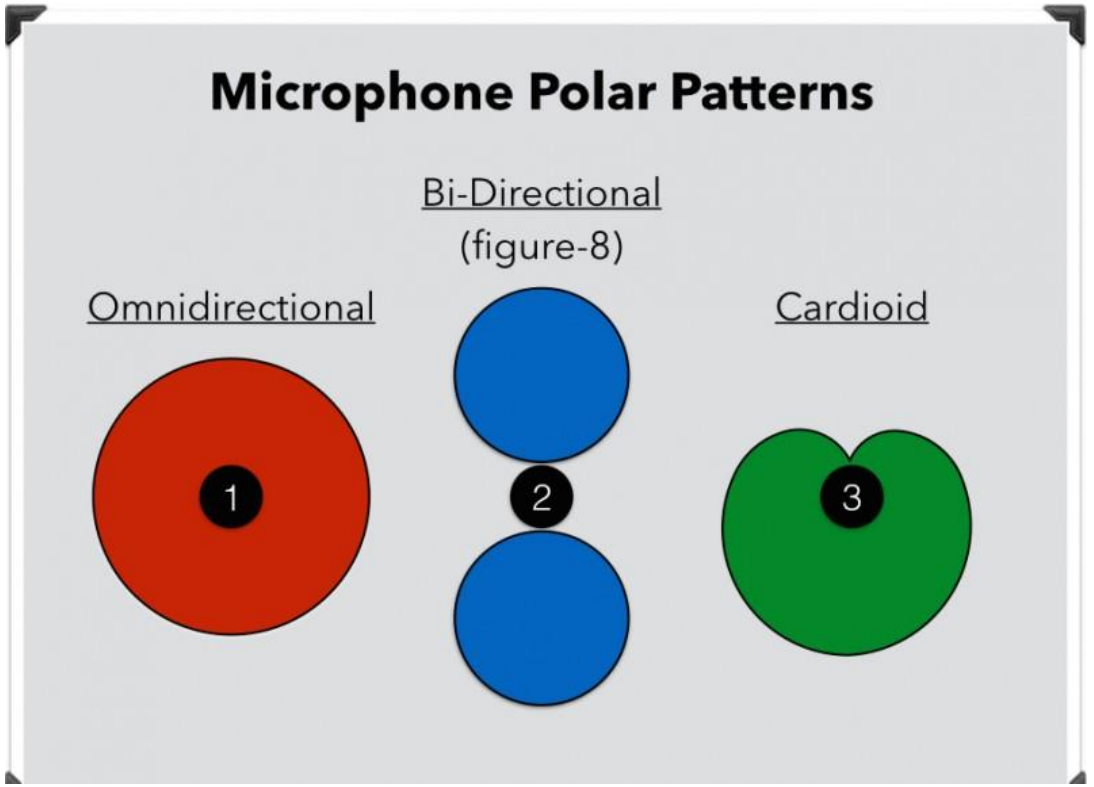
Microphones

Polar pattern of a microphone

- The polar pattern of a microphone is the 3-dimensional space surrounding the capsule in which the microphone is MOST sensitive to sound.
- The 3 basic patterns are:
  1. Omnidirectional
  2. Bidirectional (or "figure-8")
  3. Cardioid
- Here is a diagram that shows how each works:

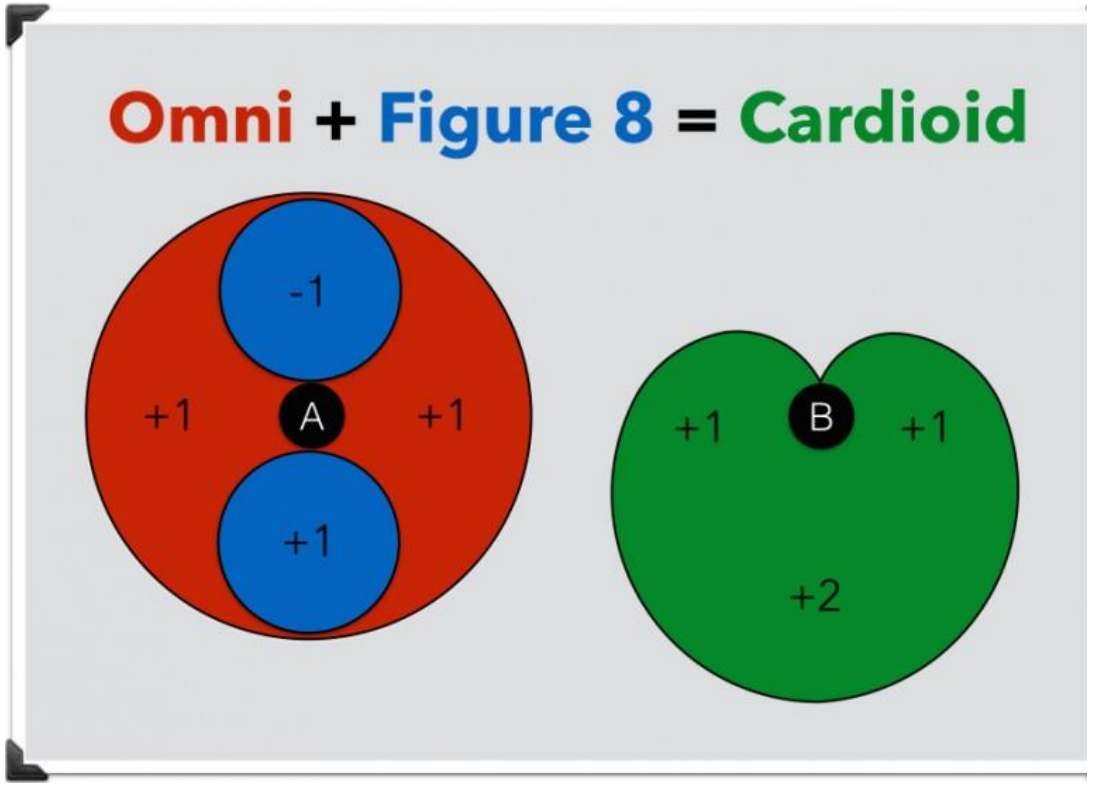


Polar pattern of a microphone

- The directionality of a microphone or polar pattern indicates how sensitive it is to sounds arriving at different angles around its central axis.
- The polar patterns illustrated above represent the geometric location of the points that produce the same signal level output in the microphone if a certain sound pressure level (SPL) is generated from that point.

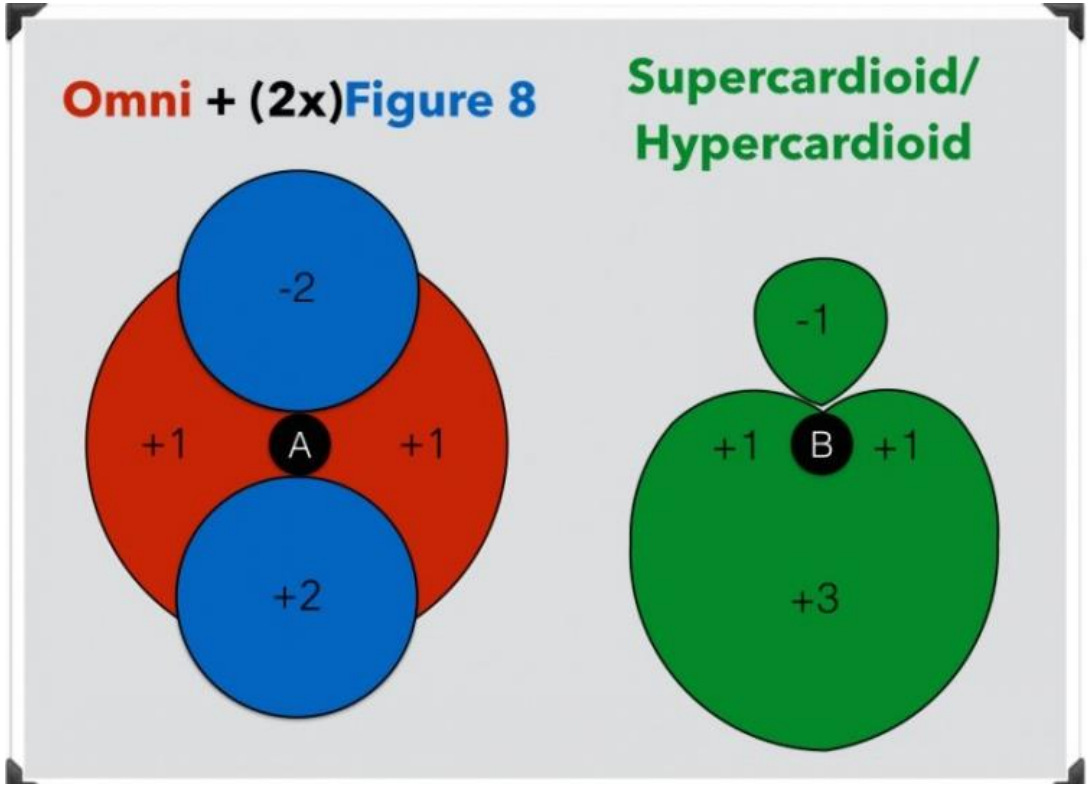
Cardioid Microphones

- Over time, someone discovered that by combining the signals from the omnidirectional micro with the bidirectional.
- This is what was happening:
    1. **In the front:** The positive signals were combined resulting in a signal that was twice as strong.
    2. **On the sides:** The signal from the omnidirectional microphone remained the same.
    3. **At the back:** The negative signal from the bi-directional mic would cancel out the positive signal from the omnidirectional.
- Here's a diagram to illustrate it:



Supercardioid/Hypercardioid

- The next breakthrough came when cardioid polar patterns could be even MORE directional by mixing MORE two-way signal with LESS omnidirectional.
- Apart from these 3 basic patterns, it is also common to see the following:
    1. **Supercardioid:** which is like cardioid but STRAIGHTER and with some sensitivity in the back.
    2. **Hypercardioid:** which is like the supercardioid: also narrower but with more sensitivity in the back.



How Multipattern Microphones Work

- They realized that just by varying the output of two facing cardioid capsules, you could recreate virtually any polar pattern imaginable.
- Instead of needing a different mic for each thing the engineers produced the ingenious idea of bringing all the versatility together in one mic.

Varieties

- There are 4 principaL types of microphones.
- **Dynamic Microphones**: Are the most common in the microphone world. Dynamic mics are responsive to handle high SPL vety efficiently, Some examples are :
- Shure SM57
- Electrovoice RE20
- Sennheiser MD421
- Shure SM7B

Varieties

- Large Diaphragm Condenser Microphones:
- Are known as studio recording microphones. Condenser microphones work by using a condenser to convert acoustic vibrations into electrical currents. This microphones are ideal for vocals. Some examples are
- Audio Technica
- AKG C414
- Manley Reference

Varieties

- Small Diaphragm Condenser Microphones
- Small Diaphragm Condensers also called pencil condensers are similar but smaller than the LDC microphones. This have great transient response and consistent pickup patterns. They are ideal for acoustic instruments. Some examples are
- SE ELECTRONICS SE4 CONDENSER MICROPHONE
- RODE M5 CONDENSER MICROPHONES MATCHED PAIR
- ASTON STARLIGHT PENCIL MICROPHONE
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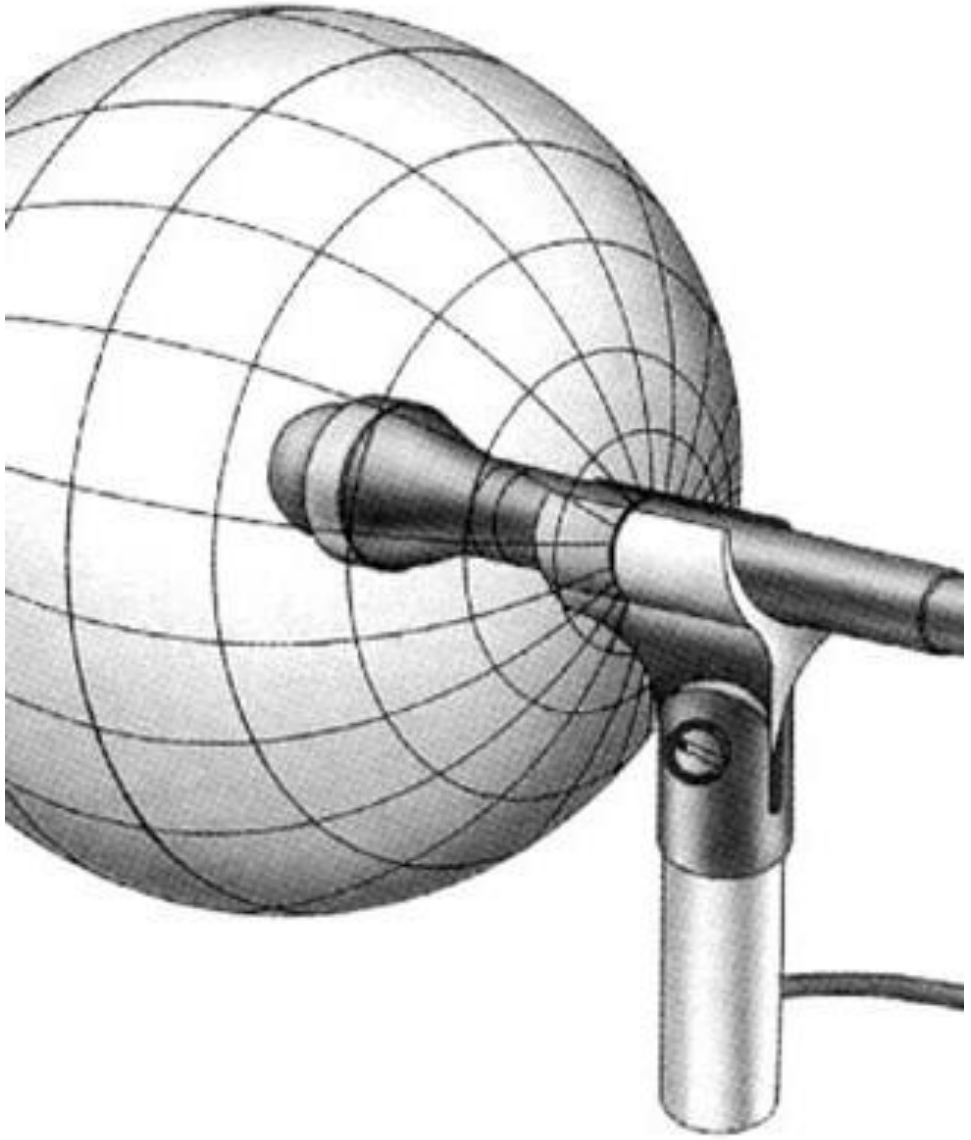
Varieties

- Ribbon Microphones
- One of the first microphones in history. They use an ultra-thin ribbon of electro-conductive material that is suspended between poles of a magnet to create their signal. They are ideal for guitar amps, drum overheads or brass. Some examples are:
- Royer 121
- Avantone CR-14
- Audio Technica AT4081.

Two polar patterns

1. **Omnidirectional Microphones**
   - Originally known as "pressure microphones", their diaphragms measured sound pressure at a single point.
   - Since they did not receive bi-directional information, they were equally sensitive to sound coming from all directions.
2. **Bidirectional Microphones**
   - Also known as "pressure gradient microphones", they measured the pressure DIFFERENCE between both sides of the open diaphragm.
   - This meant that they were very sensitive to front and rear sound, but almost deaf on the sides.



History

- The first microphone was invented as a telephone transmitter by Alexander Graham **Bell** in 1876.
- It was a liquid device that was not very practical.
- In 1886, Thomas Alva Edison invented the first practical carbon microphone.
- The carbon microphone was used for radio transmissions and extensively in telephone transmitters until the 1970s when they were replaced by piezoelectric ceramic elements.

History

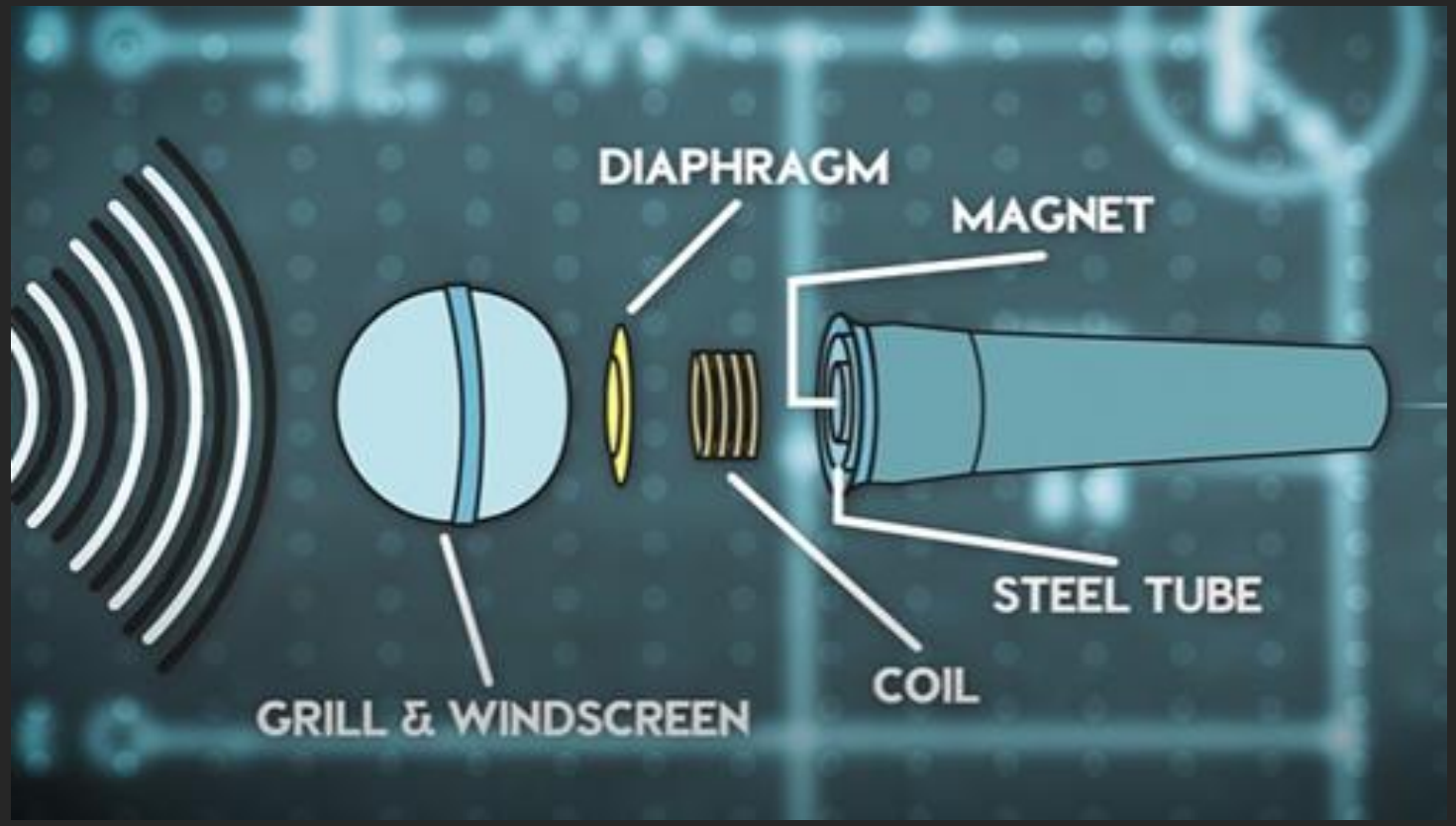
- The carbon microphone had a limited frequency range. and would not reproduce music effectively.
- In 1916, the condenser microphone was developed by E. C.
- The condensor microphone required an amplifier built within the microphone to pick up the faint signals.
- Condensor microphones were used for radio broadcasting and the first generation of sound motion pictures
- The ceramic or crystal microphone was invented 1933 by the Astatic Corporation

Construction of a Microphone

- Microphones are transducers, they convert energy from one form (acoustic sound waves) to another (electrical). Although there are two types of microphones, dynamic mics and condenser mics, which have different qualities and work in different ways, they all have a diaphragm. Diaphragms are a thin piece of mylar or some sort of metal that vibrates when sound strikes it. Once it's struck, the diaphragm passes the energy to the rest of the components of the microphone. The vibrations are later converted in electrical currents which the audio interphase receives in order to play it back.

The components of a microphone are the grill and windscreen, the diaphragm, the coil, the magnet, and finally the steel tube.

The magnet produces a magnetic field that cuts through the coil, as this one moves back and forth with the diaphragm, allowing an electric current to flow through the magnet.



Bibliography

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- https://www.youtube.com/watch?v=PE6Qn4ZiEyo