

Microphones!

Mysteries Solved

Hopefully

Plan of Attach

- Lets understand some basic characteristics first
- How do we use microphones to get a decent recording?
- How can we use microphones live to reinforce our soloists, ensembles, and expand our palate?
- Time for questions

Fundamentals

- Microphones try to be your ear, but they are not
- There are totally different ways to turn mechanical energy into electricity
- They hear in certain directions

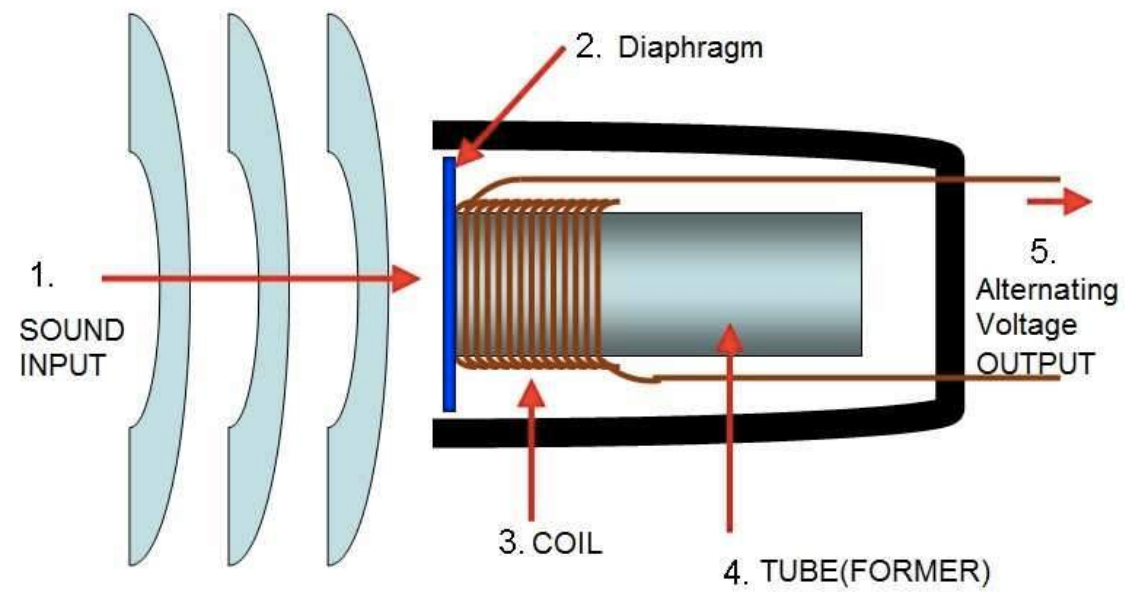
Transducer Types

- Dynamic
 - Very common, great for live, durable, cheap, lower quality
- Condenser
 - Common, great for quieter/studio work, mid to high cost, better quality
- Ribbon
 - - rare, pricey, interesting

Dynamic

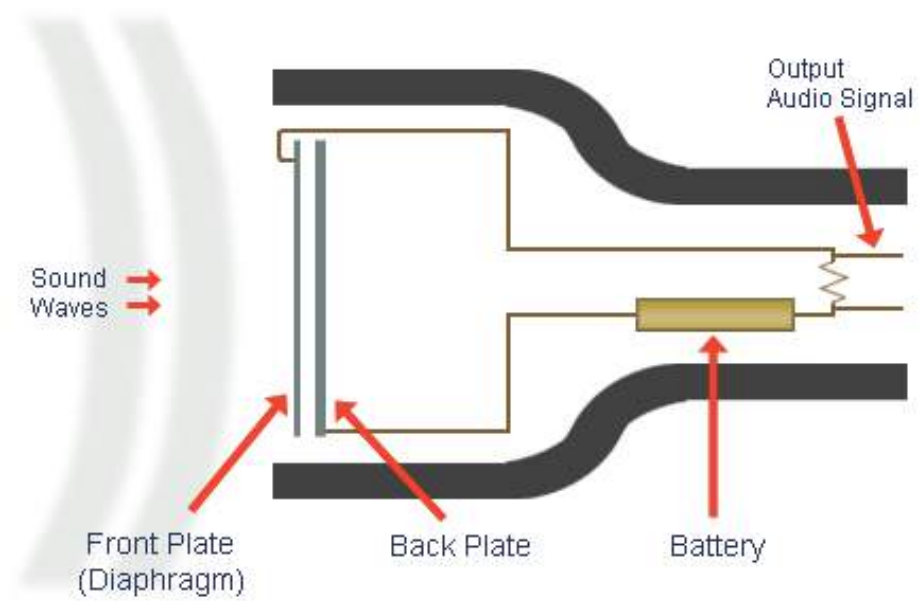
- Built the opposite of a speaker
- Uses a coil of wire floating over a magnet
- When sound strikes the diaphragm, it moves towards the magnet, sliding more of the coil over the magnet, generating a small amount of electricity

Dynamic Microphone



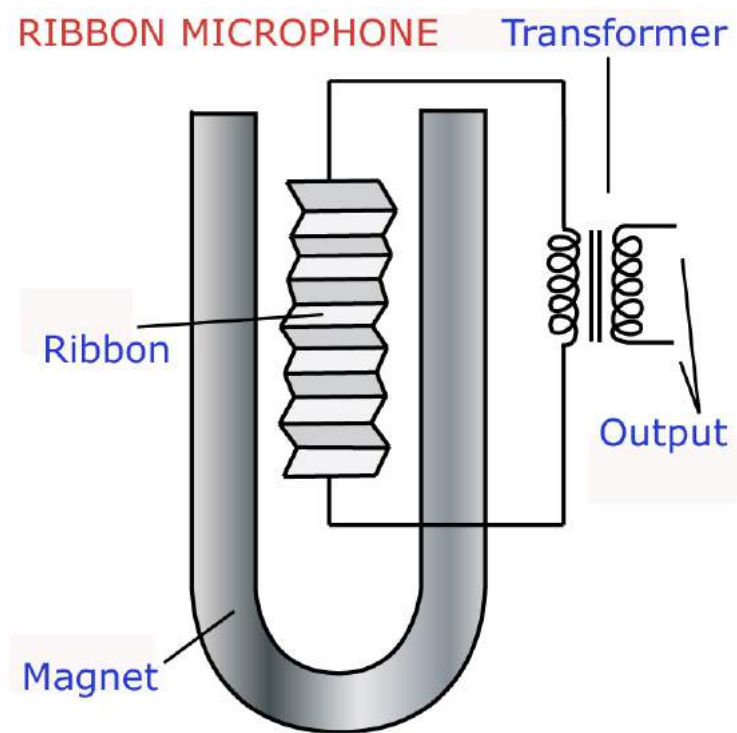
Condenser

- Uses two very thin plates of metal
- Electricity is applied, generating a small amount of static between the two plates
- When sound hits the front plate it pushes it towards the back plate
- The smaller gap allows more static electricity to pass thru, creating an increase in voltage
- Very sensitive, much better quality, more delicate



Ribbon

- One of the oldest currently used style of transducer
- An incredibly thin (2-4 microns) ribbon of metal is stretched
 - A human hair is ~100 microns across, a red blood cell is ~8 microns in diameter
- A magnet is placed around the ribbon
- The vibrations of the ribbon influence the electromagnetic field, resulting in an electric charge
- Very sensitive, very delicate, often expensive, warm sound (sometimes too warm)

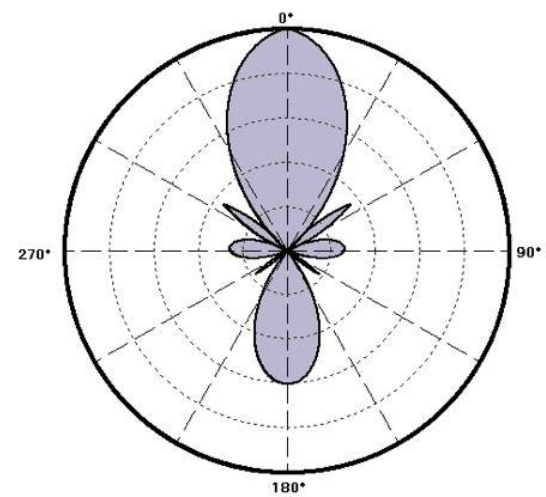
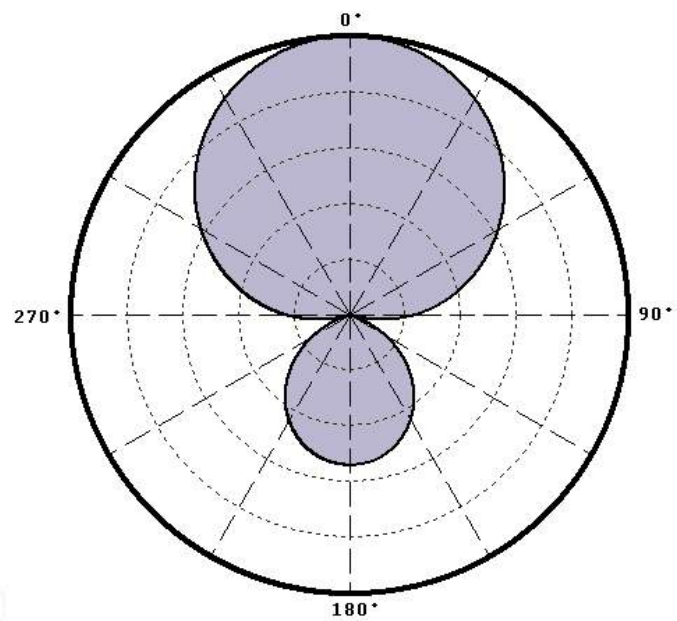
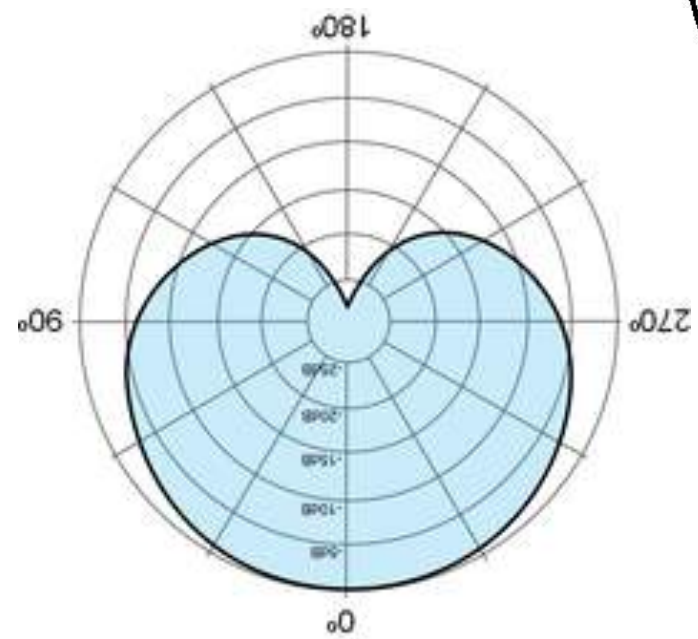


Directionality

- Your ears hear all around you. But your head is in the way
- Microphones hear in very specific and patterned directions
- Some mics do hear everything – Omnidirectional
- Some hear on two sides – Bidirectional (figure 8)
- Some hear in only one direction – Unidirectional (Cardioid, hyper-cardioid, super-cardioid)
- And through the use of witchcraft, some mics can change in which direction they hear with the flip of a switch (multi pattern, variable directionality)

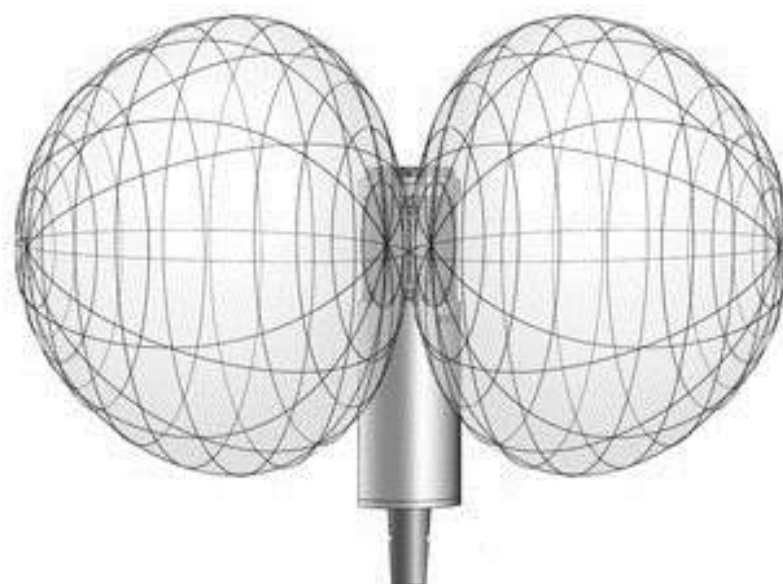
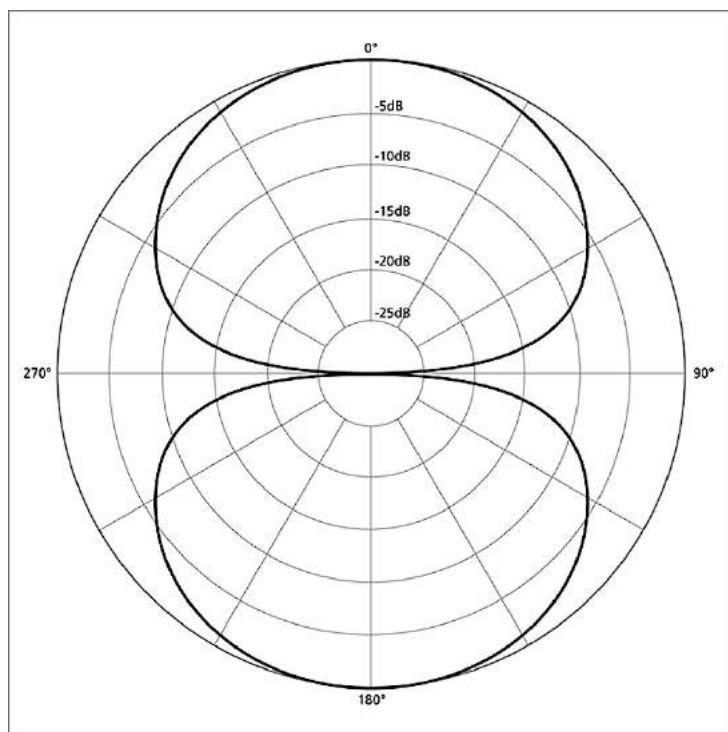
Unidirectional

- Hear mostly just straight ahead
- The pattern looks similar to a heart (cardio) and is therefore called cardioid
- Some have a more narrow focused pattern called hyper/super-cardioid. “Shotgun” mics are this pattern
- Great for stationary sound source or when focus is needed



Bi Directional

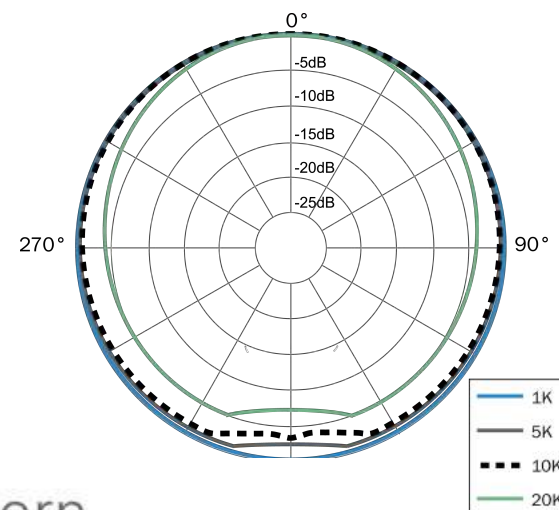
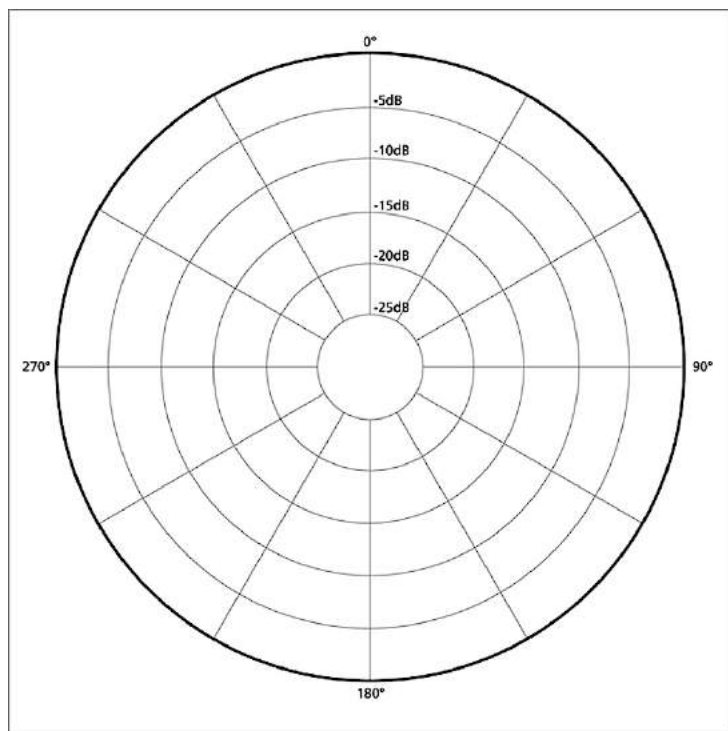
- This pattern is mostly associated with Ribbon mics, as it is the only possibility for that transducer
- Also possible with condenser mics, but not possible with dynamic
- Very popular for interviews
- Very helpful for recording in stereo with MS recording



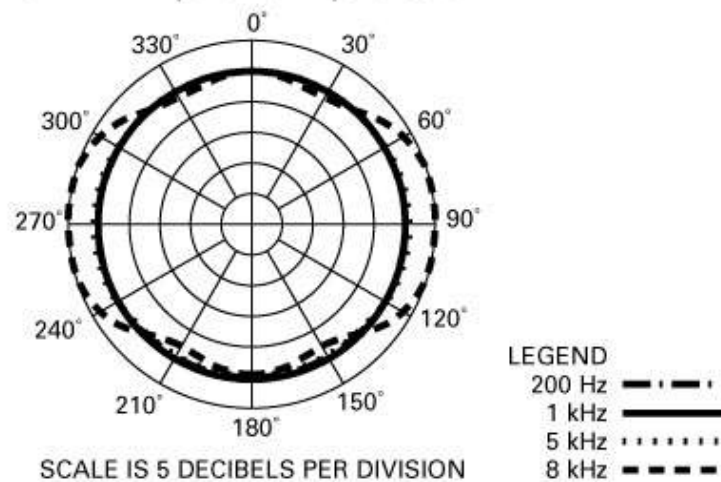
SHURE DISTRIBUTION BENELUX

Omnidirectional

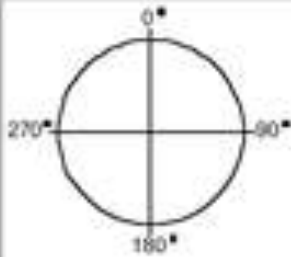
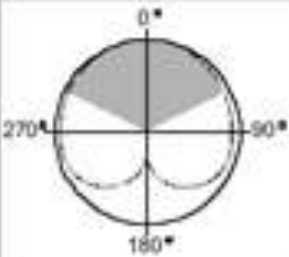
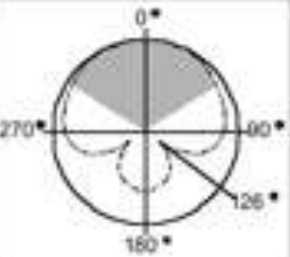
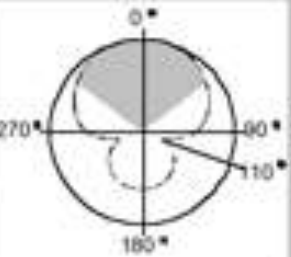
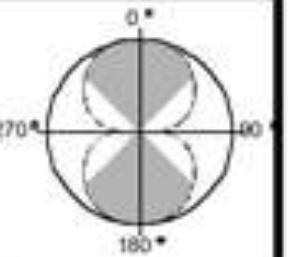
- This pattern hears in all directions
- Mostly associated with condenser mics
- Great for hanging over your stage and capturing hall reverb
- AWFUL for micing a soloist on stage



omni polar pattern



The Five Classic Microphone Polar Patterns

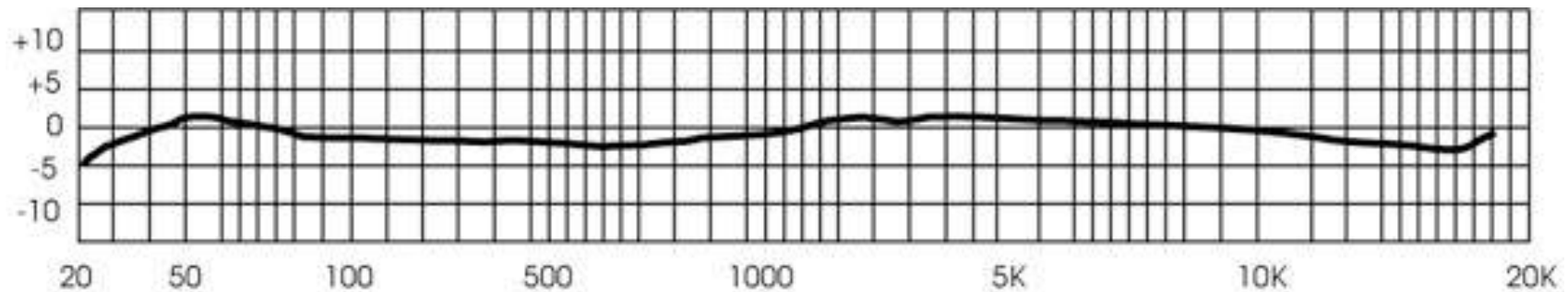
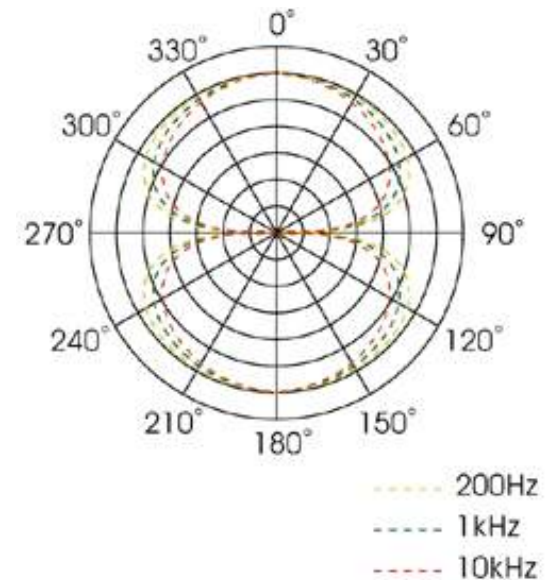
					
Pattern	Omnidirectional	Cardioid	Supercardioid	Hypercardioid	Bidirectional
Acceptance Angle	n/a	131°	115°	105°	90°
Maximum Rejection	n/a	180°	126°	110°	90°
Distance Factor	1	1.7	1.9	2	1.7

Styles of Mic

- Dynamic – usually in a “hand held” format (SM58/57)
- Ribbon – fairly large, usually mounted with a clip
- Condenser
 - Large/Medium Diaphragm – usually “studio” recording type
 - Small Diaphragm
 - Micro
- Handheld
- Hanging
- Podium
- Portable Recorders

Quality and Cost

- Acoustic Operating Principle: Electrodynamic pressure gradient
Polar Pattern: Figure-8
Generating Element: 2.5-micron aluminum ribbon
Magnets: Rare Earth Neodymium
Frequency Response: 30 -15,000 Hz +/- 3dB
Sensitivity: -50 dBv Re. 1v/pa
Output Impedance: 300 Ohms @ 1K (nominal)
Rated Load Impedance: >1500 Ohms @ 300 Ohms
Maximum SPL: >135dB @ 20 Hz
Output Connector: Male XLR 3 pin (Pin 2 Hot)



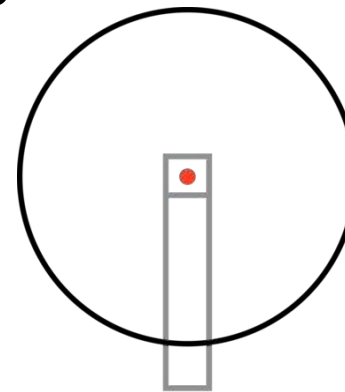
- In general, less than \$90 is not worth buying
- \$200-500 gets you A LOT
- “Studio” quality starts around \$900
- Find a friend or vendor you trust
- The cost rises exponentially with diminishing returns

Recording Ensembles

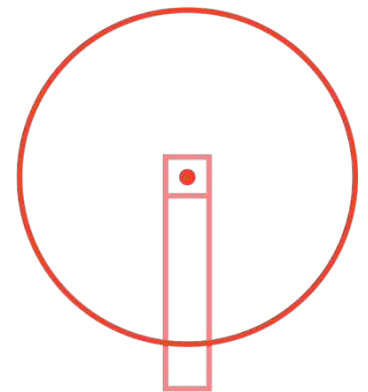
- Handheld recorders (Zoom etc)
- Environment – avoid your classroom if possible
- Place mics ~12-20' above and ~12-20' behind the conductor
- Use at least 2 mics of the same make and model (except MS)
- Use as many as you want 😊

AB

- Very simple and straight ahead
- 2 mics pointing straight ahead at the ensemble
- If mic'ing one person place the mics 9-12" apart
- For ensembles, it really varies. Anywhere from 12" to 20'
- Not a rich sound, but usually avoids problems



Left

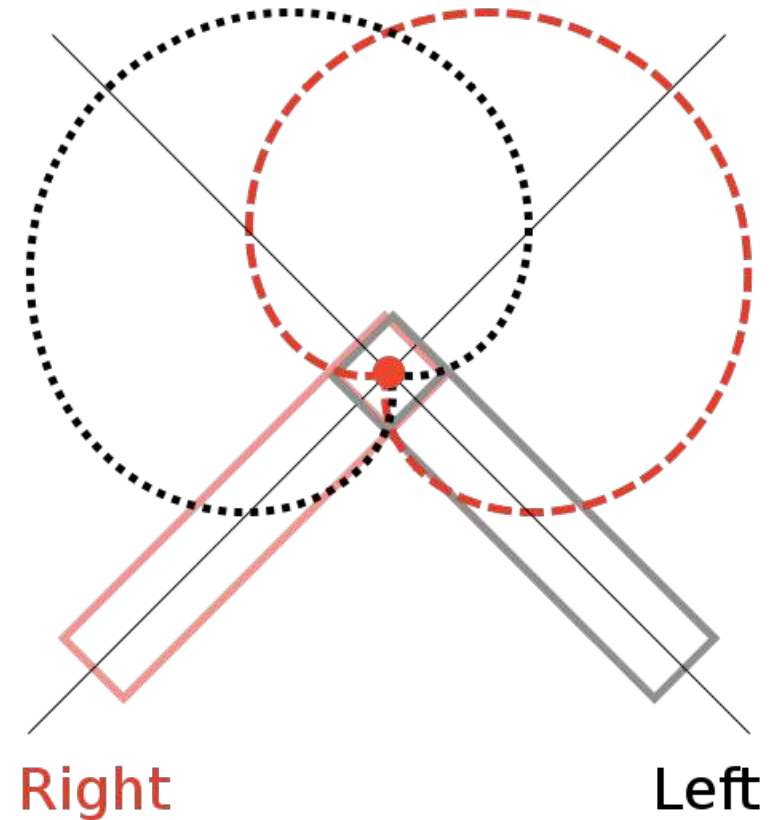


Right



XY

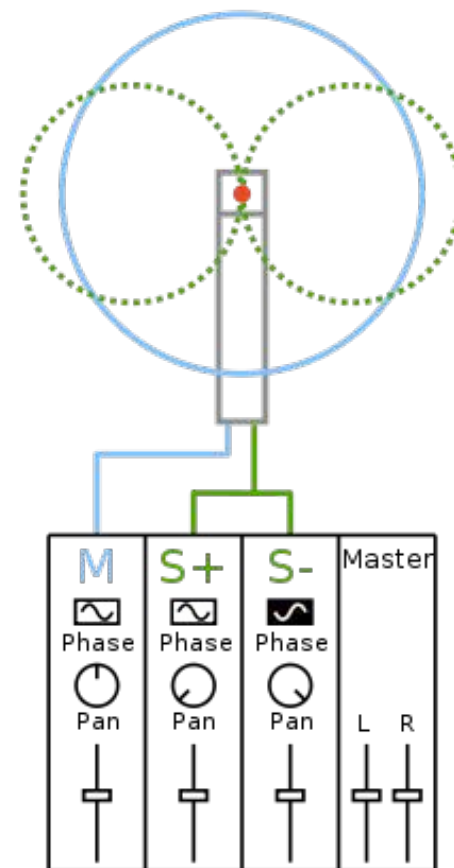
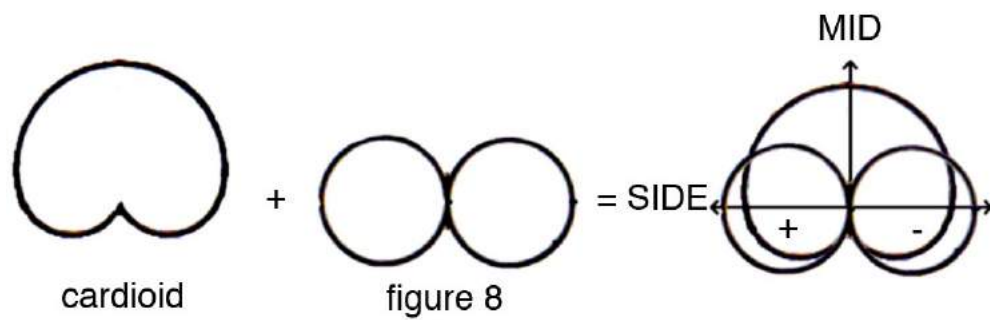
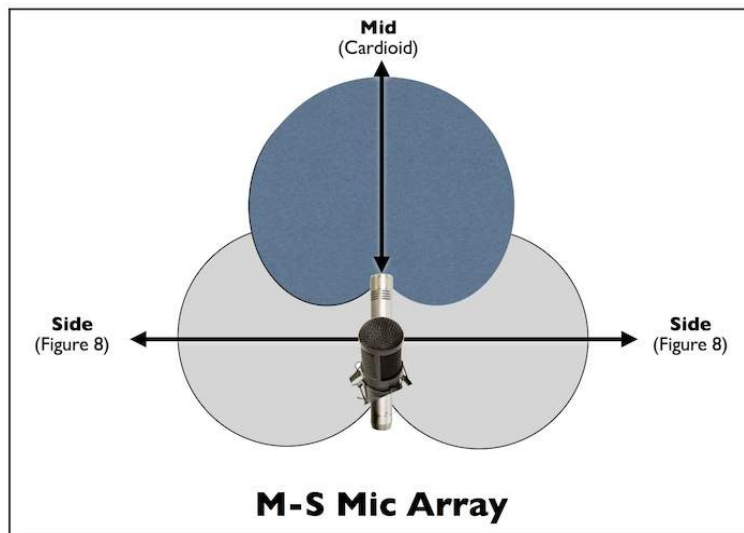
- Easy and versatile
- Can put up a simple setup at 90 degrees, or fine tune it to the room
- Wider angle can be used for a wider sound image
- Capsules must be as close together as possible (<2")
- Unidirectional works best. Figure 8 is also possible





MS – Mid Side

- Great sound, but requires some know how
- Requires a “Summing” box, or mixing board w/aux, or a computer
- One mic faces the ensemble to get a “center” image
 - Could be unidirectional for focus or bidirectional for some hall reverb
 - Unidirectional is not as good, it duplicates the second mic too much
- One bidirectional mic faces the walls to the sides of the ensemble to get a “left/right” sound
- The bidirectional mic sound is duplicated and the phase inverted
- More Mid mic = narrower image, more side = wider image
- Very warm sound, but can be too much





ORTF – Office of Television and Radio of France

- Great sounding setup
- Very dependent on the hall and the ensemble
- Requires a lot of fine tuning
- Very similar principle to XY
- Very rich sound
- If not aligned – very boxy or strained sound



More than two mics

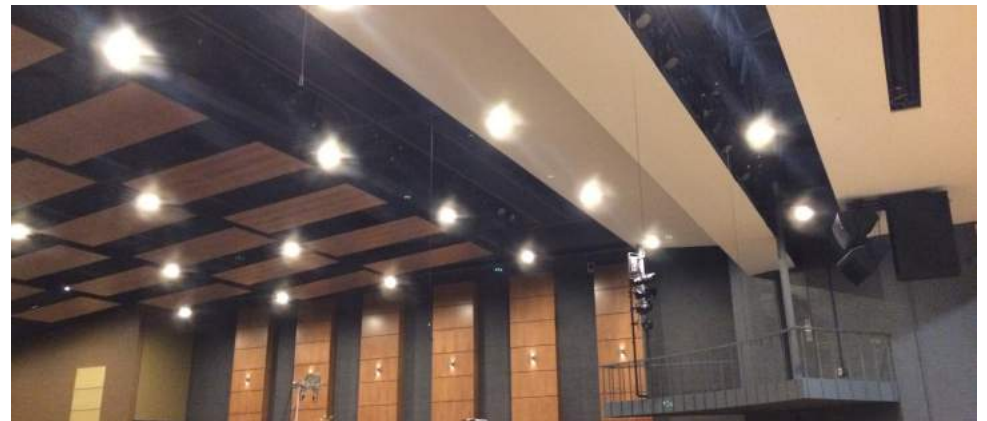
- The more mics the more warmth
- But that can turn into muddy sound
- Phasing issues can arise
- More time to mix your recording
- Using only up close mics sounds boxy

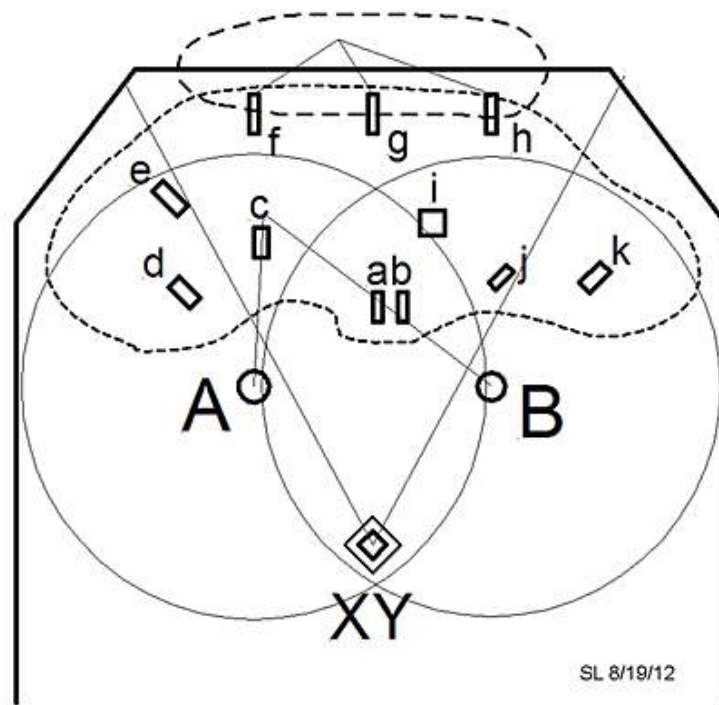
Hanging

Great double with your theater department

If you have catwalks, you can move them over your sections

Very small, not great bass response





CMEA and Midwest



Colorado Symphony



Chicago Orchestra Hall

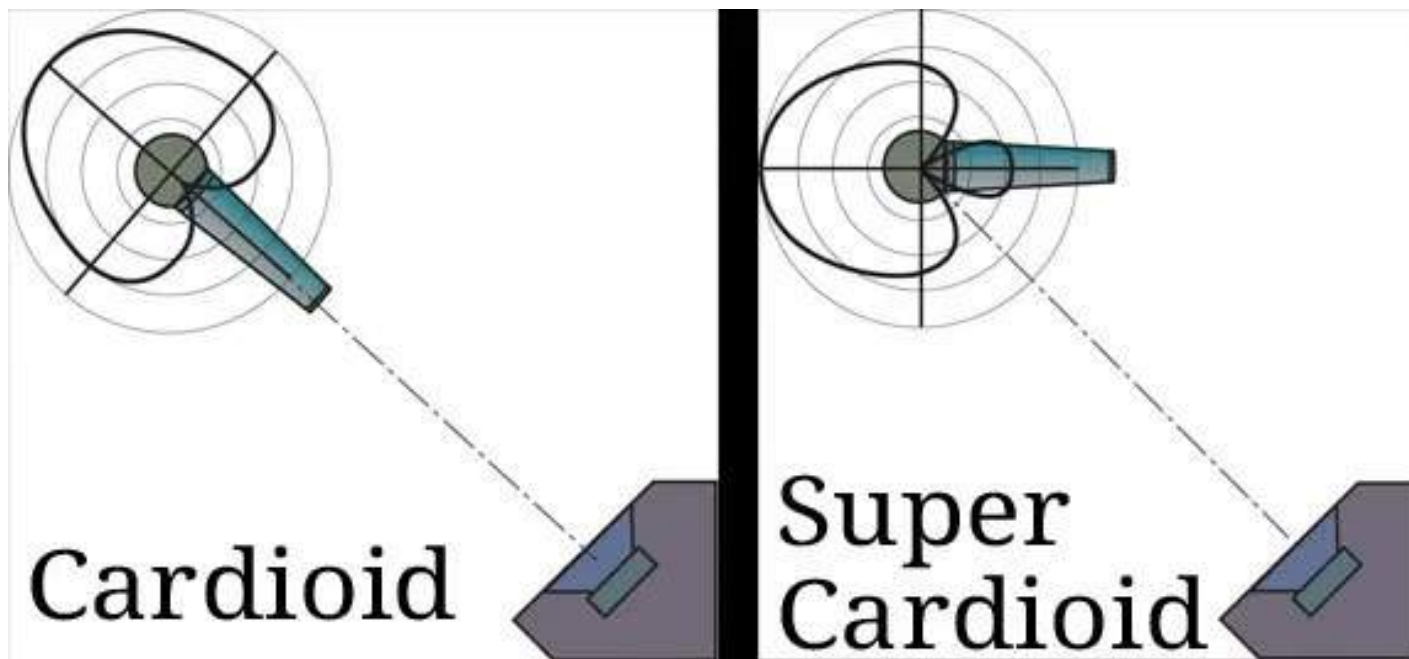


Live!

- Could mic a soloist up to a quartet with one mic
- If you need to mic your whole group, using one per section is best
- If you have the equipment and know how, one per stand is fun
- Mobility is a necessary consideration
- Feedback is the enemy and worst concern

Avoiding Feedback





- Do not let the mic “hear” the speaker
- Place your speakers well in front of the ensemble
- Use dynamic more than condenser
- Feedback eliminators – great for speech

Some mics I like to use

- Rode NT2a
- Rode NT5
- Miktek C7e
- DPA4098
- SM57
- Isomax 2
- Countryman e6
- Pickups

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- How on Earth do we afford this stuff
- Partner with other departments
- Band
- Choir
- Theater
- Technology
- Grants

Other Helpful Gear

- Mic stands, telescoping stands, clips, wind socks
- Black cable, fishing line
- Quality mic cables
- Preamp
- Interface
- CD recorder, SDcard recorder, computer
- Mixing board
- Spacer bar
- Loop Stations and Effects pedals