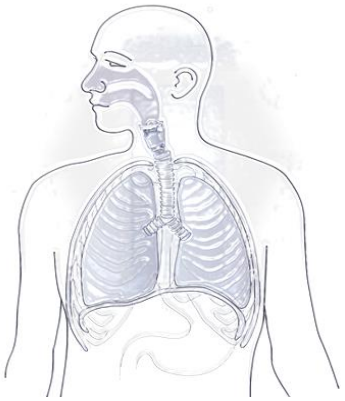
Voice, Speech and Gender

How the Voice Works

The voice production system is composed of an energy source (lungs and breathing muscles), a sound source (larynx) and an amplifier/filter (vocal tract – mouth, throat, nose). When we speak and sing these 3 components interact constantly; what we do in one part affects the whole system. For example when we skillfully tune the mouth and throat to amplify the sound produced by the larynx, the vocal folds vibrate more efficiently and we need less air pressure to produce the sound. This is good news – better vocal technique makes the voice feel easier, sound better and last longer.

For trans people who want their voice to match their gender identity the process needs to go further. An easy, efficient voice is not enough; it must also express the person inside. By subtly changing the way the vocal folds vibrate and how the mouth and throat shape that sound we can begin to develop a voice that is a better match for gender diverse people. This is the goal of Changing Keys: to give people the tools to develop a healthy voice that feels more comfortable and better matches who they truly are.

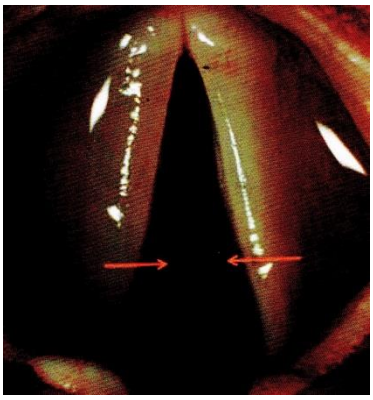
Here's a general overview of how the voice works.



ENERGY SOURCE – Breathing system

When we speak or sing the breathing muscles suck air into the lungs then carefully manage how it is driven back up into the larynx. This calls for fine tuning as the amount of breath varies with a lot of things, for example how long and loud the phrase is, how high and low the voice goes, and what speech sounds are involved. Fortunately when things are working well it all happens on automatic pilot. One sign that the breathing is efficient is that we feel the breathing movements in the middle of the body rather than up in the chest.

SOUND SOURCE – The Larynx



© National Center for Voice and Speech

As air goes into and out of the lungs it passes through the larynx, or voice box, which sits on top of the windpipe.

Vocal folds (also known as *vocal cords*) stretch from the front to the back of the larynx. At the front they attach to the thyroid cartilage; at the back they attach to small cartilages (*arytenoids*) that rotate and swivel to change the position and tension of the vocal folds. When we breathe, the backs of vocal folds are pulled apart, creating a "V" shape that allows air to pass between them. When we speak or sing, the vocal folds move close enough

together to be vibrated by the air coming up from the lungs. This vibration is very fast. In cis men the vocal folds typically vibrate around 90 to 140 Hertz., or times per second. In cis women the vibration is on average twice as fast, around 180 to 220 Hz.

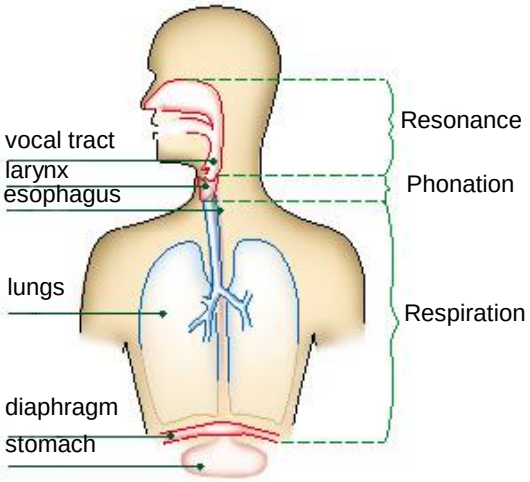
AMPLIFICATION/FILTER: Throat, Mouth, Nose

Suppose an orchestra is all playing the same note. That note will sound very different, depending on whether it's being played on a violin, a piccolo or tuba. The size and nature of the instrument shapes the sound in enormously different ways, imparting its characteristic quality on every note. In humans the vocal tract – throat, mouth and sometimes nose – is like the body of a musical instrument. It imparts its own quality or timbre on the sound. A pitch can sound higher or lower, depending on how big or small the vocal tract is. If the throat and mouth cavities are relatively large, we perceive the voice as sounding lower pitched. If the throat and mouth are relatively small, the pitch of the voice sounds higher.

Our perception of the pitch of a voice – how high or low it sounds – depends on two things: how fast the vocal folds are vibrating and how long/big or short/narrow the vocal tract is.

Turning the voice into words

At the back of your throat the voice is simply raw sound; by the time it leaves your lips it has been transformed into speech. During its passage, the voice is stopped, started, amplified, squeezed, and narrowed. It is turned into words by a series of precise, high-speed maneuvers. This shape-changing is done by the muscles in the walls of the throat and mouth and also by the articulators – the tongue, lips, jaw and soft palate.



Picture adapted from GBMC

Producing voice is a paradox. It is so simple we aren't conscious of doing it and so complex that – if we had to do it consciously – we would never get it done at all!

Sound Advice:

Your guide to a strong, clear, easy voice

What's good for you generally is good for your voice. However most people (including the people who wrote this) don't live a 100% healthy lifestyle – eating things we know aren't good for us, not getting enough sleep or enough exercise, etc. But even small changes are better than

no changes. Cutting down smoking by one cigarette a day, drinking an extra glass of water, or anything else that moves you towards health is a good thing. So…have a look at this advice and think about what you can do at this point…even making one change is a good start!

1. Keep your larynx hydrated

Drink: Lots of non-caffeinated, non-alcoholic liquids; more if exercising, using your voice a lot, or taking dehydrating medications (e.g., spironolactone). Water is easiest and it's what your system needs. Alcohol and perhaps caffeine (coffee, tea, most soft drinks) have a drying effect on your body. How can you tell if you are drinking enough water? Follow the dietician's advice to "pee pale". Check your urine – if it is pale yellow, you are well hydrated; if it is dark yellow and concentrated, reach for the water bottle.

Steam: Breathing in humidified air rehydrates the vocal folds from the outside. It can be useful if you have an upper respiratory infection, your throat feels tired or sore, you have been doing a lot of talking or singing (breathing through the mouth dries out the vocal folds), or you are in a dry environment.

Things you can do: Steam for 5 to 10 minutes, twice a day.

- Take a hot shower or bath
- Put your face over a bowl of hot water and drape a towel over your head (you get a facial at the same time)
- Use a hot water vaporizer (not cold-mister)
- Buy your own personal steamer (around $60)

2. Keep your larynx healthy

Clean air: Ideally, the only thing that should touch the vocal folds is clean, moist air; anything else can irritate them. While the vocal tract has a housecleaning system that cleanses the mild, common pollutants from the vocal folds, it cannot cope with the two main sources of laryngeal irritation – smoking and acid reflux.

Smoking (cigarettes, pot/hash, vapping, crystal, crack, heroin, PCP, etc.) brings hot gases into contact with your larynx, drying the lining of your vocal folds; crack and freebase cocaine can get hot enough to cause serious burns. Smoking also exposes your larynx to an assortment of chemicals. The tar in cigarettes and cigars is particularly toxic: people who smoke more than 20 cigarettes a day have double the risk of getting cancer of the larynx, with an even higher risk for people who drink alcohol as well as smoke. Pot is also high in tar – four times as much tar is deposited in your lungs from smoking an unfiltered joint than in smoking a filtered cigarette.
Things you can do: Reduce your exposure to smoke.

- Stopping smoking is the single biggest thing you can do for your voice. If you want to quit but you're finding it hard to, talk to a doctor or nurse about medical options.
- Avoid second-hand smoke as much as you can.
- If you are trying to cut down on smoking:
  - don't cut the filter off cigarettes: this lets more toxic chemicals into your lungs
  - don't smoke "mild" (or "light") cigarettes: studies have found that with "mild" cigarettes smokers take deeper puffs to get more nicotine, which results in more tar deposit

    - E-cigarettes: While the jury is still out on the health effects of vapping, we do know that dry, toxic substances are passing over your vocal folds and this is not good for their health.
- Protect your larynx from pollution: Dust and chemicals can irritate the delicate tissues of the larynx. If you are exposed to these pollutants, consider increasing ventilation or wearing a mask over your mouth and nose.

3. Protect your larynx from acid reflux: If you have it, treat it. The medical terms – "gastro-esophageal reflux disease" (GERD) or "laryngeal-pharyngeal reflux" (LPR) – refer to a leakage of acid and digestive enzymes from the stomach back up into the esophagus (GERD) or into the larynx/pharynx (LPR). The larynx sits right at the entrance to the esophagus, so anything leaking up can spill over directly onto the vocal folds. This irritates the vocal folds and may also cause the muscles around the larynx to tighten. Reflux is frequently a background issue in voice problems.

Do you have reflux? Common symptoms include:

- gravelly voice and irritated throat, especially first thing in the morning
- frequent need to clear the throat or cough
- feeling of something stuck in the throat
- difficulty producing the voice, especially at higher pitches

If you notice some of these symptoms, ask your doctor if you have reflux. A website that gives good information on the kind of reflux that can affect the voice is:
www.voiceinstituteofnewyork.com

Things you can do: If you have reflux, follow your doctor's advice. This may include:

- Don't eat for 2 to 3 hours before going to bed.
- Elevate the head of your bed about 6" by putting blocks or old phone books under the bed frame at the head end, so you are sleeping on a bit of a slant. (Propping yourself up on extra pillows is not recommended as it can hurt your neck and you may slide down during the night.)
- Reduce or avoid eating foods that promote reflux. These include acidic foods (e.g., tomatoes, oranges, orange juice), alcohol, caffeine, spicy and high fat foods.
- Reducing excess weight around the waist may be helpful.
- Your doctor may suggest antacids or prescribe medicines that reduce or block acid production. Typically these are prescribed for 1 to 3 months and the patient is reviewed again at the end of that time. You must follow the reflux protocol as well as taking the medication.

4.Keep your larynx harm-free (if it hurts your throat, don't do it)
To achieve the voice they want trans people often speak in pitches higher or lower than those the larynx was designed to for. To sustain a pitch that is basically outside the usual physiological range, you need to use good vocal technique.

Things you can do: To help your voice sound good and last well:

- get professional training in how to produce a higher/lower voice in a way that doesn't strain your throat
- warm up your voice if you will be doing a lot of talking
- keep the sensation of your voice up in your face rather than down in your throat
- don't compete against loud background noise at parties, restaurants, or bars: in a noisy environment you may be using your voice for longer and much more loudly than you realize, and end up hoarse.

Sex, Gender, and Speech

For trans people who want to sound more feminine, more masculine or more androgynous, it is helpful to understand the ways that sex, gender and society influence speech. Average speaking pitch, pitch range and vocal quality are largely shaped by genetic, physical makeup. But other aspects of communication, such as vocal inflections, word choice and gestures are influenced by the norms and expectations of the society in which we live.

Hormonal influences on the voice

In people designated male at birth the size and shape of the vocal tract (throat, mouth and nose) is greatly influenced by the increase in testosterone at puberty. The cartilages in the larynx grow larger and thicker, increasing the height and front-to-back dimensions of the larynx. As the thyroid cartilage grows the angle of its two halves sharpens and becomes more prominent, creating the 'Adam's apple'. The vocal folds grow longer and thicker, making them vibrate more slowly. As the facial bones grow they create bigger spaces in the mouth, nose, and back of the throat, giving the voice more room to resonate**.** The changes in the larynx produce a drop in voice pitch and the larger resonance tract gives the voice a deeper, richer resonance.

Just as there is great variation among cis males and cis females in facial hair, muscle mass, sex drive, and other physical characteristics that relate to testosterone, there is also great variation in voice: some cis men have high voices, and some cis women have deep voices. For this reason, there is overlap in what is considered standard for men's voices and women's voices.

If transmen take testosterone as adults, the vocal folds grow thicker and the speaking pitch drops. However for transwomen there is no corresponding change with hormone therapy. After the voice drops in puberty, estrogen and other feminizing hormones will not reverse this change.

Gender, voice and the vocal tract

The pitch of the voice and how it is shaped by the vocal tract convey the most information about the speaker's gender. As is seen in the table below there is an overlap in the pitch ranges of cis women and cis men. The 145-165 Hz. range might be considered androgynous as it is within the speaking pitch ranges for both cis men and cis women. In this androgynous pitch range, other aspects of the voice, such as resonance, intonation and voice quality, may become very important gender cues. This might explain why actor Sean Connery isn't perceived as female, despite having an average speaking pitch of 158 Hz. It may also explain why a transwomen may be read as male even she has have an average speaking pitch above 155 Hz.

While there are physical limits to how high or low an individual's voice can go, everyone has the potential of making a variety of pitches from low to high. Voice training can help trans people consciously shift the average pitch they use, to a higher or lower place within their physical range. This brings the pitch closer to cis female norms for transwomen or cis male norms for transmen. It is also possible to change the shape of the mouth and throat to create a bigger or smaller resonance space, which influences the perception of pitch.

Speech/voice gender cues
Other parameters of speech and voice also give gender cues and can be useful to target in a speech and voice training program. For example a breathy voice quality and greater precision in producing speech sounds ('going' rather than 'goin') are perceived as feminine qualities. Using more inflections, particularly upwards inflections may be perceived as more feminine while a flatter voice can sound more masculine. Drawing the voice out a little at the end of a word or sentence, rather than clipping the words may also give a more feminine sound. As with other aspects of speech, there is a wide range of what is considered normal for men and women in voice quality, articulation style, and duration. These speech parameters are heavily influenced by culture, class, and other social norms and will vary with the language being spoken.

Social norms of gender in voice and communication
Just as all societies have 'rules' for appropriate clothing and behaviour in men and women, they also have gendered norms for communication. These apply not only to speech but also to non-verbal communication such facial expression, gestures, posture and movement. Body language tends to be highly culturally and language-specific.

We suggest that, rather than adopting generalizations of how men or women "should" talk, you begin by carefully observing the people in your community. This lets you see what the men and women around you actually do, and gives you the chance to think about how you *want* to talk. The following table summarizes the current research literature on aspects of voice, speech and communication that may give gender information about the speaker.

Apps to measure your pitch

When you are training a higher speaking pitch, it's useful to be able to see as well as hear it.

Recommended: Voice Analyst. Cost seems to vary between around $18.00 (perhaps on Android devices) and $30.00 for Apple.
https://play.google.com/store/apps/details?id=co.speechtools.voiceanalyst&hl=en_GB
Company: http://www.speechtools.co/

Free: Seventh String Tuner – gives pitch of a prolonged sound in semitones:
http://www.seventhstring.com/tuner/tuner.html
Gstrings (Chromatic Tuner)
https://play.google.com/store/apps/details?id=org.cohortor.gstrings&hl=en
Tip. Set it to 'Auto Tuner'.

Gender Relevant Voice and Communication Parameters in North American English Speakers

Supported by research literature	Communication parameter	Perceived as more female/feminine	Perceived as more male/masculine
Best supported by literature	Average speaking pitch (fundamental frequency)	180-224 Hz.	107-132 Hz.
	Speaking pitch range	145 – 275 Hz.	80 – 165 Hz.
	Vocal tract resonances	Smaller vocal tract, higher resonances	Larger vocal tract, lower resonances
	Vocal inflections (intonation)	More upward gliding inflections; greater range of inflections	More level intonation, more downward glides
	Voice quality	Mild breathiness	Clear, resonant voice quality
Less support in the literature	Articulation (production of speech sounds)	Precise, light	Less precise (e.g. 'goin' not 'going') More forceful
May be relevant but very few studies in transgender literature	Duration	Drawing words out; lingering on vowels	Staccato speech style
	Language choices	More dramatic, emotional words, qualifying statements, less direct speaking style	More straightforward, direct speaking style, less emotional word choice
	Non-verbal communication: postures, gestures, facial expressions, etc.	e.g.: More animated facial expressions, more eye contact, nodding/inclining toward listener, larger hand/arm gestures, appears to occupy less space	e.g.: More neutral facial expressions, less eye contact, fewer gestures appears to occupy more space, gesture less, etc.