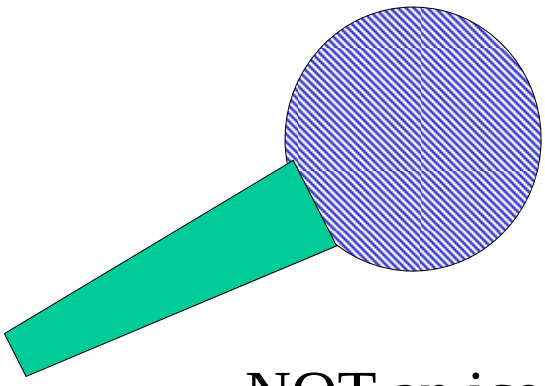
A microphone is:

- A transducer that converts pressure waves into electrical impulses
- A way to capture sound for amplification or recording
- A delicate electronic instrument

A microphone is NOT:

- Scary
- An ice cream cone
- The solution to all performance problems



NOT an ice cream cone

Types of microphones

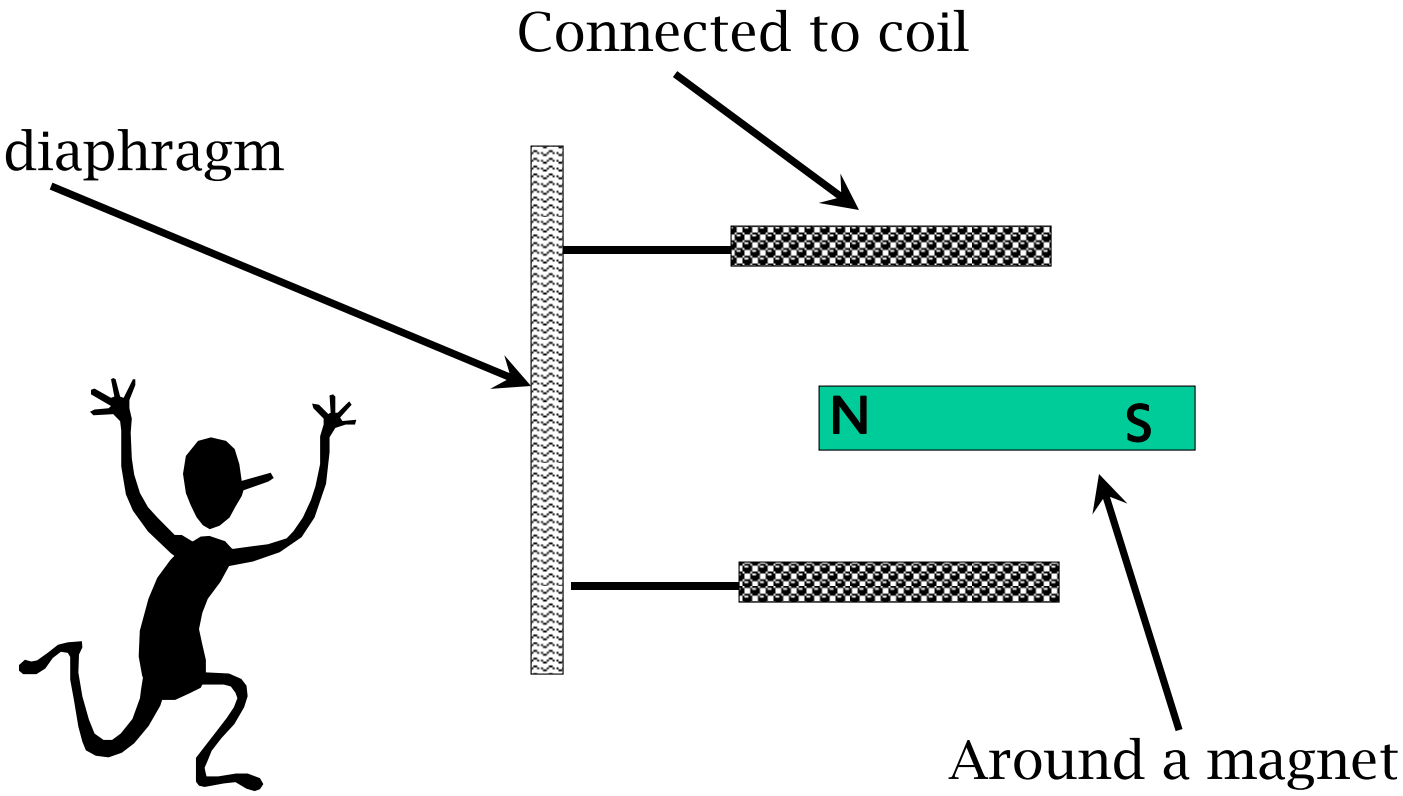
- Dynamic - a little generator that converts pressure waves into a varying voltage signal
    - Usually has a coil attached to a diaphragm, with the coil surrounding a magnet
    - Generally rugged, relatively inexpensive to manufacture
- Most other microphone types modulate an applied current or voltage, and require an energy source to operate
- Examples are electret, condenser, ribbon, and carbon pile microphones

All microphones have:

- A mechanical sensing element (moves in response to pressure waves), usually some kind of diaphragm or ribbon
- A way to convert motion of the sensing element into electrical impulses

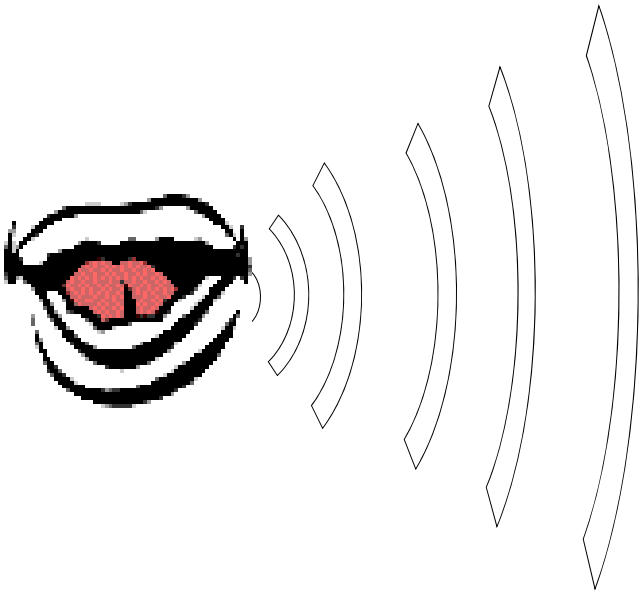
To use a microphone successfully, you need to know a little about about your friend the microphone diaphragm

- Responds to pressure from either side
- Is sensitive to contamination (don't get it wet - Uggg!)
- Has a limited range of motion, and enough inertia that it takes a certain minimum pressure change to get it moving
    - So it won't work well if the sound is either too soft or too loud



The microphone diaphragm responds to pressure from either face

- This is good and bad



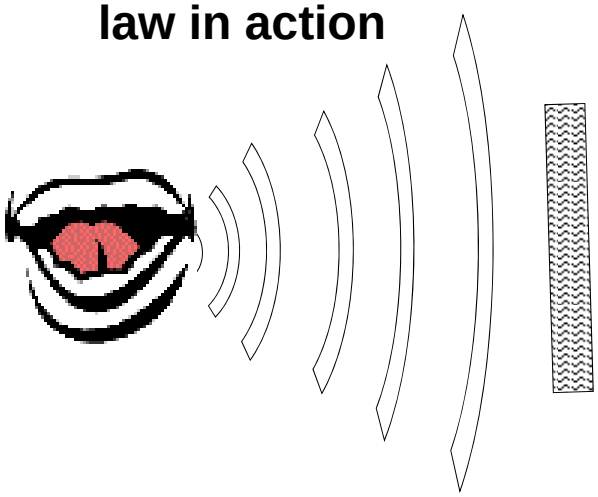
If the sound pressure strikes the diaphragm directly, the microphone reproduces sound correctly

But if the sound pressure strikes the diaphragm on edge, the pressure is equal on both sides, and the diaphragm doesn't respond

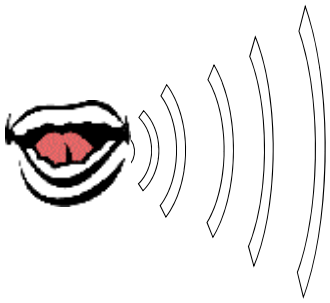
This could actually be good if the sound source is a banjo or accordion

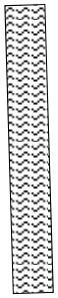
The microphone is quite sensitive to distance from the source

- **For you physicists, that's the inverse square law in action**



If the sound source is only a few diaphragm diameters away, the microphone picks up lots of sound. This is desirable!





If the sound source is over 20 diaphragm diameters away from the microphone capsule, the typical stage microphone picks up almost no sound.

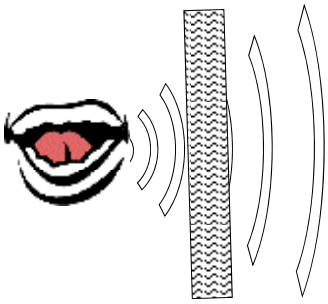
This is usually not what the performer wants!

How big is the diaphragm? Usually less than ½ inch!

What does this distance effect mean in practice?

- **Most dynamic microphones work best if the source is no more than SIX INCHES from the front of the mike windscreen. Further away sounds weak and tinny.**

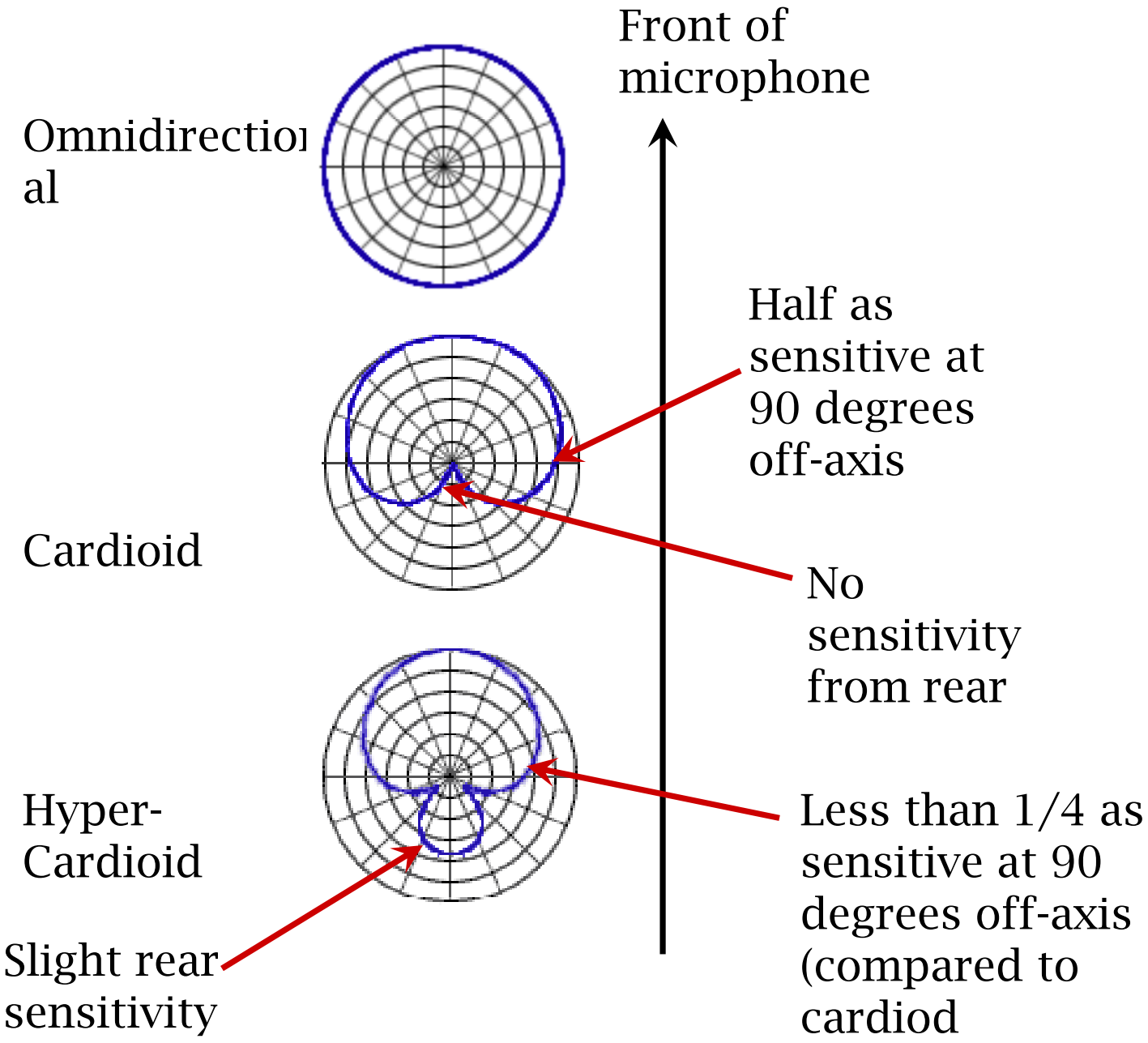
If you can fit your hand between your lips and the microphone, you probably aren't "working the mike" effectively (and the audience can barely hear you)



If your lips, or instrument, are within a finger-width (one quarter inch) of the microphone, a thing called proximity effect happens. This enhances the microphones bass response, and is generally considered pleasing to hear.

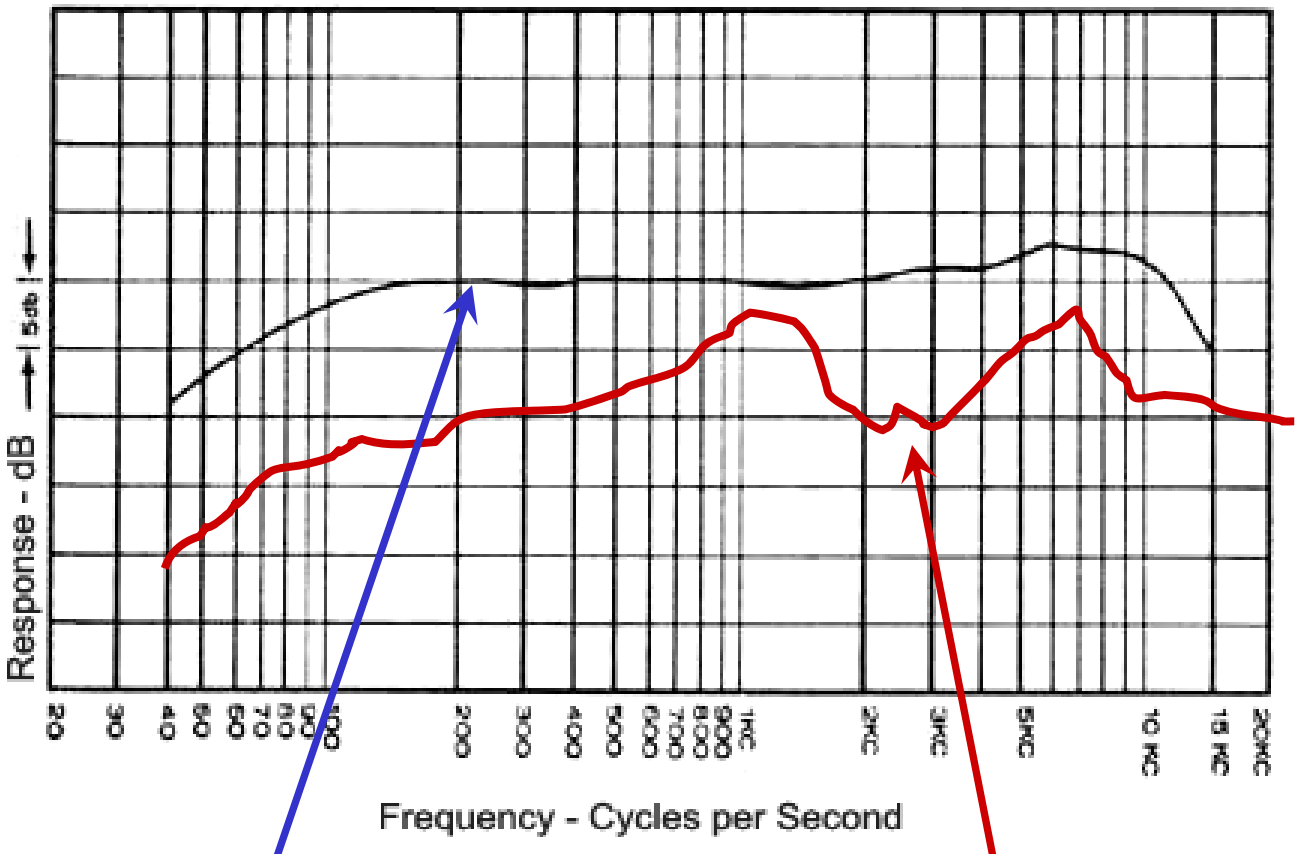
How close to “on center” do you need to be to get the best sound in a live performance?

- **It depends on the mic you are using. Mics have different “gain patterns”.**
- **Common patterns are omnidirectional, cardioid, super cardioid, and hyper cardioid**



What else happens when not “on center” in a live performance?

- Microphone frequency response varies with position of source.
- Reproduction is generally best “on-axis”
- Bass response rolls off as the source gets off axis on most microphones (except omnidirectional)



Desired frequency response On-axis

Distorted frequency response off-axis

Lessons to take home

- **Work the mike! Closer is almost always better.**
  - **Move away from the mike only when you want to reduce the sound you are projecting**
  - **And move closer if you want to increase the volume level for the audience**

- **For the most accurate and pleasing sound, keep as centered as possible on the microphone's axis**

- **Ask the sound guy about the mike you will be using - so you will have an idea how big the "sweet spot" is going to be**

- **Don't place stage monitors within the sensitive cone of the microphones you are using**
  - **Unless you really want to see how much feedback your sound system can generate**

- **Get there in time for a sound check, and have a friend available to listen and tell you if the sound is right for you or needs some help**

- **And don't forget to have a good time!**