

3.15.1.4: Sound Reinforcement

As if the problem of sound reflection wasn't complicated enough, most auditoriums today use amplified sound in the form of microphones and speakers. If presented with two different sources (for example a singer and the amplified singing from a speaker) our ear-brain hearing system may be confused about where the sound is coming from. If the sounds arrive more than 30 milliseconds apart (the case when the speaker and singer are more than 10 m apart) we will hear an echo. If the speakers are closer to the listener than the original source the sound will appear to come from the speaker, not the singer because our ear-brain system identifies whichever signal getting to the ear first as the source. This is called the **precedence effect** and can be manipulated to fool the listener into thinking the sound comes from the singer and not the speaker. This will work, even if the direct signal is much weaker than the sound from the speakers. To arrange this, a very slight delay is often introduced in the amplification system so that the direct sound arrives just ahead of the amplified sound of the speakers. If there are speakers at different locations in the auditorium this requires careful arranging of speakers and the amount of delay as shown in the following diagram.

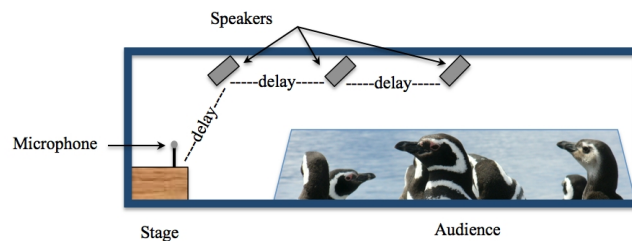


Figure 3.15.1.4.1

A common problem with amplified sound is **feedback**. Feedback occurs when sound from the speaker is fed back into the microphone (usually accidentally). The amplifier system tries to amplify the sound again (and again and again). Once the amplifier reaches its maximum capacity to amplify, the sound is distorted and an unpleasant, high pitched squeal results (although a few musicians have actually used feedback as part of their performance).

Video/audio examples:

- Wikipedia on [acoustic feedback](#).
- Jimmy Hendrix was a rock star in the 1960s who helped make the use of feedback in music popular.
- Two discussions of acoustics: [serious](#), [for the cinema](#).

A sound sample of feedback:

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