

The Significant Properties of Moving Images

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System Simulation

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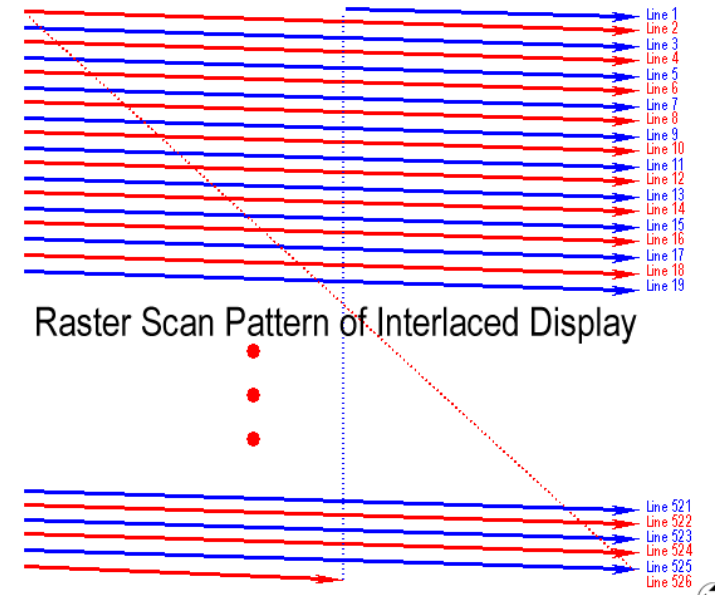
JISC/BL/DPC workshop 7 April 2008

Main sources of moving images

Film



Video



escience.anu.deu.au

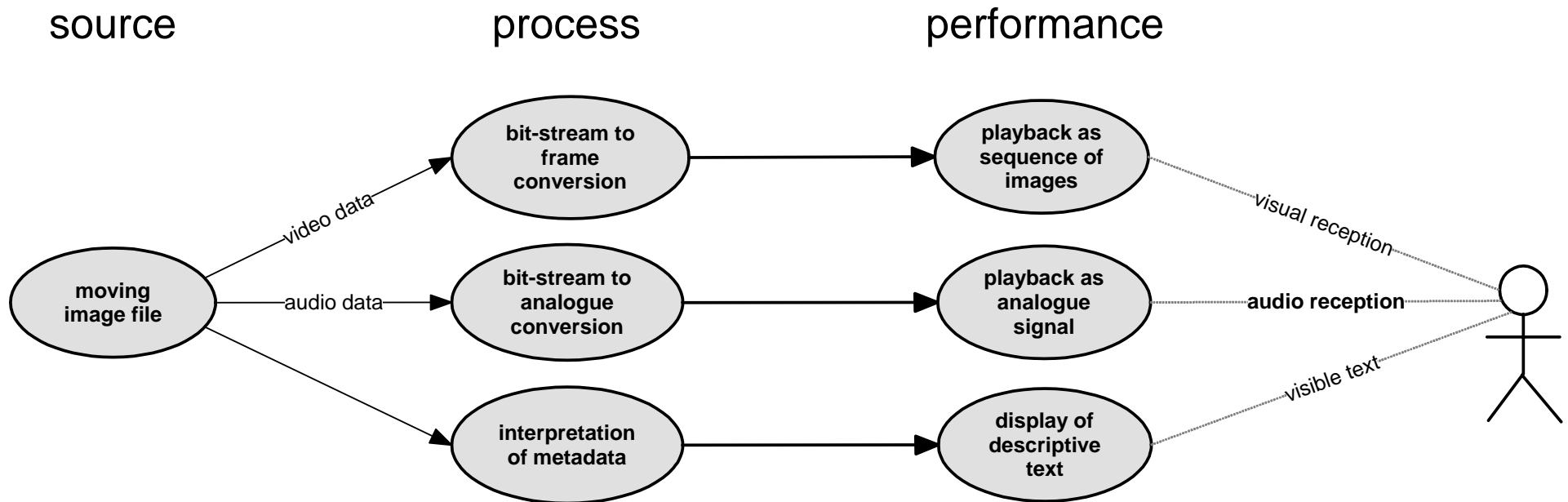
Born digital



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:

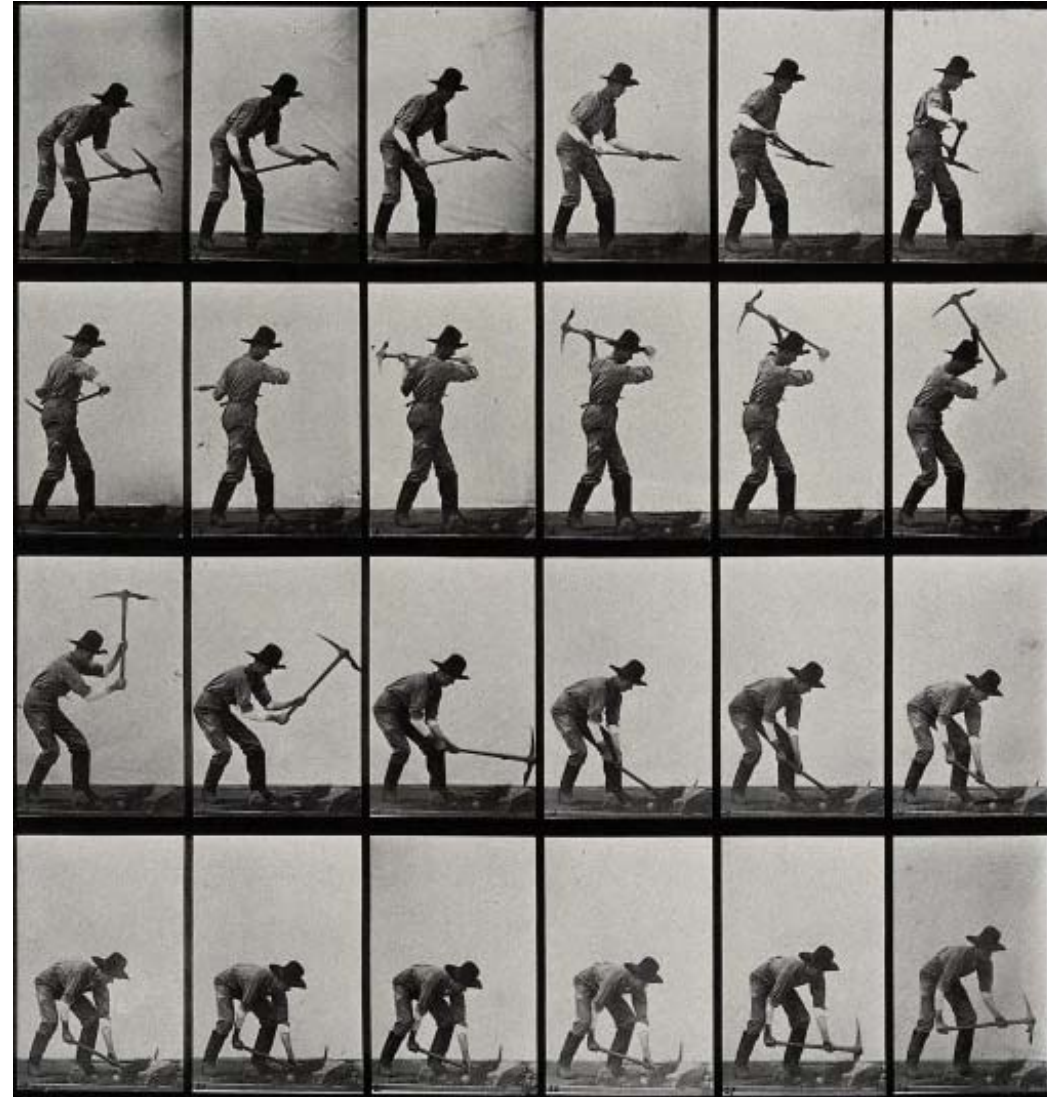
- Content – the “stuff”
- Context – the circumstances round the creation of the content
- Rendering – the information that drives the process
- Structure – relationship between elements of the content
- Behaviour – interaction between the content and stimuli

Characterised as a sequence of images

Properties of moving images

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

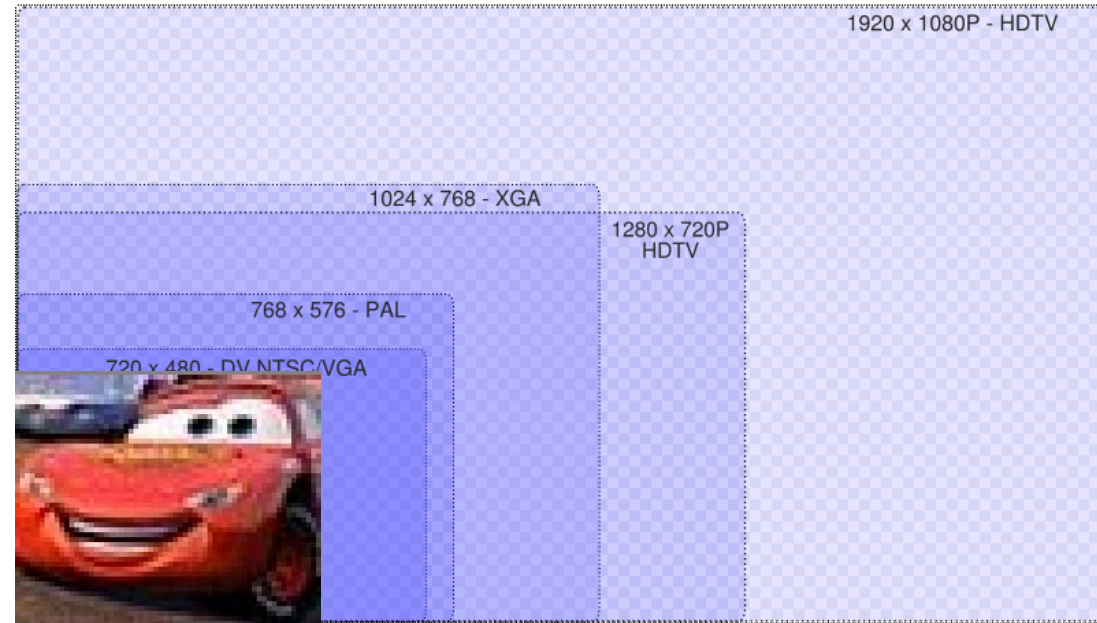
Does anything else emerge in the performance?



Properties of the frame

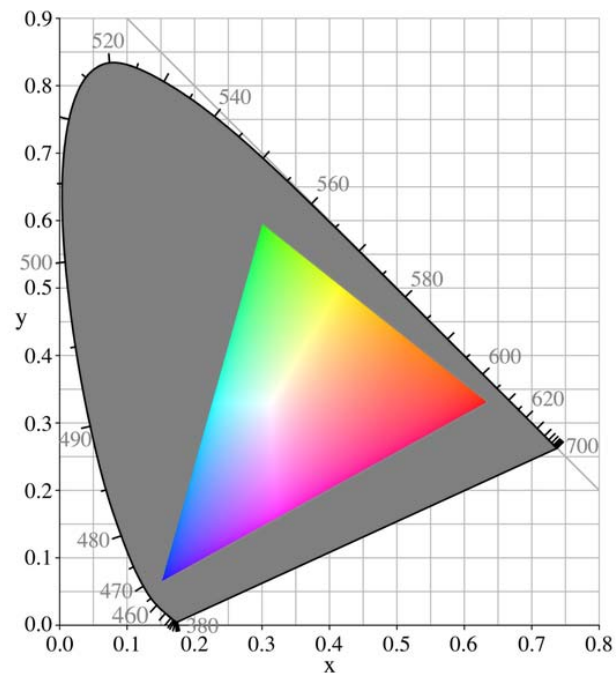
A rectangular array of pixels

- 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

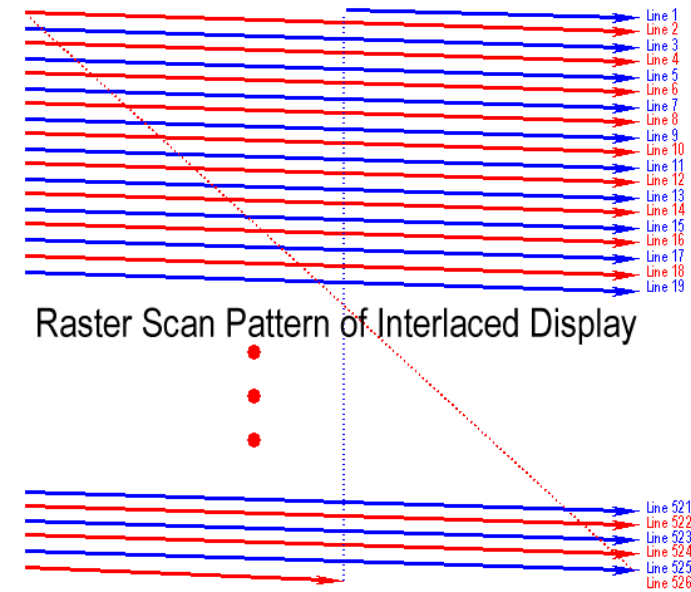
Progressive scan

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



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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