

Live Sound for Small to Medium Size Venues

Video 3 – Sound Capture – Microphones and Direct Boxes

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Recap

- In the first video in this series, we reviewed background and general information and established that speakers and microphones are the most critical components when it come to determining the “sound” of a sound system.
- In the second video we reviewed speaker systems and how to select and set up speaker systems.
- In this video we will review microphones and direct boxes, how to select them and how to use them.



Capture Philosophy

- Each channel feeding into a mix board should have one and only one sound element on that channel, one instrument or one vocalist.
- Single elements per channel maximizes control for the sound person and maximizes ease of mixing.



Single Mic Pick Up

- Single microphone pickup is sometime referred to as a “Blue Grass Configuration”.
- A single large diaphragm condenser microphone is used to capture all the vocals and instruments.
- It is very difficult to achieve an ideal balance and maintain it for an entire performance.
- Having a sound person out in the audience adjusting the balance based on what they hear will result in a more accurate and consistent sound balance.
- If you don’t have a sound person a single microphone pickup is an option, but you need to practice it to do it well.



Sound Capture Fundamentals

- Ideally each channel only captures one thing – one vocalist or one instrument, this gives the sound person the most control.
- Use microphones where you must or where a direct box will not do a good job capturing the sound.
 - Vocals
 - Drums
 - Electric guitars – mic the cabinet
 - Brass instruments
- Use direct boxes where you can because they provide isolation.
 - Acoustic guitars, mandolins, banjos, fiddles with pickups
 - Bass guitar
 - Keyboards

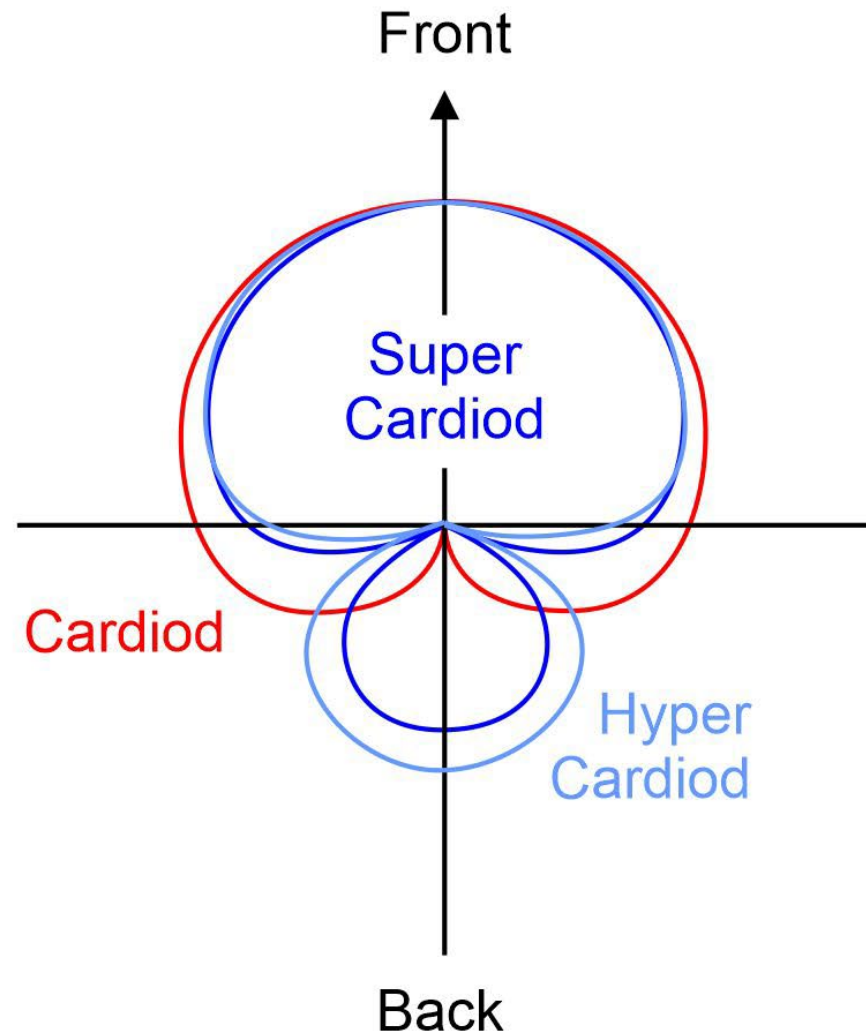
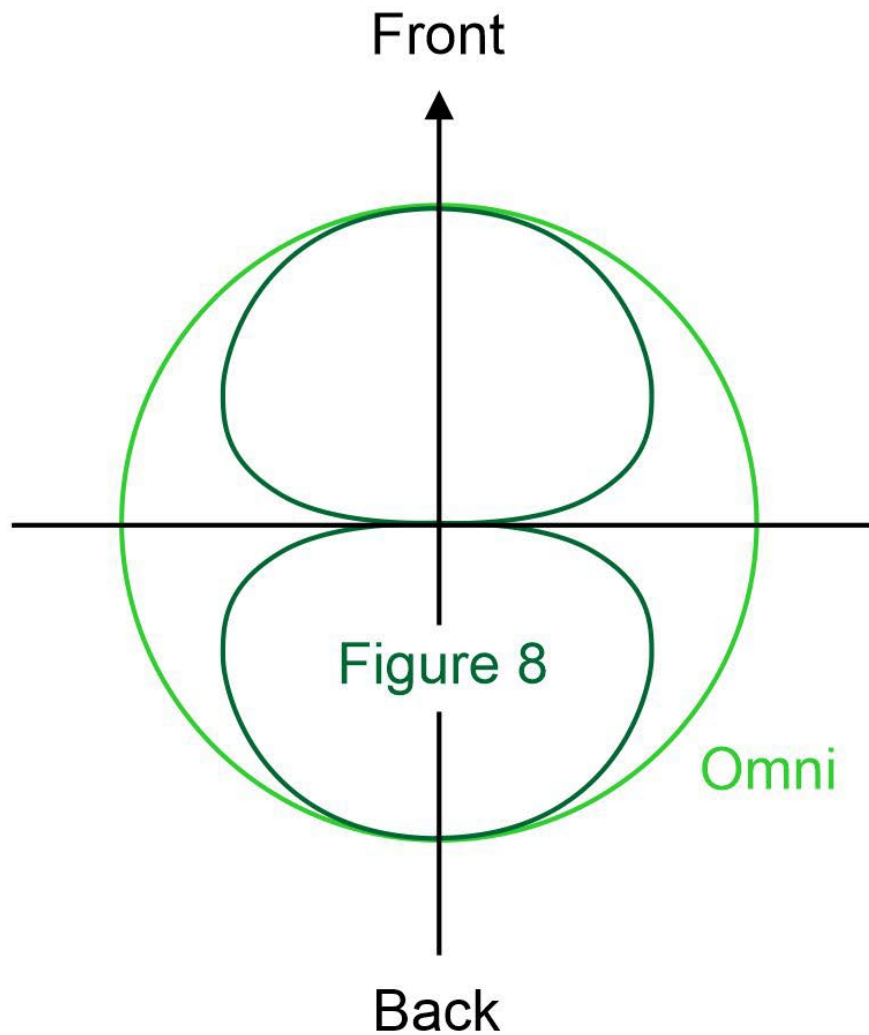


Ideal Microphone

- Tight pickup pattern.
- Short reach unless you need to pick up something at a distance.
- Pick up the frequency range needed for the voice or instrument you are capturing and rejects frequencies outside that range.
- Able to handle the volume produced by the voice or instrument being captured.

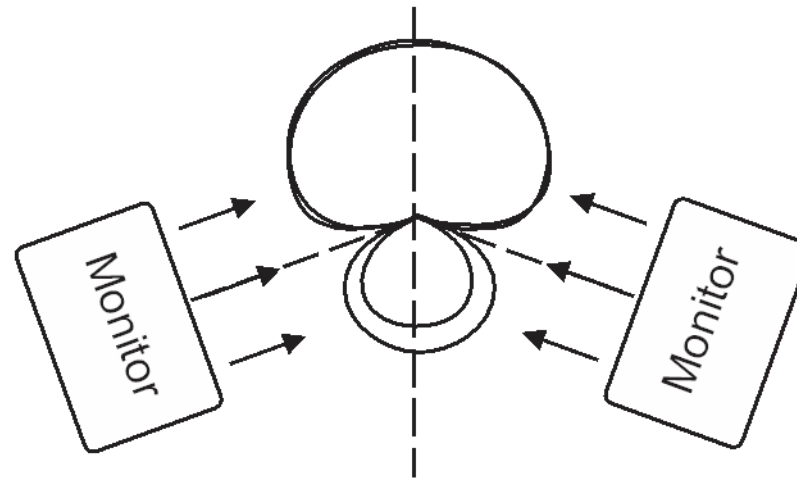


Microphone patterns

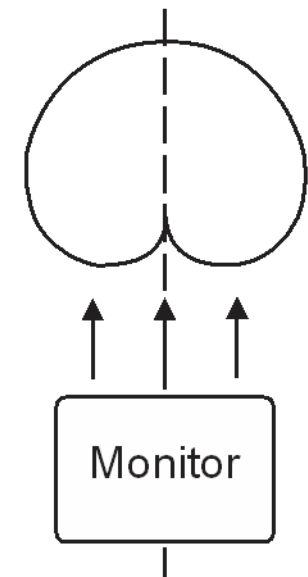


Monitor Placement

- Point the monitor speaker towards the microphone dead spot to minimize the chance of feedback.



Super and Hyper Cardioid Microphone
Monitor Placement



Cardioid Microphone
Monitor Placement



Three Main Microphone Types

- Dynamic – most common on stage.
- Condenser – less common on stage, more common in the studio.
- Ribbon – rarely seen.



Dynamic Microphones 1

- A dynamic microphone has a diaphragm attached to a coil suspended in a magnetic field, the motion of the coil in the magnetic field creates an electric current that gets amplified; think of it like a speaker working in reverse.
- Dynamic microphones are generally more rugged than their condenser counterparts.
- Because of the mass of the moving coil, dynamic microphones tend to have poor transient response and on average are less sensitive than condenser microphones.
- Dynamic microphones typically have limited high frequency response. The ability of a microphone to handle high frequency information is in large part determined by how heavy its moving parts are. Since both the diaphragm and voice coil are moving, a dynamic microphone is quite heavy compared to other microphone types, for this reason, they tend to fall off above 10kHz.



Dynamic Microphones 2

- Dynamic microphones typically have a natural resonance in the 1kHz to 4kHz range, the range that determines voice intelligibility. This means that vocalists tend to like dynamic microphones, especially in live situations.
- Dynamic microphones can handle much higher sound pressure levels than ribbon or condenser mics.



Condenser Microphones

- Condenser microphones use a thin plastic film coated with gold or nickel, giving them very little mass – making them more sensitive.
- Condenser microphones require a battery or phantom power to work, generally supplied by the preamp through one of the legs of the XLR cable.
- This sensitivity is a good thing when using them to capture the nuances of a soft vocal or acoustic guitar performance but can make them more prone to breakage if dropped or by putting a sensitive condenser mic inside a kick drum where the sound pressure levels can easily break the capsule. The size of the capsule (generally ranging from 3/8” to 1”) also has an effect on the characteristics and expense of the microphone.
- Condenser microphones generally have longer “reach” than dynamic microphones.
- Condenser microphones generally have wider and flatter frequency response than dynamic microphones.



Ribbon Mics

- A ribbon mic is a dynamic mic that uses a thin metal ribbon clamped between two magnetic poles instead of a moving coil, so it responds to the moving air's velocity rather than its pressure.
- Because it rejects signals from the sides ribbon mics form a figure 8 pattern.
- Ribbon mics have been known to provide a smoother, more detailed recording than moving coil dynamic mics but are less commonly used due to their more fragile nature.



How to Sing into a Microphone

- Project into the microphone. If you sing very softly the sound person can turn up the volume within reason but you generally won't sound as good, don't strain but project into the microphone.
- Work the microphone position to control volume, moving away or off to the side makes you softer, getting in close makes you louder.
- Some microphones have proximity effects, getting closer adds more bass to your voice.



Vocal Mics – Shure SM58/Beta 58

- SM58 is one of the classic vocals mics and has been very widely used. The Beta 58 is the modern update.
- Dynamic mics, rugged.
- The SM58 is Cardioid, Beta 58 is Super Cardioid.
- Big presence peak, cuts through the mix, can sound harsh on some voices especially if someone is loud and up close on the mic.
- Proximity effect.
- Beta 58 is reasonably priced at ~\$170.
- If they sound good with your voice, great, but not my first choice for general use.



Instrument Mics – SM57/Beta 57

- SM57 is a classic instrument mic and is the go-to mic for electric guitar and snare.
- Dynamic mics, rugged.
- The SM57 is Cardioid, Beta 57 is Super Cardioid.
- Some people use these for vocals. On women who “eat the mic” they get very “tubby” sounding.
- I love the SM57 for snare and electric guitar but avoid it for vocals



Vocal Mics – Shure Beta 87a

- Condenser mic, rugged enough for stage use.
- Super Cardioid, feedback resistant.
- Gradual presence peak rise to cut through the mix.
- Minimal proximity effect.
- High quality general use vocal mic.
- Higher priced mic at ~\$260.



Vocal Mics – Audix OM5

- Dynamic mic, rugged.
- Hyper Cardioid.
- Some presence peak to cut through the mix.
- Reasonably priced at ~\$170.
- My experience is they work well on male or female vocals under all conditions.
- This is my go to vocal microphone.



Vocal Mics – Sennheiser e945

- Dynamic mic, rugged.
- Super Cardioid.
- Very smooth response and excellent sound.
- More expensive ~\$200.
- This is a favorite for me, the higher price makes me reluctant to buy a lot of them.



Micing a Drum Kit

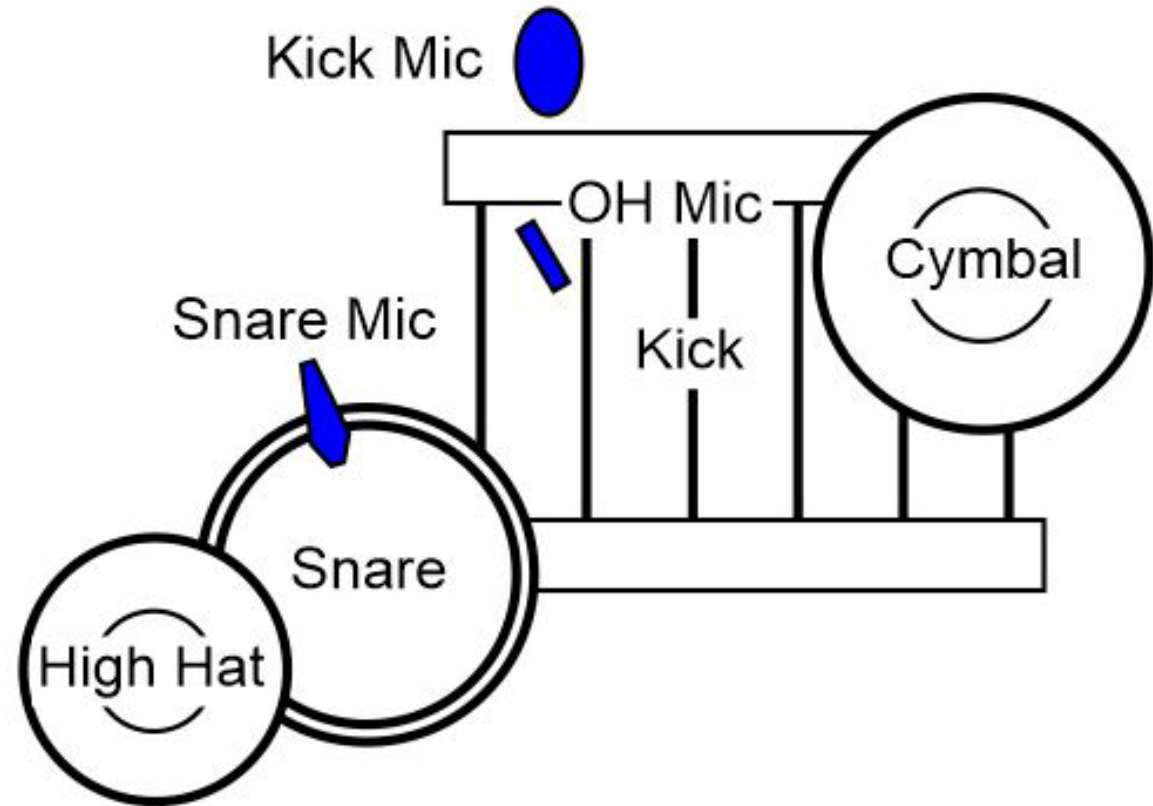
- Some examples of good drum microphones.
- Dampening to prevent ringing.

Drum	Mic	Type	Comment
Floor Tom	Sennheiser MD421	Dynamic	Large diaphragm dynamic mic to pick up the lows, can use an SM57 as well
High Hat	AKG Perception 170	Condenser	Inexpensive condenser mic to with broad frequency response
Kick	AKG D112	Dynamic	Designed for kick drum, low frequency focused
Overhead	AKG Perception 170	Condenser	Inexpensive condenser mic to with broad frequency response
Snare	Shure SM57	Dynamic	Classic snare drum mic
Toms	Shure SM57	Dynamic	Can handle smaller toms



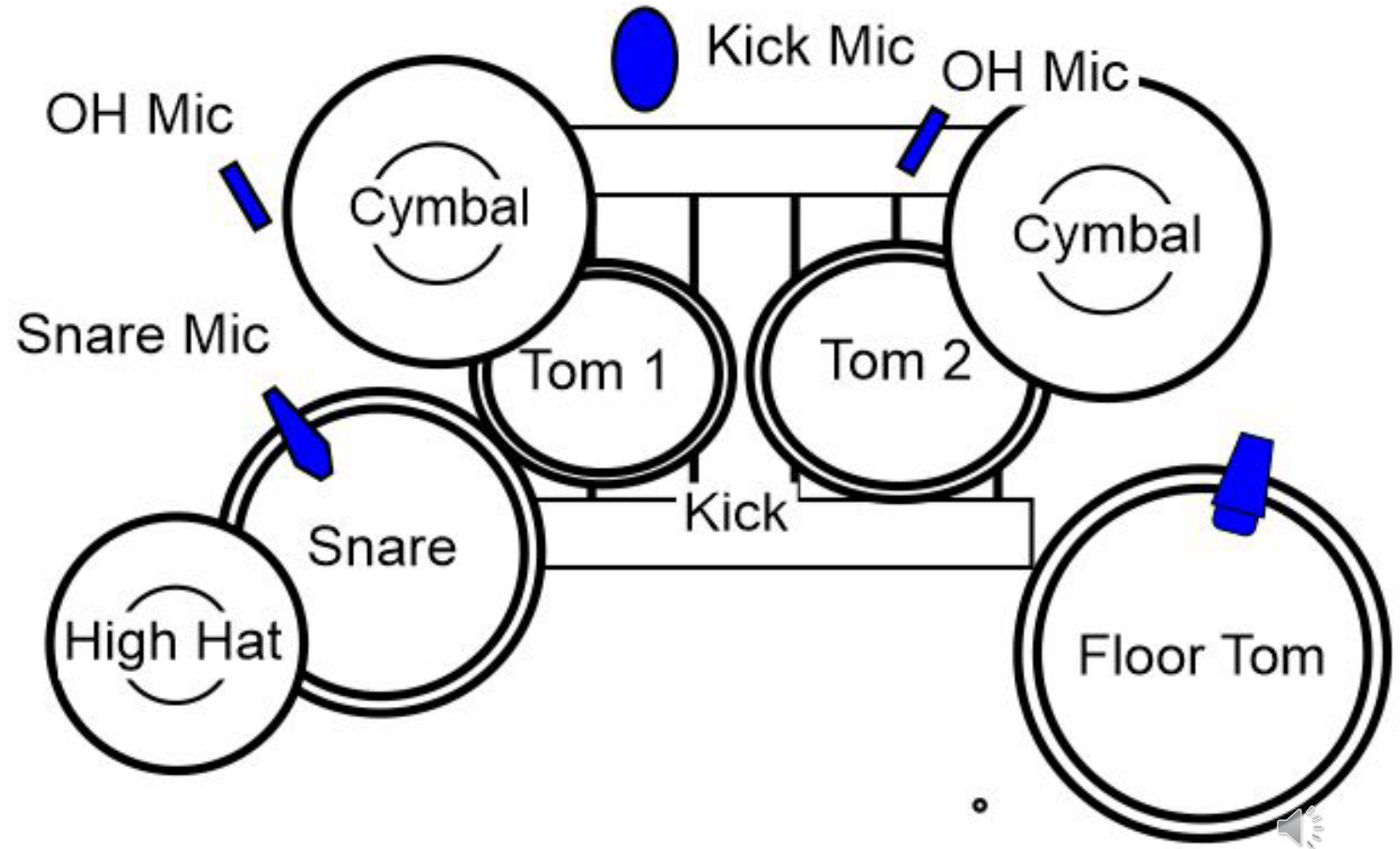
Small Drum Set – 3-mics

- Snare drum – high hat will bleed in
- Kick drum
- 1 Overhead – mainly for the cymbal, can also pick up some high hat depending on where it is positioned



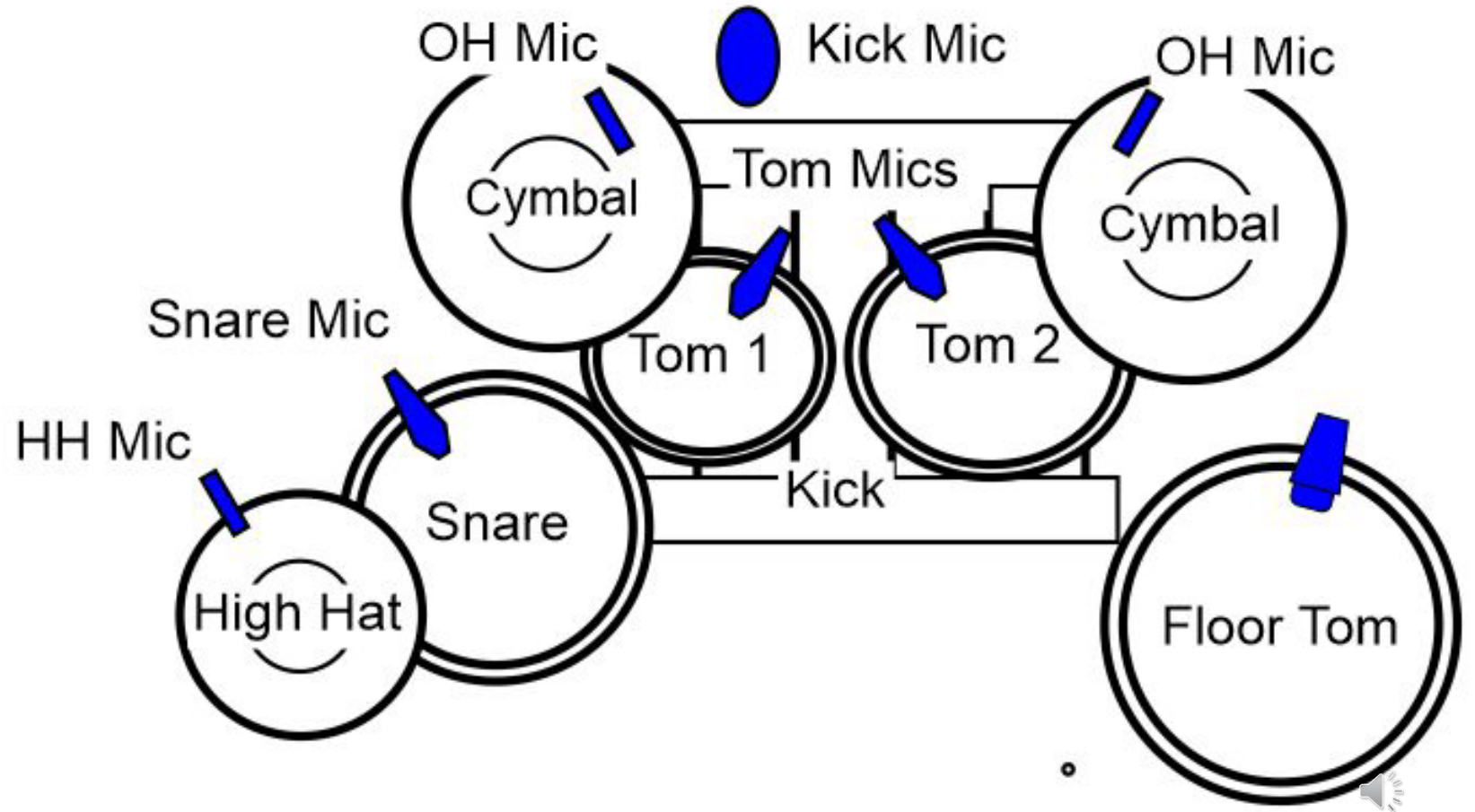
Large Drum Set – 5-mics

- Snare mic
- Overhead mic positioned to pick up one cymbal and the high hat
- Overhead mic positioned to pick up the Toms and second cymbal.
- Kick drum mic.
- Floor tom mic.



Large Drum Set – 8-mics

- High hat mic
- Snare mic
- 2 Overhead mics focused on the cymbals
- 2 Tom mics, one per Tom.
- Floor Tom mic
- Kick drum mic



Microphone Phase

- Because drum kits typically have multiple mics picking up the one instrument phase can be a concern.
- A mic above a snare drum will initially experience a negative pressure when the drumhead is struck, the head moves away from the mic.
- A mic below the drumhead will initially experience a positive pressure when the drumhead is struck, the head moves toward the mic.
- The two mics will be 180° out of phase.
- If you mic a snare from the bottom you need to reverse the polarity on that channel on the mix board to keep the mic in phase with other mics on the drum set.



Micing an Electric Guitar

- Electric guitarists put a lot of effort into getting a particular sounds that is the result of the guitar, the amplifier (a guitar amplifier is typically a combination of an amplifier and a speaker) and effects pedals.
- Electric guitars should be captured by placing a mic in front of the guitar amplifiers speaker.
- The most widely used electric guitar mic is the shure SM57, other choices include the Sennheiser e609 or a Royer R121. The Royer is a ribbon mic and may be used alone or along side a Shure SM57.
- Placing the mic in the center of the speaker will give the brightest sound and at the edge the dullest sound.



Direct Boxes and Interfaces

- Instruments typically output unbalanced high impedance signals that don't match well with mix board inputs and can't be transmitted over long distances without degradation.
- Direct boxes convert unbalanced – high impedance signals to balanced – low impedance signals that match up to mix boards and can be transmitted long distances without degradation.
- Direct boxes can be active or passive, active direct boxes need a battery or phantom power and can provide an initial signal boost.
- I used active direct boxes for low output acoustic instruments such as acoustic guitar, mandolin, banjo or fiddle and passive direct boxes for higher output bass guitars and keyboards.
- I have had inexpensive direct boxes “ring” on some signals, I used Radial JDI passive direct boxes and J48 active direct boxes.



Guitar Pickups

- If you have any success as an artists, you will be playing through a PA most of the time.
- The pickup in your acoustic instrument has a huge impact on the sound of the instrument through a PA.
- Many artists spend months picking out an acoustic guitar to get just the right sound.
- You need to be just as diligent in selecting your pickup.



Conclusion

- Capture one and only one instrument into each channel.
- Use direct boxes where you can, microphones where you must.
- Control what each microphone picks up by selecting tight pickup patterns and microphones that are well suited to what you are capturing.
 - Flat frequency response and good sensitivity in the range of frequencies you are trying to capture.
 - Limited sensitivity outside of the frequency range you are trying to capture.



Resources

- Our production page has a resource section with the presentations used to make these videos and other live sound reference material available to download.
- <https://scottenjones.com/production/>

