

## **PRINTING DIGITAL IMAGES**

Various technologies have been developed for printing digital images. These include thermal processes using wax or dye, laser technology, and ink jet. Prices of all of these technologies have fallen greatly over the last few years, and quality improved to the point where many of them match “conventional” silver-based photography.

It is probably in the field of ink jet printers where most advances have been made, enabling true photographic quality from inexpensive desktop machines.

### **Ink Jet Printers**

Ink jet printers generally use four ink cartridges, each filled with cyan, magenta, yellow and black ink, though the “photo” models, introduced specifically for the printing of “photographic quality” images, usually use 5 coloured inks: cyan magenta, yellow, light cyan and light magenta plus black. The addition of the pastel coloured inks allows much finer tonal gradations on areas such as skin tones and graduated backgrounds.

The cartridge contains liquid ink which is forced into a tiny nozzle, either by the application of heat or pressure. Several manufacturers use a thermal technology, whereby the specially formulated ink is heated rapidly in a tiny chamber in the print head, where it forms a tiny bubble at the end of the nozzle, hence the common name of “bubble jet” printers. The size of the droplets is minute - they can be many times smaller than the width of a human hair. For example, the size of ink droplets with some printers varies between 3 and 6 picolitres (1 picolitre = 0.000 000 000 001 litre!) The ink is ejected through microscopic nozzles onto the paper.

Another major system uses “piezo-electric technology” instead of the heat process. Piezo crystals control tiny pumps which can fire the ink droplets at the paper with high speed and great accuracy (piezo crystals oscillate, and change their shape when a voltage is applied - this piezoelectric effect is used in various devices such as crystal microphones and strain gauges). The shape, size and sharpness of each dot can be determined with great accuracy – some models can produce up to 6 different droplet sizes.

Inks have improved enormously recently, with new versions being quick drying, meaning less spreading as they hit the surface of the paper, leading to sharper images.

All ink jet printers work best with dedicated paper types, as the absorbency of the paper controls the brightness and definition of the image. It is worthwhile testing several different paper types and surfaces, as surprising differences in quality will be found, even between two “photo quality glossy papers” for example. Even the base white may vary from one manufacturer to another, leading to colour changes in the images. It is important to read the recommendations supplied with the paper regarding printer settings, as these will govern the amount of ink put on to the paper. Too much ink will lead to “bronzing” for example, where shadow areas may exhibit a metallic sheen where the ink has not been absorbed by the paper. Ink jet papers are made in a wide range of surfaces such as watercolour, canvas and satin, and several are available as double sided papers. It is possible to use good quality “art” paper for exhibition purposes, and experimentation is worthwhile.

The two major issues with printing are those of colour management – how to get the best colour from your images, and of resolution – how big do images need to be?

### **Colour**

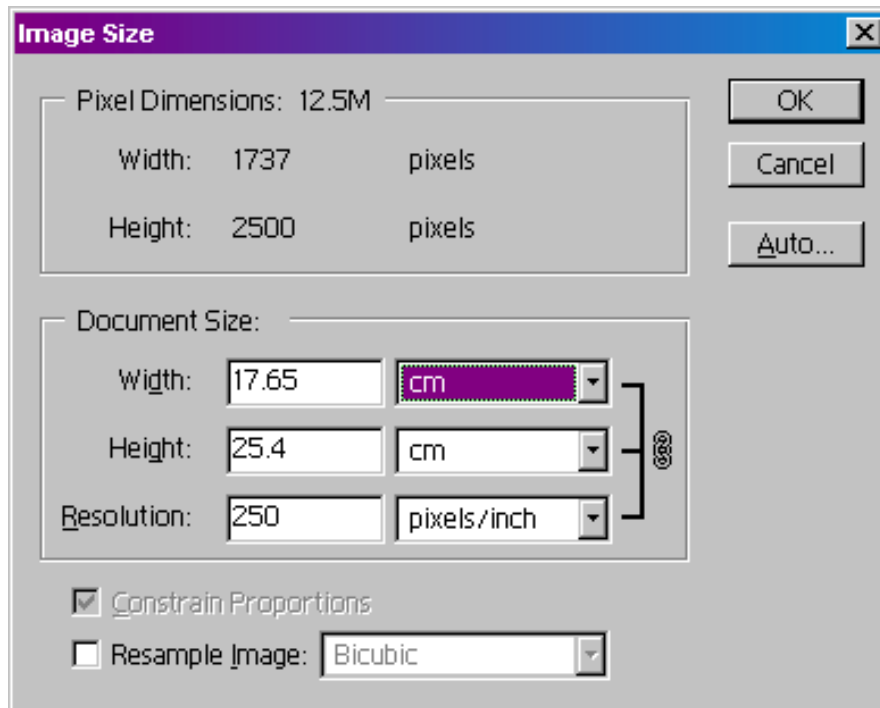
Probably the biggest problem when trying to print digital images is matching the printed output to the image displayed on the computer monitor. The fact that this is not always easy is perhaps not too surprising! The image on a monitor is in the form of glowing phosphor dots, whilst a printed image is in the form of ink or dye on paper, and is viewed by reflected light.

The first step is to “calibrate” your monitor i.e. set it up so that the amount of ambient light falling on the screen is constant. Ensure the monitor has been on for 30 minutes or so before setting it up. For imaging purposes, make sure that the desktop pattern is a neutral (boring!) grey colour, which does not conflict with the colours in the image. Some programs have a monitor calibration facility, but for others, adjust the monitor brightness and contrast for an “average” image. Once set, do not alter the brightness and contrast controls. The aim is for the monitor to display your images at a constant brightness and contrast no matter what the room lighting. Some people construct a hood to fit around the monitor to exclude ambient light.

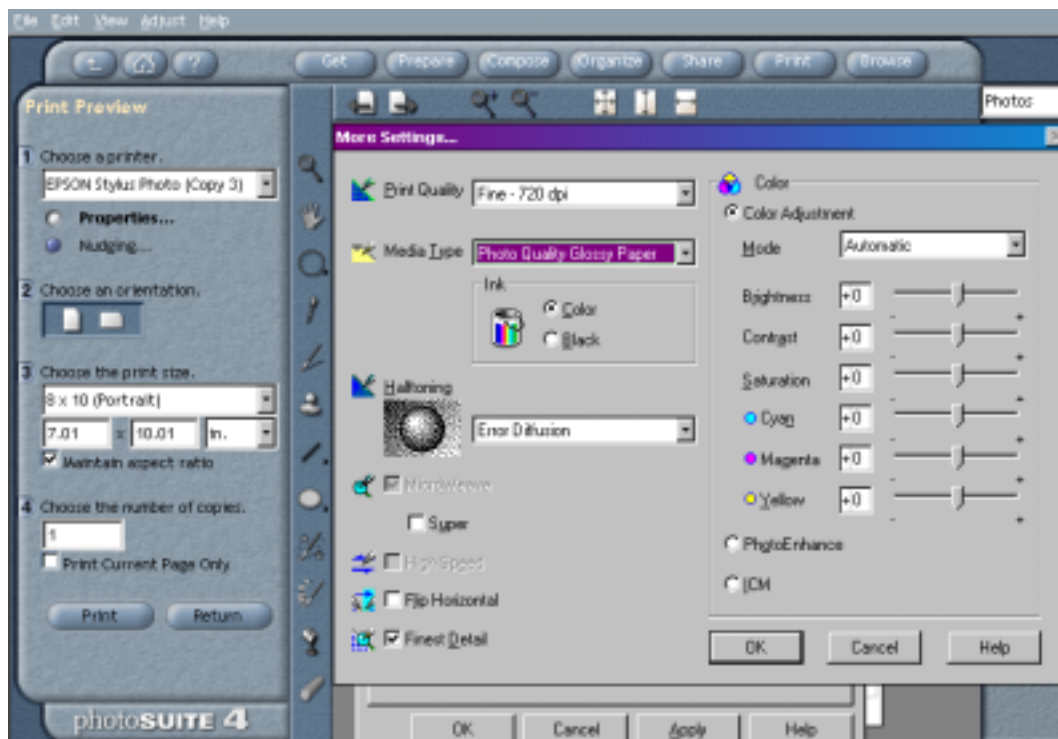
With the monitor set, produce a print, and then compare this with the monitor. With luck it will not be too far away from the monitor display. If the print is too dark or too light, or the wrong colour, then adjust the image in the software, and produce another print. Two or three test prints should be sufficient to achieve a result close to the monitor display. Several manufacturers make devices and aids to help colour balancing, which are well worth the investment.

### **Resolution**

The resolution of ink jet and other printers is quoted in dpi (dots per inch) – how many dots can the printer print. Typical figures are 720 and 1440 dpi. These printers are only capable of printing either black ink only, or a combination of coloured inks, cyan, yellow, magenta and black (plus light cyan and light magenta in some cases). Other colours or shades must be created using groups of dots to represent a single shade or colour. This means that a single pixel of information in the original image is represented by a group of dots on the page. This process means that the “effective resolution” of the printed image is lower than the value quoted for graphic or text output. Theoretically, for colour printing on an ink jet printer for example, each pixel in the image needs to be represented by four dots of ink, so the effective resolution of a 720 dpi printer is  $720/4 = 180\text{ppi}$ . Due to the way in which the dots are laid out on the print, and following extensive experimentation, most users find that printers have an “optimum” resolution, though this will vary according to the paper used. In the example above, a 720dpi 6 colour printer might have an optimum resolution of around 220ppi. Use settings for the “finest” or “best” quality in the printer dialog box. These will vary from one make to another.



Some programs such as Adobe Photoshop allow you to re-size your images for a specific resolution of printer. In this example, a 12.5Mb scan will print at a size of 25 x 17cm at a resolution of 250 dots per inch. If the resolution were lowered, the print size would increase.



A screen dump from MGI Photosuite 4 showing the chosen print size - 10 x 8", and the printer dialog box showing settings for resolution (720 dpi), paper type, and method of screening (error diffusion).

copyright BPIA 2000