Recording Process

- Analog
- Digital
Analog

- Signals on tape analogous to waveform of original.
- Signal continuous--always on
- Quality high in best machines
- Best dynamic range 80-90 db, much is 65-70 db
- Crosstalk, wow and flutter, printhrough
Analog Process

- 1. transducer (microphone)
  - sound to electrical signal
- 2. Pass tape past recording head
  - magnetic particles arranged
    - pattern ANALOGOUS to the original signal.
Analog Process

- 3. Pass tape by a play head
- 4. inherent distortion (noise) in system
- 5. dubbing & generation loss
Digital--pulse code modulation

- analog converted to dig, then back for playback
- quality excellent
  - increased dynamic range -96 db
  - reduced noise and distortion,
  - most analog problems eliminated (esp gen loss)
- Five steps
5 steps
1. Microphone--transducer

- Changes sound vibration into electrical signal
- this is an analog step
2. Anti-aliasing

- unwanted high frequency signals
  - above the normal hearing range but can be "aliased" into the audible range in sampling.
- pass the original analog (from the mike) signal through a low pass filter.
3. Sampling

- sample voltages at fixed intervals along the waveform of the analog signal.
- how often you measure the voltage
- the more often the better the signal
  - sampling frequency
    - twice its frequency.
    - for 20,000 hz, 40,000 rate
  - digital audio today uses 32, 44.1, and 48 kHz
    - 32 is for broadcast (max bandwidth is 15k)
    - pros use 44.1 and 48
Sampling

lower sample rates take fewer snapshots of the waveform.....

resulting in a rough recreation of the waveform.

faster sample rates take more snapshots....

resulting in a smoother and more detailed recreation of the waveform.
4. Quantizing

◆ samples are converted into discrete values called quantizing levels

● greater number of levels, greater the accuracy of the representation of the signal.
Quantizing--bit depth

Original Waveform

Waveform Sampled at 16 bits

Waveform Sampled at 8 bits
5. Coding/storage

- Analog voltages converted to binary digits
  - --series of pulses
    - (0--no voltage, 1--voltage)
- each digit is a bit
- each bit allows two levels of quantification
  - 2 bits gives 4 levels
- 16 bit system (65,536)
  - sufficient to deal with quantizing noise
    - artifact of the process of quantizing.)
- some 20 bit systems used.
\[ n \text{ bits} = 2 \text{ to the } n \text{ quantizing levels} \]

- 2 squared....4
- 2 cubed.......8
- 2 to the 4th...16
- 2 to the 5th...32
- 2 to the 6th...64
- 2 to the 7th...128
- 2 to the 8th...256
- 2 to the 16th...65,536
- 2 to the 32nd...4.3 million
V. WHAT IS GOOD SOUND?

- sound that is technically and aesthetically excellent
technical

◆ frequency response
◆ signal to noise ratio
◆ dynamic range
◆ clean
  ● no distortion,
  ● no hum
  ● no phase cancellation
aesthetic

◆ intelligibility--words are clear
◆ tonal balance--
  ● no one range stands out
    ◆ too much low--muddy
    ◆ too much high--sibilance + noise
    ◆ too much mid--harsh, shrill
◆ timbres sound natural
◆ ensembles blend
aesthetic

- spacial balance
  - clear where sounds are coming from
- Definition
  - --each element is defined
- Airiness
  - --open sounding
- Appropriate acoustics
  - radio announcer not in reverberant setting
- production values- combination grabs or moves you.
Slumdog Millionaire

open