations such as "nya," "yang," "wow" or "waaa" or spoken sounds, such as "quack," "waaa," or the cackle of a witch. Initially, you can just allow them to engage "full twang," which is exaggerated. This sound would only be used for character roles that are cartoony or over the top (ie.Kristin Chenowith singing "My New Philosophy"). However, this is the place to start. Once the student has become comfortable with using twang to lightly engage the constrictor muscles (as a baby does when they cry) without engaging the thyrohyoid muscle or overtightening the TA muscles, they will benefit from practicing using shades of twang. I call a very twangy sound (tight spaced/furthest forward sense of placement) "full twang," a moderate twang "half twang," and an open, spacious twang "open twang" (highest palate and furthest back sense of placement).

Recall that twang is an excellent way to bridge the middle mixed voice to the upper mixed voice over the second passaggio for both classical and belted styles of

singing. For classical singers, it is an exercise that allows them to perceive a more forward placement if their sound is too swallowed (ie if they are singing in too open of a pharyngeal space in a certain part of their register, or if they are not moving the sound past the pharynx and into the resonant spaces above.) Classical singers do not usually perform with a "twangy" sound (whereas belters do,) but learning to narrow and open the aryepiglottic area is beneficial acoustically to classical singers, as it can help them become more aware of acoustic coupling. Belters need twang to bridge their mix at the second passaggio, allowing them to maintain a strong core sound (which resembles speech) as the CT muscle becomes more active. Teach the student the difference between singing with nasality in the tone (which happens when the naso-pharyngeal port remains open due to a low palate), and twang (which happens when the student narrows the aryepiglottic sphincter. I find the twang video I shared earlier in the paper very helpful, as it provides a visual for where and how twang happens. It also helps the student understand that twang does not happen in the sinuses, or nasal cavity, and that it is possible (and desirable) to lift the palate while using twang! [Note that focusing on twang in the throat can produce a constricted sound. Belters may need the sensation of resonance in the sinus/nasal areas, similarly to how classical singers perceive forward resonance. This sensing tool may allow the belter to move sung sound through the resonant spaces more freely (i.e., an "up and over" fashion may better match the path of the sound through the vocal tract.)

9.11.1 Twang – Lips, Tongue, and Jaw

In addition to laryngeal and pharyngeal shaping, jaw and tongue positions help the singer establish the megaphone or inverted megaphone shapes for mixing/belting and classical singing, respectively.

9.12 Inverted Megaphone Shapes (for classical and legit singing)

- Lips forward and rounded/narrower. Suggested exercises: those with vowel consonant combinations like [zu, zo, za] [lu, lo, la] and [ju, jo, ja] in scale and arpeggiated patterns, especially top down.
- Exercises that encourage jaw freedom, with jaw opening as the voice ascends, even with a rounding/narrowing of the lips maintained. See above combinations but sing arpeggiated patterns and octave slides (ie. 1-8-1, 8-1, 1-8-7654321). The [j] sound followed by any vowel is especially helpful for teaching free jaw movement.
- It is often a temptation for a classical singer to pull the tongue back into the throat in order to get a darker vocal color. Encourage them instead to maintain a high tongue hump, as it sits naturally in their mouth when it is closed. To achieve this, use exercises that use bright [a] such as "almond" (5-1), [a-ja-ja-ja-ja] (54321), or "mama mia" [8675645342312711].

9.13 Megaphone Shapes (for mixed belting)

- Lips take on a different shape in the megaphone acoustic, favoring an upside-down equilateral triangle, or a trapezoid. Exercises using [gæ] – as in what a baby says – work well in a 5-3-1 or 54321 pattern. A descending 5-1 or 8-1 on "yay," "wow," or "waaa" also work well in this shape. Another option is a

1-5-1 or 5-1 pattern on the spoken sentences from the section on developing mix, such as “How dare you?,” Damn Cat,” or “Stop that!” (All with bright, called vowels.)

- A note on lips. Students will want to spread them in too exaggerated of a manner initially, which creates undesired laryngeal tension. Encourage them to use the same lip corners as for classical singing to avoid spreading the megaphone at the wrong place in the lips. What one really wants is more lift, with more top teeth showing, and good engagement of the zygomatic arch (cheek muscles) and upper lip elevators. For both classical and mixed belters, lip push-ups for stronger lip corners, and cheek lifting for a lifted palate (and more animated articulation) are helpful muscle conditioning exercises.
- Jaw freedom is important for both classical singers and mixed belters. For belters, the lowering of the jaw deactivates the laryngeal elevators to provide a counterbalance for the slight engagement of the constrictor muscles while using twang. Opening the jaw is essential as belters move up into higher extremes of mix. [gæ,] [ja,] [nœ], [ne,] [ma,] [de], [bæ] in arpeggiated patterns or octave slides work well. Ie. [ne-ne-ne-ne------] (1358-5-3-1). Voiced consonants followed by bright vowel colors [e], [æ,] and bright [a] – also [œ] - are best to maintain more narrowness at the tongue arch/palate and pharynx. (Refer to Megaphone diagrams L and M.)
- Tongue should sit high and close to the palate without tension. Close your mouth. Your tongue naturally sits in an arched shape. It is likely touching your palate in your mouth. Now open your mouth and leave your tongue as

close to the same position as possible. If the tongue is protracting at the root, pulling downward into the throat, I find [gæ] or [nga] in a 531 or 54321 pattern very useful. Also, [mæ]/[næ] or [me]/[ne] with the tongue sticking out between the lips (careful not to chew it) can loosen the tongue root if it is pulling the tongue downward during speech or singing.

Chapter 10: Vocal Cross-Training

In Part II of this paper, I offered many exercises and applied teaching approaches that allow singing students to explore both belted and classical technical approaches for singing. Many of the exercises can be used to cross train the singer. In the following section, I will examine and the review the cross-training potential of the exercises and applied teaching approaches. Postural and breath efficiency and proficiency for singing are the foundations of technique. In similar fashion to an athlete, singers must work to continually condition their bodies for elite technical faculty in these areas throughout their lifetime. Cross-training the breathing mechanism for both immediacy (faster SQ) and a floated approach (slower SQ) may potentially benefit both the classical singer and the belter. As an athletic parallel, this is like long distance runners doing wind sprints in training, although running short distances is not a needed skill for them. Truthfully, varied breathing approaches may not be needed, and the teacher may find it easier for classical singers to focus on developing long extended breath phrases, while belters learn to engage already existing breath in the lungs quickly and without a long inhalation phase. Both styles of singing will benefit from developing strength in their external intercostals and resisting collapse of the ribs as they lose air pressure in the second portion of a sung phrase. Breath cross-training should be done at the discretion of the teacher.

In the area of registration, singers of both classical and belted styles will develop a deeper understanding of registration and vocal color possibilities related to registration from exploring their head and chest voice extensively. Teachers should begin by isolating the registers, and then by engaging the singer in both top down and bottom-up mixing. Classical singers often find better vocal fold closure by exploring belt and mix,

as well as developing an understanding of subglottic pressure that comes from singing with greater TA intensity. Belters will often benefit from extensive exploration and development of their head register, which will fortify their ability to sing with ease in a high mixed belt. In general, classical singers often benefit from developing a stronger chest and chest mix, and belters often benefit from developing a stronger head and head mix.

Cross-training is very beneficial in the area of resonance. Singers of any style can benefit from an awareness and mastery of their malleable resonant spaces. Primarily, malleable resonant spaces are in the vocal tract (pharynx and mouth spaces), and the singer should feel free to work in as many different calibrations of the vocal tract as they can healthily explore. Through cross-training, singers can establish the boundaries of laryngeal positioning and pharyngeal narrowing and opening for their own instrument. For example, how low can one's larynx sit comfortably while still producing healthy, natural sound? How high? In general, the moderate position provides the best home base for the singer. Although it is good for the singer to establish the sensation of a lower, slightly anchored larynx for classical singing, and a more neutral and mobile larynx for belting and mixing, discovering the extremes of these positions are for training purposes and require discretion in performance practice.

Secondarily, malleable resonant spaces afford the singer the opportunity to regulate acoustic coupling. Different overall shapes of the vocal tract create different acoustical environments, wherein different harmonics are amplified. A singer who cross trains can come to a better understanding of the chiaroscuro of their voice, or as Matthew Edwards calls it, their "woofer" and their "tweeter." In studying classical singing, the

vocalist can learn to create a dark, round, open sound that is acoustically charged in all registers. In studying belted singing, the vocalist can learn to create a bright, brassy sound that is acoustically charged in all registers. These are general statements, as both manners of singing require brilliance and darkness in the voice. However, belters are using a different formula for acoustic coupling, raising the pitches of their formant spaces to create the ideal internal acoustic (one which favors amplification of the second harmonic). Classical singers are conversely lowering the pitches of their formant spaces to create an ideal internal acoustic space for this style of singing. This acoustic space favors amplification of the first harmonic and very high upper harmonics created within the open space of the laryngeal ventricle, known as the singer's formant. In both vocal styles, acoustic coupling principles at least partially determine the sound we anticipate aurally.

Do belters engage the Singer's Formant? Research has not yet determined if they do, but it makes sense that it is possible due to their vocal tract's natural bent toward higher harmonic coupling. It is also possible that they do not, due to the narrowing of th aryepiglottic area that may close and limit the resonance capabilities of the laryngeal ventricle. In both styles of singing, vocal power is needed. Whether to sing over an orchestra, or to sing over electrified instruments (even with a microphone), acoustic coupling creates clarity of vowel and strength of tone for both singing styles. The acoustics of mixing and belting seem more suited to singing with amplification.

Classical and belted singing represent two extremes of the sound spectrum in many regards. Cross-training the singer to engage a legit, classical singing sound, and to belt a twangy or brassy called sound, gives them bookend conceptualization of their

singing instrument, and invites them to explore the range of sounds in between. Cross training also gives singers the most vast and complete knowledge of their total instrument and the sounds it can make and affords them balancing tools if they find themselves overemphasizing an aspect of their vocal technique.

Conclusion

In the university system, voice majors are typically trained to sing classically in their individual voice lessons. Often the vocal pedagogy classes they receive are intentional for singing and teaching classical music as well. For masters and doctoral students, the goal is to provide voice majors with the pedagogical background they will need to become highly skilled performers and voice teachers. Within collegiate private instruction and pedagogy courses, resources and literature provided are typically based on scientific research and information about physiology, anatomy, acoustics, and psychology, sometimes also including traditions from historical *bel canto* best practice.

In the 21st century, there is an ever-increasing demand for pedagogically sound teaching of Contemporary Commercial Music (or CCM). Masters and doctoral voice majors are candidate voice and vocal pedagogy instructors for collegiate students for a growing number of musical theatre, jazz performance, and contemporary voice degrees. Voice teachers trained in the university system may also train future recording artists in rock, pop, country, and R&B styles. Further, there is a call for voice teachers to be prepared to teach high school, middle school, and even elementary-aged voice students with an increasingly eclectic knowledge of styles and sound production. Articles in NATS and voice science journals continue to increase their output on vocal pedagogy for CCM vocal styles, and in recent years, there are growing numbers of workshops and training courses offered, as well as the development of several master's level degree programs for CCM vocal pedagogy. (Shenandoah University and Penn State are the frontrunners in these degree programs.) Knowledge of commercial singing techniques is vital to teachers-in-training and professional voice teachers.

Another lesser explored solution to the demand for hybrid voice teachers is to offer degree and certificate programs to professional CCM singers. Industry singers bring a wealth of knowledge about the business of singing, and this could be very valuable to collegiate voice students. However, many professional singers sing well because of natural ability, and may not know how to teach functional singing where a singer's technique is built systematically and intentionally. They may not know how to address vocal pathology, or remedial work. Moreover, CCM professionals may know everything about the style of music they sing but may not know how to produce other types of sounds functionally and healthily. Academic organizations could benefit from the industry knowledge of these individuals, with an additional responsibility to ensure that they have pedagogical training that allows them to teach young singers confidently, intentionally, and knowledgeably.

There are many current CCM pedagogues and voice science researchers sharing fundamental voice training techniques based on scientific discoveries and best practice knowledge of non-classical singing styles. From Mary Saunders Barton's "Bel Canto Can Belto" program to Matthew Edwards and team's CCM Institute, to *The Vocal Athlete* resource books, there are much research-based, science-forward resources offering sound pedagogy for training CCM singers. Many resources pay respect to both classical and contemporary singing sounds, with a developing body of research into how each sound is produced healthily and efficiently.

Many CCM pedagogues advocate for training a singer in both classical and belted styles, termed "crossover training," as it can be of benefit to a voice student in the same way that cross training can benefit an athlete. Hybrid voice educators are wise to seek a

solid technical foundation, similarly to what has generally become the standard for collegiate classical voice training. Esoteric, experiential methods that do not produce consistent, predictable results, will not provide a solid technical foundation for the collegiate singer of any style of music.

Drawing on what is known about the scientific function of the voice, this DMA project seeks to join the teaching of healthy singing for classical and CCM styles. Those who teach vocal techniques associated with both traditional classical voice training, and contemporary commercial voice training (specifically using belt technique) are defined as hybrid voice teachers in this discourse. In Part I which compares classical singing and belting functionally, one notices many differences between the two technical methods of singing. These differences are not only aurally apparent but are clearly discernible in voice science research. By comparing the two methods of technical training side by side, the functional differences and training implications become clearer.

Part II is written to allow the reader to reference an applied section which mirrors the voice science findings and comparisons in Part I. The exercises and explanations in Part II allow for immediate in-studio application, partnered with functional understanding from Part I. The exercises and explanations in Part II are based on the experiences of leading classical and CCM voice teachers and pedagogues, in combination with methods that come from my own pedagogical training and in-studio teaching experiences as a hybrid voice instructor.

The final chapter of the paper looked briefly at the implications of vocal cross-training. The hybrid teacher possesses the knowledge to produce both a classical singer who can perform in an opera, and a musical theatre performer who uses belted singing in

a Broadway show. The hybrid teacher can train a singer to utilize both classical and belted techniques; two very different sounds, produced by two different technical methods, sung by the same voice. Cross training a singer involves teaching them a functional technique that produces a classical singing sound, and a functional technique that produces a belted sound. Even if the vocal student prefers or intends to perform in only one style of singing, one technical system of singing can be beneficial to the other, thus aiding in the development of a well-rounded singer. Often if a student is stuck in a bad habit or unable to achieve a desired sound for the style they are singing, a switch to a technique used in the other style can be beneficial. To accomplish this level of versatility, the hybrid teacher must understand the functional similarities and differences in teaching both styles, including how to produce many different vocal sounds that are functionally efficient and stylistically correct.

My belief is that the voice teaching world is becoming broader. It is requiring a more versatile teacher to produce a more versatile singer: one who can work professionally in many different types of arenas. In order to produce this type of versatile voice, collegiate pedagogy courses must now include the recent literature on the CCM voice, as well as exercises and song literature that are inclusive of styles other than classical literature. Twenty years ago, it was difficult to find pedagogical resources for the contemporary commercial voice. No textbook existed. In 2022, many pedagogical resources for CCM voice training are available, offering a functionally sound path of training for singers, and methodologies rooted in voice science. For those wishing to become a hybrid teacher, knowledge of both classical and CCM pedagogy is necessary, and voice science leads the way in that regard.

In the hybrid studio, singers may choose to focus on only one singing style, or multiple singing styles. Regardless of the career path of the singer, cross training supports the development of a versatile, self-knowing performer. The application of pedagogical knowledge, as given practically to the singer, affords them the ability to choose the artistry and sensibility that suits the audition, performance, or creative effort in which they are engaged. This is the overarching goal of the hybrid voice teacher: to empower the singing student to know the many ways in which their instrument can be used healthily, and for them to have artistic choices, a canvas for creativity, and the tools to create a uniquely transporting performance.

Bibliography

Allen, S.M. “Female chest voice.” *Journal of Singing 60* (Jan/Feb, 200) 267-9.

Appleman, Ralph Dudley. “Radiological Findings in the Study of Vocal Registers.” In *Vocal Registers in Singing: Proceedings of a Symposium,* ed. John Large, 59-92. The Hague: Mouton, 1973.

Appleman, Ralph Dudley. *The Science of Vocal Pedagogy: Theory and Application.* Bloomington: Indiana University Press, 1967.

Austin, Stephen F. “Treasure “chest”: A physiological and pedagogical review of the low mechanism.” *Journal of Singing 61 n3* (Jan./Feb. 2005) 241.

Balog, Julie E. “A guide to evaluating musical theater singing for the classical teacher.” *Journal of Singing* Vol. 61 n4 (March/April 2005) 401.

Bell, Jeffery Eugene. “American musical theatre songs in the undergraduate vocal studio: A survey of current practice, guidelines for repertoire selection, and pedagogical analyses of selected songs.” D.M.A. diss., Ball State University, 1996.

Benson, Elizabeth Ann. *Training Contemporary Commercial Singers*. UK: Compton Publishing, 2019.

Boardman, S.D. “Vocal training for a career in musical theater” *The NATS Journal 48* (1992) 4-15.

Blades-Zeller, Elizabeth. "Vocal Pedagogy in the United States: Interviews with Exemplary Teachers of Applied Voice." *Journal of Research of Singing and Applied Vocal Pedagogy 17*, no. 2 (Jne 1994): 1-87.

Brown, Oren Lathrop. *Discover Your Voice: How to Develop Healthy Voice Habits*. Saan Diego: Singular Publishing Group, 1996.

Bunch, Meribeth. *Dynamics of the Singing Voice.* New York: Springer-Verlag, 1982.

Bunch, Meribeth. *The Performer's Voice.* New York: W.W. Norton & Company, 2005.

Byre, Andrew. *The Vocal Athlete: Brain-Based Training for Your Voice.* New York: Andrew Byrne Studio, Inc. 2020

Caldwell, Robert, and Joan Wall. *Excellence in Singing: Multilevel Learning and Multilevel Teaching*. Vol. 3, *Advancing the Technique.* Redmond: Caldwell Publishing Co., 2001.

Christiansen, Philip A. "A musical theater program for Indiana University." D.M.A. diss, Florida State University, 2002

Cleveland, Thomas F. "Voice Pedagogy for the Twenty-First Century: Physiological and Acoustical Basis for Vocalizes Relating to Subglottal Pressure." *The NATS Journal 49*, no. 2 (November/December 1991): 25-26.

Coffin, Berton. *Sounds of Singing.* Lanham: Scarecrow Press, 1976.

Coffin, Berton. *Overtones of Bel Canto*. Lanham: Scarecrow Press, 1980.

David Merilee. *The New Voice Pedagogy.* Lanham: Scarecrow Press, 1995.

Davids, Julia and Stephen LaTour. *Vocal Technique: A guide to classical and contemporary styles for conductors, teachers, and singers* (*Second Edition*). Long Grove: Waveland Press, Inc, 2021.

Deer, Joe and Rocco Dal Vera. *Acting in Musical Theatre: A Comprehensive Course*. New York: Routledge, 2008.

Denes, Peter B., and Elliot N. Pinson. *The Speech Chain: The Physics and Biology of Spoken Language*, 2nd ed. New York: W.H. Freeman and Co., 1993.

DeYoung, Richard. *The Singer's Art*. (Chapter 10: "Training the Young Voice"). Chicago: DePaul University 1958.

Doscher, Barbara. *The Functional Unity of the Singing Voice*, 1st Ed. Metuchen, N.J.: Scarecrow Press, 1988.

Edwards, Matthew. *So You Want to Sing Rock n' Roll: A Guide for Professionals.* Lanham: Rowman & Littlefield, 2014.

Edwards, Matthew. *How the Voice Works.* Online Training Course. https://www.how-the-voice-works.com

Edwin, Robert. "Are We the National Association of Teachers of Classical Singing?" *The NATS Journal 41* (May 1985) 40.

_____. "You Can Both Have It Your Way." *The NATS Journal 42* (November 1985)

_____. “The Bach to Rock Connection: Repertoire.” *The NATS Journal 42* (1986): 30-31.

_____. “The Bach to Rock Connection: Covering All Classifications of Vocal Music.” *The NATS Journal 44 n2* (1987): 28.

_____. “To Belt or Not to Belt,... Maybe is the Answer.” *The NATS Journal 44* (January 1988) 36.

_____. “Phantom Pedagogy.” *The NATS Journal 44 (imay 1988) 25.*

_____. *“*Non-classical Pedagogy? Yes! On-Classical Student Auditions? No!” *The NATS Journal 52* (May 1996) 39.

_____. “Belting: Bel Canto or Brutto Canto?” *Journal of Singing 59* (Sept/Oct 2002) 67-8.

_____. “A Broader Broadway.” *The NATS Journal 60* (jan 2004) 285.

Emmons, Shirlee and Alma Thomas. *Power Performance for Singers*. New York: Oxford University Press, 1998.

Frisell, Anthony. *A Singer’s Notebook: A Personal Guide to Acquiring a Superior Singing Technique.* New York: Elysian Fields Books, 1996.

Gurne, Robert T. *In Memoriam: William D. Vennard*. The NATS Bulletin, 1986

Hall, Karen Sue. "Musical Theatre Vocal Pedagogy and Styles: An Introductory Teaching Guide for Experienced Classical Singing Teachers." D.M.A. diss., Columbia University, 2006.

Hall, Karen Sue. *So You Want to Sing Musical Theatre*. Lanham: Rowman & Littlefield, 2014.

Hardesty, Tamara Gavrielle. "Classical Training for Musical Theater Singing: Registration Issues in the Female Voice." D.M.A. diss., University of Connecticut, 2009

Harrison, Scott D. and Jessica O'Bryan. *Teaching Singing in the 21st Century*. Dordrecht: Springer Science+Business Media, 2014.

Hoch, Matthew, edit. *So You Want to Sing CCM: A Guide for Performers*. Lanham: Rowman & Littlefield, 2018.

Hood, Erikk. "From Bernac to Broadway: An Interview with Erikk Hood." Classical Singer Magazine, University Issue (Sept/Oct 2020).

Large, John, Edward Baird, and Timothy Jenkins. "Studies of the Male High Voice Mechanisms." In *Transcripts of the Ninth Symposium: Care of the Professional Voice.* Pt. 1, *Physical Factors, Vocal Function and Control,* ed. Van L. Lawrence and Bernd Weinberg, 109-115. New York: The Voice Foundation, 1981.

Large, John, Shigenoba Iwata, and Hans von Leden. "The Primary Female Register Transition in Singing." *Filia Phoniatrica 24* (1972): 19-29

Lebon, R.L. “The effects of a pedagogical approach incorporating videotaped demonstrations on the development of female vocalist’ “belted” vocal technique.” *Dissertation Abstracts International 47* (March 1987) 3350A.

Leborgne, Wendy D. and Marci Rosenberg. *The Vocal Athlete*. San Diego: Plural Publishing, 2014.

Leborgne, Wendy D. and Marci Rosenberg. *The Vocal Athlete: Application and Technique for the Hybrid Singer*. San Diego: Plural Publishing, 2014.

LoVetri, J. “Female chest voice.” *Journal of Singing 60* (nov/Dec 2003) 161-4.

Lyle, John-Christopher. “Register-Switching as a Pedagogical Device for Register Unification of The Singing Voice: an Historical Analysis.” D.M.A. diss., University of Oregon, 1995.

Malde, Melissa. *What Every Singer Needs to Know About the Body*. San Diego: Plural Publishing, 2009.

Manternach, Brian. “Bel Canto Can Belto: Talking Technique with Mary Sanders Barton – An Interview with Brian Manternach.” Classical Singer (March 2014).

McCoy, Scott. *Your Voice: An Inside View.* Delaware: Inside View Press, 2012.

McDaniel, Addi. “Mary Saunders Reflects on Her Time at Penn State.” Penn State Alumni Newsletter (December 2016)

Melton, Joan. *One Voice: Integrating Singing Technique and Theatre Voice Training*. Greenwood, 2003.

Melton, Joan. *Singing in Musical Theatre: The Training of Singers and Actors*. New York: Allworth Press, 2007.

Melton, Joan. *Dancing with Voice: A Collaborative Journey across Disciplines*. New York: Voice Theatre Solutions, 2015

Miller, Richard. "Sotto voce: pop music, non-Western European vocal styles, and efficient vocal function." *The NATS Journal 51 n4i (1995): 37-8.*

National Association of Schools of Music. 2013. *2013 Directory.* Reston: National Association of Schools of Music. http://nasm.arts-accredit.org/

National Association of Schools of Theater. 2013. *2013 Handbook*. Reston: National Association of Schools of Music. http://nast.arts-accredit.org/

Oncley, Paul B. "Dual Concept of Singing Registers." *Vocal Registers in Singing*, ed. John Large, 35-44. The Hague: Mouton and Co., 1973.

Peckham, Anne. "The Contemporary Singer: Elements of Vocal Technique." 2nd ed, Boston: Berklee Press, 2010.

Roll, Christianne. "The Evolution of the Female Broadway Belt Voice: Implications for Teachers and Singers." *Journal of Voice,* Vol 30, no. 5, 2016

Sanders, Mary. Bel Canto-Can Belto: Teaching Women to Sing Musical Theatre (Belting and the Mixed Middle Voice). Video, copywright Mary Saunders Barton, 2007.

Sanders, Mary. "Bel Canto-Can Belto: Teaching Women to Sing Musical Theatre." Vol. 67, No. 3 (Jan/Feb 2011).

Sanders, Mary. "Broadway Bound: Teaching Young Musical Theatre Singers in College Training Programs." NYSTA VOICEPrints, Journal of the New York Singing Teacher's Association (March-April 2013).

Sanders, Mary and Norman Spivy. "Training the Next Generation of Musical Theatre Voice Teachers: Christy Turnbow, Penn State's First MFA Pedagogy Grad Takes Stock." NATS Journal (November, 2014).

Sanders, Mary. Bel Canto-Can Belto: What about the Boys? (Teaching Men to Sing Musical Theatre). Video, copywright Mary Saunders Barton, 2014.

Sanders, Mary, Beverly Patton, Raymond Sage. *Bel Canto Can Belto* Workshop. Penn State University, 2013.

Sanders, Mary. *Cross-Training in the Voice Studio: A Balancing Act*. San Diego: Plural Publishing, 2018.

Schoenhard, Carol, and Harry Hollien. "A Perceptual Study of Registration in Female Singers." *The NATS Bulletin 39*, no. 1 (September/October 1982): 22-26, 28

Shipp, Thomas, and Kryzysztof Izdebski. "Vocal Frequency and Vertical Larynx Positioning by Singers and Nonsingers." *Journal of the Acousitcal Society of America 58*, no. 5 (November 1975): 1104-1106.

Sonninen, Aato, Pertti Hurme, and Anne-Maria Laukkanen. "The External Frame Function in the Control of Pitch, Register, and Singing Mode: Radiographic Observations of a Female Singer." *Journal of Voice 13*, No. 3 (September 1999): 319-340

Stark, James. *Bel Canto: A History of Vocal Pedagogy*. Toronto: University of Toronto Press, 1999.

Sullivan, Jan. *The Phenomena of the Belt/pop Voice: The Technique for Safely Producing the Vocal Sounds of Today.* Logos Limited, 1985.

Sullivan, Jan. "How to teach the belt/pop voice." *Journal of Research in Singing and Applied Vocal Pedagogy 13 n1* (1989) 41-56.

Ragsdale, F.W. "Perspectives on belting and belting pedagogy: a comparison of teachers of classical voice students, teachers of nonclassical voice students, and music theater singers." D.M.A. diss., University of Miami, 2004.

Tan, Haidee Lynn C. "Register Unification in Light of Twentieth-Century Vocal Pedagogy." Master's Dissertation, University of North Texas, 2003

Titze, Ingo. "A Framework for the Study of Vocal Registers" *Journal of Voice 2,* no. 3 (September 1988): 183-194

Vennard, William. *Singing: the mechanism and the technique.* Carl Fischer ISBN 978-0-8258-0055-9 (1967).

Ware, Clifton. *Basics of Vocal Pedagogy: The Foundations and Process of Singing.* Boston: McGraw-Hill, 1998.

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