

Why does my space sound so bad?

Some spaces simply sound awful. Large multi-purpose halls in schools, gyms, canteens, large corridors, even some places of worship and many bars and restaurants struggle with undesirable sound levels. This information sheet looks at why these spaces are prone to bad acoustics and a simple approach to improving them.

The first thing to note is that all the spaces listed above will, without doubt, have a number of common characteristics: parallel featureless walls, angular ceilings, multiple windows, hard surface materials and large numbers of people present at any one time. All of these elements culminate in a space where 'hubbub' surpasses comfortable levels and severely compromises users' ability to hear and understand others, even when they are in close proximity.

The perpetrator of this noise problem is reflected sound, or '**reverberation**', (caused by all the hard, straight, blank surfaces in the area), and the length of time it takes to die down i.e. '**reverberation time**'.

THE SCIENCE BIT

Reverberation...is the persistence of sound after a sound is produced¹. A reverberation, or reverb, is created when a sound or signal is reflected causing a large number of reflections to build up and then decay as the sound is absorbed by the surfaces of objects in the space – which could include furniture, people, and air.²

Reverberation time is defined as that time required for the sound in a room to decay.³

¹Michael Valente: Holly Hosford-Dunn: Ross J. Roeser(2008). *Audiology* | ²Llewelyn Southworth Lloyd (1970). *Music and Sound* | ³F. Alton Everest (1981) *The Master Handbook of Acoustics*

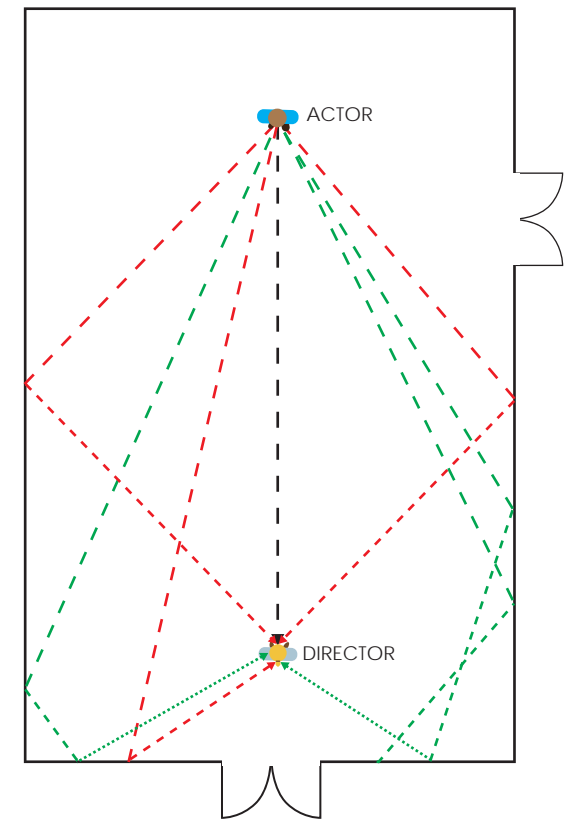
This reverberation is actually exploited in places such as cathedrals and concert halls where the reflections only serve to strengthen rousing choruses and classical music. However, in any space where clarity of verbal communication is the priority, reverberation has a hugely detrimental effect on intelligibility. It even causes its exponential degradation as speakers tend to increase their vocal effort when speaking in loud noise to enhance the audibility of their voice. This is known as the 'Lombard effect'. (Source: Lane H, Tranel B (1971). "The Lombard sign and the role of hearing in speech".




For demonstration, let us consider an actor standing at one end of a large hall, auditioning for Hamlet. The director listens at the back of the hall (see right). As well as hearing the voice directly from the actor, the director will also hear the numerous echos of the voice...and all at slightly different times depending on how many times it has bounced.


A visual representation of what the director hears could be presented thus:


~~"To be or not to be: that is the question...."~~

It should be noted that many different reflections are generated in a reverberant space, in multiple directions: however only first, second and third layers are represented for simplicity.



Primary sound waves from actor speaking




Secondary waves - reflections of primary waves


Tertiary waves - reflections of secondary waves


How can we change the acoustics of an unpleasantly reverberant space?

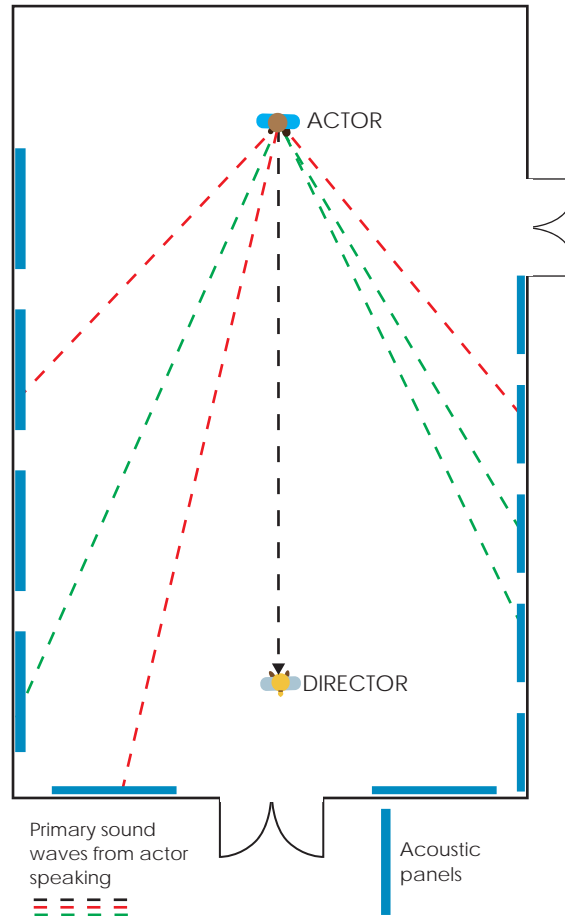
While there are a number of extremely high tech, and consequently pricey, electronic solutions that can be implemented, the simplest and most cost effective solution is the installation of acoustic panels to absorb the unwanted sound. These are simple structures manufactured from materials proven to provide a high level of sound absorption and they come in pretty much any colour a client wants. These panels are mounted (quickly and easily) at strategic points in the affected space (as shown in the illustration to the right) and the results are audible the second they have been installed.

With the introduction of the acoustic panels, the soundwaves are now being absorbed, thereby preventing the intrusive reflections. Now the visual representation of what the director hears could be presented thus:

“To be, or not to be: that is the question....”

We should clarify that is an incredibly simplified illustration of what is going on but if we were to illustrate every single reflected sound wave things would get messy and this would no longer be a ‘simple guide’. However, hopefully it underlines the ease with which problematic acoustics can be resolved.

If you further information regarding acoustics surveys and arranging panel installations, please see our data sheet - *Fixing problem acoustics in a large space.*



For more information on how Amadeus can help you with your acoustic challenges:
 Go to our acoustic solutions web page:
<http://www.amadeus-equipment.co.uk/acoustic-solutions>
 or call us for a chat on:
01424 775867

PANEL PHOTO ALBUM



Plain panels installed in school sports hall - super tough panel materials are available for activity spaces



Plain panels installed in decommissioned church, home to Royal Liverpool Philharmonic Orchestra - portable, free standing panels were also provided



Plain panels installed on ceiling of dining hall - ceilings can be a major source of unwanted reverberation



Fun printed panel for school classroom - practically anything can be printed on these panels



Plain panels installed on ceiling of club house - panels can stand out or blend in - the choice is yours

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