II. WHAT IS SOUND

- **Sound Wave**
- **vibration of air molecules**
- **compression + rarefaction = one cycle**
- **travels 1,075 feet per second in air**
- **cycles = frequency**
Sound Waves

- A = air at equilibrium -- no sound
- B = compressions + rarefactions --- sound wave
- C = sine wave representation of sound
  - A -- amplitude
  - λ -- wavelength
Sound Waves

Sound frequency + amplitude

sounds higher frequency (more waves/sec)

sounds Louder amplitude (bigger waves)
Sound and Hearing

◆ Human hearing is binaural
◆ Mono emanates from a single point source
◆ Stereo emanates from two point sources
◆ Surround emanates from multiple sources
**Stereo**

- Provides
  - sense of space, openness
  - positioning
  - sound movement

- Requires
  - 2 different channels R + L
  - more than one mic in field (or stereo mic)
Mono Example

Mono mix L + R
Stereo example

Stereo Mix
L & R Different
spatial sense
reverberation
Inglorious Basterds - Tarantino
Stereo Sound - spacial impression
Inglorious Basterds

- Tarantino--we don’t think of sound
- his films are “out there”
- Soundscape is perfectly executed
- it is not “out there”
- environmental sounds, “ambience”
- fall, phone dial, phone talk, capture chaos, voices, “bugs” clicking, dialogue, audience murmurs, head butt, truck sounds, dialogue, brakes, dog barking
- compare with “Kill Bill”
Frequency/Pitch--high and low

- hertz (Hz)
- Kilohertz
- 20-20,000 hertz human range
- 20-16,000 hertz for most people
Frequency

◆ Sound is rarely single tone
◆ Fundamental
  ◦ main frequency of the note
◆ Overtones (partials, harmonics)
  ● source of timbre
Timbre

- most sound is not pure
- harmonic structure is combination of sounds which produces timbre.
- no objective scale—subjective
- created by overtones
- We describe with non-technical terms
  - Sound metaphors
    - metallic, sweet, wood-like, buzzing, rushing
Octaves

- tonal ratio of 2:1
- ie, 20 to 40 hz = one octave
- human range about ten octaves
FREQUENCY RANGES

1. Low Bass 20-80 hz--1st 2 octaves
   - lowest notes--power and fullness
   - too much--muddy sound
FREQUENCY RANGES

- 2. Upper Bass 80-320 hz--3rd and 4th octaves
- most rhythm and support instruments (drums, piano, etc)
- provide balance in music
- too much -- boomy
- too little-- thin
FREQUENCY RANGES

3. Mid range 320--2560 hz--5, 6, 7 th octaves
- intensity--contains fundamental and rich lower harmonics of most sources
- too much mid can be annoying and fatiguing
FREQUENCY RANGES

- 4. Upper Midrange 2560-5120--8th octave--our most sensitive range
- 2560-3500--intelligibility of speech
- above 3500--definition, clarity, realism
- presence range--5,000 hz
FREQUENCY RANGES

5. Treble 5120-20,000 hz—9 and 10th octaves
- 2% total output of sound, many can't hear above 16,000
- brilliance and sparkle
What can you hear?

5120hz
Frequency and Loudness

- human ear not equally responsive to all frequencies
- ear insensitive to low frequencies at low volume
  - loudness control on stereo
Frequency and Loudness

20hz
Poor Sound Example
Filtered
EQUALIZATION
EQUALIZATION