Digital Preservation: Audio and Video Formats
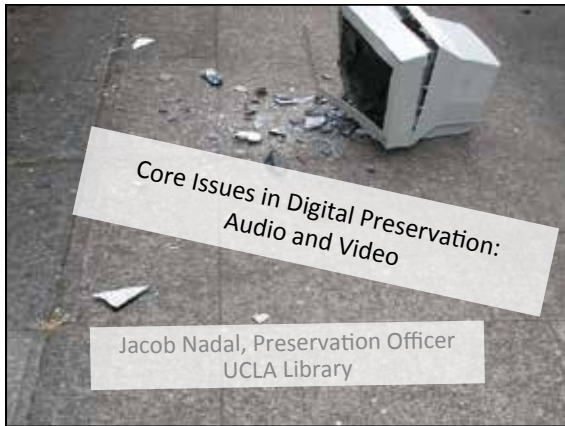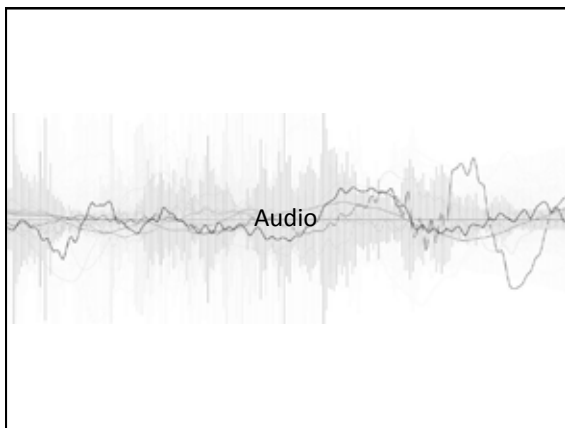
Core Issues in Digital Preservation:
Audio and Video

Jacob Nadal, Preservation Officer
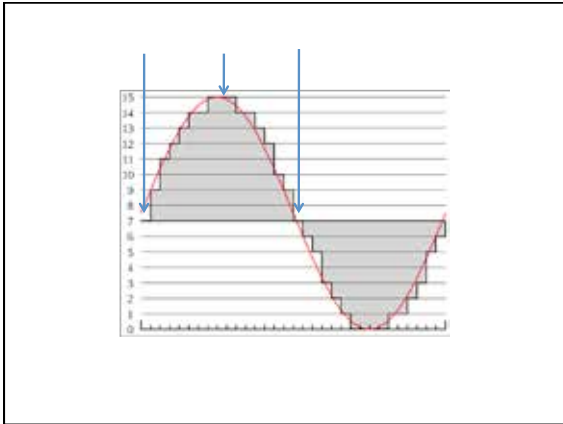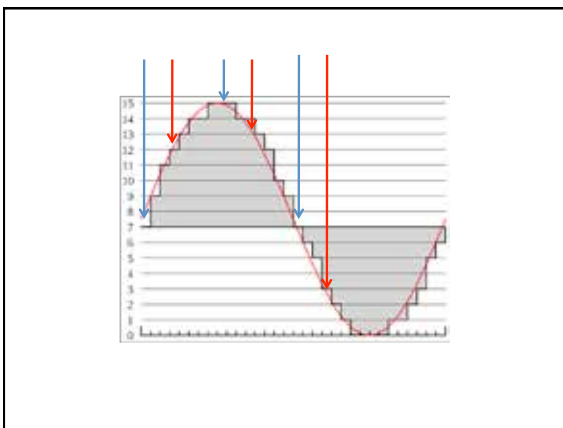UCLA Library

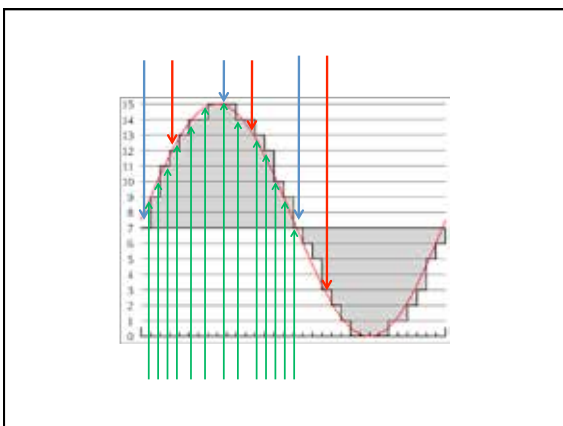---

Audio

Audio

- Core of Audio Preservation Formats:
  Uncompressed Linear Pulse Code Modulation
  (PCM)
- PCM was developed by Alec Reeves in 1937
- Basically, takes a sample of the sound wave at
  regular points
  - Quantization errors: when the sampling misses parts
    of the signal
  - Clock errors: the time drifts and distorts the sample

Digital Preservation: Audio and Video Formats

Digital Preservation: Audio and Video Formats

Audio

- WAVE (.wav) format is the norm for digital audio preservation
- Broadcast WAVE (.bwf) standard flavor of .wav for audio preservation
  - BWF is a WAV file plus *a header with metadata*
  - Metadata facilitates file editing and identification
  - "Catastrophe Metadata" for basic ID, not full descriptive metadata
  - Some tools are better (or worse) about respecting metadata headers: *ask questions*

Digital Preservation: Audio and Video Formats

Other formats

- Real Audio, Quicktime (a wrapper for other audio), Windows Media, MP3, etc.
- Similar problem to images formats – useful for delivery today, but compression, intellectual property, proprietary formats, etc., make for preservation problems
  - There are some open, lossless formats that are technically fine, but poorly supported. WAV is open and widely used.

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What's in an audio file

- Waveforms, one per channel.
  - Mono = 1, Stereo = 2, 5.1 = 6 channels
- Perhaps some metadata, in BWF especially
- A WAV file can hold up to 4.1 GB of data; W64, lots more.

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Resolution

- CD audio is 44.1 kHz (44,100 samples per second)
- Most digital preservation engineers favor 96 kHz
  - Extra sampling capacity helps avoid errors, provides finer reproduction of sound

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Digital Preservation: Audio and Video Formats

Bit Depth

- CD audio is 16-bit, which allows up to 65,536 levels of amplitude, between 0-96dB
- 24-bit audio has a theoretical maximum of 16.7 million levels from 0-144 dB
  - Current digital audio converters are limited to ~120 dB because of practical limits on integrated circuit design
- 96khz/24-bit surpasses limits of *human* hearing
  - Some signals encode data not meant for humans
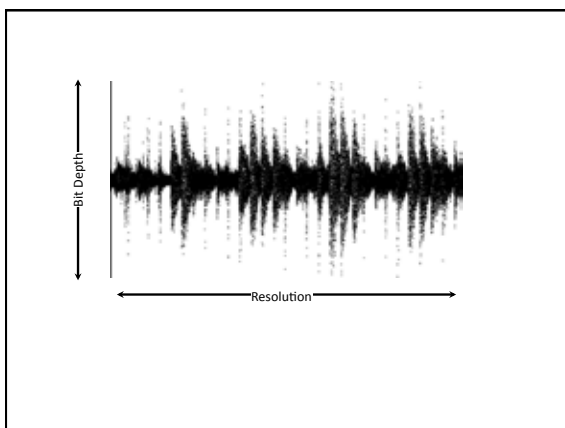
Bit Depth

Resolution

Video & Moving Image

Digital Preservation: Audio and Video Formats

Moving Image & Video

- Emergent areas in digital preservation
- Today: touch on the highlights, brief survey of problems, and some context
- Consider this a basic education prior to:
  - Seeking further help
  - Migrating lots of video data in the near future
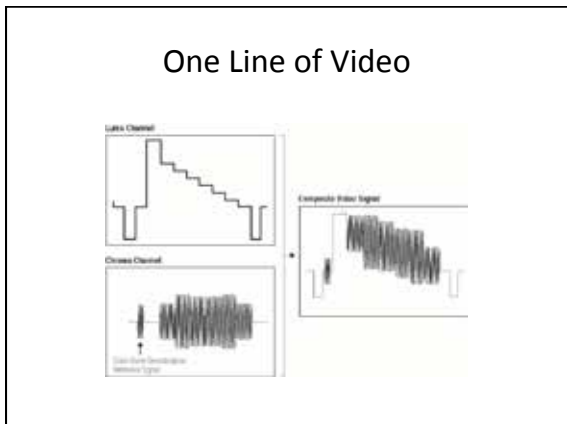
Moving Images (Film)

- Sequence of images
  - Bit depth and resolution
  - Frames per second
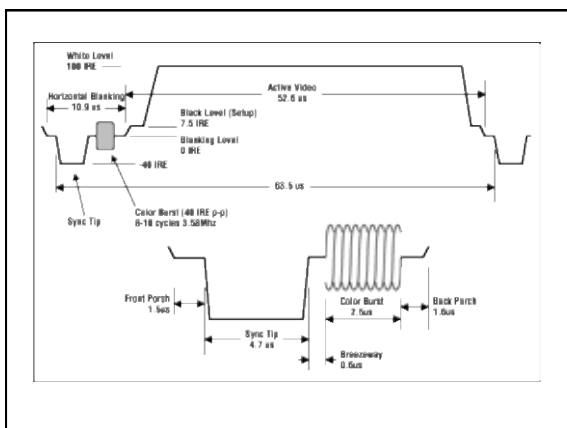- Audio data (visual waveforms printed onto the film)
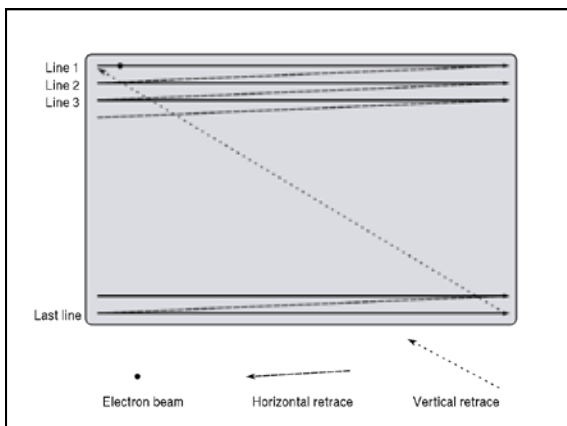
Moving Images (Video)

- Video is a way of recording image and audio electronically
- Video has a specific resolution derived from a fixed number of scan lines
- 720x480i60 from 486 scan lines is SECAM standard
  - 720x480 are picture dimensions
  - i60 indicates interlacing
  - 6 lines for (graphical, not textual) metadata

Digital Preservation: Audio and Video Formats

One Line of Video

Digital Preservation: Audio and Video Formats

Video Color: YUV

Three Channels:
Luminance (Y) and 2 types of Chroma:
Red minus Luminance (U, or R-Y)
Blue minus Luminance (U, or B-y)

Sampling Video requires capturing 4 levels of Luminance info and some degree of color information, usually 2 levels each.

Standard is for video is 10-bit (of digital color), Uncompressed (no compression in the file), 4:2:2 (sampled from the source using all the Luminance and Chroma information).

.AVI or .MOV are both used.

JPEG 2000 is in use by Library of Congress, but very few others. Compatibility and authoring tools are obstacles for JP2K.

4 Luminance Pixels, then 1, 2, or 4 Red-Luminance (R-Y) or Blue-Liminance (B-Y)

Digital Video (Masters)

- Standards and practices developing
  – Uncompressed desirable, but high storage costs
  – Compression is normal in video, but may cause preservation problems
- Uncompressed .AVI is the current safe bet
  – Motion JP2K & MPEG21 may be options
- Pick one, but plan on a migration

Digital Preservation: Audio and Video Formats

Digital Video (Delivery)

- H.264 is standard
  - Often delivered via Flash Video (FLV)
- Several more-or-less proprietary options (Quicktime, Real, Windows Media)
- HTML 5 is emerging video delivery platform
- Pick one, but plan on a migration

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AUDIO AND VIDEO Q&A

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