

How Does A Shotgun Microphone Work?

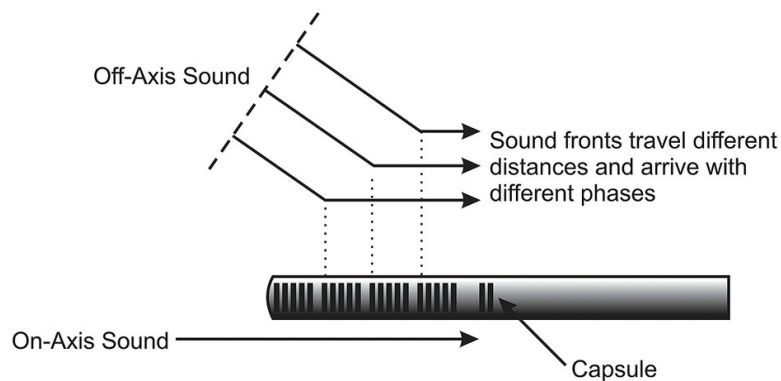
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“Shotgun” microphones are an interesting variant on the traditional microphone that places the microphone element at the end of a long tube which contains a series of slots along the length of the tube. The result is a tendency to preferentially pick up sound directly in the axis of the long tube and not from off-axis sources. These are also known as “rifle microphones”, and might be more properly called “interference tube” microphones.

How do they work?

All shotgun microphones use a standard directional microphone capsule – generally one with a tight polar pattern (supercardioid) placed at the bottom of a long, hollow tube with slots along the surface of the tube.

In essence, a shotgun microphone operates on the principle of “waveform interference”. The interference is entirely a result of the slots in the tubes and not simply having the microphone element at the bottom of the tube. Desired, on-axis sound will pass straight down the tube and be picked up by the capsule unimpeded. The slots serve as a separate entry points for off-axis sound which will enter many slots at difference locations. Since each slot is located a different distance from the microphone capsule, these off-axis sounds tend to be out of phase with each other, mix, and tend to cancel out each other. In fact, sound can either attenuate or blunt the sound coming in from the end of the tube in a process called constructive or destructive interference. On-axis sound tends to be enhanced and off-axis sound tends to be attenuated.



Shotgun microphones have limitations. By virtue of the mixing of the off-axis sound, there is lots of interaction of these sound and they become somewhat “colored” (changed). This effect is particularly prominent when the mic is moving. An additional issue is that short shotguns tend to work at higher frequencies and are not overly effective with mid and low frequency sounds. Another limitation, when used in a desktop arrangement, is that it is increasingly critical that the user stay “on axis” with the microphone. This may leave the user feeling somewhat a “prisoner” of the microphone! In general terms, longer shotgun microphones work better but are more sensitive to staying exactly on axis.

Medium length shotguns work well in most situations for voice pickup. While a short boom is less directional than medium and long booms, they still tend to be better in rejecting off-axis sounds than a standard hypercardioid microphone.



The Sennheiser MKH 416, thought by many to be the best shotgun microphone and used on many Hollywood sets.

References:

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