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**Part 1**

**Critically evaluate a range of theories and models that you have recently studied, explaining their relevance to your workplace practice and procedures and develop a strategy applying what you have learned to improve your practice.**

**Word Count for Part 1:**  
**2900**

**Impact of First Formant tuning on M1-M2 Register shifts in Classical female voice**

Like many singers, I struggled for years navigating areas where I could feel my voice changing through my range. In particular, I struggled with the range from around E4 to C5, commonly referred to as the middle voice, which is where I could feel one part of my voice abruptly 'break off' and switch to a breathy, different section of the voice. Though I feel I have largely solved the issues I described above, I am striving to understand the process from more angles so that I can better understand what is happening in my students' voices. I want to have the physical and acoustic background to understand the different phenomena that are happening in the throat. Additionally, I have noticed that in the range I mentioned above, many voices favor some vowels over others. I have also noticed voices making huge tone quality shifts just from vowel changes, and have suspected a connection. In writing this paper, I wanted to see if those suspicions had any basis in science and more broadly, try to use that information to help other estrogen-influenced voices sing confidently through the bottom and medium parts of their ranges.

**Literature Review:****Registers**

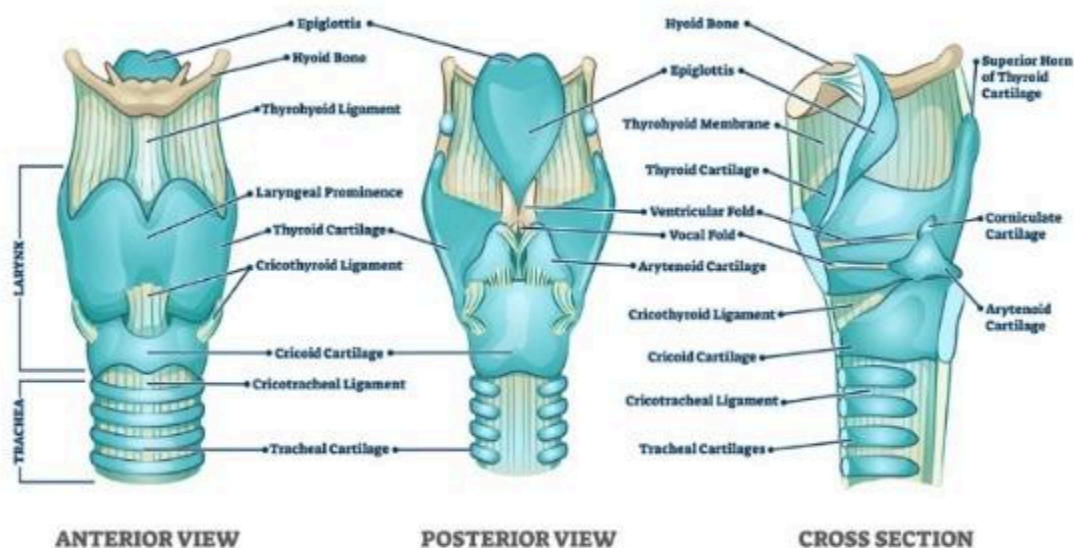
Most singers, whether they be testosterone or estrogen influenced, have experienced a 'break' at some point in their development. They will sing comfortably in the lower, buzzy part of their range, commonly known as the 'chest voice' and it will, at some point or vowel, reach its limit and break into a weaker, breathier sound, just as I experienced. Much voice training is

devoted to perceptually evening or smoothing out this sudden 'register shift.' Exactly what a register is, however, is a subject with a rich and fascinating history. Manuel Garcia, in *Hints on Singing*, defines them as 'a series of consecutive homogeneous sounds produced by one mechanism, [that] differ essentially from another series of sounds equally homogeneous produced by another mechanism' (Garcia 1894 p 8). He doesn't define exactly what he means by a mechanism, and this statement has been the source of much subsequent debate. Over 70 years later, Vennard stated that registers are what is heard "when one's laryngeal function is so crude as always to be static, with breaks between different adjustments." (Vennard 1967 p 58) Cornelius Reid states that registers are the natural state of the human voice and must first be developed before the voice is to be united (Reid 1971 p 78). While the two men seem to disagree on semantics, they both are arguing for the voice to be flexible and capable of change. Finally, in his 2013 book, Kenneth Bozeman makes a compelling argument for the existence of acoustic registration, in which noticeable and predictable changes in the sound can occur independently of adjustments in the vocal folds. Reflected in these differing viewpoints, today there seem to be two major explanations of transitions within the voice: laryngeal, and acoustic, and there is strong evidence that they affect each other (Bozeman 2013 p 43).

## **Anatomy and Physiology of the Voice**

### **The Larynx**

Before we continue, it will be useful to have some anatomical background. As you will see from *Figure 1*, the inferior part of the larynx is the cricoid, a ring-shaped cartilage that sits directly on top of the trachea. Over this sits the thyroid cartilage, which is shaped a bit like a shield and extends around the larynx. The arytenoids articulate to the very back of the cricoid and are positioned such that they can rock and glide (Vennard and van den Berg, 1960). Above the thyroid sits the hyoid bone, which forms the base of the tongue (Dimon 2018).



*Anterior, Posterior, and Cross section view of the larynx Figure 1*

*(Viki 2023)*

As we can see from *Figure 2*, The cricothyroids (CT) are a pair of muscles that connect from the frontal sides of the thyroid to the frontal sides of the cricoid. When they contract, the thyroid rocks forward or, if this is held stationary, the cricoid rocks up, either way lengthening the front to back space inside of it and therefore stretching the vocal folds (Vennard and van den Berg, 1960). The arytenoids are subject to the movements of several muscles, but importantly for us, the lateral cricoarytenoids (LCA) and the interarytenoids (IA). The LCAs pull the back of the arytenoids apart and therefore make the front of the arytenoids close. IA refers to two sets of muscles, the transverse and oblique arytenoids, which hold the vocal folds closed (Dimon 2018, Sendic 2023).

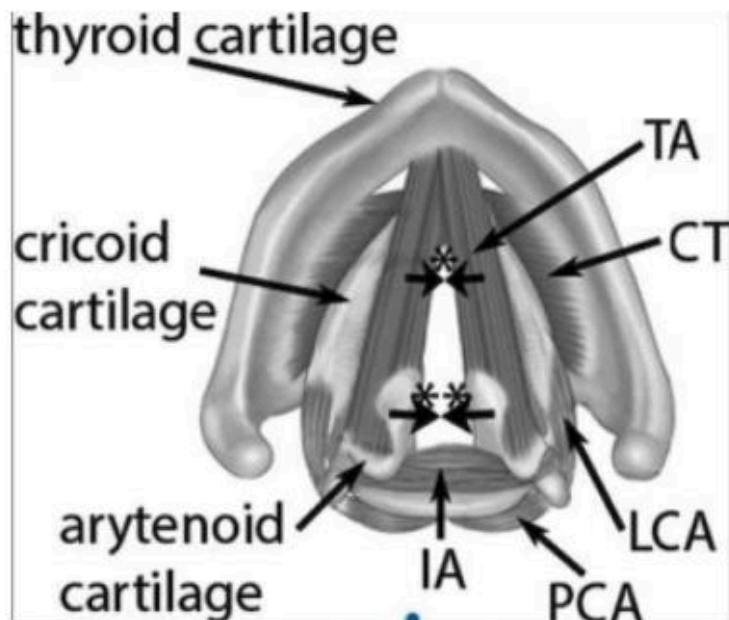


Figure 2 Top down view of the larynx (Schneider-Stickler, Guan-Yuh, Moriggl 2023 p 2878)

Continuing upwards in the larynx, the epilarynx, depicted in *Figure 3*, forms a “tube-shaped space” (Moisik 2013 p 1) whose boundaries go from approximately the top of the vocal folds and the arytenoid cartilages to the epiglottis (Moisik p 21). This space can be narrowed through the actions of both the pharyngeal constrictors (not pictured) and through laryngeal narrowing. This ability to narrow the tube directly above the vocal folds will have important acoustic and physiological consequences.

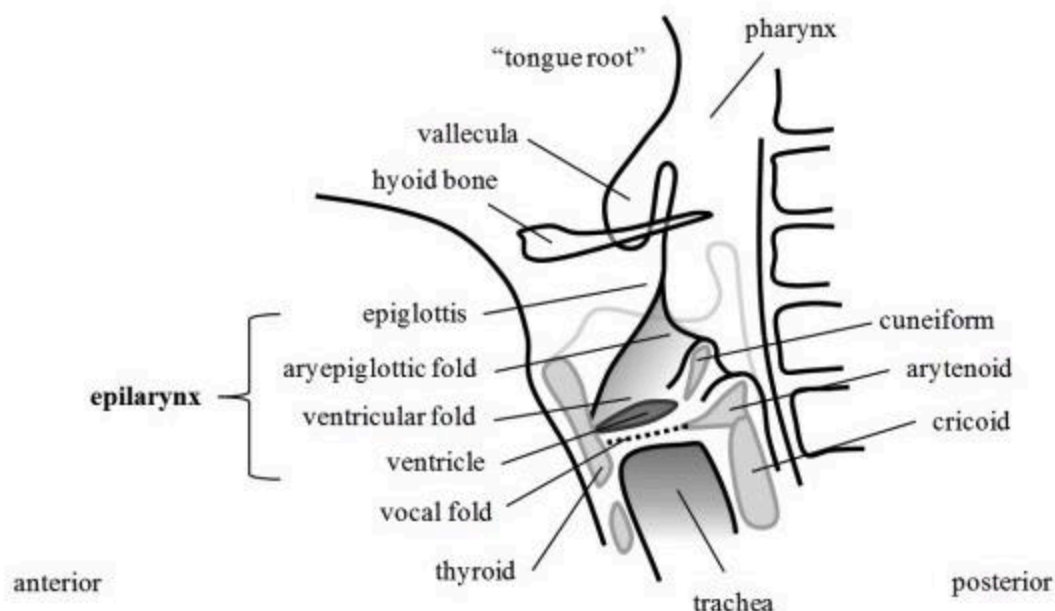


*Figure 3, anatomy of the epilarynx (Moisik 2013 p 1)*

## **Laryngeal Registration**

The bulk of the modern literature on laryngeal registration seems to build on conclusions made by Roubeau, Heinrich and Castellengo (2007): there are four major positions of the vocal folds, dubbed mechanisms M0, M1, M2, and M3. Since our focus is on the estrogen influenced voice from around E4-C5, we will look primarily at M1 and M2, whose ranges are around D3-G#4 and G#3-C5 respectively (p. 428) and whose transition accounts for the ‘break’ described above. Roubeau, Heinrich, and Castellengo conducted EGG experiments on singers performing ascending and descending glissandi, and claim that the difference between M1 and M2 is the presence or absence of a contracted TA muscle. The contracted TA increases the contact area of the vocal folds (pp 425-426). It also results in a very energized set of harmonics, or overtones produced by the vocal folds (Bozeman 2013). M2 is then defined as the absence of the TA contraction, which results in thinner vocal folds and an audibly less energized set of harmonics. During these experiments, Roubeau makes some important observations: that the border between the mechanisms is mobile because the vocal folds will tend to stay in their current position and change only when that position has reached its limit. So, in an ascending scale, the voice will stay in M1 as long as it can and then break into M2. The reverse will

happen descending. This phenomenon, mentioned also by Christian Herbst in his 'Snake Pit' series (Herbst 2020), is called *hysteresis*. It shows that there is an area of around an octave in most voices that can be sung in either M1 or M2.

Christian Herbst, with two different sets of partners (Herbst et al 2011, Herbst and Svec 2014) makes another contribution to our discussion, building on Roubeau but adding a focus on the means by which the glottal space is closed during phonation. One way is through the bulge created by the contracted TA, which he terms 'membranous medialization.' This of course is only applicable when the singer is in M1, and if this is the only mechanism with which a singer can close the glottal space, the 'break' will be very apparent due to the sudden increase in breathiness and sudden drop in harmonics. He also observes that the back of the vocal folds can close in either mechanism through the combined efforts of the interarytenoids and the lateral cricoarytenoids. He terms this 'cartilaginous adduction' because the arytenoid cartilages are brought together. The ability for the vocal folds to be closed in M2 allows them to produce an energized set of high harmonics that is less perceptually distinct from M1 as it would be without the cartilaginous adduction. (Herbst & Svec 2014) Additionally, much of a singer's perceived vocal control is attributed to the degree to which they have control over the transition from membranous medialization to cartilaginous adduction. (Herbst et al 2011, Herbst and Svec 2014)

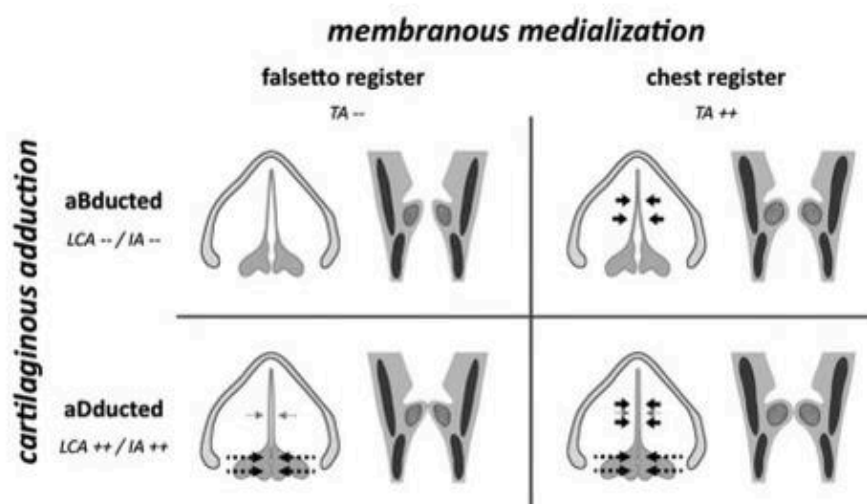
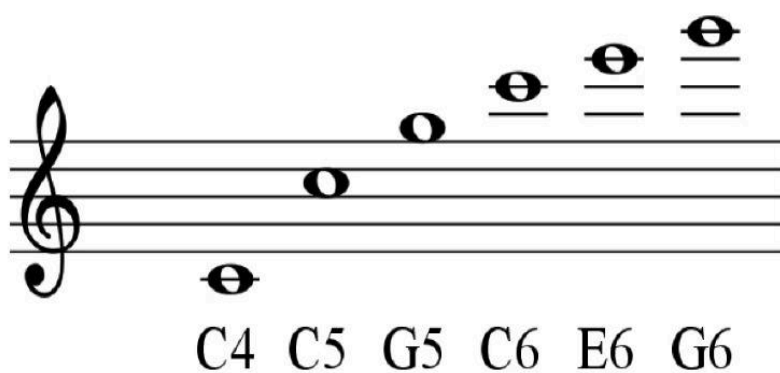


Figure 4 Illustration of the effects of two major adduction types on the glottal space (Herbst et al 2011, p 2260)

## Acoustic Registration:

### Linear Source-filter theory

Linear source filter theory explains how the harmonics from the vocal folds interact with natural resonances, or *formants* from the voice tract, which boosts some harmonics and dampens others, thereby ‘filtering’ the sound emitted from the larynx and shaping it into what comes out of the mouth. (Bozeman 2013) The formants are altered by the shape of the vocal tract- its narrowness, length and where it bulges (Nair 2021). Human ears and brains use the lowest two of these formants to define vowels (Bozeman 2013); we will be focusing on the effects of the first formant because ‘its relationship to the sung tone has a strong influence on our perception of register’ (Bozeman 2024). Bozeman defines close vowels, such as [i] and [u], as vowels with low first formants, and open vowels, such as [a], as vowels with high first formants. (See **Appendix B** for IPA sounds) He uses the term ‘close’ instead of ‘closed’ due to the word’s ability to account for the real acoustic gradations: a vowel can be more or less close depending on how it is sung. This word also allows us to compare vowels with different formants (Bozeman 2013).



**First six notes in the harmonic series for C4.**

*Figure 5, the Harmonic Series (Walker and Don, 2019)*

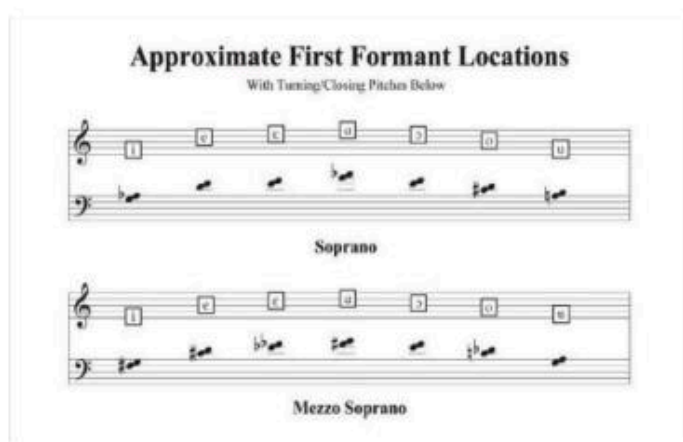


*Figure 6, Approximate First Formant Locations in Soprano and Mezzo Soprano voices (Bozeman 2013, Appendix 2, p 125)*

Once the fundamental has met the first formant frequency of the sung vowel, the first formant must track the pitch in order to receive its boost. We accomplish this by opening the vowel, or raising the first formant, along with the pitch (Heinrich, Smith & Wolfe 2010). As we can see from comparing Figures 5 and 6, the lower middle is relatively straightforward on close

vowels like [i] and [u], whose first formants are generally around the top of the bass clef and therefore the bottom of the vocal range; estrogen influenced voices are able to track these nearly any time we are singing. We tend to have problems with vowels like [a], whose first formant is generally between F#4 and Ab4, depending on the voice type (Bozeman 2013, p 125). If, as much research suggests, the M1-M2 shift tends to happen around D4 (Herbst 2020), this leaves between a major 3rd and a 4th where the voice is in M2 but lacking the acoustic boost it will later receive from formant tracking. This explains the ‘break’ that I described in my introduction: we are left with a range that, on certain vowels, suddenly feels very weak if we sing them in M2.

### **Nonlinear Source Filter Theory: A return to the Larynx**

Until recently, the bulk of the research on nonlinear source filter theory has been on the female voice singing in the higher parts of its range (Rothenberg 1988). While not directly related to the range we are discussing, this research has yielded some interesting conclusions, namely that when the first formant tracks the sung pitch, this not only boosts the perceived sound as described in Linear Source Filter theory, it can also increase the acoustic pressure heading back towards the larynx and balance this with the air pressure below the larynx. This can create a condition called inertance, which is the ‘sluggishness of the air molecules at the level of the vocal folds’ (Bozeman 2013, p 108, Herbst 2020). This condition of balanced pressure makes it easier for them to close and vibrate, which I think many estrogen influenced voices will attest to being able to feel. In his paper on lower vocal tract interactivity with the larynx (Titze 1997), Ingo Titze additionally suggests that the optimal vocal tract configuration for classical singing is a wide pharynx and a narrow epi laryngeal tube. The many benefits of this include a concentration of the formants and a lower minimum lung pressure required to initiate vocal fold oscillation (Titze 1997), and one more way to create a condition for inertance. Titze says the narrowed epilaryngeal tube is the ‘configuration of choice’ in high operatic singing, but suggests that it is both possible and beneficial lower in the range. Catherine Sadolin, writing in a similar vein but a different genre, also advocates for the narrowed epilaryngeal tube. Her graphic is shown in Figure 7 below:

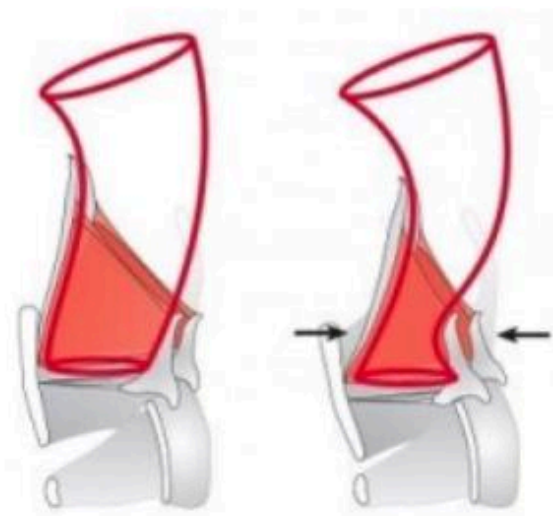


*Figure 7: A side view representation of the narrowing of the epi laryngeal tube (Sadolin)*

### **Pedagogic implications**

Based on my review of the literature, there are a few major takeaways that I feel voice teachers can use to help their students with estrogen-influenced voices sing confidently through the lower middle and break. I have focused on the M1-M2 transition, but in learning about this, I am repeatedly reminded of the ‘functional unity of the voice’ (Herbst 2016). We cannot simply focus on the ‘break’, but rather need to train and develop the whole instrument and range with the understanding that this, properly done, will perceptually bridge the gap. In light of that, I feel I have a more sophisticated understanding of what Reid’s ‘register development’ means, and why it is important for the middle voice.

It is important to develop M1, and, at least for classical singing, to train the voice to use both cartilaginous adduction and membranous medialization in this mechanism. Herbst states that learning to maintain cartilaginous adduction throughout the range makes the unavoidable switch into M2 far less jarring; maintaining closure in the back is far easier than beginning it at the break. Another concept that I take from this is use of the yodel in training ascending motion. Herbst and Svec argue against the use of ascending scales on single vowels early in the training process due to the tendency towards hysteresis (Herbst and Svec 2014). I would then posit that any strategy the teacher has to improve the ability of the students’ larynx to switch from one mechanism to the other is likely a positive one. Titze (2008, 2013, 2022) mentions that travel from an open vowel to a close one in certain ranges can ‘trigger’ a yodel,

or sudden register shift, if the close vowel has passed its first formant. A possible exercise for this would be [a] on C4 jumping up an octave to an [i] or [u] on C5, attempting as much as possible to maintain a lowered larynx and a relaxed mouth and jaw position. Once this is accomplished, the interval of this exercise could shorten to a 5th and be performed from D4-A4 and up by half steps again. The intervals could be further shortened as the student gains comfort with closure in this range, eventually learning to change mechanisms on a single note by changing only the vowel. See **Appendix C** for Exercises.

Additionally, development of the head register takes on a new meaning when one realizes how important cartilaginous adduction is, and also that there may be an acoustic means, via narrowing of the epi laryngeal tube, to make this both easier and more powerful. Herbst recommends descending scales on close vowels to develop the head register and close the vocal folds without overemphasizing M1 (Herbst 2020, Herbst and Svec 2014); from my interpretations of Titze, it seems that the epi laryngeal tube automatically narrows in the higher parts of the range; another benefit then of descending scales on close vowels would be to train the voice to maintain a narrowed epi laryngeal tube lower in the range. While for years I assumed that exercises like this were simply to teach the vocal folds to remain closed in the middle voice as they were in the higher voice, I now think the situation is more complex. If the epi laryngeal tube remains narrowed, conditions for inertance might remain even below the point of contact with the first formant, thus making it easier to keep the vocal folds closed lower in the voice. The work becomes not simply maintaining muscular effort of the LCA's and IA's. It is rather a condition created with acoustics that makes it easier for those muscles to do their jobs.

A final recommendation would be to allow the voice to stay in M1 on open vowels until they reach their first formant locations, which is in alignment with recommendations from Kenneth Bozeman (Bozeman 2013). This is another big reason to develop M1 in female singers: they will be able to comfortably sing in the lower middle parts of their voices on open vowels below the area where they will receive the formant boost. I am aware that, done poorly, this could reinforce hysteresis; however it is my hope that, if the voice has been prepared with plenty of M2 practice and yodeling, that this would reduce the tendency to 'hold on' to the mechanism past its point of beauty and usefulness.

## **Conclusion and areas of further study**

During my work on this paper, I was repeatedly reminded of the interconnectivity of the voice, and struck at how Titze and Herbst's work in particular has broken down the boundaries between the various vocal systems. I focused on the interaction between supraglottal tract

acoustics and the vocal folds, but looked at several papers on the subglottal system, the breath, and the articulators as well. All of these systems have effects on the acoustics and the acoustics feed back and affect them. All this being said, however, I have many areas for further study. I would like to investigate the mechanisms by which the singer can affect the epiglottal tube. Since the tongue is one of the major ways by which we change vowels and therefore formants, it is fair to assume that it will impact nonlinear phenomena, and I would be curious to learn to what extent.

## **Assignment 2:**

### **A Reflective Review Comprising of Two Parts:**

- a) **Reflect on your recent learning experience, and the value of learning you acquired. Assess your current competencies and identify future development needs in the context of the work situation.**
- b) **Devise a detailed personal development plan which incorporates development objectives, activities to be undertaken, methods, resources, review periods, and timescales.**

**Word Count: 1969**

In choosing a reflective model, I found myself considering a question that I have been asking my students for a couple of years: "What went well, and what can we improve?" I find that the way they answer this question tells me a lot about where they are psychologically, and also about their understanding of the concepts we have been working with. Adults, for example, unconsciously skip the first part of this question and go straight to a critique. Usually, an answer that fails to answer both parts of the question is inaccurate. I started asking this question because I realized I wanted to be asked it when I was in lessons. My teacher would jump right to a critique of something, and I started to stop him and ask if I had done another thing correctly. While my asking this of him had many positive consequences for my confidence, my initial impetus was accuracy.

As an adult learner and as someone who teaches primarily adult learners, I felt that it would be most useful for me to situate my learning and teaching in the context of best practices for this demographic. Adults tend to come to learning environments with a lot of history and emotional context, (Dirkx 2001 p 68) and I would argue that this is particularly true for adult singers, who often carry a lot of shame from previous learning environments, and also generally

from living in a world that presents ‘cracking’ or ‘singing pitchy’ as the absolute worst sins that can be committed by a performer.

With these things in mind, I considered several reflective models to evaluate my work. I found Schön’s critique of Technical Rationality, and his subsequent elevation of reflection to be validating in its intent, but he presents a ‘dichotomy between knowledge and experience’ (Harris 1989 p 16) that I found very flawed. Nevertheless, the ‘neglected aspects of practice’ he focuses on are indeed ones that are crucial for helping adult learners make sense of and learn from their experiences. Rather than, for example, ‘preserving a sense of expertise at his clients expense’ (Schön p 45) when confronted with a situation that does not fit neatly into his training, Schön’s reflective practitioner “allows himself to experience surprise, puzzlement, or confusion in a situation which he finds uncertain or unique (p 68),” and in doing so, is able to his perspective and ‘give reason’ to a wider variety of clients (p 68).

I found Gibbs’ 1988 book, *Learning by Doing*, to be a very practical handbook for understanding experiential learning theory and developing a realistic process for integrating it into practice. In *Learning by Doing*, Gibbs primarily refers to Kolb’s learning cycle (p 15). Gibbs uses Kolb’s cycle to present realistic ways of incorporating knowledge into experiential practice. The first is through Step 3, Abstract Conceptualization, in Kolb’s learning cycle (p 15). In this step, after having reflected on the Concrete Experience, the practitioner is invited to research outside information to inform her Active Experimentation in Step 4. Further, I appreciated Gibbs’ emphasis on the need for adult learners to use practice to develop and test theories (p 19) which addresses the dichotomy issue I had with Schön. Gibbs also offers some ideas for transitioning over to more student-centered adult learning that have interesting and complicated implications for voice pedagogues. I was particularly drawn to one of his examples where students performed better after being involved in their assessment criteria (p 68).

I found the most resonance in the model presented in Tony Ghaye’s book, *Teaching and Learning Through Reflective Practice* (2011). I was drawn to his insistence on appreciating what is going well (pp 16, 19, 33), which echoes ideas that I aspire to offer in my studio. Additionally, it builds on the best of what Schön was trying to say with his ‘reflection-in-action’ examples- that the artful practitioner will notice what he is doing that is successful, and keep doing it (Schön p 55). Like Gibbs and Kolb, Ghaye’s reflective cycle allows for the incorporation of outside knowledge in step 3. This open-endedness seems deliberate and an attempt to make his cycle

malleable (p 29). On balance, however, I feel that the idea of building from an appreciation of what is already going well is in line with adult learners' learning to view the situation accurately. Finally, adults need to 'make sense of learning and experiences'; this is one more concept that I found both in my reading for best practices for adult learners, and in Ghaye's book (pp 28-35).

### **Taking myself through Ghaye's Reflective Cycle**

#### **Question 1: What's successful right now?**

Framing my own research question (Schön p 40), I pushed myself to learn and write about subjects that I was not previously familiar with. I feel I ended up understanding them better this way than I would have in a traditional class setting because I had to make sense of the information in order to feel I could write about it. Part of this was asking questions of experts. I found my conversation with Gokce Kutsal very helpful because I was able to ask questions and test theories (Gibbs p 19) that I had amassed based on my reading. I also did this casually: a friend's husband is a physicist, and I spent an evening texting him about Titze's papers, explaining what I understood and where the holes in my comprehension were.

From writing the paper, I gained validation for some suspicions I had about what was going on at registrational events and I now have several strategies based on my research. Leading with descending scales and yodeling has already proven quite effective in my studio for working with both classical and pop singers.

In terms of learning environment management, I think that I am starting with a good foundation for working with my many adult students and trying to balance out their negativity bias by insisting on having them think first about what they have done well, rather than by leaping to criticism.

#### **Question 2: What do we need to change to make a better future?**

I was very disorganized with my citations for the first half of the paper. I have been more organized with the second half: I used a website, MyBib, to organize my citations and notes. Because of this, I didn't have to write all the references manually, and I felt that having all my notes in one place, with the bibliography, was much more efficient than my spreadsheet and

haphazard notes from the first paper were.

A big part of writing that I would like to improve is my time management. I know that I work best when I do something each day. This gives me time to think about ideas throughout the day, and is something I can capitalize on more proactively. I want to create more opportunities to discuss ideas and assumptions with others, particularly with experts. I feel that I learn well in conversation and this is something I want to be more upfront about going forward.

Another area for improvement: my relationship with tables and graphs! I have not needed to use them much since I was in high school, and I am more innately comfortable with words and descriptions. I found myself avoiding even looking at them when they showed up in papers by Herbst and Titze. Additionally, including them could be a great way to include more information.

With teaching, I want to develop methods with which my students can evaluate themselves. Some of this is part of a gradual transition to student-centered learning as discussed in Gibbs (p 114), but I want to find ways for them to answer the 'what did I do well/what can I improve' question when they are practicing that are more objective. Even if this is done in small ways at first, I am curious to see how it will improve their practice and coordination.

### **Question 3: How do we do this?**

To address the time management issues, I can insist on taking some time every day to do research and writing. I'd additionally like to explore more programs that will help me manage my citations and notes. MyBib is lovely but I want to be able to compare notes side by side, and use something that is compatible with tablets or phones. Finally, while I am glad that I reached out to experts when I did, I should do this more in the future.

For my teaching practice, I want to learn more about kinesthetic feedback and biofeedback in singing and integrate them into my teaching practice. Part of this will be to learn more about computer programs like VoceVista to see if the visual feedback this provides can help students hear and feel more accurately. I'd also like to research ways to use recordings and other feedback to help students understand their strengths and weaknesses.

### **Question 4: Who takes action and with what consequences?**

I take action. I am hoping for the following consequences: I gain greater comfort with

research-based literature that will deepen my understanding both of the voice and of appropriate teaching strategies to help me implement what I have learned. As I acclimate to research and writing, I improve my ability to manage my time and pace myself and my energy accordingly. As a result of my increased knowledge of both vocal realities and implementation strategies, my students improve more quickly in lessons and understand how they have improved. A big part of this is helping them to understand evaluation criteria, and possibly also participate in its creation and vocabulary. I hope that this will improve their confidence in their own practicing.

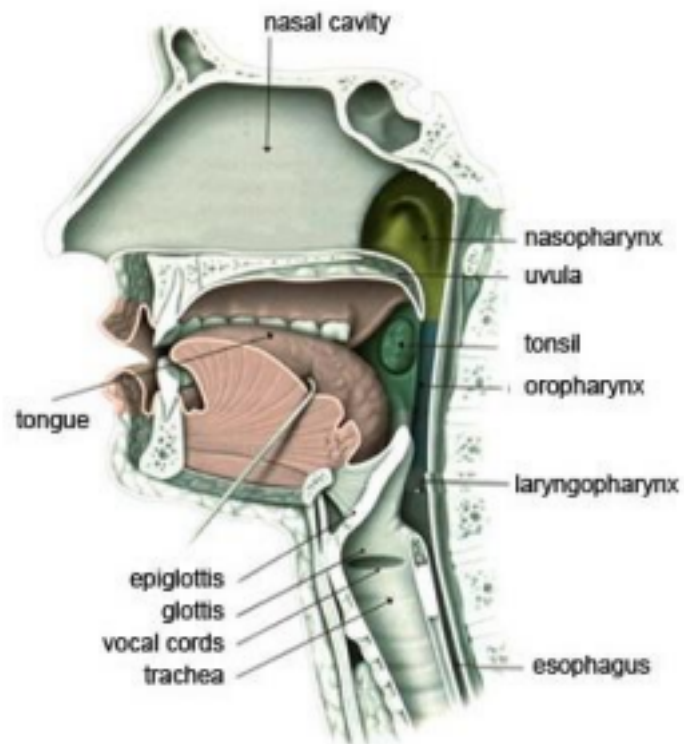
### Personal Development Plan

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|-----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Why am I doing this Course?       | I have spent a lot of time trying to learn independently, but this learning has been very disorganized because I have had neither structure nor deadlines. I also have not had to synthesize what I was learning in my writing. I am doing this in large part to remedy the above issues. I also want to have access to the resources of a school and expert community whom I can ask the many questions that come up.                                                                                     |
| What is the direct benefit to me? | I have found repeatedly throughout my journey as both a singer and a teacher that I am more effective when I can back up my intuition with actual evidence. Just from writing this paper, I have deepened my understanding of vocal subjects that have been thorns in my side for years; applying the principles I learned from this to lessons has helped my students improve. Additionally, the process of writing and structuring a paper is making me think more deeply about how I relay information. |

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| <p>Goal: Increase knowledge of Voice Science</p> | <p>Review Kerrie Obert Intro to Voice Pedagogy Course through Voice Study Centre Due<br/><b>Deadline: July 5, 2024</b></p> <p><i>Watch:</i><br/>Acoustics in the Voice Studio with Gökce Kutsal<br/><b>Deadline: May 1, 2024</b></p> <p>Basics of Voice Acoustics for Voice Pedagogues with Jan Svec<br/><b>Deadline: June 1, 2024</b></p> <p>Linear &amp; Non-Linear Mechanism of Human Sound Production with Dr Brad Story &amp; Dr. Ingo Titze<br/><b>Deadline: August 1, 2024</b></p> |
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| <p>Goal: Find ways to help learners evaluate themselves so that they can be more independent learners.</p> | <p><i>Watch:</i><br/>Biofeedback in Vocal Pedagogy with Heidi Moss Erikson<br/><b>Deadline: May 1, 2024</b></p> <p>A Systematic Approach to Kinesthetic Singing Tools with Dr. Kari Ragan<br/><b>Deadline: June 1, 2024</b></p> <p>Voce Vista: Schedule 3 tutorials through Voice Study Centre faculty to gain in person guidance on how to understand and use this in lessons<br/><b>Deadline: September 9, 2024</b></p> <p>Read Kenneth Bozeman Kinesthetic Vocal Pedagogy<br/><b>Deadline: July 5, 2024</b></p> <p>Once these are completed, design an outline with specific strategies for how to use the information gained in my studio.<br/><b>Deadline: November 1, 2024</b></p> |
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## Appendix



### Appendix A: Vocal Tract

From Tool Module: The Human Vocal Apparatus

### Appendix B: Vowel Sounds

IPA Symbols and their Associated Sounds

IPA Symbol Example English word with the vowel sound

[i] Fleet

[e] Fame

[ɛ] Feather

[a] Father

[ɔ] Faun

[o] Fore

[u] Food

\*For simplicity, I am choosing to discuss only the Primary Cardinal Vowels. The list above is my own but I checked it with Kenyon and Knott, 1953

17

### Appendix C: My recommended exercises

① [a - i - a, a - i - a, a - i - a etc a - i - a]  
or u u u u

② [a - i - a, a - i - a, etc a - i - a]

③ [a - i - u - a, u - a - i - u, Same]

## References:

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