Voice Health and Choral Singing: When Voice Classifications Limit Singing Ability

by Leon Thurman

Don't believe me. I do invite you to become curious and decide for yourself if this article helps you.

Are there conditions in singers' voices that can "fool" us into thinking that they are one classification, when in fact they are more appropriately another? How do we know if a singer is a soprano or alto, tenor or bass? Are there ages when no voice classification is appropriate, and in fact, would limit vocal potential? Are the vocal abilities of children, changing voice adolescents, changed voice adolescents, and adults held back by the labels we choral conductors, music educators, and voice teachers use?

This Article is Biased

Once a singer's voice is "classified," the singer "becomes" one of those labels, often for life. It is part of the singer's personal self-identification or self-image. Pitch range limitations often are placed on people because of their voice classifications. (Altos and basses can't sing high notes.) Sometimes young people believe that the "soprano and tenor I" categories mean they are better singers than the "II's," and the "Alto and Bass II" categories are better than the "I's." If labels can convey limits on vocal potential—perhaps for a lifetime, then an examination of how we classify voices would be helpful and practical.

Traditional Classification Criteria

1. All approaches to voice classification use a criterion related to vocal range. *"Higher" singing pitch range ability indicates soprano and tenor; "lower" pitch range ability indicates alto and bass.* Choral conducting, arranging, and methods texts generally indicate that a standard range for unchanged and changed voice sopranos is c^1 (middle C) to a^2; unchanged and changed voice alto is g to d^2/e^2; changed voice tenor is c to g^1/a^1; changed voice baritone is G/A to d^1/e^1; changed voice bass is E/F to d^1.

2. Some conductors use speaking pitch range as an indicator for voice classification. *Lower speaking ranges indicate alto and bass, higher speaking ranges indicate soprano and tenor.* They believe, based on research in the fields of speech and speech pathology, that a "normal" speaking range will "center" around a pitch that is four whole steps above the lowest producable pitch.

3. Voice quality is another criterion. *Deeper, darker, richer qualities indicate alto and bass; lighter, brighter, "flutier" qualities indicate soprano and tenor.*

4. The pitch at which register transitions occur is another standard voice classification criterion used by some conductors. Generally speaking, *lower-pitch transitions indicate alto and bass, and higher-pitch transitions indicate soprano and tenor.*

5. The soprano part almost always has the melody and is easier to learn and to maintain accurately when other parts are being sung at the same time. Singing the alto part nearly always requires the ability to accurately maintain a harmony part while others sing the melody. So one criterion for deciding who is a soprano and who is an alto—particularly among unchanged children—is: *Those who are best at maintaining a harmony part against a melody are altos.*

Is There Only One Criterion?

The genetically endowed oral dimensions of the laryngeal tissues and of the resonating areas above the larynx—*when healthy and used with physical efficiency*—reveal the appropriate and healthy classification of voices. The human gene pool is wonderfully mixed, and human brains have the capability of configuring the vocal folds and the vocal tract so that quite high and quite low pitches and a wide variety of tonal qualities can be produced.

People with larger genetically endowed oral dimensions will speak and sing more comfortably and with less vocal fatigue over time in slightly lower tessiturae and will have a "richer" tone quality. The opposite will be true of those with smaller laryngeal, pharyngeal, and oral dimensions. The distinctions are sometimes obvious. Usually, they are very subtle—especially in people who have not yet completed their physical maturation.

As voice classifiers, our goal is to distinguish between:

a. The pitch range and voice qualities produced by genetically endowed dimensions when voices are used with efficiency, and

b. The pitch range and voice qualities produced by unnecessary, excessive use of endowed vocal capacities—including "manipulation" to produce a "sound;" or by under-used vocal capacities.

Limitations in the Traditional Criteria?

1 and 2. *Pitch Range in Singing and Speaking.* We can be deceived into believing that singers have lower ranges than would be healthy for their voices? How?

Singing and speaking involve a bringing together of living tissue (the two vocal folds), and sending air between them so that vibratory ripples are produced in the surface layers of the folds. The rippling folds "collide" into one another in nearly all voicing. Singing a middle C for one second produces about 256 collisions per second.

In oversimplified terms, pitch changes happen when the relative length, thickness, and stiffness of those surface tissues change. The longer, thinner, and more stiff they are, the more collisions happen per second, thereby producing what we call "higher" pitches. The shorter, thicker, and less stiff they are, the fewer collisions happen per second, and we call the result "lower" pitches.

If a one-second middle C produces about 256 collisions, how many might there be in a three-minute choral selection, a fifty-five-minute rehearsal, a two-hour concert, a day

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of speaking and singing, a week, a month, a year? How would the back of your hand react if you hit it 500,000 or one million times? It would become very red and swollen long before you finished the count. That's essentially how vocal folds respond to their collisions. The harder they collide (the louder and more effortfully they "work"), the greater the tissue reaction.

If the vocal folds are swollen for any reason, the brain most likely will be unable to lengthen and thin the vocal folds as much as usual, so higher pitch range will be diminished. But the folds can be thickened more than usual, so lower range will be increased.

What can cause vocal fold swelling?

a. Upper respiratory infections
b. Allergies
c. Use of the folds for too much time per day, week, month, year
d. Overuse combined with overly effortful use of the folds, especially when bodies are relatively dehydrated and/or fatigued (These circumstances can lead to tissue disruption such as hemorrhaging or polyps, or to the formation of protective tissue such as nodules.)
e. Water retention in the body—possible during menstruation
f. Low production of thyroid hormone—hypothyroidism
g. Gastric reflux
h. Various drugs including cigarettes and alcohol

Will normal range ability return when the swelling subsides? When vocal folds are swollen, the brain must "refigure" the motor coordinations for the folds in order to move more mass, size and weight. If the swelling remains for a long enough period of time, the brain will change its habitual "firing" of the vocal folds to accommodate the larger size. Then, even when normal size returns, the brain's new habit will continue to produce lower range speaking and singing—unnecessary effort.

Do we now have an alto or a bass? Can an auditionee with a history of frequent colds, sore throats, and bronchitis be labeled an alto when their genetically inherited vocal fold dimensions might indicate otherwise? What about "loud talking" extroverted families with parents who smoke? What about cheerleaders?

The traditional pitch ranges for the various voice classifications are only helpful when selecting music for vocally healthy but unskilled, beginning singers. Unfortunately, they traditionally are used as indications of range *limits* for individual voices. A singer assigned to the alto or bass parts, for instance, may never have the opportunity to explore and develop higher range capabilities.

Every normally configured, healthy human voice is incredibly "talented." For example, we all have thousands of muscle motor units in the vocal folds, and the second fastest muscles in the human body are located in the larynx (eyes are fastest). Nearly all human beings are capable of producing a very wide range of pitches IF their brains learn the coordinations that produce them. For example, all normal, healthy female voices are capable of singing a high c^3 *as a minimum*, if . . . .

Remember the research that indicates "normal" speaking range to be four whole steps above the lowest producable pitch? That research just reports what the average vocally unskilled subject did. It does not reveal that a habitual pitch range which is that low would be overly effortful for nearly everyone. Speaking in pitch

ranges that are lower than would be physically efficient for endowed laryngeal size is common in our society. It can be seen easily in videotaped recordings of "talking" vocal folds.

To what extent are singing and speaking ranges reliable indicators of voice classification? Do we limit the opportunity for "altos" to develop their vocal potential by never allowing them to sing above an e^2? Do baritone-size larynges, singing in tenor ranges, teach excess vocal effort? Are some females able to sing in the tenor range only because they have a history of chronically swollen vocal folds?

3. *Voice Quality.* All voices can produce a "palette" of healthy, expressive "tonal colors." The vibrating vocal folds and the resonating spaces of the vocal tract both contribute to vocal quality. Voice quality is orignated by vocal fold vibratory patterns. When sustaining one pitch, a fundamental frequency and overtones are generated in the air column above. The resonating spaces above the folds then modify the original quality by "strengthening" some partials and "weakening" others. The overall "sound spectrum" that emerges is referred to as "voice quality."

When the folds are not quite brought all the way together, the vocal fold ripples produce tone mixed with varying degrees of air turbulence noise. We call that tone quality "breathy." When the folds are brought together with "appropriate medial compression," the now colliding folds impact into one another in a "bumping and rubbing" way to produce just tone. When the folds "over-compress" to various degrees, they "bang and rub" into each other and the collisions produce tone mixed with varying degrees of high frequency "noise" that is characteristic of over-stressed vocal fold tissue.

The harder the vocal folds work and over-compress, the more the amount of force in their collisions. The more vocal fold collisions and the greater their impact, the more likely there will be tissue reaction in the form of swelling (and tissue formation and/or disruption). When vocal folds are larger, a "thicker" sound quality is produced.

Another maneuver that some singers are taught is to enlarge the throat (pharynx) by over-tensing muscles at the base of the tongue. In addition to influencing the larynx to work harder, the resonance effect of this maneuver on the sound is to reinforce the lower overtones and absorb the higher overtones.[1] Yawning to "open the throat," and encouraging a consciously raised soft palate usually produce this effect.

Thus there is little or no balance of upper and lower partials in the tone, and high frequency "forwardness" can be nearly eliminated. If the folds provide some high frequency noise, however, we can hear some "bite" in the sound. Depending on the extent of the maneuver, we may label the vocal sound as "rich," "thick," "dark," or "throaty," and lean toward an alto or bass classification.

Do we have an alto or a bass? Or do we possibly have a soprano or tenor with enlarged vocal folds and, perhaps, a way of singing that enlarges the pharynx and fools us into assigning a lower range classification.

What does all this mean when we listen to the voices of young people who are chronically hoarse and in several choirs and a musical? What about the singers in festival, clinic, and all-state choirs? Are these important questions?

4. *Register Transitions.* In simplified, strictly physiological terms, the vocal registers we often refer to as "head" or "upper" voice, and "chest" or "lower" voice, are produced by the same basic action that produces pitch changes. The muscle actions that produce vocal fold lengthening/thinning and shortening/thickening are actions that are antagonist. The "lengtheners" and the "shorteners" "pull" the vocal folds in opposite directions.

In upper and lower voices, both the lengtheners and shorteners are active. In upper voice, the lengtheners are more predominantly contracted than the shorteners, so the folds are longer and thinner at the margins where they collide. In lower voice, the shorteners are more

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predominantly contracted than the lengtheners, so the folds are shorter and thicker at the margins where they collide.

The transition between upper and lower voices takes place when the predominance of contraction is transferred from one to the other. If the transfer adjustment happens suddenly, we will hear what we call a "break" in a voice. If the muscles involved have learned to make subtle, complementary adjustments over several pitches, there is a smooth transition that only trained listeners can detect.

Brains can learn to "fire" those transitions habitually at nearly the same pitch points every time, and singers can "choose" to "fire" transitions at various pitch points depending on various circumstances. Some transition adjustments may occur involuntarily.[2] With swollen vocal folds, a singer's brain may refigure the pitches at which register transitions are fired. Take care with this criterion.

5. *Part Reading.* Perhaps criteria related to developing vocal potential in people might be more basic than a criterion related to singing a harmony part independently.

Reducing the Chances of Voice Classification Limitations

Some general observations about classifying voices:

1. Record a brief voice use and voice health history of the singer as a guide for making decisions.

2. *When classifying unchanged children's voices*, no one is labeled "soprano" or "alto." Listening to voices speak and sing to assess present skill level and degree of health helps us "get to know" their voices. If the singers must be grouped, all groups are assigned soprano, alto, and/or all treble parts. The appropriate teaching of physically efficient voice skills, and the maintenance of voice health, become the core of any program that involves singing by children. Everyone is a singer who has great vocal potential.

The lower register, sung loud and forcefully, is not any child's "natural" voice—habitual, maybe, but not natural. Children can learn to sing with mellow voice qualities in lower voice with adequate (and healthy) loudness energy. In less skilled singers of any age, upper voice usually sounds "weaker," and is often rejected as ineffective, because the muscles involved in producing it are "under-exercised." With appropriate use over time, upper voice can develop considerable "strength" and can be "blended" with lower voice. Then a person has developed the "whole voice," not just half.

It is a myth that less skilled children must *always* sing lower range music (below about c^2 or even a^1). Most children who sing with relative accuracy in lower range can sing accurately in their upper or "head" voices if they have explored it and the music is keyed appropriately. Out-of-tune singing almost always occurs when a child's brain is trying to figure out how to manage the transition from a predominance of vocal fold shortener muscles to vocal fold lengthener muscles or *vice versa.* We can help them learn how to "meld" the two "voices" together. Taking lower voice coordination into midrange and above, is a common source of under-pitch singing.

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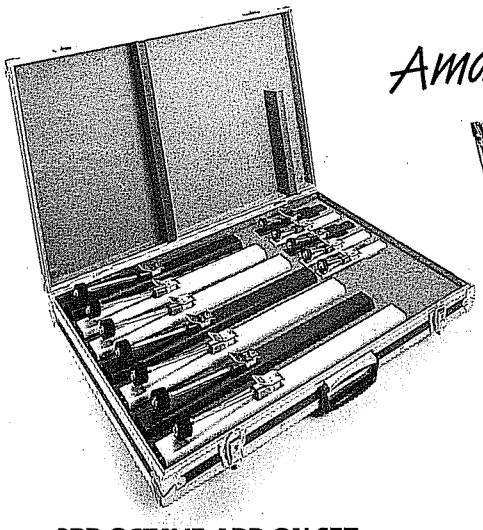

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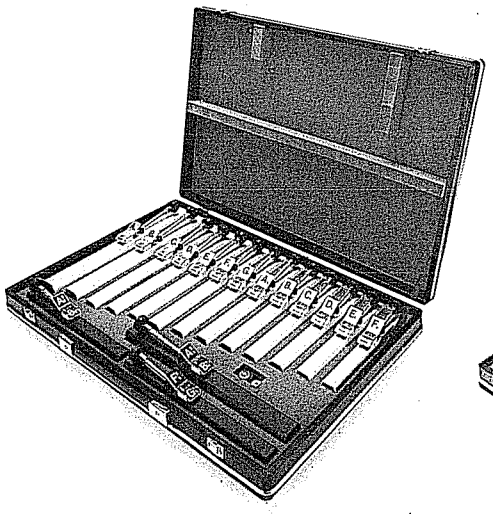

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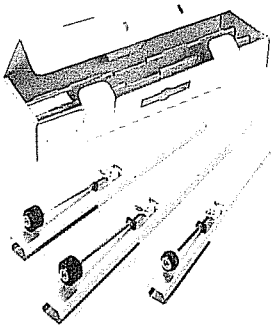

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3. *When classifying changing adolescent voices,* we hold the fragile vocal future of a human being in our hands. With adolescent voices, voice classification guidelines are necessary and, in fact, crucial to the development of physically efficient voice use. Although the rate of laryngeal growth varies with the individual, all individuals go through predictable stages of growth. Classification guidelines should "match" the physical changes in the larynx; they should be based on scientifically gathered and analyzed data; and they should enable choral conductors to assign parts, and write choral arrangements, that allow adolescent singers to sing with physical ease and health.

The pioneers in voice classification for male changing voices are due much credit, especially Irvin Cooper and Frederick Swanson. They were among the first in this country to bring reasoned analysis to this "can of worms" problem. The only data available to them was that of their own considerable experience in listening to, classifying, arranging music for, and helping young people respect their voices.

The work of John Cooksey represents a departure from past methods of formulating classification guidelines for changing voices. While the pioneers used their ears and much personal experience as the basis for their classification guidelines, the guidelines formulated by Cooksey are based on more than experience. They are also based on current knowledge about the physical growth and function of the larynx, and on scientific research carried out with two speech pathologists at California State University at Fullerton in 1977-80. A variety of special instruments were used to gather data for scientific analysis.[3] Over 90 boys were followed for three years through their voice change. In addition to other data, over 6,500 sonagrams were taken for computer analysis of the acoustic changes that occurred throughout each boy's change process. The patterns observed in the data were used as the basis for classification guidelines for male changing voices. These guidelines, therefore, are based on more refined data than is detectable by human ears, and data that has been subjected to scientific analysis and validation.[4]

Among many other clarifying observations, Cooksey identified the characteristics of the initiation of voice change, which he calls Mid-voice I. This classification had not been identified in any of the other guidelines. The sonagrams showed a clear alteration in the acoustic output of formerly unchanged voices, and Cooksey noted an increase in vocal effort and a slight decrease in tonal clarity in the upper range. *Those characteristics easily can be missed by the unaided human ear, and can result in a boy learning to sing with unnecessary effort.* Lynne Gackle has begun using similar methods to investigate the female changing voice and is developing classification guidelines.[5]

Why is all this important? When young changing voices are assigned vocal parts that exceed the vocal capabilities of their maturing anatomy, they are learning to use their voices with excess effort, and their vocal potential and health are being compromised. Many highly respected ear-nose-throat doctors recommend no singing during voice change. Until recently, they were unaware of Cooksey's work.[6] The

most accurate and helpful approaches to changing voice classification and part assignment are crucial in providing successful expressive singing experiences—*particularly for young males.*

4. *When voices have completed the rapid growth spurt* in early adolescence, their voices continue to "settle." In other words, growth and change continue, but the rate is considerably slower. Some tissue studies indicate that adult laryngeal dimensions are reached by about age twenty.[7] Even then, the calcification and ossification of the laryngeal cartilages continue and are not complete until the late twenties or early thirties. There is no scientific evidence for it yet, but many singing teachers believe that vocal capabilities are enhanced by the more bone-like rigidity of the laryngeal cartilages. The health and longevity of junior high, high school, and college-age voices can be compromised if they are asked to sound like older voices.

In carefully chosen music, one should assign "altos" to the soprano part, and *vice versa*; assign basses to sing the tenor part and *vice versa*. Allow all singers to develop all of their capable range with increasing physical efficiency.

Conclusion

Vikki was an alto in school choirs through high school, and an occasional soloist as a senior. She was an English major in college, but did not sing in choirs. After graduation, marriage, and a job with an insurance company, she began voice lessons to see if she had any potential for becoming an entertainer at the age of twenty-six.

The closer she got to singing an e^2 at the top of the treble staff, the more she tried to force the pitches out with her neck muscles. She "worked real hard." And she was frustrated.

For about six weeks we explored her "upper voice" and ways to sing with less and less effort. One evening she floated a high g^2 just as easily as you please. We looked at each other in that moment of recognition—she knew she had *released* that part of her voice for the first time since childhood.

"Why don't they teach you that in school?" she said.

Notes

[1] Jo Estill, "An Analysis of the Spectra of Four Voice Qualities: Speech, Sob, Twang, and Opera," in *Transcripts of the Tenth Symposium, Care of the Professional Voice*, ed. Van L. Lawrence (New York: The Voice Foundation, 1981), Figure 9 and p. 38.

[2] Ingo Titze, "A Framework for the Study of Vocal Registers," *The Journal of Voice*, in press 1988.

[3] John Cooksey, "The Male Adolescent Singer: Some New Perspectives," in *Proceedings: Research Symposium on the Male Adolescent Voice*, ed. M. Runfola and L. Bash (Buffalo, New York: State University of New York-Buffalo Press, 1984), 4-60.

[4] Mary Groom, "A Descriptive Analysis of Development in Adolescent Male Voices During the Summer Time Period," (Ph.D. dissertation, Florida State University, 1979).

[5] Lynne Gackle, "The Effect of Selected Vocal Techniques for Breath Management, Resonation, and Vowel Unification on Tone Production in the Junior High School Female Voice," (Ph.D. dissertation, University of Miami, 1987).

[6] Unpublished panel discussion during the Thirteenth Symposium, Care of the Professional Voice, presented by The Voice Foundation at the Juilliard School, New York. Panelists included Dr. Friedrich Brodnitz, Dr. Robert Sataloff, Dr. James Gould, Dr. John Cooksey, Dr. Leon Thurman, Deborah Lamb, and Anna Langness.

[7] Minoru Hirano, "Lecture: Anatomy of the Larynx," in *Transcripts of the Thirteenth Symposium, Care of the Professional Voice*, ed. Van L. Lawrence (New York: The Voice Foundation, 1984), 342.