3. Sampling

- Sample voltages at fixed intervals along the waveform of the analog signal.
- How often you measure the voltage
  - 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.
$n$ bits = 2 to the $n$ 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