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The Operatic Polyglot: Routes and Techniques in Western Classical Singing

Abstract of Dissertation

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Abstract

Classical singers encounter many linguistic and phonetic challenges when mastering their instrument, the voice. Pronunciation proficiency in numerous languages is necessary alongside the requirement to achieve native diction. An integral part of voice training for an opera singer is expanding vocal range through the development of vocal registers and manipulation of resonance features to enable altered voice acoustics while balancing accurate diction alongside linguistic and artistic accuracy. Indeed, appropriate vocal resonance is often balanced by phonetic symmetry through vowel production and modifications across the vocal range, regardless of the language. Furthermore, singers manipulate their subjectivity when performing to develop and embody a character or express a sacred, profound, or figurative text on stage. Accuracy of text, declamation, prosody, and phonetics is thus a vital feature of performance mastery.

This paper will speculate and explore possible techniques and practice regimens that can build creative cognitive processes in the singer's practice studio that enhance mastery of phonetic accuracy in the professional opera/ classical singer informed by principles of motor learning, neuroplasticity and fMRI studies. This thesis will investigate approaches to developing linguistic and acoustic proficiency in performers of Western opera, sacred music and art song to become an operatic polyglot. A vital aspect of the performance process is manipulating and adjusting voice across the range to convey musical intent. What explicit approaches can assist singers in integrating phonetic and linguistic accuracy alongside musical accuracy? This research aims to evaluate the viability and sustainability of neurologically informed approaches to voice training in artists, particularly relating to phonetics, pitch and resonance adjustments, as well as prosody and speculates on new approaches to voice, language and artistic interpretation practice techniques for Western classical singers for their daily practice seeking to enhance their phonetic mastery.

Introduction

The capacity to communicate through vocalisation is a fine motor skill unique to primates[1] that is predicated on a range of intelligences, including volitional control of voice behaviours, the ability to imitate and learn heard sounds with one's own voice, the capacity to react and respond to others in a meaningful way using recognisable vocal symbols, the storage and adaption of unique vocal codes among cultural groups and ability to take the spoken word and express it through musical song as a signifier or cultural, ritualistic, spiritual meaning imbued with one's own voice features and characteristics.

It is incredibly complex to define precisely what allows the singer to render their artform expertly since singing is both a cognitive, motoric and affective process and thus contingent on multiple intelligences involving a "complex hierarchical network of cortical and brainstem centres, which integrate feedback from both auditory and somatosensory pathways" (Kleber et al., 2013, p.6070). Furthermore, since "vocal production in speech and singing requires the involvement of more than 100 muscles" (Kleber et al., 2010, p. 1144), numerous functional demands impact a singer's development. The process of overt singing involves the singer's capacity to integrate creative cognition in the practice studio and performance settings with finesse. Artistry for classical opera singers is thus contingent on the successful mastery of multiple intelligences.

Significant research exists which reveals that music-making alters the motor, sensory and multimodal representations of the brain in musicians, and there is considerable support for musicians presenting with higher interoceptive awareness than non-musicians. Since "singers use a more body-centred and visceral nature of music production, involving organs and muscles of vital importance" (Schirmer-Mokwa et al., 2015 p.2)[2], it's hardly surprising that they can control their instruments more accurately than non-singers when auditory

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[1] The ability to learn vocal behaviours is an uncustomary phenomenon in animals. For example, some apes can produce sounds (like lip smacking or whistling) in response to interactions with humans; however, these sounds tend to be produced without vocal vibration and only through the manipulation of supraglottal articulators (Belyk et al., 2017, p.186).
[2] Indeed, creative cognition for singers is a form of embodied cognition.

feedback is removed (Mürbe et al., 2004, cited in Zarate, 2013, p.34) and interestingly, expert-level classical singers may, in fact, rely more on the somatosensory feedback system than the auditory system[3]. This suggests that trained singers achieve accuracy when singing more through a somatosensory feedback system. fMRI studies provide further support for this notion suggesting the need for a finely tuned somatosensory-vocal feedback loop in the development of singing skills (Kleber et al., 2013, p. 6070). Possibly the singers are able to engage in a feedforward model that allowed for correct production in the absence of sensory feedback.

Singers likely have a body memory that stores the motor schema of the complex motor processes required for their repertoire. The concept of the body matrix reconciles the multiple intelligences needed for expert musical performance, subsuming, and uniting the gestalt of creative cognition for the singer.

Creative Cognition and the Singer's Body Matrix

We can propose that the body matrix is the reasoning and processing system that determines a sense of flow in performance and practice for the artist. The Singer's Body Matrix provides a model adapted to singer cognitions and processing necessary for success in the integration of the multiple intelligences needed for creative cognition. This model can be assistive in mapping the hypothetical body memory processes that constitute elite singing, taking into account the multi-modal nature of the singing process.

Defining the Operatic Polyglot

A vital aspect of classical singing is the ability to create accurate acoustic information determined by both the musical score, the historical traditions of the canon of the art form, and the linguistic requirements expected of the singer while simulating the language they are singing in. With this is the expectation that the singer achieves native-like proficiency

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[3] Lametti et al., 2012 found that in speech acts, speakers appear to rely equally, if not more, on somatosensory feedback over auditory feedback (p. 81), refuting the widespread view that audition takes precedence in in maintaining speech accuracy.

phonetically and thus become an operatic polyglot. However, unlike speech, the act of classical singing is dependent upon musical acoustics. The singer that acquires proficiency with the musical and linguistic requirements at an elite level will be referred to in this paper as an operatic polyglot. This is a skill contingent on numerous cognitive domains and competencies of which phonetic accuracy is one small part. The operatic polyglot integrates numerous domains intricately into one gestalt-based system of embodied cognition that relies on multiple languages beyond their singing language. The singer computes and expresses through high-level proficiency in the language of music notation systems, multiple alphabet systems (Latin script, Cyrillic, the International Phonetic Alphabet), understanding of Western classical harmonic language, extramusical terminologies, engaging in the processing of semantics through varying lexicons (French, Spanish, Russian, English, Czech, German, Italian and more), diverse phonologies and phonetic inventories, varying suprasegmental and prosodies, pedagogical conceptualisations as well as an understanding of the language of gesture, non-verbal communication and empathy (the soft skills of singing). In short, singing artistry is by its very nature a multi-linguistic process achieved through communicative competence that goes beyond understanding a second language.

Artistic due diligence and Acoustic Integrity

In performing a vocal work, a singer should apply due diligence to serve the text as much as the rhythmic and melodic notation.

Fulfilment the phonetic segment[4] is the feature that separates singers as unique from instrumentalists and indeed conductors (who are also involved in the sound wave creation process although not overtly contributing to the physical creation of sound by the playing of an instrument.[5]

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[4] This chapter will consider the phonetic segment more than the whole word unit level since failures to be precise at the segment level will account for word-level inaccuracies. Of course, this does not withstand the importance of the word and sentence to the musical phrase, line and artistic expression, but this is a topic for another discussion, possibly in the future.

[5] It would be noteworthy to consider the degree to which conductors rate the importance of the phonetic segment against the metric and harmonic segment since, typically, the latter two are under their jurisdiction. Indeed, one could argue that conductors that omit overt consideration of the accuracy of the phonetic segment might betray the score. Many conductors, however, in maintaining

Phonetic tone tuning

I will refer to the process of representing the phonetic segments accurately as *phonetic tone tuning*. The term phonetic tone tuning has been developed as a unique and new term in this paper to differentiate from diction, pronunciation or speech accuracy training. Phonetic tone tuning is thus a uniquely sung skill, unlike diction-related terms, which tend to disregard musical form's necessary sung sound wave properties.

Motor control systems for phonetic tone tuning

When a singer sings, they rely on 3 core motor control functions:[6] timing, sequencing and spatial organisation of movement. The singer thus counts on their capacity to tune the vocal tract into precise postures and simultaneously create other vocal form requirements (voice quality, the singer's formant, correct pitch, rhythmic and metric accuracy) in an act of super sequencing.

The properties of sung syllables

Sung syllable segments can be composed of multiple variations, which can be best represented by my proposed model of the multi-prismic properties of the singer's syllable (see Figure 3), which is informed by phonetic tone tuning. The modifications to the vocal tract needed for singers to achieve consonant and vowel accuracy in a non-dominant language can be both subtle and drastic, the degree of which is determined by the actual phonetic inventory the singer has acquired to date. For singers to learn the pronunciation features of a target language, they need to understand the impact of micro-movements internally within the vocal tract that result in acoustic change.

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the precision of the rhythmic segments while conducting the singer, may indirectly provide metric feedback that assists in correcting the phonetic segment. The question remains as to whether conductors should go further to learn the phonetics of the text to deliver more specific acoustic cues to the singer in somewhat the same manner that they might request string players to produce a physical gesture correction in the rehearsal space relating to bowing, muting or other. Should the conductor have some jurisdiction in ensuring that phonetic singing is achieved? Alfred Alexander, in his book *Operanatomy: An Eclectic Introduction to the Art of the Conductor, instrumentalist, composer, producer and to score reading (1979)*, refers to this requirement of phonetic singing as "an attempt to achieve the almost impossible: the forming of overtones which can only be sounded under exceptional circumstances" (Alexander, 1974 , p.162).

[6] More will be discussed on suggested parameters for motor learning in the next chapter with reference phonetic tone tuning skills.

Resonance properties in Western Classical Singing

In forming the vowels of the target language, a singer is thus required to consider the phonetic placement of the vowel and the tonal and timbral properties of the vowel. This results in various adjustments in the vocal tract that rely on the singer's ability to make compromises between the structural requirement of the vowel (its anatomical placement in the mouth cavity) as desired in the spoken language and the resonance requisites of the operatic/ classical voice. Expert level singers produce phonations that show distinguishable enhancement of specific frequency partials. As such, this then means that there is a distinct process by which the expert singer acquires the postures of the mouth that achieve both the acoustic spectral quality required by the art form ameliorated with phonetic clarity.

Pitch Value

Vocal music, unlike speech, requires a stringent regulation of pitch, and thus the singer engages additional mechanisms for this process. The syllable has a fixed number of segmental properties that can provide more insight into the nuances and challenges of the expert pitch tuning required at the phonetic tone tuning level.

This dissertation explores three core skills are needed in phonetic tone tuning to maintain the desired pitch values at the syllable segment level for the precision required. Novel terms have been developed to define the complexity of alternating and sequencing complex motor movements for less familiar or demanding coarticulatory contexts for the operatic polyglot.

1) Phoneme Onset Tuning

Phoneme onset tuning is a term used in this thesis to refer to a skilful and precise entry to a pitched phoneme segment at the onset of that segment.

2) Phoneme sostenuto tuning

Phoneme sostenuto tuning is used in this thesis to refer to the singer's capacity to maintain the phoneme segment at a fixed pitch with a sustained duration.

3) Phoneme offset tuning

Phoneme offset tuning refers to the singer's ability to maintain the pitch required at the offset of a voiced phoneme without adjusting the speed at the vocal folds due to changes in pressure and tension.

The Metric or Rhythm Value of Phonemes set to Music

The metric or rhythm value relates to temporal measures of the sound stream encoded on the syllable. This can be measured concretely in seconds or milliseconds; however, it is best considered relative to the syllable values around it, which would be informed by the phrase shape, meter and pulse of the section in the work. The metric value of the sung syllable is informed by its *onset timing*,[7] its *sustained duration*[8] (the total temporal duration of the syllable)[9] and its *offset timing*.[10]

Phonetic Tuning Aberrations

Phonetic tone tuning aberrations that affect the metric value can occur on one or all three elements and would drastically constitute musical errors as much as linguistic and phonetic errors while impacting other elements of the desired multi-prismic properties of the singer's syllable.

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[7] The onset of the syllable is a term used by phoneticians such as Ladefoged (2015) to refer to any consonants that make up the syllable prior to the necessary vowel segment (p. 258).

[8] Sustained duration is not a term from phonetics but has been used in this paper to refer to the total duration of the syllable, including onset and offset. This is different from the nucleus, a term used in phonetics to refer to the vocalised part of the syllable (the vowel), since it references the duration of the nucleus (the vocalised portion of the segment).

[9] The temporal duration can be measured on one sustained pitch or note value or across different pitches and rhythmic values as is in the case of melisma where one syllable is held across a flourish of notes of varying pitches and at times varying note values.

[10] Phoneme offset timing is a term unique to this paper that refers to the fixed temporal moment at which the syllable is completed. This is distinct from the phonetic term- the coda, which is used to denote the final consonants after the nucleus- in that it refers to the rhythmic precision by which the coda is rendered.

Prosodic Stress

Several factors inform prosodic stress[11] in vocal music. Stress is usually achieved by increasing the sound pressure level, sustained duration, varying onset timing variations, or by the singer's timbral modifications.

Sound Pressure Levels (SPL) and Phonetic Tone Tuning

Phonetic tone tuning aberrations may also occur due to the influence of the singer's first language on the target language since each language can have distinct or idiosyncratic different SPL level requirements across phonemes.

Motor Learning, Neuroplasticity, and the Operatic Polyglot

Creative cognition regarding phonetic mastery for the operatic polyglot pivots around motor learning and counts on principles of neuroplasticity. However, singers and their teachers are not students of neuroscience, even if their capacity to refine their art form counts on motor learning- in fact, the daily regime of a classical singer is built around motor learning by virtue of the activity of practice.

The 3 AAAs and their role in Motor Processing

This process relies on the singer to be able to coordinate the following three motor processing behaviours described by Keller (2014): 1) Anticipation, 2) Attention and, 3) Adaption (The 3 AAAs); albeit with incredible velocity and agility. These three motor processing behaviours are vital to the integrity of the motor system and mastery of complex

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[11] Often referred to as the supra-segmental level of acoustic phonetics for speech, suprasegmentals can be transcribed for speech with superscript symbols. Since music notation does not include this type of detail on the syllable unit, singers tend to refer to phonetic transcriptions of target languages to make decisions, particularly around features like primary and secondary word-level stress, vowel length, syllable breaks and linking. However, music notation does have some symbols that do have a suprasegmental impact in the form of slur lines, staccato markings, accent markings, fermatas and even written musical instruction for singing styles like *Sprechstimme* that inform the singer of the instructions that are suprasegmental in nature. Similarly, diacritics for speech tones (levels and contours) denote the suprasegmental information related to the intonation requirements at the spoken word level in tonal languages. Similarly, note positioning on the stave also serves as a form of musical prosody for sung texts. Unlike tonal languages, however, the pitch value of the sung syllable does not provide lexical differentiation between two words with the same phoneme elements (as for languages like Cantonese or Mandarin) but instead serves to colour the setting of text to a melody.

motor skills and can be accountable for reducing error risk if the performer can produce the desired outcome.

The Phonetic Lexicon and the Motor Engram Hypothesis

The singer, when engaging in motor learning attempts to solve their artistic and technical problems in the practice context as well as the performance context retains their attempts to enhance each attempt for mastery. The phonetic lexicon of the opera singer (among other motor skills) is potentially encoded in numerous motor engrams[12] that allow the singer to retain and retrieve the complex movements and sequences needed for singing with speed and accuracy. These motor engrams are potentially coded, corrected, optimised and stored in the singer's motor area arising from interconnective processes in the singer's studio, rehearsal and performance activities.

The role of Deliberate Practice and Practice Studio Resources to boost Creative Cognition in the Operatic Polyglot

Since deliberate practise has good outcomes for an expert's superior performance over an amateur, the classical singer must understand that highly structured activities with specific tasks invented to overcome weaknesses are incorporated early to achieve the incremental build-up of skill.

The Body Matrix Theory

The conceptualisation of the body matrix mode[13] contributes to the sense of flow, accounting for how creative cognition processes (both cortical and subcortical) allow the

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[12] Where a motor engram refers to "memorised motor patterns used to perform a movement or skill, that are stored in the motor area of the brain" (Kent, 2007). The concept of engrams has been present since the term was first coined by Semon (1859-1918) however solid proof of the engram in neural imaging studies has proved challenging, although a paper by Josselyn et al. (2015), does provide evidence of both engrams and the control mechanisms that adjust it through a review of recent progress to locate engrams and cite evidence of their presence particularly through the findings of certain rodent studies.

[13] Although still a hypothetical model requiring more research, the body matrix appears to be the most apt approach to conceptualise and reconcile the cognitive, affective and sensory processes that fire neurologically to achieve elite level classical singing.

singer to "model and predict incoming sensory input to minimise the average of surprise[14]
across the different body representations" (Riva, 2018, p 251).

Intensity and Process

In solving phonetic tone tuning and integrating sensorimotor-based learning in the
practice studio, the singer might do well to consider the intensity and goal of the practice
procedure.

Autoethnomethodology and Practice Related Research

The method of autoethnomethodology in which the artist pursues art as research is a
salient learning approach for the operatic polyglot, given the temporal nature of singing
practice and performance.

Using a research log to scale as an operatic polyglot

The singer can integrate a research log into their daily practice regime to note
insights, processes and difficulties with reference to phonetic tone tuning, thus taking an
autoethnomethodological approach. This log could consider aspects of the multi-prismic
properties of the singer's syllable, accuracy drill tracking and notes for the observation and
self-evaluation of singing targets.

Mirror Work and Video evaluation of Phonetic Tone Tuning

Various phonemes have aspects that can be observed visually on the face which
allows the singer to analyse the visual features of the singing process and phonetic tone
tuning. Once the singer compiles some visual references of what their mouth, jaw and lips
actually do across their range, they can start to correlate other aspects of phonetic tone
tuning according to the multi-prismic properties of the singer's syllable and test hypotheses
and make some deductions about what benefits their artistry (timbre, tone, semantic
expression, articulatory integrity and other factors can be considered).

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[14] The element of surprise could be seen as error risk, where an anticipated or desired artistic outcome
was not achieved. Friston & Stephan (2007) explore how error causes higher free energy, a state that
all biological systems are thought to evade, since lower free energy states are important for survival in
which systems "minimise free-energy by changing its [sic] configuration to change the way it samples
the environment, or to change its expectations" (Friston & Stephan, 2007, p. 417).

Visual imitation approaches

Visual imitation may be an option to further reinforce further the development and differentiation of the phonetic placement features of the visible features of unique sounds and placement features of the target operatic languages through careful observation of native language singers.

Paced timing drills for speed enhancement versus sequential drills to strengthen coarticulation of phonetic targets

Given that researchers found the development of alternate motor engrams in speed pressure tasks versus accuracy focused tasks, the phonetic tone tuning would benefit from the implementation of both approaches to strengthen the motor circuit and reduce predictive error.

Paced timing drills

Graded timed drills could also be used to induce time-based pressure in order to enhance the phonetic tone tuning skill and learning in order to emphasise a higher level of predictive timing vital for agile performance accuracy.

Sequential drills

Sequential drills to strengthen coarticulation should also be considered where the singer adapts their overt singing into tracking the sequences in the motor movements and phonetic placement targets at the varying syllable levels. This approach may be best informed by mental planning of the sequential movements using the multi-prismic properties of the singer's syllable alongside detailed mapping of the syllable properties building up to phrase level.

Soundwave analysis and computer assisted pronunciation devices

Visual processing and sound accuracy can also be stimulated by analysing the visual features of the waveform using computer assisted pronunciation devices and recording software.

Use of such software in the music practice context could enable the classical singer to reference a visual representation of the physical properties of the soundwave in terms of sound pressure levels, voicing onset and offset and peak prominence to differentiate between their native speech patterns and attempts to produce the phonemes of non-native languages.

Pitch tracking

Pitch trackers and tuners can be downloaded as mobile apps and can provide in situ feedback with reference to the pitch accuracy of sung tones.

Phonetic transcription

Transcribing IPA information onto the score can serve as a visual reminder to focus on the correct phonology of the language in question. For this to be effective, the singer needs to inform themselves in detail of the phonological requirements of the sung language and may need more specific insights from a diction coach proficient in the language or to refer to various gold standard manuals and textbooks for singing pronunciation[15].

Cross-sectional inventories

By locating the phonemes absent from their personally calibrated phonetic inventory, the singer can start to incorporate these targets into their daily practice to build agility and accuracy in rendering the targets according to the principles of the multi-prismic properties of the singer's segment.

Phonetic placement manipulation

Liaising between phonetic targets that are neighbouring while overtly singing to increase valving ability as well as sensory and auditory insight into variations of manoeuvres and their impacts on tone.

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[15] Renowned texts that provide extensive information on the phonetics and phonology of Western classical singing include books such as Nico Castel's extensive opera libretti series, Timothy Cheek's definitive guide, "Singing in Czech: A Guide to Czech Lyric Diction and Vocal Repertoire" (Cheek, 2001) and Pierre Bernac's "The Interpretation of French Song" (Bernac, 1970) to mention a few.

Tapping tasks

Singer's may benefit from engaging in tapping tasks to improve their rhythmic accuracy and understanding of their target language's prosody features.

Motor imagery tasks and silent practice

A singer engaging in motor imagery practice with the goal of finessing phonetic tone tuning could focus on rehearsing mentally without moving in an act of silent rehearsal with the articulators and vocal tract with the attempt to integrate numerous modalities to prime their skill. This could be achieved through evoking aspects of the body matrix model since it integrates the numerous modalities required for singing. While motor imagery practice is not a replacement for the motor gains of deliberate overt singing practice, it is likely to strengthen and refine the neural correlates of singing and create deeper creative cognition for the singer.

Kinaesthetic Motor Imagery and maps

A singer might find it helpful to create kinaesthetic motor imagery maps for the placement patterns and sensate movements across an entire area or text, considering the impacts of the vocal tract and resonance tuning in addition to the physical sensation of movements that inform the prosody and metre of the text in question against the pitch and harmonic demands of the piece.

Contributions and Further Considerations

This paper has explored avenues for developing the practice studio of the classical singer to support their independent daily regime with tools and approaches to develop into the operatic polyglot. After discovering the growing research base into the neural correlates of classical singing, further research into the impact of cognitive processes in classical singers and the unique to neural correlates aligned to elite singing provide scope to considering whether the unique processes and skills acquired by professional singers can be used within a therapeutic space to benefit neurological impairment that is affecting the body-core centred motor and anatomic activities where there is an overlap between singing and

daily function (social communication, respiration, phonation, articulation, salivation, ingestion).

List of Contributions

- This doctoral thesis examines the **cognitive and mechanical processes** that Western Classical singers can deploy in their practice studio within the niche skill of tuning their voice mechanically to the pronunciation standard valorised by the tradition to be phonetically accurate. The text discusses the cognitive, scholastic and motoric processes that underpin the accuracy of text, declamation, prosody, and phonetics as components of performance mastery. It builds on the definition of creative cognition for opera singers as a term to describe singer sentience and the physiological mastery of their instrument.

- The author proposes a **hypothetical model to represent the multiple intelligences of classical singing**, selecting Guiseppe Riva's Body Matrix as an appropriate tool to explain the singing process and adapting the matrix to create a specific Singer's Body Matrix that attempts to represent the multimodal processing involved in the act of singing. The Singer's Body Matrix can be assistive in mapping the hypothetical body memory processes that constitute elite singing, considering the multimodal nature of the singing process. The model is by no means prescriptive but can be used to consider the variables at play when a singer attempts to tune their mechanism and develop the elite cognitions required for skilful singing, with particular focus on the purposes of this paper, the development of phonetic tone tuning precision. The Singer's Body Matrix could be used to explore other niche skills required in the training and development of elite-level classical singing, not only at the research level to inform various hypotheses for testing how the brain sings but also in the singer's studio as a framework for understanding the multiple intelligences that allow for artistic master more holistically.

- The author has created a **new term, operatic polyglot, to refer to the elite singer who has acquired the technical mastery of singing adeptly in languages other than their mother tongue** with the expectation that the singer achieves native-like proficiency phonetically, balancing the parameters of spoken language and musical language while vocalising in a domain that is exorbitantly disparate from producing spoken words.

- The author has delineated new parameters for sung pronunciation by defining the **sung syllable's multi-prismic properties, showcasing** the unique features and requisites of sung syllables distinct from spoken syllables. Classical singers need to grasp the multi-prismic properties of sung syllables to reach elite mastery. These new parameters for sung syllables successfully embed sound pronunciation into the acoustic, linguistic, harmonic and metric expectations of elite classical singers.

- The author has developed a new term, **phonetic tone tuning, to capture a uniquely sung skill distinct from diction, pronunciation or speech accuracy**, but instead denoting the vital process by which the elite opera singer produces accurate phoneme targets embedded within the distinct overtones and resonance properties required of Western classical singing, involving vital acoustic properties that are not always present in the speech signals as well as meeting the rhythmic and harmonic parameters of the musical and original language. The process of phonetic tone tuning is unique to opera singing. The term is unlike diction and articulation-related terms, which tend to disregard musical form's necessary sung soundwave properties. The author has outlined three skills specific to the physical properties of sung sound related to phonetic tone tuning accuracy: mastery of phoneme onset tuning, phoneme sostenuto tuning and phoneme offset tuning.

- The author has developed a classification system for phonetic errors that corresponds to rhythm and intonational aberrations so that artists can articulate their technical goals relating to phonetic tone tuning with clarity and precision and gain awareness of the equal importance of phonetic tone tuning to rhythmic and intonational accuracy.

This **classification system for phonetic tone tuning** breaches that classical singers can face while striving for mastery as an **operatic polyglot** should assist with aiding risk prediction by creating a framework for self-evaluation and a deeper understanding of how phonemes exist within the soundscape of sung music. The key phonetic tone tuning errors can be grouped under three categories: Phoneme Onset Tuning Errors, Phoneme Sostenuto Tuning Errors and Phoneme Offset Tuning Errors. It is hoped this thesis gives singers a vocabulary to define their technical goals and objectives in becoming an operatic polyglot and eminent elite artist with technical and artistic prowess.

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