The Tongue: Vowel Formation

by

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Proper comprehension and control over the tongue is key to developing the healthy, fluently communicative singing voice, as it can be the most important contributor to these objectives, but potentially the largest inhibitor. The tongue plays a large role in singing, and it must be efficiently “tamed,” similarly to how one studies the techniques of respiration and phonation. The muscles of the tongue are responsible in everyday life to move food around the mouth aiding in mastication, and to guide food to the back of the oral cavity for swallowing; in regards to speech and singing, the tongue contributes further. Articulation, timbre/color control, shaping of vowels, vowel modification, placement of tone, and adjustment of overtones are examples of the responsibility that the tongue has on the creation of vocal sound. With these responsibilities comes possible detriment to tone and vocal sound production by improper usage of the muscles of the tongue. Any manipulation of the vocal tract affects ones sound positively or negatively, so it’s important to address the functions of the tongue. Because the tongue takes up a majority of the oral cavity and its floor, it too easily becomes a tool to improperly manipulate the voice by introducing tension into the muscles, resulting in an artificially modified timbre of the voice. Learning how the tongue should properly participate in the development and production of sound is key in establishing a healthy singing voice, and one that is able to freely communicate and express as needed.

The tongue is found situated on the floor of the oral cavity, and extends from its tip where it rests against the lingual surfaces of the lower arch of teeth to its root where it connects with the hyoid bone by the hyo-glossus and genio-glossus muscles. The dorsum, or upper side of the tongue, is a curved muscular surface divided into two symmetrical halves by the median sulcus.

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This sulcus, or groove, runs down the dorsum of the tongue to about 2.5cm from the tongue’s root to the foramen cecum where it is met with the sulcus terminalis, running laterally to the sides of the tongue. The posterior portion of the tongue below the sulcus terminalis, also known as the root or the base, looks down to the throat, is smooth in texture, and is covered in muciparous glands (responsible for secreting mucus) and lymph follicles. The anterior portion above the sulcus terminalis, also known as the apex, looks forward to the teeth and is comparatively thinner and narrower. It comprises approximately two-thirds of the tongue’s mass, is rough in texture, and is covered with papillae, most of which contain the taste buds.\(^2\) The interior surface, or under surface of the tongue is connected to the mandible by the genio-glossus muscles and exhibits mucous membranes that stretch from the lingual surface of the gums to the center of the interior surface, forming a distinct raised fold called the frenulum linguae. The tongue’s apex, dorsum, sides, and part of its interior surface are all unrestricted and free.\(^3\)

The tongue is divided laterally by a fibrous septum which extends the length of the tongue and is fixed to the hyoid bone below. The two halves contain both extrinsic muscles, which have origins outside of the tongue, and intrinsic muscles, which are contained entirely in the tongue mass. The extrinsic muscles are responsible for general direction and movement of the tongue; they include the genioglossus (protrusion), hyoglossus (depression), chondroglossus (arguably part of the hyoglossus, as it shares a similar function), styloglossus (elevation and retraction), and the Palatoglossus. The Palatoglossus is often associated with the soft palate rather than the tongue, but plays a role in the development of the singing voice, as it is responsible for depression of the soft palate, elevation of the back of the tongue, and movement

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\(^2\) Gray, 1722.
\(^3\) Gray, 1721.
of the palatoglossal fold ("pillars of fauces"). The four intrinsic muscles run along the length of
the tongue, and are responsible for altering the shape of the tongue, shortening, narrowing, or
curving in certain directions. The *Longitudinalis superior* deviates, elevates, and aids in
retracting the tip of the tongue. The *Longitudinalis inferior* is similarly responsible for the
general shortening of the tongue. The *Transversus* narrows and lengthens the tongue, while the
*Verticalis* broadens and flattens it. Together, these eight muscles are coordinated to create
seven articulatory functions and configurations of the tongue during phonation. These seven
functions are the true limits of the tongue, so it’s important to understand that all articulations
boil down to these seven gestures. William J. Hardcastle identifies them as:

(1) horizontal and (2) vertical movements of the body of the tongue; (3) horizontal and
(4) vertical movements of the tip-blade of the tongue; (5) convex-concave configurations
of the tongue body in relation to the palate; (6) central grooving throughout the entire
length of the tongue; and (7) spreading or tapering of the dorsum of the tongue.

As can be seen by inspecting the physiology of the tongue and its musculature, it is clear
that a pedagogical approach to understanding how to efficiently use the tongue in vocal
production is best. Misuse of the tongue can result in not only poor execution of consonants and
vowels, but also can negatively impact the laryngeal positon, effect the rate of vibrato, cause
excessive nasality in the tone, create a squeezed “knödel” timbre, disrupt a singers legato line,
cause tensions in the jaw or neck, as well as lead to muscular tensions elsewhere in the body that
will lead to less than ideal vocalism. Generally speaking, unclear vowel execution and
inconsistent or unclear timbre are a result of a tense or muscually active tongue root, the region
below the *sulcus terminals*. Because the tongue shares muscular connection with the hyoid bone,

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4 Gray, 1723-4.
5 Gray, 1724.
as do other components of the singing voice, tensions are spilled from muscle to muscle, as in a domino effect. McCoy explains this concisely:

The hyoid bone also is the attachment point for the base of the tongue, several muscles of the jaw, and several muscles that are important for swallowing. Unfortunately, this situation can lead to technical problems for singers. Many structures important in singing share attachments to the hyoid bone; improper postures and tensions therefore easily are transferred from one location to another. This is particularly true of jaw and tongue tensions, which are passed directly down to the larynx. 8

To find where the errors in tongue usage begin, it is important to understand the neutral, relaxed position of the tongue, before onset of tone occurs, at the inhalation of air. Manuel Garcia’s description of this position is clear and concise; “The mouth should be opened by the natural fall of the jaw. This movement, which separates the jaws by the thickness of a finger and leaves the lips alone, gives the mouth an easy and natural form. The tongue must be kept limp and motionless, neither raised at the point nor swollen at the root.” 9 Carla LeFevre speaks in a more technical language that singers may find more tangible:

For a neutral position, allow the jaw to hang loosely without opening the mouth more than is necessary to speak the vowel [ɛ]. This is also an effective way to find an alignment for the jaw that is neither too far forward, nor back. The tongue should lie weightlessly in the floor of the mouth. Depending on the length of the tongue, the tip should rest comfortably at or on top of the bottom front teeth, and the middle portion should be positioned for the neutral vowel [ə]. At this point, we aren’t talking about placement in mouth specifically, but rather the idleness or limpness of the tongue at rest. 10

In this position of rest, the tongue takes on an appearance that is soft, limp, wide, and covering the floor of the mouth. The tongue has a slight curvature or arch in its shape, and is not pressed down flat to the bottom of the mouth – it simply rests and maintains its fullness.

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10 LeFevre, 157.
There are differing views on this neutral position, most of which for pedagogical reasons are not beneficial, and as McCoy stated, lead to tensions passing down to the larynx and jaw. These techniques are normally introduced and defended by the incorrect belief that manipulation of the tongue mass will create a larger, richer sound due to altering the acoustical space by means of engaging extraneous muscles in what should be a relaxed, muscularly inactive position. The desire to manipulate the muscles of the tongue in this fashion is usually due to the wish to create a larger sound than the singer is capable of producing healthily. Shirlee Emmons succinctly describes variants on the natural tongue position that are unfavorable by pedagogues and also singers that have suffered from them.

Putting the tongue tip at the root of the bottom teeth produces a dull sound. Pulling the tongue tip up and back distorts all the vowels. Pulling the tongue back into the mouth forces the larynx into a very low position, delivering unclear diction and a muddy sound, if a darker one. Pushing the tongue tip against the back teeth makes for harsh and tinny timbre.11

Carla LeFevre elaborates further on the technique which involves pressing the tongue to the floor of the mouth. “These singers often have the misconception that they need to push the tongue down out of the way to create a feeling of space. Students should be instructed to avoid pressing the tongue down to a flat position in the floor of the mouth, and instead to allow it to have a thick, full presence in the mouth.”12 This excessive engagement of the hyo-glossus and stylo-glossus muscles tense up the root of the tongue, which creates direct pressure onto the vocal cords in the larynx due to its close proximity to the laryngeal structure by means of the hyoid bone. This pressure on the glottis inhibits a healthy, free functioning crico-thyroid muscle, or the

12 LeFevre, 157.
vital muscle responsible for the tilt and stretch of the vocal cords needed to access a singer’s upper range. New York City based pedagogue David Jones goes further in depth into this harmful technique of the flattened and retracted tongue. “One need only look at the true shape and physiology of the tongue structure (see p. 48 in Richard Miller's *Structure of Singing*) to see

![Longitudinal section of the “Voice Organ”](image)

that if the tongue is flattened or pulled back, then the back of the throat or the pharynx is filled with the back mass of the tongue.”

He refers to this resulting sound as an inauthentic resonance, or one that is manipulated to achieve a specific sound that is detrimental to the vocal

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health of the singer, in time leading to a wobble or inconsistent vibrato in the tone due to wearing
of muscles such as the crico-thyroid. “If the tongue is flat, then the mass of muscle at the back of
the tongue (tongue root) is forced into the pharynx. This fills up the primary resonator (pharynx)
with tongue mass which can be compared to singing with a pillow in one's throat.”

Richard Miller suggests another problematic tongue posture that will lead us to the next
topic of interest, which is proper placement for the specific vowels. Holding the tongue in a
raised position where it consistently approximates and makes contact with the upper molars will
result in an excessively brilliant, bright timbre, as this position augments the higher overtones
that we find in the vowel [i], which requires this high arched position of the tongue. “Each vowel
has recognizable predominant formants (acoustic energy peaking) that distinguish it from other
vowels; that characteristic gives each vowel a unique spectral appearance, independent of the
spoken or sung fundamental (pitch).” We must not lose the natural positioning of the tongue,
or excessively alter the essential positioning of the tongue that properly coordinates these
formants which create the specific vowels we want to create. It is the shaping of the resonator
tube, or vocal tract, that “produces prominent distributions of acoustic energy, a phenomenon
that has led to the identification of two frequency maxima called formants, for each vowel
sound.” Vowels can be categorized as being lateral or rounded, according to their acoustic
formation. The former is distinguished by raising the posterior portion of the tongue, and the
latter distinguished by a low anterior portion of the tongue. Miller references two charts that are
particularly useful in his book Training Soprano Voices, presented below.

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15 David Jones, “Damaging Vocal Techniques,” The Voice Teacher, accessed June 17, 2014,
16 Miller, On the Art of Singing, 229.
17 Miller, The Structure of Singing, 50.
18 Miller, On the Art of Singing, 12.
As can be seen in these images, the arch in the dorsum of the tongue mass is what is largely altering the vocal tract and how the sound will resonate, thereby producing varying vowel sounds and timbres. The tip of the tongue, which is largely responsible for articulation of consonants, is not involved in the vowel making process, and assumes its neutral, relaxed position, resting at the lower teeth.

The location of the arch of the tongue is what enunciates the vowels and shapes the vocal tract, arranging the specific formant frequencies required to create the quality of the designated vowel. The flexible relationship between the volume of the oral cavity and the pharynx are what fundamentally alter the harmonic spectrum and establish the vowel’s formants:

In the vowel [i], the elevated frontal tongue posture diminishes the volume of the mouth,

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thereby increasing pharyngeal volume. As a result, the formant in the upper portion of the spectrum rises. ... Contrariwise, when the back of the tongue rises toward the velum, as in the vowel [u], and pharyngeal volume is decreased and mouth volume increases, the lower formant is strengthened.\textsuperscript{20}

When the tongue doesn’t assume the positions necessary to form the needed formant foundation for a specific vowel, the vowel will then become distorted. With the problematic tongue posture that Miller pointed out, where the tongue maintains a high arched position, touching the molars, the positioning of [i] and the formant structure therein is superimposed on whatever vowel is intended. The vocal tract then must be altered to compensate for the improper tongue placement by means of excess muscular tension in the larynx.\textsuperscript{21} However, these tongue positions for the vowels are basic positions, and depending on the range in a singer’s voice where the specific vowels lie, adjustments must be made to the vowel by altering the vocal tract so that the singer may find the most comfort in the vowel on the given pitch. One can adjust the vocal tract to tune the formants involved by modifying the position of the tongue from the “pure” positions suggested by the images above, or by modifying the oral cavity’s volume, which can be done by puckering the lips (increasing volume of oral cavity) or by spreading the embouchure of the mouth (decreasing volume of oral cavity).\textsuperscript{22} This introduces the concept of formant tuning which is beyond the intended scope of this paper, but is vital to study and understand to best master the art of singing.

The Italianate vowels, [ɛ] [e] [i] [u] [o] [ɔ] [a], serve as a foundation for many pedagogues and voice teachers when training the singing voice if they are formed to a pedagogical standard that frees the tongue from excess tensions or muscular activity unlike the

\textsuperscript{20} Miller, \textit{On the Art of Singing}, 258.
\textsuperscript{21} Miller, \textit{On the Art of Singing}, 258.
\textsuperscript{22} McCoy, 41-2.
“incorrect” scenarios as described above. Maria Lindberg-Kransmo, a former student at University of North Texas, references a chart published by E. C. Schirmer Music Company that displays the general formation of the Italianate vowels in her dissertation.

![Chart of Italian Vowels](image)

The [i] vowel, as in the English word “meek,” is considered by many to have the potential to be the most unrestricted vowel, as the tongue is in its most arched position, making contact with the upper molars. This results in the anterior portion of the tongue not absorbing the sound, as it would be (as Miller stated) with the tongue being flat, creating the sensation of a pillow in one’s throat, and consequentially muffling the sound. As with all Italianate vowels, the apex/tip of the tongue rests at the lower teeth, and the dorsum of the tongue is wide and limpid.

Because the tongue is forward and constricting the oral cavity, this vowel is referred to as a “foward, closed vowel.”

The [e] vowel is formed by the front of the tongue being brought forward, close to the

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23 Maria Lindberg-Kransmo, “The Influence of the Tongue on Vocal Production” (PhD diss., University of North Texas, 2002), 53.
24 McCoy, 42.
roof of the mouth. The tongue is not as high as it is required to be for [i] (“meek”), but not as low as necessary for [I] (“in”). This vowel has no true equivalent in English, but it can be compared to the pronunciation of the word “bacon” in a Canadian dialect. Scott McCoy suggests the English word “chaos.” 25

The [ɛ] vowel is formed similarly, with the arch of the tongue is brought forward in the mouth, elevated midway between the floor and the roof in the mouth. This too is used widely as a means of relieving the tongue from excess tensions, as it is comparable to the tongue at its rest position in a neutral vowel. 26

The [a] vowel now introduces the necessity of rounding the lips and vocal tract, as the tongue is less involved in the formation of these open, back vowels. 27 The tip of the tongue remains at the lower teeth, and the dorsum of the tongue is low in the mouth, while still maintaining somewhat of a subtle arch close to the pharyngeal wall. The open o vowel [ɔ] (“thought”) is more rounded than the [a], and one must be sure not to incorporate a diphthong to the release of this vowel, which is very common in the English language, but must be avoided in the Italianate pronunciation. 28 The proper pronunciation of [o] (“boat”) requires the lips to become more rounded yet, and the tongue’s dorsum remains low. The lips at their most puckered state will produce the [u] vowel (“boot”), and the arch of the tongue rises slightly as to achieve a more forward timbre as it is formed in the Italian language.

The position of the arch of the tongue being close to the pharyngeal wall poses a problem for some singers who have a strong gag reflex, and because of this, the tongue may incorrectly

25 McCoy, 43.
26 LeFevre, 157.
27 McCoy, 44.
move forward on these back vowels. This results in a jutting of the tongue and potentially the jaw as well, due to their shared muscles, tissues, and ligaments.\textsuperscript{29} The jaw for all of these back vowels should have the ability to “hang in the position of [ɛ], regardless of the actual vowel.”\textsuperscript{30}

Clearly, the spectrum of vowels extends far beyond the generally Italianate vowels that have been discussed here. It is with these foundational vowels, [ɛ] [e] [i] [u] [o] [ɔ] [a], that we are able to study and comprehend the central concepts of tone production and its direct involvement with the tongue mass. The principles that these Italianate vowels address should inform, for example, diphthongs of the English language, mixed vowels of the German language, or any more exotic vowel sounds that give a language its particular sound. The further study of these more complicated vowel sounds “require more care in order to produce the correct proportion, balance, or combination of the respective sounds which form the vowel or diphthong, whilst preserving in full measure the identical volume or tone and beauty of timbre that would be obtained upon the single ‘free’ Italian vowel.”\textsuperscript{31}

Understanding the proper usage of the tongue is certainly one of the most vital factors to developing a healthy singing voice. The art of singing is first and foremost a communicative art, and the tongue is largely responsible for formation of vowels and consonants. Improper usage of the tongue such as extraneous involvement of any of the eight tongue muscles can negatively affect timbre, pitch accuracy, breath management, and most importantly, a singer’s ability to communicate directly to the audience without unnecessary distraction. Without mastering the muscles of the tongue, one will have unlikely success at mastering the art of singing.

\textsuperscript{29} LeFevre, 160.
\textsuperscript{30} LeFevre, 160.
\textsuperscript{31} Garcia, 46.
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