Colour coded

Don’t feel blue when your on-screen colours aren’t printing out right. To put you in the pink again, Gordon Laing explains why and tells you how to cope with it using colour coding.

Good news for graphics fans: our annual DTP and monitor group tests appear in this issue. The former covers low-cost products as well as the heavyweights. In our monitor test this year we have concentrated on 17in monitors only, since these make up the bulk of current standalone display purchases. Our group test is broadly split down the middle into those models featuring maximum horizontal scanning frequencies of around 65kHz or 85kHz. This specification defines the highest signal the monitor can lock on to and display. As the group test explains in more detail, there’s more than just the scanning frequency involved to display a certain image.

In real terms, a 65kHz monitor will be able to display a resolution of up to 1,024 x 768, non-interlaced at a refresh rate of 75-80Hz. An 85kHz monitor will be able to display a resolution of up to 1,280 x 1,024, non-interlaced, also at a refresh rate of 75-80Hz. Again, as the group test explains, interlacing produces an undesirable image for computer applications, while refresh rates above 70Hz are considered flicker-free. In my opinion, a good monitor is essential; far more important than blowing all your budget on speed and storage. Whatever your software application, you’ll be staring at your monitor all the time, so it’s worth getting a good one. If you’re using graphics applications, the need for a quality display is immediately apparent.

It’s also worth bearing in mind that your monitor is displaying only what the graphics card is feeding it. The best monitor in the world will flicker if your graphics circuitry is telling it to, so before blaming the tube in front of you, check out those display settings from Windows (the Mac OS tends to enforce a 75Hz refresh rate on resolutions above 640 x 480). You may have to use the utility which came with your graphics card, but a little nosing around here and there will, hopefully, reveal a control panel with refresh-rate settings.

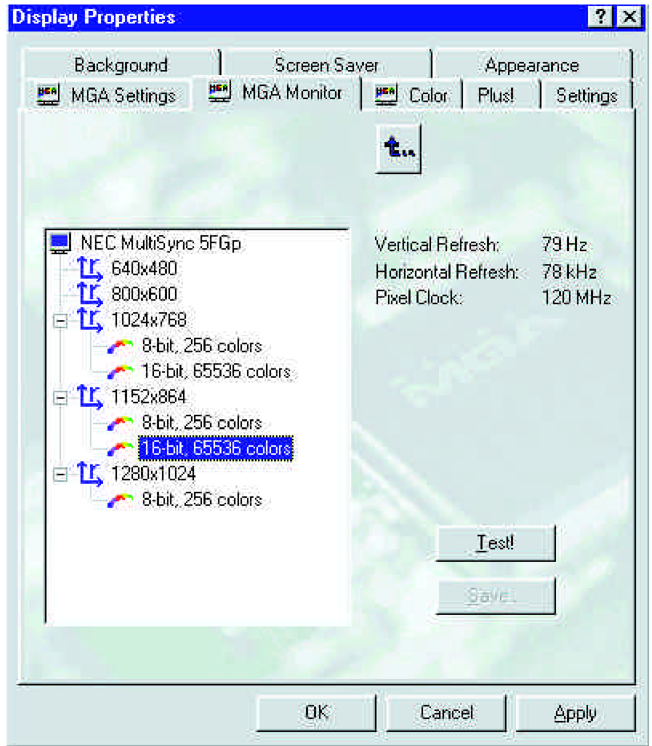

Fig 1 The popular Matrox Millenium graphics card adds its own extras to Win95’s display properties. Select a suitable monitor and the card will feed it as high a refresh rate as it can handle

I know we’re supposed to support new formats and standards but the plug-and-play monitor specification is a bit odd. It’s supposed to allow the monitor to feed back its capabilities to the graphics card to stop you selecting too high a display mode, and to allow your system to arrive at the perfect setting for your equipment. But you often end up with a non-interlaced refresh rate of 60Hz at your selected resolution, which flickers.

Often the best solution is not to select a plug-and-play monitor from the list at all, instead going for a model you know matches your monitor’s specs. If you can’t find your model on the list, I’d recommend selecting either an NEC 4FG or NEC 5FG, which support modes up to 65 and 85kHz respectively; go for the one which matches your model’s maximum horizontal scanning frequency. Now you should be able to go back into your graphics card utility and select a higher refresh rate. If you accidentally opt for something beyond your monitor’s specs, the display will go blank, but fortunately Windows 95 and NT will return to your previous settings after ten seconds or so, asking which you’d prefer.

Colour coding

Colour has been the subject of numerous Graphics & DTP columns in the past, but popular demand has brought it back into the picture. It is a fascinating topic, ranging from perceptions of colour to the physics of light. This time it is the turn of the over-used acronym WYSIWYG (you know the one; What You See Is What You Get) and the miracle that is modern graphical computing.

WYSIWYG works to a certain extent. We all take for granted the idea of designing a page layout or even just a carefully-formatted document, and seeing it print out with the same size and styled fonts in the right places. It’s fairly cunning if you examine what it entails but the whole thing falls apart when colour is involved. All you really want is for the colours you scan to be the same on-screen as when you print.

But there are two problems. Firstly, different devices (such as monitors and printers) create colours using different means and, believe it or not, many simply cannot produce the same range as others.

The second problem is down to your device’s settings. You could have a dull red on-screen, thanks to having your brightness dial too low, and wonder why the printer is outputting a bright red. You should additionally consider that the kind of lighting surrounding you will greatly affect your colour perception. The solutions are to understand the colour capabilities of your devices, followed by calibration and compensation.

So, back to the bad news that not all devices can produce the same range of colours. Monitors produce colours by combining the light emitted by the red, green and blue phosphors on the inside of the glass tube. This is known as an additive process. Printers produce colours by using inks which absorb certain colours of light, leaving the eye to see which colours remain after reflection. This is known as a subtractive process.

It would be impractical to print different inks for each shade of every colour in your document, so a technique was developed whereby most colours could be simulated by printing various-sized dots with three colours of ink: cyan, magenta and yellow. In theory, placing equal amounts of these inks should absorb all light to give the impression of shades of grey or black, but in practice you get a muddy brown. Since black is so important (consider the abundance of black type), this three-colour printing process is usually accompanied by a separate black ink. This is a four-colour process, known by the initial letters of the inks involved, apart from black which is referred to as K to avoid confusion with B for Blue. Hence the four-colour printing process used to make virtually every colour magazine and poster is known as CMYK.

Unfortunately, the CMYK colour model is only capable of reproducing a limited range of colours. The RGB (red, blue, green) colour model is capable of a wider range but still nowhere near the complete range of the human eye. The range that a device can display is known as its “gamut”, and if you try to get it to reproduce a colour that falls outside its gamut, you’ll be disappointed.

It is possible to create a profile of a device’s capabilities: say a scanner with reflective or transparent media, or an inkjet with shiny or plain paper. Such profiles could be used to calibrate and compensate for any imperfections (remember, the limited CMYK model is further limited by impurities in the ink and of course the paper on which it’s being printed). Profiles could also be used to warn an application that you’re working outside its gamut. Photoshop, for instance, can let you know if you’re working

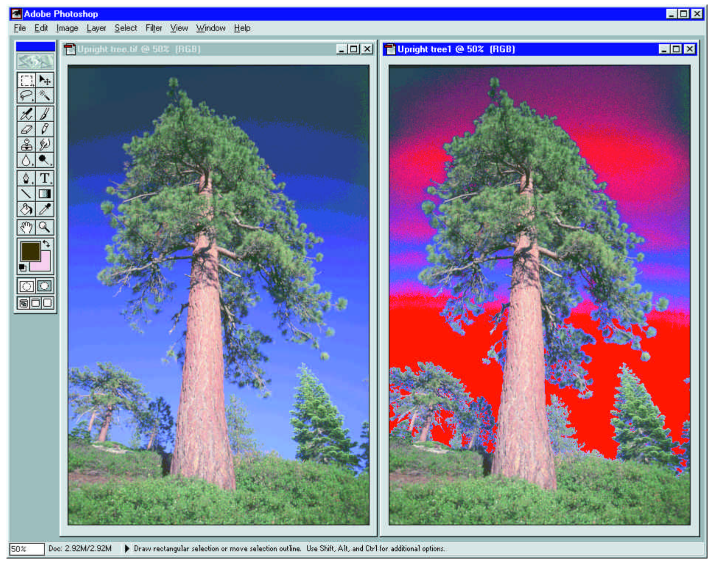
Fig 2 The tree on the left is an original RGB scan containing colours the CMYK process cannot print. A “gamut preview” in Photoshop highlights the problem areas (indicated in red on the tree on the right). The original RGB colours have been lost, as this screenshot had to be converted to CMYK for printing

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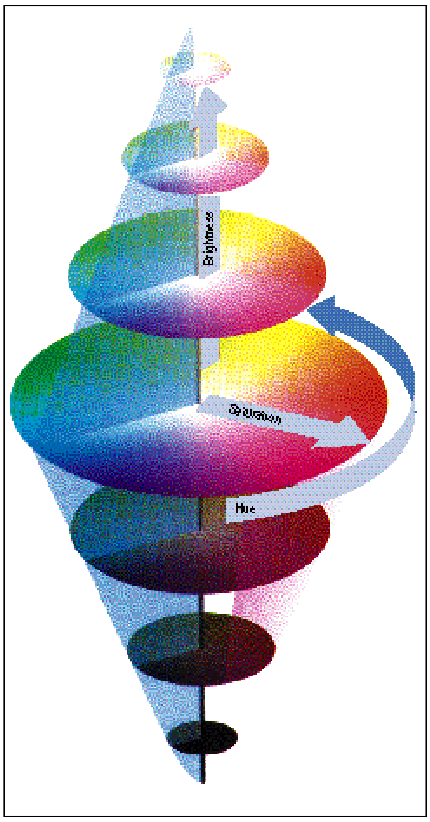

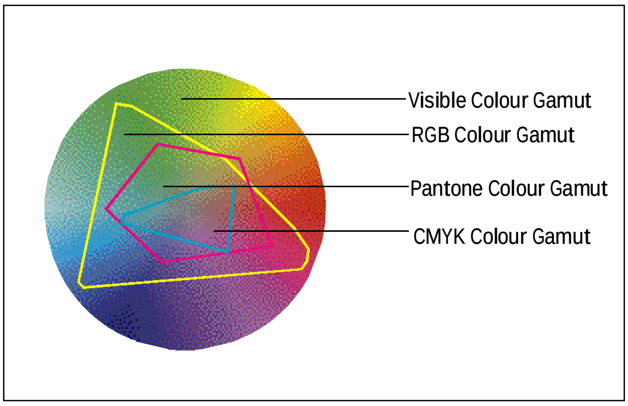

Fig 3 (far left) The CIE colour model of hue, saturation and brightness from which most colour pickers are derived

Fig 4 (left) A section of the CIE model overlaid with the ranges (gamuts) supported by various processes. Notice how some gamuts are wider than others

with a colour that your chosen printer has no intention of reproducing.

For this reason, many illustrators whose work is only going to appear in print don't bother using the RGB or indexed colour modes of applications like Photoshop, but instead start working in CMYK. That way, they know they're not using colours which won't reproduce when their precious work makes the inevitable conversion to CMYK.

Don't get me wrong, though. There's no need to avoid RGB modes from now on. You could be working on an image which is only ever going to appear on-screen, like a web page or CD-ROM title. Also bear in mind that CMYK files are one-third larger than RGB, so if you have your warnings activated you could work cautiously but more quickly in RGB and convert later.

Colour scanners are RGB devices with specific gamuts, too, which begins to make you wonder how any of the colours on your prints even remotely resemble those with which you started. There is a light at the end of the tunnel, however, with colour management systems (CMS).

A CMS system lets you measure the gamut of your devices compared to a standard colour space, such as the CIE model (Figs 3 & 4). To measure a device's gamut, you must scan, display or print a standard reference target, typically consisting of many natural colours, and compare it to a reference "perfect" version, usually supplied on disk with the target. The differences between the original and what your device produces can be used to make a unique profile, or tag, which can then be used to correct for that device's characteristics.

What happens is that an original bright red may be reproduced by a device as dull orange. This is incorporated into the profile for that device, which tells the CMS to take dull oranges from that device and turn them into bright reds. The CMS can, in some instances, modify your graphics card's output to make your monitor reproduce colours as accurately as possible.

If you're serious about colour matching, it's worth employing the aid of a CMS and regularly calibrating your system. Many decent graphics applications come with a CMS; either one of their own or, quite commonly, one devised by Kodak called KPCMS. My particular favourite is Agfa's FotoTune, which allows you to create profiles for each device and use them as exports or filters in Photoshop to convert RGB files into CMYK.

Alternatively you could use spot colours, like those offered in the standard Pantone library. Pantone offers a catalogue full of colour swatches from which you choose the ones you want: pure ink which produces a pure, solid, known colour without all that faffing around mixing cyan, magenta and yellow and wondering whether it's going to turn out right. There are many spot colours which exist outside of the CMYK gamut, allowing you to print, say, bright green, metallic silver or gold.

As explained earlier, using one ink per colour is only practical if your document consists of less than, say, four colours. However, many magazine covers and posters add one or two spot colours to their existing four-colour CMYK printing process for impact, to provide vibrant colours which liven up the image.

If your budget can stretch to six inks but you're not bothered about spot colours, you could consider using colour systems like Pantone Hexachrome, a six-colour process with a wider gamut than CMYK. Pantone also offers a CMS called ColourDrive for Windows 95 which I'll cover in detail, along with Agfa FotoTune and Kodak Precision CMS, in a forthcoming column.

Digital update

Last month I tried out Sony's consumer DSC-F1 digital camera and reckoned it was the best in its league. Bear in mind "its league" involves a working resolution of 640 x 480 pixels, which may not be sufficient for some needs. The optional DPP-M55 colour printer didn't arrive in time for my review, but I've since had a chance to play with it.

Printing from the camera is easy: select the images you want from the DSC-F1, select Print from the menu, and point the camera at the printer. A little infra-red beaming later, and the printer does its thing. It takes just over a minute for the print to arrive, which isn't bad for dye-sublimation technology. As you'd expect from continuous tone dye-sub technology, the colours look excellent; just like real glossy photos. However, even at the small printing size of 113 x 84mm, the low 640 x 480 pixel resolution is quite apparent, particularly so with regards to fine detail.

Digital photography is not yet quite there for many users, but the novelty of making your own colour prints minutes after taking the original photos is certainly pretty cool.

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