AUDIO FOR VIDEO, Part 2: Microphone Types

Now it is time to take a closer look at some of our audio practices and techniques. (You do have audio techniques, don't you?) There are 153 things we could talk about on this subject, but let us start by discussing the many different types of microphones and their uses.

Microphones can be classified in several different ways, and there is considerable overlap among the various classifications. For example, there are condenser and dynamic mics. There are handheld and purely stand-mounted microphones. There are directional mics and non-directional and some not so directional as others. And to make things confusing, there are dynamic directional handheld mics, and there are condenser omni-directional mics that are not intended to be handheld but stand-mounted, and there are condenser omni-directional lavlier mics, and there are handheld condensers that are directional and…wait. Let's examine all this in an orderly manner.

*TOPOLOGY* The word "topology" is often used to describe different types of circuits (tube verses solid state and so on). And while I don't recall hearing it in reference to microphones, it seems like a good word for the first division among microphones. There are two general catagories that all mics fit in: DYNAMIC and CONDENSER. In a nutshell, dynamic mics are purely electro-mechanical transducers, which means they don't require external power to work. Sound waves move the microphone's diaphram, and that mechanical movement produces a weak voltage which is the electronic signal that will ultimately end at the speaker, where it is converted back into sound waves.

There are roughly three types of dynamic mics. 1. Carbon, which is an extremely horrible old timey kind found in ancient telephones which require routine pounding of the mic in one's hand to shake up the carbon to make it go. You won't find these around the studio or anywhere for that matter. 2. Ribbon, which is another old timey type which is actually quite good and is making a dramatic comeback in studio recording. They are still relatively uncommon, and you are not likely to encounter one in video production. 3. Moving Coil, which accounts for about 96.3% of all dynamic mics. Your basic handheld mic is such a thing. They are rugged, usually relatively inexpensive, sound reasonably fine, and can often be used in a pinch to drive nails.

Now on to Condenser mics, which require power of some sort to operate because the diaphram is a capacitor in a little amplifier circuit, and no amount of screaming into the mic will produce a signal if the power has not been applied first. So you are now asking, "How does a mic get power?" Good question, but we are not there yet.

First, let's talk briefly about the different types. 1. Eletret, which looks deceptively like "electric" but is not the same word. In fact, no one knows what the word "eletret" means. Some technical jargon. Essentially, this is the cheaper type of condenser mic ranging from the tiny mics built into those cheap cassette recorders of the past where we all became aquainted with the term "condenser mic" as they always wrote it on there, to some very nice studio-quality mics. Eletret mics are capable of operating from a wide voltage range, and therefore most battery-powered mics are this type. (There is one answer to the above question.) 2. True Condenser, for lack of a better term, is the other type of condenser and also the original. Now, again, there is a circuit inside a condenser mic, and these come in two forms: solid-state and tube. Yes, tube condenser

mics were the first, but you might fall out of your chair to learn that tube mics are a hot item even today. They are, however, typically limited to the studio, because they tend to be expensive and big and require large external power supplies delivering typically several hundred volts.

Condenser mics are known for their low noise, good transient response (how fast the mic responds to changes in the sound), and wide, flat frequency response. In other words, condenser mics are generally considered the most accurate type of microphone. And they come in a wide arrray of styles too. Almost all modern lavalier (or lapel) mics are condenser, as are headworn mics which can be extremely miniature. Shotgun mics that we use a lot in video production are condensers. Some handheld mics designed for live performance are condensers too, although they look just like a typical dynamic (moving coil) handheld mic. We've already mentioned the big studio mics, tube or solid-state, which are about the size of a really short baseball bat and slightly heavier. There are also plain, straight, unimaginatively shaped mics used for recording instruments which are almost exclusively condensers. The very straight types you see hanging over choirs in churches are this type, as are the little bitty ones you see hanging over choirs. And speaking of church, the tiny gooseneck mics you see on pulpits and lecterns these days are condensers.

Back to powering a condenser mic. Those made for use in the field often have the capability to be powered by a single AA battery. The shotguns and lapel mics at PEGASYS are made this way. However, most condenser mics utilize what is known very cryptically as phantom power. Ooooh. Phantom power actually comes from the mic preamp that the mic plugs into (the mixer or in some cases a camcorder). The common voltage is 48 volts DC, and (here is the really scary part) it travels from the preamp to the mic down the same two wires that the signal travels from the mic to the preamp. At the same time! It's absolutely ridiculous the ideas these engineers come up with. If using a phantom powered mic, be sure and check the phantom power switch on the preamp. On our Mackie mixers, it is a skinny switch on the back panel. As said before, most tube condenser mics require such a high voltage that they have their own outboard power supplies and bulky cables with these gigantic connectors that look like the ones on our studio cameras.

*PATTERN* We finally leave the topology issue and talk about something a little easier to grasp, if not easier to see. Every mic has a pickup pattern which describes loosely how directional the mic is. There are a handful of common patterns, and they are as follows:

OMNI Omnidirectional means that the mic picks up sound from pretty much all around it. However, most omnis are less sensitive to high frequencies in the back than in the front. In fact, a common fact is that high frequencies are more directional in general than low frequencies. An omni is basically a diaphram stuck on the end of a mic without any special attention applied to its directional characteristics. So if you, as an amature microphone engineer, were to build your own mic from scratch, chances are it would be omnidirectional. That's OK, though, because there are some good uses for omnis. They are not generally used in live, public address systems, because they feed back more readily than directional mics. But they excell in some other areas. Typically, lavalier mics used for TV are omni. This means that if the mic flops over and points at the person's belt buckle, it will still pick up the person's voice with minimal expense to

sound quality. Omnis are also commonly used in handheld interview situations. At first, this may seem funny, because omni mics are the worst at keeping out background noise. But some background noise is desirable in a typical on-camera interview (think of a news reporter interviewing the fire chief), because we want to hear the authentic sounds of the event. Also, omnis have lower handling noise than directional mics typically do, they are less sensitive to wind noise and P pops, they have almost no proximity effect, which is good when the distance between the mic and the voice is constantly changing. (We'll explain proximity effect in the next section.) And finally, when the mic is constantly being moved between two or more people, omni is the most forgiving pattern if the mic isn't pointed right at the person doing the talking.

CARDIOID The word cardioid comes from cardio and is because the cardioid pattern is roughly heart-shaped. This is the basic directional mic, and most mics in the world are this pattern. The heart shape is really more like a kidney bean, and if you point the mic straight down and look at it from its side, imagine a giant kidney bean, or a very unpoiny heart if you prefer, with the mic right in the place where the two top lobes come down in the middle. This if very hard to explain without pictures. Basically, a cardioid mic is pretty dead to the world right behind, but as you get around the sides, it begins to pick up sound better and better until you are in front of it, where the sound is the best. Again, it is the high frequencies that roll off fastest as you move off axis.

Directional mics have proximity effect, which means the closer the mic gets to the sound source, the more bass response you get. DJs love this, because when they get right on the mic ("eat the mic" is the standard industry term), they get lots of bass in their voices (sometimes to the detriment of society).

What causes a microphone to be directional is one of two things. The first is some sort of porting on the sides of the mic, which cause sounds coming in from the rear to be cancelled out due to being out of phase. It is kind of technical in theory, but simple in practice. The second manner of making a mic directional is to have a second diaphram which, when manipulated electronically, causes the phase cancellation and thus directionality. Some of the more expensive studio mics have multiple patterns that can be selected by a switch on account of this method.

SUPER & HYPER-CARDIOID These two directional mics are successively more directional than plain cardioid, although some manufacturers call these more-directional-than-cardioid patterns different names. The hypercardioid pattern is narrower than cardioid, meaning there is less pickup on the sides and rear corners, but there is actually a lobe at the very back of the mic which picks up sound fairly well.

SHOTGUN The shotgun, as you may know, is a very long mic. If you pull the windscreens off the ones we have at PEGASYS, you will see about 25,000 vent slots all down the side of it. The diaphram is actually mounted at the back of all these, just a few inches in front of the connector. The long part with the slots is called an interferrence tube, and it is exagerated to the point of giving the mic a very narrow pattern. This allows it to be used farther from the sound source than a typical directional mic. Being more directional means that less of the background noise or room reflections get picked up. Because they are always used at some distance, shotgun mics are practically always condensers, which are more sensitive and have lower noise than dynamics.

FIGURE-EIGHT By nature of their diaphram construction, most ribbon mics have a figure-eight pattern, which means that the front and back pick up equally, and the

sides exhibit high rejection. Most ribbons are also side-address too, which means that the sound comes into the side of the microphone rather than the end, making it easy to address either side of the figure-eight pattern. There are also many condenser mics that are figure eight, although it is usually found as one of several patterns selectable on a multi-pattern mic. Figure eight tends to have more musical uses than otherwise, and so they are typically only found in music recording studios.

And speaking of side-address verses end-fire diaphram arrangement, that is yet another sort of mic classification. Many condensers use the side-address arrangement to more easily accommodate a large diaphram (1" or so), whereas the end-fire mics typically have smaller diaphrams. The diaphram size makes a subtle difference in the quality of the sound, and therefore can be a factor in choosing a mic. Large diaphram mics can often handle greater SPL (sound pressure level), and are therefore popular choices for certain instruments in certain genres of music (Led Zepplin). However, sometimes truly thunderous noises can be obtained with tiny microphones.

So you see how there are many ways to classify mics, and it verges on insanity. Although we did not go into a great deal of how-to information here, hopefully you picked up a few nuggets of knowlege that will help you understand and choose the best microphone. As always, if you have any questions on the subject, see A.J. or myself. If you have any complaints, see Penn.

Dane Tate
Evening Production Coordinator