Sound Basics

Digital or Analog

• What are they?
• Pros and Cons for both
• Good analog better than poor digital
• If choice, opt for digital
“It's not easy being a stylus. You’re under a lot of pressure”
Signal is enveloped by a high frequency bias signal.

Biasing overcomes problems with tape hysteresis.

Region of net positive magnetization

Region of net negative magnetization
Sound Basics

Digital Pros

• Wider dynamic range
• Increased resistance to noise
• Better Copyability
• Error correction
• Durability of storage
Sound Basics

Sound Capture

• Human Voice—20 to 20,000 Hz (20 KHz)

• Minimum Recommendation
  - 44.1 KHz Minimum Sampling Rate
  - 16 Bit Minimum Bit Depth

• Archive Standard
  - 96 kHz/24 bit
Sound Basics

Mapping Air Pressure Change:

• Loudness: Bel (Sound Pressure Level) dB (1/10 Bel) logarithmic scale
• Frequency: Pitch
• Timbre
Sound Basics

Octaves
Sound Basics

- Analog

Diagram showing the relationship between air pressure and voltage level, indicating a waveform for each.
Sound Basics

Digital Capture:
Turn into
Numbers
Analog waveform represented as sound pressure (SPL) level over time

Sampling rate = # of samples per second

Same waveform quantized proportional to SPL
Each sample is a measurement of the instantaneous amplitude of source signal
Sound Basics

- Nyquist-Shannon theorem
Sound Basics

- Nyquist-Shannon theorem
Remember Humans hear up to 20,000 Hz
Sound Basics

Sound Capture

• **Human Voice and hearing**
  - 20 to 20,000 Hz (20 KHz)
  - Voice range 100 Hz – 5000 HZ (5 KHz)

• **Minimum Recommendation**
  - 44.1 KHz Minimum Sampling Rate
  - 16 Bit Minimum Bit Depth

• **Archive Standard**
  - 96 kHz/24 bit
Sound Basics

- **Bit Depth**
  - Values recorded at Capture
  - 16 bit: 65,000 levels of resolution
  - 24 bit: 16 million

- **Bit depth increases dynamic range:**
  - Rounding Off: quantization error (noise)
  - Low levels—signal submerged in background noise
Sound Basics

Decibel
•  Bel (Sound Pressure Level)
•  dB (1/10 Bel) logarithmic scale
•  0 dB Arbitrary start
  o  0 The softest sound a person can hear with normal hearing
  o  10 normal breathing
  o  20 whispering at 5 feet
  o  30 soft whisper
  o  50 rainfall
  o  60 normal conversation
  o  Over 85: harm over time
  o  110 shouting in ear
  o  120 thunder
  o  140 Damage
  o  Voice Recording -12 to -6
  o  Music Recording -6 to 0
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- Bit = Binary Digit
  - 8 Bits = 1 Byte
  - 1000 Bytes = 1 Kilobyte
  - 1000 Kilobytes = 1 Megabyte
  - 1000 Megabytes = 1 Gigabyte
  - 1000 Gigabytes = 1 Terabyte
  - 1000 Terabytes = 1 Petabyte

- CD Size: 74 minute/650 MB (12 cm),
- DVD+RW and DVD-RAM discs come in 4.7 GB single and 9.4 GB double-sided (12 cm)
- 44.1 kHz /16 bit depth will run 10MB per minute: (uncompressed)
Sound Basics

File Format

• **Uncompressed (lossless)**
  - WAV, AIFF
  - Archive and Preservation

• **Compressed or down-sampled formats**
  - MP3, MP4, Real Audio, Windows Media, Apple AAC (lossy)
  - WMA vs MP3 (Voice or Music)
Sound Basics

Microphones
- Most important purchase
- Never built in or handheld
- Placement key
- Lapel microphone
- Tell shop you are doing voice over music
Sound Basics

Microphones

- Frequency Response (20 hz to 20 kHz)
- Max SPL 130-148 dB
- SNR 75 – 80 db (Usual home one 20 db) (Signal strength relative to background noise)
- Equivalent Noise 10-20 dB (lower the better) (how noisy microphone itself is)