

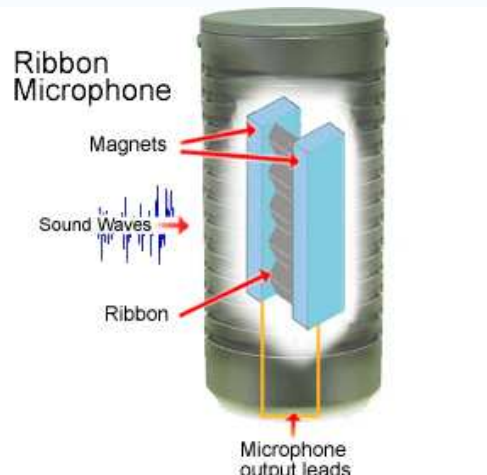
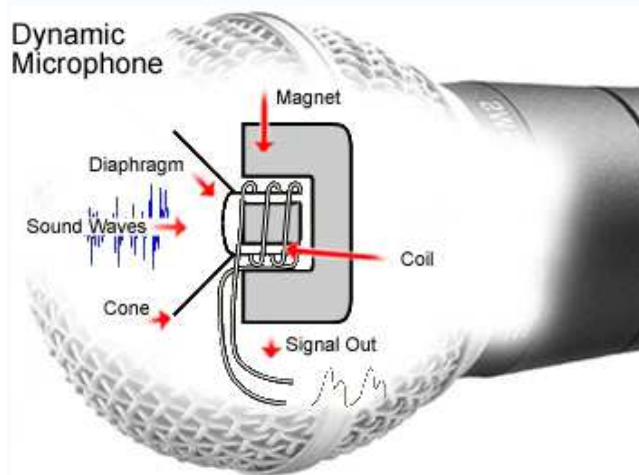
## Recording Techniques

### Microphones

In recording, the choice and usage of microphones are important. Mic choice and placement also affect how distant the instrument sounds in the recording, and how much background noise you pick up. We will take a look various types of microphone and their directional response and what they may be suitable for.

### **Dynamic Microphone**

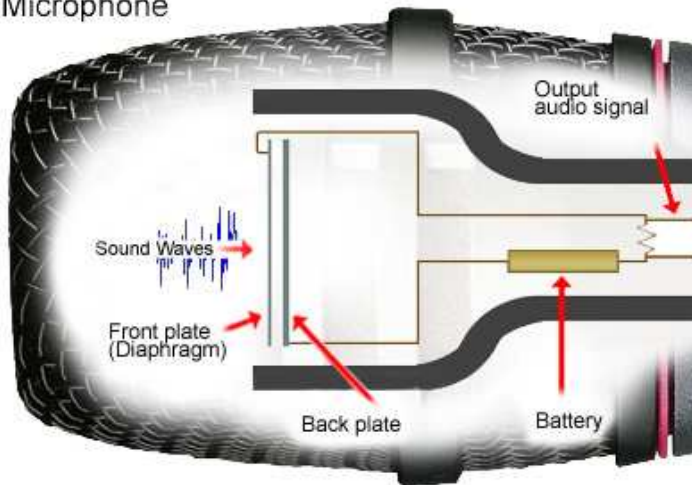
Microphones capture sound waves and translate them into electrical signals. Dynamic microphones functions through electromagnetic induction. They are known to be sturdy, relatively inexpensive and resistant to moisture, and generally ideal for close miking. There are two basic types: the moving coil microphone and the ribbon microphone. In a moving coil mic, a small movable 'voice coil' is attached to the diaphragm. When the diaphragm vibrates, the coil moves in the magnetic field to produce an electrical current. In ribbon microphones a thin, usually corrugated metal ribbon is suspended in a magnetic field, electrically connected to the microphone's output, and its vibration within the magnetic field generates the electrical signal. The Shure SM57 is an example of an inexpensive dynamic microphone in most studios.



### **Condenser Microphones**

In a condenser microphone, the diaphragm acts as one plate of a capacitor, and the vibrations produce changes in the distance between the plates when voltage is applied. Phantom power provides the voltage necessary to drive a condenser mic. Condenser mics tend to be more fragile and expensive than moving coil mics, but provide better transient response and can be suitable for both close and far-miking applications.

## Condenser Microphone



Dynamic Mics	Condenser Mics
Need no external power. Durable. Handle high volumes well.	Require Phantom Power Fragile. Louder output.
Common Examples: Shure SM-58, SM-57, SM-7 Electrovoice RE-50, RE-20, 635A Sennheiser 421	Common Examples: AKG 414, C-3000, C-1000 Neumann U-87, KM-series modular Sennheiser K6-series modular

Directional Mics	Omnidirectional Mics
Heightened focus on centered subject. More rejection of ambience. Needs precise mic placement, off-axis sources often sound bad. More susceptible to handling noise, wind and plosives.	Natural, "you are there" sound. Picks up more of surrounding ambience. More forgiving on mic placement, off-axis sounds are more natural. Less susceptible to handling noise, wind and plosives.
Common Examples: Shure SM-58, AKG C-1000, Sennheiser ME64 capsule, shotgun mics	Common Examples: Electrovoice RE-50, 635A, Sennheiser ME62 capsule, most Lavalieres

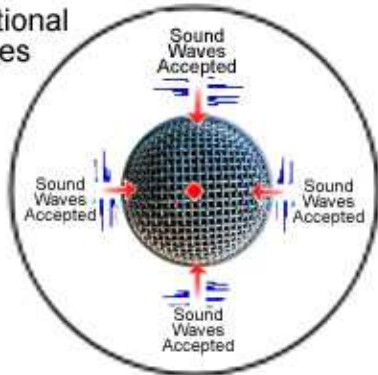
### **Polar Patterns/Directional Response:**

Microphones respond to sound sources in different ways. A microphone's directionality or polar pattern indicates how sensitive it is to sounds arriving at different angles about its central axis.

## Omnidirectional

An omnidirectional mic is equally sensitive to sounds emanating from all directions.

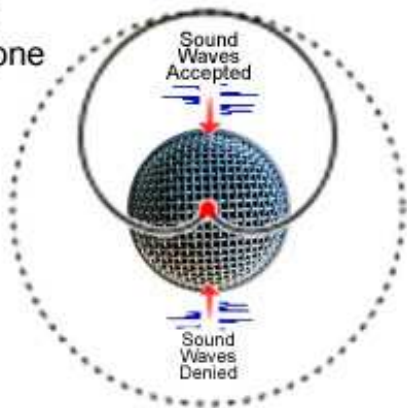
### Omnidirectional Microphones



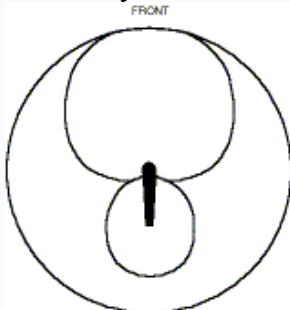
## Cardioid

A unidirectional microphone is sensitive to sounds from only one direction. The most common directional microphone is a cardioid microphone, so named because the sensitivity pattern is heart-shaped. It is more sensitive to sounds coming from the front of the mic.

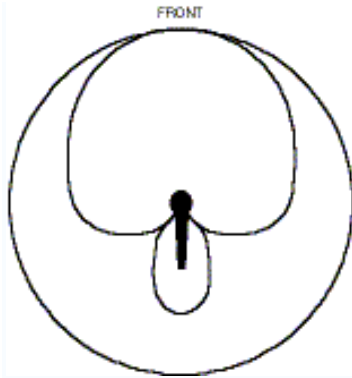
### Cardioid Microphone



A hyper-cardioid is similar, but with a tighter area of front sensitivity and a tiny lobe of rear sensitivity.



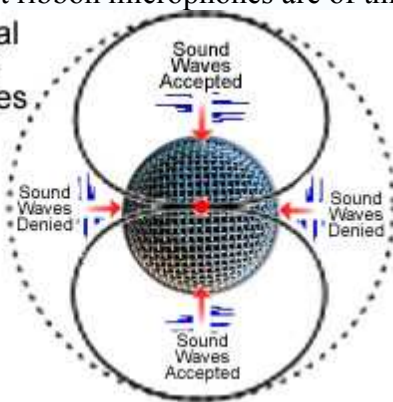
A super-cardioid microphone is similar to a hyper-cardioid, except there is more front pickup and less rear pickup.



### Bi-directional

‘Figure 8’, or bi-directional, microphones receive sound from both the front and back of the element. Most ribbon microphones are of this pattern.

#### **Bidirectional or Figure 8 Microphones**



### Common Microphone Placement Techniques

Use of a single microphone is pretty straightforward. Having chosen one with appropriate sensitivity and pattern, you simply mount it where the sounds are. The practical range of distance between the instrument and the microphone is determined by the point where the sound overloads the microphone or console at the near end, and the point where ambient noise becomes objectionable at the far end. Between those extremes it is largely a matter of taste and experimentation.

### **Stereo**

Stereo miking can give us an illusion of spaciousness produced by playing a recording back through two speakers. The success of this illusion is referred to as the image. A good image is one in which each instrument is a natural size, has a distinct location within the sound space, and does not move around. The main factors that establish the image are the relative loudness of an instrument's sound in each speaker, and the timing of arrival of the sounds at the listener's ear. In

a studio recording, this image is often produced artificially. Each instrument has its own microphone, and the various signals are balanced in the console as the producer desires.

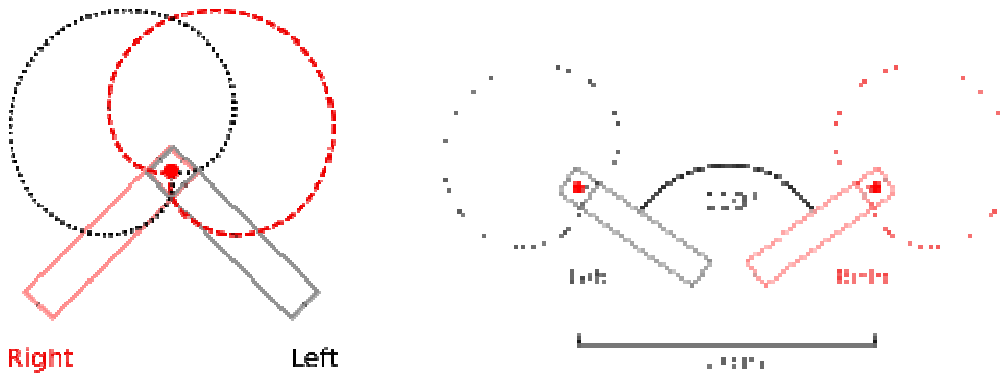
### Spaced microphones

The simplest approach is to assume that the speakers will be eight to ten feet apart, and place two microphones eight to ten feet apart to match. Either omnis or cardioids will work. When played back, the results will be satisfactory with most speaker arrangements. The big disadvantage of this technique is that the mics must be rather far back for an ensemble - at least as far as the distance from the leftmost performer to the rightmost. Otherwise, those instruments closest to the microphones will be too prominent. There is usually not enough room between stage and audience to achieve this with a large ensemble, unless you can suspend the mics or have two very tall stands. Furthermore, because there is a large distance between the mics, it is quite possible that sound from a particular instrument would reach each mic at slightly different times. This effect creates phase differences between the two channels, which results in severe frequency response problems when the signals are combined which results in an uneven sound.

### Coincident cardioids

This is most often done with two cardioid microphones, one pointing slightly left, one slightly right. The microphones are often pointing toward each other, as placing the diaphragms within a couple of inches of each other and thus eliminating phase problems. No matter how they are mounted, the microphone that points to the left provides the left channel. The stereo effect comes from the fact that the instruments on the right side are on-axis for the right channel microphone and somewhat off-axis (and therefore reduced in level) for the other one. The angle between the microphones is critical depends on the actual pickup pattern of the microphone. If the mics are too parallel, there will be little stereo effect. If the angle is too wide, instruments in the middle of the stage will sound weak, producing a hole in the middle of the image.

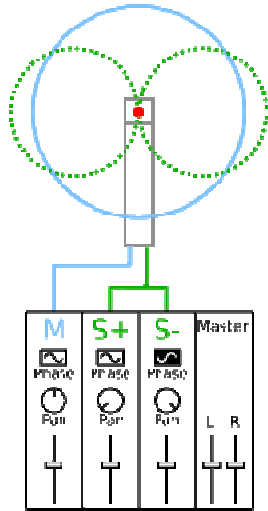
You may place the microphones fairly close to the instruments when you use this technique. The problem of balance between near and far instruments in an ensemble is solved by aiming the mics toward the back row of the ensemble; the front instruments are therefore off axis and record at a lower level. You will notice that the height of the microphones becomes a critical adjustment.



### Middle-Side Technique

This is usually done with a stereo microphone in which one element is omnidirectional, and the other bidirectional. The bidirectional element is oriented with the axis running parallel to the stage, rejecting sound from the center. The omni element picks up everything. If the instrument is on the left half of the stage, a sound would first move the diaphragm of the bidirectional mic to the right, causing a positive voltage at the output. If the instrument is moved to center stage, the microphone will not produce any signal at all. If the instrument is moved to the right side, the sound would first move the diaphragm to the left, producing a negative voltage. You can then say that instruments on one side of the stage are 180 degrees out of phase with those on the other side, and the closer they are to the center, the weaker the signal produced.

The signals from the two microphones are not merely kept in two channels and played back over individual speakers. The signals are combined in a circuit that has two outputs; for the left channel output, the bidirectional output is added to the omni signal. For the right channel output, the bidirectional output is subtracted from the omni signal. This gives stereo, because an instrument on the right produces a negative signal in the bidirectional mic, which when added to the omni signal, tends to remove that instrument, but when subtracted, increases the strength of the instrument. An instrument on the left suffers the opposite fate, but instruments in the center are not affected, because their sound does not turn up in the bidirectional signal at all.



<a href="#">Electrovoice 635N/D (pdf file)</a>	Dynamic, Omni, Small diaphragm	All-around workhorse reporter's mic. Cheap. Can hammer nails with it. (80hz-13khz)
<a href="#">Electrovoice RE-50 (pdf file)</a>	Dynamic, Omni, Small diaphragm	Same microphone as the 635A, but with better pop filtering and isolation from handling noise. (80hz-13khz)
<a href="#">Beyer M-58 (pdf file)</a>	Dynamic, Omni, Small diaphragm	Better frequency response than above mics (40hz-20khz), hotter output. Long handle.
<a href="#">AKG D230</a>	Dynamic, Omni, Small diaphragm	Similar to RE-50, but with much wider frequency response (40hz-20khz)
<a href="#">Shure SM-58</a>	Dynamic, Cardioid, Small diaphragm	The most popular all-purpose vocal mic in the world. Very rugged, good sound. Cheap. (about \$100)
<a href="#">AKG C-1000</a>	Condenser, Cardioid, Small diaphragm	Good frequency response (50hz-20khz,) uses standard 9 volt battery for power.
<a href="#">Sennheiser K6/ME66</a>	Condenser, Short shotgun, Small diaphragm	Modular, can fit different capsule on K6 power supply. Very tight pattern, good for recording from medium distance. (50hz-20khz)
<a href="#">Sennheiser K6/ME64</a>	Condenser, Cardioid, Small diaphragm	Modular, can fit different capsule on K6 power supply. (50hz-20khz)
<a href="#">Sennheiser K6/ME62</a>	Condenser, Omni, Small diaphragm	Modular, can fit different capsule on K6 power supply. (20hz-20khz)

Neumann 180 series	Condenser, Small diaphragm	Omni, cardioid and hypercardioid mics. Very small. (20hz-20khz)
AKG C-414	Condenser, Variable Pattern, Large Diaphragm	Classic, versatile large-diaphragm condenser, suited for studio announce.
AKG C-3000	Condenser, Cardioid, Large Diaphragm	Affordable large-diaphragm condenser, with sound similar to AKG 414.
Neumann U87	Condenser, Variable Pattern, Large Diaphragm	THE big, warm announce mic. Large-diaphragm condenser with superb sound. Pricey.
Neumann TLM 103	Condenser, Cardioid only, Large Diaphragm	Affordable Large-diaphragm condenser with Neumann sound. (About \$700)
Electrovoice RE-20 (pdf file)	Dynamic, Cardioid, Large Diaphragm	Perhaps the most common on-air announce mic. Warm, flat sound. Good pop-rejection. (45hz-18khz)
Sennheiser 421	Dynamic, Cardioid, Large Diaphragm	Versatile mic effective on everything from voice to drums. (30hz-17khz)
Rode NT1	Condenser, Cardioid, Large Diaphragm	Very inexpensive large-diaphragm condenser (about \$200) Good sound quality, similar to Sennheiser 421, but louder. (20hz-20khz)
Oktava 319	Condenser, Cardioid, Large Diaphragm	Another very inexpensive large-diaphragm condenser mic (about \$200 in some stores and catalogs) rounder, warmer sound than AKG or Rode.

### **Recording Live Instruments**

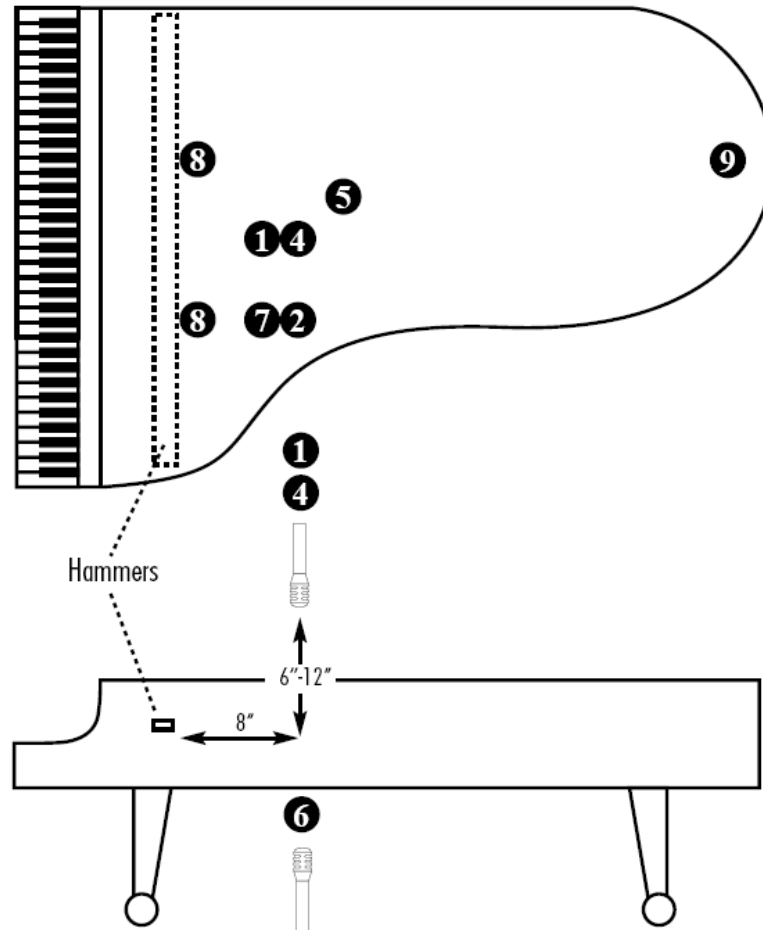
There is a wide range of techniques that can be applied in live recording depending on the kind of instrument you wish to record. Certain instruments can be connected to your audio interface or mixing console through a direct box, and recorded via direct input. Most instruments can be recorded using microphones connected through the audio interface. There can also be multiple ways of recording one type of instrument. We will look at some of these techniques for some of the more common instruments we see.

#### **Grand Piano**

- Pianos are usually recorded with two mics for the stereo sound effect. Raise the lid and place a condenser mic approximately 8 inches over the treble strings and 8 inches horizontally from the hammers. Place another flat condenser mic 8 inches over the bass strings, about 2 feet horizontally from the hammers.

- Alternatively, you may tape 2 mini condenser mics to the underside of the lid, one over the bass strings and one over the treble strings. You may also close the lid for more isolation if you want.
- For scenarios like a classical-music solo performance, you may set a pair of mics about 7 to 9 feet away and 7 to 9 feet high. To hear more room reverb, you may want to place a distant mic pair in the audience area.

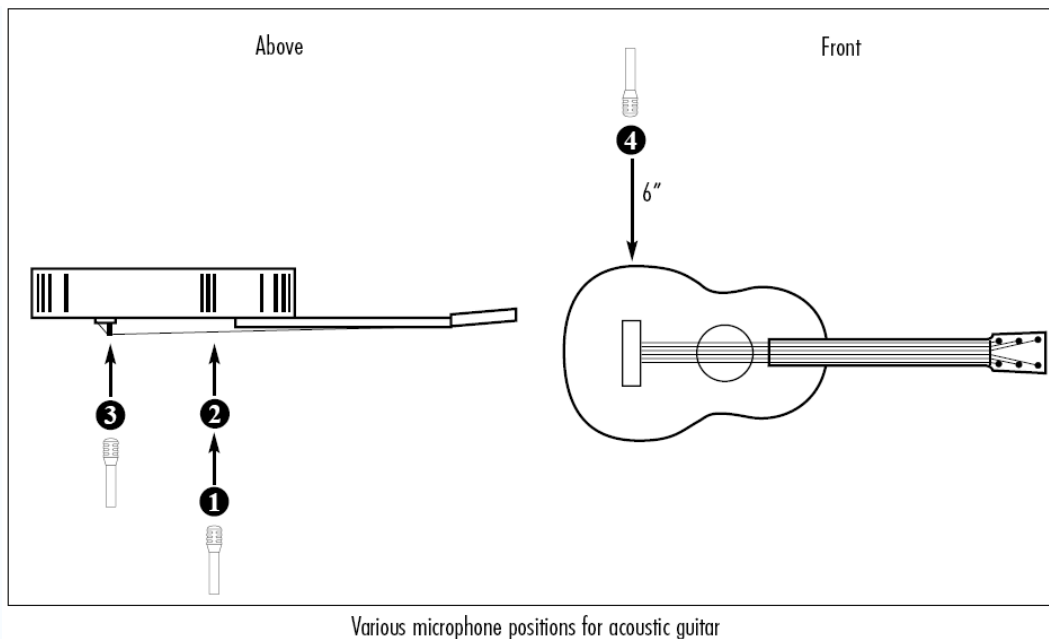
## Acoustic Pianos



## Acoustic Guitar

- The simplest way to mike an acoustic guitar is to place a condenser mic anywhere between 6 to 12 inches from where the fingerboard joins the body. For stereo, add another mic the same distance from the bridge. For more isolation, mike 3 inches from the end of the fingerboard.
- Alternatively, you may attach a mini omnidirectional mic to the guitar soundboard, halfway between the bridge and the sound hole, 1/2" from the low E string, not under the strings.

- You may also plug the guitar to an amplifier, and place a cardioid dynamic mic about 1 inch from the amp's speaker cone. For the brightest tone, place the mic near the center of the speaker cone. For a mellower tone, place the mic near the edge of the speaker cone.
- The amplifier may also be directly connected to your mixer console without using microphones.



### Electric Guitar

- Plug the guitar into a direct box, then plug the direct-box output into a mixer mic input. You can then record directly through direct input.
- Similar to the acoustic guitar, you may connect an electric guitar to an amplifier and mike up the amplifier as explained above, or directly connect your amplifier to the mixer control.

### Vocals

- Place a mic approximately 8 inches away from singer's mouth. You may want to mount a hoop-type filter to remove breath pops.
- Alternatively, you may raise the mouth to eye level to avoid breath pops.

## Others

- **Brass:** The majority of the sound comes from and projects in the direction of the instrument's bell. Place a mic about 1 to 3 feet out front. Mike on-axis to the bell for a bright, edgy tone; mike off-axis to the bell for a mellower tone.
- **Woodwind:** The majority of the sound comes from the instrument's 'tone hole'. Place a condenser halfway between the mouthpiece and the tone hole of the instrument, between 6 to 12 inches away.
- **Violin/viola:** Place a condenser about 1-2 feet over the top of the instrument, above one of the f-holes. You may also place a stereo mic about 12 to 20 feet away for the room reverb.
- **Drum set:** For common acoustic drum sets, you can mike up each individual drum or cymbal in the set with multiple different techniques. For a basic, simplified setup for miking a drum set, you can mike the drum set with a pair of condensers overhead, and another mic in (or in front of) the kick drum, and one more near/over the snare drum.