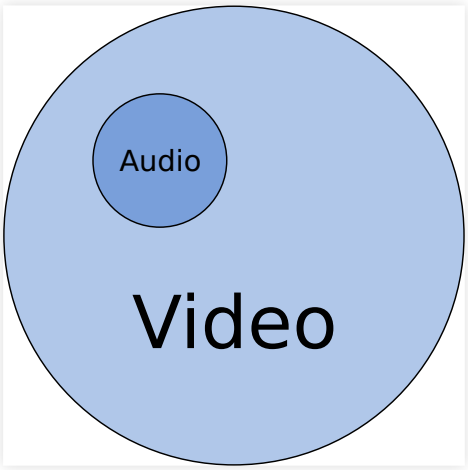
Digital Audiovisual Properties Advanced

Peter Bubestinger-Steindl
(p.bubestinger@av-rd.com)

March 2019

Audio vs. Video



Speaker notes

Audio benötigt nicht nur wesentlich weniger Speicherplatz als Video, sondern ist im Allgemeinen auch einfacher. Abgesehen davon, ist Ton Teil des Videos - und somit sind bei Videodigitalisierung immer die Eigenschaften beider Formate zu berücksichtigen.

Aspect Ratio

> *Most people only mean/know the "**Display Aspect Ratio**" (DAR).*

- 4:3
- 16:9
- 5:4

DAR... SAR? PAR!

- DAR: **Display** Aspect Ratio
- SAR: **Storage** Aspect Ratio
- PAR: **Pixel** Aspect Ratio

DAR... SAR? PAR!

- DAR: **Display** Aspect Ratio
- SAR: **Storage** Aspect Ratio
- PAR: **Pixel** Aspect Ratio

Formula: DAR = SAR x PAR

Letterbox

Pillarbox

Windowbox

Anamorphic Video

Format	DAR	SAR	Resolution
Digibeta	16:9	5:4	720 x 576
HDV	16:9	4:3	1440 x 1080

Speaker notes

Use VLC’s key “A” to switch DAR on-the-fly during playback.

Good to know

DVD SAR = 5:4
So 16:9 is either letterboxed or anamorphic.

HD is always DAR=16:9
4:3 in HD is impossible without editing.

Links

- Aspect Ratio (image) [Wikipedia]
- Pixel Aspect Ratio [Wikipedia]

Interlacing

- 2 fields in one frame
- Field: half of vertical resolution
- Field: twice the time resolution

Top Field

Bottom Field

Links

- Wikipedia: “Interlaced Video”
- Videolan Wiki: “Deinterlacing”
- 100fps.org: “What is Deinterlacing? Facts, solutions, examples.”
- Lair Of The Multimedia Guru: “Deinterlacing filters”

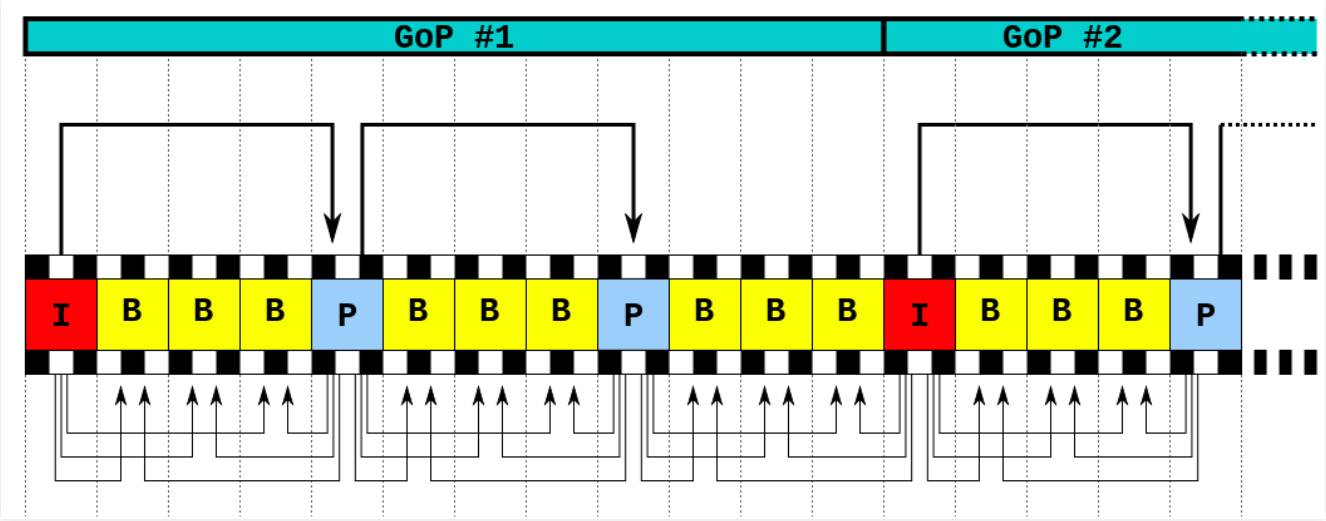
GOP: Group Of Pictures

The GOP is a group of pictures in a video that are depending on each other.

GOP Frametypes

- **[I]**ntra:
  Independently encoded single frame (aka “keyframe”)
- **[P]**redictive-coded:
  Difference-informations to previous I- or P-Frame.
- **[B]**idirectional predictive-coded:
  Difference-informations to previous *and/or subsequent* I- or P-Frame.

GOP Dependencies



GOP and Recording

- Recording *should* be done with GOP=1.
- This means:
  only I-Frames (=no dependencies between frames).

GOP and Editing

- With GOP = 1: No issues.
- With GOP > 1: Watch out!

btw: Some (but not all) video editing programs are able to perform “GOP-aware” cuts

Links

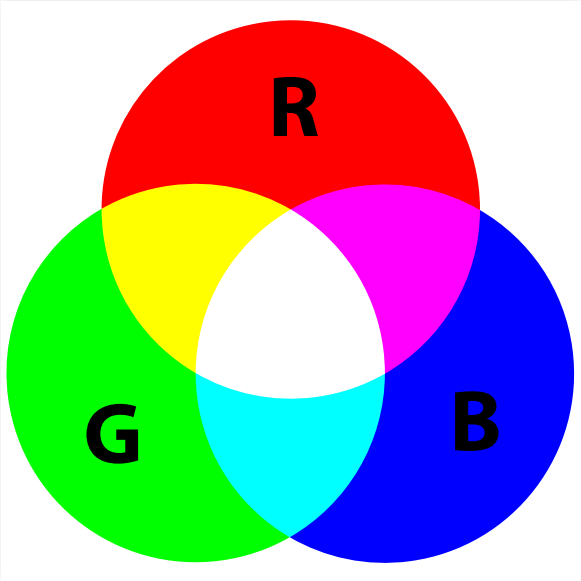
- Wikipedia: “Group of Pictures”

Color models

- RGB (Red-Green-Blue)
- YUV (Luma/Chroma)

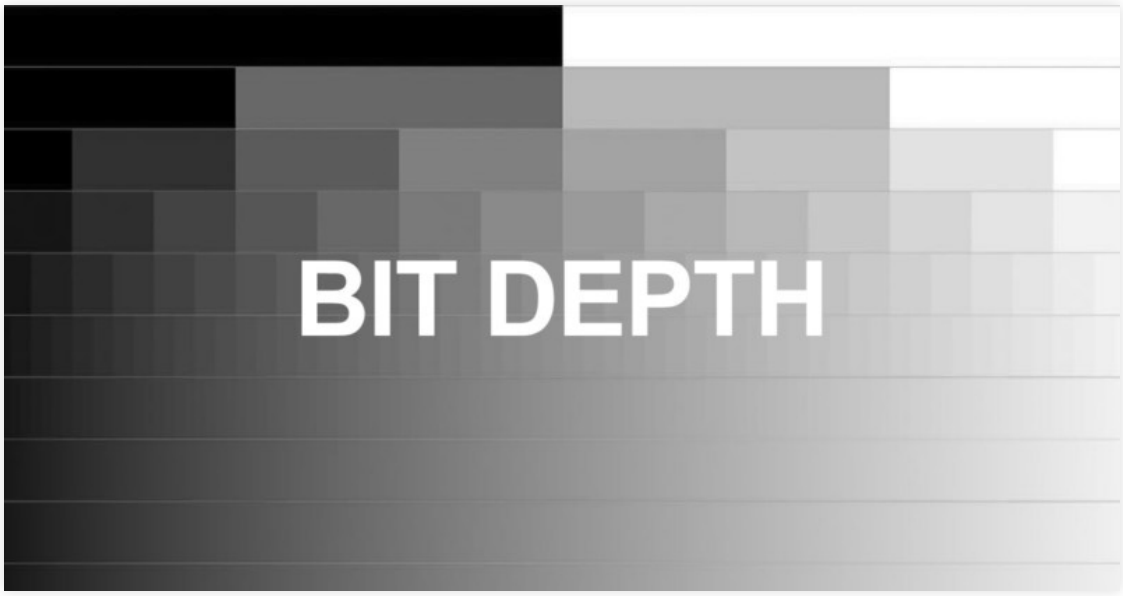
Note: Those are just 2 for video. There are more…

Color Model: RGB



Color Model: YUV

Bits Per Component/Sample



Color Components

- **RGB:**
  Red, Green, Blue
- **YUV:**
  Y', Cb, Cr

Bits Per Component/Sample

BPC	Gray shades	Pixel	Byte(s)
8	2^8 = [0..255]	24 Bits	3 Bytes
10	2^10 = [0..1023]	30 Bits	6|4 Bytes
16	2^16 = [0..65535]	48 Bits	6 Bytes

Chroma Subsampling

The color information in YUV is stored in a reduced resolution.

This principle originates from analog transmission and was kept in digital, because it allows smaller data sizes.

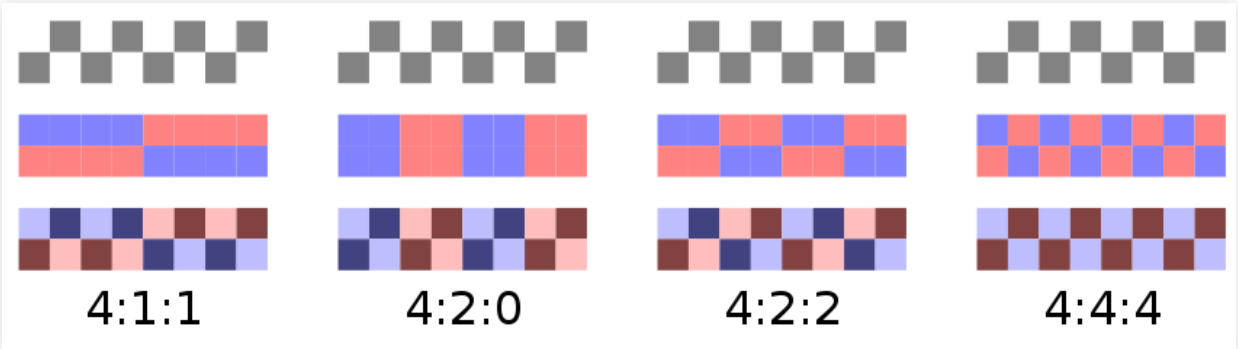
“J:a:b” Notation

J: Horiz. sampling reference (usually “4”).

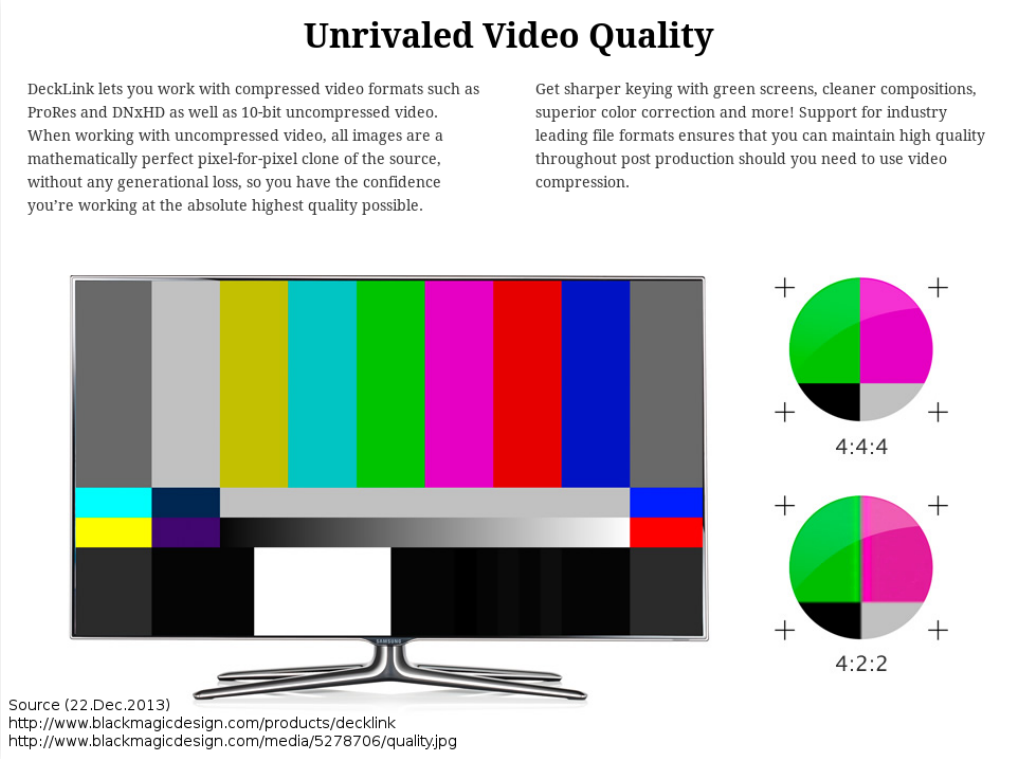
a: Number of color samples in 1st row of J pixels.

b: Number of change in color samples between 1st / 2nd row of J pixels.

Chroma Subsampling



Confusion / FUD?



Speaker notes

Even vendors of professional applications/hardware promote with the confusion/misunderstanding that “compression is always lossy”.

Example: On Blackmagic website, they say “quality loss through compression”. But in their image example for this, they actually show quality loss through color subsampling…

Diskspace

BPC	Subsampling	Diskspace
8	4:2:2	1.16 / 1.74 GB
10	4:2:2	1.45 / 2.17 GB
16	4:2:2	2.32 / 3.48 GB

Speaker notes

Diskspace: The left number is with 4:2:2 subsampling, whereas the right number (=larger) is without subsampling.

For example:

- 8 BPC:
  - 4:2:2 = 16 BitsPerPixel
  - 4:4:4 = 24 BitsPerPixel

Formula for GB/Min (PAL SD, 8BPC):

- Width * Height * FPS * BPP * SecondsPerMinute / BitsPerByte / BytePerKB / BytePerMB / BytePerGB
- 720 * 576 * 25 * 16 * 60 / 8 / 1024 / 1024 / 1024

Links

- Wikipedia: “Chroma subsampling”
- Wikipedia: “YCbCr”
- Wikipedia “RGB color model”