All About the Voice

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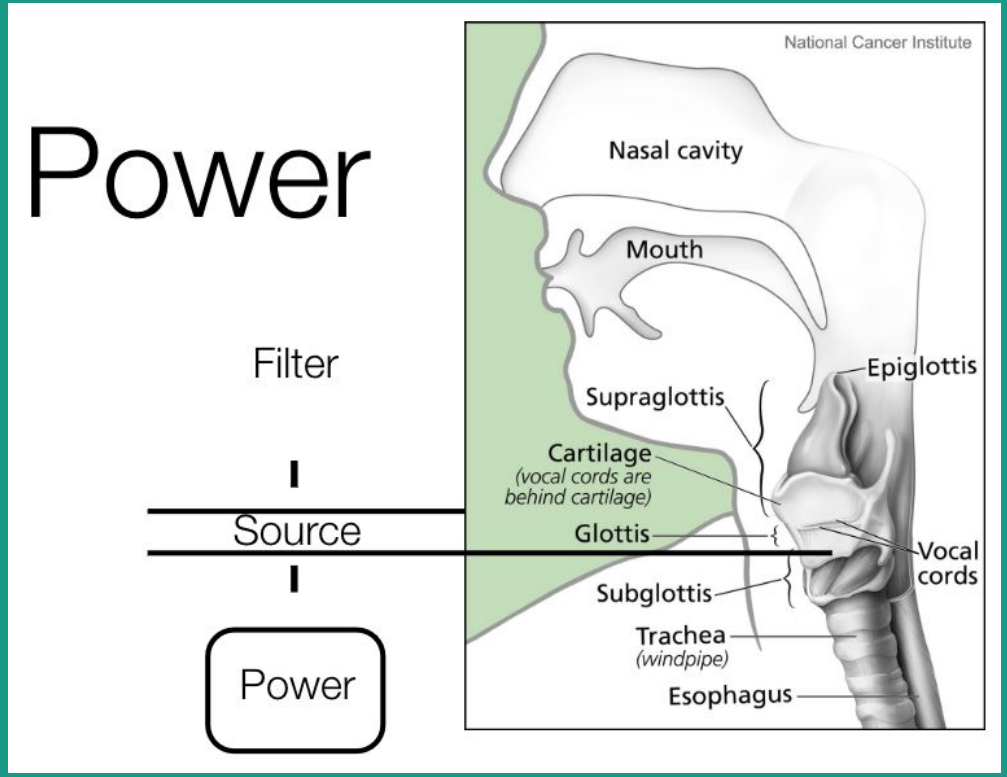
The Vocal Mechanism

- Four subsystems
  - Respiration (Power)
  - Phonation (Source)
  - Resonation (Filter)
  - Articulation

Respiration - Power



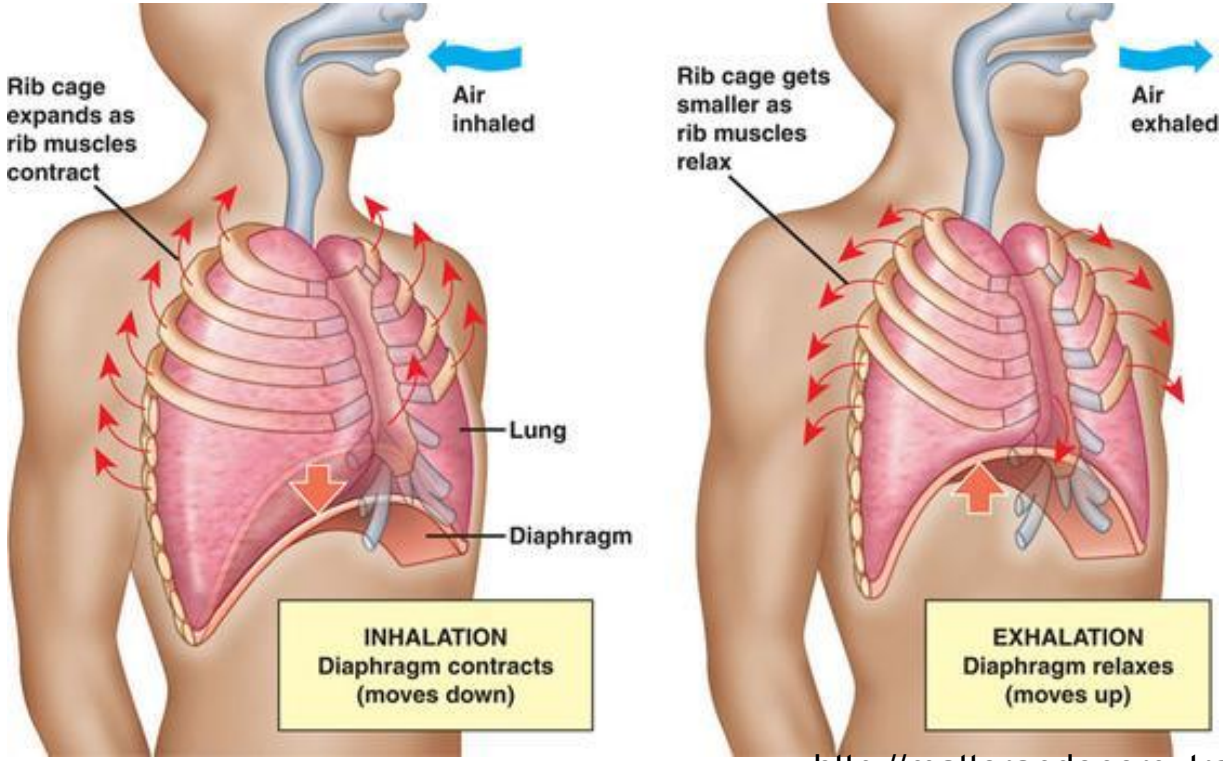
Respiration

- The exchange of gas between an organism and its environment
- Inhalation draws air into the lungs, exchange O2 and CO2
  - Chest cavity expands as the diaphragm lowers and other respiratory muscles engage
  - Chest expands→lungs expand→air is inhaled due to lower pressure in the lungs
  - Muscles contract, reduced volume of chest cavity, causes exhalation

Respiration

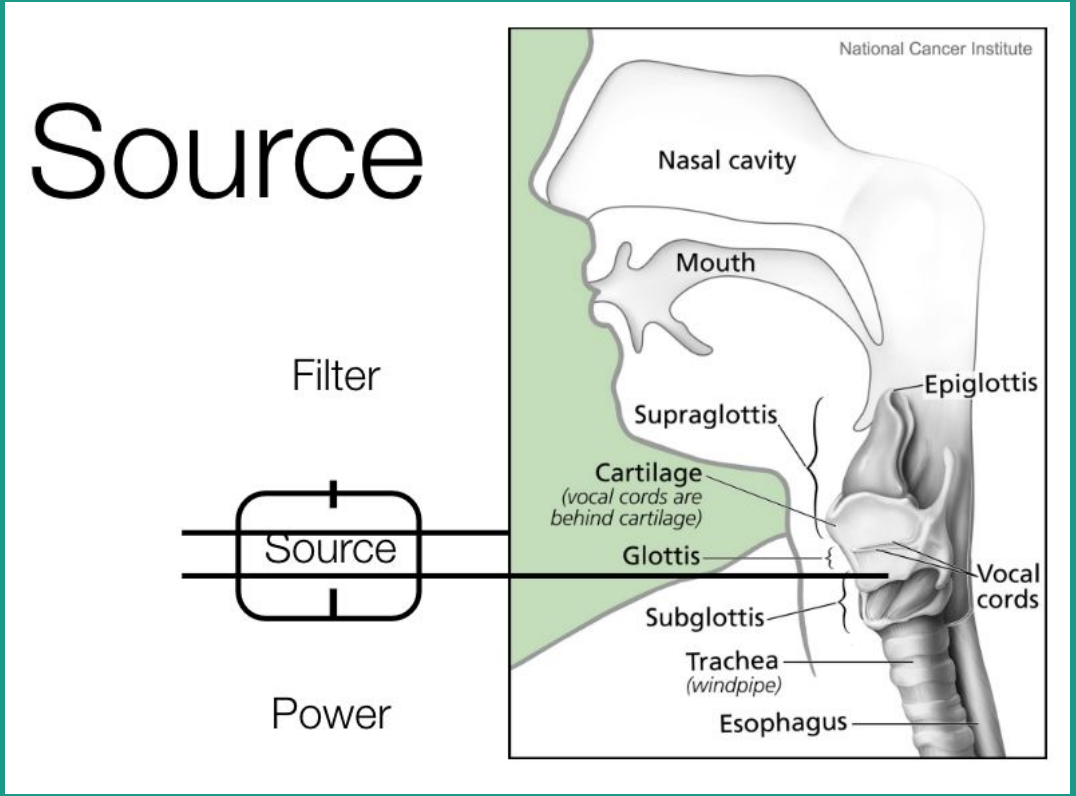
- Respiration provides the air supply (power) needed to vibrate the vocal folds
  - The foundation and energy for phonation
  - The “generator” of the voice
- Consciously monitor breathing for speech and singing to meet the demands of the situation

Respiration



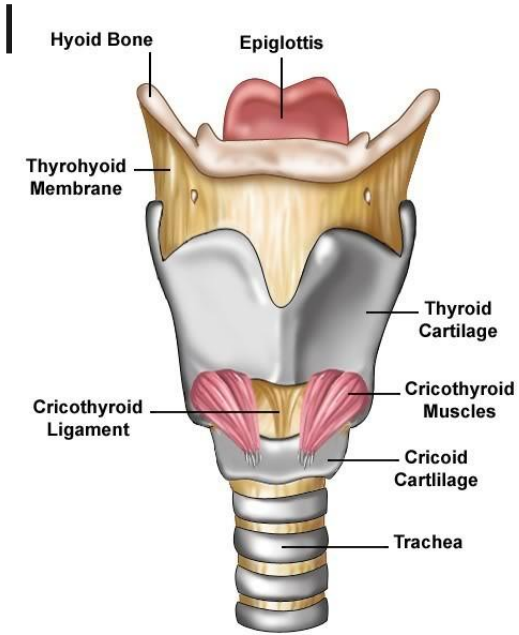
http://matterandenergytransformation.wikispaces.com/Cellular+Respiration

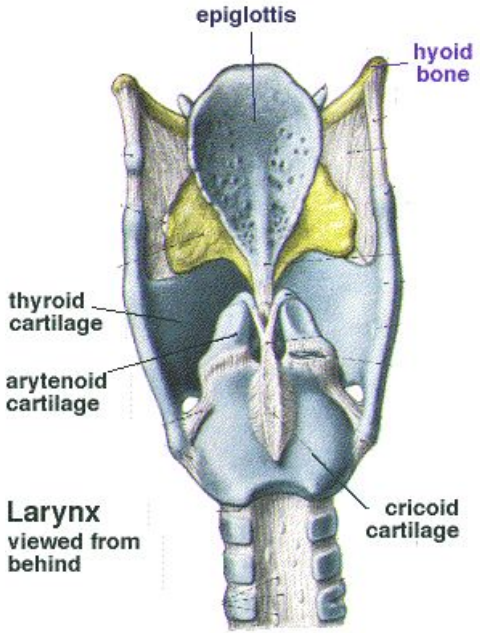
Phonation - Source



Phonation

- The production of sound by vibration of the vocal folds (AKA vocal cords)
- Creates a sound wave
- Exhale→vocal folds brought together (adducted) →air bursts through the closed vocal folds→pressure between folds drops, sucks folds back together (this is the vibration of the vocal folds)
  - Vibration occurs hundreds of times per second, produces voice



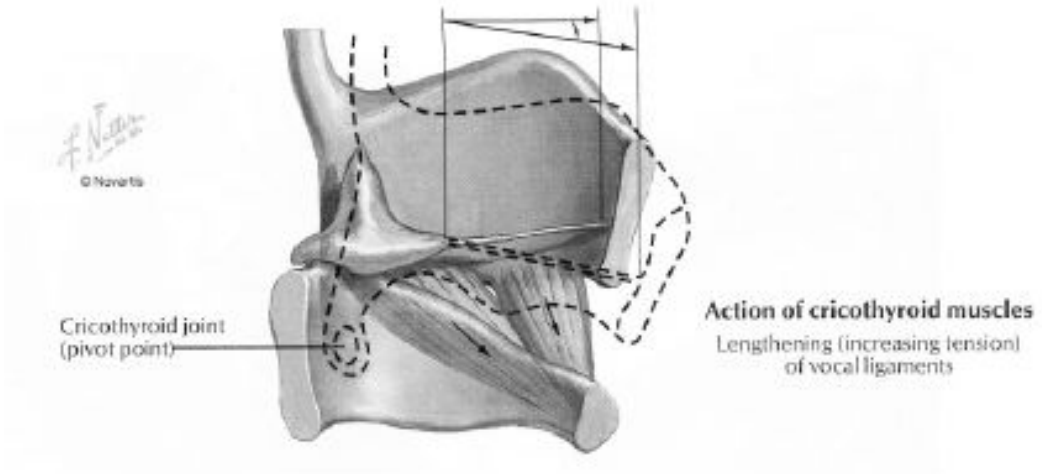


http://www.innovateus.net/health/why-electrolarynx-used

http://www.celebritydiagnosis.com/2010/02/

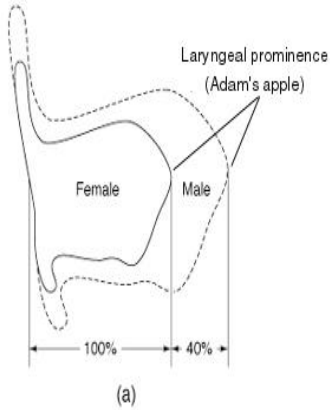
Cricothyroid

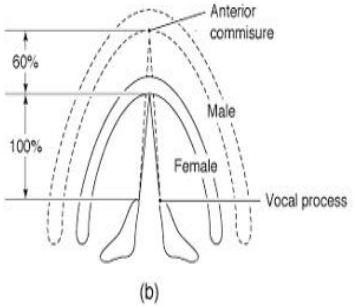
- Responsible for stretching and tightening the vocal folds
- Primary means for controlling pitch



Phonation

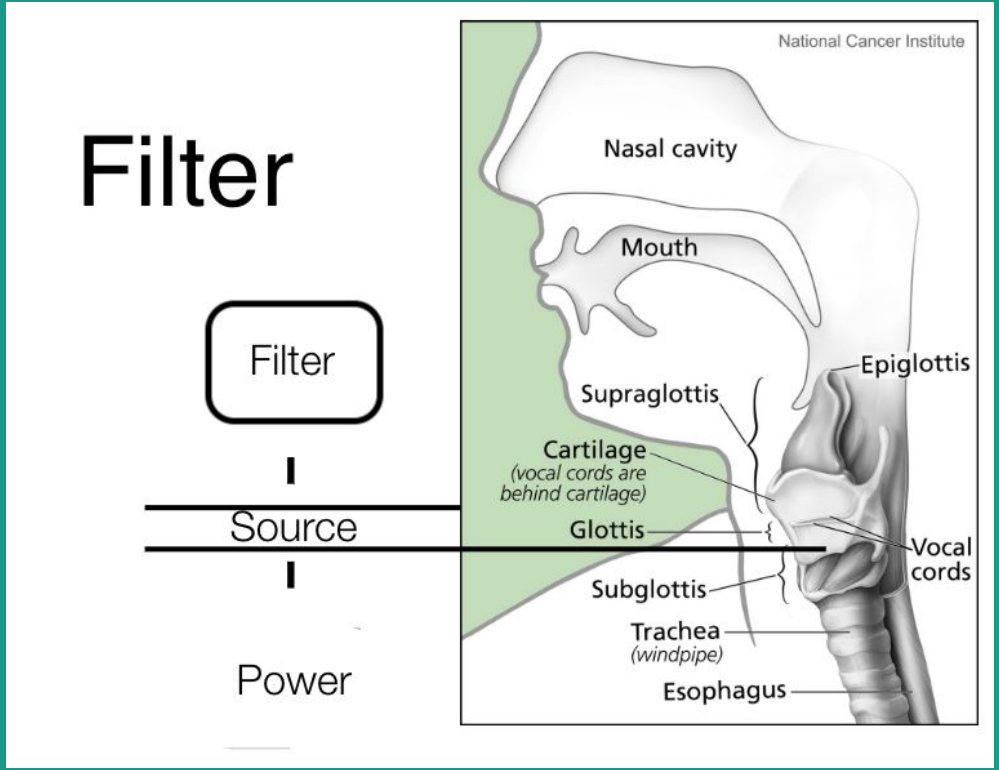
- A man's larynx is, on average, ~40% taller and longer than a woman's larynx
- The length of the portion of the vocal folds that vibrate is ~60% longer in men than women
- Fundamental frequency
  - Men: 85-180Hz
  - Women: 165-255Hz
  - Gender neutral: 165-180Hz





Phonation

Resonation - Filter

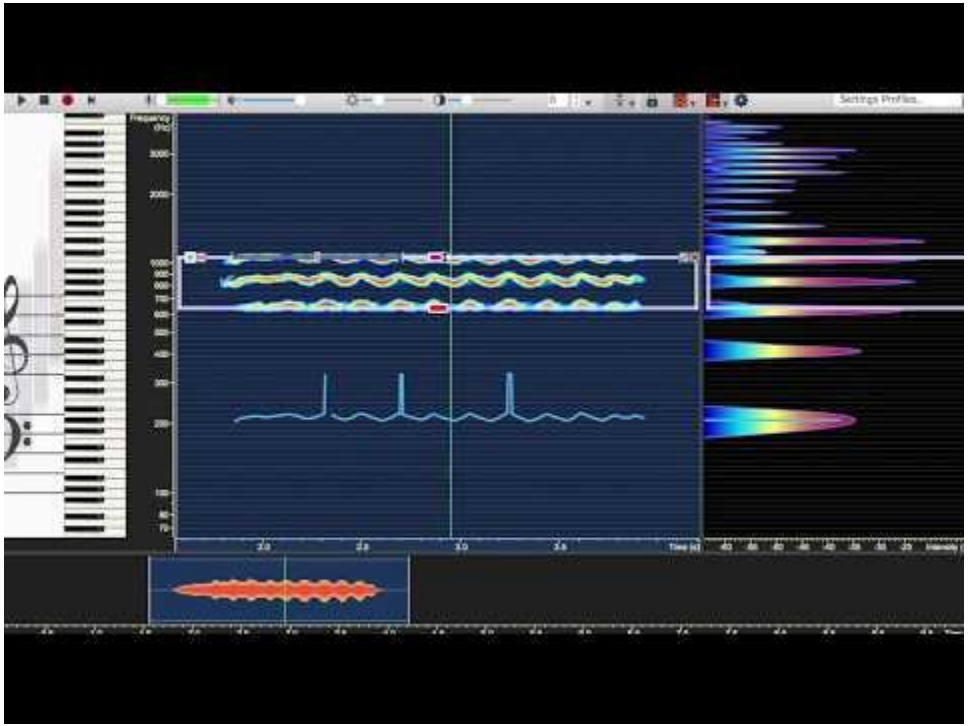


Resonation

- The vocal tract gives individuals their unique voice
- The sound created by the vocal folds is shaped by the pharynx, oral cavity, and nasal cavity
    - Different frequencies are amplified or dampened to enhance harmonics/overtones
    - Resonance can be altered by changes in anatomy or physiology (a cold or surgical procedure→hypo- or hypernasality)

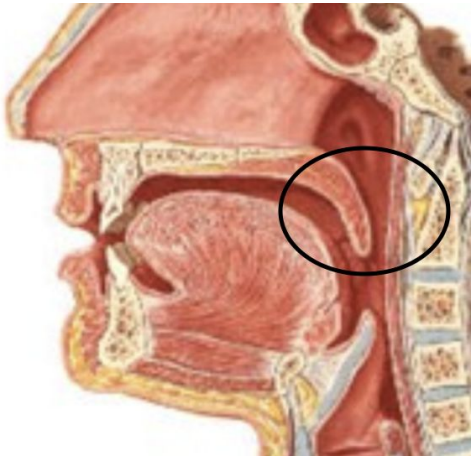
Odd-numbered harmonics:	Even-numbered harmonics
1st harmonic = fundamental tone	2nd harmonic = octave,
3rd harmonic = fifth above octave	4th harmonic = 2nd octave
5th harmonic = third above 2nd octave	6th harmonic = fifth above 2nd octave
7th harmonic = minor seventh above 2nd octave	8th harmonic = 3rd octave

Harmonics



Hypernasality

- Hypernasality is our enemy!
- Singers hear “sing in your mask” or “place the sound more forward”
  - The coach/director often mean they want more ring in the sound, the singer is singing with their tongue pulled back which creates a dark sound, the singer isn’t singing with full resonating space, there is tension, the larynx isn’t in its optimal position
  - When the singer hears this, they typically lower the soft palate and place the sound in the nose→hypernasality



Hypernasality

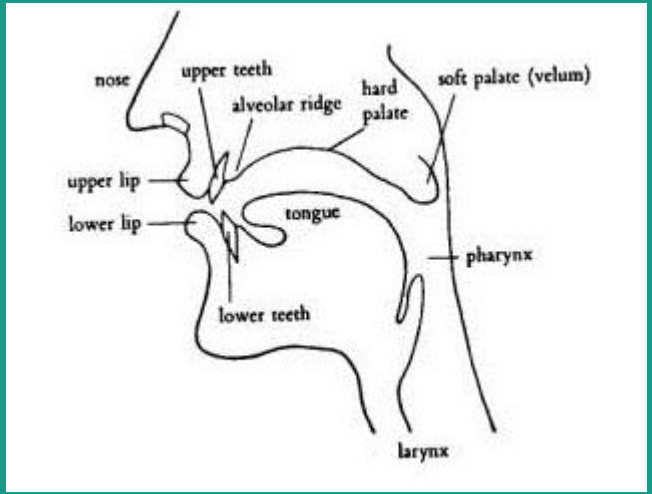
- The only sounds which should be resonated in the nose:
  - M
  - N
  - Ng
  - Sounds surrounding the nasal sounds may be resonated in the nose (anticipatory or carry over nasalization)
    - The amount of nasality in traditionally non-nasal sounds can (and should) be modified, especially if the vowels are sustained

Hypernasality

- Let’s try it!
  - “Peter Piper picked a peck of pickled peppers”
    - Plug nose--any change in sound?
  - “Mary had a little lamb whose fleece was white as snow”
    - Plug nose--any change in sound?
    - Prolong “Maaaaaaaaary”
      - Can you make the vibration in your nose stop?
      - Can you make the vibration turn on and off?

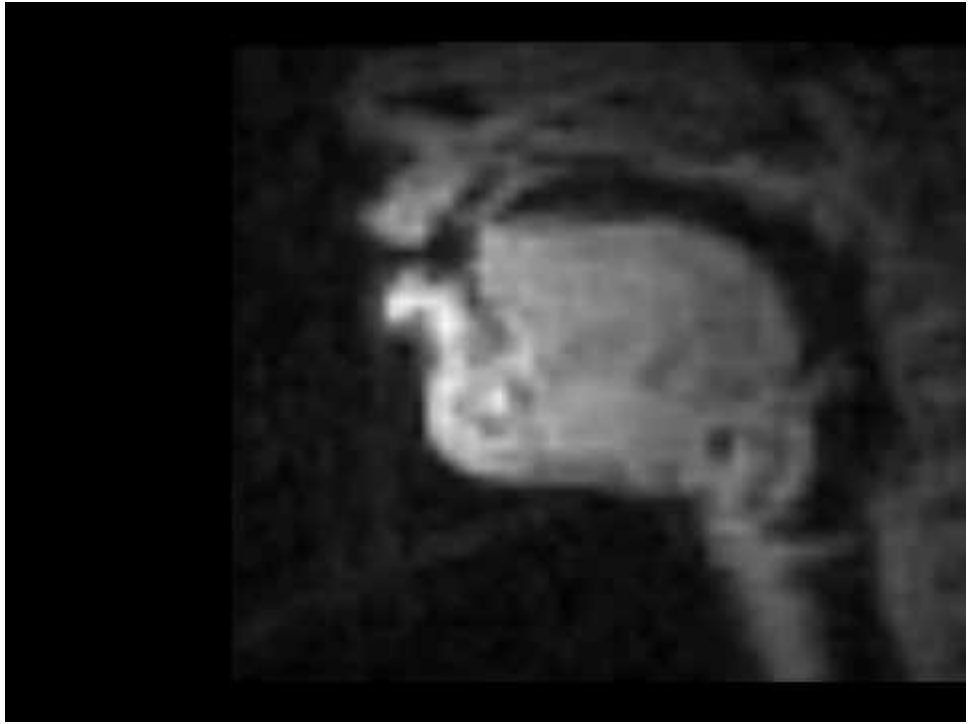
Articulation

- Once modified by the resonators, the sound is shaped by the articulators
  - Lips, tongue, and teeth are primary articulators



https://pancaller27.wordpress.com/2011/10/03/the-production-of-speech-sounds/

Articulation



https://www.youtube.com/watch?v=M2OdAp7MJAI

Putting It All Together!

The vocal mechanism involves four subsystems and lots of muscles, several of which are susceptible to injury. So what do you do if you start having voice problems?

Voice Disorder

- Occurs when voice quality, loudness, and/or pitch differ or are inappropriate for an individual's age, cultural background, gender, or geographic location
- Present when an individual expresses concern about having an abnormal voice that does not meet daily needs
    - Still considered a voice disorder even if other individuals do not perceive the voice as different or deviant

Causes of Voice Disorders

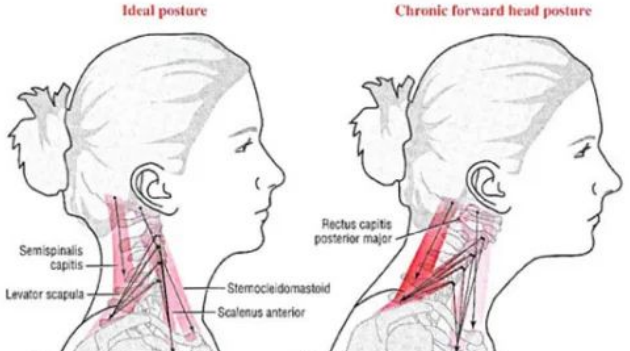
- Physical changes to the mechanism (i.e. swelling, nodules, changes due to aging)
- Problems with the nervous system(s) (i.e. vocal fold paralysis, tremor)
- Improper or inefficient use of the mechanism with a normal physical structure
  - Muscle tension dysphonia
    - Improper singing or speaking technique
    - Response to a structural cause, response remains after structural cause is resolved
      - Vocal fold hypomobility→use improper compensatory strategies→develop muscle tension dysphonia→vocal fold hypomobility improves→compensatory strategies remain so voice does not improve
- Psychological stressors that lead to habitual, maladaptive dysphonia or aphonia (complete lack of voice)

Avoiding Vocally Abusive Behaviors

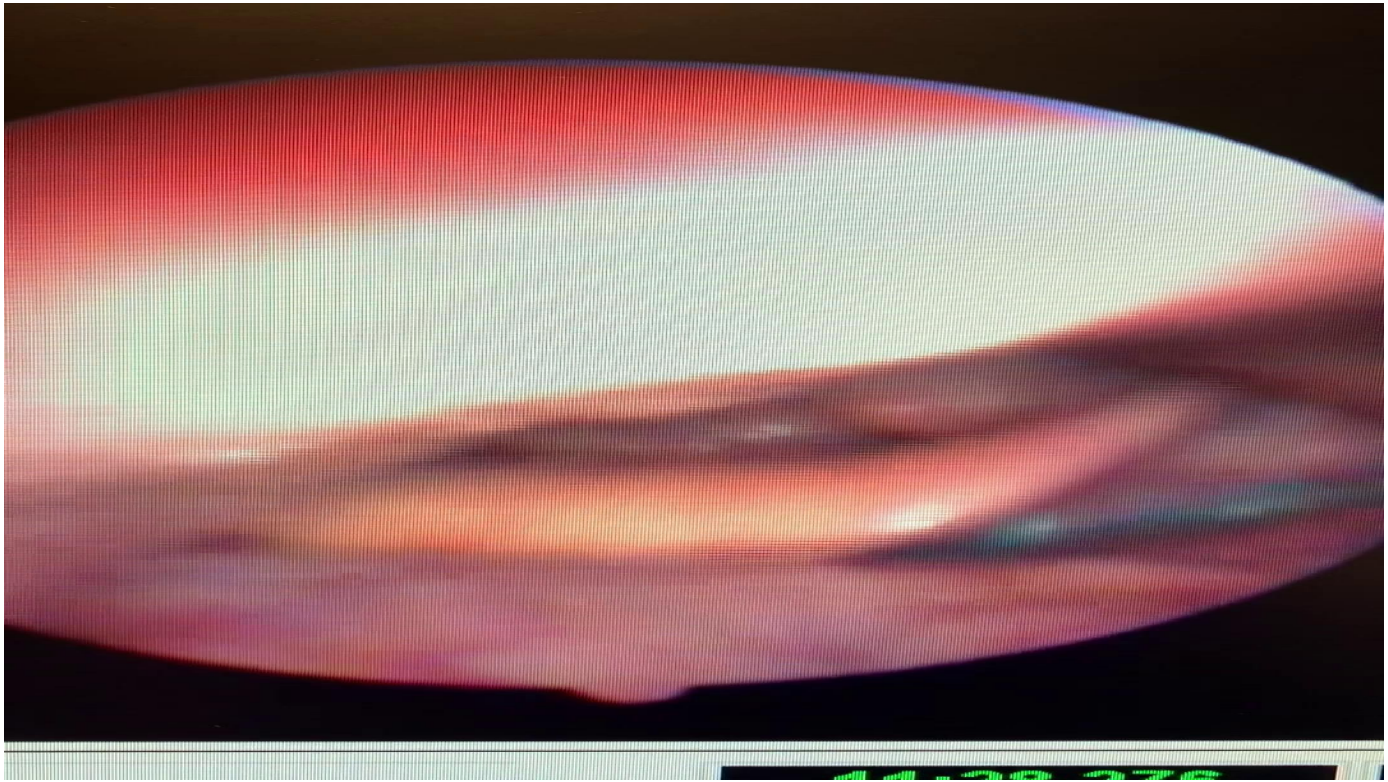
- Clearing throat or coughing too much
- Yelling, screaming, LOUD whisper
- Being in smoky environment
- Talking too much in an abnormally low or high pitch
- Singing or speaking with excess tension
- Inadequate breath support
- Overusing the voice

Be Aware

- Proper breath support while speaking (and singing) is vital
- Hydration is key
  - Directly impacts tissue viscosity
  - Lowers phonation threshold pressure → reduced effort to phonate
- Other irritants to the mechanism (reflux, pollution, allergies) can contribute to vocal issues
- Background noise can contribute to strain
- Poor neck posture can cause strain
- Know what is normal for your voice



Reflux



Recognizing signs of vocal fatigue or abuse

- Difficulty producing sound in parts of your vocal range or reduced vocal range
- Change in vocal quality (particularly breathy or hoarse)
- Pitch and/or phonation breaks
- Feeling a persistent “lump in your throat”
- Voice “gets tired” easily
- Pain is never good!

Voice Therapy Techniques for the Non-Injured Singer

- Semi-occluded vocal tract exercises
  - Layman's terms: the mouth is partially closed
  - Narrows the vocal tract above the vocal folds to maximize interaction between vocal fold vibration (production of sound) and the vocal tract (the sound filter) and to create resonant voice
  - Increases the air pressure above the vocal folds to reduce the impact collision force of the vocal folds
  - To put it simply, partially closing the mouth creates back pressure at the lips to help the folds vibrate with more ease and less muscular effort

Voice Therapy Techniques for the Non-Injured Singer

- Semi-occluded vocal tract exercises
  - Examples:
    - Bubbling (lip trills)
    - Tongue trills
    - Sing on “oh”, “oo”, “v”, “z”
    - Straw phonation
    - Vocal function exercises
  - Focus: Improve breath support and produce voicing without tension
- Yawn-sigh
- Circumlaryngeal massage

What do you do if you find your voice is changing as you age?

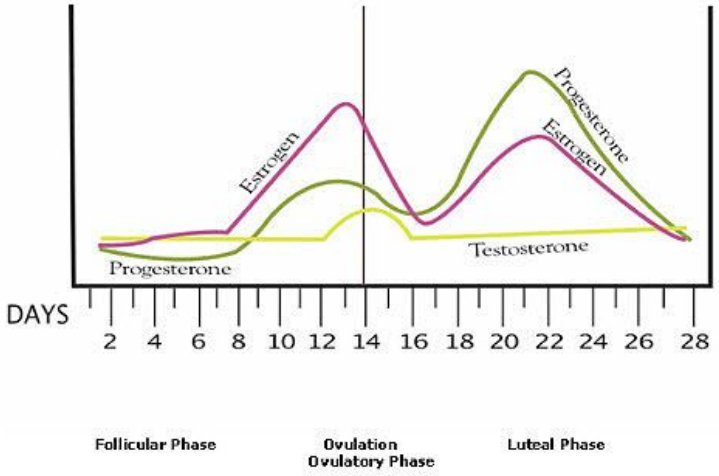
How would you describe an “aging voice”?

The Aging Voice

- ~20-30% of individuals over 50 years of age have altered vocal function
  - Due to onset of disease or age-related physiological changes
- Older individuals are perceived to present with more roughness, breathiness, strain, and instability
- Studies have shown dramatic impact of dysphonia (voice disorder) on quality of life
  - 53% reported dysphonia impacted past job functions, 49% for current job functions, and 76% believe their dysphonia will impact future job functions
  - 75% felt social interactions were adversely affected, with patients frequently limiting their social interactions

Hormonal Impact on the Voice

- Hormone changes can profoundly affect the voice
- As hormones change throughout the menstrual cycle, the changes can manifest in the voice
- Changes typically occur right before menstruation, though some women note changes during ovulation
- Vocal changes can include:
  - Loss of upper range
  - Vocal fatigue
  - Husky vocal quality
  - Reduced vocal flexibility and/or power
  - Reduced vocal efficiency
  - Pitch uncertainty



Hormonal Impact on the Voice

- Hormone shifts cause laryngeal changes
- Vocal fold bulk increases due to dilated blood vessels and fluid retention
    - Increase in bulk results in lower pitch and change in vibration, resulting in more effortful speaking and singing
- Hormonal changes affect the fundamental frequency (determined by vocal fold vibration) and formant frequencies (resonance; determined by size and shape of vocal tract)
    - Studies have shown a link between oral contraceptives and a more stable fundamental frequency
- Important to note that vocal fold changes can lead to use of compensatory strategies that can be harmful
    - Increased muscle tension in head, neck, base of tongue, jaw, throat, larynx
    - Can result in vocal fatigue and hoarseness
    - Can result in vocal fold trauma, depending on how long the negative compensatory strategies are used and how traumatic they are

Voice Changes During Perimenopause and Menopause

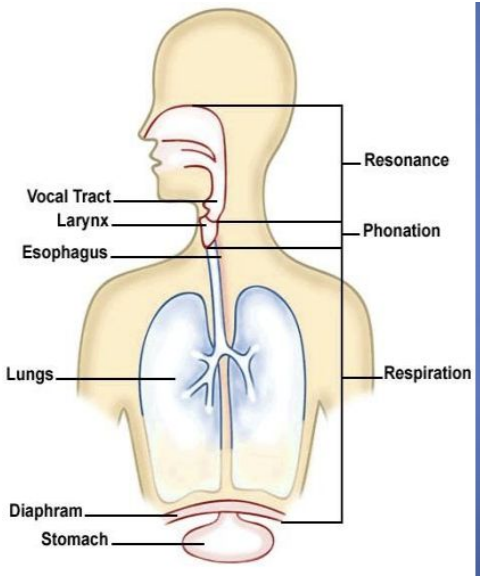
- Menopause: a point in time. A person has “reached menopause” when they have not had a menstrual cycle in one year
- Perimenopause: an extended transitional state. Begins with irregular menstrual cycles and ends a year after the last period
- Estrogen levels fall and androgen levels increase relatively
- Structural changes and issues impacting voice during perimenopause and menopause:
    - Drier larynx
    - Less lung power
    - Weakened laryngeal muscles
    - Stiffer laryngeal cartilages
    - Thickened vocal folds (due to relative increase in androgen levels)
    - More masculine voice

Voice Changes During Perimenopause and Menopause

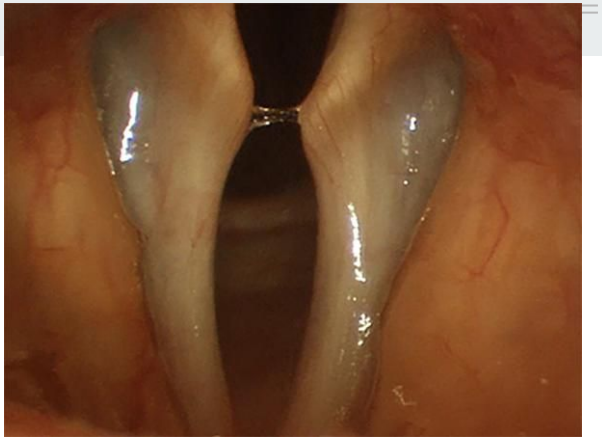
- Menopausal voice changes have been studied less than the premenstrual phase voice changes
- Frequently reported menopausal voice changes:
  - Breathiness
  - Decreased range
  - Less breath control
  - Vocal fatigue
  - Pitch inaccuracies
  - Changes in vibrato
- Hormone replacement therapy was frequently offered in the past, though links to increased incidence of cancer may make hormone replacement unsafe (talk to MD)

Causes of Presbyphonia (The Aging Voice)

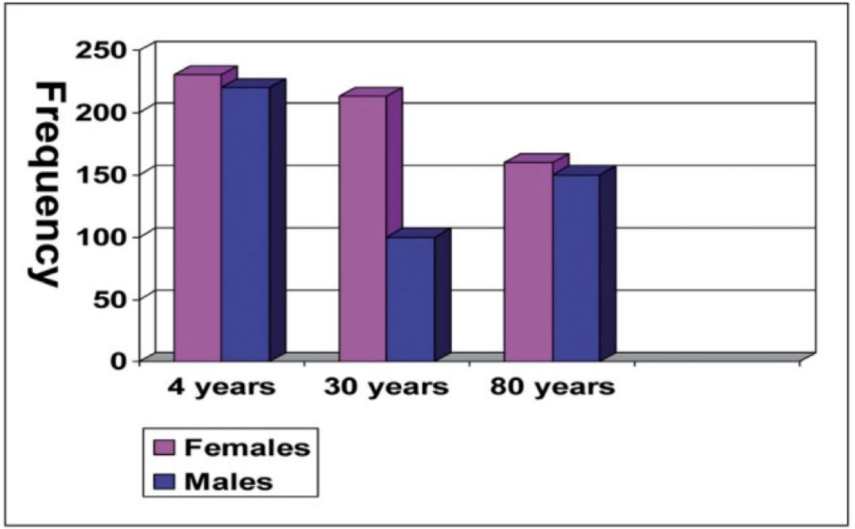
- Age at which people begin to “sound old” varies widely
  - Time does not define aging, biological changes and the functional deficits of those changes define aging
- Normal aging process can affect the larynx and vocal folds:
  - Muscle atrophy
  - Thinning of mucous membranes
  - Stiffening of connective tissues
- What about the rest of the body?
  - Muscle loss in the other systems involved in speech and singing can affect the voice
  - Respiration: stiffer and weaker lungs/muscles of respiratory system, reduced amount of air inhaled, reduced ability to regulate air pressure speaking/singing
  - Resonation and Articulation: slowed articulation rate, less precise articulation, change in shape of resonators impacting overall resonance



Aging Voice Symptoms



- Higher pitch in men (thinning of vocal folds due to fall in androgen level and relative rise in estrogen/androgen ratio)
- Lower pitch in women
- Reduced projection
- Loss of resonance
- Reduced endurance
- Voice tremors
- Weak (asthenic), breathy, and/or strained voice
- Typically gradual

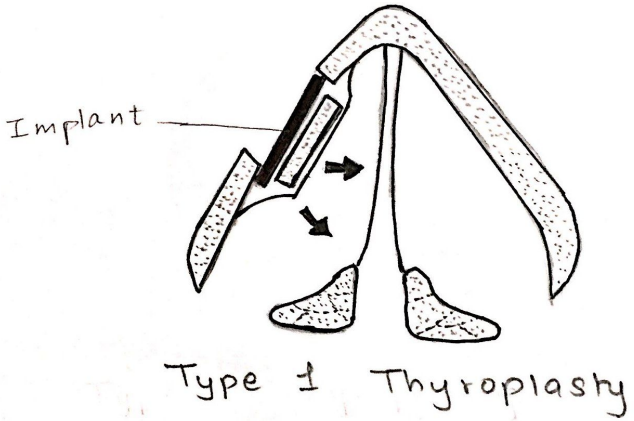


“Normal” Voice

Presbyphonia

Treatments for the Aging Voice

- Botox injections
  - Can reduce vocal tremor
- Vocal fold filler injections
  - Enlarges vocal folds that have lost muscle tone
- Permanent fat injections
  - Uses abdominal fat to enlarge vocal folds
- Thyroplasty
  - Surgical procedure
  - Portion of the thyroid cartilage or an implant is pushed towards midline
- Voice therapy by SLP
  - Reduces laryngeal strain/muscle tension dysphonia
  - Improves vocal stamina
  - Assists patient in finding optimal pitch and volume



So What Can You Do?

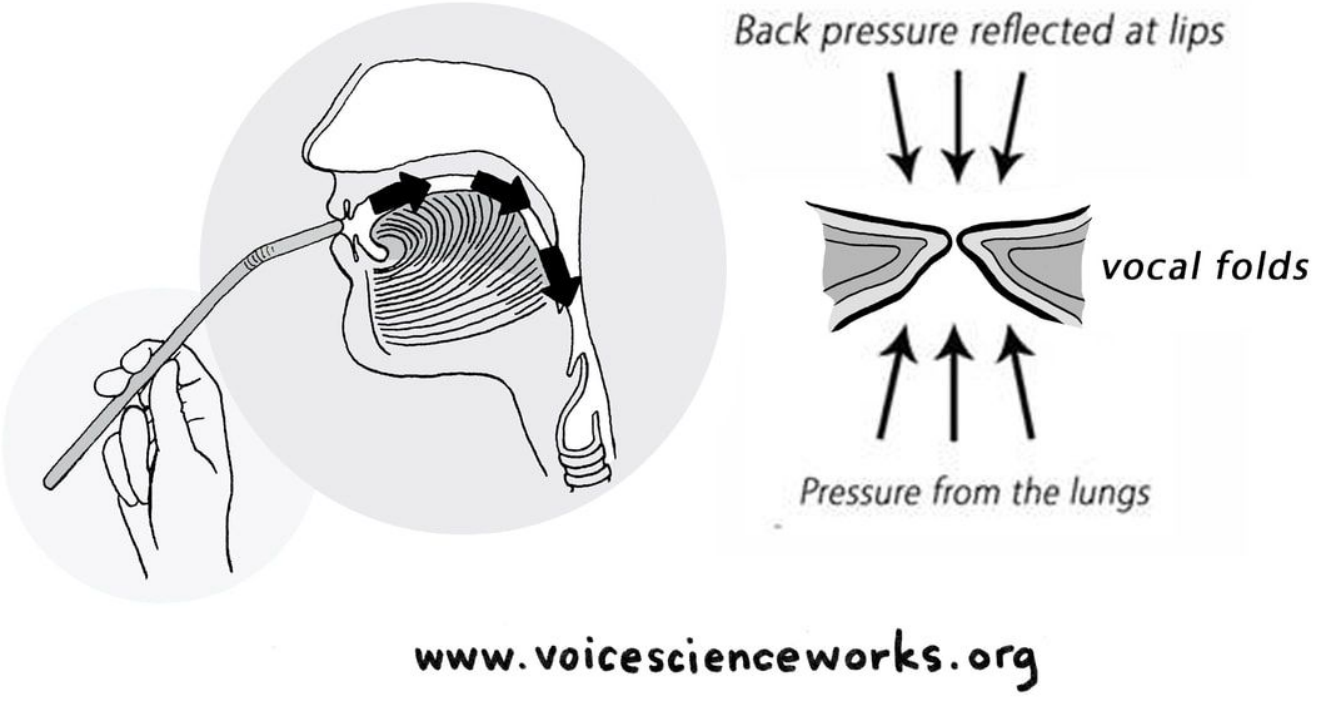
- Be aware
  - Know the signs of presbyphonia so you can seek help if they begin
- Maintain your overall health
  - Other health issues that restrict breathing (i.e. asthma, allergies, COPD) can affect your voice
  - Regular exercise improves stamina, builds muscle tone, and improves posture
  - Smoking, alcohol abuse, reflux, inhalation of irritants all worsen the aging process
- Continue using your voice!
  - Make sure your voice is being produced freely. No tension!!
  - The more you use it, the stronger it will be
  - Keep singing in Sweet Adelines!
    - Study showed regular choral singing assists in preserving the speaking voices of older adults
  - Use it or lose it

So What Can You Do?

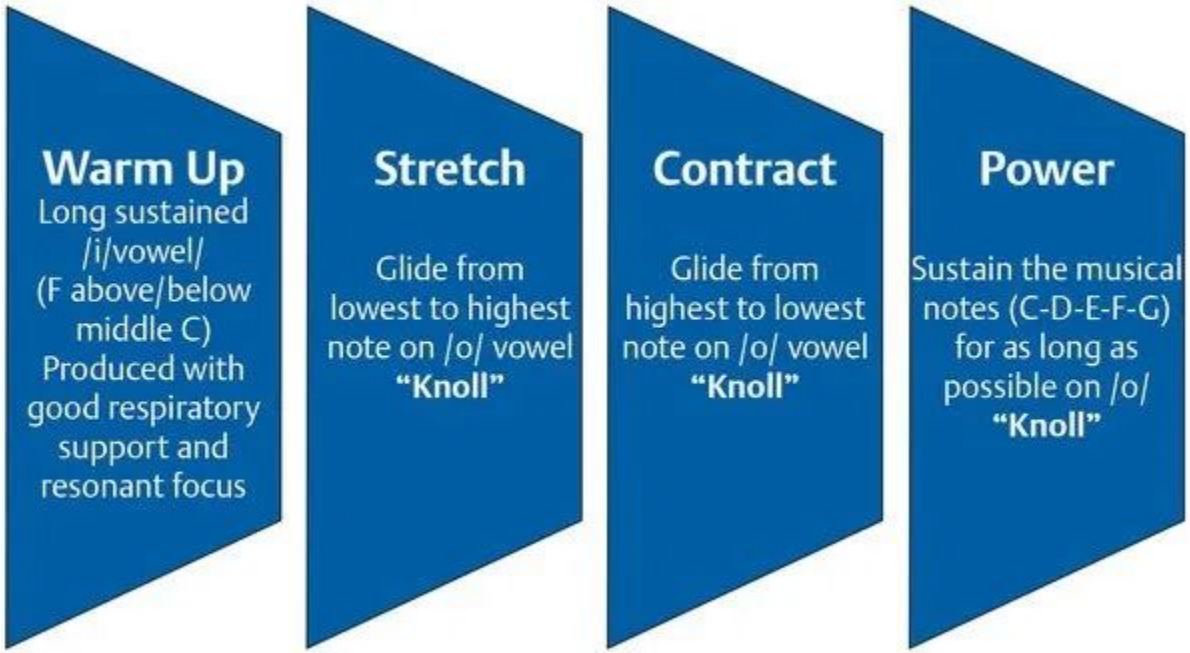
- Practice good vocal hygiene
  - No smoking
  - Avoid abusive behaviors (i.e. coughing, throat clearing, yelling, loud whispering)
  - Stay hydrated
    - Adequate hydration directly impacts tissue viscosity
    - Lowers phonation threshold pressure→reduced effort required to produce voice
    - Limit dehydrating drinks (i.e. caffeinated and alcoholic beverages)
- See an ENT if you notice symptoms of presbyphonia
  - Follow up with a voice teacher or Speech-Language Pathologist based on findings from ENT
    - See a professional sooner rather than later! The longer you wait the more negative compensatory strategies you may be developing, which could take longer to reverse
  - Talk to your doctor about treatment options if voice therapy does not help

Straw Phonation in Water

- Multiple studies have shown an improvement in vocal quality and perception of severity of voice disorders when individuals with presbyphonia completed straw phonation in water
- Lower vocal effort required for phonation when performing straw phonation in water
- Tasks completed over a 6 week exercise program:
  - Abdominal breathing
  - Relaxation exercises
  - Straw phonation in water (submerge bottom of straw 5cm below the surface of the water)
    - Sustained vowels (schwa or “oo”)
    - Pitch glides (ascending and descending)
    - Engine sounds (5-7 “hills” of sound with varying pitch and loudness)
    - Singing the melody of songs


Back pressure reflected at lips
vocal folds
Pressure from the lungs
www.voicescienceworks.org

Vocal Function Exercises




I LOVE QUESTIONS
QUESTIONS ARE MY FAVORITE