

Acoustics in the Worship Space X

Good Acoustics—the Economic Factors

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In today's world and economy, costs and budgets loom large in almost all activities and endeavors. During discussions of new church building or renovation projects, it might not be uncommon to hear the following ideas expressed: "Good acoustics aren't really worth it for the average worshipper who won't notice or appreciate it—that's just for the elite 'Carnegie Hall crowd,'" or, "It will cost too much to have good acoustics, and we cannot afford it." When these notions surface they can sometimes be the cause for a church being doomed to a less than excellent acoustic environment.

Scientifically and experientially, it can be proven that good acoustic settings are indeed noticeable and appreciated by many, and not only by the "Carnegie Hall crowd"! In fact, acoustic qualities such as speech intelligibility, musical balance,

and rhythmic and tuning accuracy can be scientifically tested and documented as being perceived and valued by a cross section of the population. The notion that "regular folks" won't notice good acoustics is just scientifically false!

Economic issues are often the most difficult to resolve in many projects. Reduced availability of funds, lack of confidence in the economy, and the fear of future economic conditions are often governing factors. Indeed, when constructing a new worship facility or remodeling an existing one, many important matters tug at the purse strings, and budgeting can often be a stressor to a project. That said, it would still be eminently beneficial to consider acoustic issues seriously, and not simply dismiss acoustic excellence as being unaffordable or unattainable. Acoustic excellence does not necessarily mean purchasing "extra" or expensive features. Often, acoustic excellence can be realized from wise decisions and design choices regarding elements that are already a given part of a project.

The primary architectural factors that affect the acoustic environment include

the *geometric form* of a room (does the structure's cubic air volume and shape enhance or detract from good sound?), the *interior materials* of a room (to what extent do selected interior finishes reflect, absorb, or transmit sound energy in a structure?), and the *location of key elements* (do the relative proximities of things such as microphones, speakers, singers, organ pipes, instruments, and even potentially noise-generating equipment help or hinder sound perception?). Wise or poor design choices regarding any of these factors can result in acoustic excellence or disaster.

Geometric form of a room

Geometric room forms can distribute and project sound evenly through a space, or can generate unwanted tonal focusing, echoes, and standing waves. Successful worship space geometries typically have generous cubic air volumes, longer and shorter axes, and unobstructed "line of sight" sound projection paths. Sound-diffusing wall and ceiling surface profiles and features will also contribute to even distribution and dispersing of sound energy. Alternatively, low ceilings, flat and parallel surfaces, concave forms, deep transepts, etc., typically limit acoustical potential and create echoes, "hot spots," "dead spots," flutters, trapping, and other unwanted and disturbing acoustical anomalies.

Interior materials of a room

Appropriate ratios of sound-reflective to sound-absorbing materials in a room



Unwanted noise and vibration can be controlled when equipment is resiliently mounted.

can result in a vibrant and reverberative space that enlivens music and liturgical participation, and produces

authoritative speech. Alternatively, excessive amounts of carpeting, draperies, and other sound-absorbing features can deliver a dull, dead effect that suffocates worship participation and leaves music and speech uninspiring. Having a carefully selected ratio of sound-reflecting to sound-absorbing materials, which results in an appropriate reverberation period, is essential to a worthwhile acoustic setting.

Location of key elements

Then there is location! The relative placement of organ pipes and choir singers together will allow choristers to hear accompaniments and each other clearly and facilitate accurate rhythm and tuning. For example, positioning singers in an ensemble format, forward and below organ cases or chambers, can maximize musical potential. If singers are placed far from organ pipes, within restrictive alcoves, behind obstructions, or strung out in long lines, the entire musical ensemble will suffer from being disengaged. Similarly, the correct location of loudspeakers relative to both microphones and the listening congregation can assure speech intelligibility for all, while inappropriate placement of sound system components can result in frustration and lost clarity for all; if loudspeakers are placed with direct "line of sight" access to all listeners, they can deliver sound with clarity. Ultimately, it is not enough to have all of the sound sources and listeners "somewhere" in the room. Relational locations and proximities are critical to success.

Finally, even if all of the beneficial acoustic design features for room geometry, material selections, and functional proximities are adopted, all can still be ruined if unwanted and interrupting noises invade the worship space. Techniques such as placing noise-generating equipment and functions away from the worship space, and using resilient mountings and discontinuous structures can mitigate "noise to listener" pathways.



Excessive amounts of sound-absorbing material, including carpeting, pew cushions, draperies, and acoustical tiles, will lower reverberation periods and inhibit music and sung and spoken liturgical participation.



Hard-surfaced floor, wall, and ceiling materials, with sound-diffusing profiles, will help to reinforce sound energy and provide generous reverberation periods.



Long and tall geometric forms, with organ and choir located at the end of the long axis of the room, have excellent acoustical potential.



Concave and curved geometric forms, low ceilings, and limited air volumes typically cause acoustical difficulties.

Acoustic excellence

In all of these examples, acoustic success is not derived from expensive treatments or extra apparatus. Acoustic excellence is instead derived from wise design planning and decision-making regarding elements that are already “givens” within a project and budget. It may cost no more or less to place organ pipes in good or poor proximity to choir singers! It may cost no more or less to place noise-generating air-conditioning compressors near or far from the worship space! It may cost no more or less to angle a wall profile to avoid or create an echo! In many instances, the good acoustic choice can indeed be the least costly choice. For example, a hard surface floor that reinforces sound energy will last a lifetime, while a carpeted floor that removes sound energy from an environment will wear over time and eventually require replacement.

While significant acoustic success can be realized from informed design and decision-making, it should not be inferred, however, that all acoustic matters are free and easy! There are some acoustic benefits worth paying for. Hard, dense walls that reinforce and balance low frequency tone near organ pipes and choir singers are indeed more expensive than thin gypsum board, but the price of the thin walls can be perpetually brittle and “tinny” music. It may cost more to hoist heavy loudspeakers to a high ceiling location than to wall-mount smaller units, but the price of poor speaker placement is a missed opportunity to proclaim the word with clarity and

intelligibility. It may cost more to line air-conditioning ducts to prevent noise transmission, but constant HVAC noise interrupting speech and music during worship ruins the experience for all. While these and similarly important acoustic details do have an initial price tag, the cost of remedying these details later is even greater. As a wise observer once said, “If you don’t have the funds to do it right the first time, where are you going to find the additional funds to do it over again?” So, the functional value of design decisions must also be considered along with cost.

Substantial and significant acoustic benefits can result from making wise choices about already-fixed costs. A building will have floors, walls, and ceiling; these can be designed to work in favor of a good acoustic environment through careful detailing, and not necessarily through additional expense. A good acoustical environment can be defeated through uninformed and unwise design, and not necessarily because of lack of spending! Great acoustical worship environments are indeed achievable, even on a budget. Careful overall planning that maximizes the acoustic potential of a design, combined with reasonable spending on priority features, can result in architectural, functional, and inspirational value for generations. ■

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A good choir layout with singers in an ensemble format, located below and forward of organ pipes



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