Dr Who and HD

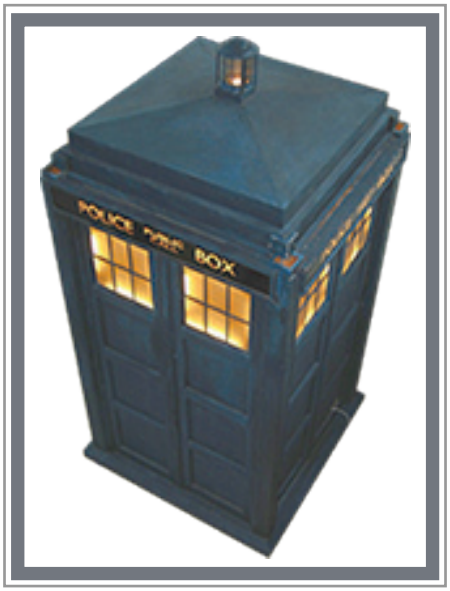

Image by Sceptre.

Dr Who and his time-travelling TARDIS first appeared on BBC television at 5:15 p.m. on 23 November 1963. Since then he has regenerated ten times, saved the Earth from a hundred alien invasions and moved from low resolution, black and white to thousand-pixel-plus, full-colour HD. What does this all mean? (Other than the Earth is safe from the Daleks!)

Black and white

Black and white television works by placing dots on a screen. An electron beam scans across the screen from right to left. When the beam is ON chemicals in the dots, called phosphors, glow white. When the beam is OFF the chemicals are black. By switching the beam on and off it is possible to paint a line of black and white dots across the screen.

Once a line has been scanned the beam is quickly flicked back and down to draw the next line and the next. If the lines are drawn quickly enough and close enough our brain this as a complete picture. If successive pictures change quickly enough the brain sees a moving image. For the first Doctor the screen had 405 lines of dots which changed 25 times a second.

Colour

To show the Doctor in colour needs three different phosphors: red, green and blue. The phosphors are placed on the screen as dots, in groups of red, green and blue lit by three electron beams, one for each colour. The power of the electron beams can each be varied, and the brain mixes the different light levels from the coloured dots to make a single colour. Colour televisions had 625 lines on the screen.

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LCD

LCD televisions use a completely different technology. The image is produced by light coming through individual elements on the screen called pixels. For a colour LCD display, each pixel is divided up into three stripes of red, green and blue. The amount of light coming through each stripe on a pixel can be separately controlled, so the overall colour of each pixel can be changed. A standard LCD screen has 768 lines of pixels, with 1024 pixels per line (a widescreen would have more).

High definition

You may have seen the modern doctor in High Definition (HD). HD screens contain many more pixels than the old televisions - sometimes called Standard Definition or SD. A modern large screen HD television will have 1080 lines of dots and many more dots on the screen than the older SD sets.

Resolution

The resolution of an image describes how much detail it can hold: high resolution images show more detail than low resolution images. The true resolution of a display depends on many factors but an important one is the number of pixels per unit area. A display with more pixels per unit area will have a better resolution than a display with fewer pixels per unit area, even though both may have the same number of pixels overall!

Table 1: Charactersitics of different screens

Video format	Lines	Dots per line	Pixels (millions)	Notes
405	405	405	0.16	The original screens were 20 cm square.
PAL	625	576	0.41	A modern standard definition TV.
720p	1024	768	0.8	A standard computer monitor.
1080p	1080	1920	2.1	Known as HD-ready and used on LCD displays

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1 Write a sentence to explain the meaning of each of these words:

a resolution

b phosphor

c pixel

2 a How many pixels are there on a 1080p television screen?

b What is the main advantage of more pixels per square centimetre of screen?

3 a Complete the table below showing the screen area and resolution for each of these sets.

Television system	Screen size (cm)	Screen area (square cm)	Resolution (pixels per square centimeter)
405 line system	20x 20		
MacBookPro laptop computer monitor	32 x 18		
A 1080p plasma television screen	96 x 45		

b Which screen has the highest resolution (pixels per square cm)? Did the results surprise you?

4 a If you magnified a colour television picture 100 times what would you see?

b How would this be different from a picture on a black and white television set?