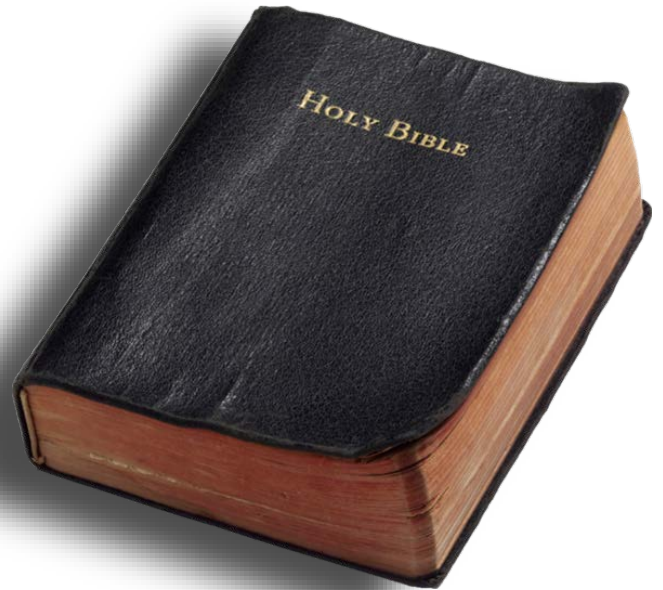


# What does the Bible teach us about Church Sound?

*By Joseph De Buglio  
A servant in Christ*



## Introduction

The quality of church worship is critical to the health of a church. The better the excellence of worship is, the stronger the church will be. Quality of worship is not about packing the church full of people for the sake of filling a worship space so much that it becomes necessary to keep building bigger buildings. We worship God, not buildings or pastors or knowledge. It is the Gospel, the Bible that leads us to God. It is God's words that keep us in a relationship with Him. The strength of a church is not measured in numbers in the seats or money. Jesus taught us to feed the hungry, clothe the poor, and shelter the homeless. The Bible teaches over and over again that we are to live by example (Psalms 1:1-6), to be a light in the world (Matt 5:16), when they see that we are different (James 2:14-26), it will be that difference that will attract people to God.

The strength of a church is measured by how people support each other, and by how much a congregation supports each other as a family first, as brothers and sisters, and then the local community. Is the church feeding the hungry, clothing the poor, and sheltering the homeless? The modern version of Jesus teaching for us in countries with a democracy and wealth should look like this. Is the church cutting lawns, clearing driveways, cleaning people's homes, fixing up members and non-members homes? How often are church members spending time with the widows, the singles who have never had a partner, or the elderly? Are these not the things included in what Jesus told us to do? Are not these the same teachings in the Old Testament? This is just a small sample of how Christianity should look like to the secular world. Mission work starts at home, not in other countries. Support for missions in other countries comes out of our abundance after we have supported our own. Isn't that what the Bible teaches? Quality of worship impacts all of these things.

The Pastor does his best to preach the Gospel but is the Gospel being properly understood? The music is carefully selected to begin worship and prepare people for the message, but is the congregation really participating or are they just going through the motions? The quality of worship is far more important than the quantity of worship. Cameras, lights, projection, video walls, state of the art sound systems, internet streaming, the latest and best technology are all meaningless when the quality of worship is being hindered by another force many churches ignore or think it doesn't matter.

Packing a church full of people where when they leave, no one in the community knows who they are, is wrong. Packing a church full of people where most of them have to drive more than 30 minutes to get there, is not good. Almost always it is a church full of people who want to be entertained, hear a feel good guilt free message where the conviction of faith, listening and practicing the Gospel is an option and not an obligation, it is wrong. Packing a church full of lukewarm people or people who like the idea of being a Christian but are not practicing it through the week could be a church where most of the people are not going to heaven, which is wrong. Where many of the people are being denied salvation because the message is not really understood, that is wrong.

When the message is not being communicated clearly, is this reason why entertaining people with gifted preachers, high-quality music, and technology, the only way to get people into the front doors of a church? When the Gospel message is not clear and properly understood, when the pastor is forced to water down the message, because church members didn't understand and demanded the minister to water it down, where the painful message of the battle for people's souls just adds to the confusion, all of these things are related to the quality of worship. Quantity of worship is no substitute for quality. At the root of many of these issues over time is church acoustics.

## Short History Lesson Part 1

Choirs didn't disappear because contemporary music was better, choirs disappeared because of poor acoustics. The choir was to lead people to prepare for worship. When older churches had better acoustics (not biblical quality acoustics), the choir was sufficient. When technology – the invention of the sound system - tried to help the choir, it failed. The technology was also used to try and help with congregational singing, and that failed. Contemporary music was

supposed to be a replacement but has now become worship-tainment because it too is failing to adequately prepare people for worship spiritually. Church acoustics can bring people together or make everyone feel alone, and the quality of congregational singing demonstrates this the most.

When the local community sees how the Christians they come in contact with, live, is it any wonder that all they see are people who don't practice what they preach or what they believe? Jesus pointed his fingers at the Pharisees over and over again for being hypocrites. When we don't practice what we preach, are we no better? Could church acoustics be such a contributing factor where over time, it has become such a monster? Where over generations of time, since the invention of the sound system, where the lie of the devil is that sound systems allow bigger churches and the sound system will create the perfect worship space in any room size or shape? The devil wants us to focus on quantity. God wants us to focus on quality, and in the Bible, that quality is detailed for all houses of worship for both the Jew, the Gentile, and all followers of Christ.

Church acoustics is the most important part of a house of worship. It is what allows us to communicate the Gospel in a confined space freely, without hindrance and interference. It is what allows a smaller sound system in a good room to outperform any sized sound system in an unmanaged room. Yet church acoustics is most often dismissed as pseudo-science, art or an educated guess. ***What is most distressing is the vast majority of churches who completely disregard the Bible's detailed teaching of how to design and treat a house of worship that God Himself designed.***

There are many words or ways to describe a good sounding church, but most of those descriptions are like sound effects. People often describe the sound in a church in terms of music quality or speech quality, but rarely both. When do people ever say that their church acoustics allows them a full worship experience at every service? The truth is, so few churches have good acoustics as the Bible says we should have, that most Christian can't even imagine what biblical worship should sound like.

What is often shared is how sound disrupted church worship. The sound is too loud, it has poor speech intelligibility, and the room has deadspots and hotspots. People don't want to sing because the room makes everyone feel like they are alone when they can't hear themselves, and the sound system keeps ringing with feedback and so on. People are quick to comment when unpleasant sound interferes with their ability to worship. Poor sound is often so distracting that most people spend more time struggling with trying to hear rather than spending their time understanding and reflecting on the Gospel message.

## The Lie of the Sound System Promise

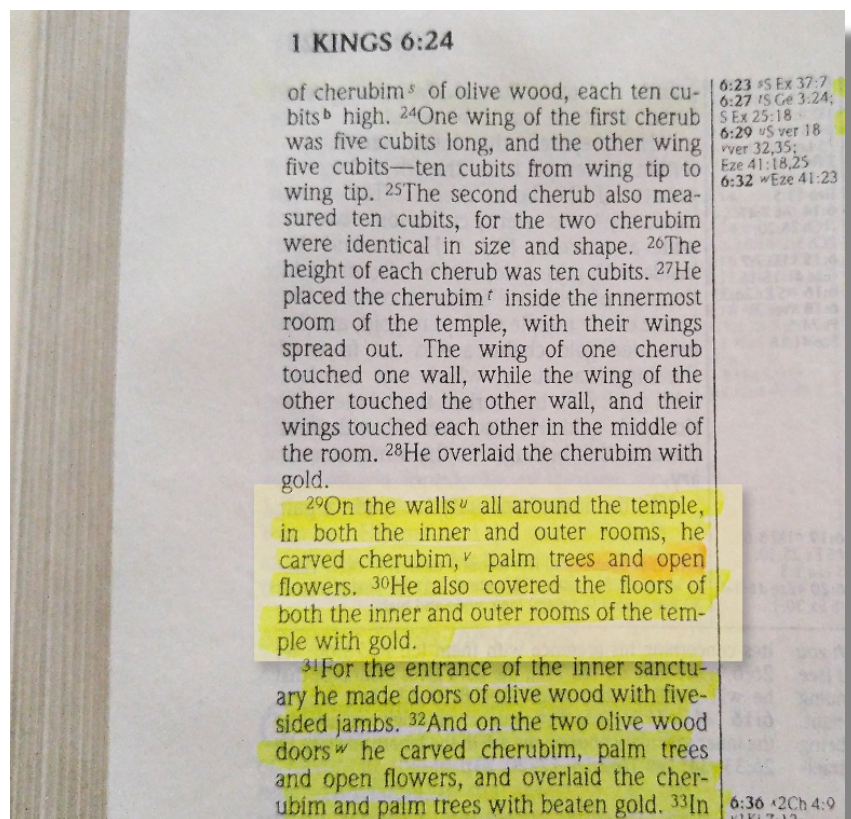
The sad part is, most churches don't know that the Bible has real solutions to church sound problems which includes, in a roundabout way, the sound system. Instead, we have been conditioned to look at what the world has to offer to deal with sound issues. The first tool most churches are handed to them is the sound system and

most often, it is someone from the secular community or someone trained by the secular community. This tool set is not working for most churches. The secular community fails so often in providing high-quality, consistent results that there is little trust from any sound expert – Christian or not. Many churches have bought expensive sound systems and inappropriate acoustical products only to get marginal improvement. Over the last 100 years churches feel let down or burned for the many promises for comprehensive sound solutions. This is the massive reason for the skepticism and distrust for sound and acoustical expert help. As a result, many church attendees have given up on quality worship, and they have stopped complaining because they have been brainwashed into believing that it cannot be any better.

The same people pray and hope that whenever a guest visits their church, the sound quality will not be a reason for visitors not returning. To that end, a few churches have questioned visitors for a year where audio was not the best but not the worst either. Around 21% of visitors complained about the sound for various reasons. The number one complaint was poor congregational singing. Who knew that poor quality congregational singing was a reason for not returning to a church? This is an issue that no sound system can fix but churches keep trying.

## Turn to God, not secularism

One of the biggest lies that churches are taught to believe is that for a church to be good for music, it comes at the cost of good speech. When the church wants a good room for speech, they are told that music has to be sacrificed. The Bible says a church can have both. The problem is, churches are comparing their needs to what the secular community does in large rooms. There is a huge missing part of this picture. There is no secular multipurpose facility that does what churches do every week. What the secular community calls a





multipurpose room is a room that is converted to single purpose function events, or they design rooms with single purpose events like a movie theatre. For the secular community, it is quantity over quality, one function at a time. Who cares how a wedding reception sounds as long as the room is big enough? Who cares how the convention hall sounds as long as it is big enough? The secular communities treatment of large spaces is mostly about quantity first, and quality is way down the list following facility accommodations to provide for a specific function.

For a church, the Sanctuary is a multipurpose room in a large space where all kinds of functions are done without changing the room. A church needs all kinds of functions to be performed equally whether planned or spontaneously. The secular community doesn't know how create such spaces and many churches that are designed and managed the same way just put up with the limitations the secular community also tolerates.

Can a church have great sound for all aspects of a worship service? Yes. What is the recipe? It's in the Bible. What does it take to have a church that has all of the right qualities for Christian Worship as God wants for us? Two words – **Solomon's Temple**. You know... The house God designed!

## Where to Begin

God speaks to us through His Holy book, the Bible. Many declare that the Bible is sufficient in all things. With that mindset, there does appear to be a plan for worship space acoustics in the Bible. Doesn't anyone wonder why churches and synagogues don't follow what the Bible teaches about worship space designs and acoustics? I wonder why people are not asking this question more often.

The only example of a room designed or inspired by God – depending on a person's point of view – is Solomon's Temple. There are enough details of this room to test to see if Solomon's temple has anything to offer to us today; it comes in two parts. The first is about the shell of the room, and the second is about how the interior of the worship space was finished.

When it comes to Solomon's temple with all of its glory and splendor as detailed in the Bible, it seems more like a fairy tale than a real place. Some consider Solomon's Temple to be a legend or story, and never an actual building. Part of this doubt comes from the fact that with such a fantastic building, why is there so little archeological evidence? We know a lot about Herod's Temple thanks to the Roman's and other historical records, but there are almost no details about the interior of that temple. (Perhaps that is because the Ark of the Covenant was never in Herod's temple.) Whereas, in Solomon's temple, there are a lot of details. The lack of evidence of Solomon's Temple is mainly because when Nebuchadnezzar II, the King of Babylon attacked Israel; he utterly destroyed the temple to such an extent that there was almost nothing left for us to discover today. That is what happens when God's people worship false God's.

Proving the existence of Solomon's temple with significant physical evidence would be great, but in the meantime, what if there was another way? What if the recorded details of Solomon's Temple was also intended as a blueprint for modern-day churches and synagogues? Is there any way to test that?

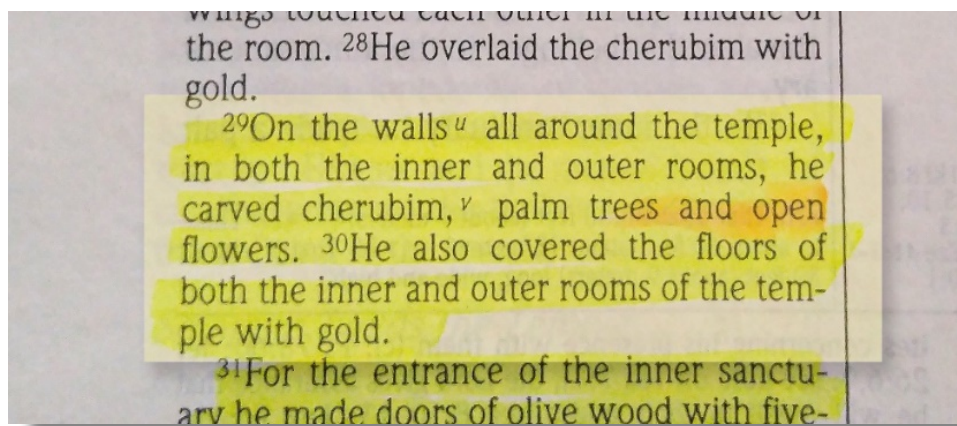
When reading about the building of Solomon's Temple in 1 Kings Chapters 5, 6, and 7, there are many details. Some of the features seem to describe something that would look more like a tourist attraction rather than a house of worship if something like that was to be built today. Some of the temple features seem gratuitous rather than holy, but upon a closer look, was there a secondary purpose to some of those spectacular details?

When doing a quick read of the building of Solomon's Temple, for many, the last thing that comes to mind is how would that building sound? After all, the inside of the temple was off limits to everyone except the Levites who were in charge of the temple, and it was the Levites who were the Priests, teachers, scholars and Pharisees of the temple. The temple grounds were for the public who were permitted to bring their offerings and sacrifices to God. The Holy Place was limited to the Levites who used the temple for rituals, ceremonies, teaching, learning, singing, music, and congregational singing as detailed in the Bible. For them, the acoustics of the temple had to be perfect for them to carry out their constant hive of activities. From the Biblical record, the Holy Place was their Sanctuary, and it was also was as much a multi-purpose room as modern churches are used today.

## The Three main parts of the Temple

Solomon's Temple had the Holy of Holies (the most sacred room on the planet), the Holy Place or Main Sanctuary and the storage rooms around the temple. The Storage rooms didn't have any requirements for good sound, but they did contribute to sound proofing of the space. The Holy of Holies only had to have sound good enough to hear clear speech up to 3 meters or 10 feet. (More about that later.) The Holy Place or Main Sanctuary was at the center of the complex, and it was a room with a hoard of activity. The room had to perform well acoustically to carry out all kinds of undertakings.

At this point, we can conclude that it was necessary to control the sound in the original temple. In a building made of stone, does the Bible reveal any clues as to what they use to manage sound? Let's take a closer look at the two main rooms in the Temple.



## The Holy of Holies

The Holy of Holies was a cube. It was a room built of stone, covered in wood, so no stone was visible including the floors. All of the wood on the walls and floors were covered in Gold, including the Holy Place.

God communicates with us in two ways, physically or supernaturally. God spoke to Moses in the Tabernacle (Numbers 7:89) where Moses said the voice came from the Mercy Seat on top of the Ark of the Covenant. This suggests a physical form of communication when in the presence of God. A person can conclude that there was a need to hear clear audible speech within the Holy of Holies. For this room, it would be safe to determine that God will want to speak to whomever in an audible, physical way. Therefore, the room's only acoustical function was to distribute speech from the Ark of the Covenant to a priest who would stand just a foot or two just inside the entrance to the Holy of Holies, which was 20 x 20 x 20 cubits, once a year. This level of acoustical performance was not an option.

## The Holy Place or Sanctuary

For the Holy Place, which could represent modern-day Houses of Worship, this was a multipurpose room and there are lots of details on how this room was completed. The acoustics of this room had to be perfect for the kind of activities that it was used for. The activities of the past is not much different than how modern churches are used today, even when including sound systems.

## Let's investigate

Solomon's temple was either designed or inspired by God, through King David and King Solomon. King David drafted most of it, and King Solomon built the temple.

## Inside the Holy of Holies

The Shell of the Holy of Holies was a cube. The room was the resting place for the Ark of the Covenant. The acoustical requirements of this room was to hearing clear speech up to 3 meters (10 feet) in a room 30 x 30 x 30 feet (30 feet = 9.1 meters.) What would a person experience in a cube-shaped room with nothing but bare flat walls? Such a room would ring so much that at 3 meters, understanding what a person would be saying would be impossible. For a cube to support speech, there would have to be something else in the room to control the sound to allow speech at that distance.

## Fragments of the Holy Place around the world

The shell of Holy place of Solomon's temple reveals enough detail about length, width, and height that many successful secular performance spaces use these same ratios. The length and width of



the room give us ideal speech conditions as well as for listening to live music. The ceiling height provides us with the ideal conditions for robust congregational singing. These ratios are repeated in the better-known concert halls and opera houses around the world. These buildings have only been around for about 350 years. Solomon's Temple was built over 3,000 years ago. It seems that the secular community recognizes these ratios even though they may not realize the source of that knowledge.

The shell of the Holy place was two times longer than the width, and the height was 75% of the length of the room. The better performing classrooms, lecture halls, concert halls, and recital halls around the world have this two to one ratio in the length and width. Here is science showing us that such a room with these dimensions is desirable for the foundation of a great room. For the acoustical requirements of a church, there needs to be more than just the right dimensions. The surfaces of the room need to be manipulated to support speech and music. (For the past thousand years, churches have attempted to create good acoustics with just the room shape alone. It is an ongoing experiment, and for the record, it hasn't created a single space where other churches would want to make exact copies.)

In the epic account of Solomon's Temple being built, two events stand out. The first part is while the temple was being constructed, God spoke to Solomon. This happened after the walls were finished, the building was closed in, and all of the stonework was covered with planks of cedar for the walls and fir wood on the floors. Then the word of the Lord came to Solomon, 1 Kings 6:11-13. Construction of the temple continued, and when arriving at verse 29 in First Kings six, these details of the building design were added. It says, "And he carved all the walls of the house round about with carved figures of cherubims and palm trees and open flowers, within and without." (KJV) Since the walls were already covered in wood, it would have been the wood that was carved, not the stone. Was the carved wood decorative, or did it have a secondary role?



## What's in the Toolbox

When researching church acoustics, churches seem to use one of two main global tools in the acoustical toolbox. The first and most popular is absorption. Absorption is a single purpose brute force method of treatment of a room. When absorbers are being used for managing large rooms, a lot of them are needed. As a result, it will absorb all of the sound waves that are shorter in length than the thickness of the absorber. It is the higher pitched frequencies which are essential for the task of hearing clear speech and music, but are removed by absorber. This makes fixing a church with absorption to be a one-way path to killing any benefits of the size, shape, and materials used in building the room. This method essentially kills the room. As a result, the acoustics of a church treated with absorption turns a worship space into a subpar entertainment performance space - into a room that robs the people of the real joy of the full worship experience and congregational singing.

One of the main reasons for using absorption is that there are calculations for how much absorption is needed to achieve the right reverberation time. Much of that math originated from a room that was well diffused. All of the calculation models and 3D computer simulations work on the same premise. The assumption is that sound will decay at a specific rate and adding the right amount of absorption will give the correct reverberation. This would be true if sound moved around like a narrow beam of light. Sound is complex, and it is made up of sound waves used for speech that measure between 13 feet or 4 meters to 1 inch or 2.5cm. When adding absorption in a calculation for sound, it assumes that the room has a flat frequency response. On that principle, the math is correct, but in a church, that is rarely the case.

Many churches have unintentionally and repeatedly created worship spaces with very long reverberation times around 200-800 Hertz and short reverb times at 2,000 Hertz and higher. What that means is that a room can be measured to have 2.6 seconds at 200 Hertz and 0.6 seconds at 2,000 Hertz and when measured with instruments, it most likely gives an average that falls within a target number range of 1.4 seconds to 1.9 seconds (depending on the size of the space.) Naturally, it would look like it is a good room on paper. When you start using the room in real life, the disappointment sets in. Frustrated with the room's behavior, a sound system is added, and it seems to magnify the issues, not solve them. After putting up with poor sound quality, people blame the equipment, the person who designed the sound system or the people operating the sound system. No one blames the room because someone has previously shown misleading data that falsely supports the notion that the room has the right reverberation time. For acoustics, there is no single variable to determine the desired result. The correct thing to do is look at all of the data, and have a closer look at the frequency response of the room, reflection sequences, standing

waves, and other details before looking at the reverberation time of the room. If anything, reverberation should be last on the list.

## Short History lesson Part 2

Wallace Sabine, who is considered the father of modern-day acoustics, did a lot of his early testing in a library. There is a reference in one of his journals that he would change the depth of the library books in the shelves to create the right amount of diffusion so that he could get the best results in testing absorptive materials. As a result of Wallace Sabine's works, he and others since then have created equations for calculating the coefficient values of surfaces and products to accurately predict the Reverberation Time of a room. Then when adding products or when changing the surfaces of the room, the calculation will predict the reverberation.

The foundation of all of our acoustical calculations worked on the assumption that the room is sufficiently diffused. In his notes that were available at the time of writing this, it doesn't say whether he measured the changed frequency response of the room, nor does he mention that he changed the signal to noise ratio of the room sufficiently enough so he could measure absorption properly.

None of the coefficient equations used in computer modeling include frequency response and signal to noise ratios. As a result, anyone can input numbers into a computer simulation or spreadsheet and produce numbers that will appear to validate what is being sold to a church. This setup doesn't reveal the full picture of the acoustical problems nor the full picture of the results when absorbers are added to worship spaces. While the math is correct, it is also incomplete. The way that it is often presented to churches could be considered fraudulent. Will this math get the reverberation asked for? Yes. Is it the kind of reverberation suitable for worship? No! Will a fix based on this math interfere with the performance of sound systems? Yes!

Absorption is part of managing sound in a church, but it has to be used correctly. According to Wallace Sabine, it is required to diffuse a room first before adding absorption. This important detail is often



dismissed or ignored by the secular community who say they honor the work and research of Wallace Sabine. People who work in large room acoustics are either unwilling or unable to deal with this crucial detail but the Bible makes it clear that this detail is not an option.

The other tool used for acoustics is diffusion, which is done with hard shapes. There are endless options. Most of them are limited in what they can do, as most of them are designed and installed as stand-alone single purpose items. Most often, these tools are used to manage mid, and bass sounds and they are very effective in removing standing waves, echoes, and flutters. They are the best tool for increasing the signal to noise ratio of a room. When hard shapes are designed to work together in large groups, they create an incredible *system* for sound management. It is when these pieces are assembled as a system; real support for meaningful worship performance for speech and music comes into play.

## The Essential Detail

In Solomon's temple, the main acoustical management of sound came from diffusion created by the hard shaped surfaces. The clues are all there in 1 Kings 6: 29 with the details of carved figures of cherubims and palm trees and open flowers, inside the Holy of Holies, the Holy Place and both sides of all of the doors inside the temple. The carvings were on all of the walls. On closer inspection, each shape was unique. The Cherubs are winged animals or angels. The Bible doesn't offer any details as to the kind of Cherubs that were carved. Then there are carvings of Palm trees. Palm trees have all of their branches on top called a frond, and some also have fruits. The trunk is either with spiked rings or semi-smooth. Palms trees have no growth rings, and they can't heal themselves when the trunk is damaged. The Bible doesn't say what kind of palm trees were carved. The open flowers suggest flowers in full bloom. Again, it doesn't say what kind of flowers.

For the Holy Place or main sanctuary, there was a curtain or veil suspended in front of the door of the Holy of Holies. The veil went from the ceiling down to the front of the doors or about 45 feet high and 30 feet wide. In some other historical writings, it suggests that the veil was as thick as the width of a person's hand or around 3 inches thick. This is all there was for absorption in the Holy Place, and it was needed.

## Field Testing to Learn

In an acoustical plan, everything needs to be exact. The shapes and the depth or thickness of the carvings are important details. Again, the depth of the shapes are not detailed in the Bible, but trial and error experiments revealed how deep a shape has to be. Of all the things on the walls of Solomon's temple, the simplest shape, and the only thing that seems out of place would be the Palm Trees. With the Palms trees being so different from everything else, what would happen in a church when experimenting with the largest part of the tree, the trunk portion of the palm tree shape?

To prove if the carvings on the walls of Solomon's temple could be an acoustical system, a group of us did physical testing. Since the carvings on the walls would only show half of an object, half rounds



*Figure 1 Just standing up full tubes alone 3 walls is sufficient to convince churches that what the Bible teaches works.*

of different sizes were tested. Noticeable changes began to occur at 4 inches of depth or when using 8 inch half round pipes. When the half round shapes were put together in groups of 4 or more units and spaced apart between 15 to 27-inch centers, the performance of the combined shapes exploded.

## Testing Results

After months of testing in modern house of worship, using the trunk portion of the palm tree shape, the results showed an incredible amount of performance from the simple form. At first, all of the testing's were completed with uniformed spacing. Those results are well documented, and we discovered what spacing distances got the best performance for the most common acoustical problems churches experience. At the same time as learning about how to best use the half rounds, papers on phase gradient diffusers and prime number sequences were published. This leads us to discover the use of different sizes of the half rounds with different spacing patterns. The results surprised us all.

The half round diffusers in uniformed patterns do several things very well. From a technical side, they do a lot of low frequency and midrange absorption. They will also cancel standing waves. On top of that, they provide the ideal signal to noise ratio of 25dB, which is needed for speech and for church quality music. To our glee, on the music side, with such a high signal to noise ratio, it didn't matter whether the music was contemporary or traditional.

When we started applying what we learned about gradient diffusers and prime number sequences, we soon learned that by using combinations of 8, 12, and 16 inch half rounds, we could not only maintain a high signal to noise ratio, but we could **equalize** the room. Some churches can have up to 40dB of excess energy between 100 to 800 Hertz. We discovered patterns that can remove up to 40 dB of energy at a given frequency range of a half to a third of an octave without killing the room. This system is so powerful that it can change the frequency response of a church. This is something that a



sound system cannot do. The frequency response of a worship space can be flattened with these diffusers, which creates the ideal conditions for greater congregational singing. This was also when we learned something else.

### How long Should the Reverberation be?

With a signal to noise ratio of 25dB and the frequency response has been flattened, there can be a longer reverberation time that compliments both contemporary and traditional music at the same time. The room becomes well behaved no matter what kind of program is being done for either speech or music. The other bonus was for the sound system. Without changing existing sound systems, there was between 10 to 20dB, more audible and undistorted bass, and in most cases, there was an extra octave of lower bass sounds that were never heard or felt before. The system could perform 10 to 15dB louder without distortion, which means fewer or no complaints of the sound being too loud.

The conclusion of our testing with the half round shapes is that it confirms the idea that the carving on the walls of Solomon's temple did have acoustical properties.

### Computer Modelling Busted

Satisfied with the testing results, we applied what we learned to computer modeling. No matter what we did, the results didn't match the real world performance – even when adding numerous fudge factors to force the program to fake the results. We contacted the software developers, and they are aware of the issues. Some day they will figure it out.

This was not a discouragement for real-world testing. From our testing, a database was created for the most common problems churches have. Since around 1995, over 400 churches have installed such an acoustical system. The results have been nothing less than amazing, and as some have said, spectacular.

With our limited investigation, one can conclude that the carvings on Solomon's temple walls were more about managing sound while not being distraction. It should be pointed out again that the wall carvings may or may not have been covered in gold\*\*. The carvings on the doors were covered in gold. The cedar wood is so dense that covering it in gold or not would have made little difference acoustically.

### No Diffusion = No Worship

Without the carvings, the flat walls would have made the temple impossible to perform any of the rituals and ceremonies as described in the Bible. How thick the carvings were, we are not told, but we do know that the planks used in those days could have been around 6 to 7 inches thick or the length of a person's hand 3,000 years ago. That would have been deep enough to create a working acoustical solution.

The implications of the purpose of the wall carving in Solomon's temple is enormous. First of all, this kind of system is already working in hundreds of churches today. Since it does work in existing churches, they are now getting the highest level of performance their worship spaces can ever hope for. It implies that the acoustical



*Figure 2 Weeks after the demo test, the church completed the recommended design of the full installation.*

treatment of Solomon's temple is relevant today. This system gives all churches a free plan to manage sound. For all existing and new worship spaces, this plan creates the right kind of acoustical conditions for church worship. Since this acoustical system is based on hard shapes and not what it is made of, this acoustical system becomes something that all churches can afford as the half round shape is economical to make.

### It's a Miracle!

For those who want proof of the existence of Solomon's temple, it would be safe to say that the temple is not a relic to be forgotten in the past, nor a myth. Myths don't turn into acoustical solutions in hundreds of churches 3,000 years later. Imagine this. Over 400 churches have already taken a leap of faith in using an acoustical system that the secular community hardly understands or uses. It is an acoustical system that computers cannot model or predict the final outcome accurately.

The tested details of the Bible's way of managing sound works. With that foundation, we know that such a system is the best or perfect solution any church or synagogue. This ancient method also creates an ideal set of acoustical conditions for our modern ways of worship.

When looking at other details about Solomon's temple, it becomes apparent that the whole sanctuary was a template for church worship. The carving, while unique, was not about being extravagant, bragging, or showing off. They were just plain pieces of wood with carvings on them. Their purpose seemed to be about managing sound as well as being ornamental. For lighting, they had candles and lots of them. The only natural light was from small windows near the roof in the larger room. Without lower windows, there was no distraction. Thick walls meant soundproofing, safety, and to protect the Ark. A lot of the rest of the temple details are about the quality of worship.

## Solomon's Temple is not a Myth

Many people believe that God inspired the Bible. When reading the Bible, it seems that everything in the scriptures is with purpose, many things are deliberate and it all points to choosing what kind of eternity will be in your future. If acoustics matters to God, it would have been God who made sure that such details were included in the scriptures. If Solomon's temple were a myth, then the details of the interior walls of the building wouldn't matter, and they could have been left out of the scriptures. Since they are included in the Bible, and these details have now been tested, this should make Solomon's Temple a very real temple. The details of the wall coverings made the temple the functional place that is was for rituals, teaching, learning, singing, music, and congregational singing. This then begs the question, why are churches and Synagogues not following the Bible teaching for acoustical help? Let me put it out there in another way.

I believe that the Bible is sufficient for all things. God speaks to us through the Bible in the past, present, and future. Along with everything else, God has given us a blueprint to manage and to repair the sound in all of His Churches. Every church out there that is dedicated to God belongs to God. Why would any congregation choose any other design for a church and omit the acoustical treatment God created for us? Why follow the Bible for everything else except for knowing how to build His churches?

### Did Jesus Give us the First Church Design?

Here is another point of view. John 1:1-3 says; "In the beginning was the Word, and the Word was with God, and the Word was God. The same was in the beginning with God. All things were made by him; and without him was not anything made that was made." (KJV) The Word is referred to as Jesus. God and Jesus created all things. Jesus said he came to fulfill the law. Why? The reason is, He created the laws in the first place. Jesus didn't have to give us a new worship space design in the New Testament because He already gave us the design in the Old Testament in the example of Solomon's temple.

When Jesus cast out the money changers, in John, Jesus said, "My father's house." In Matthew, and Luke, He says; "My house is a house of Prayer, but you have made it a den of thieves." In Mark, Jesus said: Is it not written, My house shall be called of all nations the house of prayer? Then there is John 14:9 Jesus saith unto him, Have I been so long time with you, and yet hast thou not known me, Philip? he that hath seen me hath seen the Father; and how sayest thou then, Shew us the Father?

When it comes to any place that is dedicated to God, it belongs to God and His house should be treated with the highest form of respect. Jesus said it when He was in a copy of Solomon's temple



when casting out the money changers. Jesus claimed ownership of a copy of Solomon's Temple. Doesn't that suggest that any synagogue or church belongs to God?

Interestingly, we have no details as to the inside of Herod's temple other than carvings on the ceiling of which there is no details of what those carvings were. There are no other specific details from any of the historical writers who were living at the time of Jesus where written records were common.

Why would God go through the effort of designing a temple through David and Solomon, keep so many details of such a building in His Bible unless there was something more to the building than being a symbol of wealth, glory, and power? Solomon was not a conqueror or a warrior. His success in his early years was through judging rightly, with wisdom, love, kindness, generosity, loving God's people and in loving God. With all of the evidence presented, one can conclude that Solomon's temple was and is an example of how all houses of worship should be designed, funded, built, and completed.

### Recommended Modern Church Planning

The Sanctuary portion of the structure is to be simple, easy to build, cheap to construct, and maintain. It is to have natural light, but the light is not to be a distraction. (Small high on the wall windows were used. No low windows to look out from.) It has to be built well enough to keep the noise out, and the sound of worship in. The thick walls were used to keep the temperature of the room reasonably controlled. The walls are to be ornate enough to manage sound properly but not so to be a distraction. The length and width were to support speech. The height to support congregational singing. It is to be a functional space with lots of storage.

The Holy of Holies can be viewed as a room of solitude praying just as Jesus went alone to a mountain to pray. On the Mount of Olives, Jesus withdrew from His disciples to pray alone. Jesus went where there was little distraction. Jesus told us to go to a closet, shut the door, and pray in secret.

The Bible teaches us exactly what we need to know about designing, building, and completing a house of worship in these modern times.



The acoustics of Solomon's temple was perfect in the past, and in the present for Christian worship today. From our experiments, with the smallest of adjustments, the results make a worship space better for contemporary worship or traditional worship to both without sacrificing congregational singing or speech.

Continuing this train of thought further, Solomon's Temple was built 3,000 years ago. If a man had designed the temple, it would have been a monument. A different building would have been built knowing man's sinful ways. God had to be the designer of the temple. God and Jesus designed it to be the best room possible for His people to use in the past, present, and future. Everything in the Bible is either a lesson, a warning, a way to live, an example to follow or about a relationship with God. All of the historical references have lessons for us to learn. Solomon's Temple is no different. Along with everything else we know about the temple, the House of God is also an example of church sound for us today, and it supports a full range of performance requirements including modern day sound equipment, and system designs. Solomon's Temple was future proof.

For anyone who considers Solomon's temple to be a myth, forget it. The temple was as real as pinching yourself. Many Christians talk about the plan of salvation, about being followers of Christ. The Apostle Paul said many times that we are to follow the example Jesus



created for us. Jesus said He came to fulfill the Law. Jesus told us to follow Him. Doesn't that include His Temple and the buildings we dedicate to Him? Yes, our bodies are to be a temple for the Holy Spirit and treated with respect, but we shouldn't forget the purpose of the temple He designed for us.

For those who want to make this into something super spiritual, is it because of our sinful nature that we think we can design a house of worship better than what God has already given us? Is it because of our arrogance that we have ignored what God has already planned for us? Has Satan been so clever at deceiving and blinding us to this Biblical truth? Seek your hearts. Pray. Solomon's temple should not be frozen in the past but be part of the living truth today.

## Conclusion

In writing this article, it was necessary to include a whole lot learned in the last 25 years. From it, five main results stand out. They are about; existing churches, new churches, sound system performance, cost, and aesthetics.

### Existing Churches

Any existing church out there that doesn't have any or the wrong type of acoustical management is getting a limited level of worship space performance according to the laws of physics. The limitation can be anything from 20 to 60% of the rooms full potential. Regardless of the shape of a church, after adding half round diffusers in the right quantities, spacing and sizes, the room's performance increases around 85 to 95%. The only reason that a church can't get 100% of room performance most of the time is because of architectural features that get in the way which cannot be changed. There are two categories of existing churches. Those without any acoustical management and those with the wrong acoustical management system.

Churches with no acoustical management, their rooms are often running at 20 to 40% of their potential. These churches realize the most significant amount of change. Going from 40 to 90% of overall room performance is enormous, and most churches years later are healthier, stronger, while some churches reach out by open their



doors for community events such as concerts and public hymn sings to let the community hear what they have.

Churches that are using absorption panels for whatever reason, when they add diffusers see a big change too. Even better yet, in most churches, the absorbers are removed, and the diffusers are installed. For those churches that are already getting 60% performance, jumps to 90 to 95% are just as dramatic. Not just improved sound system performance, but in congregational singing, and how that singing pulls people together, and so much more.

The other thing absorbers are not good at is reducing floor monitor noise and spill. Many churches switch to In Ear Monitors(IEM) which is already getting a bad rap for speeding up hearing loss. Distortion speeds up hearing loss. The acoustics of many churches forces the musician to raise the volume in the headsets to unsafe levels. At those levels, many IEM distort. When the worship space is properly diffused, the IEM can be turned down a lot, and many wind up returning to using floor monitors, which also reduces hearing damage. Quality and safety over quantity.

## New Churches

There are many advantages to building a church that follows Solomon's Temple Model. Apart from all of the acoustical benefits you have already read, there are lower construction costs, lower maintenance costs, and lower heating and cooling costs with the right HVAC system. There is no downside to Solomon's design. For those who want to personalize the worship space, there are many ways to make the template of Solomon's temple to look unique. To make a church stand out, the shell of the rest of the building can be whatever statement a church wants to make in a community. The foyer, fellowship hall, offices, classrooms, or gym can be whatever the church can afford to build. There is also landscaping that can have a considerable impact on how the community sees the church.

Every church can have the same interior dimension ratio's and the same level of diffusion with other shape design and aesthetics, and most of them will not look the same, but the performance of the room will be perfect for worship, and that is what matters. All churches should have the same level of performance so that none can boast.

Besides, what if all the churches looked the same? Think about this; every gas station built since 2010 has the same layout because of all of the regulations, codes and standards. Every brand of gas out there has found ways to make their station look unique to service their needs. This is what could happen if churches started to standardize worship spaces using the example of Solomon's Temple. The church community as a whole has not yet adopted such a standard, so there are no examples of churches being the same and being unique at the same time. (A few denominations have tried this and failed. It could be because they were following a design not based on the Bible.)

The church community should end this costly experiment of second-guessing God or trying to create something better than what God has given us. God gave us the ideal house of worship plan for preaching the Gospel. It is time we complete God's plan of salvation to include His Houses of Worship so we can all experience the full range of worship God intended for us to know. This is not about feelings. It is about being closer in a relationship, as described throughout the Gospel, with God.

## The Sound System

Sound systems are very much impacted by the acoustical condition of a worship space. In the secular community, "lip syncing" or performing to soundtracks is done frequently and the public complains loudly. The secular community seems to have their ways of working around acoustical problems, but these solutions wouldn't be accepted in a church. Would a congregation lip sync a hymn and consider it spiritual or uplifting?

Sound systems in an underperforming room amplify all of the acoustical problems a church has. Unfortunately, far too often the blame is put on the system design, types of speakers, the equipment, poor equalization or the people operating the mixer. Many sound system experts refuse to concede that the room is in the way and are hopelessly brainwashed into believing that there is always a technological solution to any sound problem.

When there are too many subs, it is a sign of standing waves or there is too much bass buildup in the room. When the size of the speaker system looks like it can serve an outdoor event for an audience 3 or 5 times bigger than the church, again, standing waves, excess bass, hotspots, and deadspots and feedback issues are all pointing to acoustical issues.

Experience has taught us that for those churches that already have decent speaker systems, when those rooms were diffused properly, almost all of the sound issues disappeared or improved. What disappeared was hotspots and deadspots. Sound coverage throughout the room became even. Distortion in the sound system disappeared, or rather, the sound system can now perform way past the sound levels needed for any kind of church worship without complaints.





The improvements were many. Here are some of them. System feedback is so reduced that if all of the microphones are left on when the pastor is preaching, not a problem. The sound system can perform 10\* to 15dB louder without people complaining. The Subwoofers can perform 10\* to 20dB louder without distortion. The soundperson can create a better quality mix because they can hear everyone on stage. The IEM work so much better. It takes fewer microphones to amplify the choir, and so on.

Other sound system related issues include the removal of drum cages as the drummer starts playing quieter or at the same level as the other performers. The musicians start to improve their talents. Best of all, sound complaints almost disappear, and some people who used to ask the sound system to be turned down now ask for the sound to be louder. That is what happens when you have quality over quantity.

## Cost

The main cost of acoustics in a *new church* is the cost of the knowledge from an expert to custom adjust and complete the template of Solomon's temple. The material cost is often none or less than the price of all of the doors used to exit the Sanctuary. Any new church can afford that. Essentially, there is no excuse for a church to leave out acoustical planning. It is much cheaper than doing acoustical work later and aesthetically, looks better as wider full size barrel diffuser can be used instead of half-rounds.

For *existing churches*, it is about the shape of the diffusers that matters, not what they are made of. For churches that don't have the resources, a typical 400 seat church can be fixed for under USD 1,000.00 when the church does the work themselves using simple cardboard tubes. For churches that have someone donating the money, or if they have the resources, they can spend up to around \$18,000.00 to get a better looking acoustical solution of the same performance. When using ready-made products that the secular community sells, to get the same level of performance, a 400 seat church will have to spend over \$50,000.00 when compared to the performance of cardboard tubes. The bottom line is, doing the acoustics as the Bible teaches is affordable for all churches. There is no excuse for a church to have lousy sound – ever!

It should also be pointed out that absorbers have a limited life expectancy and they are dust collectors. Dust also builds up over time and makes the absorber less effective. That makes absorbers a poor example of stewardship. Half round diffusers will last the lifetime of the church and they can be painted as often as the rest of the church is painted without any change in room performance.

The other cost saving is in the sound system. When an audio system is too old and has to be upgraded, with good acoustics, the size of the



sound system can be modest and affordable. When churches refuse to fix their acoustics, the sound system cost often is 3 to 6 times higher. Good acoustics lowers the cost and people are more likely to work harder to maintain the sound system in better condition because, in a good room, when the sound system works, there are no surprises. In a bad room, sound system issues show up so often that fixing sound system problems on the fly is discouraged because the outcome often doesn't mean better results. When that happens, there is no incentive to prevent such problems in the future because they will happen again and again. In a good room, if the pastor's headset mic fails because the battery wasn't recharged or replaced, for a person to approach the pastor to change the battery in the middle of the sermon is no big deal because the reward is the continuation of good sound. When this happens in a bad room, the pastor often will grab a handheld mic to continue the sermon because no sound person would dare to run up to the stage to change the battery in the middle of a sermon. The reaction of most audience members is that they wonder why the pastor doesn't use the handheld mic all the time. These are my personal experiences and those shared to me by other church sound mix engineers. Again, this is another example of quality over quantity.

## Aesthetics

The biggest objection to fixing the acoustics of a church is how the treatment will look. If Solomon's Temple was here today, I don't think anyone would notice the carving on the walls or the lack of windows at eye level. Solomon's Temple is about focusing on worship and spending time with God. Not entertainment and not about aesthetics.

The question I keep asking is, why are palm trees in the two Holiest rooms in the world? Palm trees in the temple seem so out of place. At the time when Solomon's Temple was built, there wasn't anything spiritual about palm trees deserving a place in God's house. Anyone who knew that wouldn't "say, those palm trees are out of place." If anything, because Solomon's temple sounded so good, no one notices

the palm trees. Consider this too, the Levites, who were the priestly tribe who observed all of the rules and laws of God, wouldn't they be the first to complain about the palm trees?

From personal experiences, when people visit churches that already have these half-round tubes on the walls, most people have the reaction that they look good or great. Whenever I show photos of these churches to other churches, some speak out and say, "do you have anything else to put on the walls?" Yes, there are many other options if you can afford them. When people experience good sound, aesthetics become a much lesser issue. When the acoustics of a church is less than what Solomon's Temple would have been like, every mark on the wall, every fixture, every safety device, everything mount on the wall has to be perfect. Good acoustics helps people to focus on God and not on aesthetics. When the aesthetics are more important than sound, who gets the glory? Man or God?

## Priorities

Solomon's Temple was never about putting God on a pedestal and leaving Him there. It was not meant to be a monument to God's Greatness as so many people put it. It was supposed to be a place where people can publically show their faith in God.

The sin offering of blood was about washing your sins away, removing the barrier between you and God, and then to bring God with you as you left the Temple. It was the old way of being renewed, like being "Born Again," before Jesus expanded the meaning of it. Before it was just about the atonement of our sins. When Jesus explained it, it was about loving God with all of our hearts, minds and souls. In the Old Testament, when God accepted our offerings, it was like starting over again. Going to the Temple was about repentance, forgiveness of sins and committing ourselves to God. God loved Job even though he was not perfect. Job was faithful to God. Job loved God no matter what trial or tribulations he went through. Going to the Temple was an act of faith to show God that you loved Him.

Going to church today should be a similar experience. Ok, we don't need to go to church to show God that we love Him. We do that by spending time with Him in prayer, reading the Bible and by doing what is expected of us in wanting to serve Him. One of the teachings in the Bible is to have fellowship with one another. To spend time with each other and to be better grounded in the faith.



People go to church in faith. Many share how going to church is like getting recharged. Sometime what you learn is something that you use the following week or learned something to help you understand what happened the week before. Have you ever considered that the poor acoustics of a church could be watering down the message of pastors? I have never heard of a person being saved because of lighting, windows or comfort of a seat but I have seen people walk out of church because they misunderstood the message that I thought was crystal clear, but then I sat where the confused person was and the message was not clear when the recorded message was played back over the sound system. When aesthetics starts winning people to Christ, I can quit this message. Solomon's Temple gives us permission to do whatever it takes to make His House sound as best it can be. It is awful when a minister waters down the Gospel\*\*\*. It is unforgivable when a house of worship waters the message the minister preaches and people wonder why the church is not healthy.

Years ago, someone wrote these two sentences to make a point about the quality of sound.

***How to wreck a nice beach?***

***How to recognize speech?***

In many churches, when one of these two lines are spoken over the sound system quickly, most people guess wrong when these two lines are projected onto a screen or scored on a sheet of paper. You can have the best pastor around but if the acoustics are not up to Solomon's Temple quality, the room could be watering down the message more than what many may believe. The priority for a house of God should always be quality of sound over the Aesthetics.

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## Notes:

\*10dB is equal to 10 times the power. If you have one sub and you want to increase the bass 10dB, you have to add 10 subwoofers.

\*\* The carvings on the wall may have not been covered in gold on the inside walls. Just on the doors, the floors, the Ark of the Covenant and the two Oracles in the Holy of Holies. While earlier passages describes gold covering the walls, it does not say what was carved to form the Cherub, Palm Trees, and open flower. If the Gold was on the cedar planks, then the Gold would have had to be reapplied after the carvings were made. The Bible only states that after the carvings were done, Gold was applied to the floors and doors within the temple. Whether Gold was reapplied after the carvings were made, the Bible is not 100% clear, but it would not have mattered as the density of cedar is high enough that it would have no major acoustical impact on room performance.

Gold is so dense that it does not absorb or get stained with blood. Blood would often be sprinkled around the sanctuary/Holy Place of the temple, fall on the floor, or get on the priests hands who had to open and close doors. To remove any dried blood from gold all you need is a water and a cloth. Any other surface would be permanently stained with blood. Water was used to clean the spilled blood. Cleaning the blood in the temple was such that the water could not seep down into the wooden floors.

In the Holy of Holies, it was said that the Ark radiated light or energy. Traditions says that the priest would sprinkle blood onto the Ark once a year which was covered in Gold. Could the radiant energy consume any blood spilled and anything that splattered unto the two large Cherubs? If it did, what happened in the Holy of Holies was a self-cleaning system to keep the room pure. With all of the Levitical laws about keeping things clean, if the Holy of Holies needed to be cleaned, you would think that it would have been mentioned as blood will cause a stench after a while.

Perhaps the Gold wasn't so much about flaunting wealth, but was the best surface to keep the temple clean and pure. The two Oracles over the Ark were covered in Gold yet kept in the dark to make sure they never became something to worship like a Golden calf, but rather the Gold was to keep them clean.

\*\*\* For un-churched people visiting a church for the first time, often the language and terms may seem unfamiliar. That is often referred to as "Church Speak". When I first started to attend a church, I often heard the word "witness" or "witnessing" repeated many times. Having not read the Bible yet, I thought witnessing meant seeing criminal activity and when the adults around me were using the term so often, I often thought it was about some legal issues. For a short time I thought many of the church members were police officers or somehow involved in the local police force and these people were attending the local court house almost daily as witnesses to crimes.

Church speak can be confusing to unchurch people. However, when the acoustics are bad, the meaning of some of that church speak can frighten

people away and that happens more often than what many church people may realize.

I often meet non-Christians and when I tell them what I do for a living, people often share their awful experiences. They often say that the reason for not going to church is because of what the minister said. Often they say that what they heard the minister say in the sanctuary was something that even I would find offensive. Often it was something that no Christian minister would dare say, but that is not what the person heard. Sure, it does give me an opportunity to share the Gospel but it also points out how bad acoustics can affect un-churched visitors. If your church is planning an outreach in the local community to seek out the un-churched, the acoustics and sound system need to be the best it can be if you want to get more people to come back for another visit. It would also worthwhile for the minister to not use any common church terminologies the secular people would be unfamiliar with. Then again, just read from the Gospel of Mark Chapter 2, 3 and 4. They will either run or repent.