

Chiltern U3A Digital Imaging – 18 September 2009

Pixels, PPI, DPI, LPI – hopefully removing some of the confusion.

Definitions:

Pixel – the smallest element of a digital image. It is a square block of a single colour with no shading. Normally smaller than the eye can resolve.

PPI – pixels per inch.

DPI – dots per inch. Only relevant to printers, though often wrongly used in place of ppi.

LPI – lines per inch. Only relevant to scanners, though often wrongly used in place of ppi.

Resolution:

Usually shown as 300ppi, 72dpi, etc. This figure is MEANINGLESS except in relation to printing.

A computer screen is effectively made up of a number of tiny liquid crystals. A group of red, blue and green crystals form a single pixel. When a digital image is displayed at 100%, one pixel of the image is represented by one pixel of the screen.

Your screen is probably 1280 pixels wide by 1024 pixels high (smaller ones are 1024 x 768, widescreen models are different again).

So, if you have an image which is 600 px x 500 px and display it at 100% it will fill about half the screen width and height. You can change the resolution (ppi) in, say, Photoshop, as much as you like and it will make absolutely no difference.

If you have an image that is 2500 px x 2000 px and display that at 100% you will only be able to see about half of it, the rest falling off the edge of the screen. You will have to tell the software to display the image at 50% if you want to see the whole of it.

Note that many programs will automatically scale the image to fit the screen.

So, if you are producing an image that will only ever be seen on a screen there is no point in making it bigger than 1280 x 1024. While a bigger image will contain more detail, the software will have to reduce it for display and that detail will be lost.

You may have a camera that boasts 12 Mpx – approx 4000 x 3000 px. But on screen you can still only display 1280 x 1024 or about 1.3 Mpx. The rest are wasted unless you are printing or cropping a small part of the whole.

Many people try to email images straight out of their camera. The recipient then wonders why he can only see part of the image. If the sender had reduced the image to say, 800 x 600, a perfectly good size to display in a email, all would have been well. Added to that the file size would only be 1/25 of the size so would download much more quickly.

PRINTING:

Unlike displays, printers do not have a fixed pixel size, so resolution is now important.

If you have an image 800 x 400 pixels, with a resolution of 200ppi, then it will print as an image 4" wide and 3" high. Change it to 100ppi and it will print as 8" x 6".

The usual recommendation is to print at 300ppi, as the eye cannot resolve anything less than 1/300". In practice you will see very little difference if you print at 200ppi.

So, when printing:

1. Decide the size of the final print, say 10" x 7" (roughly A4)
2. Decide the resolution you require, say 300 ppi
3. Resize your image, in this case to 3000 x 2100 px.

You can see that this is much larger than you need for viewing on a screen.

So, store your images at their maximum size if you think you may want to print them at some stage. But, if you are emailing them, take a copy, reduce that to a sensible size and send that.

More confusion:

When you come to print an image you will be asked to decide on the printer quality (sometimes called the printer resolution'. This is typically a figure like 360dpi, 1440dpi, etc. This is something entirely different from image resolution.

The printer puts very small dots of coloured ink on the paper (4, 6 or more different colours depending on the model). The dpi figure defines how small and closely spaced these dots are.

So, if your image has a resolution of 300 ppi and your printer quality is 360 dpi, there will be roughly one dot of each colour for each pixel. If the printer quality is 1440 dpi there will be roughly 25, much smaller, dots for each pixel.

The more dots, the easier it is to produce subtle differences and tones. Therefore photographs are best printed at 1440 dpi or greater, while 360 dpi is fine for text. Note that the pixel size is unchanged and therefore the detail in the image is also unchanged – the difference is quality of tone and colour.

The downside is that printing at 1440dpi takes 4 times as long as at 360dpi.

RESIZING:

There is no problem in making an image smaller.

If you enlarge an image you cannot create any more detail. Software can do a reasonable job of enlarging, without the image being obviously pixellated, but you cannot go too far.

To resize using Photoshop (others will be similar) ensure that the 'resample' box is ticked, that the size and resolution are as you want them, and that the method is 'bicubic'.

You may be able to resize without resampling by adjusting just the resolution – provided that you can keep the resolution between 200 and 300 ppi.