Acoustic Challenges in Worship-Space Design

By Scott R. Riedel | Volume 1.1 Fall 2014

Worship is a multisensory activity, employing sights, sounds, scents, and tastes that immerse individuals in both personal devotion and communal action. Particularly during sung and spoken parts of a service, the assembly actively participates together in prayer and praise. This shared experience of speech and song builds community and draws all into the closer presence of God and of each other. Song gives an added dimension and artistic rendition to texts. It has the capacity to connect worshipers not only with each other in the here and now, but also with others across time and space.

For song to happen during worship, a great company of individuals must contribute to the interaction. These include not only the worshipers and leaders joined together at the moment in a hymn, psalm, or canticle on any given Sunday. The great company also includes composers, text-writers and poets, printers, publishers and editors, instrumentalists, singers and directors, instrument makers and tuners. These and a host of others all have added their contribution, even from across decades, so that a hymn can be sung in the great “today” of the liturgy.

Why Buildings Matter

A key element in giving life and vitality to song and to creating an environment that invites and encourages all to sing (even those who may be reticent) is the architectural-acoustical space that envelopes assembled worshipers. An architectural environment and its acoustical character can inhibit or encourage song. An environment that distributes sound energy evenly throughout a room and that has a reverberation period that blends sound energy and allows all participants to hear each other can inspire and magnify song. It opens up new dimensions of participation. An environment that obstructs, separates, and absorbs sound energy away from the assembly, on the other hand, can stifle, dampen, and deaden the song, even of those most inclined to enthusiastic participation.

The creative designs of architects and acousticians thus have the potential to make music and song an inspiring, community-building part of worship. The geometric form and size of a room, the location of furnishings, instruments, and people, and the interior finish materials (sound-absorbing, -reflecting, or -diffusing) all contribute to the success or failure of song-supportive acoustics. Long and tall “shoe-box”-shaped rooms with generous cubic-air volumes remain key ingredients in acoustic success [see Figure 1]. Round, conical, “fan,” pyramidal, and square geometric forms with limited air volumes are typically not conducive to good song and participatory acoustics. The placement of musical instruments, leaders, and assembly, so that sound can be projected directly and without obstruction to and from all, is also important to acoustic success. An appropriate ratio of sound-reflective and sound-diffusing materials in a room for a “live” reverberation is also necessary, as is the absence of intruding noise and acoustic anomalies. Given these many variables, the task of achieving a good architectural and acoustic design can be difficult. In addition, there are often societal and functional challenges to achieving a song-supportive worship space today.

Figure 1: Christ Presbyterian Church, Madison, Wisconsin

Example of a well-proportioned geometric form and air volume. Interior-finish surfaces are primarily reflective and diffusive of sound, with an approximate 2.0-second reverberation period that enables
liturgical song. Ensembles that lead music in both traditional and contemporary styles sound originate on the long axis of the room.

Negotiating the Challenges

The first challenge may be the apparently reduced societal interest and aptitude for involvement in song. Communal singing, in either secular or sacred settings, is less frequent today than it was in our
parents’ or grandparents’ generation. Music is more often heard and observed than participated in. The public even seems to have difficulty singing “Happy Birthday” in tune! Music education is often one of the first victims of school budget cuts. Given these realities, it is essential that the church find ways to support and enhance the song of the faithful. The biblical directive to “sing unto the Lord” is clear, and the inspirational and community-building benefits of group singing and speech during worship are obvious. Communities that fail to support worship and song with commodious architectural and acoustic environments place the heritage and future of corporate worship at risk. Mary sang when her cousin Elizabeth greeted her as “blessed.” The angelic host sang at Jesus’ birth. The angels sing around the throne of heaven. The disciples sang a hymn before they went out. We must do likewise.

Another challenge is the current nature of congregational song itself. The standard and traditional hymn form, while very much alive and well, is not the only musical style used in worship by many congregations today. Gospel, spiritual, contemporary, jazz, ethnic, and call-and-response, are but a few of the musical forms used in worship — often by the same congregation in the same building and during the same service. The diversity of styles, instrumentation, and tempi represented in congregational song today become scientific and design challenges. Although the goal of facilitating musical participation by the assembly remains the same across the stylistic soundscape, the reality is that these musical types require different reverberation periods and settings for best rendition. Up-tempo and percussive music will need shorter reverberation periods, while melodic and organ-oriented hymnody is best with generous reverberation periods. Some instruments are “acoustic” and resonate with air, such as organ pipes, strings, woodwinds, and brass. Other instruments, such as electric guitars and keyboards, require electronic systems to create tone. Variable environments, with movable sound-reflective or sound-absorptive features that can shorten or lengthen the reverberation period in a room and shift the distribution and diffusion of sound, are helpful tools in meeting diverse musical and acoustic needs in a room [see Figure 2].

**Figure 2**: The Community Church of Vero Beach, Florida

*Wall and ceiling treatments are primarily sound-reflective and sound-diffusing, so that the room is supportive of congregational song. Retractable draperies increase or decrease the reverberation period to tailor the room to different musical styles and occupancy rates.*
Lack of understanding or appreciation and funding challenges can often work against supportive architectural and acoustic settings for worship. Attitudes such as “It doesn’t matter. Who can hear or appreciate good or bad acoustics anyway?” or “Good acoustics are for the Carnegie Hall crowd, not for us” or “It only needs to be ‘good enough for church’” all lead to less than noble or functional worship spaces. The fact is that if something is worth doing, it is worth doing well. The worship of the Lord should receive “first fruits.” Lost opportunities do matter and can be harmful by diminishing inspiration and not being inviting. The reactions and future choices of a visitor or “seeker” at worship can be significantly influenced either by dull and lifeless, or by vibrant and active liturgy and song. Long-term church members may not be able to verbalize their reactions to liturgical song, but dull or vibrant perceptions indeed have an effect. It may be easier to exclude these factors from building budgets because acoustics, music, and liturgical song are ephemeral, unlike bricks and mortar.

A common current practice is that of “value engineering” a design after a project price quotation is received. To lower project costs, under a “value engineering” plan, apparently unnecessary features are
skimmed away from a design. The thick and dense gypsum board walls that reinforce low-frequency sound energy, the hard-surface flooring that aids in reverberation, and the lined HVAC ducts that suppress background noise might be replaced with lower-cost thin walls, carpeted floors, and hard ducts. The result is a room that has poor musical presence, suppresses liturgical song, and magnifies unwanted noise. While realistic budgets are essential, so is the need for a worship environment that meets its functional goals.

Inappropriate reliance on technology can also create challenges to congregational song. A worship space might be viewed mistakenly as only a lecture and concert hall, where the single acoustic goal is to deliver electronically reinforced speech and music to the “audience” in the “auditorium.” Extensive systems can be designed and installed to accomplish high-energy sound projection. To be sure, the speech of sermon, lessons, prayers, and instrumental and vocal music must be well presented to worshipers. Often forgotten in this approach, however, is the fact that the congregation’s interaction in liturgy and song is fundamental to worship and community. The members of the assembly must hear each other well and not be only recipients of spoken and sung presentations [see Figure 3]. Further, the assembly must not be overwhelmed by excessive amounts of “lead” sound during their participation. While electronic room-reverberation simulation technologies have been invented, these systems cannot replace the truthful sounds of human voices traveling, blending, and reinforcing each other in the life-giving air of a reverberant architectural space. More speakers and microphones cannot supplant human interaction and participation.

Figure 3: Harvey Brown Presbyterian Church, Louisville, Kentucky (second photo by Eric Wolfram)

Reverberation period was too low and singing diminished before renovations; carpeted flooring and soft-wood ceiling materials absorbed sound energy even though the geometric form and air volume were good. The building redesign with hard-surface flooring and sound-reflective ceiling treatments increased the reverberation period to be song-supportive. Pews are now canted to draw worshipers together.
Best Practices

What are the architectural and acoustic factors that enable and enhance the song of God’s people at worship? Important ingredients, in appropriate proportion and relationship, include:

- A generous cubic air volume
- An enhancing and enveloping geometric building form
- Good proximity and location of worshipers, leaders, musicians, instruments, and furnishings
- An appropriate ratio of sound-reflective and sound-diffusive interior finish materials and surfaces
- The control and absence of interrupting noise and acoustic anomalies
- Appropriate use of electronic technologies
- A means and methodology of accommodating differing musical styles and forms within the same room
- Realistic project goals and budgets
- A keen appreciation of corporate worship, prayer, praise and song as a prized heritage, present gift, and future investment for a community.

Whatever the size of a worship space or the stylistic music leanings of a faith community, there is a fundamental biblical and liturgical need for worshipers to participate together in song. The architectural and acoustical design details that facilitate this participation are what distinguish a worship space from other places of public assembly. In the worship space the assembled faithful are not just receivers and observers of speech and music; they are active participants in sung and spoken liturgy. It is therefore a high priority to design a worship environment that has the capacity to support and encourage the singing of all. Recognition of this priority, and careful attention to the acoustic-design factors described above, can result in functional, elegant, innovative, and inspirational environments that encourage faith communities to worship with songs of prayer and praise.
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