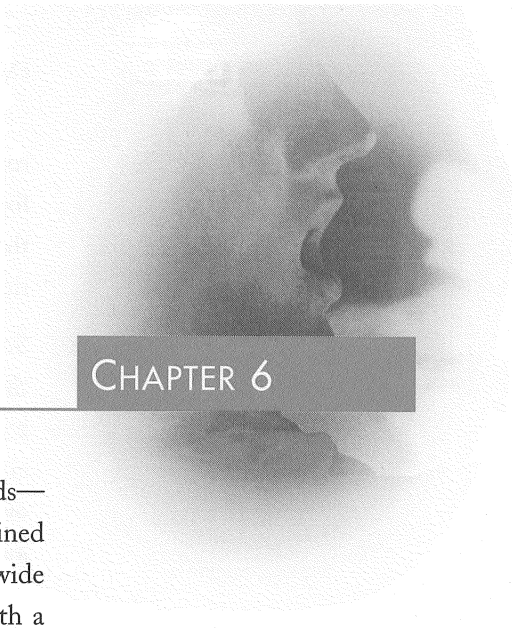
EXCELLENCE IN SINGING

multilevel learning and multilevel teaching

VOLUME 1: Beginning the process

CELUMBRA
Redmond, WA



The Sound: The Interplay Between the Body and Air

Chapter 6

We humans communicate with an incredible range of sounds—from the sounds of any language to the exquisite sounds of refined singing. As we've seen, the human voice can produce such a wide range of tones because it has many parts, each functioning with a wide range of capability.

The complexity of the voice lets us produce a wide enough range of sounds to articulate the finer shades of the human experience. With the ability to create language sounds and varying tone qualities, we humans can express emotions, ideas, and attitudes—the nuances of our inner lives—so that another human can experience them.

In the preceding two chapters, we discussed the complexity of the human voice, pointing to its various components. In this chapter, we look at the results of all that complexity—the sounds themselves. From this perspective, you can determine how the physical parts that control your student's voice should be contributing to her final sound.

Pitch, Timbre, and Dynamic Levels

People describe the voice and vocal sounds in many ways. As singers, we usually describe them with musical qualities—warm, bright, vibrant, free, and expressive, for instance. We might ask for a more resonant sound, a fuller, more supported sound, or a

rounder, more fluid tone. Although these kinds of terms are useful for teaching, they are not specific enough to describe variations in the sound itself, the variations your students create in the air particles at the lips and nostrils.

Sound has two components—the acoustic pressure variations in the air particles over time and the complex responses within the human hearing system to those pressure variations over time. Scientists have boiled down the complexity of the pressure variations over time to only three characteristics: *frequency, shape* (phase), and *amplitude*. Generally, though with some variation, we can also boil down the complex responses of our human hearing system to only three characteristics, which roughly correspond to the three characteristics of the pressure variations: our musical sense of *pitch, timbre,* and *dynamic levels.* (For a more detailed description of how pressure variations of the air particles become sounds perceived by the human hearing system, see the animation series *Human Hearing*, by Robert Caldwell and David Mountain.[1])

Table 1: With some variation, the differences in pressure variations in the air particles generally become differences in the nervous system, which, in turn, produce differences in our musical sense.

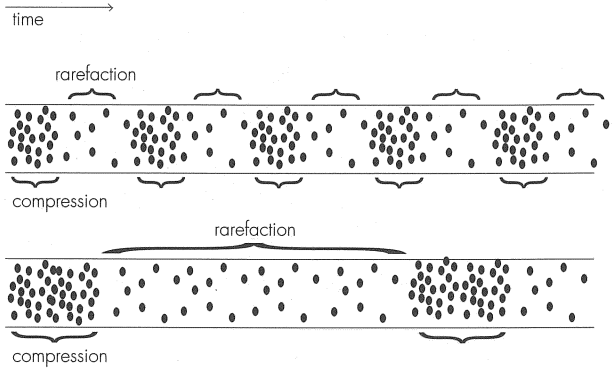
Differences in the Singer's Nervous System Become →	Differences in the Singer's Muscular System Become →	Pressure Variations of the Air Particles Become →	Differences that Are Perceived by the Listener's Nervous System
wide range of kinesthetic and auditory sensations →	wide range of movements in the parts that control the voice →	frequency →	pitch
		shape (phase) →	timbre
		amplitude →	dynamic level

By pairing the three qualities from the pressure variations with the three qualities of music perceived by our nervous system, you can relate your musical sense to the inner workings of your student's voice. The connection is this: your nervous system registers and

translates the pressure variations at your ears into musical sounds; those pressure variations are virtually identical to the pressure variations at your student's lips and nostrils; the pressure variations at your student's lips and nostrils are created by the inner workings of her body—the muscular system that pushes and pulls the air inside; and your student's muscular system is stimulated by the complex sensations of singing within her nervous system.

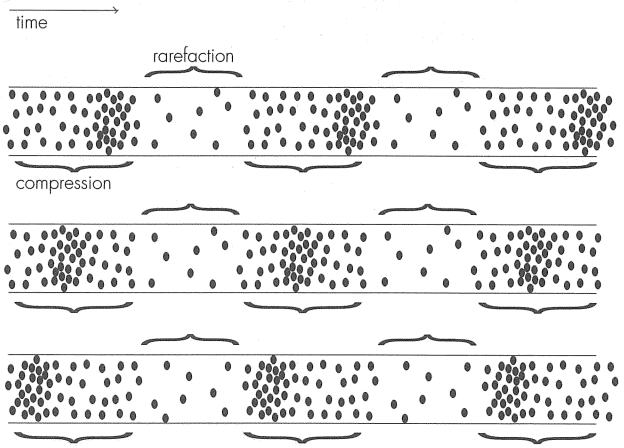
Frequency to pitch. The acoustic ripples—made of alternating air pressures resulting from a traveling density followed by a traveling gap (rarefaction) in the air particles—can occur as many as 20,000 times a second or as little as 20 times a second, and our human hearing can detect the differences. These acoustic ripples push and pull the eardrum, so the frequency of the ripples equals the frequency of the eardrum as it moves back and forth. Our human hearing system responds to those vibrations in complex ways to create our sense of pitch. Though not always a one-to-one relationship, differences in the frequency of the ripples generally become differences in our sense of musical pitch. (See the heading "Sound Waves," in v. 1, ch. 5.)

Figure 1. In a given time span, ripples of air particles can occur more frequently or less frequently per second, which generally relates to differences in our sense of pitch.



Shape (phase) to timbre. A pulse within a traveling ripple can also have its pressure distributed unevenly, which gives the pressure ripple a shape. Within the same overall frequency of the ripples, the most dense area can be anywhere from the front to the back of each ripple. The different shapes of a ripple affect the motion of the eardrum. Our human hearing system responds in complex ways to these subtle differences in motion to create our sense of timbre. Though not always a one-to-one relationship, differences in the shape of the pressure variations generally become differences in our musical sense of timbre.

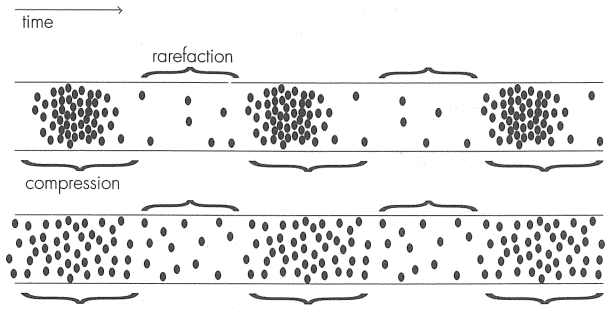
Figure 2. Pressure distributed differently within the pulse.



Amplitude to dynamic level. Within the same frequency of ripples, an individual ripple can have a greater number of air particles packed together, whereas another ripple has fewer. The amount of pressure change affects the movement of the eardrum. Our human hearing system responds to these differences in complex ways to create our sense of loudness or softness. Though not always a one-to-one relationship, differences in the amount of pressure change

generally become differences in our musical sense of dynamic levels.

Figure 3. Different density of air particles within the same frequency.



Reducing all musical qualities to only three characteristics is not intuitive and may seem impossible. We teachers are accustomed to hearing all three qualities at once. A melody begins with a pitch, a timbre (tone quality, vowel, or consonant), and a dynamic level—but these quickly change. As the voice flows over a range of pitches, we hear the timbre become brighter or warmer, the vowels and consonants rapidly change, and the dynamic levels crescendo and decrescendo. We hear the vocal line full of nuance, in which the changes in pitch, timbre, and dynamic levels are rapid and virtually continuous.

But as television can produce millions of colors with only red, green, and blue, the voice can produce millions of vocal tones with only these three characteristics. You can mentally slow down the rapid changes and learn to imagine the sounds as having only these three qualities. For example, with a little imagination, you

can describe the following qualities of singing in terms of pitch, timbre, or dynamic level.

Table 2: Musical Topics that Relate to Pitch, Timbre, and Dynamic Level

Pitch	Timbre	Dynamic Level
flat intonation	color	forte
sharp intonation	register	piano
vibrato	tone quality	messa di voce
portamento	ring	sotto voce
scoop	vowel	crescendo
slur	weight	decrescendo

You can view more complex musical qualities, such as musical flow, rhythm, and lyricism, as *transitions* in pitch, timbre, and dynamic levels. (See the heading "Smooth Transitions in Pitch, Timbre, and Dynamic Levels," in the introduction to v. 3, ch. 11.)

Mentally breaking down musical sounds into these three categories prepares you to look into the inner workings of your student's voice in a way that is relevant for singing. You can learn to see her vocal sounds as pressure variations in the air particles, a view independent of the sensations of hearing. You can then develop a mechanical view of how her voice produces those pressure variations—a view that helps you define problems and solutions efficiently. You are then free to teach in any way that successfully produces a difference in those pressure variations.

Voice scientists have already given us many tools and concepts to advance us in this way. These tools require us to visualize those pressure variations with different descriptions.