

DISSECTING THE FROG

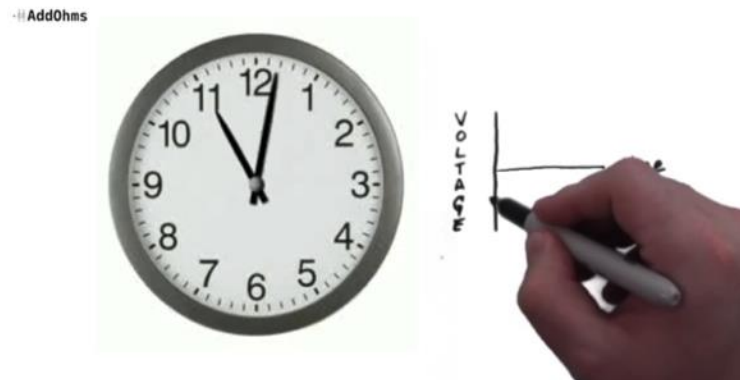
What defines the digital image?



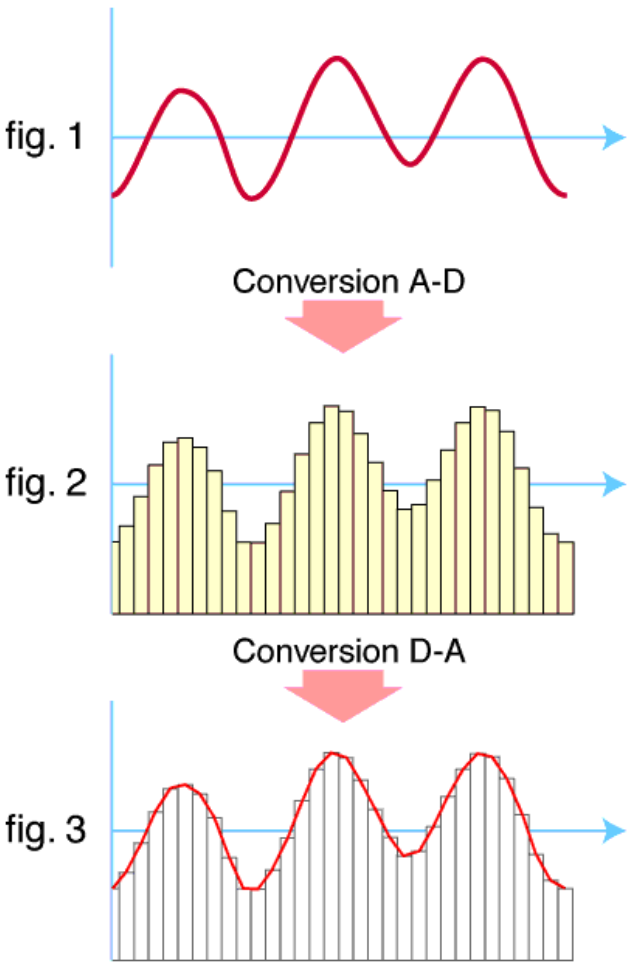
Analog vs Digital



<https://www.youtube.com/watch?v=yfyAen-bJS8>



<https://www.youtube.com/watch?v=WxJKXGugfh8>



DIGITAL IMAGE


A **digital image** is a numeric representation (normally binary) of a two-dimensional image.

Depending on whether the image resolution is fixed, it may be of vector or raster type. By itself, the term "digital image" usually refers to raster images or bitmapped images.


http://en.wikipedia.org/wiki/Digital_image

BITS AND BYTES

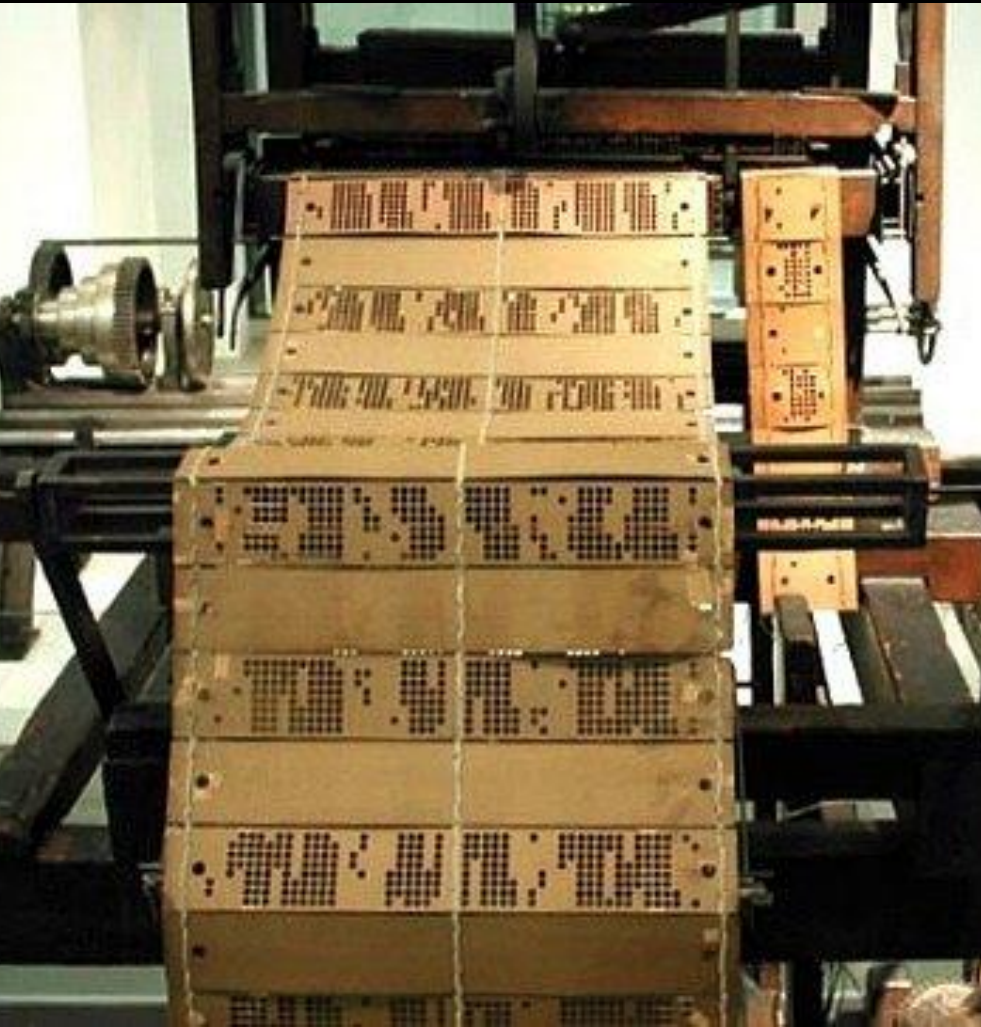
A byte is a group of bits, forming a ‘word’.

bit¹
/bɪt/ 
noun

1. a small piece, part, or quantity of something.
"give the duck a bit of bread"
synonyms: [small portion](#), [small piece](#), [piece](#), [portion](#), [segment](#), [section](#), [part](#), [More](#)
2. *informal*
a set of actions or ideas associated with a specific group or activity.
"Miranda could go off and do her theatrical bit"



<https://www.youtube.com/watch?v=AdF2uk-EscE>



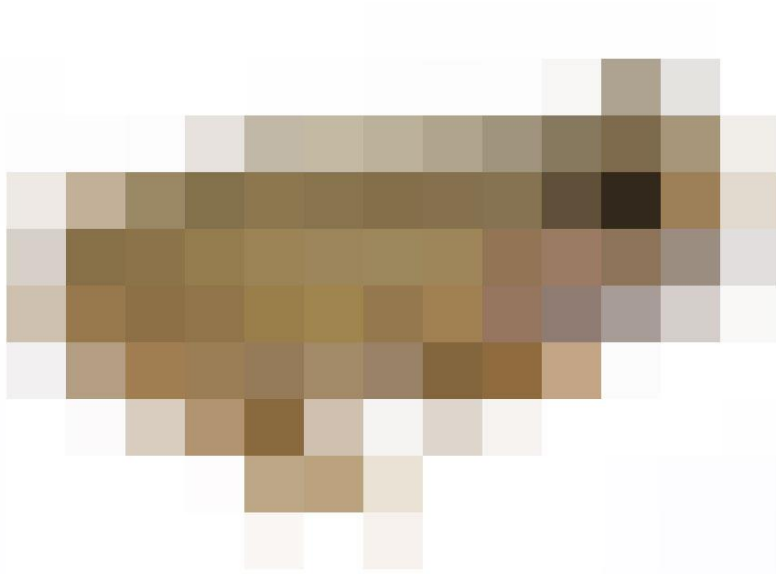
PIXEL

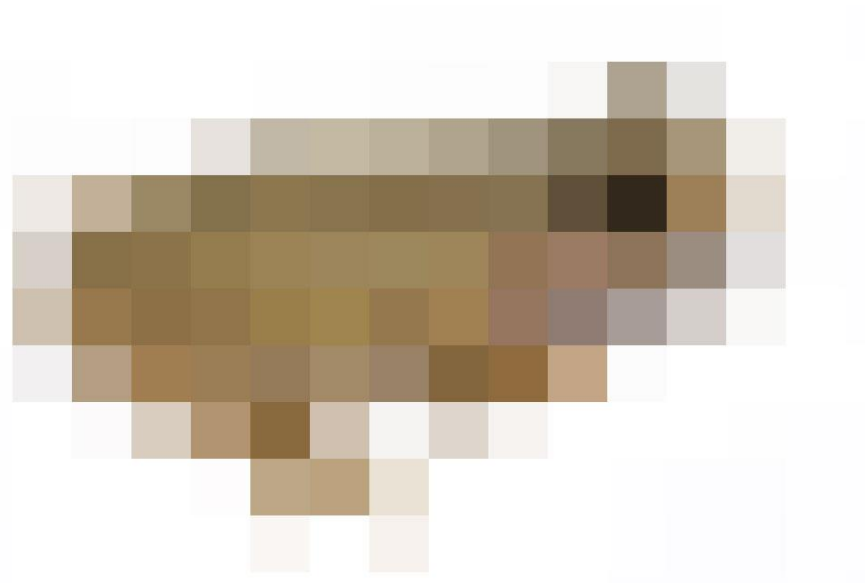
(Picture – element)

The smallest element in a digital image.

As opposed to for instance silver particles in film emulsion.

“There is no picture if there is no grain.”





PIXEL DIMENSIONS

Image resolution describes the detail an image holds.

Photocameras are often described in MP.

Video: PAL, NTSC, HD

Resolution vs. pixel size

DPI vs. PPI

4K DCI (4096x2160)

2K DCI (2048x1080)

1080p/i ATSC/DVB (1920x1080)

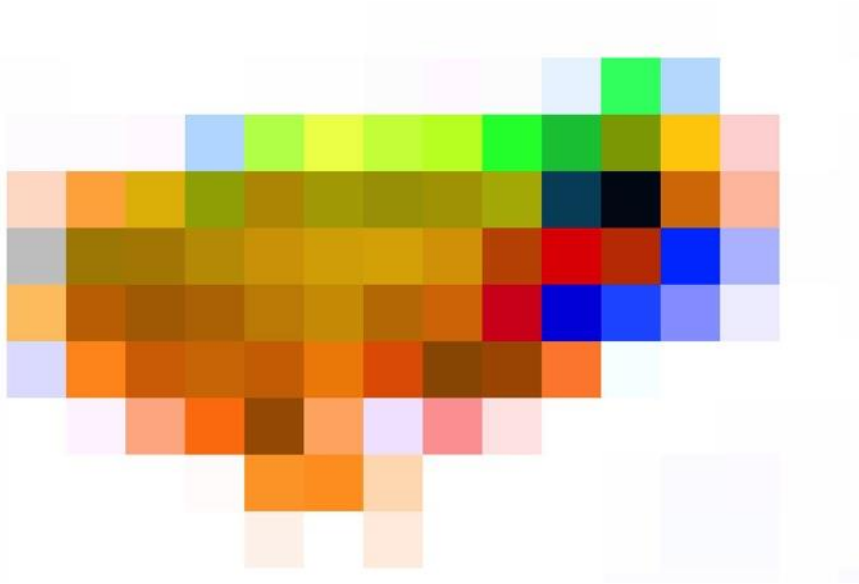
720p ATSC/DVB (1280x720)

576p/i PAL (720x576)

480p/i NTSC (720x480)

COLOUR (or color)

Every pixel has a value describing the colour.



BIT DEPTH

(colour precision)

The number of bits used to represent the color of a single pixel.



1-bit per pixel (2 colors)

BIT DEPTH

(colour precision)

The number of bits used to represent the color of a single pixel.



4-bit per pixel (16 colors)

BIT DEPTH

(colour precision)

The number of bits used to represent the color of a single pixel.



8-bit per pixel (256 colors)

BIT DEPTH



8-bit per pixel (values from 0 to 255)



4-bit per pixel (values from 0 to 15)

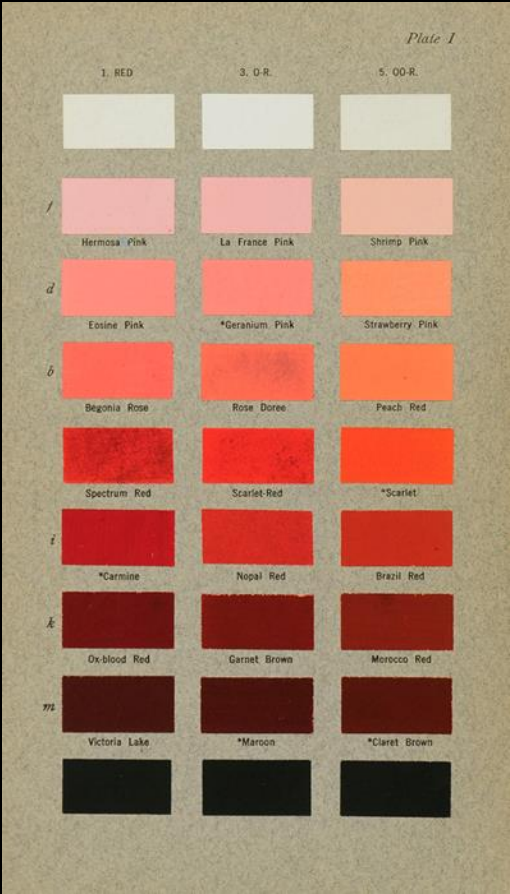
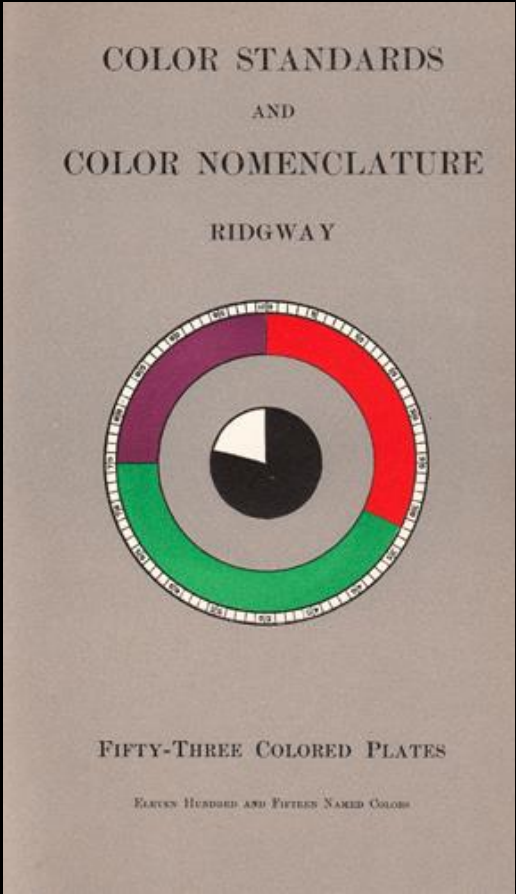


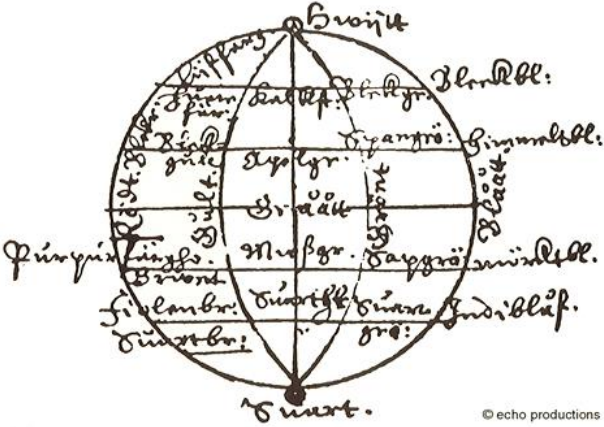
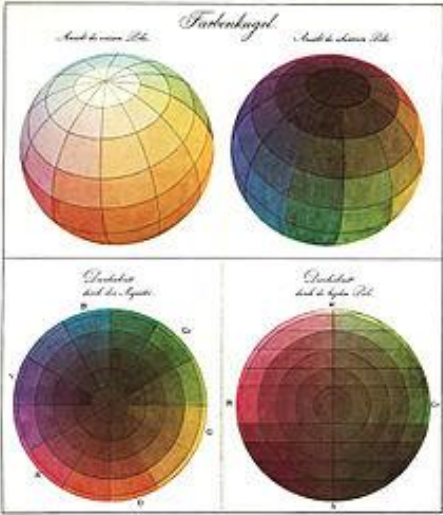
1-bit per pixel (values from 0 to 1)

COLOUR

How do we describe colour?

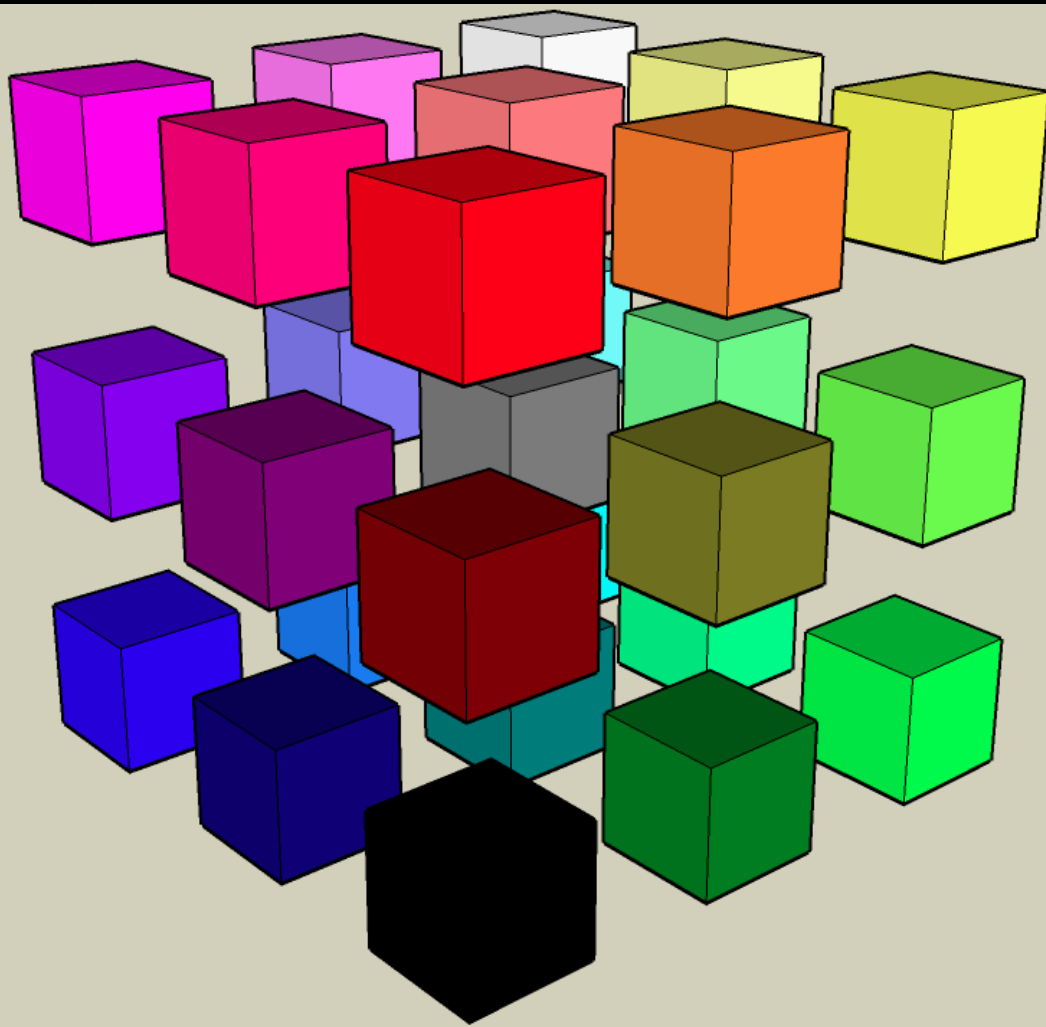


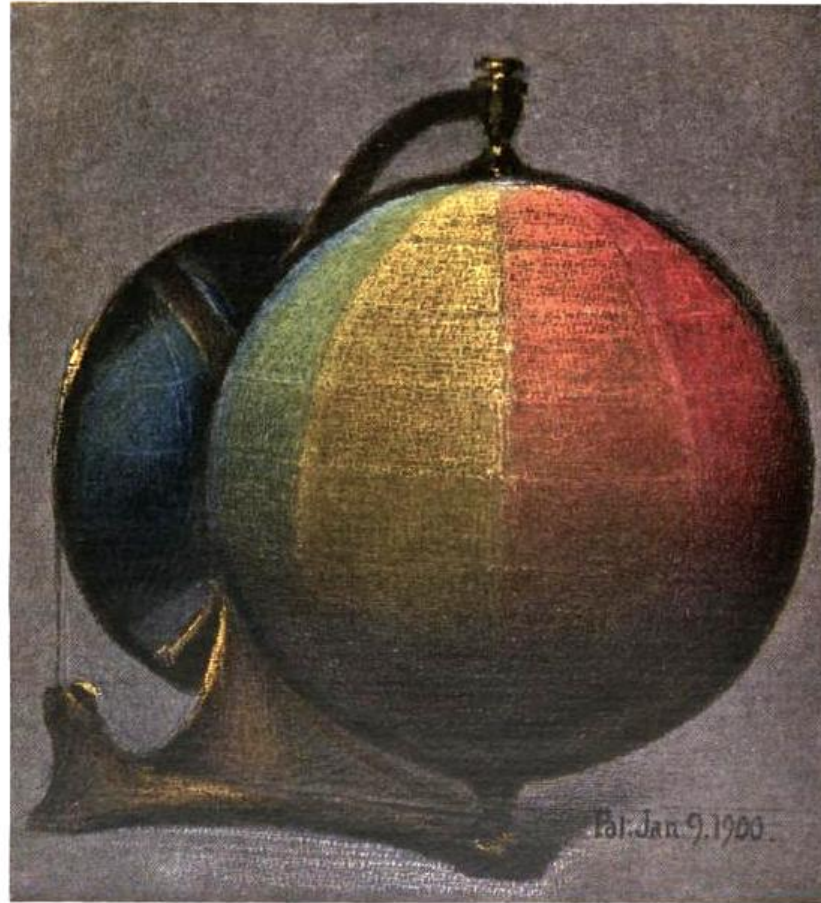




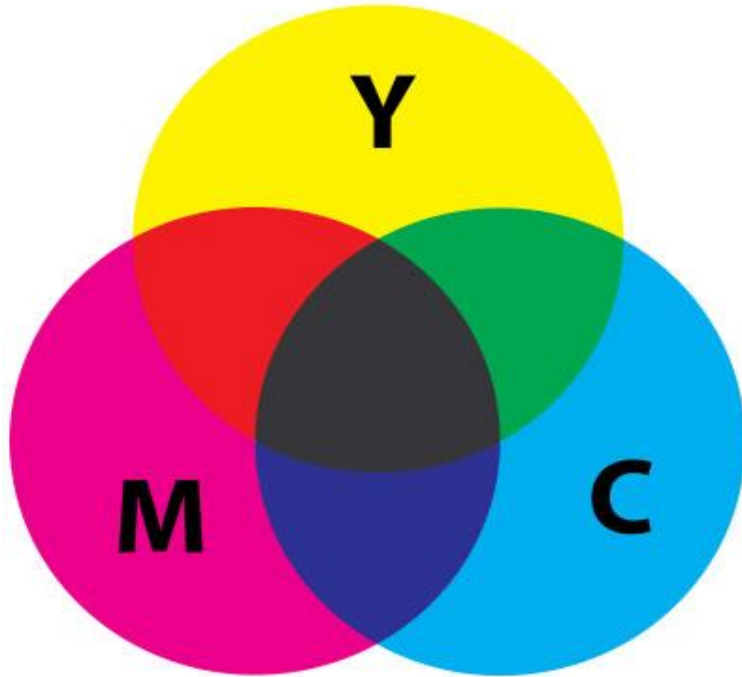
© echo productions







A BALANCED COLOR SPHERE



Subtractive colour

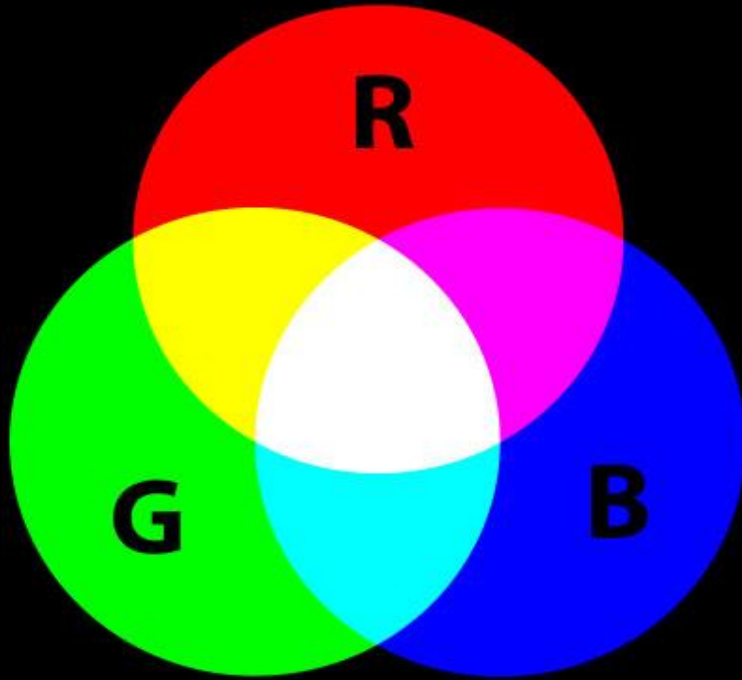
The primary colors define the amount of colours possible.

For a long time the only way to mix colours has been using paints, inks and dyes.

We call this subtractive colour mixing.

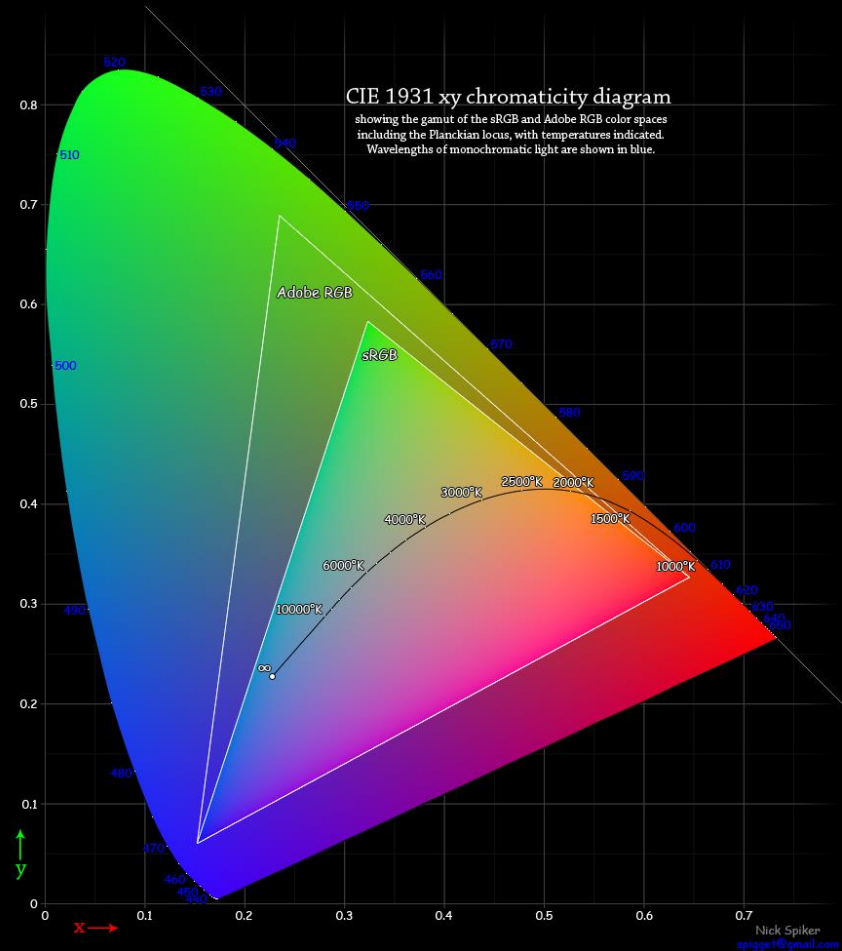
Examples: print, painting, the first colour photography.

Additive colour



The primary colours define the amount of colors possible.

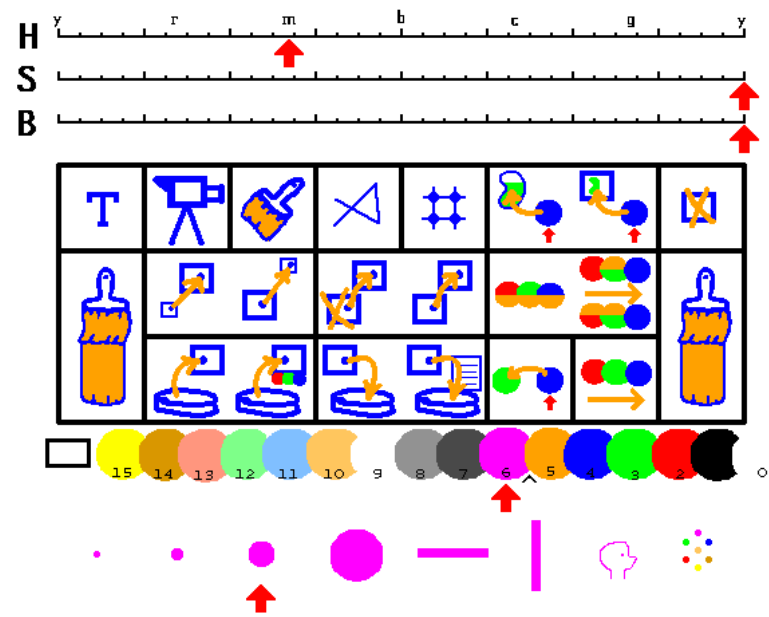
Common colour spaces based on the RGB model are sRGB and Adobe RGB.



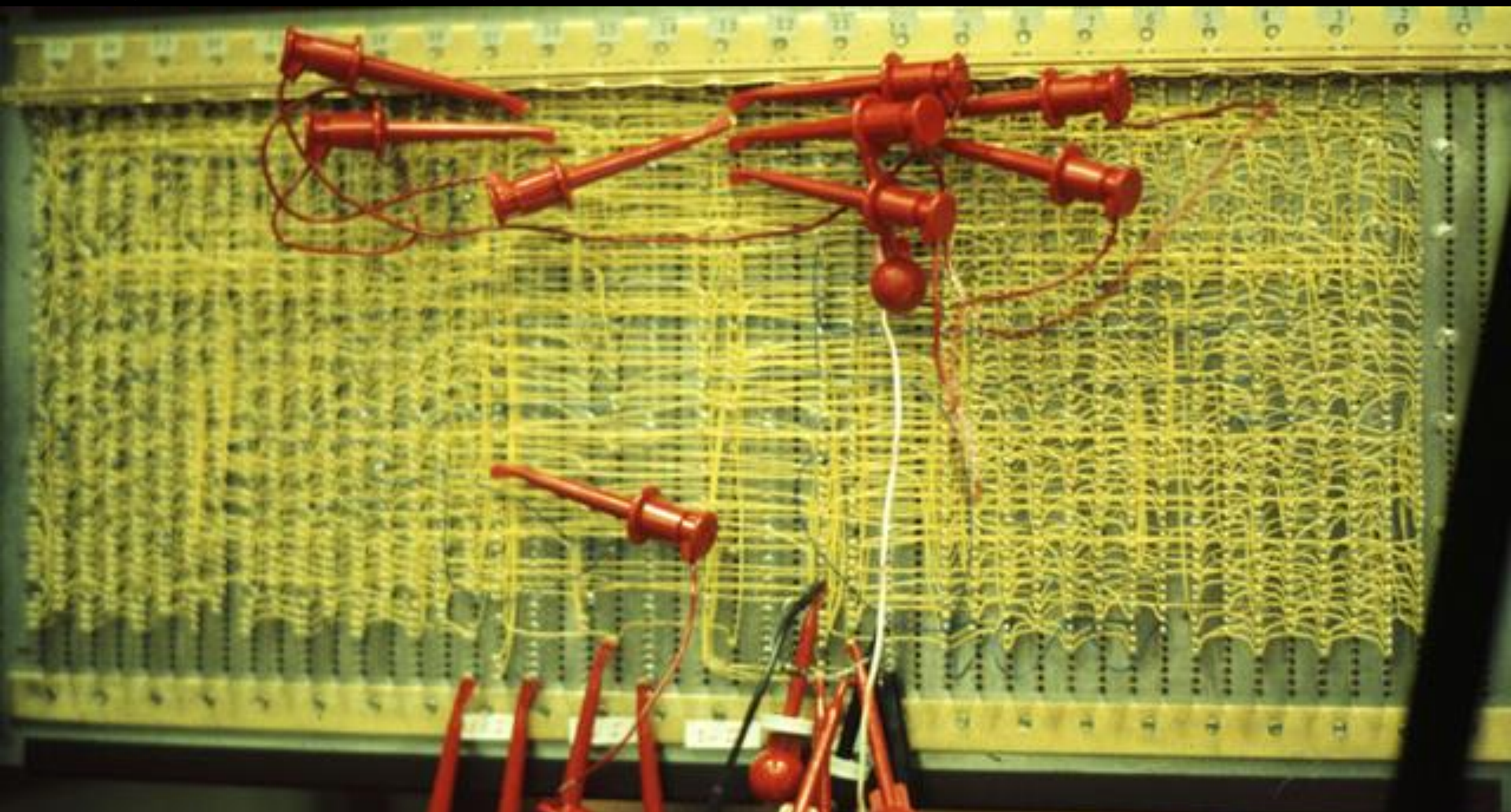
CIExy1931 sRGB gamut

Gamut is the range of colors possible with a given set of primaries.

(Wide gamut means the primaries are chosen to create a large triangle of possible colors).



Superpaint GUI in 1973



In practice

Most computer screens and graphics cards are limited to 8 bpc. This is also in many scenarios sufficient.

Underexposure

Overexposure

Clipping

Banding

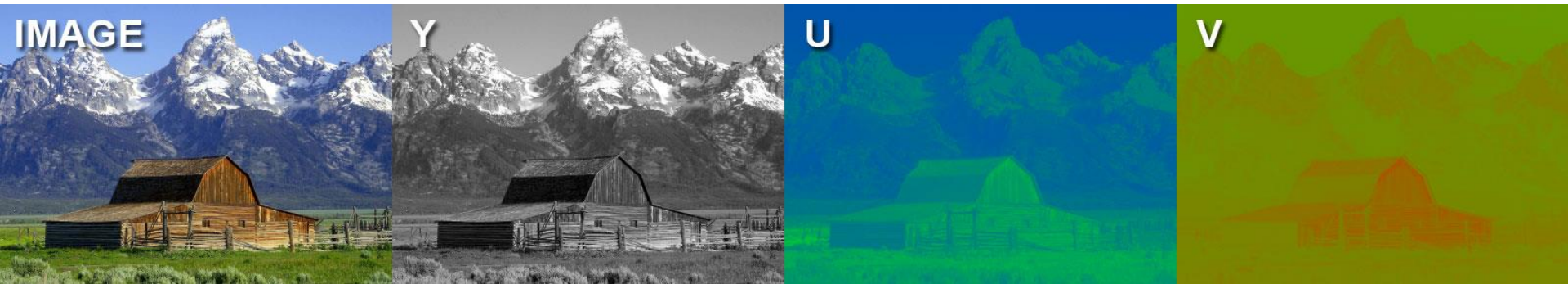
In processing the images the additional precision from higher bit-depths is very useful.

RAW files from a DSLR are (depending on the camera) 10, 12 or 16 bits). Their colour precision is actually limited by the precision of the AD converter.

YUV

YUV was invented to allow for colour TV in a B&W infrastructure.

Most video camera's (and FCP) still work in this mode.



COLOUR CHANNELS

For digital processing RGB color space is the standard.

The RGB image consists of 3 channels: R, G and B.



RED CHANNEL



GREEN CHANNEL



BLUE CHANNEL



OTHER CHANNELS

The year was now 1977 and while sitting around one night with Ed Catmull, who was complaining about the annoying aspect of having to re-render whole frames, Smith and Catmull then invented the Alpha channel, Smith staying up all night so that his friend Catmull could use it in the morning. He named it Alpha “as we always used greek letters for things,” he says.

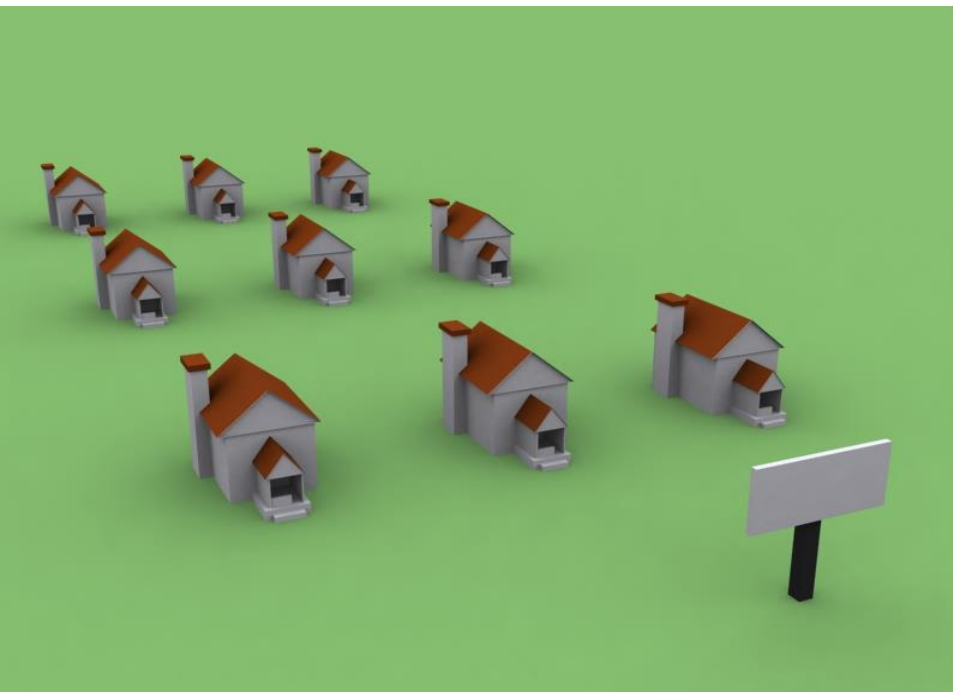


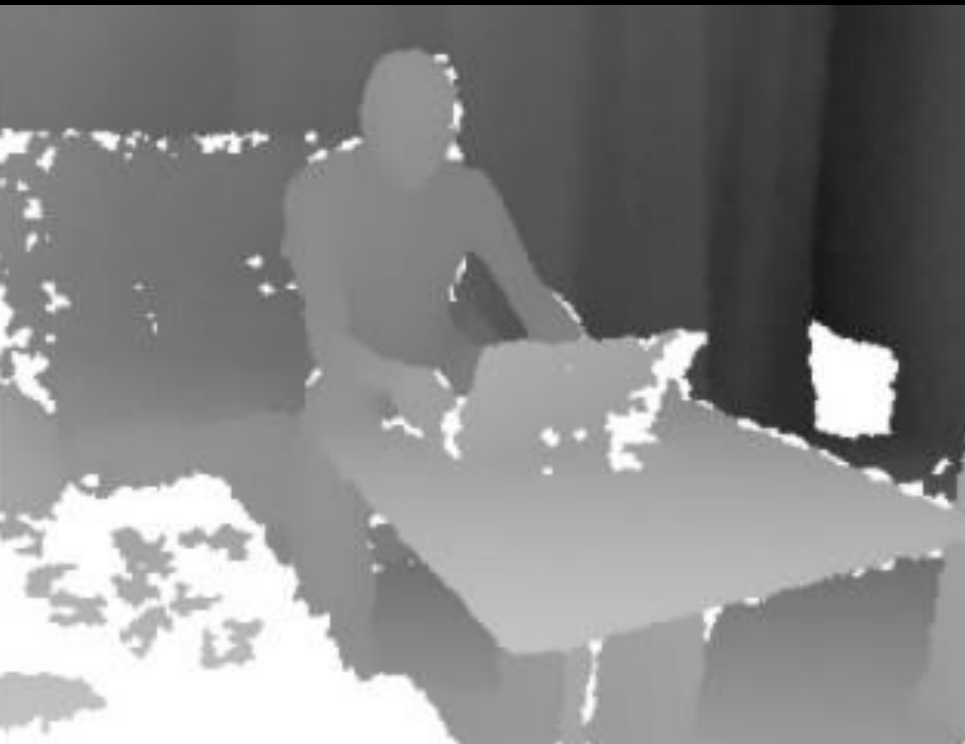
α



OTHER CHANNELS

Channels can be used to hold any kind of information. This is used a lot in images rendered from 3D applications. (z-depth etc).





FURTHER READING...

<http://en.wikipedia.org/wiki/Pixel>

http://en.wikipedia.org/wiki/Image_resolution

http://en.wikipedia.org/wiki/Color_depth

http://en.wikipedia.org/wiki/Color_space

http://en.wikipedia.org/wiki/RGB_color_model

<http://en.wikipedia.org/wiki/YUV>

http://en.wikipedia.org/wiki/Colour_banding