Multimedia Representation

- pixel
- colour
- motion
- sound
- perception
- encoding

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Michael Fourman

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Pixel (picture element)
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Smallest item of information in an image.
Pixels are arranged in a 2-D grid.
Resolution is measured in dots per inch.
Each pixel stores a uniform colour or grey-scale value.
A digital scanner selects a value for each pixel by sampling from the original image.
A RAW image file contains raw data from the image sensor of a camera or scanner.
More samples – more dots-per-inch (dpi) – typically provide more-accurate representations of the original.
A 10” x 8” picture requires

- 400 kilopixels @ 72 dpi
- 7 megapixels @ 300 dpi
- 700 megapixels @ 3,000 dpi
Pixel Aspect Ratio (PAR)

Modern systems use square pixels.

Traditional TV formats led to rectangular pixels.
How are colours represented?
Normalized response of short, medium & long human cones

wavelength in nanometres

400 450 500 550 600 650 700
single-colour sensitivity of the human eye
print – display
subtractive (inks) – additive (LED)
encoding colour

In full-colour systems, each pixel has typically three or four components – each with 256 possible values using various colour encodings

red - green - blue (RGB),
cyan - magenta - yellow - black (CMYK),
hue-saturation-brightness (HSB)

Monochrome systems represent grey levels from white to black in 2 (1-bit), 16 (4-bit), or 256 (8-bit) shades of grey.
RGB
red-green-blue
additive

HSB
hue-saturation-brightness
perceptual

CMYK
cyan-magenta-yellow-black
subtractive
indexed colour

- indexed colour systems use a limited palette of colours
- 4 bits can select from a palette of 16 colours
- 8 bits can select from a palette of 256 colours
Zoetrope I & II – persistence of vision
Animation
Computer animation started as early as the end of the 1950’s
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IBM and General Motors created Design augmented by Computers (DAC)
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Film animation started as early as 1900
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Film animation started as early as 1900

http://www.youtube.com/watch?v=zBFAhCxN0T0&feature=related
How is film animated?

Still images that change slightly are being photographed frame by frame.
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These frame sequences are being played like a film.
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Hence animation.
Computer animation or better said ➔
Computer-Generated Imagery (CGI) animation
Computer animation or better said ➞ Computer-Generated Imagery (CGI) animation

is the art of creating moving images with the use of computers.
Computer animation or better said \(\rightarrow\) Computer-Generated Imagery (CGI) animation

is the art of creating moving images with the use of computers.

To create the illusion of movement, an image is displayed on the computer screen and repeatedly replaced by a new image that is similar to the previous image, but advanced slightly in the time domain (usually at a rate of 24 or 30 frames/second). This technique is identical to how the illusion of movement is achieved with television and motion pictures.
Motion Capture
Motion Capture
Motion Capture
For 3D animations, objects (models) are built on the computer monitor (modeled) and 3D figures are rigged with a virtual skeleton.
New Ways of Computer-Generated Imagery

Emily
Rendering
Rendering means creating a picture from a 3-D model – adding lighting effects, occlusion, surface effects, transparency, reflection, and more, to your animation/picture.
To render Gollum and the many other CG creatures and scenes in "The Lord of the Rings," the animator team used 3,200 computers running 24 hours a day.
left eye sees

right eye sees
3D Techniques

Anaglyph

Anaglyph images were, until recently, the most popular method of presenting 3-D and the one 3-D method most commonly associated with stereoscopy by the public at large. They were made popular both because of the ease of their production, and also due to the fact that this technology was the first 3-D technology widely adopted by the Hollywood film industry.

In an anaglyph, the two images are either superimposed in an additive light setting through two filters, one red and one cyan. In a subtractive light setting, the two images are printed in the same complementary colours on white paper. Glasses with coloured filters in either eye separate the appropriate images by cancelling the filter colour out and rendering the complementary colour black.
Most recently, the \textit{anaglyph 3-D system} has been superseded in popularity by the \textit{polarization 3-D system}. The polarization system has been found to generally appear more life-like, and to also be more easily viewed with less eye-strain over longer periods of time.
Polarization 3-D System

Using circular polarization, two images are projected superimposed onto the same screen through circular polarizing filters of opposite handedness. The viewer wears low-cost eyeglasses which contain a pair of analyzing filters (circular polarizers mounted in reverse) of opposite handedness. Light that is left-circularly polarized is extinguished by the right-handed analyzer; while right-circularly polarized light is extinguished by the left-handed analyzer. The result is similar to that of stereoscopic viewing using linearly polarized glasses; except the viewer can tilt his or her head and still maintain left/right separation.

Polarization is also more popular since the introduction of digital movie projectors.
3D computer modelling in engineering

Computer aided design (CAD)
3D computer modelling in engineering

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