

A Sketchbook Atlas of the Vocal Tract

THIRD EDITION

Cheri Montgomery

Presentation slides: [Link available with purchase](#)

S.T.M. Publishers
Nashville, TN

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A Sketchbook Atlas of the Vocal Tract, spiral, 3rd edition
 ISBN 979-8-9898107-0-3

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Preface

A Sketchbook Atlas of the Vocal Tract is designed to help students gain articulatory awareness. It was written for singers, but has a broad range of practical applications. The visual-based approach makes it ideal for ESL studies or speech therapy. Readers discover accurate pronunciation by learning how breath and tone flow through the unique vowel and consonant formations of the English, Italian, German, and French languages. Sketch pages engage students in the learning process. The third edition contains improved images and additional units that cover airflow trajectory and the muscles of the tongue, lips, and palate.

Topics are organized according to point of contact. The first unit contains an overview of articulatory phonetics. Following units guide the reader through the major contact points: from bilabial consonants and front vowel formations, to glottal consonants and back vowel formations. Vowels unique to English, German, and French are introduced in the final units. Access to full color images, enunciation instructions, links to audio examples, and sketch pages are included. The novel method of charting vowels clearly identifies the unique formations that shape the vocal tract. This chart was introduced in two articles: *Diction (Still) Belongs in the Music Department* and *Defining the Schwa for the English, German, French, and Russian Languages* published in the *Journal of Singing* (National Association of Teachers of Singing).

The International Phonetic Alphabet (IPA) is applied throughout the text. It is the standardized system for dictionary transcription and in use by educational programs throughout the world. Many students outside the U.S. are familiar with the IPA. For those new to the IPA, the symbols are easy to learn and closely align with spellings of the European languages. A free listening lab, IPA charts, and recommended resources are available at www.stmpublishers.com.

The transcriptions in this text are based on rules established by standard textbook authorities: Madeleine Marshall for English, Evelina Colorni for Italian, William Odom for German, and Thomas Grubb for French. Students are encouraged to sing the sample words. Singing slows down the articulatory process and releases the jaw providing more space to discover formation.

The contents of this book represent years of experience gained from teaching voice and the English, Italian, German, and French lyric diction courses at the Blair School of Music at Vanderbilt University. Research as

Preface Continued

author of *The Singer's Daily Practice Journal*, the *Lyric Diction Workbook Series*, articles published in the *Journal of Singing*, and co-authorship of *Exploring English Lyrics* published by Rowman & Littlefield and *Exploring Art Song Lyrics* published by Oxford University Press served to further develop the concepts outlined in this text.

The voice is a phonetic instrument. Vowels and consonants are the basic elements of languages that serve as tools for vocal discovery. It is my hope that this workbook will help students enjoy the lovely sounds that are uniquely designed for the human voice.

Cheri Montgomery

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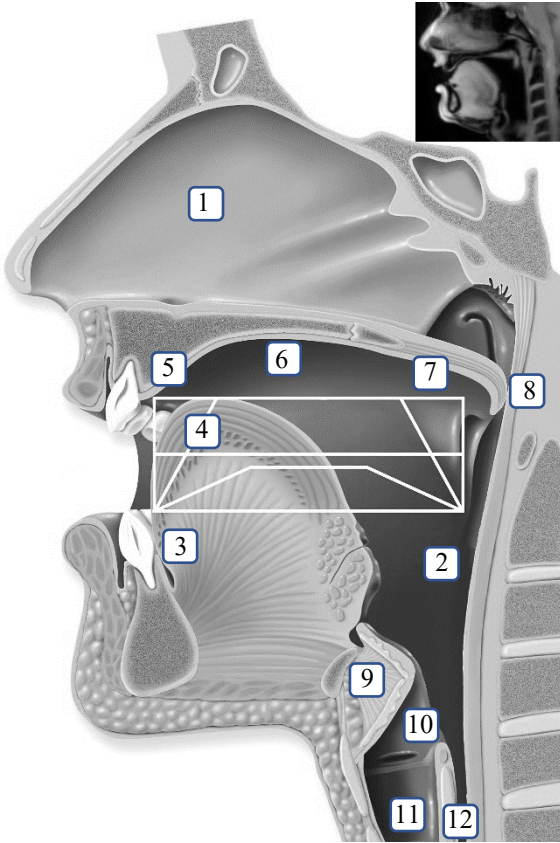
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UNIT 2:

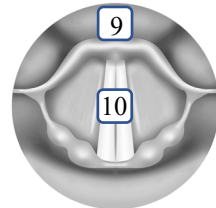
Steep closed front [i] and bilabial [p] and [b]

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STEEP CLOSED FRONT [i]



1. Nasal cavities
2. Pharynx (p. 144)
3. Tongue tip
4. Tongue arch (p. 12)
5. Alveolar ridge
6. Hard palate
7. Soft palate
8. Uvula
9. Epiglottis
10. Vocal folds
11. Trachea
12. Esophagus



Description. The term *front vowel* refers to a vowel that is formed with a forward tongue arch. Closed front [i] maintains the most forward arch of the tongue. In speech, front vowels are enunciated by spreading the lips. The singer must learn to release the jaw and form front vowels with the tongue (not lips). Front vowels are also called tongue vowels.

Enunciation. Release and lower the jaw. Find the space of *ah* without spreading the lips. The tongue tip touches the lower front teeth, the front of the tongue arches *far* forward, and the sides of the tongue contact the length of the upper molars (to the eye teeth). Raise the soft palate and direct vocalized tone toward the upper front teeth.

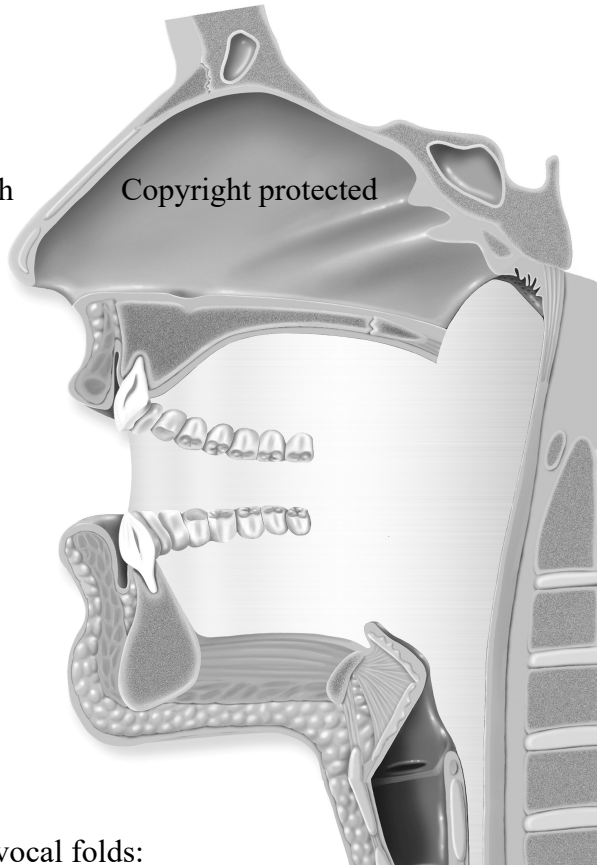
Warnings. Form [i] with the arch of the tongue (*not* by spreading the lips). Do not replace [i] with [ɪ]. Avoid the low placement of [i] in spoken English. Do not mask the brilliance of [i] by making it dark or covered. Avoid a nasalized tone. Maintain an unaltered formation of the vowel throughout vocalization.

Examples: *eve, reed, seat, eagle, dreamer, pleading*

VOWEL WORKSHEET

Sketch the tongue and palate formation of steep closed front [i] and label the numbered points of the vocal tract:

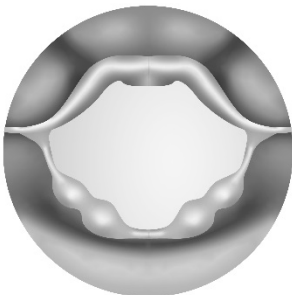
1. Nasal cavities
2. Pharynx
3. Tongue tip
4. Peak of tongue arch
5. Alveolar ridge
6. Hard palate
7. Soft palate
8. Uvula
9. Epiglottis
10. Vocal folds
11. Trachea
12. Esophagus



Full color image:



Sketch and label the vocal folds:



Draw a dotted line to indicate the airflow pathway through the vocal tract. Mark the narrowest point of airflow with an x. See page 180.

ORAL CAVITY

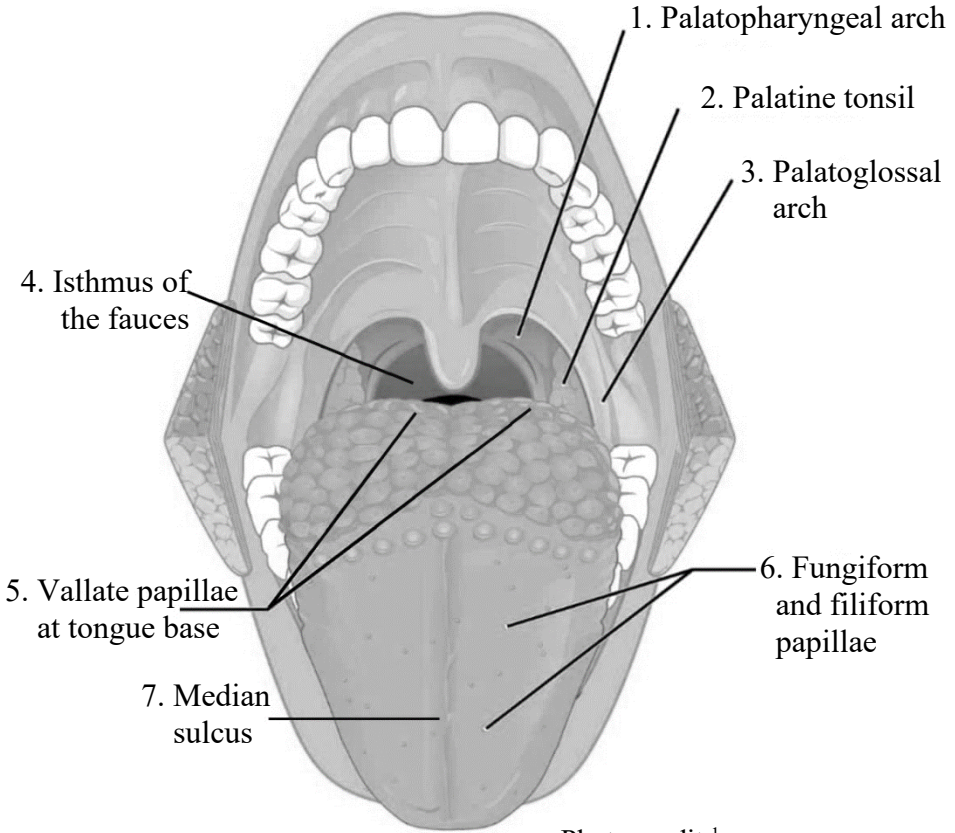
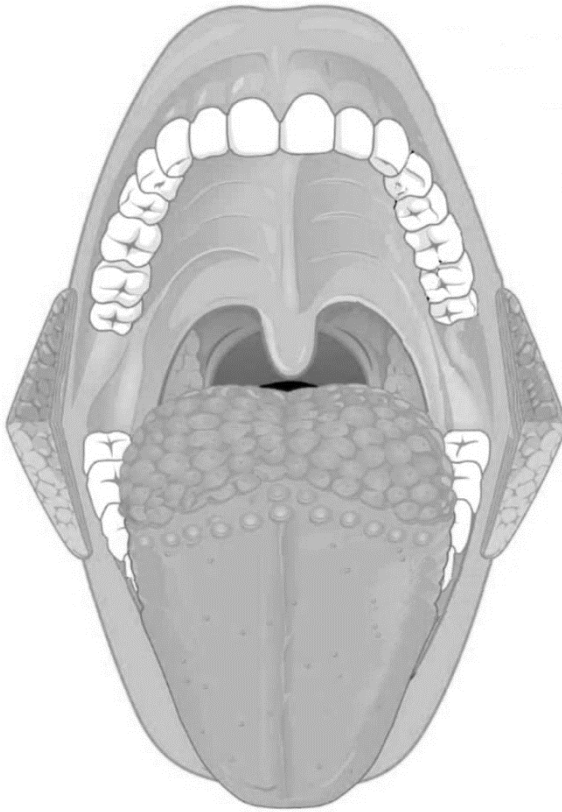


Photo credit ¹

DESCRIPTION

The vestibule and oral cavity proper form two regions of the mouth. The vestibule is the space external to the teeth and gums. The oral cavity proper is the area between the tongue, teeth, and palate. It extends posteriorly to the area between the velum (soft palate) and the tongue base. The tongue root is below the tongue base. The isthmus of the fauces (4) is part of the oropharynx. Arches form the pillars of the fauces: the palatopharyngeal arch (1) and palatoglossal arch (3). The palatoglossal muscle (3) is visible from the oral cavity. The body of the tongue is divided by the median sulcus (7). The vallate (5) and fungiform (6) papillae are taste buds. The filiform papillae, along the upper front and sides of tongue, are associated with the sense of touch.

ORAL CAVITY WORKSHEET



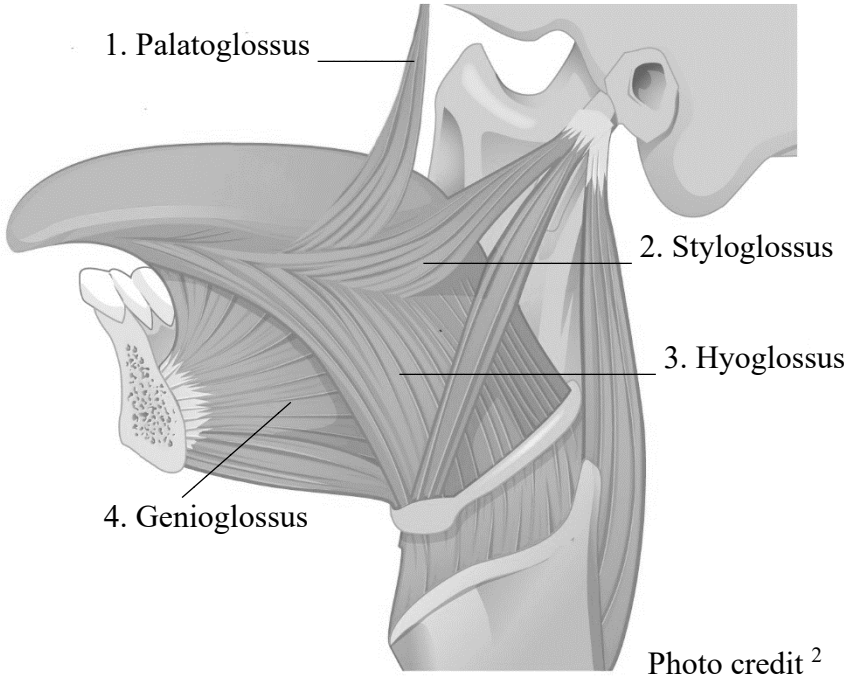
Exercise: provide a numbered label for the blank points above

1. Palatopharyngeal arch
2. Palatine tonsil
3. Palatoglossal arch
4. Isthmus of the fauces
5. Vallate papillae
6. Fungiform and filiform papillae
7. Median sulcus

Full color image:



EXTRINSIC MUSCLES



EXTRINSIC MUSCLES

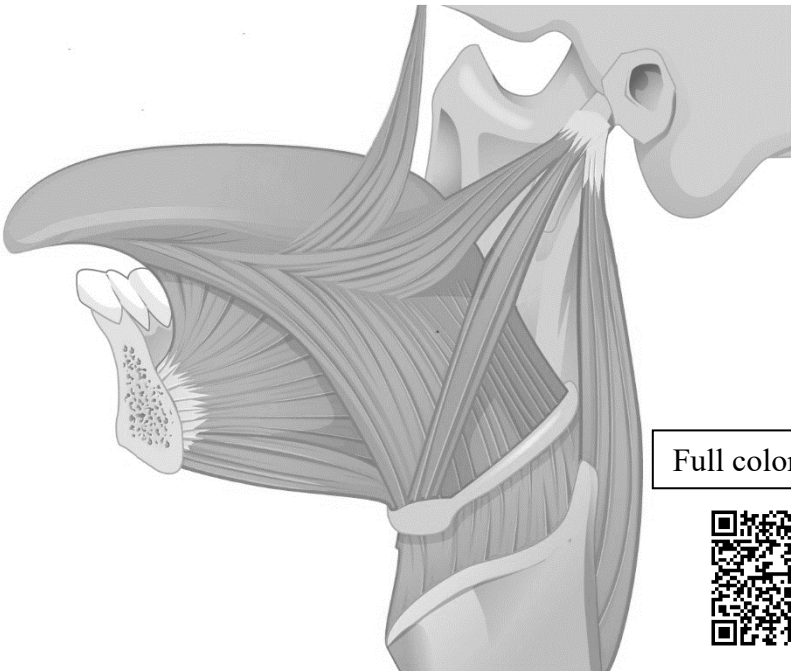
1. **Genioglossus (chin to tongue):** a muscle that originates from the mental spines of the mandible and inserts along the root of the tongue, hyoid bone, and epiglottis. This muscle pair forms the majority of the body of the tongue. Genioglossus is a triangular shaped muscle with fanning fibers that, when acting as a pair, protrude and depress the tongue. When acting alone, it moves the tongue from side to side.

2. **Hyoglossus (hyoid bone to tongue):** a muscle pair that originates along the body and length of the greater horn of the hyoid bone and inserts along the sides of the tongue. The hyoglossus has almost vertically running fibers that engage to depress the tongue. These muscles can be activated by closing the mouth and releasing the tongue from its resting place against the palate.

3. Styloglossus (styloid process to tongue): a muscle pair that originates from the styloid process and inserts along the sides of the tongue in three bundles. The styloid process is a spiked bony protrusion coming from the temporal bone. The pair of styloglossus muscles engage to bring the sides of the tongue up and back. When activated, these muscles draw up the sides of the tongue to create a trough for swallowing.

4. Palatoglossus (palate to tongue): a muscle pair that originates from the soft palate and inserts into the sides of the tongue. These muscles can be observed as pillars at the back of the tongue. The palatoglossus muscle stalks elevate the root of the tongue drawing it up toward the soft palate closing off the oral cavity from the oropharynx. This muscle pair is activated while swallowing.

EXTRINSIC MUSCLES WORKSHEET

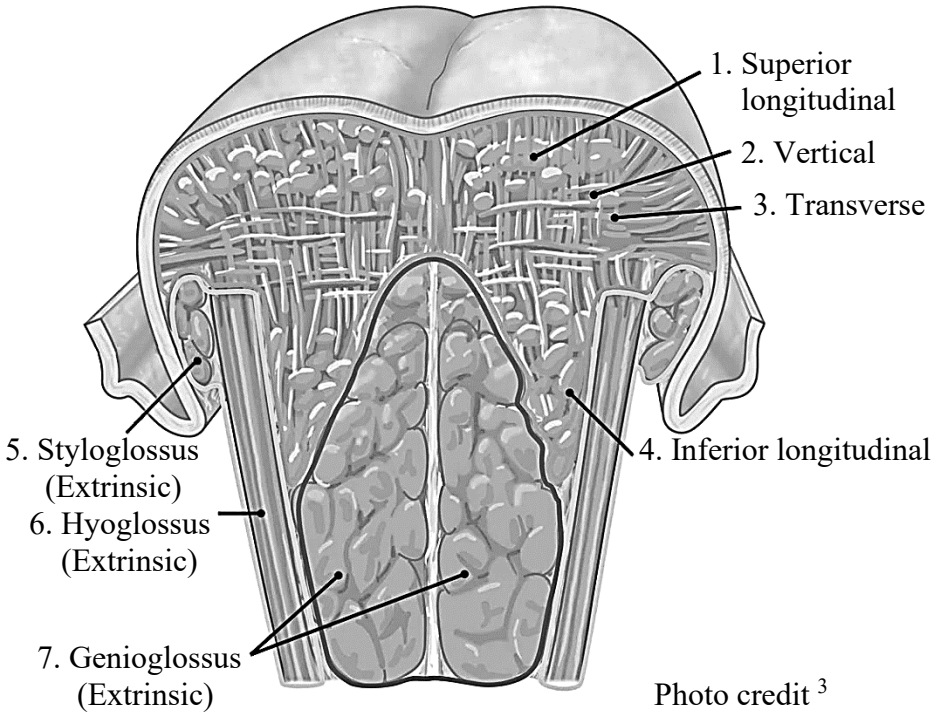


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Exercise: provide a numbered label for the blank points above

INTRINSIC MUSCLES



INTRINSIC MUSCLES

The body of the tongue has two halves which are divided by a narrow groove called the median sulcus. All muscles within the tongue are paired. They alter the tongue shape by: lengthening and shortening the tongue, curling and uncurling the tongue's tip and edges, and flattening and rounding the tongue's surface.

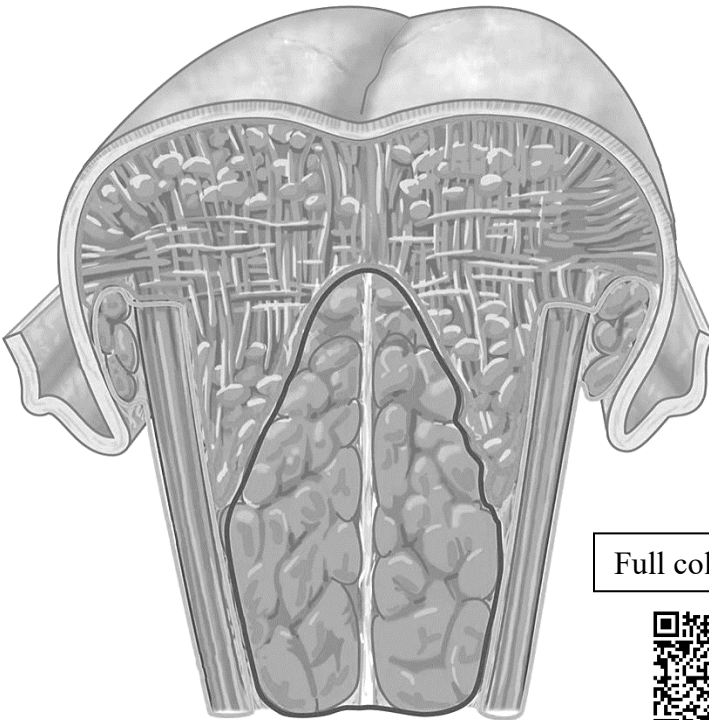
1. Superior longitudinal: the muscle beneath the mucosa of the tongue. It is located throughout the dorsum of the tongue (top surface of the tongue). This muscle pair extends laterally from the lingual septum (partition of the tongue) to the edge of the tongue on both sides. These muscles act to elevate the tip and sides of the tongue making the dorsum concave. Examples: the sides of the tongue can roll up to make a tube shape; the tip of the tongue can curl up to form retroflex [ɹ].

2. Vertical muscle: a muscle that extends from the dorsal side of the tongue to the inferior side of the tongue. This muscle pair acts to flatten and widen the tongue. Example: rest the lower surface of the tongue on the upper surface of the lower row of teeth, including the molars.

3. Transverse muscle: a muscle that extends laterally from the lingual septum to the edge of the tongue on both sides. This muscle pair acts to narrow and elongate the tongue. Example: curl the edges of the tongue down to tuck in beside the lower row of teeth while the tip is extended just above the lower front teeth.

4. Inferior longitudinal: a narrow band close to the bottom surface of the tongue. This muscle pair originates at the root of the tongue and inserts at the tongue tip nearest the inferior surface of the tongue. It arches the tongue making it convex and shorter. Example: all vowels except [ʌ] and [ɜ].

INTRINSIC MUSCLES WORKSHEET



Full color image:



Exercise: provide a numbered label for the blank points above.

pair might engage to help lift the tongue for the tallest vowel formations. The tallest vowels are [i] and [u]. Since the palatoglossal muscle pair originates from the palate, the singer should be aware that its use could pull the palate down making [i] and [u] nasalized. The hyoglossus muscle pair might engage to help lengthen the tongue for the longest vowel formations. The longest vowel formations are [ɑ] and [ʌ]. Since the hyoglossus muscle pair originates from the hyoid bone, the singer should be aware that its use could pull the tongue down and back blocking the pharyngeal space. This action would result in a muffled sound.

AIR SPEED

Singers often report feeling an increase in breath energy at the first or second point of airflow contact. This sensation is often called spin or ping. The Venturi Effect describes a phenomenon in which air speed increases as it travels through a constricted passageway. The pressure of the air moving through a smaller cross section of a pipe drops suddenly leading to an increase in velocity. This principle can be observed with water as it flows through a garden hose. If the opening of the hose is constricted, water shoots faster and farther than before. The vocal tract has a similar reduction in the “pipe” at the peak of the tongue arch where the tongue draws closest to the roof of the mouth. Beyond this point, according to the Venturi Effect, the constricted passageway opens releasing a faster flowing stream of air.⁹

SUMMARY

The tongue and lips function as devices that narrow and intensify the airflow. Remember also that arching the tongue shortens and lifts the muscle mass (giving it a column-like shape). This increases the pharyngeal space while intensifying and focusing the airflow. Also note that the articulators and posture are lax in speech. It serves the singer well to think of vowel and consonant formations, and the posture needed for singing, as unique and separate from speech. Postural alignment has a direct effect on the trajectory of the airflow. Similarly, releasing the jaw and arching the tongue have a direct effect on pharyngeal space and the speed and focus of the air.

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END NOTES

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