Excerpt from Chapter 10

Chapter 10

Registration

Few aspects of voice pedagogy are as perennially controversial as registers. Theories and opinions abound as to their number, names, impact on the voice, and even to their very existence. The entire issue is also a semantic minefield, requiring one to tiptoe through diverse, competing terminology ranging from *chest voice* and *falsetto* to *modal voice* and *flageolet*. Anyone who has been around singers for very long has almost certainly been exposed to registration concerns. How many of the following terms are familiar to you?

Lowest tones	Middle tones	Highest tones
Fry register	Mixed register	Falsetto
Pulse register	Head voice	Bell register
Click mode	Transition area	Whistle register

Lower tones	High tones
Chest voice	Falsetto
Modal register	Head voice
Heavy mechanism	Light mechanism
Belt voice	Loft mechanism
Speech range	Feigned voice

The above list is far from comprehensive and deliberately excludes many common terms borrowed from other languages, such as *flageolet, voix mixte*, *voce di petto*, *passaggio*, and *strohbass*. As you can well imagine, this diverse terminology often leads to confusion and misunderstanding, especially among singing students.

What exactly does the term register mean? One generally accepted definition is attributed to the nineteenth century pedagogue Manuel Garcia:

> "By the word *register* we mean a series of consecutive and homogeneous tones going from low to high, produced by the development of the same mechanical principle, and whose nature differs essentially from another series of tones, equally consecutive and homogeneous, produced by another mechanical principle" (Garcia, 1847).

Three key elements are present in this definition:

1. A register is composed of contiguous pitches
2. Pitches within any given register are produced in the same physiological manner
3. Pitches within any given register share the same basic timbre

Given this definition, the next task is to determine the number of registers present in the voice; this, however, is not always easily accomplished. In many singing genres, ranging from yodeling to popular commercial music, obvious breaks between two distinct registers are part of the stylistic norm. For males, there is a clear demarcation between pitches that lie within the speaking range, almost universally identified as chest voice, and the high, light tones of falsetto. For women, the same type of transition occurs between the low tones of chest voice, which can be quite strong and relatively clear sounding, and the higher tones of head voice (also sometimes called falsetto), which tend to be weaker and breathier sounding, especially in untrained singers.

Opera singers and others trained in the Western, classical tradition generally try to minimize or eliminate noticeable changes of timbre within the total musical scale. Of course, some music is written to *highlight* these changes; Fiordiligi's aria "*Come scoglio"* would be much less dramatic were the huge leaps from high to low all sung in the same register! But since the goal usually is to make all tones share the same basic timbre, as in point three of Garcia's definition, it could be said that accomplished singers learn to unify the voice into a single register. While this might be the perception of the listener, voice science clearly shows that it is not actually the case. The most perfectly blended voice will still exhibit at least two primary registration events related to laryngeal physiology, accompanied by acoustic adjustments related to formant tuning. Physiologic events in registration are determined by changes in the voice source relating to the manner in which the vocal folds vibrate and the glottis is configured. The two main options for glottal source mode have been given many labels over time, including chest/falsetto, chest/head, and thick/thin folds. In previous editions of this book, I used the terms thyroarytenoid and cricothyroid dominant production (TDP/CDP). But in an effort to avoid all semantic issues associated with these terms—especially chest and head voice[30] and the question of dominance—these two primary registers simply will be labeled according to laryngeal function: Mode 1 and Mode 2 (Roubeau et al, 2009)[31]. Acoustic factors in facilitating the movement between registers, thereby producing an "even scale," will be discussed as the Chapter progresses.

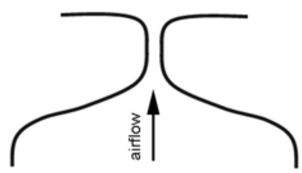

Figure 10-1: Mode 1 glottal shape

Mode 1 glottal source

Mode 1 glottal configuration is the source mode for various sound qualities, including chest voice, operatic head voice (the upper extension), and *voce finta* (feigned voice) in men, and chest voice and heavy belting in women. In Mode 1, the vocal folds are thickened by contraction of the TA (thyroarytenoid) muscles, resulting in greater mass per unit of length and a square-shaped glottis when viewed in frontal cross section (Figure 10-1). Because the folds are relatively thick, there is a significant vertical phase difference during each cycle of vibration, as demonstrated in example **10/1**. Because they are relatively short and have little longitudinal tension, the amplitude of vibration (range of movement during each oscillatory cycle) is high.

[30] Great controversies have arisen among singers and teachers over the terms chest and head voice. Many eschew them because they do not accurately represent the source of the sound, preferring terms such as modal and loft voice. Register names typically have been derived from sensation, not function. Low tones, be they called chest, modal or heavy mechanism, tend to create sympathetic vibrations through forced resonance that can be felt in the thorax. High tones often—though not universally—create sympathetic vibrations that are felt in the head. While neither chest nor head accurately describes all aspects of a register, they are common to our singing lexicon. In this author's experience, few people misunderstand the basic concept of *chest voice*; the same is not necessarily true for alternate terms, including modal and heavy.

[31] While the terms Mode 1 and Mode 2 are far from universal, they are commonly used by many members of the voice research community, especially in Europe. Readers are welcome to substitute their preferred nomenclature for these terms.

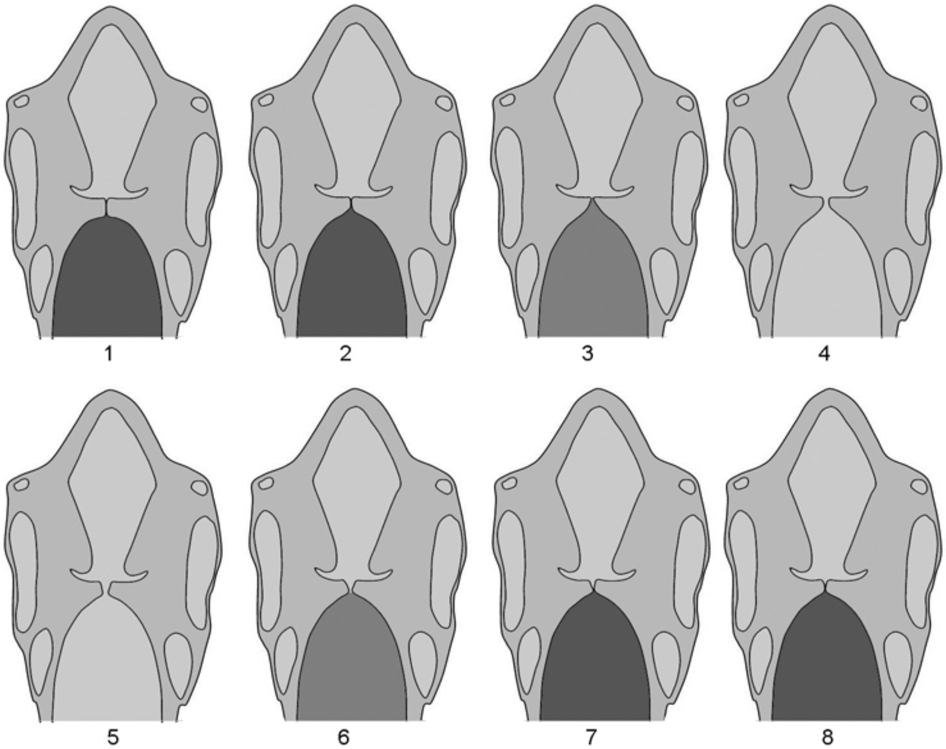

Figure 10-2: Mode 1 cycle of vibration showing vertical phase difference at glottis

Higher Pitches: Mode 2 glottal source

Mode 2 is the glottal source for sound qualities identified as falsetto in men, and head voice (falsetto, etc.) in women. Glottal configuration and phonation characteristics contrast sharply with Mode 1. Pitch modulation now relies more heavily on contraction of the cricothyroid muscles (CT), which simultaneously elongate and thin the vocal folds. The glottis assumes a triangular shape in cross section with a narrow area of vocal fold contact during phonation (Figure 10-3). Vertical phase differences are greatly reduced and can entirely cease to exist. Mucosal movement is focused along the medial margins of the vocal folds, as can be seen in video example **10/2**. Because they are relatively long and have increased longitudinal tension, the amplitude of vibration is low.

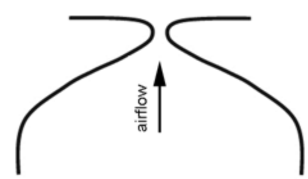

Figure 10-3: Mode 2 glottal shape

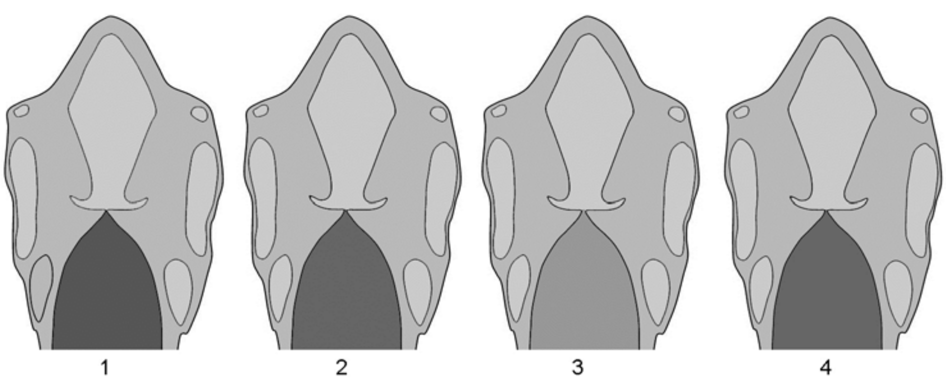

Figure 10-4: Mode 2 vibration showing little or no vertical phase difference

For very high pitches, as typified by male falsetto and female flageolet or whistle voice, the glottis might never completely close during Mode 2. The vocal folds, however, continue to oscillate, alternately making the glottis wider and narrower (Figure 10-5). This change in dimension alone is sufficient to induce pressure variations in the air that are identified as sound (**10/3**).

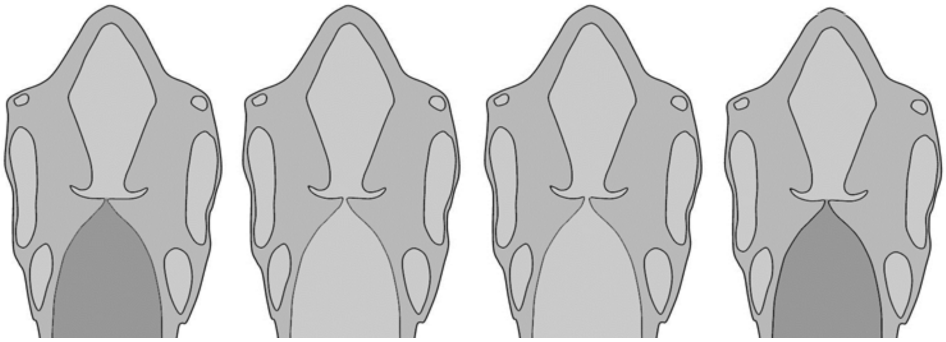

Figure 10-5: Incomplete glottal closure during flageolet or falsetto production

Further information about glottal source modes is revealed through electroglottagraphic analysis (EGG) and computer software such as *Voce Vista.*[32] As demonstrated in Chapter 5, EGG estimates glottal closing patterns by measuring resistance to signals passed through the larynx between a pair of electrodes. The procedure is non-invasive, safe, and totally free from discomfort; test subjects are able to sing absolutely normally while measurements are taken (Figure 10-6). Video example **10/4** demonstrates Mode 1 and Mode 2 in male and female voices. Remember that in the EGG tracing, maximal glottal closure occurs at the top of the graph, maximal opening at the bottom.

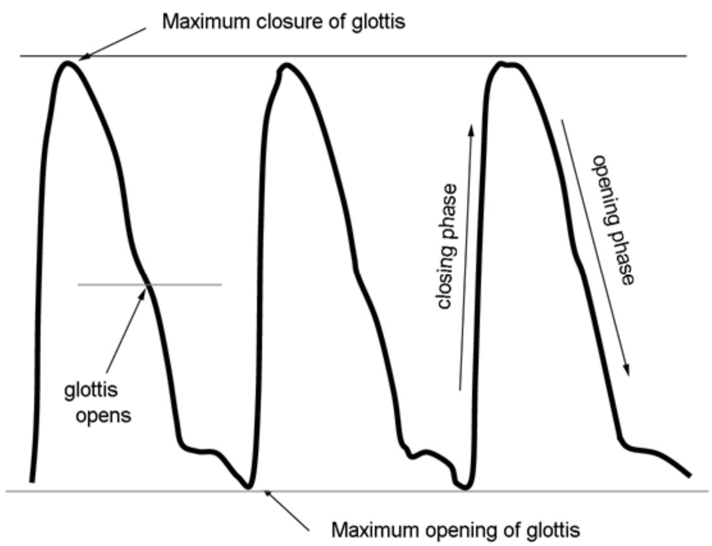

Figure 10-6: Characteristics of EGG signal

As shown in the EGG signal, closed quotient in Mode 1 is relatively high, generally greater than 40% and potentially reaching 85% in strong baritones and tenors (CQ typically increases with ascending pitch and with increasing amplitude) (D. Miller, 2008). More importantly, the contour of the EGG signal shows a distinctive pattern in which the glottis closes much more quickly than it opens during each cycle of vibration (Figure 10-7) (Baken, 2000).[33] Because the area of contact between the folds is wide and glottal closure is rapid and prolonged, the sound produced has a shallow spectral slope, generally twelve dB/octave or less, with strong acoustic energy in high harmonics (Sundberg, 1987).

[32] *Voce Vista* is the creation of D. Miller, G. Nair, H. Schutte and R. Horne, in association with the University of Groningen Voice Research Laboratory.

[33] CQ measures of >40% for Mode 1 and <40% for Mode 2 can be extremely variable—a reading of 50% is not sufficient evidence to make the inference of Mode 1 vibration. It is safe to say, however, that if a pitch can be sung in either in Mode 1 or Mode 2, CQ will be higher for the former. When using EGG to make assumptions about registration, it is essential to consider both the CQ reading and the shape of the signal, which indicates the relative speed of opening and closing portions of the cycle.