The sound of a choir’s performance can be affected by many spatial and personal configurations: the shape and dimensions of the performance space, the number of singers in the ensemble, the distance between choir and audience, and the amount of space between individual singers. These factors may affect a singer’s performance ability in different ways since different acoustic spaces can alter the singers’ perception of sound and, consequently, intonation plus other musical elements.

Let’s say a choir rehearses day after day in a classroom with cinder block walls and a fifteen-foot ceiling. The acoustic “feel” of such a space is quite different from the school auditorium where the same ensemble presents its concert, especially if the school auditorium has a twenty-five-foot ceiling and walls with acoustic diffuser panels. Perhaps a choir holds its concerts in the school’s black box theater, a space known for its intimacy due to the proximity of the performers to the audience. Imagine the sound a twelve-member chamber choir would make in that space. Now imagine the sound of eighty singers in that same room. The difference would be dramatic.

Acoustical considerations must be taken into account for a teacher to maximize the performance experience for his/her students. While identifying potential acoustical pitfalls in performance spaces and adjusting for each room’s unique characteristics is important, knowing and responding to the aural needs of individual singers is a surefire way to ensure a choir’s success.

This article will examine one acoustical aspect of choral performance: the physical placement of singers within a choral ensemble. By observing the effects of singer placement in relation to those who sing the same part and in relation to other singers in the chorus, choristers and conductors can discover ways to create the best possible choral sound.

Voice Part Placement: Formation

A number of choral and vocal methods books discuss seating and standing formations for choirs. Robert Garretson believes that “certain seating arrangements are preferable to others [depending] on the number of voices singing each part, the voice qualities [timbre] of the various members, and the relative musical experience of the singers.”

When choirs are physically placed for rehearsal and performance, they are often organized according to voice part—soprano, alto, tenor, and bass. Organization into sections usually helps singers hear their voice part, thus lending a measure of security to any music making. For this reason, a block formation (i.e., in parts) is typically preferred for beginning- and intermediate-level singers.

Don Collins diagrams several choral formations and explains the rationale for each. When dealing with mixed gender choirs in middle school, he recommends that boys be placed in the middle of the formation with girls behind and on either side. (Figure 1) For boys whose voices have not yet begun to change, Collins recommends they be seated with the other boys so that they are “a part of the guy team” yet positioned next to the female voices. (Figure 2) These fellows would sing the treble part.

High school mixed choirs can be grouped by section or placed in a mixed formation. (Figures 3 and 4) A mixed formation, however, should be reserved for more advanced singers who are confident in performing their parts without the aural aid of another person from the same section. The same principle applies to single-gender ensembles. Less experienced groups will have more success when grouped in sections, while more advanced choirs may choose to stand in mixed formation.
Research on choirs in block vs. mixed formations has not found a significant difference in sound quality between the two formations. Aspaas et al. studied the blend of a choir in three different formations: mixed, block, and columns. Acoustic data was gathered in the form of long-term average spectra (LTAS) to identify possible differences in energy patterns. Results indicated that no significant spectral differences were found among the three formations. Despite the lack of differences in spectra, the choristers expressed particular personal preference for the different formations. Interestingly, the preferences were split by gender. Males preferred the block formation for ease of production, ability to hear others, and to blend.

Morris et al. replicated the Aspaas study with two added components. First, the researchers recorded a choir singing two contrasting works—one homophonic and the other polyphonic—to determine if the texture of the works affected LTAS. Secondly, they recorded these two works from three different locations. One microphone was located in the audience; another was placed at the conductor’s stand, and the third was situated directly in front of the choir.

LTAS was measured in eighteen different scenarios: singer formations, microphone placement, and the texture (homophonic and polyphonic) of two differing musical works. The researchers found that, once again, no significant difference occurred among the signal amplitudes across choral groups; in fact, they were almost perfectly correlated ($r = 0.996$).

A significant effect, however, was found in the differences between the three recording locations. The signal at the microphone in front of the singers exhibited a much greater spectral slope, indicating a stronger signal in the fundamental and first formant frequencies.

The authors suggest that since what a choir hears is different from what audiences hear, this may affect the chorister’s preferences for standing positions. The research team surmised that microphone distances from a mixed choir possibly lead to differences in standing/seating preferences between males and females. Female singers tend to “match their fundamental frequencies to their first formants.”

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**Figure 1. Middle School Mixed Gender Formation**

- Men
- Soprano 1
- Soprano 2
- Baritone
- Alto
- Tenor
- Bass

**Figure 2. Middle School Formation w/ Boy Trebles at the end of the Section**

- Soprano 1
- Cambiata
- Soprano 2

**Figure 3. High School Block Formation**

- T B T
- A S A
- B T B
- S A S A S A S

**Figure 4. High School Mixed Formation**

- T B T
- A S A
- S A S A S A S
Placement in Relation to Others: Spacing

Preferences in seating/standing formations may be driven by what a singer hears in a particular place in that formation. Sten Ternström\(^8,9\) believes that a singer needs to balance his/her own sound (the “self”) with the sound of the remainder of the choir (the “other”). The researcher labeled this relationship the Self-to-Other Ratio (SOR). SOR is affected by several factors, primarily the acoustics of the room but also the arrangement of different voice parts within a choir (e.g., how far apart the singers are spaced). Ternström refers to SORs through the use of a positive or negative number of decibels, signifying the relationship between Self and Other. When one hears more Self than Other, the decibel measurement is positive; for example, +5dB.

Ternström\(^10\) measured a singer’s SOR preference through the use of binaural microphones, a type that is located inside the ear and measures the amplitude of each singer’s sound. He found that while singers can be successful despite a wide range of SORs (between -23 and +5dB), their preference for an optimal range is much narrower.

In Ternström’s study of twelve singers, the typical preferred SOR values ranged from +1dB to +7, with an average of +3.9 dB. In a different study, Ternström\(^11\) created a virtual choir by broadcasting the vocal parts of the other choir sections through room speakers (e.g., if the subject was a soprano, she would hear a recording of the alto, tenor, and bass parts and then “perform” with the recording of those three parts). The subject could move toward or away from a microphone in order to change the sound pressure levels of the “choir” and consequently allow the subject to control the ratio of “Self” to “Other.” The amount of “Self” the subject heard was measured through binaural microphones placed in each subject’s ears. As in Ternström’s previous study, the preferred SOR range was narrow—a mean of +6.1 dB with a standard deviation of +2 dB.

Ternström admits, however, that one of the limitations of the study lay in his inability to measure the bone conduction of the sound, which could have an impact on SOR levels. It is interesting to note that sopranos prefer the highest SOR, while basses prefer the lowest; this may be explained by the fact that the human voice is more acoustically efficient at high frequencies. Ternström suggests that knowing singers’ SOR preferences can be taken into consideration when designing concert halls and other choral performance venues.

James Daughtery conducted a number of studies in which he observed the effects of differing choral formations and varied spacing between choristers. His 1999 study\(^12\) recorded singers in two different formations—block and mixed—and also three types of spacing—close, lateral, and circumambient. Close spacing is the typical shoulder-to-shoulder placement. Lateral spacing means having a space about the width of each singer between individuals. Circumambient spacing is the same as lateral but with an empty row between each row of singers. The 160 musicians and auditors (non-musicians) were asked to judge which recording they preferred. Daughtery also asked the choristers which formation they preferred for singing. Both auditors and singers preferred circumambient spacing. Daughtery posits that spread spacing assists with the SOR, helping choristers hear themselves better and therefore improving the blend and overall sound of an ensemble. This could, in turn, presumably result in better performances.

In a later study,\(^13\) Daughtery expands on the idea of a mixed formation, placing singers in either block or synergistic patterns. In the latter type, singers stood in pairs with the strongest voices placed in the center and the most rhythmically accurate voices located at the end of rows. He repeated the three different choir spacing choices—close, lateral, and circumambient. Choristers in this study unanimously preferred formations with greater distances between singers, feeling that they could hear other singers better and that they used better vocal production while singing. As in the previous study, the auditors preferred the recordings of choirs singing in spread formation. An interesting gender split was noted. Auditors preferred male voices in lateral spacing and circumambient spacing for females.

Daughtery believes these results should cause choral directors to reconsider long-held assumptions concerning the placement of singers in their choirs. Choral methods books spend much time suggesting different possibilities for placement of singers but with the assumption that no differences exist between male and female singers. Daughtery suggests that all voices are not equal, and therefore equal spacing between singers—be they male or female—may not be the best pedagogical choice.

Implications for Classroom Teaching

The ideas offered in the above studies have great potential for improving a choral director’s strategies for singer placement. While it is universally understood that it is good vocal technique to have choristers stand while singing to better control the singing mechanism,\(^14\) choral directors may not
always carefully consider where and how far apart their singers should stand in order to optimize the choral sound. The following section offers factors for choral directors to keep in mind when considering changes to their ensemble’s formation and spacing.

Practical Suggestions for Singer Placement

When dealing with middle school choirs, especially those of mixed gender, it is of upmost importance to ensure singer comfort during this rather awkward pubescent period, especially for males, since they experience more dramatic voice change than females. Teachers must carefully consider how they deal with male singers who are in different stages of voice change.

Avoid singling out a middle school male singer, especially in front of his female peers. Much uncertainty surrounds pubertal change, and a boy may not welcome the attention. For this reason, when grouping middle school singers in mixed choirs, keep all males together whenever possible, in spite of vocal range variables. Creative placement (e.g., boy trebles sitting between male and female singers) will allow those treble vocal range variables. Creative placement (e.g., boy trebles sitting between male and female singers) will allow those treble singers to make optimal use of their voices with minimum embarrassment.

In general, beginning choirs are seated by voice part. Help young singers grow in confidence early on so that they are not so reliant on others. Often, ensembles have strong singers, but the other members “hide” behind or blend in (“blenders”) with the more vibrant, confident sound of the leaders. When the leaders are absent and the weaker singers do not have their anchors to hold them together, the results can be disastrous. Short solo singing opportunities early on can help singers grow in confidence. Teach brief warm-up songs or rounds that are sung every day and then ask for volunteers to sing the rounds in small groups—trios, quartets, sextets, etc.

When reviewing solfège syllables in preparation for sight reading, ask the singers to echo short patterns, first as a class, then by row, and finally by individuals. Encouragement from you and positive comments from their peers will help ensure singers gain confidence, sing out with greater assurance, and rely less on their peers. Younger choristers may sing more softly due to a lack of confidence; however, this may also be due to their SOR (Self-to-Other Ratio). That same singer may not be able to hear herself clearly and thus may hold back for fear of making a mistake. In such cases, try to place the singer in the back row or at the end of a row where she can hear herself more clearly. This will avoid her standing in front of a “wall of sound.”

For advanced singers, mixed formations may be preferred since they may result in optimal SOR, helping the singers hear across the ensemble better, thus promoting better intonation. Formations such as Figure 4, in which a singer is surrounded by all voice parts but with the same voice part nearby, may optimize balance. Improvement in the choir’s balance between parts can help improve overall blend and, consequently, the overall sound of an ensemble. Garretson’s book also describes a formation, attributed to Louis Diercks, called a “mask”—a front row consisting of strong singers standing in mixed formation. This arrangement will further optimize the sound that reaches an audience.

Practical Suggestions for Alternatives in Spacing

The research studies noted above clearly show that an optimal SOR can help singers optimize their own sound and that spread spacing tends to be a preferred method for optimizing a choir’s sound. It is still important to remember that SOR preferences can vary by individual. Many choristers may not be accustomed to singing in a spread formation.

Utilizing strategies to build comfort when hearing oneself as opposed to hearing others can aid singers in meeting the challenges of spread formation. For example, young singers may need practice in hearing themselves within their choir. Techniques such as cupping a hand over one ear or using a finger to plug the ear can be helpful. A teacher should not encourage such methods over the long term since using these techniques is not aesthetically pleasing during performances. Another method for helping singers hear themselves is through the use of a PVC P-trap. Holding the P-trap like an old-fashioned telephone so that the sound of the individual singer is directed back to his or her ear, effectively increasing the amount of sound of one’s voice. Once a singer grows in confidence, he or she will be more willing to try choir formations in which individuals are at a distance from their peers in the same section.

Finally, practicing in the formation in which you perform is a tried-and-true rehearsal technique, yet the possibilities for variations in spacing are not always utilized. Choirs often practice day after day sitting in chairs spaced closely together in their classroom but practice on the risers in a spread formation during the final rehearsals before a concert. If students practiced in performance formations, increased confidence
will result. Some teachers have their singers rehearse exclusively on risers. Separate areas of the classroom are utilized for backpacks, paper and pencil work, chairs, tables, etc.

Choral directors must be wary of falling into the trap of using the same routines over and over without frequent assessment of the success of those techniques. Analyzing the various aspects of one’s instructional approach, even seemingly small items such as how students are seated in class and arranged during performances, can have significant and long-lasting effects on a student’s aural development and growth in applying healthy vocal technique.

NOTES

3 Garretson, “Planning and Management,” 289.
4 Collins, Teaching Choral Music, 354.
7 Ibid., 574.
10 Ternström, “Hearing myself with others,” 296.
14 Collins, Teaching Choral Music, 212-213.
15 Garretson, “Planning and Management,” 289.