CHORAL RESONANCE: RE-EXAMINING CONCEPTS OF TONE AND UNIFICATION

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Resonant singing creates possibilities with dynamic shading, subtlety of phrasing, and rich vibrant tone that astonishes listeners. Choral singing that employs resonance as a fundamental ensemble virtue yields impressive results that lend themselves well to the varying demands of any choral score. Fortunately, choruses of every level can benefit from an increased understanding of the basic principles of resonance in the singing voice.

Research on issues of upper partial energy and the presence of the singer’s formant in a choral ensemble has been limited in approach. Many published studies regarding upper partial energy in the choral ensemble are based on what the ensemble is already doing, which is linked to the teaching of that specific director and that specific choir. Research must include a wider range of aesthetic choices with regard to choral unification.

Through examining spectrograms that represent the sound of some of the most renowned choirs, it is possible to see that many of these ensembles are producing tone that contains a high level of upper formant energy. Interviews with established conductors reveal approaches and teaching methodologies that reinforce this type of singing.

It is possible to teach the individuals in a choir to increase the level of resonance in their voices, creating a collective sound containing a vibrancy that is easier to tune and unify. This paper explores resonance in choral singing by first explaining the basic principles of sound production, then defining a resonant tone as one containing the strong presence in the upper partials generally associated with classically trained singers, and finally discussing how this type of resonance is developed in choirs.
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Resonant singing creates possibilities with dynamic shading, subtlety of phrasing, and rich vibrant tone that astonishes listeners. A reviewer of the Estonian Philharmonic Chamber Choir described the ensemble as delivering a "powerful, ringing performance."\(^1\) Other choirs such as the Rias Kammerchor of Germany, Swedish Radio Choir and the Monteverdi Choir of England have been praised with comments such as "alert, vibrant, responsive"\(^2\) and "perfectly blended partials."\(^3\) Ensembles such as these create a unified sound that not only serves the music, but also excites the listener, due in part to their singing with a timbre that includes high levels of acoustic energy in the upper partials of the tone. Choral singing that employs resonance as a fundamental ensemble virtue yields impressive results that lend themselves well to the varying demands of any choral score.

Fortunately, choruses of every level can benefit from an increased understanding of the basic principles of resonance in the singing voice. This paper explores resonance in choral singing by first explaining the basic principles of sound production, then defining a resonant tone as one containing the strong presence in the upper partials generally associated with classically trained singers, and finally discussing how this type of resonance can be developed in choirs.

Research on issues of upper partial energy and the presence of the singer’s formant in a choral ensemble has been limited in approach. Many published studies regarding upper partial energy in the choral ensemble are based on what the ensemble is already doing, which is linked to the teaching of that specific director and that specific, often amateur, ensemble. In an article regarding formant frequencies in choral singing by Sten Ternström and Johann Sundberg, the authors noted a study they performed along with T.D. Rossing. They reported the following.
findings: "In the choir mode, the singer's formant was less prominent, and the amplitude of the fundamental was higher; hence, the articulation was closer to that of speech." This statement was based on a specific group of vocalists, and does not really give us any information about choirs in general.

In the past, conclusions about upper formant energy have been based on preconceived notions about blend. Research should now also focus on choirs that consistently work, with great success, to sing and unify with resonance. A conductor requiring a resonant tone must consider the use of vibrato, listening, intonation, and teaching methodology. It is the purpose of this paper to examine the research on choral resonance, as well as the choral ensembles and conductors that employ it successfully, and to illuminate the need for such resonance in creating healthy, beautiful, unified tone. In addition, an exploration of scientific issues and teaching methods will provide more tools for choral conductors who share in the responsibility of the vocal production of their singers.
CHAPTER 2
DEFINING RESONANCE

The most applicable definition provided by the Merriam-Webster Collegiate Dictionary for our purposes here states that *resonance is the intensification and enriching of a musical tone by supplementary vibration.* Another way to understand this concept is that a sound will become more intense and colorful through something that vibrates beyond the original sound source.

One author describes the resonance phenomenon with an example of a child on a swing. When the person pushing synchronizes their action with the swinging child, the system becomes efficient and the required energy input can be very small. The same is true in a system with resonance. "Small vibrations (the gentle pushing of the helper) induce large vibrations (the swinging child)." If the energy input (pushing) gets out of sync with the child, the swinging, or resonance, will stop.

Our sound source is our vibrating vocal folds, which combined with the breath, our energy input, creates a sound capable of becoming resonant. A singer's resonance occurs as the result of the vibration of air molecules and reflections of sound waves within an airspace, the vocal tract. The human voice employs a system called free resonance. To be a free resonator, an object must have volume, space, and an open end through which the sound waves can exit. A hollow tube can serve as an example of a free resonator. Clapping the hand over one end of the tube can generate sound waves that will be resonated as they reflect back and then exit the other end. The vocal tract is a flexible tube and changing the shape of the tube affects the particular resonance frequencies. As the sound generated from the larynx passes through the vocal tract, it is amplified by the reflection patterns of the compressions and rarefactions of the sound waves, and the airspace within the "tube" becomes resonant due to the well-timed input of the energy...
The above explanations serve to define the basics of resonance for any human voice. For the purposes of this paper, the term "resonance" will be used to describe the fundamental pitch in combination with the strong presence of the upper partials in the sound, or the "ring" of the voice, typically found in the timbre of a classically trained singer. The upper partials, or overtones, are possible because free resonators are able to optimize not just one, but a series of pitches. In a complex tone, overtones occur at whole number multiples of the fundamental pitch. For example, if the fundamental pitch is 400Hz, the first overtone will be at 800Hz, then 1200Hz, etc. This relationship is called the harmonic series, and the varying strength of each of the partials above the fundamental determines the timbre and presence of the voice. Professional singers learn to manage their resonance to create maximum volume and clarity with minimal vocal stress, allowing for efficient tone production that carries over an orchestra.
CHAPTER 3
FORMANT TUNING/VOWEL MODIFICATION

Formant tuning is best described by the Source/Filter Theory of voice production. The source is the sound generated by the vibrating vocal folds, and the filter is the vocal tract. When the sound passes through the vocal tract, the shape affects the timbre and vowel perceived by the listener. "Most of the tuning of the resonator is brought about by the altering of its shape by the tongue, lips, jaw, soft palate, elevation of the larynx up and down, and the narrowing or widening the side walls of the throat just above the larynx."6

Humans have the capability of changing the color of their voice in the way a graphic equalizer changes sound coming through a stereo. Turning certain knobs on an equalizer boosts aspects of the sound coming through the speakers. Small adjustments made in the vocal tract can impact the timbre in the same way by reinforcing certain partials of the fundamental pitch. Due to the manner in which sound waves travel in a free resonator, only certain frequencies will be boosted based on the shape of the vocal tract. This is because those frequencies fall within the range of formants, which affect our perception of timbre and vowel. A formant is essentially a resonance of the vocal tract, but it is not the sound itself, it is sound potential.

A spectrum is a graphic representation that plots frequency (pitch) and amplitude (volume) of the partials of a sound. In looking at a spectrum, we can see the impact of formants (resonances) on the sound being produced. (See figure 1.) The x axis shows frequency and the y axis shows amplitude. The partials that fall under formants are being resonated by the vocal tract. They are higher in intensity than those found outside of the frequency range of the formants. A process known as ‘linear predictive coding’ provides an outline or envelope of the
resonances. The formants appear like ocean waves, and the fundamental frequency plus its partials are the smaller peaks. The partials that fall under the formants are boosted, while the others are attenuated.

Figure 1. Sound spectrum showing the impact of formants on partials.\(^7\)

The first two formants (F1 and F2) are necessary to produce an identifiable vowel sound. There are six rules for altering the frequency of the formants:

- A constriction in the front of the vocal tract lowers F1 and raises F2
- A constriction in the back of the vocal tract raises F1 and lowers F2
- All formant frequencies lower uniformly when the vocal tract is lengthened
- All formant frequencies rise uniformly when the vocal tract is shortened
- All formant frequencies lower uniformly with lip rounding and rise with lip spreading
- An increased mouth opening raises F1
Figure 2. [i] vowel. The tongue pulls forward to create an acoustic constriction in the front of the oral cavity and an open space in the oropharynx. The palate is lifted and the nasal port closed.

Men: F1 ~ 270 Hz (C4-sharp)  
Women: F1 ~ 310 Hz (D4-sharp)  
F2 ~ 2,290 Hz (C7-sharp)  
F2 ~ 2,790 Hz (F7)

Position of [i]  
Formants of [i]. F1 and F2 are represented by first two high peaks. The x axis represents frequency and the y axis represents amplitude.

Figure 3. [a] vowel. The tongue pulls backward to form an acoustic constriction in the oropharynx and a relatively large space in the front of the oral cavity. It is classified as a back, open vowel. The palate is raised to prevent air leakage into the nasal cavity.8

Men: F1 ~ 730 Hz (F5-sharp)  
Women: F1 ~ 850 Hz (G5-sharp)  
F2 ~ 1,090 Hz (C6)  
F2 ~ 1,200 Hz (D6)

Position of [a]  
Formants of [a]
Formant tuning involves the change of the shape of the articulators (essentially a change of the vowel), allowing us to align the partials of the pitch we are producing to a potential formant, boosting the volume of the pitch without extra effort from the vocal folds. "For resonant singing the fundamental frequency and the vowel resonances must be in harmonic relation to each other so that sympathetic vibration can occur." As early as 1862, in On the Sensations of Tone, Hermann Helmholtz discusses vowel modification. He recognized the important relationship between the voice source and the vocal tract when he said that a "ringing, keen and powerfully penetrating" quality of tone implies "many and powerful upper partials, and the stronger they are, of course the more marked are the differences of the vowels which their own differences condition."10

Another aspect of the ring in the voice is called the "singer's formant." Some discrepancy still exists as to how exactly this phenomenon is produced, but it may be a result of the clustering together of formants three through five. This "super" formant occurs on average around 3,000Hz, and is most often found in the male singing voice. The presence of this formant creates the very intense "ring" that allows a tenor to be heard over an orchestra because most orchestral formants peak at much lower pitch levels. When women are singing in their lower range, they may also be able to tap into this formant, but when they are singing at a higher fundamental frequency, it becomes unnecessary and at some point impossible to produce. The higher the fundamental, the more efficient the resonator becomes, and the louder the volume of the voice, thus reducing the need of the singer's formant for sopranos singing in their high voice. The singer's formant tends to occur with a comfortably low laryngeal position and firm glottal closure.
CHAPTER 4
RESONANCE IN THE VOICE STUDIO

There are many different schools of thought on teaching singers to find the ring in their voices. The elements of *chiaroscuro*, the balance between the light and the dark of the voice, are central components to many lessons. Light and dark might also be called ring and space. Some pedagogues teach a sense of an open feeling in the voice first and bring the voice forward (ring) later, others would reverse the order. Richard Miller, vocal pedagogue and writer, addresses this careful balance as he warns against the perils of trying to help students find upper frequencies through all the vowels by smiling or grinning rather than just lifting with an inside smile.

"Although a feeling of 'internal smile' does tend to enhance the pharyngeal portion of the ring on these vowels, a 'grin' tends to pull up the jaw and larynx and thus usually blocks the availability of tracheal interconnection on those vowels."¹¹

Chiaroscuro

There are many aesthetic choices a singer or conductor must make when creating vocal tone. In general, however, a sound that includes a vibrant or bright component balanced with a round or darker component creates the foundation for most classical singing. Variations in the balance between these two elements are dependent on the color choice of the singer, but some presence of both elements is fairly consistent in this type of tone production.

"An extensive terminology exists, in several languages, for the description of variations of vocal timbre found within the several [national] schools. One such term is *chiaroscuro*, which literally means the *bright/dark* tone, and which designates that basic timbre of the singing voice in which the laryngeal source and the resonating system appear to interact in such a way as to present a spectrum of harmonics perceived by the conditioned listener as that balanced vocal quality to be desired - the quality the singer calls 'resonant.' "¹²
We know that the strength of upper partials (ring) is related to the degree of glottal closure, and the bright or dark quality (space) is often associated with laryngeal posture. If the singer is achieving good closure but singing with a higher larynx, the tone may tend to seem brighter, or darker with a lower posture.

Frontal Resonance, the Mask, and Nasality

One of the most successful means of teaching voice is through remembered sensation. Since a singer cannot remove their larynx and manipulate it with their fingers the way one can with an instrument, they must often rely on feeling. A resonant tone is sometimes said to include sensations in the "mask", or in the front of the face. The issue of whether or not resonance is actually occurring in those areas is a matter of debate.

"There are teachers of singing who insist on distinguishing between 'nasal resonance' and nasality. They are convinced that when the harmonic spectrum is in good balance-having strong first and third formants (chiaroscuro timbre)- it is because some degree of nasality is always present. Most probably this perception on the part of singers is due not to nasality but to frontal vibratory sensations that are conveyed from the buccopharyngeal resonator by means of the hard palate and by the bony structures of the head. Such sympathetic vibration registers subjectively as 'mask brilliance' associated with 'forward placement' concepts."13

We know through scientific research that air is not actually traveling through the nasopharynx when the velopharyngeal port (soft palate) is lifted and sealing off the passageway from mouth to nose, but the sensation of vibration is often felt in the nasal cavities and front of the face by singers who are producing a vibrant ringing sound by boosting the upper partials. "Suggesting to a student singer that when his or her voice is well produced he or she may feel resonance in the vicinity of the nasal passages is very different from telling him or her to actually let the sound go
An incredible amount of acoustical energy is produced when a trained professional is singing, and this energy typically creates a vibratory sensation in these areas. While vocalises that employ nasals to begin the sound are quite common and effective in aligning the vocal tract, it is important that the final product generally not include air actually flowing through the nasal passages. Successful professional singers have been found to sing with the nasal port closed most of the time, because allowing air to flow through the nose can actually cancel some of the resonating capacity.

"In no way should resonant voice be confused with nasality, even though nasal sounds are often used to train resonant voice. Nasal consonants, for example, are like lip trills and bilabial fricatives (for vocal training) in that they lower the first formant and allow the vocalist to achieve an inertive vocal tract for all fundamental frequencies above 300 Hz." 

Figure 4. Nasopharyngeal port.

The discovery of the sensation of acoustical energy in the nasal and frontal parts of the head in a singer can, however, be a positive step in the direction of learning to find efficient
frontal resonance. Many pedagogues preface sung phonation with nasals; this helps the singer adjust the vocal tract for optimum resonance of vowel sounds. "Nasals tend to have acoustic strength in regions of the harmonic spectrum that are similar in distribution to the harmonic-partial distribution (overtones) found in the well-balanced spectrum of the singing voice."17 If a singer cannot make the transition from a nasal to a tone that does not include air moving through the nose, one of the easiest ways to fix this issue is to ask them to hold their nose while singing. This is not possible during phonation with consonant nasal sounds, but to have a student move from a "nasal" sound to a vowel with similar "ring" with the added holding of the nose can be very effective in training the proper closure of the velopharyngeal port while maintaining resonance.

In teaching resonance, vocalises employing sounds like "ming" or "ning" are often useful, as well as beginning training with the more closed vowels, such as [i] or [e]. Teachers also design exercises that allow for vowel modification from vowels that make it easier to find "ring" to those that tend to fall back out of placement. Sliding from [i] - [e] - [a] - [o] - [u] is popular for a reason, and used by vocal pedagogues and choral directors in many settings. Manuel Garcia, in his Complete Treatise, asserted that "the vowel [i] aids this movement of the organ (glottal closure). The Italian [i] being the most ringing vowel, the same (glottal closure) which gives it its brilliancy may be employed to give brilliancy to the other vowels."18

All of the knowledge about resonance and what is actually occurring in the body when the vocal tract is well-tuned to its formant potential is helpful. However, any information given to students about the scientific aspects of the voice should be handled with care. While it is important that they understand the actual happenings of the vocal tract, some information can be
misleading when taken out of context. For example, when a student comes to the understanding that the vocal tract itself is the true source of free resonance, a student attempting to "feel" and control this from the throat may create problems with tension and undue muscular involvement. 

"(Vocal mechanics) studies address matters and acoustic/physiological phenomena that will only confuse and complicate matters should a singer attempt to bring them under direct control."^{19} It is logical that many teachers approach the singer with imagery and exercises designed to create healthy sensations that reflect good technique rather than directly addressing the actual organs and tissues in use. A balanced approach between the sensational and scientific seems the most appropriate, depending on the singer's experience and learning style.
CHAPTER 5
CONCEPTS OF CHORAL UNIFICATION

Blend and the Least Common Denominator

"Chiaroscuro is a tone quality so distinctive that even a casual listener will quickly associate it with operatic singing; it can hardly be confused with vernacular styles of singing or with the choral voice." This statement, made by James Stark in his book *Bel Canto*, is likely based on the mode of singing employed by many choirs in search of blend. The idea that choral singing does not or should not include the elements of *chiaroscuro* does not reflect all conductors' approach to tone. There are as many aesthetic ideals in choral singing as there are in solo work, and many of the most successful choirs produce a tone that is closely aligned with the goals of *chiaroscuro* singing.

There are almost as many different concepts of "blend" as there are choir directors. Arnold Jones, in an article about choral tone quality and blend, suggests that the singers in the choir must learn to sing with as much of the fundamental pitch as possible, minimizing any overtones. "It is the fundamental pitch minus the high, strident overtones of a poorly produced tone- that will produce a beautiful blend." This author suggests that the choir use a hum to reinforce good intonation and the removal of harsh vowel formants of tone quality.

The approach involving singing with fewer overtones to achieve perceived blend is something of a trend in many choral programs, as singers are often being taught to produce tone with less presence in the upper partials. Allen Goodwin conducted a study in choral blend by recording a group of sopranos in a variety of tonal scenarios and observed results in many vocal elements when the group tried to "blend", including their use of upper partials. "Interestingly, these acoustical changes (including a reduction in the proportionate strength of the upper
partials) were the ones most often employed by the singers in this study as they attempted to blend with the ensemble.  His work caused another researcher to conclude that, "blended singing is characterized by a stronger fundamental frequency and weaker, less intense, second and third formants." The problem with these statements is that they are based on one group of singers, and one aesthetic ideal for choral singing.

Many directors ask their ensemble members to blend by singing more softly, and by trying to match the voice next to them. The concept of trying to match one voice to another through absolute homogenous tone production may not be a good one. Each singer may have a slightly different method of creating their best sound, and asking the singers to use the exact same mouth shape or to sing with less of the natural color or their voice can actually keep beautiful blend from happening. "The ability of many to sound as one is a dynamic power of any ensemble. One must be cautious when using the word blend, even though unification is most often a goal of ensemble sound. Blend may imply that a singer should change the way that they sing in order to sound like someone else. This can cause a lack of support, over-singing, or imitating a color that is not natural to the physical make-up of the individual."

We often find the more developed voices "stick out" in choirs because they are using more "solo technique." While it is possible that the singer is doing more singing than listening, more often than not we ask our developed voices to match the tone of the less developed ones.

Some choral directors may lack the pedagogical knowledge of the voice to teach the entire ensemble to sing with more resonance in the tone, or may be afraid to address the issue, finding it easier to reduce everyone to the least common denominator. "In an effort to promote the elusive 'blend,' directors sometimes subscribe to reducing their singers' sound to the level of the least resonant voice in the group." Berton Coffin is quoted in an article by Stephen Bolster as
having said, "There is no reason to have a Stradivarius sound like a cigar-box violin so that both will sound the same." The author follows "instead of removing the (resonance) from voices that have it, one should try to establish the formant in all voices of the choir in which it is lacking."  

Vowel modification, which is the way that singers learn to create resonance, is the most effective means through which we impact tone. Directors often try to create blend by using big round vowel sounds asking that all vowels be sung through an [o] or [u] shape. Vowel modifications such as these can be quick fixes, and sometimes help produce a pleasing sound. However, when these modifications are employed without some ensemble training in resonance, the sound is often swallowed, lacks ring, and is out of tune.

Collective Resonance and Unification

In many European and Asian choirs, especially those who have made their mark on the choral world, the concept of resonance is essential to the collective tone of the ensemble. A reviewer for the San Francisco Bay Times refers to the Eastern European choir Kitka saying, "The rich sound these women produce resonates as if energized by the universe itself." The RIAS Kammerchor, a choir based in Germany, received the following comments in a review: "There are dynamic extremes, too: extraordinary chords hit with a force that seemed doubly overwhelming Thursday because of the palpably dead-on accuracy of the tuning. The volume was almost physically intimidating. It seemed impossible that so much sound could come out of such a small group of people and yet not sound in the least like shouting." Singers such as these are able to use their vocal training to influence their formants to create volume the way a
soloist would. The difference is the added necessity of listening and tuning their resonance to the other singers in the group.

A comparison between a professional chamber choir with twenty to thirty voices and an amateur choir of more than 150 voices illuminates the necessity of formant tuning. One would assume that the larger choir would be capable of producing more volume, simply due to the sheer number of singers. This is actually not true, and there are two reasons for this. One is that "the principles governing amplitude/volume state that the greater the number of singers, the smaller the dynamic increase." The second is the presence or absence of upper partials and the singer's formant. A group of professional singers is much more likely to produce the singer's formant "ring" (occurring around 3000Hz) along with a boosted volume level due to formant tuning. When all of the singers are capable of producing the ring, the sound is unified, but also allows for greater dynamic shading. With an amateur choir, unless the director is teaching and consistently asking for a tone that is resonant, the volume level can only reach a certain point, and the tone generally lacks interest. When a choir sings a harmonically thick chord at a forte dynamic level while employing resonance, the result is exciting, as well as vibrant and beautiful.

The spectrograms below reveal varying levels of upper partial energy in the sound of choirs. While looking at these graphic representations, it is important to remember that differences in acoustic environment and recording technique can affect the results. It is also necessary to realize that the acoustic energy being produced is not based on one pitch, but often a chord containing four or more pitches. This being said, it is still helpful and illuminating to examine the spectrograms of choirs to see the differences in upper formant energy. The x axis shows time and the y axis shows frequency, while the intensity of color shows amplitude. The first two (see figure 5) spectrograms show two choirs performing the same segment of music
from Morten Lauridsen's "Ov'è Lass', Il Bel Viso?" from his *Madrigali*. The first choir is a professional European choir, and the second is a high school choir performance from a national convention. Differences in acoustical energy are noticeable around 3000Hz, and everything above the fundamental (approx. 750Hz). The European choir is producing around 45 decibels of sound near the singer's formant, where the high school choir is producing around 27db. The red dots indicate formant history.

Figure 5. Spectrograms of the European choir and the high school choir.

The trend toward the use of resonance in choral singing in other parts of the world may be connected to the color of the native language of those countries. In Europe, for example,
vowels in many languages such as German and Swedish tend to be more closed. Eric Ericson (former conductor of the Swedish Radio Choir), in response to a question about the sound of his choir, said, "Your resonance naturally influences the sound. The type of consonants produced in a language modifies the sound by the position of the tongue, and in that sense one could talk of some languages being more healthy, so to say, for tone production."\textsuperscript{30} There is no doubt that native language can greatly impact a singer's ability to find resonance in their voice, but this has not limited American solo singers, and should not limit American choirs either. A reviewer of the American ensemble Cantus, comprised of 11 men, states, "The big, bold sound of Cantus is a welcome splash on a national choral palette, where sameness of tone has often been the highest virtue."\textsuperscript{31}

With regard to American choral directors, Ericson observed, "I have found that in this country a lot of people work with choirs without, in my judgment, having a very good or solid technique. They somehow have a sort of homemade technique."\textsuperscript{32} Some choral directors tend toward easy fixes, instead of addressing the actual vocal technique of the ensemble. This may be due to a lack of vocal training on the part of the conductor, or the fear of dealing with an issue that is a process and takes time to teach. It is easier to ask a choir to just round their lips or to sing everything through an [o] shape than it is to teach them to find a collective resonance on all of the vowels (which will include some vowel modification anyway, in the same way it would in the voice studio.) However, teaching a choir to use resonance for blend, intonation, and dynamics, not only yields sounds that are electrifying and exciting, but also creates a healthy vocal environment for the individuals in the ensemble.

The spectrograms below (figure 6) show the same passage of music from Sergei Rachmaninov's "Bogoroditse Devo" from the \textit{Vespers}. The first choir is a professional Swedish
choir, the second is a professional American choir. These spectrograms may give us some insight into these two highly established conductors’ preferences for tone and blend. The x axis shows time, the y axis frequency, and the intensity of color shows volume.

Figure 6. Spectrograms of Swedish choir and American choir.

When individual members of a chorus are singing with resonance, they learn to sing into one another’s ring creating a collective sound that is not only vibrant and rich, but also carries
and is easy to produce. Utilizing the natural upper partials of the voice while listening to surrounding singers can create a situation that requires less vocal strain. Choir directors that ask singers to modify vowels without encouraging and teaching resonance as a part of the tone may exhaust their choir members. "The voice works efficiently when this resonance is present in the chest or mixed voice and becomes fatigued when it is played down." Choirs that sing with a characteristic "darkened" vowel color without ring may not only become tired, but also tend to sing below the pitch.
CHAPTER 6

TEACHING RESONANCE IN THE CHORAL REHEARSAL

There are several approaches to achieving unification. The goals of the method I am suggesting encourages the most beautiful, vibrant and colorful sound from each individual voice, combined with listening and joining the individual's resonance with the collective whole. In order to do this, the singers need to understand how to create the sound in their own voices through formant tuning (vowel modification) and place their best sound within the scope of the choir's resonance. "With young singers I have always tried to encourage them to place their voices forward and to achieve volume through focus rather than sheer noise. The concept of sending the voice forward through the sleeve of the sound is one to which I refer constantly."34

Teaching a choir to sing with collective resonance is very similar to teaching an individual to find the ring in their voice. The same exercises used in the studio will work in the choral rehearsal, with some modifications. As in the studio, teaching collective resonance is a process during which the ensemble works to build tone. The conductor needs to assess the needs of the group based on what he/she hears, and plan exercises and repertoire accordingly.

The first step for addressing upper partial energy in a choral rehearsal is to design exercises that will encourage successful formant tuning. The vowels that work best to bring the sound into focus are at the closed end of the spectrum, such as [i], [e], or [u]. These vowels create the right acoustical environment due to epiglottal adjustments, other vocal tract alignments, tongue placement, and the natural occurrence of formants. Adjustments at the laryngeal level also impact the strength of the sound. When the folds are in vibration, they are
opening and closing at a rapid rate. The amount of time within each open/closed cycle that the vocal folds are closed is called the closed quotient. The closed quotient for all the vowels is highest for [i], which is an additional reason this vowel works quickly to bring a resonant sound to the voice.

The German umlaut [ü] is another great training vowel because it combines both of the closed vowels ([i] and [u]) with a balance between tongue and lips. Extending the lips for [u] helps the larynx to relax while bringing the tongue forward for [i] can help to create ring. This can also help vocalists find the singer's formant. The lowered laryngeal position combined with the consistent and firm glottal closure associated with these vowels creates the right balance to achieve the clustering of upper formants that occurs with this phenomenon.

Suggested Exercises

The following exercises are suggestions for establishing these vowels in a choir with a spread or unfocused tone needing to find more resonance in their sound. Each of these should be performed with the men an octave below where written:

1. Starting on G above middle C, sing a five note descending scale on eighth notes using the sound [miη], moving up by half step. Upon reaching D or E above, begin moving back down by half step.

![Musical notation](image)

The goal of this exercise is a bright, very forward, free sound. The singers should not feel confined by trying to make a "beautiful" sound, because this exercise is a means to
an end. Encourage women to use the head register rather than the chest so the sound is focused rather than pressed. Some students will feel this exercise, when done correctly, in the "mask", but not all will. Some may find they can feel it in other ways, or can use their ears to assess their sound with the conductor's guidance.

2. Starting on G above middle C, sing a five note descending scale on eighth notes using the sound [zi], followed by an ascent and descent of those same five notes. This can also move up by half or whole step.

![Musical notation for exercise 2]

This exercise works best in the beginning with an initial consonant such as [z] or [v], but can eventually be done just on the vowel. Changing vowels is also useful once a clear resonant [i] has been established.

3. Starting on G above middle C, sing an ascending four note scale into a descending arpeggio, changing vowels from [i] to [a].

![Musical notation for exercise 3]

Using different vowel structures for this exercise can also work well, as long as the sound being produced is consistently resonant.

4. Begin a tone with a vibrant hum, moving into the five pure vowels ([mi]-[me]-[ma]-[mo]-[mu]), sustaining the same pitch.

![Musical notation for exercise 4]
This exercise should be done in octaves, as with all the others. This works well for finding overtones with the choir and unifying the approach to the vowels. Slow sustained work builds the mechanism and allows the singers to find the collective resonance of the choir. The hum tends to focus the sound before opening to a vowel. As with any of these exercises, singers that have an issue with nasal sounds may start with a different voiced consonant, or none at all, which is the eventual goal. Once a great octave has been established, the choir can move from that sound into a major chord, working to maintain the ring within the new set of pitches. This allows the singers to hear the overtones align within the context of harmony.

These exercises are by no means the only way to address choral resonance, but they are some starting suggestions for groups that generally lack core in the sound. The next step in the process is to apply the vocalism learned in the warm-up to the repertoire. The repertoire selected for the ensemble is paramount to their success. Pieces that encourage good vocalism should contain appropriate ranges for each voice part, a variety of vocal styles, and works that allow the singers to explore dynamic range and harmonic complexity. Renaissance music, due to its clear and open chord structures, tends to be effective in teaching resonance. Works that contain added tones and chord clusters can also help singers establish ring since the color of the music requires clarity and strength to create the sonority of the harmonic structures.

The process of vowel modification is the cornerstone of resonance work, because vowel modification is essentially formant tuning. When making vowel adjustments, the singer is able to sweep the sound in and out of formants and find the right vocal tract shape for optimum resonance to occur. When working with repertoire, it is useful to begin learning the piece on a neutral vowel that allows the singers to find the piece in their voices. After establishing good color on a vowel, transfer the piece to the text, working to maintain the color established previously. It may be helpful for part of the choir to remain on the vowel, and the other part to sing the text.
The conductor, by listening, can ask the singers to make vowel adjustments to assist in formant tuning. For example, if the alto section is singing out of tune and spread in their low register on an open vowel, the conductor might suggest modifying to a more closed vowel to help them gain resonance and unity. If the basses are in the passaggio singing [e], they might find it easier to resonate on a more open vowel, whereas the tenors might need to modify to a more closed version of that vowel. Knowledge and use of the vowel chart is essential for this process. (See figure 7).

The concepts of resonance, space, and vowel modification, in their most simple forms, are taught by an awareness of the vowel chart. Thinking about how vowels are formed monitors attention to pure vowels and how to modify the vowel, or not modify. Knowing that [U] is more open than [u], or that an [i] is a tongue vowel can help to guide the conductor towards giving the proper feedback to the ensemble. The singer's awareness and ownership of this chart can help them to make informed decisions about how to more easily sing a certain note or passage of the music. Selecting music that helps to build the pure vowels and allows the singers to have success in building a vocal technique is also crucial in this development.35

Figure 7. Vowel chart of the five fundamental vowels.
Vowel modification can be addressed through description and imagery, through individual work, or by vocal modeling. Modeling is an efficient way to help singers gain an understanding of the desired sound. While no two singers are alike and the conductor may or may not be the most skilled vocalist in the room, the ability to model different sounds in order to teach is very important. Demonstrating the sound in your own voice when you move in and out of a resonance is crucial to help them understand what you are looking for. It can also be effective to ask one of the choir members to model the sound you want to hear. This can have negative consequences if the model is bad, but the choir should be encouraged to learn the concept of the model, not necessarily imitate the sound exactly.

The ultimate goal is to teach the ensemble to gain a sonic world that includes resonance, and eventually teach them to make the adjustments on their own. When the sound contains enhanced upper partials involved in a brilliant tone, the collective ring unites the colors in a far more energetic sound. The very process of all the singers producing vowels with the adjustments that work best for each voice creates unity, without the problems of intonation and lack of dynamic interest that occur when "blend" is attempted by working toward eliminating this type of timbre.

Great sound has a core. It gives the fine characteristics of pitch and vibrancy. Around this core should be the ability to affect color. The height, depth, and timbral choices that we affect by the shape of the vocal tract allow for a great spectrum of tone. The balancing of this core and the variation of colors surrounding this center creates a sound that can respond to music from differing musical periods and from our international community. The ideal choral sound begins with a center and then is always responding to the demands of the music.36

These comments are from Joe Miller, Director of Choral Activities at Westminster Choir College. His ensembles sing with an incredible vibrancy of tone, clear intonation, color, and expressivity. He discussed his methods for teaching his choir to sing with resonance and unity in
an interview for this project. He uses the term "core" quite often to define the vibrant center of the sound, or resonance. In a discussion involving upper partial energy in choral sound, he further explains his ideas surrounding these concepts:

When defining the core of the sound, resonance is being addressed. My concept of this balance can be visualized in concentric circles. The inner circle defines the core and the outer circle defines the space. Some singers will need to begin by finding the space of the sound (pharyngeal, oral) and others will need to define the center circle, frontal resonance, or “ring” in the tone. An ensemble is very much the same. As a conductor, you listen for the overall initial sound. If the sound is spread, you must work to narrow the center and expand the vertical space. If the sound is swallowed, you must work to define the core resonance while maintaining space.

The conductor is constantly balancing, extending to one side or the other, and then re-balancing. Monitoring consistent resonance or core in the sound is crucial while guiding this process. Some teachers call this singing on the breath. When the feeling of resonance is tactile and grounded in the breath, there is a sense of stability in the sound.

As a singer or ensemble develops, the teacher works to further define the clarity of these concepts. The strong area of acoustical energy (in the center of the circles) are formants, and possibly the Singer's Formant. I am looking for a Choral Formant when I teach. A Choral Formant, or perhaps an area of “supercharged” acoustical energy, allows an ensemble to sing a wide divisi or a cantabile line with great ease. When the Choral Formant is engaged, the overtone series is strengthened and the harmony is clarified.

Resonance and Intonation

Teaching the singers to use resonance and listen for collective ring can be very helpful with overall ensemble intonation. When two or more sections are singing the interval of an open fifth, for example, it becomes fairly easy to adjust the vowel colors just enough to tune the formants and bring overtones to the sound that are easily audible to many choristers. When they hear and even feel the overtones ringing in the room and among the other singers, they can feel and hear that the fifth is "in tune." If the interval goes slightly out of tune, the ringing is lessened, and "beats" come into the sound. Of course, doing an exercise like this with the piano is counterintuitive since through modern temperament a piano is actually out of tune. A tuning
fork works better as the reference point for good intonation; it produces a simple tone, is accurate and allows the singers to use their ears and voices to tune intervals and chords. In the interviews following this paper, conductors Simon Carrington, Joe Miller, and Robert Sund discuss their ideas for teaching intonation.

Vibrato

The issues surrounding vibrato are impossible to avoid when discussing choral tone. Although a detailed discussion of vibrato is beyond the scope of this paper, it must at least be mentioned in the context of choral unification. There are many debates about the use of vibrato in choral settings, but evidence as to whether or not it is "unhealthy" to produce a tone with almost no vibrato is inconclusive.

Carl Seashore, one of the important early researchers on the subject, published a study in the 1930's regarding physiological origins, rate, extent, timbre, and the ability of listeners to perceive vibrato. James Stark references Seashore's work in his book Bel Canto, stating that his study is the most complete compilation of research we have, but the information is still partial at best. "The physiological and neurological origins of the vocal vibrato are not yet fully understood."\textsuperscript{37} One theory states, "the vibrato corresponds to pulsations in the neural control signals going to the various laryngeal muscles, [specifically] those associated both with fundamental frequency control and with closing the glottis. The cause of the neurological pulsations is uncertain, although the tremor in the laryngeal musculature is similar to the tremor or pulsating contraction of other muscles that occurs after an extended period of constant contraction."\textsuperscript{38} A second theory explains the physiological control of vocal vibrato as a
combination of the laryngeal and respiratory mechanism, with the laryngeal musculature predominating.39

Some view vibrato as a timbral choice, or as an element of expression. Historical periods and genres have changed regarding vibrato, as the changing demands of the opera stage and choral literature impact our perception of beautiful tone. Throughout time, vibrato rates have tended to become slower, and range of pitch fluctuation has tended to increase. Richard Miller asserts that the slower rate of today's singers may be due to the cultivation of a darker voice quality.40 Successful vocal pedagogues throughout time have been concerned with the quality and healthy production of tone. The fact that vibrato presence and rate has changed over time is an indication that the occurrence of more than one degree of vibrato variation is within the realm of healthy production. "Vibrato, being an art and stage question, is not easily defined scientifically and, therefore, there are no common criteria for what is normal or abnormal. Different singing styles usually have their own 'standards' for the range of the vibrato rate, frequency (pitch), intensity (volume), and color (timbre)."41

People often equate the use of resonance with vibrato in solo singing. However, when employing a resonant sound in an ensemble, the members have the capability to vary the amount of vibrato they use. It is considered by many pedagogues to be a sign of healthy tone production, but almost all sung tone has some vibrato in it at all times. According to Sten Ternström, Swedish pedagogue and researcher, the fundamental frequency of a sung pitch is always fluctuating slightly. He claims that a pure straight tone is impossible for the human voice to produce.42 "Healthy vocal production perceived as straight tone is still, to some degree, vibrating. Even when vibrato is minimized in straight tone, the carrying power and ring of the voice associated with the singer's formant can still be present."43
Below is a spectrogram showing three tenors from the University of North Texas singing with and without vibrato. (See figure 8). These singers were asked to produce a tone that they considered both resonant and unified. They are singing an [a] vowel, moving from middle C by step up to G. It is easier to see in the first spectrogram (without vibrato) when the singers arrive at the G, but in both examples the singer's formant is present.

Figure 8. Spectrograms of three tenors singing without and with vibrato on [a].

In certain genres, it is necessary to alter the presence of vibrato in the sound to reflect the style of a piece, or to allow complex chordal structures more clarity. "Most choral works require
singers to play both a melodic and harmonic role; thus, one must occasionally adjust the vibrato's components in order for the vertical sonorities to sound clearly."44 Simon Carrington, founding member of the renowned British ensemble The King's Singers, has enjoyed a highly successful career in America as a choral conductor. His choirs are noted for their beauty of tone, unity, and expressiveness. In regards to vibrato, he stated, "for two years I taught clear, line singing with minimum wobble vibrato and maximum vibrancy at New England Conservatory where the emphasis is on the burgeoning solo voice! I had no issues with either the students or my voice professor colleagues. I make it clear that I expect singers to use their voices musically and expressively like a violinist, matching the tone and the vibrato to the music rather than imposing the same acquired technique on every note."45 Robert Sund, Swedish conductor of the world renowned men's chorus Orphei Dränger, discusses his preferences for vibrato within the context of his choir:

Most singers (at least here in Sweden) have a small natural vibrato when they sing in a relaxed and natural way. For me it is important that singers don't have uncontrolled big vibratos, as that often blurs our normal repertoire. In very general terms I would say that in old music non-vibrato is often very effective, in classical music a little vibrato adds some warmth to the sound, in romantic music I often encourage some more vibrato (but not too much!) and in many contemporary pieces very little vibrato is needed because of the harmonic complexity with closer intervals and more parts. An ideal choir singer should be able to control his or her vibrato so well that they can use this freely depending on the music that is being sung.46

When the voice is allowed to use its natural resonance capabilities to achieve good tone regardless of the amount of vibrato, the singer can produce a sound within a vocally healthy context. In a choral setting, the amount of vibrato being used impacts the unification of the sound. As in individual performance, if the vibrato is too wide or obscures the pitch, it is unpleasant to hear. The same is true with a choral group. When the vibrato rates and pitch
fluctuations of each individual are managed so that the tone and pitch are clear, the sound will be much more unified. This is achieved primarily through good technique and listening.

The Importance of Listening

Isolating the use of resonance from the importance of listening is useless to a choral ensemble. If a group of great soloists sing together employing the singer's formant without regard for each other, the sound is not necessarily pleasing, and certainly not unified. An ensemble needs time to spend singing and listening together. Kevin Ford, a writer for the *International Journal of Research in Choral Singing*, performed an experiment in order to determine whether or not people enjoy the sound of the singer's formant in a choral setting. "Singers first employed a full soloistic placement that resulted in a tone with strong upper resonance in the singers' formant range (2 kHz - 4 kHz). The same singers then employed a greatly reduced singer's formant resonance." The results of this experiment showed that listeners preferred the sound of the choir with less singer's formant presence. The problem with this experiment, however, reflects the same issue of many choir directors that avoid teaching choral resonance. Simply asking a group of singers that do not regularly sing together to produce the singer's formant or even just added strength in the upper partials of their voice will not yield a sound that is collectively resonant as well as balanced. It is easy to get a group of people to sound mildly pleasant while singing with very simple, non ringing sound, which is why so many teachers settle for this. It is a simpler process and takes less time to achieve. Employing resonance in the rehearsal situation of a choir that meets regularly, however, will yield far different results than those listed in Ford's survey. As the choir learns to find its
resonance through a process of free singing combined with vowel modification and listening, the blend will be established, with much better intonation and vibrancy in the sound.
CHAPTER 7
CONCLUSIONS

Choirs that employ resonance in their singing tend to sing with better intonation, balance, blend, dynamics, and artistry. When the ensemble members begin to find the ring in their own voices, they will find it much easier to unify the tone as they learn to sing into the resonance of those around them. The choir can sing with more ease, not become quickly fatigued, and the collective blend will become aurally apparent because the sound is vibrant and rich and can be felt among members of the ensemble. Teaching this concept in the choral rehearsal requires time and study on the part of the choral director, but the results are compelling. With richer resonance creating an increased color palate, a choir can approach choral music of almost any era and style, with greater confidence that their performance will reach the soul of the listener.
APPENDIX

CHORAL RESONANCE INTERVIEWS
Three widely recognized choral conductors were interviewed for this project. Biographical information for each of these outstanding conductors is listed below, followed by their respective answers to a list of questions.

**Simon Carrington**

Simon Carrington is Director of the *Yale Schola Cantorum* and professor of choral conducting at Yale University, where he has also led the introduction of a new graduate voice degree for singers specializing in oratorio, early music, art song, and chamber ensemble. From 2001 until his Yale appointment in 2003, he was director of choral activities at the New England Conservatory, and from 1994 to 2001 he held a similar position at the University of Kansas. Prior to coming to the United States, he was a creative force for twenty-five years with the internationally acclaimed British vocal ensemble The King’s Singers, which he co-founded at Cambridge University. He gave 3,000 performances at many of the world’s most prestigious festivals and concert halls, made more than seventy recordings, and appeared on countless television and radio programs including nine appearances on the Tonight Show with the late Johnny Carson. He maintains an active schedule as a freelance conductor and choral clinician, leading workshops and master classes around the world. He has conducted the Monteverdi *Vespers* in Barcelona, the Fauré *Requiem* in Orchestra Hall, Chicago, Beethoven's *Meeresstille* with the Texas All State Choir, Handel's *Messiah* in Dublin and the Rachmaninov *Vespers* in Victoria British Columbia with singers from all over Canada. He is a regular guest conductor at the Monteverdi Choir Festival in Budapest and the Tokyo Cantat in Japan, and leads annual workshops at the Chamber Choir Festival in Sarteano (Italy), and the Yale summer festival in Norfolk, Connecticut. He has taken Yale Schola Cantorum to perform at the two major choral conventions in the US where they received standing ovations, and his recordings with the choir of baroque masterpieces by Bach, Biber and Bertali have received rave reviews. In 2008 he conducts Dvorak's *Te Deum* and Prokofiev's *Alexander Nevski* at the International Choir Festival in Szczecin, Poland, the Choir and Rebel Baroque Orchestra at Trinity Church Wall Street, the Desert Chorale in Santa Fe and returns as president of the international jury at the choral festival in Leipzig, Germany. Professor Carrington's choirs are known for their incredible attention to musical detail, phrase shaping, vibrancy of tone, and intonation.

1. Please discuss your general thoughts about choral tone and "blend." What do you want to hear when listening to a choir?

   I look for a focused, flexible tone with plenty of colour variation. I try and achieve blend by matching vowels and concentrating on legato line rather than by
taking time (to me it’s “wasting time”!) matching voices.

2. How would you characterize the components of your ideal choral sound?

I imagine in my head the choral sound I wish to develop to suit the music being prepared. In general this might be a clear, fresh, “tall” sound with a range of colours from bright to dark, cold to warm, hard to soft. I want a flexible sound, but with a consistent intensity and a controlled vibrato which can range easily and swiftly from none-at-all to moderate, much like the vibrato of an accomplished string player.

3. What is your feeling about addressing vocal technique in the choral rehearsal?

I do address technique but only obliquely without appearing to dwell on this tricky subject too much – tricky only in the sense that voice teachers have such fixed ideas that I have found it counter-productive to be too specific. I try to encourage good vocal health, good breathing, lack of tension, and a center to the tone to avoid spread. The concept of sending the voice forward through the sleeve of the sound is one to which I refer constantly.

4. Do you address topics such as "resonance", "upper partial energy", "ring", or the use of "overtones" in your choral sound? If so, how does that figure into your overall concept of tone for your choirs?

To be frank I have never been able to hear overtones very clearly even when they are being demonstrated by experts! Rather I search for a certain vibrancy in chording which comes with good tuning and a bright, (but not shallow) focused tone. With young singers I have always tried to encourage them to place their voices forward and to achieve volume through focus rather than sheer noise. Wherever possible I avoid discussion of open and closed vowels as above all I like the tone to be consistent.

5. How do you teach these concepts to your choir?

My warm-ups are a combination of ear training, musicianship, intervallic confidence and tone building. I always start from a soft sound and build from there. I discourage any kind of loose, flapping “vibrato” mainly by having the singers experience and hear the difference between a centered focus tone and a loose wobbly sound which anyway doesn’t carry as well.

6. What are some basic principles behind your approach to teaching intonation?

I spend a great deal of time on careful chording and making sure that all the singers understand harmonic concepts. I find that if this is practiced regularly,
steadily, (and unthreateningly!) it is not laborious and doesn’t slow rehearsals except in the very early stages as the general principles are established. Each voice part is always considered in relation to the others, dissonances and their resolutions are always analyzed and underlined, and chord doublings, octaves, fifths etc. are always considered carefully. All my singers, be they highly sophisticated and well trained, or relative beginners, are given the responsibility of learning intervals themselves and noting how each note relates to those around it.

7. Please discuss your approach to vibrato in choral tone.

For two years I taught clear, line singing with minimum wobble vibrato and maximum vibrancy at New England Conservatory where the emphasis is on the burgeoning solo voice! I had no issues with either the students or my voice professor colleagues. As stated above I make it clear that I expect singers to use their voices musically and expressively like a violinist, matching the tone and the vibrato to the music rather than imposing the same acquired technique on every note.

Joe Miller

Joe Miller is conductor of two of America’s most renowned choral ensembles – the 40-voice Westminster Choir and the 150-voice Westminster Symphonic Choir. As director of choral activities at Westminster Choir College of Rider University, he oversees an extensive choral program that includes eight ensembles. Before his appointment at Westminster, Dr. Miller was director of choral studies, professor of music and voice area chair at Western Michigan University School of Music. With the Western Michigan Chorale he received a number of awards, including the Silver Medal at the 2005 European Grand Prix for Choral Singing in Varna, Bulgaria and the Grand Prize at the 2002 Robert Schumann International Choral Competition in Zwickau, Germany. He has also served as director of choral and vocal activities at California State University Stanislaus, artistic director/conductor of the Stockton Chorale, and music director of the Mother Lode Music Festival.

He has conducted choirs in both national and international festivals, and he has served as guest conductor for numerous all-state and honors choirs. A respected solo artist, he has performed with orchestras and in recital throughout the Midwest and in California. In addition, he has served as music director at churches in Ohio and Tennessee. Joe Miller earned a Master degree and a doctorate in choral conducting from the College-Conservatory of Music, University of Cincinnati. He holds a bachelor’s degree in music education and voice from the University of Tennessee.

1. Please discuss your general thoughts about choral tone and “blend.” What do you want to hear when listening to a choir?

    Sound should be directly linked to the music, a representation of the text and the musical setting. If the listeners are consciously thinking about tone, it is usually
because the sheer vibrations enthrall them, or they are distracted by a sound that does not respond to the music. Characteristics of great sound should include: vibrancy, freedom, sonority, color, and most importantly the ability to change.

The ability of many to sound as one is a dynamic power of any ensemble. One must be cautious when using the word blend, even though unification is most often a goal of ensemble sound. Blend may imply that a singer should change the way that they sing in order to sound like someone else. This can cause a lack of support, over-singing, or imitating a color that is not natural to the physical make-up of the individual. One cannot also overlook the important quality of listening to others. I know in my own singing, I learned so much from listening to Dietrich Fischer-Dieskau sing Schumann. Blend may be a debated term, however, vowel modification is a daily part of choral rehearsals. In order to achieve a healthy tone that is unified, there must be a constant awareness of how vowel production is modified within a singer’s vocal registers. A tenor may need to sing a different modification to come to a unison with an alto singing the same pitch. If one listens to the great violin sections of the world, there is an amazing sense of “blend.” The advantage is that there is a similarity in the physical instrument. For a singer this variation can change from day to day. However, the ability to listen and respond instantly to the overall sound creates an amazing sense of unity and power.

2. How would you characterize the components of your ideal choral sound?

Great sound has a core. It gives the fine characteristics of pitch and vibrancy. If the core is defined, then tonal flexibility can be achieved. Singers are trained to define this core by the use of onset, release, and messa di voce. These techniques allow the choral sound to have a definition. This core is also based on solid breath support. The building of core begins with the quality of inhalation and the balance of the release of this air.

Around this core should be the ability to affect color. The height, depth, and timbral choices that we affect by the shape of the vocal tract allow for a great spectrum of tone.

The balancing of this core and the variation of colors surrounding this center creates a sound that can respond to music from differing musical periods and from our international community. The ideal choral sound begins with a center and then is always responding to the demands of the music.

3. What is your feeling about addressing vocal technique in the choral rehearsal?

A choral conductor is often the only voice teacher that many singers will encounter in their musical lives. We do a disservice to our choristers by not
addressing them as singers. There are many ways to be a successful choral conductor, but in my opinion, the conductor must be responsible for the vocal health and development of the ensemble. The level of addressing vocal technique should respond to the ensemble. If I have a ninth grade group of young men, we are going to work on basic vocal technique, use of head voice, and development of the vocal mechanism every day. If I have a group of professional singers, I may only have a short amount of time to monitor them to ask for certain vowel colors that will help in expressing the music. My ears and mind respond to what I hear and what I want to be expressed in the music. The conductor uses this information to draw from their experience as a vocal pedagogue and provide vocal leadership.

With the growth of vocal training in our community, singers and teachers of singing are becoming more enlightened. In turn, conductors are being trained to be part of this community. We are beginning to become more unified in our belief that knowledge of vocal science is changing the way that we teach. It is encouraging to see that differences can be expressed and that we can work together to create a diverse and vital community of vocal arts.

4. Do you address topics such as “resonance”, “upper partial energy”, “ring”, or the use of “overtones” in your choral sound? If so, how does that figure into your overall concept of tone for your choirs?

When defining the core of the sound, resonance is being addressed. If you teach from the concept of chiaroscuro (light and dark), you monitor the need of the singer to find a tone that is balanced. My concept of this balance can be visualized in concentric circles. The inner circle defines the core and the outer circle defines the space.

Some singers will need to begin by finding the space of the sound (pharyngeal, oral) and others will need to define the center circle, frontal resonance, or “ring” in the tone. An ensemble is very much the same. As a conductor, you listen for the overall initial sound. If the sound is spread, you must work to narrow the center and expand the vertical space. If the sound is swallowed, you must work to define the core resonance while maintaining space.

The conductor is constantly balancing, extending to one side or the other, and then re-balancing. Monitoring consistent resonance or core in the sound is crucial while guiding this process. Some teachers call this singing on the breath. When the feeling of resonance is tactile and grounded in the breath, there is a sense of stability in the sound.

It is generally not possible to address each singer on an individual basis, but through balanced teaching the conductor can offer an opportunity for the
ensemble to build the skills necessary for each person to grow in their vocal development. The choral ensemble offers a great opportunity for a singer to further expand and practice their individual skills by working to keep resonance in every sound. In a choral rehearsal there are often multiple repetitions within a mid-ranged tessitura, and with proper monitoring, this allows the ensemble to increase their ability to develop consistent vocal technique.

As a singer or ensemble develops, the teacher works to further define the clarity of these concepts. The strong area of acoustical energy (in the center of the circles) are formants, and possibly the Singer's Formant. I am looking for a Choral Formant when I teach. Formant tuning and the Singer's Formant allows a singer to be heard above a symphony orchestra. A Choral Formant, or perhaps an area of “supercharged” acoustical energy, allows an ensemble to sing a wide divisi or a cantabile line with great ease. When the Choral Formant is engaged, the overtone series is strengthened and the harmony is clarified.

5. How do you teach these concepts to your choir?

Assess the Sound
The conductor should make an assessment of the basic ensemble sound. A plan may then be developed to improve the foundations of singing. A daily vocalise that addresses these vocal issues is important. If a young choir cannot sustain a melodic line, devise a series of exercises to build the concepts of support. If a Women’s Choir is singing mostly with chest voice, choose daily exercises that build the light mechanism. Building a strong sound means having a disciplined approach to technique.

Select Repertoire
Select repertoire that helps meet these vocal goals and that highlights the good qualities that are already present in the ensemble. If an ensemble conductor can make an ensemble fall in love with the sound, the singers will want to sing any music that allows this “magic” to happen. Repertoire in conjunction with musical and vocal training are essential to building an ensemble that can communicate at the highest level.

Train the Breath
The foundation of singing is based on refining the respiratory process. Teaching these concepts must begin with building the support mechanism through posture, relaxation, inhalation, and exhalation.

Use of the Vowel Chart
The concepts of resonance, space, and vowel modification, in their most simple forms, are taught by an awareness of the vowel chart. Thinking about how vowels are formed monitors attention to pure vowels and how to modify the
vowel, or not modify. Knowing that [U] is more open than [u], or that an [i] is a tongue vowel can help to guide the conductor towards giving the proper feedback to the ensemble. The singer's awareness and ownership of this chart can help them to make informed decisions about how to more easily sing a certain note or passage of the music. Selecting music that helps to build the pure vowels and allows the singers to have success in building a vocal technique is also crucial in this development.

Vowels First
A conductor should generally begin by training the choral sound through a vowel. This will develop more unity and beauty of tone when adding text. Achieving vocal balance and vitality in a single vowel before moving to multiple vowels allows the singer to have a physical and aural memory of the tone that matches the music.

A choral conductor should be keenly aware that in the middle register, which so much of choral literature is written, great pitch and tone may be created when utilizing a closed vowel. My concept of the vowel chart is with the open vowel [a] at the peak of a triangle. This reinforces the concept that even in open vowels there is a sense of core. With a choir that has average skills, begin by defining the closed vowel. After [i] and [u] have clarity and freedom, then work to build a consistent resonance in all of the vowels, working from the closed to the open. The goal is to create this sense of balance in the sound.

Listen, Give Feedback, Choose Repertoire
Many conductors are puzzled as to what to say when a sound is not correct. By stepping away from the ensemble and really listening to the sound, one can hear if the sound is out of control, unsupported, spread, pressed, etc. The vowel chart can be a way of looking at the counter balance. When hearing spread [i], counterbalance by looking at [u] on the other side of the chart. So much of the teaching of singing is discovering how far you should lead a student right or left to eventually achieve a balanced middle. An ensemble that only makes a “pretty” sound will have difficulty singing music from many parts of the world. An ensemble that only makes a sound with “squillo” may not know the ethereal pleasures of singing Britten’s The Evening Primrose. By searching for balance and a sense of exploring the entire timbral range of the ensemble, the singers become capable of a wider more satisfying variety of repertoire.

6. What are some basic principles behind your approach to teaching intonation?

While teaching in California, one of my students came up and applauded me for working on the techniques of singing a certain difficult passage. He said, “I learned so much watching you choose to ignore the fact that our pitch and intonation have been awful for the past 15 minutes in order for us to understand
how to have better technique.” He was learning that working on technical issues can make a huge difference. I learned that I did not want to have an ensemble that sang out of tune. From that moment on, I began to think about how to achieve both freedom and good intonation.

All of the greatest ensembles and singers that I have admired have sung with an amazing sense of pitch. I also knew that when teaching studio lessons there are times that a student must sacrifice one element to achieve another. If a soprano has a great fear of singing a high a, I must first allow her to find courage to take the risk and sing without fear of criticizing. It is my role as the teacher to keep my eye on the overall balance and the end result. It is the same with the choir. I know if I allow this process to go too long, then I have engrained a poor muscle memory and must determine a new way to teach the concept or to accept that I have selected repertoire that does not help me stair-step toward the goal.

**Developing core or resonance in a sound builds clarity of pitch.** It is the center of the sound that must be aligned with the breath and the pitch. When this pitch is sung into the harmonic series of a chord, then the Choral Formant is achieved. The tone has ring and the acoustical properties of the sound are amplified. This is when the senses are most alive and we find ourselves engaged in a sound that is greater than ourselves.

**Learning to sing unisons, fourths, and fifths are the basic building blocks of accurate intonation.** The third of a triad cannot be in tune if there is not a clear fundamental. The fifth must ride within the vibrations of this fundamental. Then the trick is to layer the other pitches in the harmonic spectrum that has been established. The tuning of an ensemble can have great possibilities because the voice has so many timbral variations. Like a string, we can easily bend by using our ears. Like a frequency, we know that we must make smaller adjustments for higher pitches. Training an ensemble to make these fine adjustments can have a great effect on the ability of fine intonation to reach the soul of the listener.

**Knowing when to modify a vowel can be crucial in finding harmonic synthesis.** There are no absolutes in singing. What works for one person may, or may not, work for another. When a singer recognizes the feeling of singing in tune, they begin to make adjustments in their vowel formation to find a way to achieve this connection to the harmony with ease.

**Great ensemble intonation comes from an acute sense of listening.** One of my favorite parts of being a musician is to sing next to someone and find their center. By listening to where they place their sound, form their vowels, and treat the temperament, I am able to respond and sing with them to form a musical idea. This fine sense of listening is developed when I have a confidence in my own technique and can rely on my ears to inform my larynx.
Robert Sund

Robert Sund is currently the conductor of Orphei Dränger (OD), one of the world's foremost male choruses. The choir is based in Sweden, where Professor Sund resides. Robert Sund sings, plays, arranges, composes and conducts. His multi-faceted gift has given him a prominent position both on the Swedish and the international music scene. Most importantly, Robert Sund has been a principal driving force behind OD's development, and has contributed greatly to the broadening of the choir's repertoire.

In 1993, Robert Sund was named Conductor of the Year by the Föreningen Sveriges Körledare [Association of Swedish Choirmasters]. For 17 years he has been teaching conducting and ensemble leadership at the Musikhögskolan [Academy of Music] in Stockholm. He is in great demand to lead courses for both choral singers and conductors in Scandinavia, Europe, the USA, South America and New Zealand. He has been guest conductor everywhere from the Radio Choir in Vienna to the Coro Nacional in Cuba. He is a guest lecturer and a diligent jury member at choral competitions, and a conductor at choral festivals all over the world.

Robert Sund began his time at OD as second bass in 1965. Just three years later he became assistant conductor. In the early 1970s, he studied choral conducting under Eric Ericson at the Musikhögskolan. In 1991, Robert took over full responsibility as OD's conductor. In 2003 Robert Sund was awarded, among other distinctions, an honorary stipend from the Municipality of Uppsala, the Peter Cornelius Plaque in Mainz, and the King's Medal of the 8th Magnitude with a bright blue ribbon "for valuable service as director of the male-voice choir Orphei Drängar - OD."

From the OD website (http://www.od.se/eng/koren.php): "Many people talk of the unique blend of young, lighter voices with older, more mature ones - a blend which produces a sound all of its own. Intonation, phrasing and purity are other words that are often used to describe OD's sound."

1. Please discuss your general thoughts about choral tone and “blend.” What do you want to hear when listening to a choir?

I think the most important factors in choral tone for me are a good vocal technique and relatively good blend. With good vocal technique I mean that the sound must be free and unstrained in all dynamics from ppp to fff. Also the choir should be able to change the vocal sound depending on the style of the music that is performed, i.e. if you want to sing jazz or pop music or on the other hand renaissance music the sound must find other expressions than in general classical repertoire. With relatively good blend I mean that the voices in each part should come rather close together, but not too close. I know that many conductors prefer a totally blended sound, but I prefer a sound where there is some colour in the parts. Especially in dramatic passages I want to leave the singers free to a certain extent and not having a feeling that they have to adjust.
totally to the others. In soft pieces of course you have to be more careful and there I often instruct my singers to listen more carefully to each other and step into the line.

2. How would you characterize the components of your ideal choral sound?

The choral sound is composed of the sound in the different parts and my favorite qualities in the individual parts are:
sopranos: both a rich full voice and a light piano sound available from the bottom to the top; very important is an energy in the voices to lead the ensemble
altos: dark big voices that can be heard in their low registers, but they also have to be able to sound beautiful in soft dynamics and also up into the second octave
tenors: a round, free sound in both full voice, mezza voce and falsetto is my dream and also possibilities to colour the sound lighter and darker
basses: a couple of real second basses with low C's or more are really important and give character to the bass part and a base for the overall choir sound

3. What is your feeling about addressing vocal technique in the choral rehearsal?

As I have been very fortunate and have had auditioned singers in all my regular choirs, I have not had to work very much with the vocal technique itself. They already have had singing lessons and know very well how to give their best. For me as a conductor I have been more concerned with creating a nice balance within and between the parts and coloring of the whole choir depending on the repertoire.

4. What are some basic principles behind your approach to teaching intonation?

Intonation is a subject that is always present in the choir work. I try to never accept bad intonation (except for the first 5 minutes on a Sunday morning with my most tired low basses!). Apart from telling the singers when they don't sing right, it is important for us as conductors to try to teach them the most common problems for bad intonation. There are problems related to the individual: e.g. bad posture, bad respiration, dark sound and different vowel coloring and problems related to the music, e.g. chromatic scales, fourths and fifths downward, repeated tones, bad phrasing, etc. I try to point this out often in the rehearsal and sometimes I notice that the singers are more aware of these factors. If I have the time (which unfortunately is very seldom) I like to include one or two intonation exercises after the warm-up session in the beginning of the rehearsal, which helps the choir to focus on this aspect.

5. Please discuss your approach to vibrato in choral tone.

Most singers (at least here in Sweden) have a small natural vibrato when
they sing in a relaxed and natural way. For me it is important that singers don't have uncontrolled big vibratos, as that often blurs our normal repertoire. In very general terms I would say that in old music non-vibrato is often very effective, in classical music a little vibrato adds some warmth to the sound, in romantic music I often encourage some more vibrato (but not too much!) and in many contemporary pieces very little vibrato is needed because of the harmonic complexity with closer intervals and more parts. An ideal choir singer should be able to control his or her vibrato so well that they can use this freely depending on the music that is being sung.
REFERENCES


2 Richard, Morrison, Review of Monteverdi Choir/Gardiner *Times Online*, 20 December 2006, visited June 15, 2008. entertainment.timesonline.co.uk/article/0,,14936-2511778.html


7 McCoy, 40.

8 Ibid., 44-45.

9 Coffin, 33.


12 Stark, 34.


McCoy, 5.

Miller, 29.

Stark, 38.


Stark, 34.


Joe Miller, interview by author, 1 June 2008.


Bolster, 51.


49
32 Wyman, 5.


34 Simon Carrington, interview by author, 1 June 2008.

35 Joe Miller, interview by author, 1 June 2008.

36 Ibid.

37 Stark, 138-139.


43 Skelton, 51.

44 Ibid., 51.

45 Carrington, Interview.
