Vox Evocative: Pinpointing a possible sociological strategy for the typing of the phonatory and articulatory features of a singing genre

Introduction

The human singing voice. Discrepancies in the quantification and description of the work of our vocal cords offer a seemingly eternal source of academic discord. Despite the ubiquity of familiarity with singing voices, scientists and listeners alike seem to still perpetuate these massive discrepancies over the shared experience of listening to singing voices. One might expect a phenomenon almost as accessible as observing the blueness of the sky to have a consensual academic explanation. However, despite the amount of attention paid to the phenomenon of human singing by scientists and listeners around the world, much discordance and attention remains over how to describe and quantify this experience.

Maybe this aforementioned academic conflict over quantitative and qualitative evaluations of the singing voice owes to the sheer acoustic diversity of human singing voices. If singing voices and styles were more homogenous objective entities, maybe the work of voice scientists and critical listeners would be simpler.

Works of science fiction, even popular cartoons like Dexter's Laboratory and Family Guy, beg the comparison of voice scans to fingerprints. Just like the right voice evokes a response in these fictitious scanning machines, certain vocal qualities tend to evoke certain evaluations by humans. The ubiquity of references such as the ones from the described cartoons makes a case for the existence of a common latent acceptance of the unique and evocative qualities of the human voice.

Most of the musically inclined among us even tend to have their ideas of what singing voice is "good" or "bad" or even which voice belongs with which genre. What determines which voice belongs to which genre? The notion of genre authenticity of a given voice, despite studies by Scott McCoy showing expert accord in series of sung voice sample evaluations (McCoy 2004), appears to be a difficult notion to navigate. This will be shown in the historic discrepancies between various schools of vocal thought, and even by the sheer amount of time vocal thought has taken to become objective. Evaluation of genre authenticity never even arrived at the forefront of Western vocal science until recently, as the only genre in the limelight preceding this breakthrough was classical. As this new vocal science evolves to teach singers how to sing emerging genres authentically, what methods exist for the appreciation of something as abstract as vocal authenticity?

The following thesis attempts to identify such a mode. The term mode here references several shades of meaning. Firstly, it occurs as a synonym to method, an accepted definition. Mode here also indicates a statistical mode of authenticity ranking. The choice of the word mode, in its statistical sense, implies a latent frequency of a pattern of thought within the lay and expert listening populations. While statistical methodology is only hypothetical at best in the case of this thesis, this thesis hopes to point out a potential construct of authenticity determination that reflects the thought process of a large amount of music listeners, or, more specifically, a mode.
There hardly seems to exist a point in targeting a hypothetical process of authenticity determination that has little to no bearing on what the majority of listeners experience. Or at the very least, one can find a point in discovering what a notable mode of listeners experience.

Starting off with sorting through the evolution of vocal thought and considering the influence of prior vocal thought on singing behaviors in today's artists, this thesis will expand upon the work of modern vocal pedagogy and science to make claims about the latent process of determining vocal authenticity. Hypothetical model methodology and potential outcomes will be discussed in an effort to give application to these claims about this process. However, what model of vocal authenticity appraisal might best reflect reality?

**Fallacies from Flamenco: A Quick Rhetorical Cold Open into Approaching Vocal Thought**

First, how about an exercise in looking at voices, specifically embarking on a journey through a vocal genre? Picking a less globalized genre might highlight the universality of what one might find in this exercise. Even if the ins and outs of this genre aren’t all universally familiar, hopefully the line of thinking practiced here pans out when examined in the rest of the thesis. In fact a lack of familiarity with the following genre features may symbolize the universality of the analysis given.

Picture an imaginary flamenco singer. No need to be super original and imagine something outlandish, a typical example more than suffices. They can have the raspy, broken afillo of Diego El Cigala, an Iberian Romani, or Concha Buika, a Guinean emigrant’s daughter. Or they could possess the sweeter, loftier approach of Madrid singer Clara Montes or even the nostalgic, withering cabaret delivery of the emotive Afro-Cuban Bola de Nieve. As long as they have the heart wrenching, melismatic duende of cante flamenco this imagined typical singer should hold up for this exercise.

Surely they must come from a typical flamenco background, but then again, while flamenco and related genres boast that conflicted Iberian Romani brand, none of these singers seems to come from just the same national origin, ethnic origin, gender identity, or even sexual identity. Maybe it serves better to skip the part of the exercise for assigning nationality to this imaginary singer.

Maybe there’s a dialectal common thread. Except that each of these singers seems to present different dialectal features from standard prestige Spaniard Spanish to Romani influenced Spanish to Cuban Spanish, which isn’t even canon for flamenco. It would seem dialect is out. Just like soul music finding its way into the British English of acts like Adele and Amy Winehouse, or the Dutch accented English of fusion group Quadron, or even the Portuguese of masterful Brazilian soul singer Ed Motta. In addition to the fact that these singers all come from different dialectal backgrounds, they range greatly in ethnic and physical appearance.

Since most flamenco singers, through their references to 'gitanos' or 'tanos', would posit that their singing evokes a particular branch of Romani tradition, maybe authenticity to cante flamenco somehow genetically derives from Romani heritage. Then again, not one of the singers listed above comes from the same background as another, and there is only one Gypsy listed in the bunch. Maybe in summatting the discourse thus far, an adequate conclusion may be reached on a feasible mode of pinpointing what qualifies this imaginary flamenco singer to sing flamenco. It seems there exists something beyond dialect and looks that makes the singer authentic to the genre they claim and thrive from. Some might assert this exercise in attempting to correlate
singing ability with race, nationality and physical appearance was never necessary, positing that nobody thinks that way. Given that vocal practitioners use physical appearance vocal facher, Schwarzerbass is a fach based on racial heritage, and the writings of one Julian Lee, all to be discussed later, I would argue this refutation is actually vital.

Fine, strip that imaginary singer of looks. Maybe make them into an iguana. What about dialect? No words then, just humming. Anyone familiar with the genre should know there is somehow something there that still instills that genre defining feeling of duende. Proper posture? This is a magical iguana with human vocal cords. It can surely exhibit the same kind of genre authentic performance in its natural four-legged state as Fergie can give covering a Heart classic while doing cartwheels. Crisp diction? As long as this imaginary flamenco singing iguana doesn’t have a case of the sniffles, they should be able to access the nasal cavity enough to articulate the syllabic [m] necessary to perform the mimetically named task known as ‘humming’. The duende of canon flamenco can still remain in such a diction-free mode of singing as humming, but where?

Maybe it’s in that ‘raspy’, ‘broken’ afillo. Perhaps the ‘sweet’, ‘lofty’ angel approach. Perchance the way those melismas, or vocal runs, contain all their pitches articulated sleekly on the same sustained vowel. But what do all these features have in common?

It would seem the answer to that question would be as simple as assessing what component of the human body is always active while singing. The vocal cords. There may be more to it, though. A floating pair of excised vocal cords vibrating in space a singer does not make. The tract in which the vocal cords are contained appears to be as amply important to the nature of the voice and which genre, in this case flamenco, listeners can sort the voice into.

The vocal cords discussed earlier must certainly come into play, as their vibratory, or phonatory, settings always relate in some way to the production of a human speaking or singing voice. Without the settings, or articulations, of the vocal tract containing these cords we just have the sound of two flaps of flesh flailing in the wind. The vocal tract includes everything from the larynx and pharynx to the 'false' ventricular folds that keep you from choking, the aryepiglottic sphincter above the ventricular folds, to the biggest resonant chamber of the vocal tracts: the human mouth. So after suggesting that the core features of the voice do indeed derive from phonation of the vocal cord and the articulations of the tract, which phonatory and articulatory settings make a flamenco singer? While one need solely look at the lyrics of flamenco to observe its blatant Gypsy roots, once again it is apparent that Romani blood does not serve as a prerequisite for authenticity in cante flamenco. Singers all over the Hispanic diaspora, and certainly some outside of it, can claim the traditions of the gravelly, jaded rasp of the afillo and the lucid warbling of the softly caressing angelillo to claim their authentic cante flamenco duende. The ability to employ these phonatory and articulatory features clearly transcends regional accent, class, race and whatever identity that does not hold specific dominion over the vocal mechanism. And there we may have tracked the common thread of genre-authentic singing, for flamenco as well as other genres. Putting all this speculation together, a pathway to pinpointing what makes a singer fit to their genre may open up.

**Statement of Thesis and Deliberation Strategy**

This paper seeks to suggest and elucidate a hypothetical basis for perceiving and/or determining authenticity to a sung genre. If the basis asserted here proves to be realistic, it may explain such phenomena as the auditory perception of phenotypically white UK born singers
such as Tom Jones, Jamiroquai, Amy Winehouse and Adele as black. It may explain why one
may consider a voice such as Britney Spears' as sexy or why people feel Susan Boyle's voice is
deaftively pretty. It may disambiguate the use of the term 'soulful' to describe a singing voice.
Finally, it may assist vocal pedagogues in keeping up with ever-changing vocal genre stylings.

This hypothetical basis consists of several levels of thought and processing. First, singers
utilize certain phonatory and articulatory features in their singing. Projected listeners then assign
values with sociological undertones to the acoustic perceptions of these features. The
sociological undertones in turn evoke demographics across race, class, age and other spectrums.
If these evoked demographics map to those commonly associated with the genre that the singer
attempts to emulate, an audience should likely perceive a higher degree of authenticity. Further
elaborated, this basis, or construct, consists of the following elements explained by vocal
theorists Lave and Trudgill in singer and academician John Potter's *Vocal Authority*:

"Changes in potential meanings, or the reinforcement of existing ones, occur in specific
performance parameters which identify a singer's position in the socio-musical field. These sites
of potential meaning fall into a number of broad categories: technical (i.e. aspects of voice
production), linguistic, kinetic (non-verbal body language, dress or gestures), technological and
sexual. By examining how these markers of meaning operate, it is possible to accept for certain
areas of meaning creation...

The musculature of the human voice is so complex that the chances of any two voices
sounding the same are extremely small. Yet the cues given by an individual voice are sufficient
to enable many judgments to be made by listeners both in terms of the individual and the set or
sets of voices to which he or she may belong. Individual voices may be differentiated by tone
colour (or voice quality) and groups of similar sets of voices (opera singers or pop stars, for
example) may also be differentiated as groups by perceived difference in voice quality...

The sound will also contain additional information, which will be used or filtered by the
listener. There is an important distinction to be made between anatomical factors, such as the
length of the vocal tract, size of tongue, the shape of laryngeal structures, and the use to which
these are put. While both contribute to individual differences in auditory colouring, the former
are not controllable, whereas the latter 'phonetic settings' are the product long term habitual use
and muscular constraint, and can be learned. Anatomical features can be a reliable indicator of
certain qualities in the speaker such as age, sex and height, all of which have some bearing on the
size, shape and efficiency of the vocal apparatus." (Lave and Trudgill 1979 In: Potter 1998)

Before looking at this hypothetical sociolinguistic method of assigning vocal genre
authenticity, it may serve better to assess historical precedent around the notion of establishing
vocal genre and similar notions. After all, the science of voice is still evolving. In the evolution
of vocal science one can see the evolution of the vocal pedagogies that have influenced singers
of each generation. In addition, following the history of the evolution of vocal thought
demonstrates a potential precedent for a feedback system between singing strategies and
presiding dicta of pedagogues and theorists.

In this feedback, one may observe examples of assignment of the aforementioned
sociological values to elements of vocal performance. This often results in the selection of these
elements. For instance, if a physiological phonatory feature is coded as "lower class", it may be
discouraged by a pedagogy associated with the upper class. The features, values and evaluations
cited in the following section represent crucial elements of the construct of vocal authenticity determination laid forth by this thesis.

Rephrased yet again, the following couple sections provide not only insight into the evolution of vocal pedagogy, but more importantly demonstrate historical precedent for the sociological constructs and processes behind vocal genre authenticity to be explored further later.

**Classical Era Pedagogy and Vocal Thought: Opera to Bel Canto**

When following the history of studying singing, oft intertwined with the history of singing itself, it makes sense to look further back to some of the first big movements in vocal study. While it certainly did not emerge first, nor does it embody the only directed vocal art form, Eurocentric Classical singing has held, and in some circles continues to hold, a hegemonic high seat reigning down over modern and non-Eurocentric genres. This may have manifested from European military and economic clout in the golden era of opera. This clout may translate to the profoundly permeating power of European culture to have controlled something as intrinsic as phonatory and articulatory features of conquered vocal art forms (Potter 1998). The rigidity of Eurocentric Classical pedagogy may have reflected the clout and socio-cultural bleaching power of this singing movement. This bleaching, in turn, reflects a historical example of assignment of social values to vocal features, specifically Eurocentric prestige.

From the engorging of singers to get that desired “dramatic” tone to the even more dramatic castration of both prepubertal and post-pubertal singers, the less informed vocal practices of the classical area reflected the lesser development of anatomical and acoustic sciences at the time. Basic biology would later show that girth is not necessary to dampen the vocal folds and post-pubertal castration is useless. Also, the broad sopranist vocal range of non-castrated Aussie pop singer Eric Lopez more than heavily implies there are methods of achieving vocal range in males beyond castration.

However, a certain degree of scientific rigor abounded in the efforts towards vocal uniformity. This manifests in the strictness of pedagogy applied at the time, as well as narrower ideas of positive vocal production. It takes scientific rigor to aim for such exactness. Just as in the parallel study of standard language in linguistics, historians and sociologists note this movement of vocal standardization as tantamount to the preservation of a prestige culture within, and at times outside of, the upper class (Potter 1998). Also, just as with standard language, the definition of prestige European classical vocal form bears ample constriction of linguistic behavior at the level of spoken phonemes. The goal of this micromanaging of singers' vocal behavior seemed be oriented towards the achievement of an ideal timbre.

Timbre, as defined by acoustic musicologists (Sundberg 1994), denotes all the factors that contribute to perceptual differences of notes at the same pitch and amplitude. An A5 sounds distinct on a piano versus on a violin. The same goes for human voices. If voice teachers seek to teach 'beautiful' singing, and beauty is arguably a form of timbre, it probably follows that in most singing pedagogies, there exists some preference for timbral qualities. It also may follow that there may be a translation of the strictness of vowel feature regulation to the strictness of timbral regulation. Upon surveying the cannon of classical dicta mentioned in *Solutions for Singers*, this strictness prevails in classical pedagogy. It prevails in commanding features such as the slackness of jaw. It instructs the amount of breath a singer allows through their notes. It confines the degree of dilation of different sphincters located along the vocal tract. Finally, classical pedagogy tends to favor a lowered position of the larynx (Potter 1998, Miller 2004). In
psychoacoustic studies, these features all produce an effect along continuums of timbre perception (McCoy 2004). In summary, classical pedagogy demonstrates that timbre can be an area of focus and control for vocal pedagogies.

Instructors tended to even the minutiae of consonant production. Firstly, they subjugated freeness of pronunciation seen in standard dialect to perceived notions of linguistic musicality (Aikin 1951). Even in rhotic dialects and languages such as some Southern varieties of American English where speakers pronounce the sound coded by the orthographic ‘r’ by ‘r-coloring’ (lifting the tip or blade of the tongue, or bunching the back of the tongue) an ‘r’ adjacent vowel such as in *car* or *rain*, teachers encouraged the usage of trills and taps (Spanish ‘r’ equivalents like in *rosa* or *arroz* (trill) or *oro* or *ir* (tap)) to avoid this ‘r-coloring’. Proper IPA formalism is not used here, as this refers to articulatory behavior that seems more dictated by orthography than phonology. Natural standard dialects of North American English seem not to perform this substitution of rhotic ‘r’ with trill and tap ‘r’ under normal phonological circumstances. However, what seems to relate the implementation of these three different sounds, tap, trill and rhotic ‘r’, is their orthographic equivalence in languages with high amounts of operatic repertoire such as Spanish and Italian. Theorists give numerous implicit and explicit explanations for this, most relating more to the sub-optimality of rhotic vowels as opposed to the optimality of trills and taps that don’t affect vowels as much (Aikin 1951). The two most salient explanations from literature dictate that, firstly, rhotic lay singers distort vowels from an ‘ideal vowel’ (sources seem to vary on the nature of this vowel) (Miller 2004) due to the backwards repositioning of the tip of the tongue. Secondly, cited zeitgeist associated rhotic vowels with ‘harsh’ dialects (Potter 1998). The notion, of an ideal singing vowel, itself deserves some unpacking.

The consideration of what comprises a vowel may actually further elucidate the consideration of the Eurocentric classical ‘ideal vowel’. Vowel differentiation basically stems from the elevation and longitudinal extension of the tongue during phonation. For those who may read this from a non-linguistic background, high/closed vowels such as /i/ and /u/ mandate an elevated tongue, while front vowels such as /a/ and /e/ require the forward stretching of the tongue towards the teeth. Low/open vowels like /a/ and /o/ form with lower tongue position, while back vowels such as /u/ and /o/ form upon the retraction of the tongue towards the throat. These high/closed versus low/open and front versus back features occur on a continuum, onto which the vast majority of spoken vowels may fall.

The aims of the classical school in formulating an ‘ideal vowel’ seem to mainly center on projection, clarity, and beauty. The latter feature receives relatively deficient definition in available sources. The notion of clarity by producing some singing-specific vowel also seems oxymoronic when these vowels may not reflect those found in the spoken counterpart of the language. In other words, communicative clarity seems unlikely to be achieved by altering vowels for singing. Potter’s cited "received pronunciation" singing vowels, prestige in classical singing, are in fact all articulated with the tongue higher and more front than their regular spoken counterparts in American English varieties (Potter 1998). As for projection, this may serve as an illusory means of raising ring, a quality that can assist in being heard over louder noises. Ring is an important acoustic topic to be tackled later.

Although the means, altering communicative vowel production in accordance with some non-communicative property, are phonetic and linguistic, the ends classical pedagogues hope to achieve are phonetic, paralinguistic and psychoacoustic. This discordance in means and ends reflects a potential oversight by vocal pedagogues in attempting manage phoneme features when timbre seems to be what they really wanted to alter. Because timbre is a variable controlled by
far more variables than vowel features alone, it is no surprise that a pedagogy two dimensional vowel alteration may provide shaky guidance for tasks performed by a poly-dimensional vocal tract. This itself may contribute to the perpetuation of discord about the science of timbral production by modern day classical voice pedagogues.

While the height and longitudinal position of the tongue dictate the core aspects of a vowel, nasality also comprises a contentious component of sung vowels in classical pedagogy. Literature, from past experts to current protectors of the classical tradition, all seems to converge on the practice of reducing nasality. Linguists not as versed in the intersection of sociolinguistics and musicology may not be as familiar with the confusion of nasalance with twang quality. For those without a background in linguistics, who may be familiar with other definitions of nasality, nasality in this context refers to the opening of the velopharyngeal port to the nasal resonance cavity during the production of a vowel. In personal experience, pedagogues mention the confusion between the twang quality, to be further discussed later, and the nasal quality. Vocal researcher Scott McCoy also addresses this confusion in his work, making sure to isolate the two features. (McCoy 2004) Gillyanne Keyes notes a physiological conflation of twang quality with nasality in her set of vocal posture triggers. (Keyes 2004) From the summation of all these different sources, it seems important to specify the nature of nasality, as it plays both linguistic and paralinguistic roles in the singing voice.

Exercises for the reduction of this nasal quality have assumed the form of anything from quacking to nose pinching (Garcia 1894). The purposes of this nasality reduction appear to tie in to similar classist aesthetic principles that encourage the reduction of rhoticity, more informally known as r-coloring. (Potter 1998) Modern studies after the advent of more precise diagnostic technology demonstrate the persistence of such nasality reduction in singers trained in classical schools (Birch 2002). Foreign voice instructors even continue to admonish the specific degrees and onset time of nasality in certain mandatorily nasal French vowels (Miller 2004). In monitoring nasality levels so closely, singing instructors appear to have impinged on the territory of altering vowel production to the point that vowels lose linguistic resemblance to the spoken-language counterpart. It would follow that this pedagogy participated in classist exclusionary tactics, namely avoiding ‘harsh’, ugly tonal qualities associated with perceptions of lower class diction and paralinguistic behavior. This claim is further solidified by the work of Potter, who describes features of this underclass as the rhoticity and nasalance that this pedagogy trains operatic singers avoid. (Potter 1998)

The proposed aims of the classical school of singing are more practical than some of the means used to achieve them. In the formative era of classical singing, singers had no means of amplification over their relatively large and sonorous instrumental backings. As such, a salient, piercing quality that vocal scientists later quantified as ring was became many instructors’ goal. This ring quality manifests as a formant intensity peak around 3 kHz. Even if a voice using ring had a lower amplitude than the orchestra accompanying them, listeners may somehow have found the singer’s voice to be salient (Bloothooft 1986). It may be that in addition to avoiding the perils of ‘harsh’, non-prestige diction, achieving salient voice without amplification served as impetus for distorting vowel qualities found in speech. The historical need for ring in part explains the lasting prestige associated with classical diction Instructors tended to manage even the timbral qualities of these more salient and ‘ringing’ vowels (Miller 2004).

It wasn’t until more sophisticated vocal science that physical anatomy mapped on to producing these qualities. Notwithstanding, the work of 1860's prominent voice teacher Manuel Garcia, bel canto and opera proponent, serves as a missing link of sorts for ascribing concrete
features to classical timbres that modern scientists understand. Using a mirror and a light, Garcia pieced together the inner workings of the voice, using his own as a model (Garcia 1854).

Even though historians may note him as a progenitor of modern pedagogy for his thorough observation of vocal tract features, even though he elucidates even those features that modern pedagogues implicate in non-classical styles (Garcia 1854, 1894), Garcia shows a pronounced classical or neoclassical bent for which features he deems worthy of using during singing. The name ‘bel canto’ was no mistake; classical pedagogues held a definite idea of what was ‘bel’ (beautiful) of vocal features and what was not. Namely, instructors like Garcia tended to encourage lower laryngeal position, widening of sphincters above the vocal cords, and the reduction of breathiness via the adduction of the vocal folds (Garcia 1894). The acoustic outcomes of these postures were valued as superior. His work even present tendencies towards controlling vowels, one such control being the encouraging of single vowel melismas, also known as riffs/runs. In his work, he orthographically specifies strings of notes should be sung as ‘a-a-a-a-a’, not as ‘ha-ha-ha’ using the voiceless aspiration of ‘h’ to break and restart the repeated vowel (Garcia 1854).

However, before the advent of laryngeal explorers like Garcia, the Eurocentric classical singing world resorted to relatively vague terminology to express its timbral choices: “forward versus back”, “thin versus thick”, “light versus dark”, “lyric versus dramatic” (Potter 1998), without objective explanation. In fact, many voice teachers dialoguing in Solutions for Singers still vaguely employ this same terminology (Miller 2004). Of course timbre is useful to talk about from an impressionistic angle. This may capture the perspective of a listener who cannot see the mechanics of the singing voice, but one might expect a voice teacher to understand the mechanics behind these timbral features they are encouraging and discouraging.

Later exploration, such as the mirror-based techniques employed by Garcia, may point to a fuzzy proprioceptive origin for the vague vocal terminology discussed. However, this does not hold true for all interpretations of these vague descriptors. For instance, classical pedagogues refer to vocal registers, or vocal fold vibratory patterns, by the areas of the body in which they are perceived to resonate such as the ‘head’ and ‘chest’ registers. The problem with this lies in the fact that this proprioceptive terminology is subjective and potentially inaccurate, as no resonation in the chest is needed to form what is called the ‘chest’ register. While some singers may feel the chest register in their chest, this proprioceptive idea is tangential to the actual nature of registers. As will be discussed soon, registers themselves are actually another interesting timbral element whose true mechanical properties classical singing may confound.

The key to registration lies in the behavior of the vocal folds regarding vibration. More specifically the term register refers to the amount of the mass of the vocal chords that vibrates during a phonatory cycle and the way this mass of vibrating folds negotiates the glottal space (Popeil, Personal Communication: Sept 20th 2012, phone conversation). Terminology from the modern school of South African opera may serve as better exemplars of descriptors with staying power, such as the “potato throat” description of laryngeal lowering and widening inherent in many schools of operatic singing. This clarity becomes even further lost when discussing the variables with which pedagogues conflate timbral perception.

These variables can include anything from weight, shape, height, and age to perceived vocal range limitations. For instance, a more corpulent singer may come across as a ‘dramatic’ singer despite actual timbral qualities. Richard Miller debunks these ideologies in his open treatise Solutions for Singers. In a similar vein, thinner singers may be perceived as more ‘lyric’ while taller singers may be perceived as ‘darker’ in tone. These kinesthetic vocal tone
interpretations even extend so far as to make claims of racial vocal features in certain schools of vocal thought. While Miller describes a definite demographic correlation of the accordingly named Schwarzerbass with African American schools of singing, he notes the broad expansion of the tone beyond the African American community. Miller implicitly enumerates the features of the Schwarzerbass as a slow vibrato, ‘dark’, ‘thick’ texture, and ‘dramatic’ weight. Furthermore, Miller notes that it is well within the range of possibility to emulate these sounds without the blood or phenotype of African American heritage (Miller 2004).

What would later be defined as timbral elements, namely "registers", also seemed to be tied within the pitch range prescribed by vocal facher, or the ranges of pitches singers are capable of producing, as literature yields little to no discussion of coloratura basses. Coloratura refers to a light, versatile texture, which basses are somehow inherently barred from having. Why must lower range be dissociated from lightness and versatility? Singers' prescribed ranges of pitch were closely linked to their register in general. This is fallacy that would later be deconstructed.

Along the lines of the limiting features of fach, there were also recently debunked myths of the flageolet, or whistle register, being a female sex-exclusive feature of coloratura singers. This alludes to a greater misconception that registers are entirely separate entities that occur over different pitch ranges. In reality, singers can sing the same pitches in different registers. While work on the mysteries of the flageolet continues, it is already apparent that the flageolet register is mainly just a covering of the glottal space with sphincters higher up in the pharyngeal cavity. Though the inherent features of the register allow for the production of higher pitches (Henrich 2004), this covering ability is not biologically specific to range or gender. Correspondingly, falsetto had long been thought a male specific ornament. This may owe to how women may tend to exhibit a less pronounced timbral difference between their head and falsetto registers. Either way, the case seems clear that clarity itself does not abound in traditional Eurocentric classical vocal thought. This occasional lack of clarity can instigate suppression of vocal forms, assign values to others, and reduce objectivity about modern vocal thought.

Even though the genesis of this school of singing antiquated, its sphere of influence is still relevant in modern vocal thought. The point of debunking notions held by certain members of the Eurocentric classical school of singing is not to ridicule the school, but point out its many constraints and biases as a vocal form that is still venerated today. This veneration can present as blatant discrimination in many cases, such as classical aficionado Julian Lee's treatises on the black destruction of the sanctity of white vocal music. This may seem like an isolated event to the completely uninitiated, but the amount of feedback on his forums and like-minded publications say otherwise. While the understanding of vocal behavior of these not-really-so-extreme extremists is predictably limited, their perceptions, though at times incomprehensibly distorted, serve as yet another suggestion of the validity of the construct proposed by this thesis. Following the model, Lee takes the few objective features he can attempt to describe, translates them to psychoacoustic terms, and extrapolates the psychoacoustic evaluation as a trait of a social demographic:

For whites:
"White singing strives for an open throated tone. To achieve this a singer learns to support his voice consciously from the abdomen, providing foundational strength to the final voice."

"It is a high value not to strain the voice, but to let it flow out in a pure, undistorted way."
As well as blacks:
"A vocal style that constantly shifts about — to the point that melody is obscured — stands for waffling, laziness, freneticism, and hype. A “shifty” vocal style represents a “shifty” approach to life. I have to note that is a trait of so-called black “soul” singing. (I distinguish this from the vocal music of India which, though containing subtle dips and trills, holds to a well defined melody.)"

In fact in the true spirit of this thesis, Lee arranges a compendium of thought streams following this construct:
"A voice can be chaste or dissolute, economical or wasteful, spiritually inspiring or carnal and debasing to the mind. Whenever anyone sings they are representing some kind of human value through singing style. A beautiful and original melody enlivened by a chaste and disciplined voice lifts the human spirit."
"A light and breathy sound telegraphs femininity, innocence or childlike qualities."
"Deep, firm voices in men bespeak manliness, fatherhood, strength, and authority."
"A forced voice that strains bespeaks impetuosity and impatience, bullheaded youth and the eternal green yokel."
(Lee 2011)

Just as uneducated, syllogistic biology served to certify the "inhumanity" of slaves, herein lies a danger of subjective, academically incestuous and pretentious vocal science. When a school of vocal thought, such as classical, seeks to permeate, control, and equate compliance to its dicta with personal worth, the power of the potential construct laid forth in this work can twist into a malicious power.

From personal, literary (Miller 2004) and internet accounts, the supremacy of classical pedagogy, even today, appears to be frequently enforced with the threat of supposed damage by vocal nodes for deviance from dicta. Given the longevity of the careers of many non-classical artists, it would seem that deviance from the dicta of classical singing is not only possible; it is sustainable. However, classical still clearly holds a place as prestige form, permeating the practices of even modern singers. As such, an understanding of the current state of vocal thought and practice may necessitate an understanding of the supremacy and hegemony of this vocal form.

In summation, an understanding of the persistence of classical vocal thought in singers and the listening and critical public who evaluate them can bestow insight into typing of vocal features from the classical tradition. Most with access to modern media may find themselves aware of the prestige, higher class associations, Eurocentricity and academia associated with the classical traditions. Thusly, it should stand to reason that listeners assign these same values of class and race to the traits associated this vocal school. More specifically, the enunciative precision in conforming tongue articulations to the specificity of ideal vowels may sound calculating and academic. The lowering of laryngeal position to a posture markedly different from that seen in common speech may give a "rounder" or "richer" sound that feels less accessible and higher class. Even the use of psychoacoustic term such as “rich” bears blatant socioeconomic weight. The production of ring and salience over instrumental backing may instill a sense of prestige in the abilities of a singer to accomplish this antiquated feat. The composite
framework of vocal genre created by the selection of these features shows a historical precedent for the sociological selection processes of authenticity and evocative power of singer behavior. Moving forward, the articulatory and phonatory behavior of classical singing still receives ample veneration in neoclassical vocal thought.

**Neoclassical Era Pedagogy and Science: Bel Canto to Sprechgesang and Early Estill, The Introduction of Psychoacoustic Linguistics**

Neoclassical vocal pedagogies appear to emerge during the modern classical and jazz eras around the turn of the 20th century. While many of these pedagogies engaged with classical tradition and offered alternative modes of voice production, as time passed, few of these schools seem to diverge from certain central classical dicta.

A shining example is the later work of Manuel Garcia during a transitional period in the late 1800’s. Instead of the very heavily repertoire focused approach of classical pedagogy, he hones in on the core mechanics of voice production and makes notes of many non-standard timbral features that do not appear to get as much spotlight in previous pedagogy. These features include breathiness, nasality and a contraction of the aryepiglottic sphincter that would be later labeled as twang. He describes the pathology of each of these vocal features in accordance with more scientific investigation that would surface later. However, these features are listed more as pathologies that need to be corrected. For instance, in his letters to a famous soprano Paula Viardot, he points to the production of nasality and aryepiglottic sphincter contraction with duck-quacking mimetic exercises only to demand precise modulation of these features. He also discusses adduction and abduction of the vocal folds during phonatory cycles and how too wide of a glottal space (“glottal chink”) can lead to aspirated phonation. After this detailed description of the production of ”insonorous” air, he dismisses breathiness as inefficient use of airflow and detrimental to tone (Garcia 1894). Using Garcia as an exemplar, it becomes obvious that while insight grew into a wider and wider spectrum of vocal tract settings, the ideal settings of classical singing were kept clearly in mind. With the advent of more theatrical forms of singing and less classical forms of instrumental music, pedagogy began to challenge notions of singing as a monolithic, conformist entity.

Sprechgesang, a style that reflects the German compound of 'speaking' and 'singing' by which it was named, quickly gained popularity in opposition to classical pedagogy. Like the name suggests, the school of singing consisted in integrating more speech like elements into singing for more emotive and expressive purposes. According to *Vocal Authority*, such features could be assumed to include the nature of vowels. This allowed a wider range of non-"ideal", more speech-like vocalic articulations. Accordingly, it would seem that ring would be reduced as well. This reduced ring has subsequently been described by experts as a "conversational" tone (McCoy 2004). In what may be described as a bid for popularity, some forms of theatrical classical singing began taking up some of the practices of the increasingly appealing Sprechgesang school. In times to come, singers would push for more analysis of non-classical vocal postures for increased expressivity (Potter 1998). Fortunately, coincidental advances in phonetic and phonological understanding further enabled vocal science to accommodate more profound understanding of the range of the human voice.

In efforts to document the vast range of linguistic usages of the human voice, researchers Catford and Ladefoged unwittingly paved the way for voice teachers of the mid 1900's. Their work, starting with the diverse phonatory demands of different languages, eventually branched
into expository papers on the range of phonation and articulation possible by the human voice. The main findings included elucidation of the vocal fold widening process of breathiness, the glottal constriction and partial phonation of creaky voice, and the modal voices in between. The important thing to understand as that these features are on a continuum, the breathiness of a breathy vowel could hypothetically be exaggerated while singing to communicate the psychoacoustic values of breathiness. (Catford 1964, Gordon 2001) Understanding the anatomical and acoustic features of these ranges of phonations facilitated the more thorough and broad dissection of singing voices. While not directly cited as frequently in the realm of modern vocal science, work in the field of psychoacoustics bears some powerful implications for evolution of neoclassical and classical vocal thought.

Vocal psychoacoustics, while not always as scientifically rigorous as phonatory studies, creates a precedent for vocal evaluation. Starting with speech voice analysis, studies dissecting prerecorded vocal features and then displaying them for mass evaluation show that underlying vocal features can pretty reliably provoke certain personality perceptions. For instance, breathiness in females often evoked evaluation as sexy or lively (Laver 1968). Classical singing had received analysis long before this level of speech voice analysis, but with the new tools of scientific analysis in tow, fuller analysis was possible. "Dramatic" voices became linked to positions of the larynx that thickened the vocal folds while "lyric" voices were defined more scientifically as those with thinner vocal fold postures (Potter 1998, Sundberg 1994). The most important derivation from vocal psychoacoustics, however, is the understanding that phonatory and articulatory features, like accent and dialects, have a degree of social learnability. More technically speaking, cultures, classes and demographics can impress and transmit phonatory and articulatory singing features by which audiences will identify singers. Further examples of psychoacoustic interpretations of vocal tract settings in this vein will arise en masse as the argumentation of the thesis reaches its climax. However, this is a still expanding field, hence the following expansion upon the precursors of this kind of vocal thought. More specifically, the increasing range of coverage of non-standard vocal tract settings allows more acute analysis by voice scientists Jo Estill and Gillyanne Keyes.

The work of Jo Estill and Gillyanne Keyes emerged as some of the first pedagogy that completely embraced non-classical phonations and articulations. Operatic vocal posture was now only one of several among the vocal posture conceptions popularized by Estill's work. A new wider array of postures allowed for the more quotidian, relatable expressivity observed in musical theater. These postures included: sob, a further exaggeration of the lower laryngeal posture of opera along with spatially sunken articulations; speech, a less ringy, lower effort posture that evokes Sprechgesang; belt, a contentious posture that allows projection in non-classical styles; falsetto, a vocal setting that only uses the edges of the true vocal folds to phonate as opposed to their full mass, and twang, a style marked by the contraction of the aryepiglottic sphincter and raised articulations. This latter posture became the basis of the "ring" of musical theater. The contraction of the aryepiglottic sphincter dominated as the major non-classical form of producing higher formants (Yanagisawa 1989). Since this contraction is so clearly independent of tongue-based vowel articulations, it would seem that this would "allow" consistent production of higher formant ring despite vowel characteristics (despite earlier assumptions to the contrary, hypothesized methods of ring have not been shown to be truly limited to one method of production in surveyed literature (Sundberg 1994)). However, some took note with the "tinny" timbre produced as a side effect of the sphincter contraction. In
addition to these postures, experts also began to consider phonatory ornaments such as onsets (note attacks) and offsets (fades or decays).

From the literature surveyed, the nature of phonatory offsets and onsets seems to be discussed more consensus than many other phonatory features in the field. Glottal onsets are harder sounding onsets that occur when vocal cord musculature preps the chords for vibration before pulmonic airflow is even introduced. The reverse is true for the softer aspirate onset in that airflow starts before vibrations and glottal contractions. Simultaneous onsets require the coordination of both airflow and vibration at the same time. Offsets are thought about similarly, with glottal offsets consisting of a rapid fold adduction to choke off airflow. This results in a note termination accompanied by a sometimes-audible release of air. Aspirate offsets allow a decay of a sustained note as phonation transitions from fuller voicing to a whisper where the majority of the air that passes through the vocal tract vibrates minimally. In addition, there are creak offsets that produce either single fold or aperiodic phonation towards the end of a note (Colton 1981, Chaté).

Neoclassical pedagogy still set some of its preferential limits on which features produce ‘beautiful’ phonation. For starters, belt was treated as a monolithic entity whilst neoclassical pedagogy allowed for an expansion of belting styles that encompassed the aims of musical theater. Nevertheless, this school of thought still left a fair amount of styles out of academic focus. With the increasing pressure on existing pedagogy to cover more "commercially" profitable styles, modern pedagogy entered its formative years piggybacking on the discoveries of this neoclassical pedagogy. Modern voice science marks the emergence of the work most relevant to this thesis: documenting the phonatory and articulatory traits that sound the most endemic to the genre that the singer aims to perform.

Modern Era Vocal Pedagogy and Science: Post-Estill to Present Day Popular Singing, The Introduction of Multimedia Vocal Observation

In any venture in the field of modern vocal science, one would be remiss not to draw heavily from the work of Johann Sundberg. Not only does his work constitute some of the first insights into modern vocal genre definition, but his work with electroglottographic studies exemplifies parameters by which to define vocal characteristics. In a nutshell, these vocal characteristics include:

- Subglottic pressure: the pressure level of air underneath the vocal folds
- Open/closed/contact quotient: the amount of time the vocal folds spend apart, together, and in contact respectively
- White noise levels: amplitudes of sound produced without distinguishable formants
- Nasalance: resonance of sounds from the lower vocal tract within the nasal cavity due to nasal port opening

Finally, there are the cases of abnormal phonation that Sundberg and company explain as aperiodicities. Some of these fall under the heading of ‘rasp’. Such features include aspiration through tense, adducted vocal folds, rumble/growl quality, collision and co-vibration at the tips
of the vocal folds, dist tone, and the complete co-vibration of the vocal folds known as strohbass. These terms receive further detailing later.

In addition to these more recently solidified concepts, Sundberg, his colleagues and protégés inherit and expand upon the mechanistic discoveries from earlier branches of vocal thought. These include the Estill tonal postures (speech, twang, sob, opera, belt, falsetto), vocal fold density changes resulting from laryngeal tilts (true vocal folds get thinner as larynx tilts forward), aperiodic phonatory phenomena resulting from unsteady vocal fold vibration, spacing, or interactions with neighboring elements of the vocal tract, and contraction and expansion of regions within the vocal tract (to include the mouth). Notably, in this era researchers approach more objective universal definitions of registers. Chest or modal register uses the majority of the vocal fold to vibrate. Head uses less. Falsetto just uses the tips of the folds. Flageolet or whistle register uses the tips and occurs within physiological enclosure (Popeil, Personal Communication. Email, Sept 22, 2012). With these parameters of measurement, Sundberg and his fellow researchers and protégés guarantee a baseline degree of consensus when defining the voice. Although such consensus is hard to observe before the advent of this brand of vocal science, stylistic differences still persist between modern vocal pedagogues.

On the note of style, modern vocal pedagogues find themselves charged with the task of defining and instructing vocal styles. A great pedagogue to start with is Lisa Popeil, who actually works with Sundberg in single-voice-source studies to document diverse vocal genre features. This single source controls for individual biological vocal tract attributes (including maximum tract length, maximum vocal fold thickness, and nasal cavity volume). A novel feature discussed more in her writings than encountered elsewhere is the modulation of the shape of the pharyngeal cavity. Despite all these diverse tract configurations, her work in these studies and as a pedagogue anchors in controlled body posture, minimized jaw tension, diaphragmatic control and safe experimentation, but her motto in pedagogy is still "sing anything". As such she specializes in dissections of popular singing genre based configurations of the vocal tract (Latimerlo 2012).

Utilizing the parameters laid forth in prior vocal science, Lisa Popeil compares and contrasts sets of vocal features for modern Western genres. Her work with Johan Sundberg performs an acoustic dissection of the anatomical efforts behind Western genres. For starters, higher air pressure levels tend to be observed in rock, with classical and musical theater following closer behind, and pop, jazz, rhythm and blues: R&B and country having lower or variable pressure levels. This measure of pressure, as shown later, tends to translate to perceived effort. Higher air pressure often measures out as higher efforts and the same for lower air pressure levels. In terms of the activity of the vocal folds, classical and musical theater had higher open quotients while rock had a very low open quotient and the remaining styles had variable open quotients. Open quotient is another variable linked to perceived effort level. Higher closed quotients suggest a greater strain of phonation in which the "glottal chink" stays smaller and less air passes, while higher open quotients suggest that phonation is free and easy. According to her personal work, laryngeal height tends to be lower for R&B and classical, giving a fuller, older sound, while laryngeal height for musical theater, pop and rock tends to be higher to give a more speech-like, younger sound. In terms of laryngeal tilt or lean, R&B and classical once again pair up in tendency towards the heavier sound of thicker vocal fold postures, while pop, rock and musical theater gravitate towards the speech-like, lighter thin folds of the forward laryngeal tilt. (Henrich 2003, Latimerlo 2012) Already, a trend emerges of classical and R&B adopting features that Popeil assigns connotations of being heavier, older and fuller while genres
such as pop, musical theater and rock opt towards younger, lighter and more speech-like features. Therein lies the work of this thesis, tracking the impressions singers induce with their choice of vocal tract configurations.

Popeil's fellow voice researchers develop and apply these genre definitions. In doing so, they help to document genre endemic phonatory and articulatory features. These researchers tend to emphasize more liberal vocal experimentation, directly challenging the admonishment of certain classical pedagogues, while maintaining vocal safety. Leda Scearce is one such fellow researcher, defining holistic vocal tract postures and identifying the genres to which they are authentic. The postures she describes with novel terminology (for the sake of minimizing obfuscation with similar ideas with different theorists) in her work on non-classical genres include brassy, twangy, squeezed, whispy, and booming:

Brassy posture is described as a bright, loud posture where the thyroarytenoid muscle shortens the folds while adducting them, combining with higher laryngeal position, high subglottic pressure, a tilt of the larynx downward towards the cricoid cartilage, and an aryepiglottic sphincter contraction.

Twangy quality is a close neighbor to the former quality, marked by high laryngeal position, thickened vocal folds, nasal port opening, and constriction of most of the sphincters and chambers above the glottis, to include oral constriction.

Squeezed posture, described as a tight, gravelly screaming quality, demands constriction at the false vocal folds and the true folds, with a very high closed quotient and potentially high contact quotient, and high subglottal pressure. This posture is most popularly linked with growl, scream, fry and 'dist' tones.

Whispy posture, evoking a thin, breathy description, is a fairly freer posture only defined by lower subglottic pressure with a higher open quotient and stiff vocal folds that permit vibration only towards the edges of the folds where the ligamental tissue is. This posture is most popularly linked with falsetto.

Finally, booming posture gives a rounded, woofing quality with a lower larynx position, thickened vocal folds, and stiffened pharyngeal walls.

(Scearce, Anatomy and Physiology of Five Commercial Singing Vocal Postures)

Scearce makes a monumental step forward in singing genre analyses with these postures of independent, but inter-correlated, vocal tract configurations. Describing the tendencies of genres towards different postures, Scearce relates a set of vocal features endemic to individual genres. R&B tends toward the higher effort, more psychoacoustically impacting brassy, squeezed and booming postures. Rock tends towards the intensity of squeezed posture. Jazz shows a wide variety of manipulations to include whispy, booming, and brassy. It may serve well to note here that Popeil also notes a wider modulation of features in jazz. Pop tends towards the lower effort qualities of booming and whispy postures. (Scearce, Anatomy and Physiology of Five Commercial Singing Vocal Postures) Other genres are defined here as well, but they are not as major as the other genres. These major genres continue to receive expository treatment in the work of vocal pedagogue Donna Soto-Morettini.

Like her colleagues in modern vocal pedagogy, Soto-Morettini advocates more liberal vocal exploration, explicitly advocating freeness of diction. In fact, the methods of liberal vocal exploration she alludes to, such physically engaging the false folds in the phonatory cycle of the true folds, are among some of the most dangerous phonatory settings noted by other pedagogues.
Even among modern pedagogues, many of these features are considered as a possible source of injury to the vocal cords. This is interesting considering her roots performing in a rock group with several vocalists. One of the fellow vocalists, in a Tom Waitsian quest to produce a more genre authentic grit, would drink and then scream into the sea nightly after gigs to wear his voice. Ironically, the singer's voice grew stronger, not just despite this, but seemingly owing to this esoteric ritual. In later years, she would temper these frank experiences with her work as a rising vocal pedagogue in collaboration with Gillyanne Keyes. Together, they would practice the Estill method, which resonates deeply within Soto-Morettini's own novel work. The brunt of this work forms an engaging pedagogy that aims to disseminate a vocal practice that strikes a balance between individual expression and authenticity to the once invisible dicta of established musical genres. (Soto-Morettini 2006)

Of all the pedagogues mentioned, Donna Soto-Morettini may be working with one of the more expansive toolkits. In the tone section of this kit there are:

- Thin and thick fold qualities: qualities that keep with the aforementioned descriptions of vocal fold density modulation via laryngeal tilt
  - Aspirate quality: a quality where the glottal space is more permeable to non-vibrating volumes of air while the vocal folds themselves assume a somewhat falsetto-esque posture
  - Elongated quality: a throatier quality marked by forward tilting, lowered laryngeal position and possible elongation of the false vocal folds
  - Twang quality: still the same aryepiglottic sphincter contraction from Estill
  - Belt quality: a thicker fold posture often combined with twang and some personal modulation to produce a modal register, projective sound
  - Rumble quality: a quality marked by the physical intervention of the neighboring false folds in the vocal phonatory cycle.

This rumble quality contrasts with the constricted quality where the false folds are adducted enough to act as a dampering body but do not interfere with the vibratory cycle of the true folds. Finally, there is creak quality (not to be confused with the more limited phonetician’s definition): a collection of qualities with aperiodic events at the level of the vocal folds themselves, including incomplete vibration and collision. Bookending these qualities of sustained notes are the expanded set of Estill inspired onsets and offsets she enumerates. (Soto-Morettini 2006)

Donna Soto-Morettini dominates the market on these nooks and crannies of vocal expression by detailing the various ways in which phonation can be stylistically induced or terminated. In the category of onsets, Soto-Morettini first offers the standard fare of Estill's aspirate, glottal, and simultaneous onsets. Expanding further, she introduces

- Flip onset: a rapid, almost automatic phonatory intensity switch from breathy and thin folds to modal and thicker folds, the transition speed of this quality can be dramatically adjusted
- Creak onset: an onset alluded to by the quality of the same name where aperiodic vocal fold vibration occurs at the start of phonation, potentially transitioning into regular phonation
- Rumble onset: this is the rumble analog to creak onset.

Among these onsets aspirate, glottal, flip and creak have corresponding offsets. (Soto-Morettini 2006)
Some of these onset forms have a bit of physiological variation as offsets. Namely, these offsets physiologically act as a means of cutting off phonation whether it be by over-dilating the space between the folds in aspirate offset or pressing them together as in glottal offset. The mutual effect of these two processes is dampening the vibration of the vocal folds. Functions unique to the offset category include the gospel, yodel, and vibrato offsets. (Soto-Morettini 2006)

Vibrato, and the similar tremolo, do not forcibly dampen the vibratory cycle of the folds, but these ornaments can accent the end of a note. Vibrato consists of the regular oscillation between set pitches while tremolo consists of an oscillation in amplitude. Various kinds of vibrato, tremolo and other periodic elements are at the disposal of singers to match to genre. The gospel offset and yodel offset return to the mode of interrupting the vibratory cycle common to the other offsets. The gospel offset ends with an ejection of air after a slamming together of the vocal chords not unlike a forceful glottal offset. Speaking in simile, it resembles the gust of air and noise emitted from a door as it slams shut. The yodel offset ends with a register shift from the chest register to falsetto register, which dampens vibration on the majority of the fold, save the tips. Now this physiological toolkit is about complete for the purposes of this project.

Drawing from the modern school of vocal thought, this work will continue forward in analysis of vocal behavior. However, sociological background may be necessary, in addition to physiological background, to fully process the discussion to follow.

Just as in the work of Donna Soto-Morettini, a brief overview of the social connotations of each genre may do well to introduce commentary on the vocal stylings of said genres.

**Timbral Colors in Context: Introduction and Brief Description of Modern Western Schools of Singing**

In this first section, cursory analysis of the sociological and historical cofactors of the creation of these genres is given. This serves two main purpose: the first, to introduce entities that receive varying degrees of discussion throughout this work, and the second is to establish the "aims" of a genre, its zeitgeist, to which vocal behaviors are catered. These analyses will be composites of Potter and Soto-Morettini’s musicological descriptions. Note, while these descriptions follow in a rough chronological order, this is by no means a chronology.

Starting off with country, formerly known as hillbilly music, therein lies an example of underclass resurgence against the upper crest domination of vocal forms. Eventually, a Marxian cultural synthesis would occur and these folk styles would be accepted, appropriated and modified by members of more elite class backgrounds. One of the more emblematic artifacts of this resurgence is the almost inseparable nature of country singing and white Southern-accented English varieties. This music, as the name suggests, tended toward the simple and rustic. A nostalgia for this simplicity and rusticity abounded, and only magnified as the genre changed its name to country and began to be commercialized.

Jazz, a transition into the greater mélange that would resemble modern American popular music, reflected a cooperation between various parties. Among these parties features such as "hot" and "cool". The hot side of jazz referenced the spontaneous, fevered outlet this music represented for financially and racially oppressed communities. The more sensual cool side of jazz embodied the calmed, jaded mellowing of this hot side more accessible to the communities on the other side of this oppression. Styles combined here consist of opera, old-time, and gospel and traditional white and black styles closer to antiquity. However, today, the cooler side of jazz
appears to be the more dominant one, and as such it seems to have more of an association with the more affluent, white populations implicated.

Next comes a very foundational genre: blues. Blues came from a more disjointed ethnic diaspora than country, so its formation was a bit more multi-faceted. Though, similar to country, it was contained to more monotonous ethnic origins than genres like pop and jazz. There oozed a grittier, more heavy-handed sexuality than jazz that challenged the gender roles of those involved. This may have been a larger symptom of the overall exaggeration of the cathartic elements of jazz for oppressed African-American populations. However, Motown acts and appropriation would package this style into the more palatable offshoot known as rhythm and blues.

An offshoot of the blues, rock started out as "race" music, a more streamlined-for-consumption effort in the same cathartic vein as blues. The consumption of this controversially received style eventually grew into appropriation as the style mellowed and became "white". The edge remains, but to varying degrees depending on which canon or non-canon subset of rock one consults. Among all these subsets, there is a trend of higher energy qualities that rival blues.

Finally, pop may be best described as an amalgamation of all the above. The practice of tending to the majority friendly middle earned the genre's descriptive moniker "popular music". Eventually, the modern incarnation of this genre would tow the norms established in the genres before it. Performers are considered as whole packages, and the voice is just one component of many features considered. This downplays the role of exaggerated, artistic vocal qualities and upgrades the role of more pragmatic, speech like vocal qualities. (Soto-Morettini 2006) (Potter 1998)

For the most part this social description maps out parallel onto the features assigned to the vocal progenitors of the genre by Soto-Morettini and colleagues. Once again starting with country, the features most associated with the genre are twang quality and posture, flip onsets, yodeled offsets, minimal vibrato and riffs for ornamentation, constricted pharynx and a favoring of the modal register and thicker fold postures. Many of these features, modal register, twang, minimal ornamentation, hark back to the speech-like expressivity of the Sprechgesang school of singing. These qualities can be heard in regular speech voices and do not require some act of singing to access. In this context, the contribution of these features may be that of the rustic, non-prestige socio-economic feel of the Southern accented English varieties famously associated with the genre. Soto-Morettini posits that Southern Accented English may predispose a singer to flip and twang. As well, she stresses a lower overall perceived proprioceptive effort level.

Continuing with jazz, a lower effort level persists in the more popular cool stylings. This takes the more intentional, artful form of aspirate quality, offsets and onsets. In addition, the pharyngeal position remains neutral and thinner fold postures such as Scearce's whispy posture (Scearce) and higher open quotient dominate. Occasionally there are aperiodic events in the cases of Louie Armstrong and Billie Holiday. Overall, however, the artful tendency towards a perception of effortlessness may reflect the urbane, upper class approximation of original stylings coming from a trained background. (Soto-Morettini 2006) (Potter 1998) This artfulness may also be expressed in the large propensity toward melodic improvisation in the fundamental frequency or pitch (Henrich and Popeil 2003).

Blues brings a spike of effort level, sacrificing the detached artfulness of jazz for the emotional content of higher effort level settings. Squeeze and brassy postures trend towards muscular constriction of the vocal tract while rumble onsets and gospel offsets play to the higher pressure produced by these tract configurations. While there may be ring, it is not produced with the loftiness of classical singing. Thicker fold postures and high closed quotient dominate and
modal, maybe even strohbass, registers persist. This grit may speak to the raw, working-class sexuality imposed on African-Americans in that era, male and female alike. In the offshoot style rhythm and blues, some of the intensity level may be brought down and more artful items such as ad-libbed melismatic ornamentation via rapid laryngeal height oscillation may be added on. (Henrich and Popeil 2003) This may reflect the upward mobility of African-Americans in that era and the incorporation of more prestige elements, a reminder of the mono-vocalic melisma articulation style encouraged by Garcia. (Garcia 1894)

Rock continues with this effort level spike, adopting the squeeze posture of blues. In addition, the dist-tone created by cyclic vocal fold collisions comes into play (Borch 2004). As an aperiodic event, it may count as a form of rasp. As in country, the pharynx is constricted, as are the vocal folds, giving a higher closed quotient value. However, thinner fold postures occur far more than in blues. The risky, constricted forms of this genre may give the impression of rebellion against the Eurocentric classical vocal hegemony. (Potter 1998)(Soto-Morettini 2006) The party behind this rebellion seems like it would be younger, white and lower class, as Eurocentric singing styles logically have a Eurocentric sphere of influence. As well, rebellion is natural after a period of time, and classical voice lessons, just as classical voice itself, is emblematic of economic privilege.

Finally, pop completely flatlines the effort level with thin fold postures such as whispy. In addition, creak offsets and onsets mixed with aspirate qualities. The loftiness of a more open vocal tract and low level of ring formant may arise as well as a lower rate of vibrato. This vocal neutrality is once again reflected in the neutrality of the neutral pharyngeal configuration. (Potter 1998) This neutrality may speak to the mitigation of several vocal styles to create a marketable, accessible style without too much threatening, foreign expressivity. The creak and aspirate fixtures (Soto-Morettini 2006) may speak to a vocal communication of intimacy of speech-sounding singing that is part of the sexual packaging of modern pop singers. As psycholinguistic studies showed earlier, creak and aspiration in women is associated with sexuality. Even in men, the lower phonatory activity in these features may convey a sense of conversational and physical intimacy similar to whispering, where there is no phonation.

As belabored here, it is possible to trace a correspondence between the social climates of vocal genres and the features they center around. While it certainly provides no empirical proof of the construct for authenticity determination laid forth by this thesis, this demonstrated pattern of correspondence suggest that such a construct is at least possible.

Applications and Analysis: A Potential Methodology for Observing this Phenomenon and Speculation on Current Outcomes of this Methodology

All of the analyses of modern singing genres thus far are well and good, but where do they come from? How are we sure that the above listed features are truly authentic? How do the movements of an organ not even normally visible get assigned the some of the aesthetically motivated social values of a genre?

More importantly, how can these analyses stay up to date with the natural progression of the phonatory dicta of popular vocal genres? It would serve well to procure an understanding of the underlying workings of the productions of such dicta. With this notion placed forth, the focus turns once again to the model of genre authenticity set forth earlier in this work. Recapped, this model proposes that determination of vocal authenticity is a stepwise process, starting first with
the psychoacoustic digestion of the auditory signals produced by mechanical, anatomical settings. From here, listeners assign these impressionistic psychoacoustic labels with socio-demographic values. These socio-demographic values receive audience interpretation as native or non-native to the genre.

More concretely, say a singer employs the squeeze posture during a rock number. Their vocal folds adduct into a pressed phonation that facilitates a high contact quotient between the vocal folds. Acoustically this might present as a percussive aperiodicity from the collision of the vocal cords, having different amplitudes and pitches from the fundamental frequency responding to vocal cord phonation. These aperiodicities receive processing into subjective labels such as "edgy". The label "edgy" in turn may evoke an image of young, rebellious white male. This socio-demographic level of processing may be more latent in some than in others, but en masse commentary on how "black" British Invasion soul singers sound makes a great case for the existence of such processing. The final step in this processing, the image of a young white male may strike listeners as genre endemic to rock. Once again, this is all well and good, but what methods exist to track such sociological psychoacoustic processes?

The hypothetical method proposed by this thesis consists of three prongs. The first prong would be interviewing singers. More specifically, this would consist of exposition to voice qualities in relative isolation. These samples may be obtained from the work of Jo Estill, Leda Scearce and Lisa Popeil. The singers interviewed would give their evaluation of the authenticity of vocal qualities and postures to their genre. Ideally this probing barrage of audio samples evaluation would include the qualities of Estill pedagogy, the postures of Leda Scearce and the anatomical modulations of Popeil. This interview process certainly has room for ambiguity and error, but from the psychoacoustic studies conducted by researchers Edith Miller (2004), Virginia Mallory (1958), David Addington (1968) and John Laver (1968), this route of investigation proves to be worthwhile with the proper analyses. A relatively freer-form interview would then be conducted to understand the performance and pedagogical history of each singer so as to gloss potential impressionistic labels and values of phonatory and articulatory traits. Comparing usages of vaguer psychoacoustic terms, along with digesting vocal data with an audio program such as Praat, could draw powerful conclusions from seemingly esoteric terms. This comparison could derive from stated literature values or instances of the term observed from expert interviews. The next phase of the singer interview would help to further illuminate psychoacoustic interpretation of the singers' genres' endemic features.

This next phase would entail collection of spoken and sung samples. A spectrum of standard vowels would be collected in spoken, sung and belted instances. To contrast, a set of "colored" nasalized, rhotacized and lateralized vowels would be collected in phonetic environments induced by different words. For example the word 'word' may induce a rhotic schwa vowel. Since studies of vocal genres have documented articulatory trends, such as the de-rhoticization of classical singing and the rhotic nature of country music (Zimmer 2006), these samples may be relevant to compare to sung and belted samples on the same word. From here, a sample of lyrics with which the artist is comfortable would be collected as spoken and sung. This would help get a baseline of which phonatory and articulatory features are endemic to the singer and which are potentially performative. For instance, most speakers do not have the "ring" formant in their modal speech voice, yet this formant is almost ubiquitous in operatic singing. Features would be dissected via Praat methods, where current knowledge of Praat is not able to pinpoint features auditory evaluation with control sources. A feature that Praat may not be equipped to easily handle is determining contractility of different sphincters along the vocal tract.
One could ascertain a reading on the formants produced by such contractions, but it may be a lot harder to deduce which sphincter is producing said formant. Finally, a sung sample would be recorded on a single vowel to the tune of a highly canonized melody in order to sterilize genre endemic vocal features from genre endemic melodic features. This last sample would play an integral role in the next prong of the process.

The following phase would serve to extrapolate sociological values from the sterilized vocal samples by mass untrained listener survey. Listeners would hear each sung sample and evaluate selecting among common psychoacoustic descriptors heard amongst the parlance of experts and singers interviewed. These descriptors would include terms such as "ringy", "tinny", "thick", "raspy" that have a higher degree of correspondence to the same underlying features in their usage, according to the aforementioned linguistic researchers. Listeners would then draw links from these psychoacoustic descriptors to different evoked demographics on the spectrum of race, age, class and gender in addition to rating for other such non-vocal traits such as attractiveness. These demographics would then be linked to which genre(s) they evoke together. To allow for maximal thoroughness, features could be linked to multiple evocations. The glue for this piecewise process would be the valuable input of experts.

Experts, mainly pedagogues and voice scientists, may perform cursory analyses of the sung samples obtained for the project. This would be similar to work done by Scott McCoy cited at the beginning of this thesis. In offering these analyses, they may offer more specific evaluations of which phonatory and articulatory features they are employing and what sociological effect those features impart. As well, these experts may help further detail their sources and offer newer information not yet available in the growing field of modern vocal pedagogy.

The potential efficacy of this method rests upon a concordance in the surveys described. As the surveys themselves derive from the previous input of the singers, concordance with the self-evaluation of the singers assigns some level of agency to the vocal behavior of the singers in creating authenticity. Expert opinion can serve to verify this whole process with their sets of experience with singers and critics in the field and point out finer details of these sociological evaluative processes. With the verified concordance of these singers' self-perceptions of their vocal efforts with the input of listeners, a case is made for the construct of authenticity determination laid forth in this paper. In summary, the key aspects of this methodology of proving the authenticity construct are a relative consensus among singers and listeners in psychoacoustic and authenticity evaluation, a expert verification of the codification of vocal behaviors by which this consensus is achieved, and possibly some proof of a degree of communicative agency in singers' selection of phonatory features.

The potential impact of proving this construct is manifold. It could potentially predict trends in vocal stylings, given relevant sociological and psychoacoustic data. The further fallout of this construct is a potential to better keep vocal pedagogy up to date even as vocal styles grow and evolve, with construct acting as fingers on the pulse of trending vocal stylings. It also may help establish a precedent for differentiating elements of vocal authenticity from individual vocal style. More specifically, some features may be more integral to genre while some features may be used as trademark embellishments. All in all, the potential outcomes of this hypothetical construct all follow from its potential predictive power of the features most likely to earn authenticity in a certain genre.

So what might this look like in an applied context, like in the vocal artistry of today? As resources implicated in the execution of the above methodology are not currently available in the
writing of this thesis, this paper resorts to alternative methods. Drawing from linguistic, as well as auditory and musicological resources, it is possible for any average music enthusiast to draw some conclusions about the manifestations of a construct like the one discussed.

In this paper, evaluations of psychoacoustic reception of singers follow from my extrapolated knowledge of vocal features and their impact. Surveying pre-existing sung performances in context could substitute for prongs of the hypothetical methodology laid out earlier. By analyzing estimated vocal features against critical review and audience reception, this paper can roughly simulate the first two experimental prongs mentioned beforehand. Cross-checking this with academic sources, one can simulate the inferring and extrapolating lens of experts. Moving forward, topical discussions of some popular singers and impressionistic insights into their vocal behavior may shed light.

One of the best venues to observe a rapid-fire stream of correlations between phonatory vocal behavior and social interpretations is voice competitions. Fortunately, America has three major voice competitions airing and the UK has two. As both of these countries are fairly diverse with significant ethnic and immigrant populations, judges may be exposed to a fair continuum of diversity of contestants and styles. As a result, the judges may have a propensity for making occasional comments about the translation of vocal features to one or several demographic groups along this continuum of diversity.

One such case may be seen in the 2012 US X-Factor audition of Carly Rose Sonenclar. Even from the outset, the judges express surprise at what seems to be the discord of the phenotypical appearance of Caucasian 13 year old Sonenclar with the persona evoked by her performance of “Feelin’ Good”. The first instance of this startling evocation shows on the face of music mogul L.A. Reid when she executes a rapid melismatic riff on one of her first notes. These melismas, further characterized, occur on a single vowel (/a-a-a-a-a-a/ as opposed to /a-ya-ya-ye-yel/ or /ha-ha-ha-ha/) via laryngeal shakes, and are a melodic trope endemic to older classical and neoclassical styles, as well as some of the African-American diaspora genres that her Nina Simone-popularized song choice evokes. As demonstrated by electroglottographic and spectrographic studies of Lisa Popeil and Johan Sundberg, jazz and rhythm and blues seem to favor this ornamentation. Regarding the actual origin of Sonenclar’s choice of this melisma and its articulation, that remains to be seen, however the dexterity involved in this articulation may translate its prestige roots even when occurring in genres of the African-American diaspora. As the geneses of these styles owe to communities of a different racial and age background from Sonenclar, this may explain the surprise on L.A. Reid's face. The audience, unable to see the judges faces directly or focused on the act, appear to instinctively resonate with L.A. Reid's impression. This may speak to a larger universality of the tendency to on some level impressionistically process the vocal behavior given as described here. She continues on to use high effort qualities such as belt and booming posture, the characteristic lip rounding of booming apparent on her face at several moments. Surges in amplitude levels utilizing these qualities seem to evoke similar responses.

Britney Spears, the first judge to speak, flatly remarks that none of the judges were expecting this performance. Reid, at the close of the number, goes on to remark: "Honey, you may be 13, but your soul is old!" This sentiment of her iconoclast performance echoes in the subsequent incredulous words of judges Simon Cowell and Demi Lovato. It is interesting that L.A. Reid, an African-American music manager behind many popular R&B acts assigns the age disparity to her "soul", and not her voice. This may derive from the usage of the term “soul” to describe features of music endemic to African-American populations. Before definitive
evaluation of the definitive quality of her performance as 'good' or 'bad' is given by the judges, Sonenclar seems to smile. One might speculate that this follows from some unspoken understanding of the evaluation of her performance as authentic. In another context, say the performance of a standard pop number, being called old sounding might be taken as an evaluation as inauthentic. After continuing to remark on the perceived phenotypical-sociological disjointedness of her performance, Simon Cowell explicitly tells her she has "soul". The judges then continue to be incredulous about her age.

The incredulity might stem from specific features during her performance, the vocal tract elongation of booming posture and the thicker fold favoring posture. Vocal tract elongation lowers the fundamental formant, and lower fundamental formants might evoke the physiological and psychological effects of aging on the voice. Thicker folds give off lower co-vibratory formants due to the raised inertia of the denser vocal folds. They also evoke other post-pubertal physiological changes in the vocal folds that endow a tendency towards thicker vocal fold postures. Inferring from the contestant's speech voice, as well as her age, she appears to take some agency in these settings to warrant the authenticity she was assigned as she smiles upon hearing the remarks about her vocal age. Despite this physiological, vocal youth betrayed by her age, her singing features seem to age her according the panel, this further solidifies the notion of some degree of agency in aging her voice while she is singing.

A parallel performance comes in the form of Bianca Ryan's 2006 America's Got Talent audition. Before performing in front of the panel, a pre-recording of Ryan's quick self description includes the notable declaration that she is often told that "a black woman's ghost just got into [her] body" after a sung performance. Assumedly, she is not told this while she is not singing as implied by the adverbial "just" following her performance. Although there are other readings of the adverbial “just”, this one seems the most logical in this context. This evaluation resembles that of the judging panel, to include R&B singer Brandy, who cautions her of the audacity of song choice. Impressed by her treatment of the song, Brandy is in fact the first to rise, moved by the rendition. Her performance suggests the implication of high glottal pressure in favoring settings augmented by the contraction of several sphincters and cavities, namely brassy posture and adduction of the root of the tongue towards the adenoids. As well, she drives against this high-pressure level with thicker fold postures than Sonenclar demonstrates. In addition to these high-pressure qualities, the velopharyngeal port sounds notably slack, to allow for both total vocal tract elongation as well as the higher overtones introduced by nasal resonance. In this elongated tract, Ryan manages to conduct a vibrato with a noticeable range of oscillation and hold relatively high notes down from falsetto into mix and chest registration. Both of these feats may go towards Sotto-Morettini's parameter of perceived effort level.

The song “And I Am Telling You”, originally performed by Jennifer Holiday (as cited by Ryan prior her performance), was popularized by the Dreamgirls musical movie of the same year, 2006. This movie features a performance of the number by Jennifer Hudson, a singer who appears to favor similar vocal features to those employed by Ryan and even Holiday herself. If anything, these qualities are exaggerated by Ryan's predecessors on the song, with more contracted sphincters, wider pitch ranges of vibrato, and more vocal tract elongation. However, the qualities are still far more exaggerated in Ryan than Sonenclar. These three singers, Ryan and the two Jennifer's predating her on the song, may be viewed as a possible "dramatic" soul school of singing counter the "lyric" school of soul singing evoked by Sonenclar, just as Jennifer Hudson may represent this for Beyoncé, following the evaluation of the singer on the music blog site Diva Devotee. Just as the Schwarzerbass dramatic texture more quickly evokes images of
blackness in operatic canon than other lighter flächer, it may be that Bianca Ryan's more dramatic texture evokes a more overt "blackness" than in Sonenclar. Some might argue the same for Jennifer Hudson and Beyoncé. This discussion of differences in levels of vocal "blackness" brings up a notion to receive further attention later.

As for the reception of Ryan's performance, moments of applause tend to arise during higher sustained notes in mix and chest register tempered with a vibrato end. During one such note, Brandy raises her hand to express a measure of what appears to be captivation. She proceeds to shake her head in disbelief on subsequent belted notes. Just as with Sonenclar, following the performance, comments on the age discrepancy abound. A degree of agency seems to linger behind the vocal behavior of Bianca Ryan as she describes her gospel upbringing and habitually selects R&B numbers for her subsequent performances.

On the note of the vocal "blackness" of R&B, this may pose an interesting topic for further discussion. Why is it that dramatic textures displayed by Bianca, Hudson and Schwarzerbasses might be more quickly deciphered as black? Various papers on AAVE (African-American Vernacular English) and AAE (African American English) such as one by Erik Thomas suggest that African Americans speak with a lower fundamental frequency than their Caucasian counterparts (Thomas 2007). This depth of pitch might inspire the vocal tract elongation features of Sonenclar and the lower overtone features Bianca utilizes. It may be that these same features in the lower pitches and overtones characterizing the Schwarzerbass indeed convey a historical precedent for this sense of vocal blackness. A parallel may be drawn between this sort of ethno-cultural thought about phonation and speculation on sources of paralinguistic indicators of Asian-ness. According to empirical studies, late phonation onset and breathiness are associated with Asian-American speakers fluent in English. (Newman 2011) Interestingly enough, both of these studies show a degree of random listeners to pick up on paralinguistic cues of ethnicity. However, how deeply can we read into ethnic patterns of speech when describing vocal patterns? That still remains to be seen as more research turns up.

On the note of subsequent performances, years later, Bianca would undergo stylistic changes in performance: both musical and vocal. Musical changes take the form of acoustic tracks without the production characteristic of her R&B performances, and with the addition of an acoustic guitar with which she poses on her album cover from that era. One performance of her single "In Your Head", at The 10! Show on NBC Philadelphia in 2010, highlights her vocal stylistic changes in conjunction with her image and musical changes. The initial notable difference is the introduction of a rhotic overtone to the majority of the notes, possibly brought on by a slight elevation of the sulcus of the tongue. Other differences include, increase of flip onsets, yodeled offsets, more frequent use of head and falsetto register, lower subglottal pressure, occasional aspirate qualities and creak onsets with a narrow vibrato, if any, at the ends of notes.

Reading from the Sotto-Morettini school of analysis, the majority of these features and the lower effort and intensity levels fall into the pop school of vocal analysis, and her utility of the wispy posture from the Scearce school also seems a firm cross-reference. However, the consistent non-phonological rhoticity begs further commentary. Looking back towards classical pedagogy and "phonology", rhoticity seems like a discouraged articulatory element of diction, and much discouraged diction is dismissed as harsh and uncultivated (Zimmer 2006). The genres that appear to capitalize on these attributes are folk and country. On the YouTube page featuring this video, the top commentary with 220 votes of concordance begs the comparison to the likes of Lady Gaga, Miley Cyrus, and Taylor Swift: all white female singers on the pop charts who have expressed a country and/or folk bent at one point:
Username: Liza Williams: "I love singers like Taylor Swift, Miley Cyrus, Lady Gaga, etc., but it's crazy how she's not very famous and she has a 495849679867 times better voice!"

It is imperative to look at the phrasing of this comment, while Ryan is put in a category all her own, the description "better" seems to suggest that these singers are in the same vein, though of different calibers. This vein is constructed by the similarity of all these singers. Why pick all white female pop singers with country/folk bents when there is a bevy of non-white, non-female, non-pop singers to choose from? The answer seems to be that the writer of this comment has sorted them into the same musicological category. Further supplementing this line of thought is the fact that this track was included in the Twilight soundtrack. This movie has arguably far less R&B culture undertones than Dreamgirls, a movie based off of a musical about a Motown act. While it may be possible that the writer of this YouTube comment has only listened to singers in this category, would not the favoring of that category and the subsequent favoring of Bianca suggest that she is indeed a powerful evoker of this genre?

While this commentary is informal, internet informality appears to be a choice method in collecting candid opinions of regular listeners. As these opinions are candid, their veracity in face of the sociological connotations involved seems more assured.

Maybe the value of lay opinion will make its case better in a case of a mistaken vocal identity. Enter Josh Strickland, former American Idol contestant and reality/Broadway singer. He leaks a single, "Last Dance", that disseminates rapidly on YouTube, but the credit for this success is not initially attributed to him, or even any "him" for that matter.

The credits on several initial postings of the single actually name Christina Aguilera and several renowned DJs such as David Guetta as the artists behind the track. In a review of Aguilera given by Donna Sotto-Morettini, the voice teacher notes Aguilera's predisposition towards thicker fold qualities and favoring of lower registration on higher notes, utilizing chest for belt instead of mix registration other singers use, as suggested by the author of Diva Devotee. In addition, Aguilera ornaments her notes with rumble onsets to which she may be predisposed by the elongated quality of her false folds. (Sotto-Morettini 2006)

These are exactly the features that Strickland emulates on his single, in addition to the feminization of relatively raised laryngeal position. The author of Diva Devotee comments on the similarities and differences stating that even Strickland's "talk-singing" voice evokes Aguilera. Having heard the track and Aguilera's speaking voice, the similarity seems to be evoked by the first utterances in "Last Dance". These utterances lack the ring quality of Strickland's singing on the majority of the track, but there is a distinctive thin-fold laryngeal tilt, aspirate quality in those utterances that evokes Aguilera's texture while speaking.

As has been repeatedly asserted through theory, historical context, and vocal pedagogy, vocal genres can be viewed as sets of vocal features that can be coordinated, to some degree, at the discretion of the singer. The evaluation of authenticity seems to rely on the reception of these sets of vocal features, showing that many listeners are able to sort singers into larger sociological-musicological categories comprised by these genres. In this case however, listener consensus in misattributing the song to a specific singer introduces the notion that listeners may also be able to compromise the evaluation of authenticity to a larger genre construct while recognizing and drawing comparisons between individual identifying vocal behaviors. This too appears to be a point upon which singers and the music industry capitalize as well.
Take the case, or cases rather, of one Tom Waits. According to a 2007 article in the BBC New Entertainment online publication, Tom Waits filed suit against a the forces behind a Scandinavian car advertisement he claims copied his vocal style. He won this case and another several years ago against a Volkswagen-Audi for a commercial appropriating his "[gravelly]" voice aired in Spain. The usage of the vague synesthetic psychoacoustic term "gravelly" appears to refer to qualities in Waits also described by the term rasp. After having listened to Waits and his vocal doubles, the similarity of the impressions to the original was not as impressive as the relative divergence. The voice doubles, and even Waits himself from track to track, all employ various techniques that may be grouped under the terms 'gravelly' or 'raspy'. The grouping of these physiologically unique processes, strohbass, dist, pressed aspiration and rumble/growl, under one psychoacoustic heading suggests that psychoacoustic labels, as well as the socio-demographic labels they appear to evoke, show both specificity and generality in their application. Specifically, a feature can individualize a singer as well as identify them with a larger genre construct. Additionally, multiple features may gloss onto similar psychoacoustic and socio-demographic values. (BBC News 2007)

The values here appear to be that of advanced age and working class. Upon viewing the Spanish Audi commercial, two things become unmistakably salient: the false fold elongated, dist toned, aperiodic vibrato voice of the impostor and the old fashioned working class ambiance. What do these two things have in common? Potentially a whole lot. The video, while high definition, has an almost sepia tinted filter. This is, of course, an artistic measure by means of which the advertisers portray a collage of dilapidated objects in everyday, humble backdrops. For instance, two night-lights shine in a pool filled only with leaves, dirt and residual rainwater. Eventually, the composite of these run down objects suggest the image of a refurbished car. Once this composite is complete, a quote in Spanish reads: “¿Y si las cosas soñaran con una vida mejor?” (Hartmans 1999) This translates to something along the lines of “What if things could dream of a better life?” This further cements the working class undertones of the imagery apparent throughout the short clip.

What does this have to do with Tom Waits' voice? Why are so many advertisers after his voice in the first place? Breaking down the different features of his voice, there is a potentially powerful sociological evocative property that resonates with the content of commercials like these. Firstly, the elongated false fold quality goes against classical instruction and even many modern voice teachers according to Soto-Morettini’s description of the quality. This may stem from the physiological likeliness of the false folds to interfere with regular phonation if they are extended, therefore spread out less densely, therefore more mobile and likely to co-vibrate with the phonation of the true vocal folds. While the classical school may or may not have been aware of this peril when proposing such guidelines against this form of singing, it still stands to reason that going against such guidelines has historically relegated singing forms as uncultivated, and quite probably underclass. Secondly, the adduction of the false folds into the glottal space may serve as a compensatory mechanism for the lesser phonatory amplitude those with weakened vocal fold mobility. Aging can generally cause muscles, including the thyroarytenoid muscles anchoring the vocal folds, to deteriorate. Therefore, it stands to reason that dysphonic use of the false folds by Waits and his impostors evokes the hyper-compensatory nature of false fold addition in vocal aging (Nasri 1996). In short, the elongated quality sounds old. Minus the aging effects, the next salient feature of the Waits impostor, dist tone, seems quite probably spiritual kin to the elongated quality already mentioned.
Dist tone, primarily an ornament of harder rock and blues (Zangger 2004), also possess risk to vocal folds. This may equate the risk of the elongated quality, if not exceed it, as the vocal chords actually come into contact. As such, it may evoke the aforementioned fringe social and class values of those styles. In addition, it clashes with vocal dicta of classical music thereby associating it with the 'underclass' singing forms relegated beneath it. There is a certain straining effort level that may be implicated in continuing fold vibration with the inertial opposition of co-vibratory bodies. Whether this strain is conveyed psycho-acoustically or proprioceptively, strain itself represents the grit and hardness discouraged in classical singing. Returning to the note of vocal aging, the flailing vibrato of the Waits entourage serves as yet another sociological signifier.

It follows that from the aforementioned weakening of the thyroarytenoid muscles in those of advanced age that phonation may not only lose amplitude, it loses consistency. Irregular vibrato, falling outside of the standard of four to eight fundamental frequency pulses per second, as well as other unpredictable pitch variation, jitter, communicate vocal age. It is theorized that the vibratory rate of the weakened vocal folds can correspond to somatic processes such as skeletal muscle movement and autonomic nervous processes such as heart rate (Wilcox 1980) (Orlikoff 1990). As such, there may be a latent carnality associated with this irregularity as well as the advanced age connotation.

Together, these vocal features greatly resonate the grit, antiquity and working class undertones reflected in the video's grimy, sepia toned minimalism. The elongated quality that Waits uses from time to time does in itself evoke Louis Armstrong, predating many styles of blues and a large player in the jazz Waits himself favors from time to time. Additionally, these features and reflected values appear to solidify with his authenticity to his genres: blues, rock and folk, and to his social views. Tracking back to the beginning of this section on Waits, recall that he declined inclusion in the commercial ventures of the Audi, and most other, advertisers. The outright declining of these assumedly lucrative offers may speak to a set of views about socio-economics and authenticity that would brand him as a sell out if he were to indulge such offers. It seems fans expressed surprise at the notion of him actually featuring in a commercial, as that is how the ad first came to his attention anyways. By successfully imitating Waits, the impostor and the advertising firm that hired him successfully evoke the personal values of Waits on top of the values of the genres with which he aligns himself. All in all, Waits commitment to the genres which he performs, including folk, country, and blues, have sensibilities that he might offend by "selling out", implying he has something to "sell" out in the first place (Hartmans 1999). It would seem this thing to sell is authenticity to their genre and demographic values.

So far discussion of singers has shown what features they employ to identify with their respective genres, but what about singers who might move between genres at distinct moments? How does this happen?

On some level, Jamaican dancehall singer Patra might know. One of her major US crossover singles, Worker Man, combines her native tongue and genre: Patois and dancehall, with the broader appeal of more Standard English and pop/R&B.

She reflects the dual genres of the song with a dichotomous vocal performance. On the verses, we have the vigorous glottal onsets, elongated quality, tongue root bunching, rumble and gospel offsets of her Patois speaking dancehall affectation. In this style, she clings to thicker folds and modal and chest register. Reinforcing the intensity of this style is a high closed quotient. This contrasts almost entirely with her vocal affectation sliding in the chorus with her softer pop/R&B styling. Her onsets switch to simultaneous and aspirate, her quality is loftier,
more freed from anatomical obstructions. Additionally, her laryngeal height is elevated, shortening her vocal tract to make a more shallow, potentially feminine, overtone. The registration of these choruses tends to head and falsetto with overtones of the Scearcean whispy posture. Of course, on these choruses, she code switches to the Standard English endemic to the national origins of the genre.

The lyrical content of the verses resonates with this dichotomy. The verses contain more explicit, overt sexual references common in dancehall, while the chorus is more innocent and cutesy like the pop/R&B of that 90's era. Even during the choruses, Patra adlibs in her dancehall voicing to exclaim more overt references to her sexuality over the poppy choral vocal take:

“I have a real man problem
Gotta find a guy who can solve dem (Fi real!)
One who loves to play in
Many different ways (All night long)
I want a real teddy bear
No matter how big I don't care
One who can love me up
And pour juice in my cup (Squeeze me right)”

The dancehall style adlibs are put in parentheses. The cutesy lines of the choruses, referencing things such as “teddy bear[s]”, are sullied by the dancehall style adlibs that expose the innuendos intended by the main lyrics of the chorus.

Patra presents a case of how singers may switch between genres and actually may manipulate the sociological features encoded by different genres and even crossover to different markets.

All in all the composite of these individual cases presents a strong argument for the existence of a central mode of authenticity determination as described by this thesis. In fact, singers may even be capable of manipulating this construct for their own ends. Moving forward, the hypothetical methodology laid forth and methodology akin to it may present options for following future trends in vocal music.

**Summary, Conclusion and Future Trajectories in the Field**

After saying that, let us return to all that has been said. Hopefully through the composite of the brief introduction and imagery, historical context in socially charged vocal pedagogy, introduction of vocal features and their place in music culture, hypothetical methodology, and appreciation of scenes of current vocal behavior the construct imagined by this thesis has come to life. Stated one last time this construct of authenticity set forth by this thesis consists of first, the production of acoustic data from the selection of phonatory and articulatory features, second the assignment of psychoacoustic features to the aforementioned acoustic data; third, these psychoacoustic interpretations translate to socio-demographic values. Finally, these values may then be lined up with the quintessental values of the standard genre singer.

In this thesis Eurocentric classic has been shown to promote and charge features with class, and possibly racial, prestige values. These features include and "open throat" free of "strain" and sphinter constriction, and even non-paralinguistic features such as non-rhoticity and ideal vowels. Next, neoclassical pedagogy responds to a demand for more diversity and
expressivity by addressing different vocal features never before considered, responding to the publicity of cultures and classes outside of the classical sphere. However, neoclassical pedagogy still remains mindful of some of the idealizations held by classical music. These fade significantly as modern vocal pedagogy takes a more scientific approach, considering an ever-wider range of vocal features, even some thought to be taboo. The contribution of linguists and sociolinguists respectively pinpoint and diversify the efforts of modern voice pedagogy, encouraging physiological analysis of more styles. The thesis then applies these tools.

The first application is theoretical. In laying out a hypothetical methodology, the core symptoms of the construct proposed by this thesis receive examination. The second application deals with selected instances of codification of vocal behavior. These instances present as what could be more overt manifestations of the construct set up by this thesis in authenticity determination. All in all, several of the singers listed seem to take some agency in the vocal behaviors they select, capitalizing on an effect they are ensured the features will achieve. This sureness may stem from a relative ubiquity, naturalness and consensus of opinion regarding the nature and outcomes of the proposed authenticity determination construct. In the given examples, the construct is fairly reliably shown to consider race and age in the case of Bianca Ryan and Carly Rose Sonenclar, class and age in the case of Tom Waits and even gender in the case of Josh Strickland. While every permutation of these demographics has not been explored to exhaustion, the work in this field is still very much ongoing.

Various works cited by this thesis, to include the survey of African-American fundamental frequency by Erik Thomas, suggest that there is much work to be done in the future. Personally, I agree, this thesis has been as exhaustive as possible in attempting to find self-contained sources explaining phenomena around the authenticity construct explained here. However, in writing, the majority of my work has been to infer and synthesize from these interesting discussions. Limited discussion has occurred on demographic phonatory features, but only the most cursory analysis has been given as of yet, quick, dry measurements such as breathiness and formants. What about movements of the larynx? What about sphincter and pharyngeal contractility? What about movements in the sulcus and root of the tongue? In other words, unless some stone or grotto has been left untumed, this thesis seems to be one of the first to engage in a direct discussion of the potential sociological, musicological, and ethnological underpinnings of something as ubiquitous yet overlooked as authenticity determination.

I believe I am far from alone in feeling these underpinnings, and my construct, manifest in music culture. I can't count the times I've played "guess the race" or "guess the age" or "guess the gender identity" with singers in the car on the way to high school, and I don't believe my little competition would have been so long entertained if there were no basis to it. Here's to hoping that future research will continue digging, and look at the hard questions on many a mind: "why do they sound black?", "why do they sound fat?" or "why do they sound pretty?" as I believe the resources for such exploits have been around since I first started asking these questions. Thank you for reading, and I hope if nothing else this thesis leaves yearning for an answer to questions like these at least half as much as I am.

Incidentals

On Vocal Beauty
The driving force behind marketing singers, the ultimate goal of many singers themselves, seems to be vocal beauty. What exactly is vocal beauty? There are some characteristics that instill a sense of beauty in the imagined physical appearance of a singer. ‘Harsh’ qualities such as twang may detract from that while the sexuality of creak and aspirate onsets and offsets may add to it. High pitches associated with femininity and low pitches associated with masculinity may too enforce gender norms of attractiveness. However, in recent years we have phenomena such as the sultry Estillilian sob tones of Toni Braxton being seen as sexy, while on the other hand, personal experience has shown women find themselves drawn to the high pitch, thin folded whispy qualities of Maxwell. A steady tone with low rates of aperiodicity, raspiness or other irregularity may connote the biological attractiveness of youth, but the withering pressed aspiration of Kelis appears to contradict this. Therefore, what vocal features encode beauty?

I believe these features are in the ear of the beholder, while my ear has its own preferences, so does any other music inclined ear. In fact, vocal features that encode physiological beauty may not even, in and of themselves, make a composite representation of vocal beauty. ‘Bel’ canto, even containing beauty in the name, appears to focus on the ‘beauty’ of technical soundness rather than any physiological reflection of sexual virility or femininity. As many fans as Tom Waits has garnered, vocal age seems to be far from central to vocal beauty. Bob Dylan’s fans make a case for the lack the of necessity of ring quality and other elements from operatic, let alone most, schools of singing in beautiful voices. On that note, Dylan shows that pitch accuracy is another item that can be distorted even in likeable singers.

In my opinion, I feel people value expressivity in singers, especially when what is being expressed and the mode of expression is something that the listener can identify with. In the spirit of Sotto-Morettini in describing Christina Aguilera, expressivity may be achieved by utilizing a full arsenal of the kinds of vocal features described by this thesis. The knowledge and manipulation of when to use which features, which features work best in unison, and what these features imply sociologically and musicologically bestows true vocal virtuosity in my opinion.

While virtuosity is not beauty, I feel virtuosity transcends the personal tastes involved in the notion of beauty and offers something that can be objectively respected. As the sets of vocal features mentioned are not all encapsulated by one singular school singing, it would seem no one school of singing can claim the rights to absolute vocal virtuosity or even absolute vocal beauty for that matter.

On the Multiplicity of Vocal Feature Interpretation

In writing this thesis, I have attempted to steer clear of over-constraining vocal features with the meaning they may evoke. Inevitably a litany of other factors are at hand when considering the authenticity and unique sound of a singer. Even modern vocalists seem to receive bias in their evaluation based on the way they look, what they wear and their selections in instrumental backing.

However, when given the genre a singer aims to perform, or even the collection of features a singer employs, the potential interpretations of singers’ given features become narrower. Creak voice, for instance, may represent the low phonatory activity of an intimate conversation; this might read as sexuality. On the other hand, in some lounge and alternative genres or shoegaze, creaking may represent a nonchalant delivery of minimal phonatory effort. Further still, in some punk music, creaky voices may represent a defiantly begrudging phonatory effort.
For the sake of ease of reading the dense and under-documented subject matter this thesis has attempted to explain, I have dealt with the interpretations of vocal features that seemed most relevant as the features themselves came into mention. This is not to relegate other interpretations of vocal features to the background, but rather to focus on the relevant readings of vocal features. However, as one can see with the common thread of low phonatory activity in creaky voice, certain features may have some universal underlying physiology that helps color their different meanings in context.

**On the Scope of this Thesis**

As has been mentioned earlier, many factors are interwoven into the complex, but familiar fabric of vocal genre authenticity. I have chosen to tug at the paralinguistic phonatory and articulatory features involved in authenticity determination as this thread feels most integral to the meshwork of everything that goes into determining authenticity. As paralinguistic studies have not received as much academic attention as sociolinguistic studies and musicological studies relating to singing, my resources have been notably limited.

I have considered the introduction of several dialectal sociolinguistics-focused resources in this thesis, but the vast majority of them either did not provide sufficient documentation of the paralinguistic features I am observing or offered disputed features that I felt might not have been necessary to include in this thesis. Finally, as the majority of the sociolinguistics-focused resource documented speech behavior, I felt it necessary to maintain the boundary between speech behavior and singing behavior. There is definitely a lot of intermixing between the behaviors, but many vocal behaviors may be exclusive to singing. Sprechgesang also represents a large intersection between speech and singing, but as the name suggests, this is purposeful and stylistic, not engrained in the same way speech features are.