

The Significant Properties of Moving Images

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System Simulation

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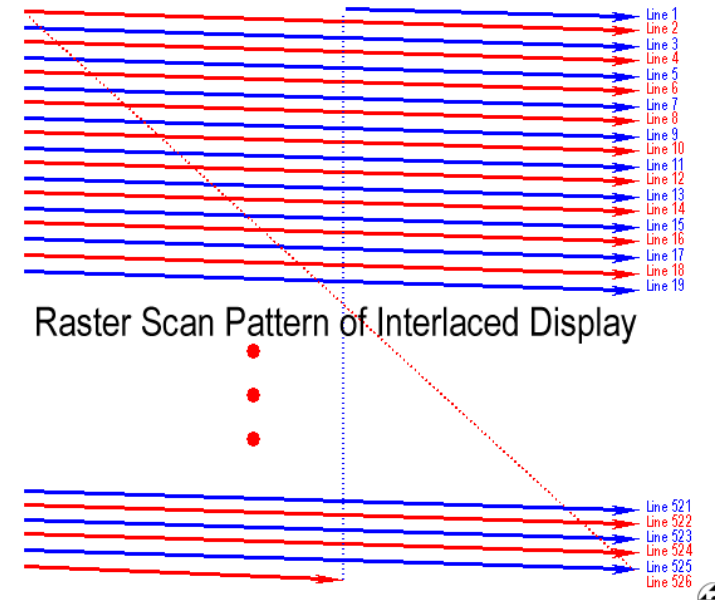
JISC/BL/DPC workshop 7 April 2008

Main sources of moving images

Film



Video



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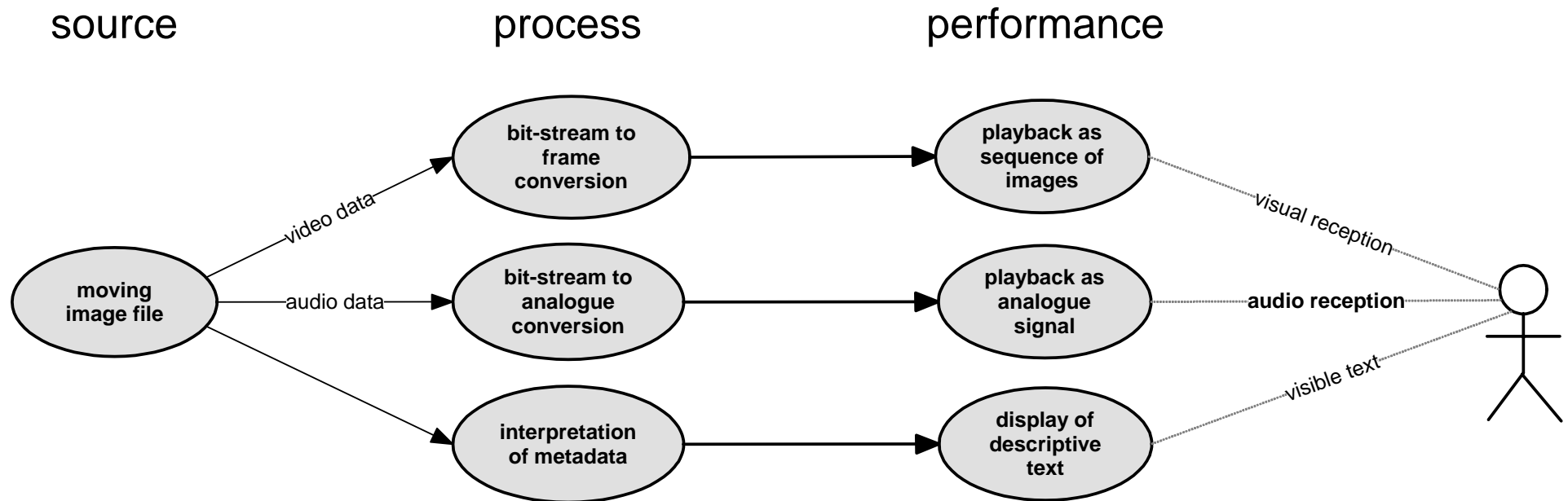
Born digital



Exciting times

- Consumer video is increasingly digital
- Broadcasters are switching to digital transmissions
- Moving image production and post-production moving from film to digital techniques
- Digital formats increasing used for theatrical distribution
- Increasing use of moving images in today's society
- All video tape is deteriorating rapidly

InSPECT: Performance Model, Taxonomy



Taxonomy of properties relevant to authenticity:

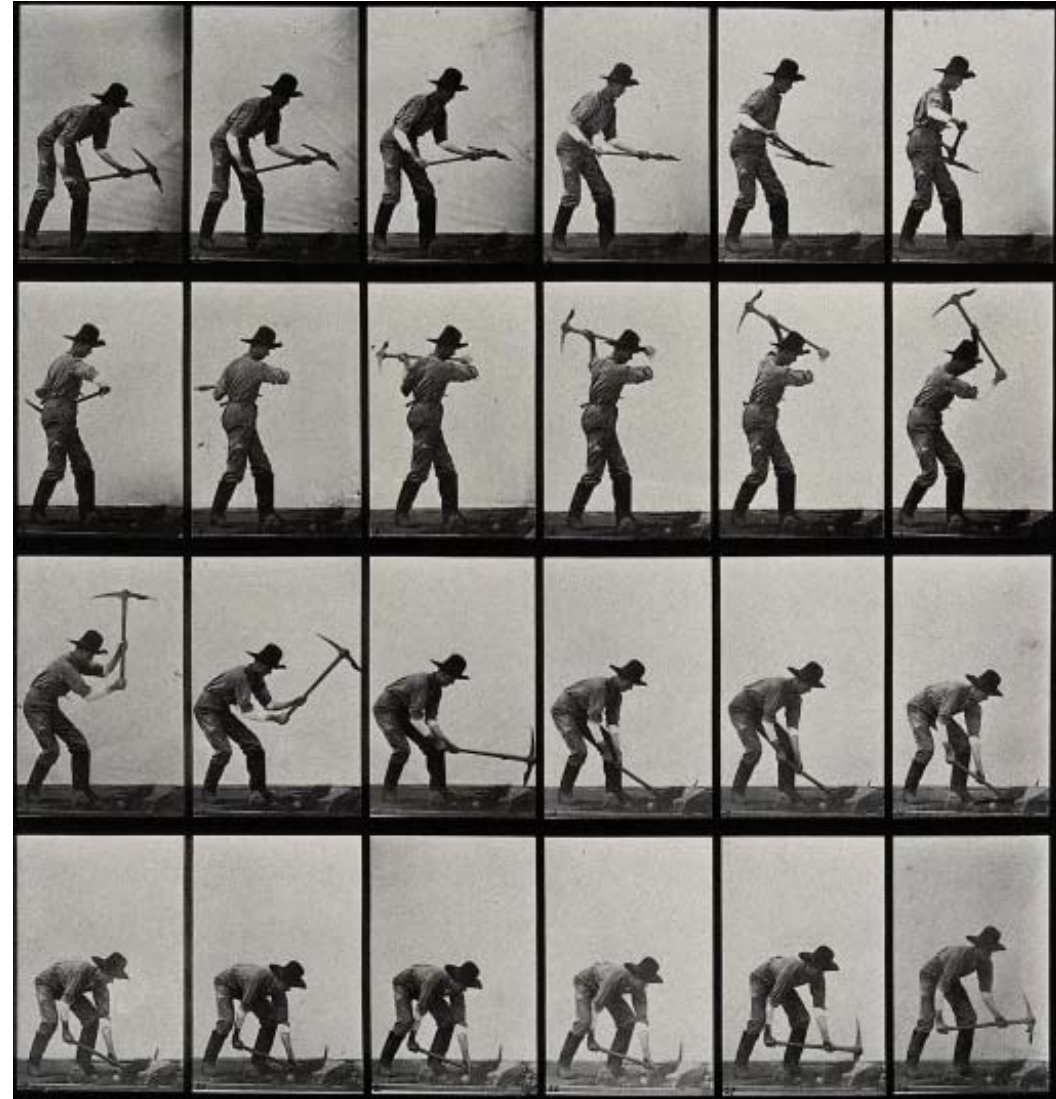
- Content – the “stuff”
- Context – the circumstances round the creation of the content
- Rendering – the information that drives the process
- Structure – relationship between elements of the content
- Behaviour – interaction between the content and stimuli

Characterised as a sequence of images

Properties of moving images

- Rendered as a sequence of frames
- Properties of the individual frames
- Frame rate

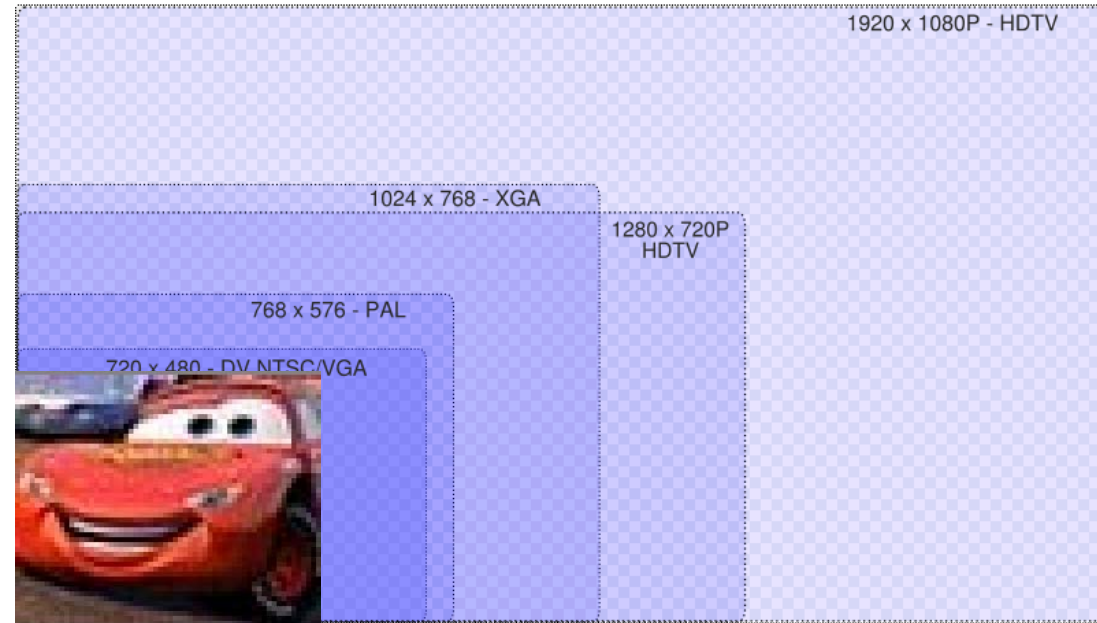
Does anything else emerge in the performance?



Properties of the frame

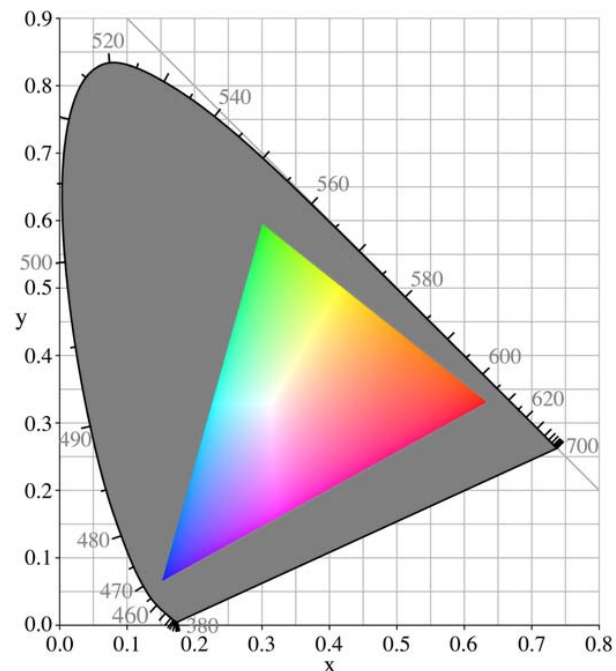
A rectangular array of pixels

- Width
- Height
- Bit-depth
- Pixel aspect ratio



Gamut

- Colour model
- Colour space



Properties of the sequence

Images

- Frame rate eg
- speed
- look

23.97 fps

24 fps

25 fps

30 (29.97) fps

Structure - the relationship between

- Images
- Audio
- Metadata



The tyranny of data rates

What you need:

- Serial Digital Interface: 4000 Mbit/s
- Uncompressed SD TV: 270 Mbit/s

What you've got:

- LAN ~600 Mbit/s
- USB-2 480 Mbit/s
- DVD 11 Mbit/s
- Digital Terrestrial ~6 Mbit/s
- ADSL ~1 Mbit/s
- MPEG-1 (VHS quality) ~1 Mbit/s

Compression

Lossless:

- Limited reduction in size
- No data loss
- No reduction in clarity of the image

Lossy:

- Significant reductions in size
- Attendant reduction in clarity

Encoding

Codec

- Encodes video signal for transmission or storage
- Decodes bit-stream for display

Compression ratio

- Measures data discarded
- Bit rate can be variable

Quality metrics - clarity

- subjective
- objective

Encoding “freezes” the rendering SPs

Interlaced and progressive scan

Interlaced scan

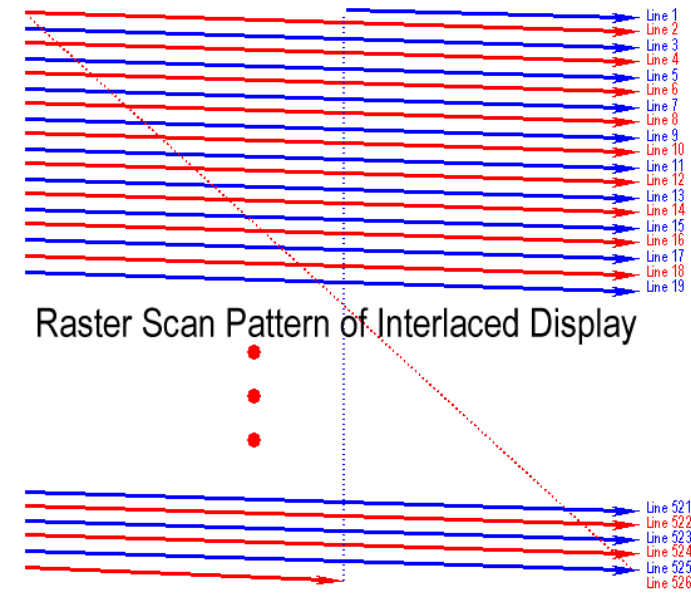
Progressive scan

De-interlacing

- Merges fields
- Adjacent scan lines were recorded 50th second apart in time
- Annoying effects with rapidly moving subjects

Future technologies may not support interlace

Record scan type of source as metadata



Raster Scan Pattern of Interlaced Display

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OAIS Reference Model

Framework for discussing archival concepts

Open Archival Information System

SIP: Submission Information Package

AIP: Archival Information Package

DIP: Dissemination Information Package

Significant Properties inform the discussion

Significant properties

Size:

- Height, Width, Bit-depth, Pixel aspect ratio

Colour:

- Colour space

Sequence:

- Frame rate

Clarity:

- Compression ratio
- Codec
- Scan type of source

Formats

Encoding - encode the bit-stream for storage or transmission

- eg: DV, H.264 (MPEG-4 AVC), DPX, JPEG2000

Wrapper - encapsulate multiple bit-streams, different encodings, additional metadata

- eg: AVI, MXF, QuickTime

Bundling - containers for multiple files and metadata:

- eg: MXF, METS, MPEG-21

Submission Information Package

If you have a choice:

- Larger image size
- Higher bit-depth
- Larger gamut
- Low compression ratio, if lossy
- High frame rate (if video)

- Digitise film directly, not via video

Archival Information Package

Preservation strategies:

- Bitstream preservation
- Technology preservation (interlace)
- Migration
- Emulation (interlace?)

Migration to new formats

- Transcoding
- Lossless compression
- eg JPEG2000 encode frames in MXF wrapper

May not be usable for delivery

Dissemination Information Package

Dictated by:

- Available data rates for delivery
- Available technology

Technology will change

Expectations may conflict:

- Ease of access v Clarity

Expectations will rise

SIP, AIP, DIP revisited

Take the hit once:

- Migrate SIP to AIP with lossless encoding once (possibly delayed)
- Thereafter lossless migration to future AIPs

If you are not ready for this, make the best of what you've got:

- The SIP may not be suitable for a AIP (lossy compression)
- The SIP may be suitable for a DIP
- Preserve the SIP (Bit-stream preservation)
- Deliver DIPs based on SIP
- Monitor the expected life of the SIP encoding

Significant properties

Size:

- Height, Width, Bit-depth, Pixel aspect ratio

Colour:

- Colour space

Sequence:

- Frame rate

Clarity:

- Compression ratio
- Codec
- Scan type of source





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