

The Choir and the Musical Space

An Overview of the Acoustical Environment

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In my own singing, as well as in my work with choirs and vocalists, I have experimented with and discovered how different rooms' acoustical principles affect the singer's use of breath management, the choice of vowel modifications, the selection of tempi, various articulations, dynamic levels and intonation.

A live acoustic with good reverberation allows a singer to use the voice more intelligently in terms of healthy vocal production with a better sense of connected breath to the vocal tone. The voice travels better in this type of acoustical environment, allowing for better decisions to be made by singers on how to best use their voice.

All of us have observed in our choral work and solo singing how a room's particular acoustical properties influence our choices of vocal tone and timbre. Often a *live* rehearsal or performance room brightens the tone, sometimes requiring timbre shadings and vowel modifications better suited to that particular acoustical environment. Many singers will unconsciously choose to spread their vowels in a *live* acoustic requiring some vowel modifications to adjust and compensate for this acoustical influence upon vowel timbre qualities and the choir's uniformity of vowels. An acoustically *dull*

rehearsal or performance room also influences singers and choirs and encourages them to create vocal tone that is often pressed, strident, less bright, and lacking in resonance.

A room with good reverberation allows the vocal tone to travel more easily than in a room that lacks reverberation, and this in turn encourages singers to use their voice and supported breath control more wisely. An acoustically *dull* room makes demands upon a singer's voice, use of breath, and selected tempi that often put the singer at a disadvantage in terms of healthy vocal production. Typically, this type of acoustical environment encourages forced over-singing, resulting in a pressed laryngeal position that places great demands upon the musculature involved in the singing effort.

Acoustical environments require singers, choirs, and their choral directors to make decisions regarding tempi, articulations, and dynamics for successful singing and performance. A room that lacks good reverberation requires faster tempi so that the singers can sing more easily, hopefully creating vocal production that is healthy, buoyant, and supported with good use of breath. In an acoustical setting with good reverberation, singers, choirs, and choral directors will often choose slower tempi so that the resulting sound is not muddy – this being especially important in polyphonic choral works and musical compositions which have a great deal of eighth-note and sixteenth-note subdivision.

As far as dynamics are concerned, it is much easier to sing softly in a room with a *live* acoustic than it is in a room with little or no reverberation. Of course, it is also dangerously easy and tempting for singers to over-sing in a room with a *live* acoustic.

Singers must choose wisely when determining duration of note values, type of articulation (accented, *staccato*, stressed, *sforzando*, weighted, lengthened notes, melismatic runs, *tenuto*, etc.), clarity of diction, use of voiced and unvoiced

consonants, and the dynamic level and intensity of the articulations, because all of these musical, vocal, and textual decisions are directly related to and greatly influenced by a room's particular acoustical properties and response.

The acoustical properties of rehearsal rooms, sanctuary spaces, and performance halls also have a direct impact upon intonation and successful choral blend. The placement of voices within a choir contributes to how singers hear themselves in relation to other singers in their own section and in relation to the entire choir. Choir singers need to hear both the sound of their own voice and the sound of the other choir members.

Depending upon a particular room's acoustics, I often move around individual singers within the choral ensemble as I try to match better their vocal timbre, sense of pitch, loudness or softness of voice, and intensity of vibrato to the other nearby singers, as well as to the room's acoustical response. The strong need for hearing one's own voice, called the feedback, as well as hearing the sound of the rest of the choir, called the reference, is one of the more important acoustical factors in choir singing.

"Sten Ternström has investigated what he terms 'Self-to-Other Ratio' (SOR). This phenomenon may ultimately relate to singer preference for spacing. In a choral situation, a singer attends to two sounds: the sound of his or her own voice and the sound of the choir as a whole. Choral singers apparently have rather defined preferences for the balance between self-sound and other sound. According to Ternström's research, when the reference sound of the rest of the choir overpowers the feedback received from one's own voice, as might happen in a choir singing with cramped spacing between and among singers, potentially all manner of chaos may ensue: over-

singing, intonation problems, and less than ideal vocal production. Venue acoustics, of course, can exacerbate the problem still further, especially in absorbent and overly reverberant rooms.”¹

Because this is a constantly changing variable in our choral work, the placement of voices within a choral ensemble is one of the most important decisions a choral conductor must make. I believe that choral singers perform at their best when they are positioned in SATB quartets with no two similar voice parts next to each other and with a fair amount of distance between singers so that they can better hear themselves as well as the other parts that make up the choral texture. Spacing with distance between and amongst singers leads to more independent singing, improved vocal production, an ability to hear better, and a better awareness of intonation.

With more knowledge about these relationships, choir directors can be better equipped to optimize the conditions for performance or rehearsal or both (for example, by changing the spacing between singers, the placement and position of particular singers within the choral ensemble as well as placement of the entire choir, and/or by making alterations to the room’s absorption).

“Results of research into this area of choir acoustics suggest very practical applications for your choir. Position your singers with sufficient space between them laterally, ideally 18-24 inches. If possible, grant them circumambient space as well (the equivalent of a vacant row between all rows of the ensemble). Since all choirs and all singing venues are not alike, experimentation may be necessary to determine optimal conditions for your choir. Consider also that research results suggest that ‘weaker’ singers may at first resist

spread spacing, especially circumambient spacing. These singers may actually have to hear themselves for the first time. 'Average' and 'strong' singers, however, appear to prefer spread spacing. Male voices, particularly basses, may do fine with a little less spread spacing, especially if they are positioned in the center block of the choir. Soprano voices, by contrast, will likely do well with as much spacing as feasible. Let your singers assist in the process of experimenting with spacing. Not all voices emit the same acoustical power, and some individual variation in spacing may work well [depending upon your particular choral singers]. Spacing your singers is not a magic technique to solve all choral sound problems. But it may add a desirable nuance to choral sound, while improving intonation and blend. Spacing, moreover, is a vocally non-intrusive strategy that is relatively easy to implement with smaller and medium sized ensembles."²

The final placement of singers within the choir and within a particular room space has a strong and immediate impact upon the resulting choral blend and intonation. And, it is hoped of course, that this final placement and arrangement of the singers within the choir and within the performance space will enhance

"...the ensemble effect or chorus effect; [which] arises when many voices and their reflections create a quasi-random sound of such complexity that the normal mechanisms of auditory localization and fusion are disrupted. In a cognitive sense, the chorus effect can magically disassociate the sound from its sources and endow it with an independent, almost ethereal existence of its own. The sensation of this extraordinary phenomenon, strongly perceived inside the choir, is one of the attractions of choral singing."³

1 James Daugherty, *Spacing Your Singers Can Make a Difference*, Unison, 1999, p. 4.

2 *ibid.*

3 Sten Ternström, *Acoustical Aspects of Choir Singing*, Royal Institute of Technology, 1989, p. 10.

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Bibliography for Further Reading:

Vance Breshears, *Build for Sound: Notes from a Consultant on How to Build Acoustics Into a Church*, Your Church, Jan./Feb. 2000, Vol. 46, No. 1: 26-30.

James Daugherty, *Spacing, Formation, and Choral Sound: Preferences and Perceptions of Auditors and Choristers*, Journal of Research in Music Education, Fall 1999, Vol. 47, No. 3: 224-238.

James Daugherty, *Spacing Your Singers Can Make a Difference*, Unison, Washington State American Choral Directors Association Newsletter, Spring 1999, Vol. 12, No. 3: 3-4.

Duane R. Karna, *Choir Acoustics*, Unison, Washington State American Choral Directors Association Newsletter, Winter 1999, Vol. 12, No. 2: 7-9.

Duane R. Karna, and Sten Ternström, "Choir." *Applied Music*

Psychology – Creative Strategies for Music Teaching and Learning. Richard Parncutt and Gary McPherson, Editors. London, England: Oxford University Press, 2002.

David Lubman and Ewart Wetherill, *Acoustics of Worship Spaces.* New York: American Institute of Physics Inc., 1985.

Steven Powell, *Choral Intonation: More than Meets the Ear*, Music Educators Journal, May 1991: 40-43.

Scott R. Riedel, *Acoustics in the Worship Space.* St. Louis, Missouri: Concordia Publishing House, 1986.

Sten Ternström and Johann Sundberg, "Acoustics of Choir Singing" in *Acoustics for Choir and Orchestra*, Publication No. 52, Stockholm, Sweden: The Royal Swedish Academy of Music, 1986: 12-22.

Sten Ternström and Johann Sundberg, *How Loudly Should You Hear Your Colleagues and Yourself?*, STL-QPSR, RIT, Stockholm, Sweden, 1984, Vol. 4: 16-26.

Sten Ternström and Johann Sundberg, 'Intonation Precision of Choir Singers' in *Journal of the Acoustical Society of America*, 1988, Vol. 84: 59-69.

Sten Ternström, *Acoustical Aspects of Choir Singing*, Dissertation, Royal Institute of Technology, 1989. Stockholm, Sweden: RIT Library, 1990.

Sten Ternström, *Hearing Myself with the Others – Sound Levels in Choral Performance Measured with Separation of Their Own Voice from the Rest of the Choir*, Paper presented at the 22nd Symposium: Care of the Professional Voice, Philadelphia, PA., 1993.

Sten Ternström, *Kor Akustik*, Stockholm, Sweden: Carl Gehrman's Musikforlag, 1987.