Television

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Television

Introduction

- Mechanical Television – early developments.
- Electrical Television – how it works.
- Digital Television – advantages over analogue.

Television

Mechanical television

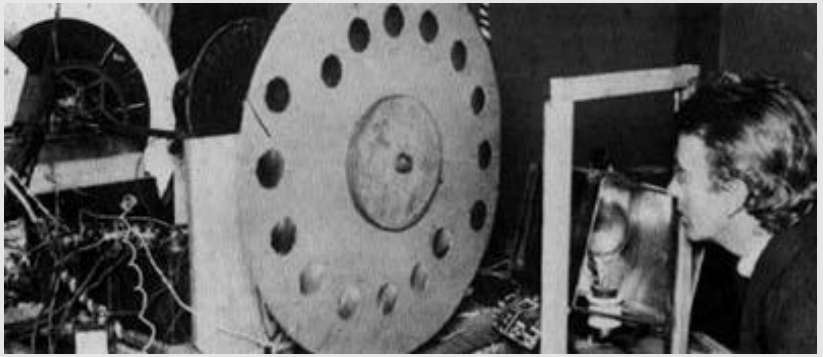
First televisions were mechanical based on revolving disc, first invented in 1884 by Paul Nipkow, to scan transmit and receive images.

First public demonstration of 'Noctovision' on January 27th 1926 by John Logie Baird.

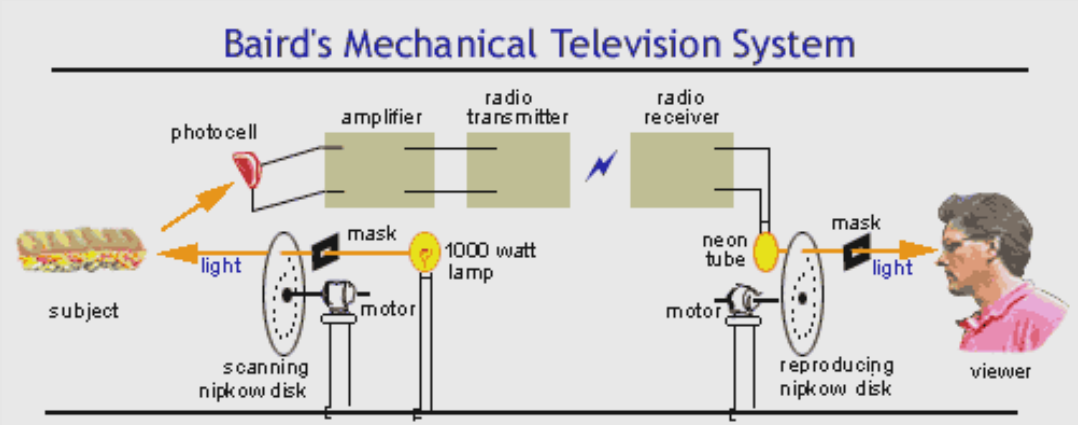
1927 transmits signals from London to Glasgow via telephone line.

1928 uses radio waves to transmit pictures between London and New York.

1929 'Baird Television Development Company' makes first Television programme for the BBC.



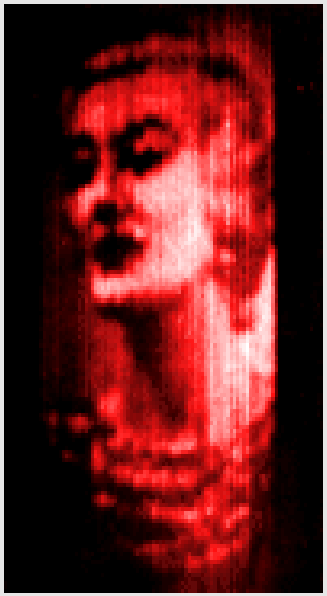
J. L. Baird and his television apparatus



Television

Mechanical television

The Plessey model: most popular version of the mechanical "Televisor" available in Europe between 1929 and 1932.
Only ever 1000 produced.



Produced 30 line images.
Area of image was 6cm by 2cm.
Black and red due to neon gas in the lamp.

Electronic television

Vladimir Zworykin and Philo Farnsworth in the 1930's make critical breakthroughs and electronic television soon becomes commercially viable.

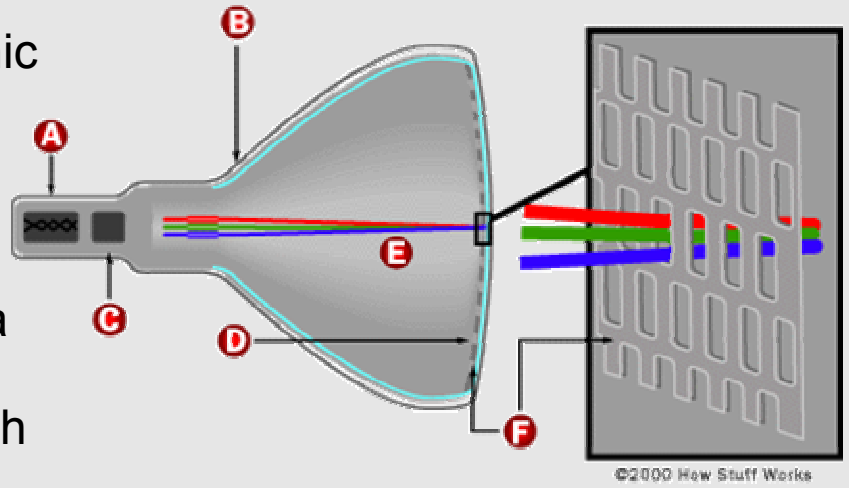
Based on Cathode Ray Tube (CRT).

Cathode is heated filament in a vacuum inside a glass tube.
Negative electrons are attracted to anodes which accelerate and focuse the stream of electrons.

Beam hits flat phosphor coated screen at end of tube which glows.

Phosphor: Any material that when exposed to radiation emits visible light.

Beam lands in one spot. How is it steered?



A Cathode
B Conductive coating
C Anode
D Phosphor-coated screen
E Electron beams
F Shadow mask

Television

Electronic television

Steering Coils:Coils of copper wire wrapped around tube.

Create magnetic fields to which the electron beam responds.

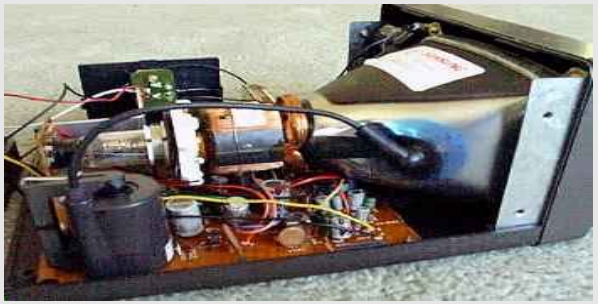
One set of coils moves beam vertically, while another moves beam horizontally.

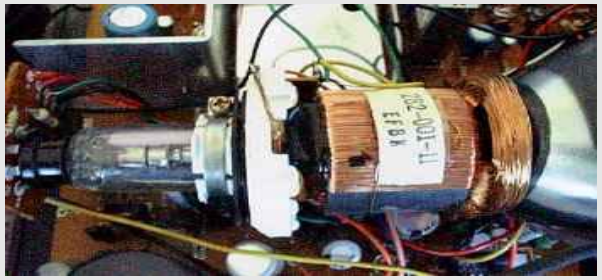
Electron beam “paints” image onto screen- raster scan.

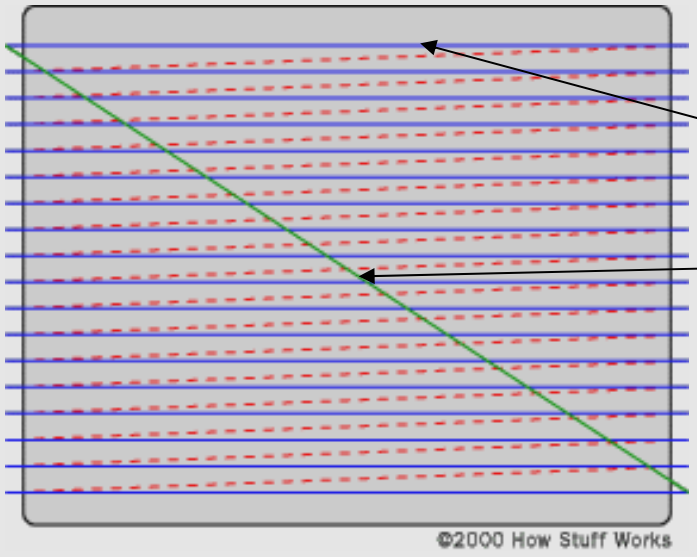
625 lines from top to bottom.(Normally about 480 visible)

Interlacing:Screen is painted 60 times per second. Only half of the lines (field) are painted per frame.

Progressive scanning:paints every line on the screen 60 times per second.







Television

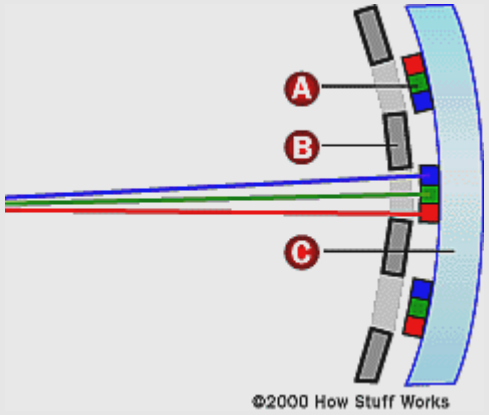
Colour

3 electronic beams: red, green and blue.

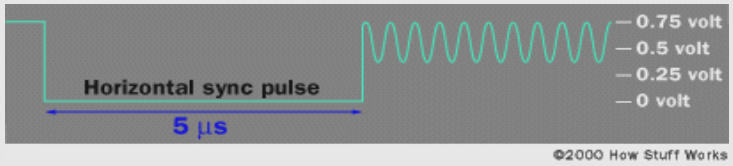
Screen coated in red, green and blue phosphors arranged in dots and stripes.

Inside the tube is a thin metal layer called a shadow mask. Perforated with small holes that align withthe coloured dots and stripes.

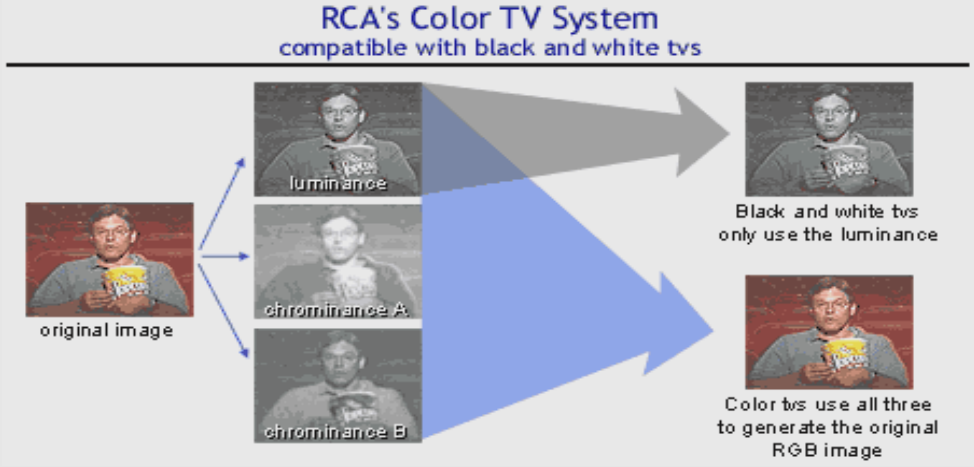
To create a red dot the red beam is fired at the red phosphor etc.
To create a white dot red,green and blue beams are fired simultaneously.



A Phosphors
B Shadow mask
C Glass



Chrominance signal: 3.579545 Mhz sine wave. Followed by 8 cycles as a colour burst then a phase shift in the chrominance indicates the colour to display. Amplitute determines the saturation.



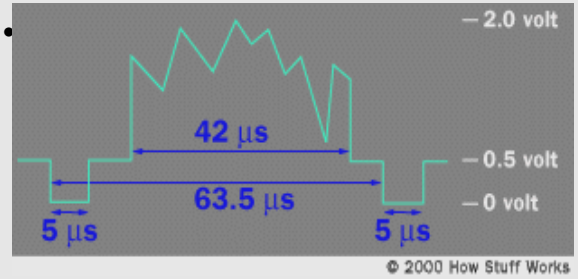
Television

Composite Video Signal

Signal sent to TV is made

up of 3 parts:

- Intensity information
- Horizontal retrace
-

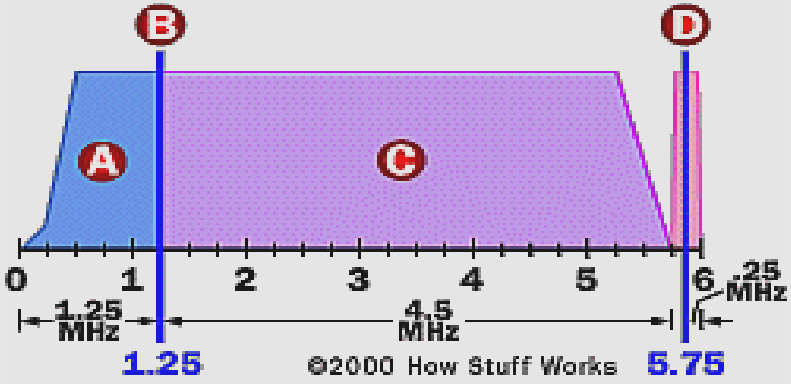


Horizontal retrace signal

Signal can be sent to TV as:

- Radio waves (antennae)
- Via cable
- Via satellite
- Via VCR or DVD

Broadcasting a TV Signal



A Vestigal picture sideband
B Video carrier
C Fully transmitted picture sideband
D Sound carrier

TV signal requires 6MHz of bandwidth.

In Analogue TV the video and sound are seperate.

Yellow plug is composite video.

Sound is red and/or white.

Digital TV - Resolution

Resolution is determined by the number of pixels.

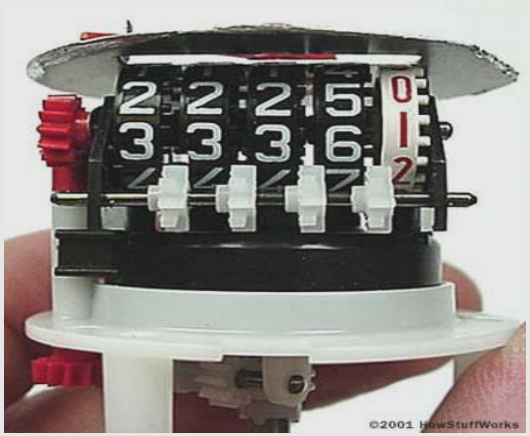
Improvements in television due largely to developments in computer monitor.

Lowest resolution computer monitor displays about 640 x 480 pixels.

Due to interlacing effective resolution of an analogue TV is 512 x 400 pixels.

The best computer monitors can display up to 10 times more pixels than an analogue TV

High density televisions (HDTV) have 720 or 1080 lines of resolution.



Digital TV - Multicasting

Digital signal carries a 19.39 Mbps stream of digital data that the TV recieves and decodes.

Broadcasters have the possibilty to use this stream in several ways.

Signal could be sent in its full 19.39 Mbps or alternatively it is possible to split the screen for “muilticasting”.

For example four standard definitions can be broadcast at 4.85 Mbps each instead of one high definition picture.

Could be done for daytime viewing and then for prime time viewing return to full definition.

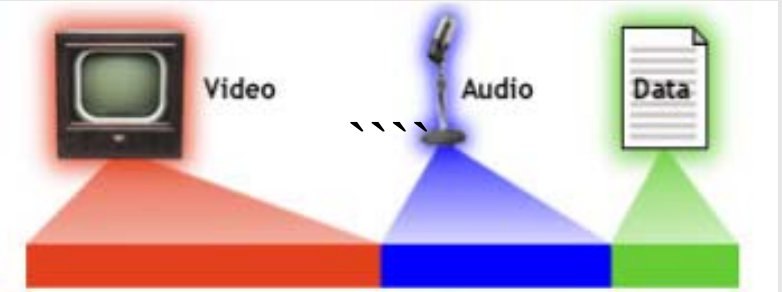
Digital TV - Format

Sub channels can be created because digital TV allows several formats.

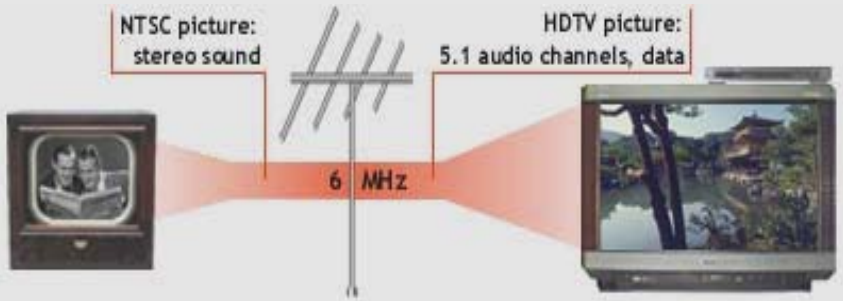
Standard definition (SD). Roughly equivalent to analogue TV :
480i – Picture is 704 x 480 pixels, sent at 60 interlaced frames per second (30 complete frames per second).
480p – Picture is 704 x 480 pixels, sent at 60 complete frames per second.

High Definition (HD) signals:
720p – Picture is 1280 x 720 pixels, sent at 60 complete frames per second
1080i – Picture is 1920 x 1080 pixels, sent at 60 interlaced frames per second (30 complete frames per second).
1080p – Picture is 1920 x 1080 pixels, sent at 60 complete frames per second.

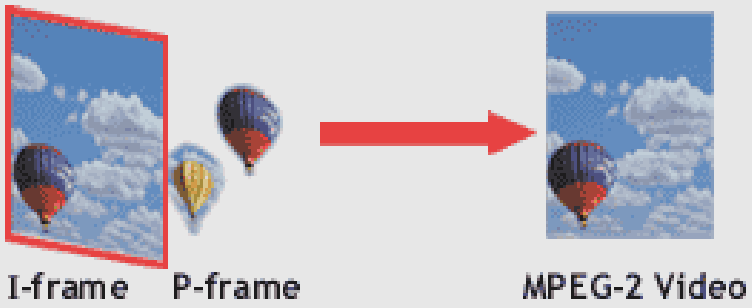
i = interlaced p = progressive



Not only video and audio can be transmitted. Part of the signal can be used for other forms of data.
TV becomes interactive, access to information related to the programme
being viewed, incuding games and additional images and sounds
The signal for interactivity is embedded in the broadcast signal.



Digital TV – MPEG-2 Compression



Increased picture detail and higher quality sound needs to be squeezed into the same 6MHz bandwidth.

To do this digital TV uses MPEG-2.

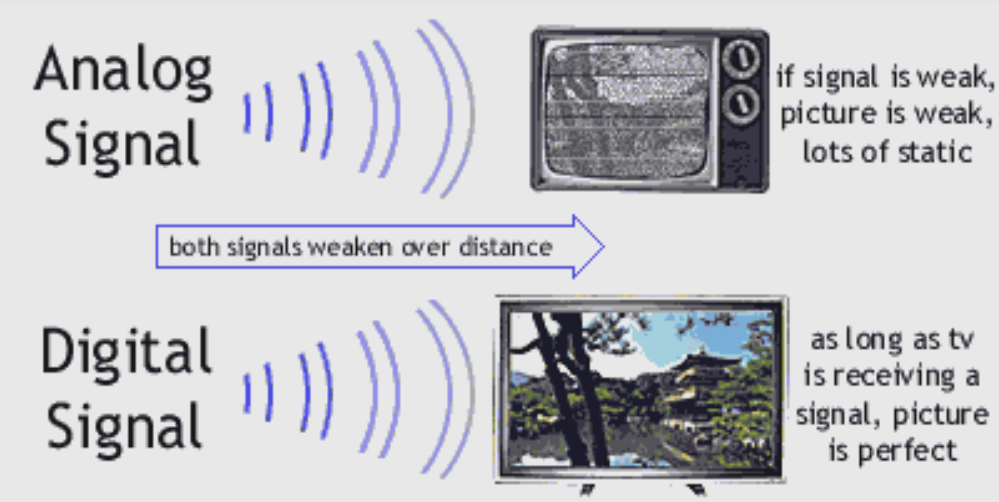
Encoder records only the sections of image that have moved or changed.

MPEG-2 is a “lossy” compression method and reduces the amount of data by about 55 to 1.

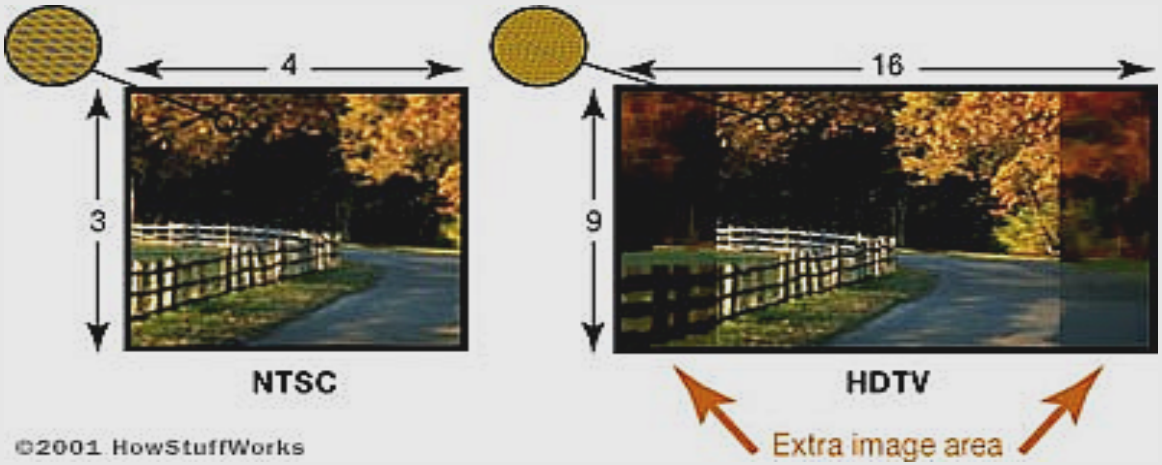
Digital TV – Signal Quality

In digital TV the picture quality remains perfect until the signal becomes too weak for the reciever to pick up.

In a digital signal a one is always a one and a zero is always a zero!



Digital TV - Aspect ratio

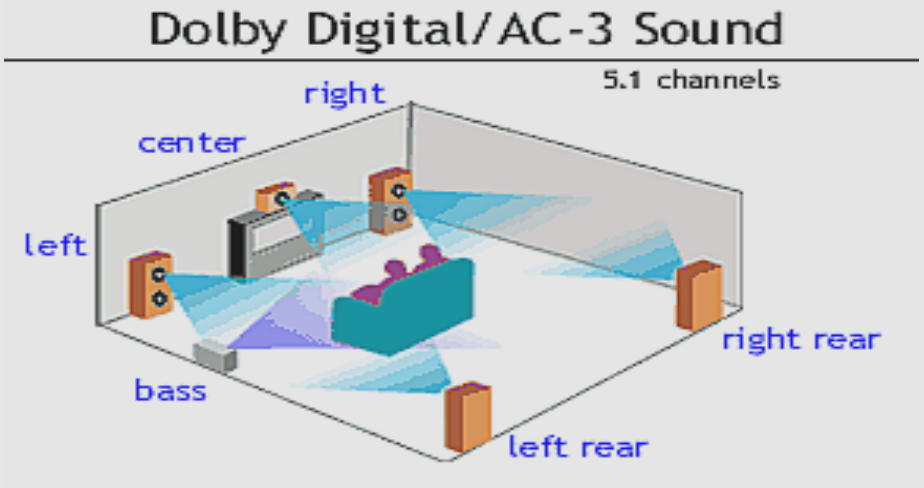


Aspect ratio of a standard TV screen is 4:3 (1.33:1)
[Standard 35mm film has aspect ratio 1.37:1]

Cinema theaters have aspect ratio of 1.85:1 or 2.35:1

High definitiondigital TV is 16:9 (1.78:1) which is closer to the ratios used in cinema.

Digital TV - Sound



In America HDTV uses Dolby Digital/AC-3 audio encoding system.

Includes up to 5.1 channels of sound;
3 in front, 2 to rear and (.1) a subwoofer base.

In UK only 2 channels available for sound.

Digital versus Analogue TV – Summing up

	Analogue	Digital
Total lines	625	1125
Active lines	486	1080
Aspect ratio	4 x 3	16 x 9
Max resolution	720 x 486	1920 x 1080
Sound	2 channels (stereo)	5.1 channels (sorround)

THANK YOU!

Questions.....??