

Sound design

Dominik Pecka

Sound composition

- ✦ Contains:
- ✦ Dialogues
- ✦ sound effects
- ✦ Atmospheres
- ✦ Music

Technological Process

- ✦ Recording
- ✦ Editing
- ✦ Mixing
- ✦ Mastering

What is Sound?

- Sound is a vibration that typically propagates as an audible wave of pressure, through a transmission medium such as a gas, liquid or solid.
- sound is readily dividable into two simple elements: pressure and time (This is known as a waveform)
- Human hearing is approximately 20hz-20 000 hz (adult usually no more than 16 000Hz)



Speed of sound

- ✦ air 20° - 343 m/s
- ✦ Speed of sound is affected by temperature and humidity

Effect of temperature on properties of air

Temperature T (°C)	Speed of sound c (m/s)	Density of air ρ (kg/m³)	Characteristic specific acoustic impedance z_0 (Pa·s/m)
35	351.88	1.1455	403.2
30	349.02	1.1644	406.5
25	346.13	1.1839	409.4
20	343.21	1.2041	413.3
15	340.27	1.2250	416.9
10	337.31	1.2466	420.5
5	334.32	1.2690	424.3
0	331.30	1.2922	428.0
-5	328.25	1.3163	432.1
-10	325.18	1.3413	436.1
-15	322.07	1.3673	440.3
-20	318.94	1.3943	444.6
-25	315.77	1.4224	449.1

SPL - sound pressure level

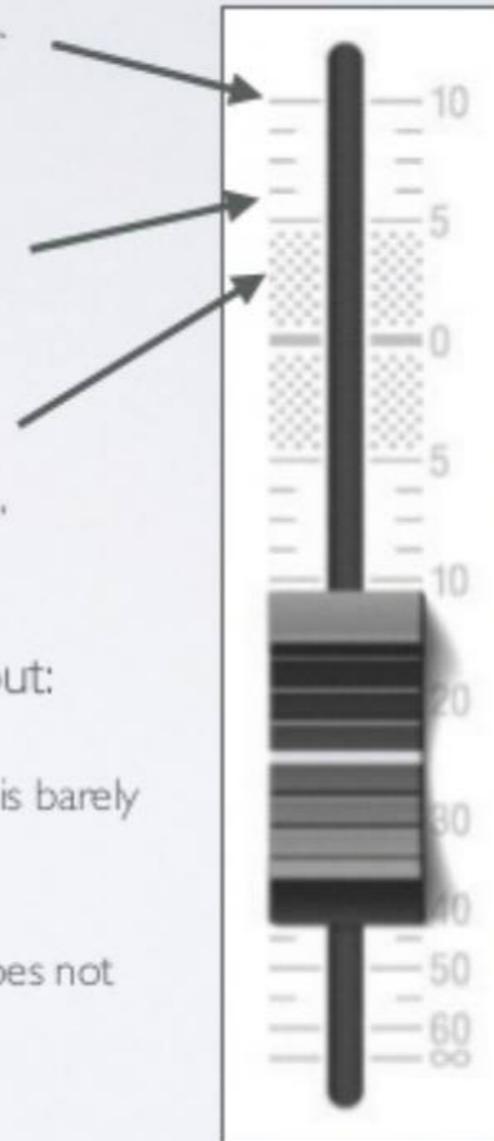
- Sound pressure is the difference,
 - in a given medium, between average local pressure and the pressure in the sound wave.
- $L_p = 20 \log \frac{p}{p_0}$ - unit is dB
- Near total silence - 0 dB
 - A whisper - 15 dB
 - Normal conversation - 60 dB
 - A lawnmower - 90 dB
 - A car horn - 110 dB
 - A rock concert or a jet engine - 120 dB
 - A gunshot or firecracker - 140 dB
- Treshold of pain 130 dB (some sources says 120)

LEARNING TO THINK IN TERMS OF DECIBELS

+10dB is:
10x the acoustic power
and 2x as "loud"

+6dB is:
4x the acoustic power
but only 1.5x as "loud"

+3dB is:
2x the acoustic power
but only 1.23x as "loud"

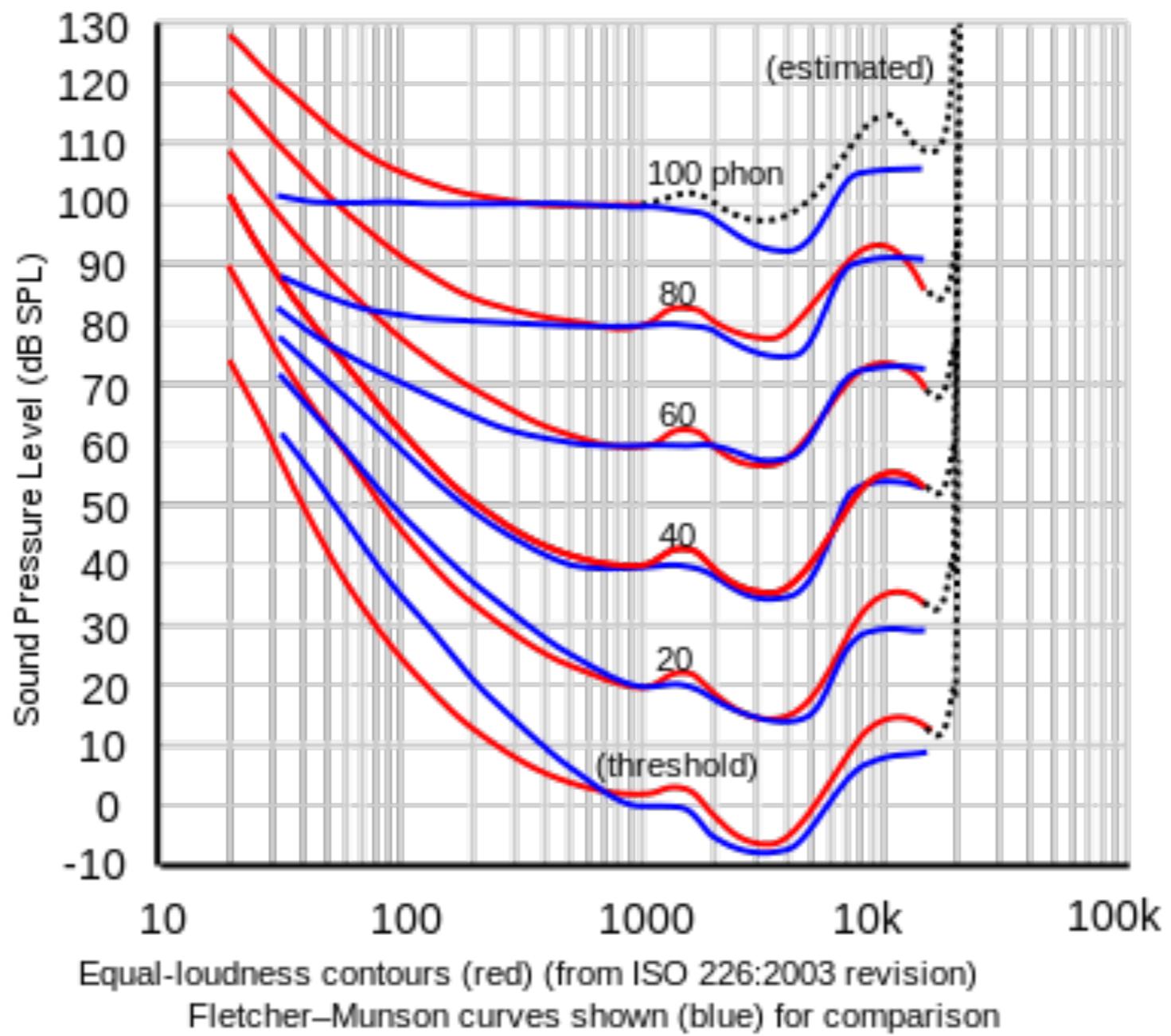


Some implications to think about:

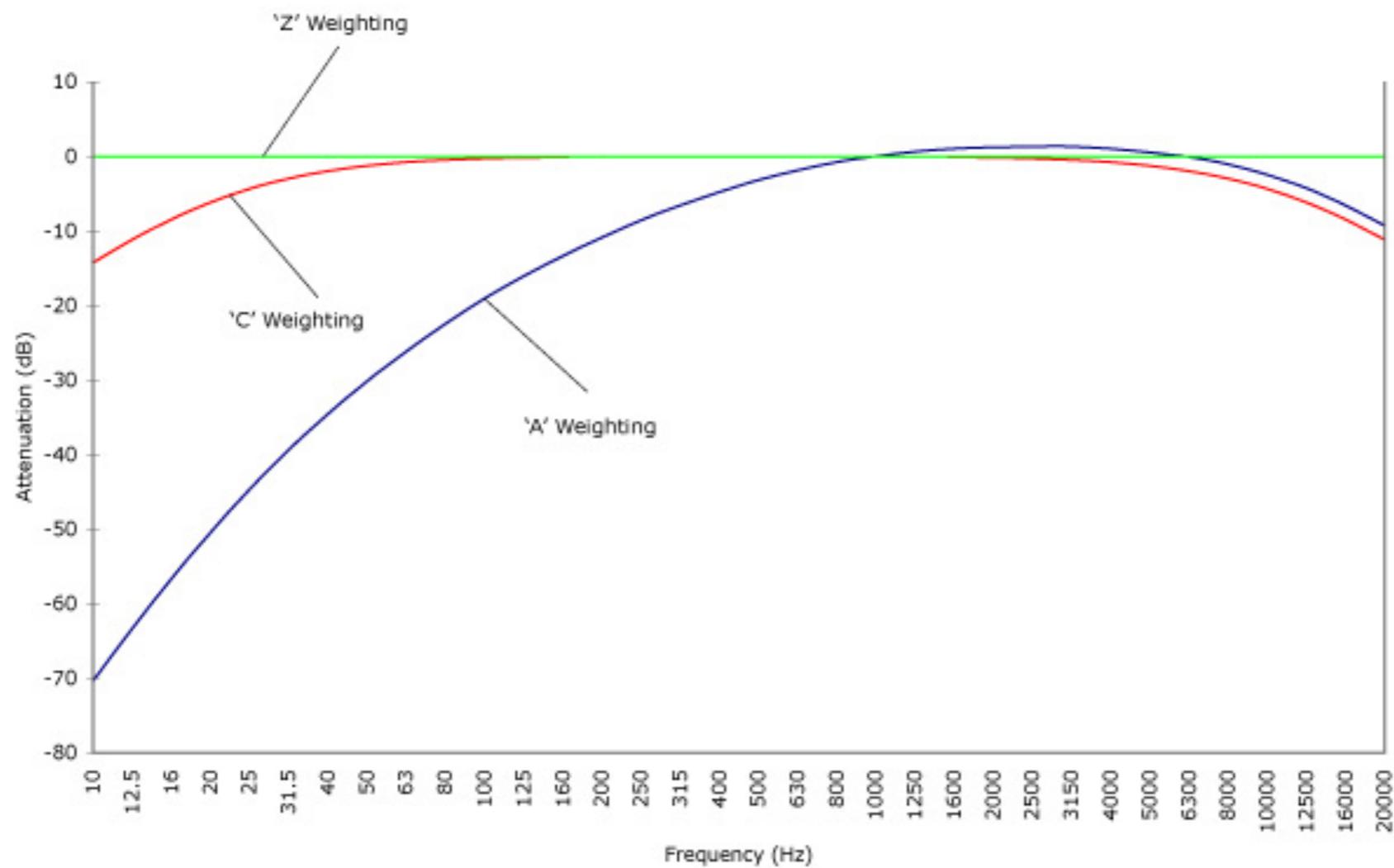
- A 1-2 dB change in volume is barely perceptible
- Doubling amplifier power does not double loudness

Equal Loudness contour

- ✦ An **equal-loudness contour** is a measure of sound pressure (dB SPL), over the frequency spectrum, for which a listener perceives a constant **loudness** when presented with pure steady tones. The unit of measurement for **loudness** levels is the phon, and is arrived at by reference to **equal-loudness contours**.



Weighting Curves



Pitch

- ✦ We have non periodic sounds - noises
- ✦ And periodic sounds - tones
- ✦ These are often combined and define timbre
- ✦ Also these parts changes in time (envelope)
- ✦ vowels - tone / consonants noise

Frequency

- periods per second is frequency (unit is Hz) , T is time how long one period occurs.

$$\nu = \frac{1}{T} \quad \lambda = \frac{v}{f}$$

- Wave length
- 50hz - 6.8m 1000hz - 34cm 10000 Hz - 3,4cm
- v speed of spreading of vibration in mass
- lambda - wavelenght a f - frequency

Envelope

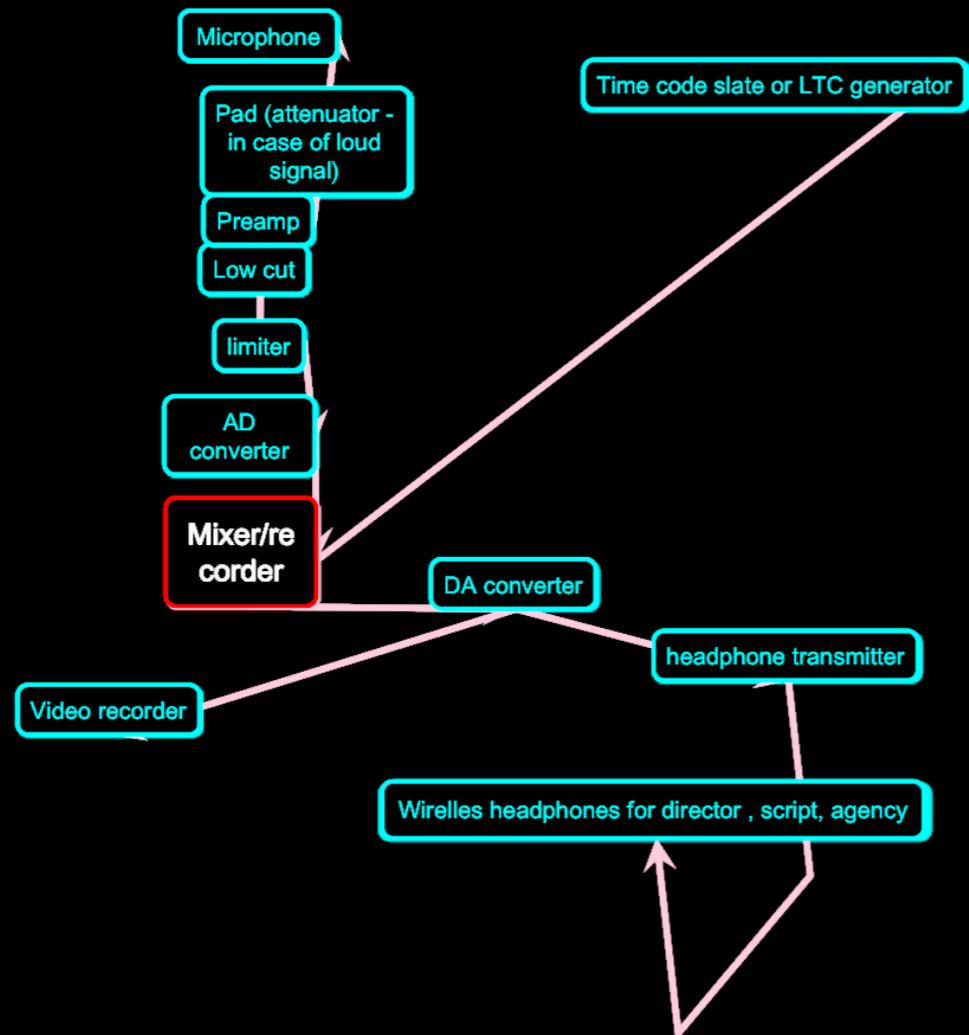
- **Attack** is the time taken for initial run-up of level from nil to peak, beginning when the key is pressed.
- **Decay** is the time taken for the subsequent run down from the attack level to the designated sustain level.
- **Sustain** is the level during the main sequence of the sound's duration, until the key is released.
- **Release** is the time taken for the level to decay from the sustain level to zero after the key is released.^[2]

Recording

- ✦ Field recording
- ✦ Foley
- ✦ ADR (automated dialogue replacement)
- ✦ Music recording

Recording signal chain

- ✦ Microphone
- ✦ Preamp
- ✦ Analog/Digital Converter
- ✦ Digital recording (SSD drive)
- ✦ Monitoring
- ✦ (for sound engineer , mix for director etc.)



Microphones - specs.

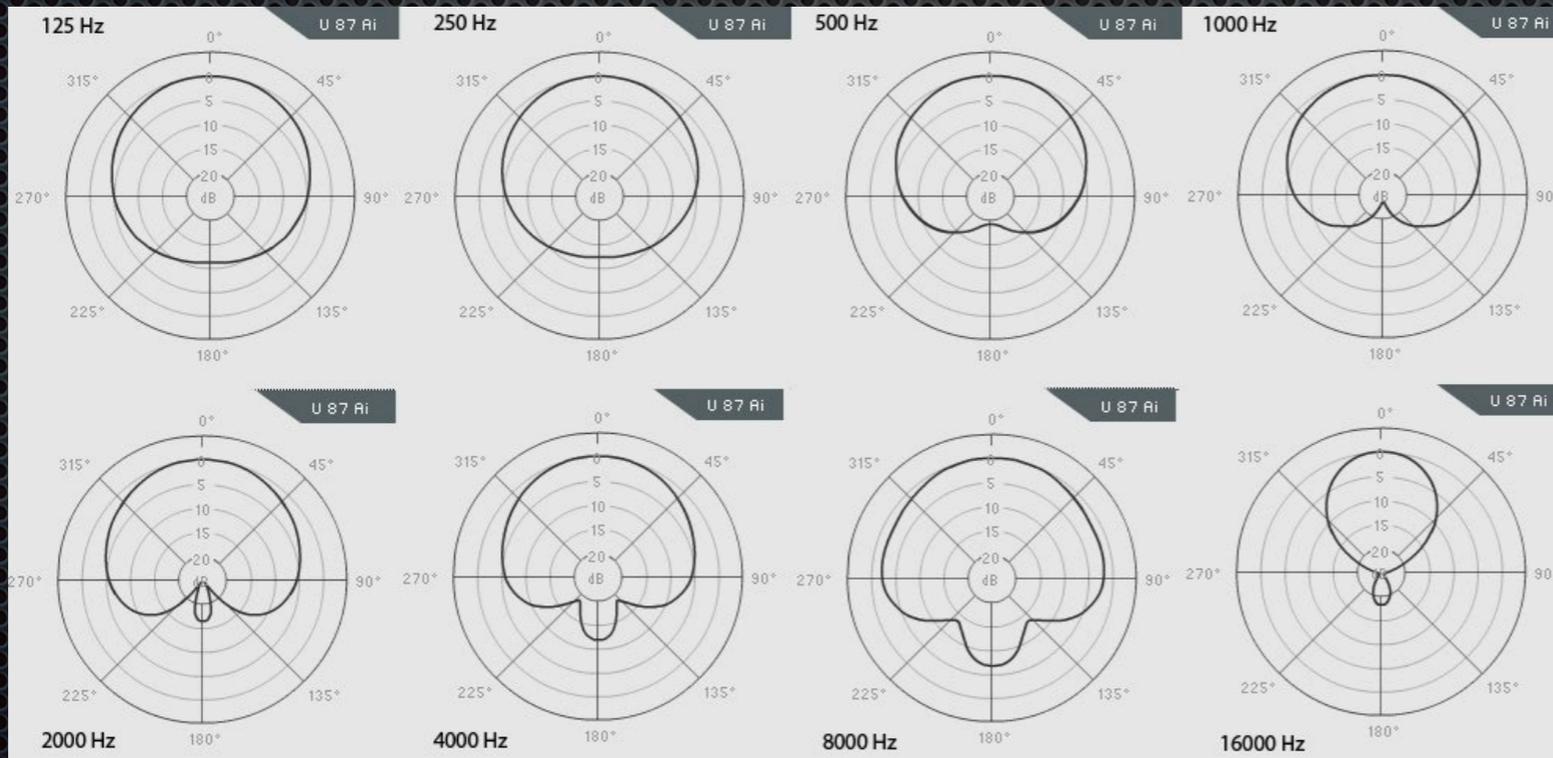
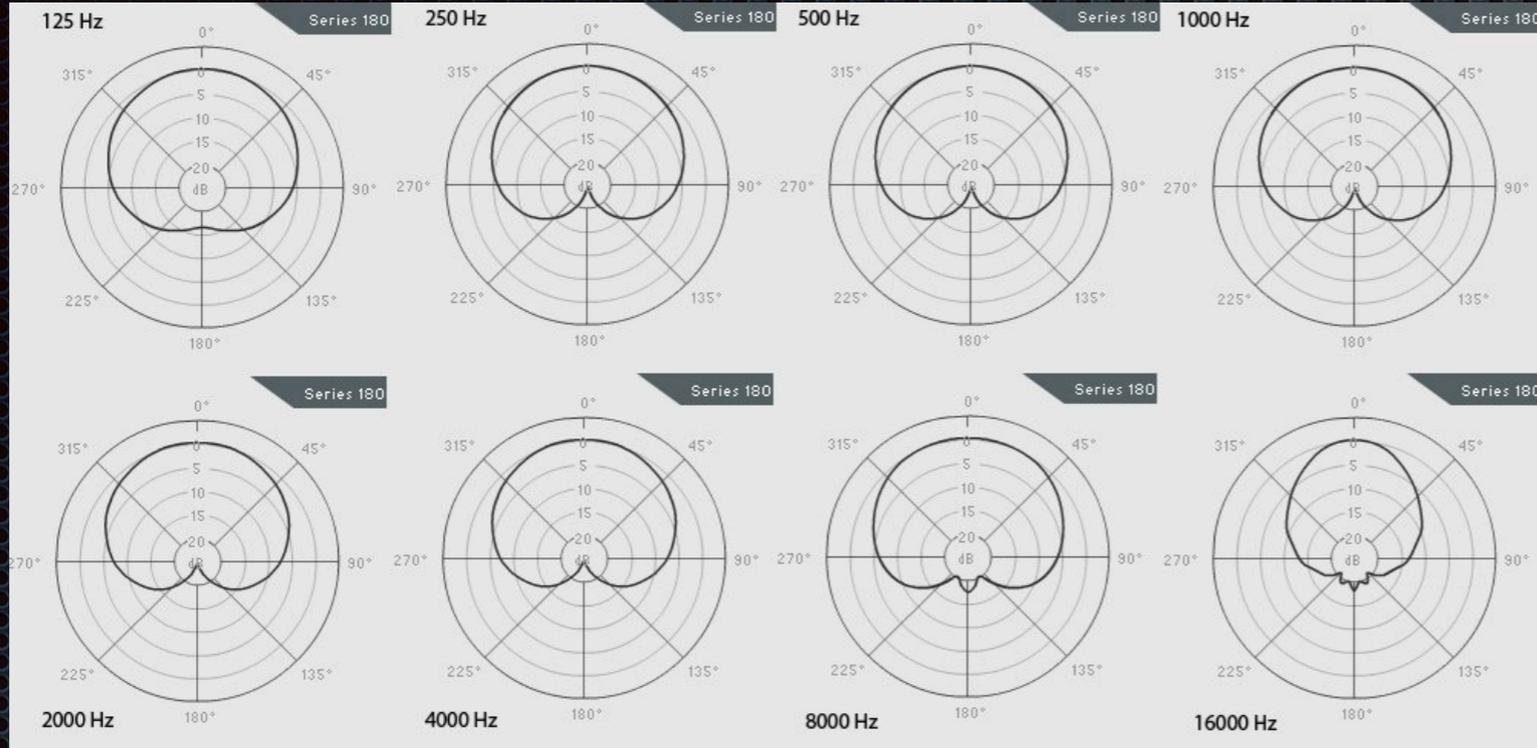
- ✦ Sensitivity (mV/pa)
- ✦ Directivity pattern
- ✦ Frequency response
- ✦ Dynamic range
- ✦ noise floor
- ✦ Distortion specs of U87

Microphones by construction principles

- ✦ Condenser (most used in film recording)
- ✦ Dynamic
- ✦ Ribbon

Condenser microphone

- Light membrane
- Better highend and transient response than dynamic
- Needs powering (Phantom 48)
- Large diaphragm / small diaphragm
- Large diaphragm less noise - more signal
- Smaller diaphragm more noise less signal ,
- but more uniform directivity



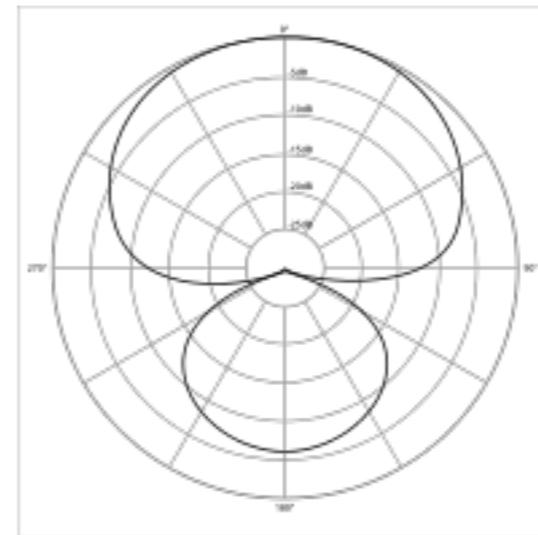
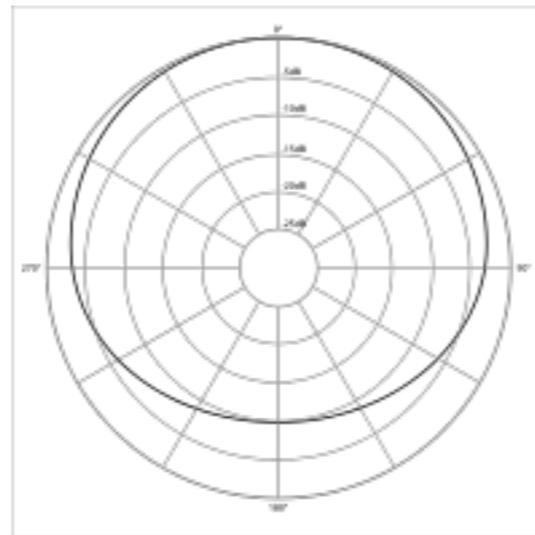
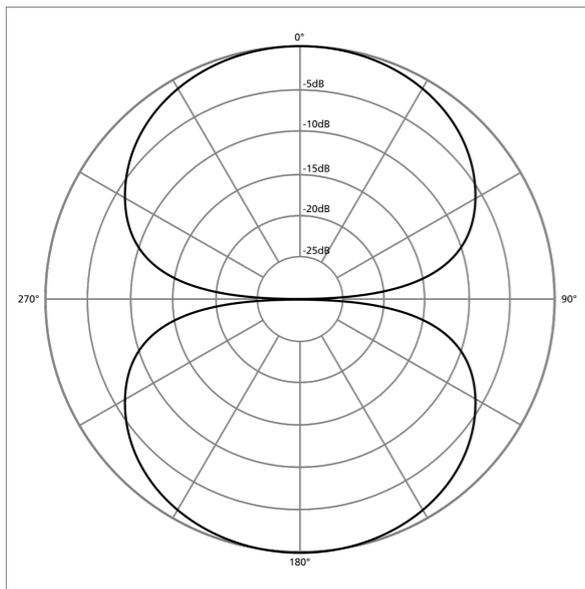
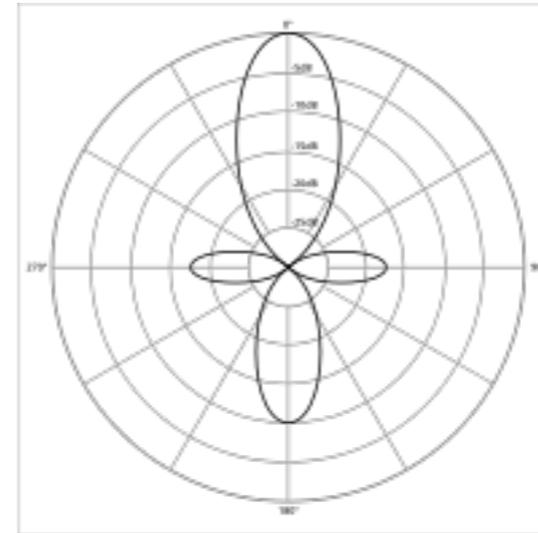
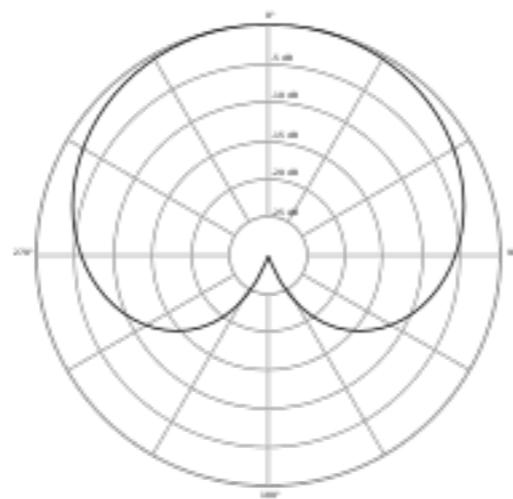
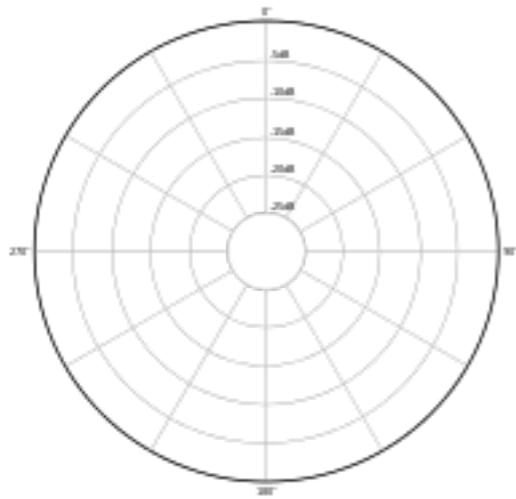
Dynamic microphones

- ✦ Less sensitive
- ✦ Good isolation of sound
- ✦ Close miking
- ✦ Stage , Radio and Broadcast
- ✦ (EV RE20, Shure SE 7B)
- ✦ Moving coil

Ribbon Microphones

- ✦ Ribbon in a magnet.
- ✦ Typically figure 8
- ✦ Vintage sound quality (less high end)
- ✦ Phantom can destroy some older models
- ✦

Directivity Patterns



Use of mics in Film

- ✦ Highly directive condenser microphones on boom
- ✦ Microports hidden in clothes
- ✦ On set recording during shot is mainly for dialogues (sound effects recorded separately)

Preamps

- ✦ Headroom
- ✦ Noise floor
- ✦ distortion
- ✦ hysteresis curve

Converters

- ✦ frequency resolution (48kHz, 96kHz) determine highest possible frequency
- ✦ Bit depth (24bit, 16bit)
- ✦ determine noise floor

Recording media

- ✦ Now typically digital
- ✦ SSD , HDD
- ✦ Tape (DAT)

Interaction with other members of the Crew

- ✦ Script - important to use same numbering of takes
- ✦ Sound reports for postproduction
- ✦ Syncing with camera/slate via LTC
- ✦ Daily work data export for editors

Gain Structure

Sound postproduction

- synchro with picture (daily works done by editor).
- Conform files by sound editor using editing list
- ADR - re recording dialogues
- Foley art
- Editing foley and atmospheres from archive
- Cleaning dialogues
- Music recording/editing/mixing
- Mix / mastering for multichannel format