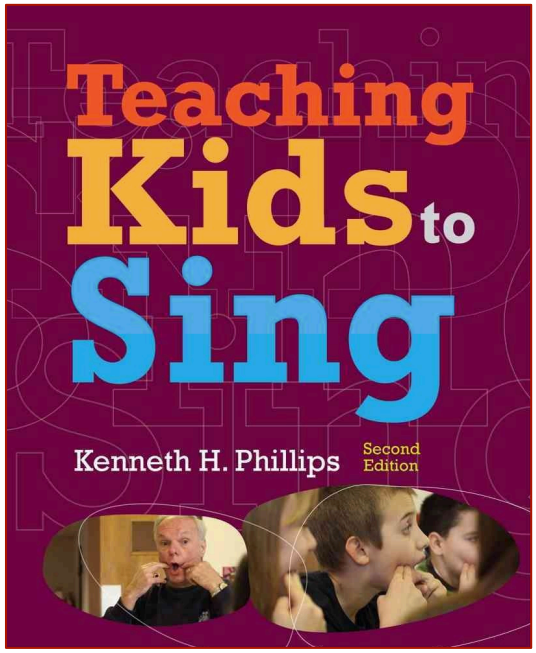
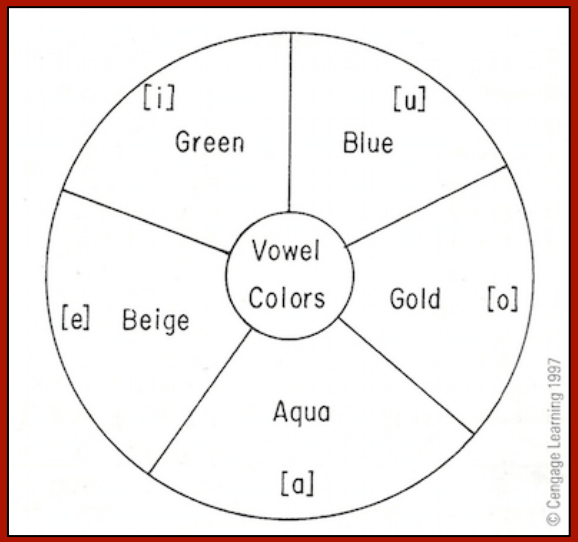
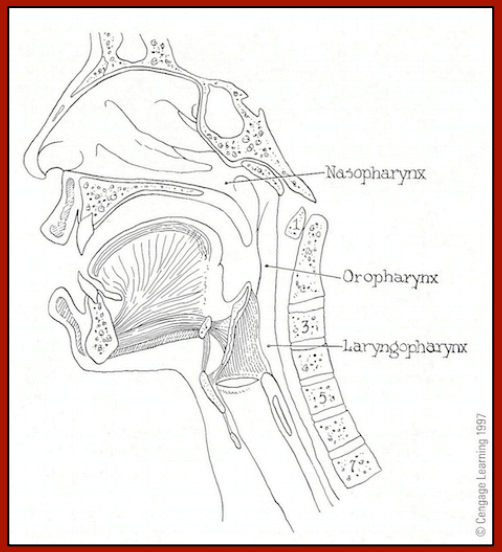






Source: Phillips, *TKTS*, p. 145/157.

The Art of Choral Techniques

In-class Review of *Teaching Kids to Sing*: Chapter 7 Vocal Physiology: Resonator and Articulator Mechanics

Main Sources for Images:

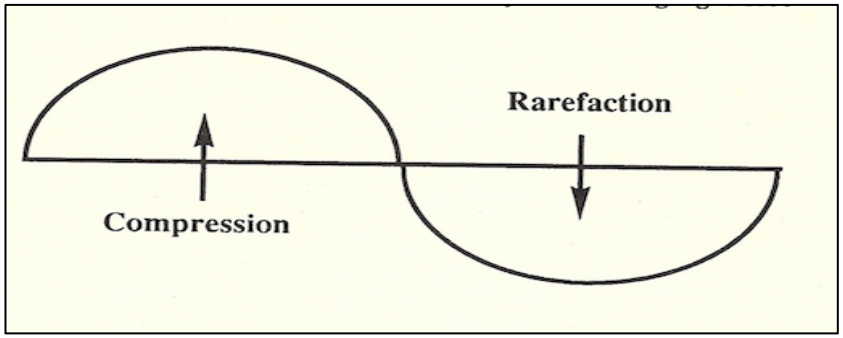
Phillips, Kenneth. *Teaching Kids to Sing* ***(TKTS)***, 2nd ed. U.S.: Schirmer CENGAGE Learning, 2014.

Doscher, Barbara. *The Functional Unity of the Singing Voice* ***(FUSV)***, 2nd ed. Metuchen, NJ: Scarecrow Press, 1994.

Alderson, Richard. *Complete Handbook of Voice Training* ***(CHVT)***. West Nyack, NY: Parker, Publishing, 1979.

Resonant Tone Production

- A beautiful voice is rich in resonance, characterized as having uniformity of vowels, depth and fullness of tone, and projection, or "ring."
- Energy is generated from vocal folds in form of a complex sound wave, which travels through the pharynx (throat) and the oral cavity (mouth), resulting in a loss of energy.
- Vocal tract has acoustic properties apart from the pitch and harmonics produced by folds



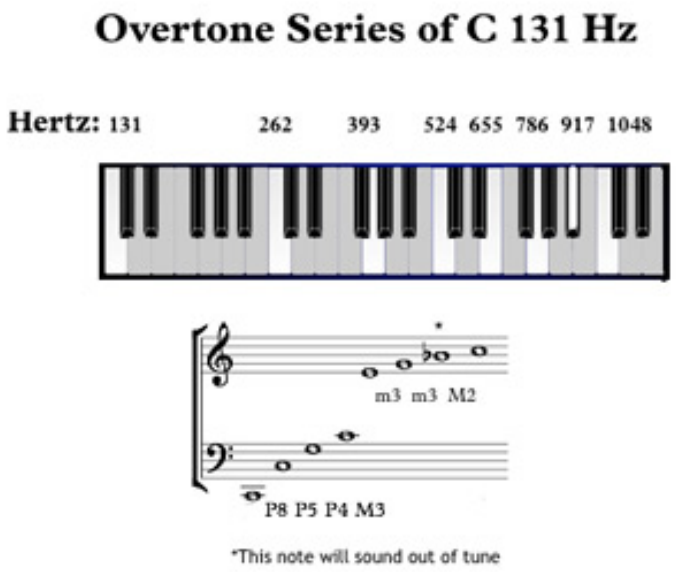
Source: Doscher, *FUSV*, p. 86.

Formants

- Formants are resonance frequencies of the vocal tract.
- Not to be confused with fundamental frequency, which is the pitch heard (cps or Hz.
- Every sound of the human voice is a combination of fundamental frequency and formant frequency.
- In general, overtone or harmonic series of any instrument is a fixed set of frequencies above the fundamental, which, when dampened or strengthened by the shape and size of the instrument, determines the tone quality (timbre)and resonance of the instrument.
- Formants of the voice are similar to overtones, except that formants are not fixed. *[Let's review from last chapter.]*

Vocal Folds, Fundamental Pitch, and Overtones

- Two "sound generators" alternately close and open from air passing between them in exhalation
- Vibrations generate energy in the form of complex sounds waves, which travel through air and are perceived as sound in the form of both pitch and quality
- Rate of vibration expressed in "cycles per second" (cps) or "hertz" (Hz)
- In addition to this fundamental pitch, "overtones" or higher-frequency pitches are also produced that add resonance



Vowel Formants

- In the voice, overtones are called "formants," or frequency "regions" that are not fixed frequencies, as are the overtones produced by musical instruments.
- Each region is a width of frequencies, which permits different voices to blend on any vowel as long as the vowel is shaped in the vocal tract within the range of variation. *[This is why vowel unification is so important to achieve "blend" of ensemble.]*

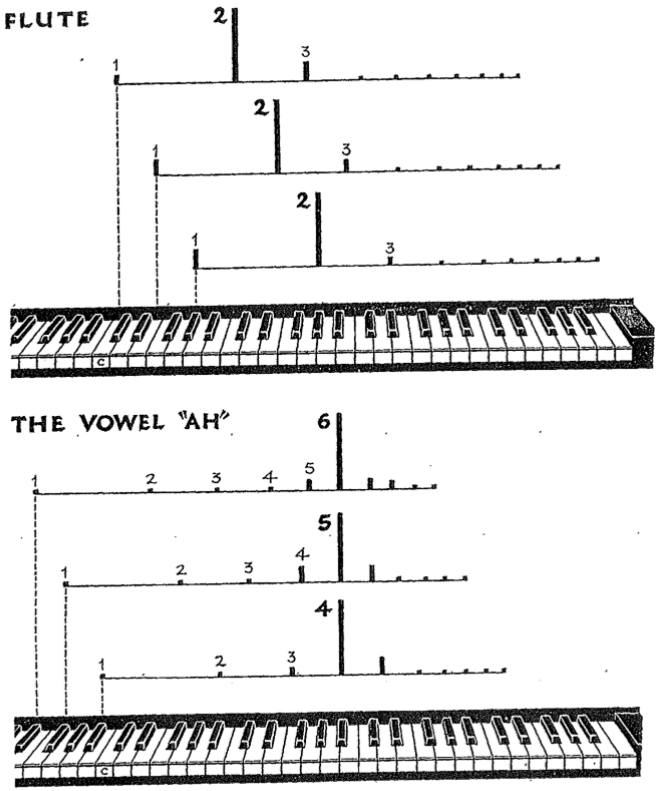


Fig. 54. Spectra of Flute and Vocal Tones
From Dayton C. Miller, *The Science of Musical Sounds*., Copyright, 1916 by the Macmillan Company and used with their permission, p. 256.

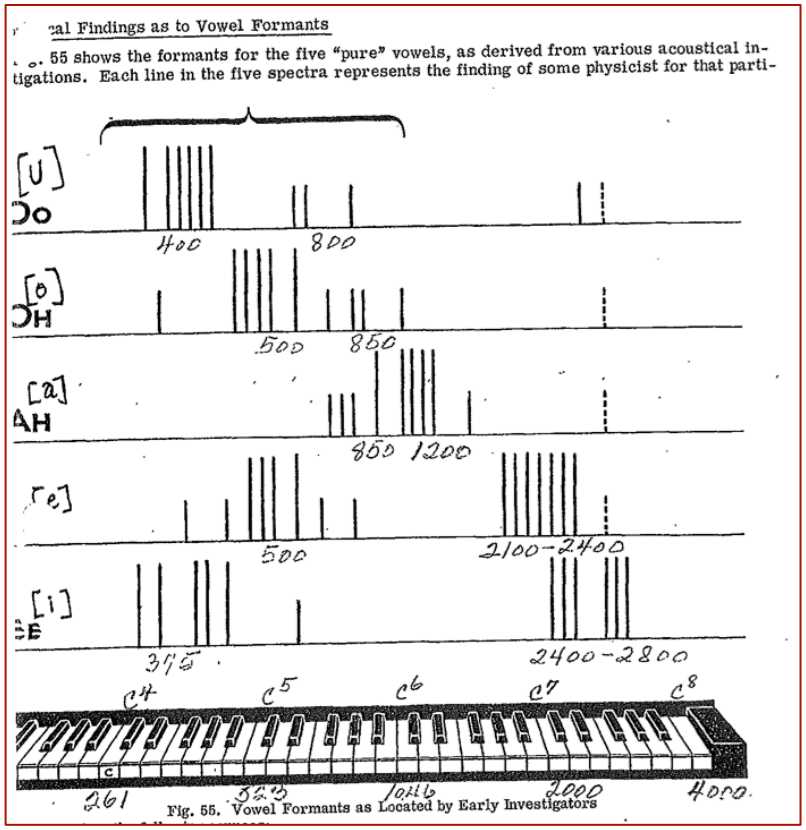
Tuning Formants

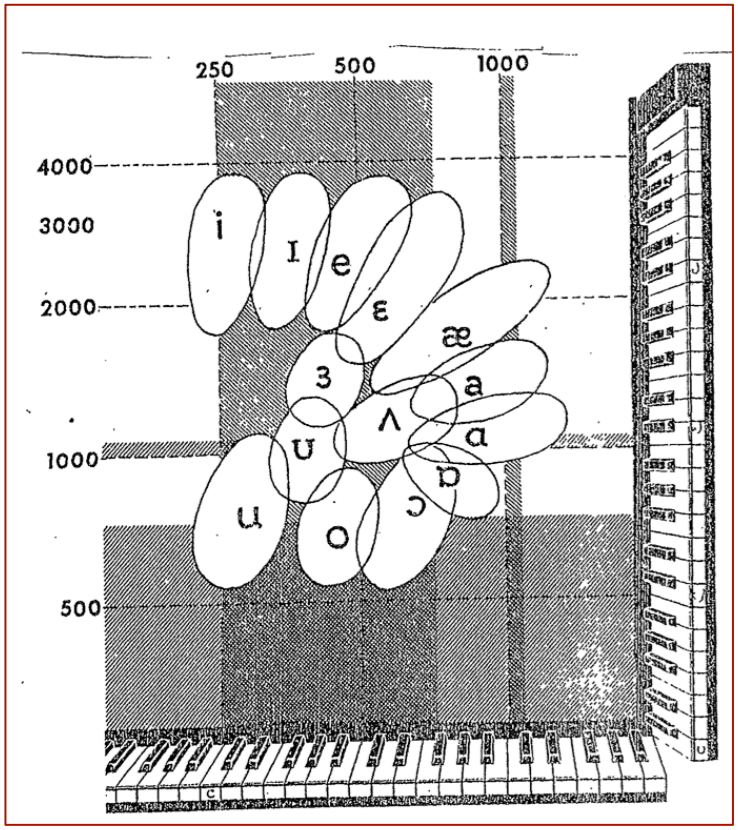
- Formant frequency "regions" or bands of frequencies can be changed (lowered or raised) according to the configuration of the vocal tract.
- Ability to change vocal tract distinguishes human voice.
- Vocal tract is capable of countless changes through movement of the articulators (tongue, lips, palate, jaw, etc.) that result in a variety of vowel sounds, consonants, and resonances called language.
- Instruments produced fixed set of overtones (series), whereas voices produce fundamental pitches and accompanying formant regions that can be varied *[tuned]* by changes in articulators.

Vowel Production

- Vowels form the basis of resonant tone production.
- *[Vowels have pitch and account for 99% of the sung sound!]*
- Individual vowels have from 5 to 30 formants, though the first four (lowest) are most important to vowel identity and quality. The lower two formants (F1 and F2) provide most of the identity of the vowel (see previous slides w/spectral analysis graphs).

Vowels Have Pitch! (Acoustics)

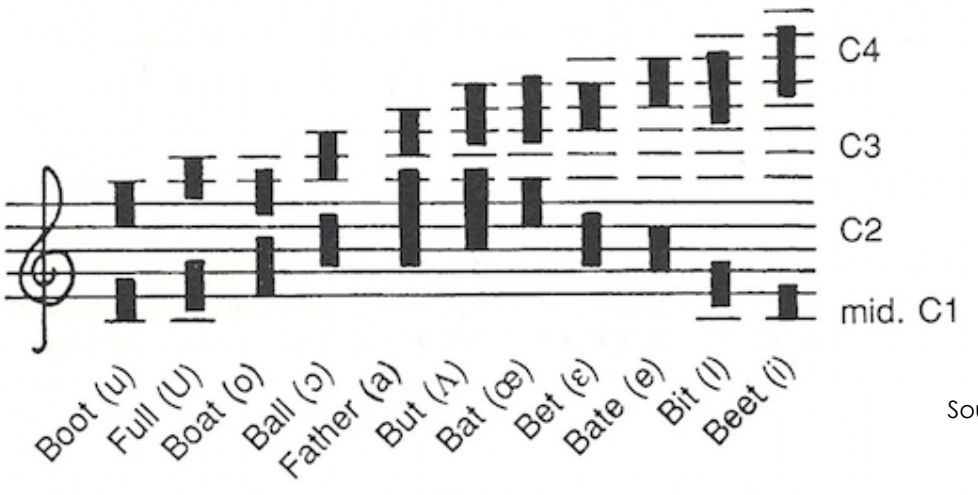




Spectral Analysis showing the formants of five "pure" vowels

The Importance of Tuning Formants in Choir

- In choral situations, too much variation in vowel production causes the formant frequencies to "beat" against each other resulting in poor intonation.
- The fundamental frequency generates the most energy and is heard as pitch. Overtones and formants progressively decrease in energy the higher they become.



Source: Phillips, *TKTS*, p. 169.

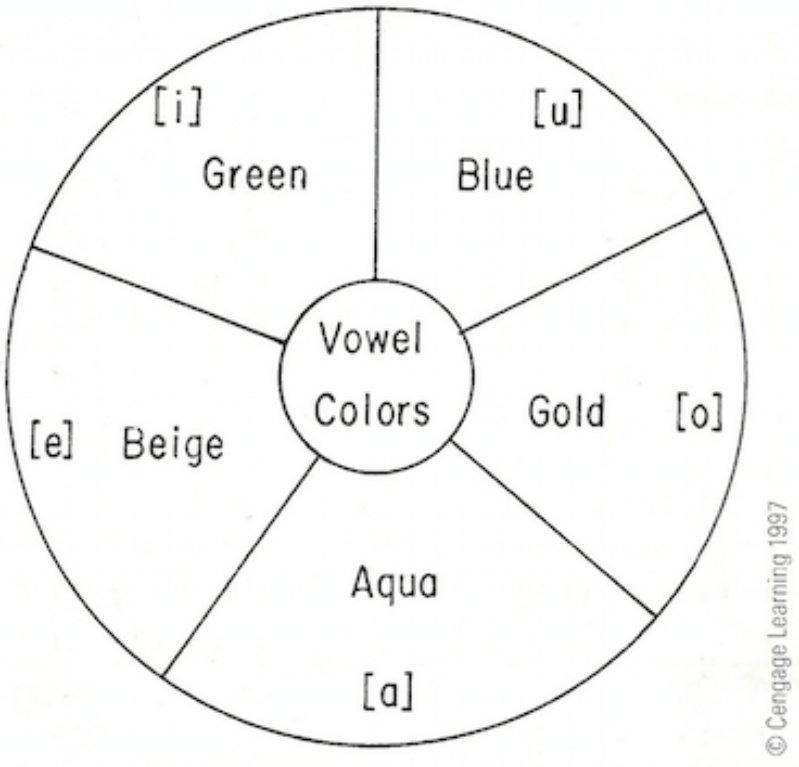
How to Tune Formants

- Average male uniform vocal tract (perfect cylinder, closed at the glottis and open at lips) is 17.5 cm long. Shorter vocal tracts of women and children shift all vowel frequencies 17% and 25% higher, respectively. Longer vocal tracts, as in a deep bass, shift all formant frequencies lower.
- As shown in previous slides, each vowel is determined by its own arrangement of formant frequencies.
- These vowel formants must be tuned *[by each individual]* so as to achieve the most resonant and in-tune singing

Singer's Diction

- Poor speech habits become poor singing habits.
- Singing diction is distinct from speaking diction.
- Sung vowels are often elongated and given different stress than for speech.
- Five primary vowels: a, e, i, o, u.
- Use Italian enunciation for in vocalization and vocalises to teach clear, pure sound.

Vowel Color Chart



Source: Phillips, *TKTS*, p. 170.

Vowel Formation

- Students tend to sing all vowels with a rather small, narrow, and horizontal (east-west) mouth opening. Resonance suffers.
- Encourage tall, vertical (north-south) production for all vowels
- Old "two finger in the mouth" technique provides example of how far mouth can open, but it's more important to teach dropping of the jaw from the rear (at the hinge). Use candy jawbreaker image.

Rounding Lips

- TKTS approaches all vowels with a vertical, flared position of the lips, with the lips extended slightly forward as for the [u] vowel.
- Frauke Hassemann (Westminster Choir College in the 1980s) called this, "Fish lips with rabbit teeth!"
- With jaw relaxed, swallowing muscles/false elevators will not trigger raised larynx.
- Flared lips make a mouthy, thin sound less likely, because the vocal tract is lengthened, thus lowering the vowel formants.
- Lowered formants produce a slightly darker, more mature sound. Flared lips counter spread vowels.

In sum…

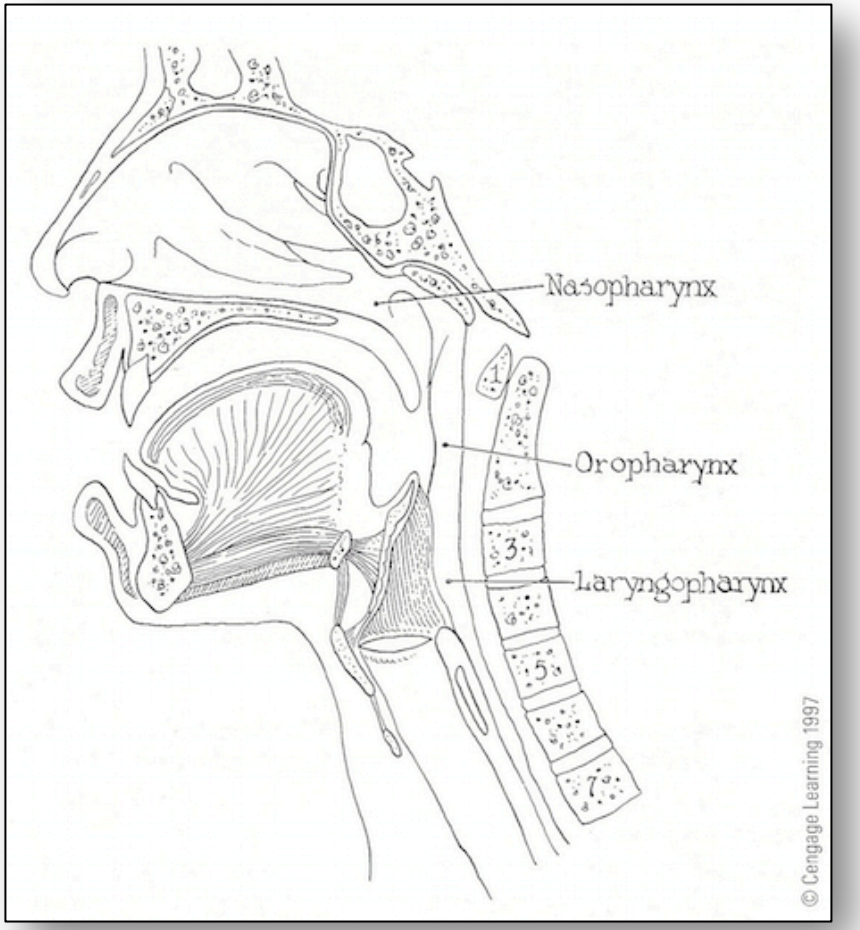
- Fuller, richer vocal resonance depends upon a longer, open tract with jaw relaxed, larynx at rest, and lips slightly forward for all vowels.

Source: Phillips, *TKTS,* p. 173 .

Resonator Physiology

- Pharynx and mouth are major resonators of the voice. Chest cavity, larynx, nasal cavity, and sinuses play minimal role.
- **Pharynx:** cavity above larynx extends upward behind the mouth and nose.
- Three parts of pharynx:
  - **Laryngopharynx** (below tongue)
  - **Oropharynx** (behind oral cavity and tongue)
  - **Nasophraynx** (above soft palate, behind nasal cavity)

Divisions of the Pharynx



- Nasopharynx can be closed off by arching soft palate
- Soft palate must be "raised and arched" to maximize resonance
- Sensation of stifled yawn (lips slightly touching) is recommended for sense of palatal lift.
- Palate is involuntary; best not to call attention to it, but teach through indirect means.

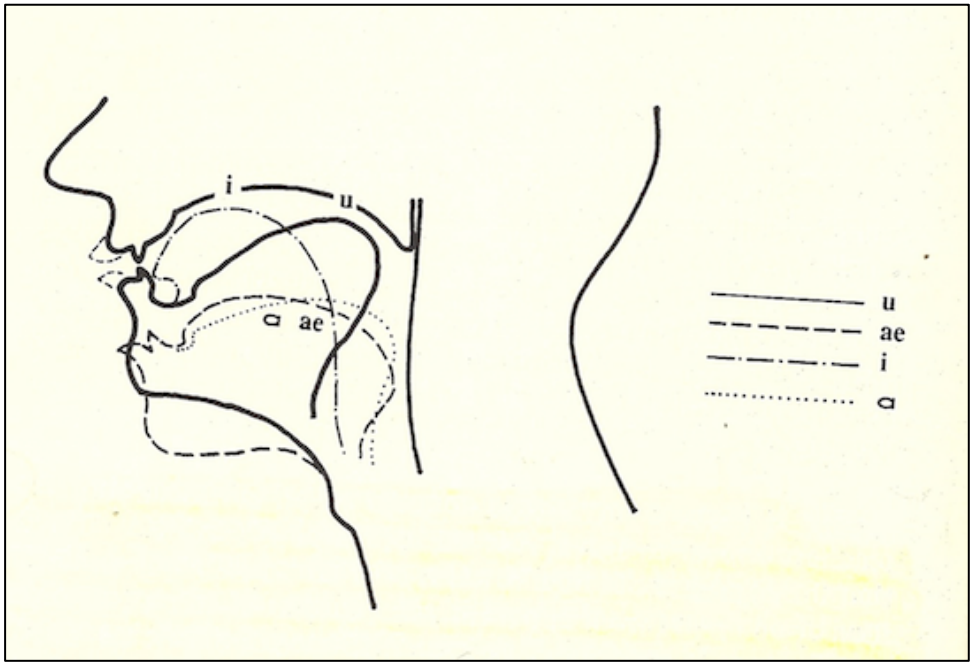
Source: Phillips, *TKTS,* p. 174.

The Tongue

- Gives shape to both the oral cavity and the phraynx.
- Carried too far back, causes constriction of the pharynx and loss of resonating space.
- Tip of tongue should rest on the fleshy ridge at base of lower front teeth.
- Back of tongue is to be kept forward and arched high enough to keep it out of the throat.

Tongue Positions

- Vowels [u], [i], and [e] have highest postiions for the back of the tongue.
- Vowels [o] and [a] progressively lower the tongue to the base of the mouth.
- Tongue must remain relaxed [flexible and free] for singing.
- Any rigidity causes constriction of the vocal tract and reduces resonance.

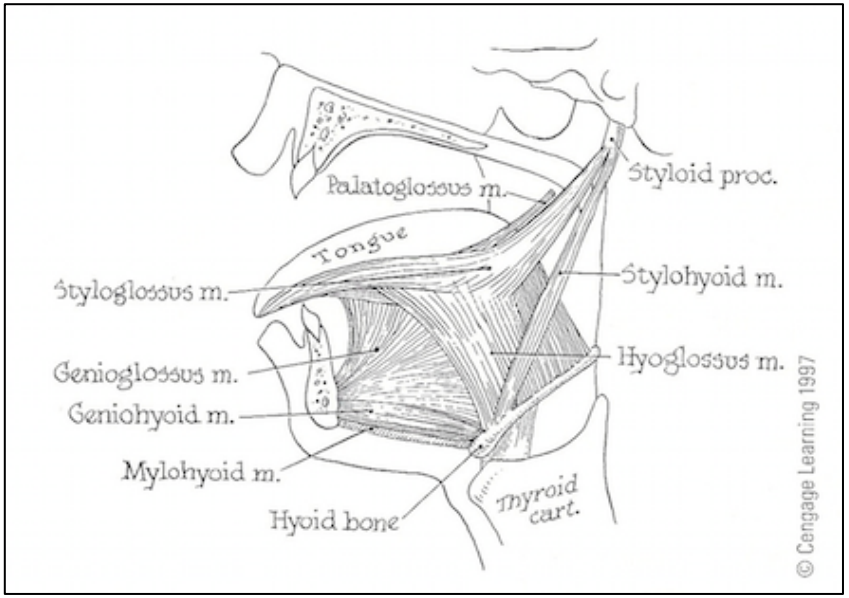


Source: Doscher, *FUSV*, p. 112.

Note: Use lip bubbles or raspberries to loosen/unlock the tongue, decrease tension, promote abundant air flow, and bring the tongue forward.

DEACTIVATE False Elevators

- Remember to deactivate the false elevators, especially geniohyoid and mylohyoid!
- Tension here elevates the hyoid bone, which raises the larynx, and reduces resonance.
- Any tension or hardness in these muscles while singing is indication of partial swallowing action.
- Massage tension away from these muscles with the thumbs while vocalizing.



Source: Phillips, *TKTS,* p. 175 .

The Singer's Formant

- Professional voices (opera singers) need to project above orchestral accompaniment.
- These singers, especially males, often develop an extra formant that increases the power of the voice and is produced at frequency c. 2800 Hz.
- Origin is theorized to be at the laryngeal level, when the larynx is at rest and the pharynx is open.
- Believed that the larynx must remain in a relatively low position for it to produce formant capable of adding brilliant and substantial carry power to the voice.

Head Position: Tenor

Head Position: Bass

Singer's Formant Spectra

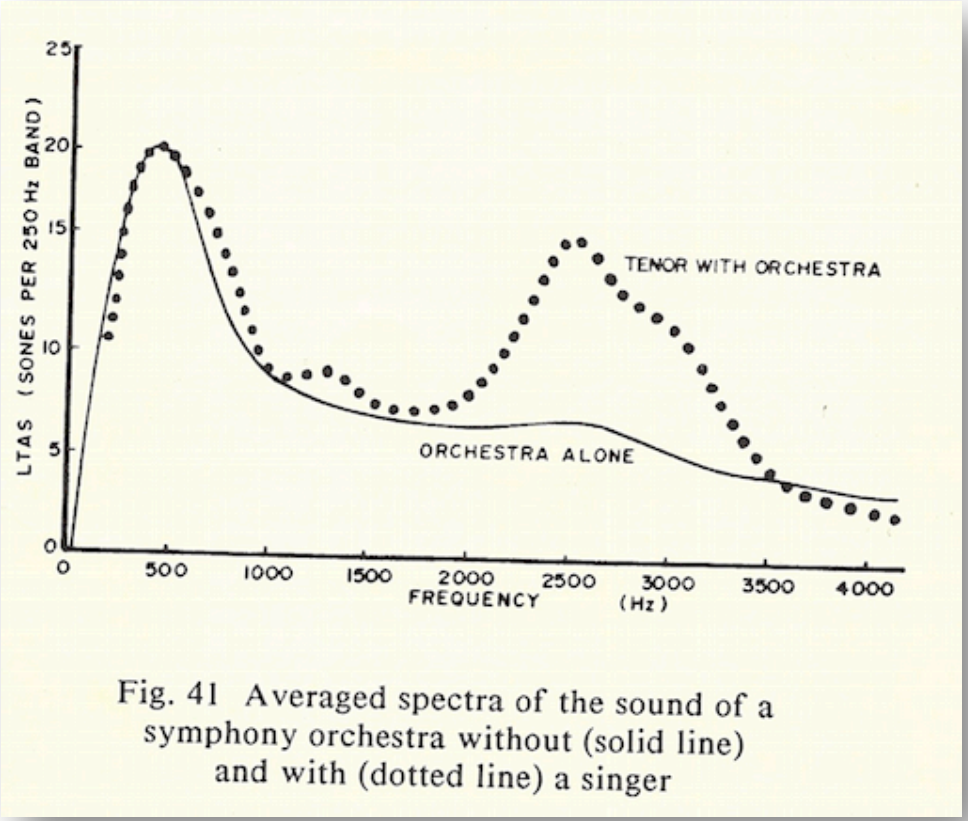


Fig. 41 Averaged spectra of the sound of a symphony orchestra without (solid line) and with (dotted line) a singer

Source: Doscher, *FUSV*, p. 143.

Developing Resonance

- In addition to uniform vowels (vertical), two other characteristics of the resonant voice are depth (richness) and projection (ring). These qualities are developed through proper tuning of vowel formants.
- Singer must learn to tune vocal tract (adjust articulators) to the frequency region of lowest formant of given vowel.
- The closer the fundmental pitch interacts (is in tune with) the formant frequency, the clearer and more resonant the vowel and its pitch will sound.

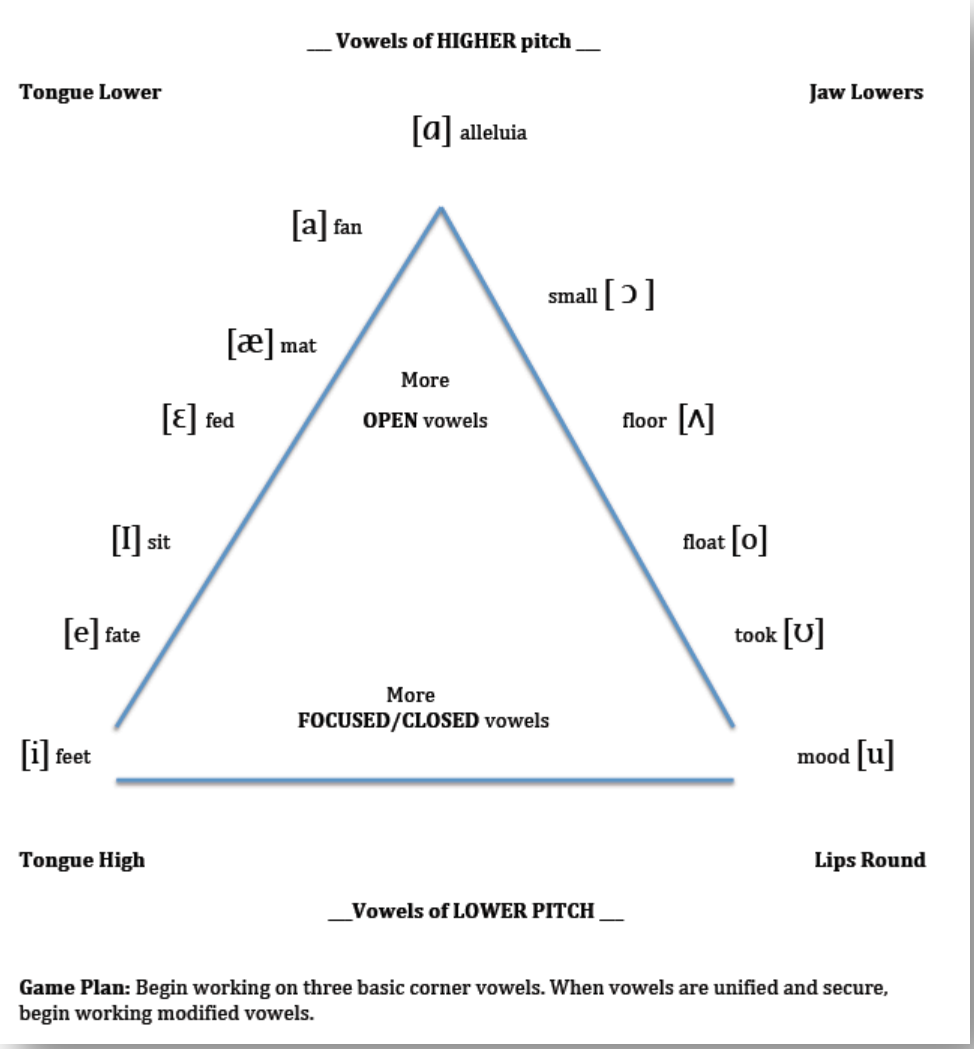
Your Job: Listen and Instruct

- It is the EAR of the music instructor that must determine the correct sound for each voice.
- *YOU must listen for optimal tuning of the formants and be able to instruct students about how to tune them better! Listen for the QUALITY of the resonance (depth and ring) and be sensitive to INTONATION for signs.*
- *As students' skills develop, this becomes easier: they'll FEEL the difference when it's right. Another benefit if all is working properly: VIBRATO emerges as product of freely functioning (and formant-tuned) voice.*

Vowel Modification

- Difficult to sing pure vowels throughout the vocal range, especially above f2 in adult female voices and f1 in adult male voices.
- Problem when frequency of sung fundamental is higher than the first formant.
- Sopranos and Tenors: the higher they sing, the more the jaw must open if vowel integrity it to be maintained.
- Most pitches in the adult male voice are below the first formant; the vowel integrity is maintained. As pitch rises above f1, formants of some vowels fall below fundamental, necessitating vowel modification.
- Fortunately, this doesn't apply to children, as their voices are so much higher than those of adults that vowel modification is not a problem.

Vowel Pyramid as Guide to Vowel Modification



Why are Vowels Important?

- Have pitch.
- 99% of sung sound.
- How feelings are expressed through music.
- Used to achieve unified ensemble "blend."

What about Consonants?

- Required for intelligibility.

Vocal Vibrato

- Heard as slight undulation of pitch at between 5-6 cps.
- Numerous theories as to source: good breath management and a relaxed throat seem essential. In
- In western culture, it is considered a mark of a beautiful voice *[product of a freely functioning voice]*.
- Yes, children and adolescents can develop a natural vibrato through proper vocal technique.

What a Vibrato Isn't!

- Tremolo = too fast
- Wobble = too slow
- Both undesirable.
- Vibrato enhances beauty and gives voice a certain luster; tremolo and wobble interfere with tone *[draw attention to themselves]* and corrupt its beauty.
- Wobble can be from weakened abdominals or tension, which prevents relaxation during inhalation. Tremolo usually excessive tension in abdominals, tranferred to vocal folds as "overdrive" of energy.
- These problems are usually with older adult singers.

Articulator Physiology

- Jaw
- Tongue (lingual)
- Teeth (dental)
- Lips (labial)
- Soft palate (velar)
- Hard palate (palatal)
- Upper gum line (alveolar ridge)
- Gottis (space between vocal folds in open position)

Classification of Vowels: Open vs. Closed

- Classified according to amount of jaw opening.
- Open Vowels: [a], [o], [E], [ɔ]
- Closed Vowels: [e], [i], and [u]
- Closed vowels are particularly troublesome, as they tend to be horizontal and thin in production. All practice of vowels should involve excercises for vertical mouth placement.
- Vowels are also classified according to natural darkness or brightness. "Dark" long vowels ([u], [o], [ɔ]) vs. "Bright" long vowels [i], [e], and [ɑ]. Use exercises to balance darkness and brightness.

Consonant Classification

- See **physical-origin** classification, p. 184
- Second classification is by similarity of sounds, perhaps more useful to singers:
  - **Voiced** (carry a vocal buzz)
  - **Tuned** (carry a pitch)
  - **Voiceless** (do not carry a pitch)
- Subdivisions:
  - **Plosives** (explosive sound when articulators come together and interrupt breath)
  - **Continuants** (articulators briefly sustain the consonant on pitch)
  - **Similants** (stream of air passing between teeth and lips.
  - **Aspirates** (silent stream of air at the glottis)

Diction for Singing

- **Diction** is the manner in which a language is spoken.
- Word intelligibility is a primary requirement for communicating lyrics, and beautiful tone quality is based on properly resonating vowels.
- *Remember:* ***Vowels = feeling; Consonants = intelligibility!***
- Singers must develop "singer's diction," which involves three areas: **prounciation** (how a word is spoken), **enunciation** (how a vowel or syllable is spoken), and **articulation** (how a consonant is spoken).

Other Important Issues

- Study of diction is easier if students understand symbols associated with the **International Phonetic Alphabet (IPA)**. Use it!! At the very least, post the Vowel Pyramid or Vowel Color Chart presented earlier.
- **Rhythmic Diction vs. Sung Speech**, pp. 186-188. Be familiar with the debate. Which will you use? Hint: depends upon the music!
- Singing in a **Foreign Language**. Yes, encourage it for students of all ages. Always provide a good translation.
- See **32 Common Pronunciation Issues**, pp. 188-191.