Picking your pixels

Gordon Laing resolves resolutions between your digital camera and output hardware.

There's always a period of overlap – between dumping one technology and adopting another, that is. But you know the signs when the older system is on the way out. I never thought I'd tire of my beloved LaserDisc collection, but today they simply look terrible compared to most DVDs. The only reason my LD player remains on the equipment rack is because of pesky George Lucas. Yes, the man who tempted me to adopt the format in the first place with the *Star Wars* Definitive Collection box set, now forces me to keep it on thanks to the fact we're unlikely to see DVDs of these movies any time soon. But the instant they arrive (and a load of Amblin/Universal stuff too), I'll be 100 per cent DVD. I can't wait.

The same thing's happening with me and digital cameras. Always a fan of photography and gadgetry, these little devices should really have won me over some time ago. However, it's only just recently they've begun to offer the kind of facilities and quality that would make me consider abandoning film for all but the most specialised applications.

This month's *Hardware* takes a closer look at a few of the finer details of digital cameras for the real photo enthusiasts out there. What to look out for, what it all means, and does any of it make a difference at the end of the day.

Before going any further, I'll just finish this train of thought by saying my days of using APS for snapping are truly numbered. A fortnight ago I had a very pleasant weekend away and took two and a half rolls of 40-exposure APS. It's taken me this long to get round to processing them at my preferred lab, not to mention scanning them for my website.

Oh, and half a roll is still in the camera. The one thing people rarely mention about digital cameras is that you can take just one picture if you want, and still get at it. And the killer fact? That the last few two-megapixel digital cameras I've used offer greater control and produce far better quality prints (with an Epson Stylus Photo printer) than I get from my Canon Ixus APS and favourite lab. Definitely time for a change.

Resolution

Back in November we looked at scanning tips in this column and described what kind of resolutions were suitable for which applications. Exactly the same rules apply to digital cameras, but the numbers are often described differently.

Normally a scanner's resolution is described as a matrix of dots per inch (dpi), say, 600 x 600dpi. That's 360,000 dots in every square inch. As these dots can capture any colour from a 24bit (or higher) palette, it's often fairer to describe them as pixels. This eliminates confusion when comparing specifications with printer dots, that normally can only be one of a few 10 or 100 colours.

A digital camera comes at resolutions the other way around from scanners, and is normally described as having, say, 1.3 or 2.1 megapixel resolution (at least they don't call them mega-dots). Working backwards, this results in an imaging CCD with a matrix of 1,280 x 1,024 or 1,600 x 1,200 pixels respectively.

Now these full-colour pixels are effectively the same as those captured by scanners with the same rules for printing. Generally, most colour inkjet printers are perfectly happy being fed image files with around 200 pixels per inch (ppi). This is however very much down to personal preference and hardware capability, with some printers unable to improve on more

Enlarged portions of a post box taken with the Kodak DC290 camera; if the full image was shown, it would fill the page. Left: optical resolution of 1,792 x 1,200 pixels and highest-quality JPEG setting; the printed resolution here is 195ppi. Middle: interpolated resolution of 2,240 x 1,500 pixels and highest JPEG quality; printed resolution here of 230ppi. Right: optical resolution of 1,792 x 1,200 pixels and saved as RAW TIFF file; printed resolution here of 195ppi. Note the text was slightly out of focus so the interpolation doesn't offer any particular benefit, considering its file size was bigger.

than 150ppi, and some photographers demanding files of 300ppi.

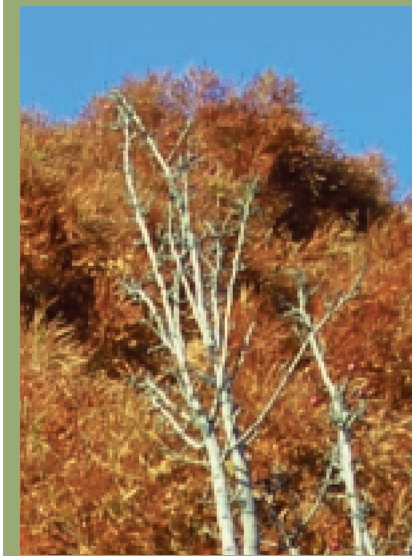
Either way, you can work out what size prints your camera can produce. Take a 2.1 megapixel camera with 1,600 x 1,200 pixel resolution. Printing at 200ppi would result in a picture measuring 8 x 6in. At the same printing resolution, a 1.3 megapixel camera would be good for just over 6 x 5in output. Reducing the printing resolution to 150ppi would produce output around 10 x 8in or 8 x 7in for 2.1 and 1.3 megapixel cameras respectively.

Clearly a higher-resolution camera means bigger prints, or the ability to pick out portions without too much loss in quality. It's an easy numbers game to play, so manufacturers are using it. While most of the current crop boast 2.1 megapixel resolution, Fuji squeezes a little more quality by using 1,800 x 200 2.3 megapixel CCDs. It's not a massive difference, and it looks like consumers may be stuck at this level for some time.

Over a year ago, a Nikon spokesperson at Comdex said 2.1 megapixel resolution was sufficient for consumers as they could produce decent quality A4 colour inkjet prints – since most people are happy with 5 x 7in prints from labs and only use 10 x 8in for rare enlargements, it's probably a fair comment. I've personally seen Fuji's 2.3 megapixel cameras pushed to A3 colour inkjet output, and the results look pretty good.

So is 2.3 megapixel as far as consumer resolution is going to go? I had a word with a salesperson from Fuji who mentioned its next consumer development would be to use CCDs with better colour response. I can't confirm, but I guess that these could be the new Kodak chips with far-improved blue response that astronomers are currently so excited about using for their digital imaging. Such chips would allow the cameras not to compensate so highly, with the result of more realistic images and better performance in low light.

Interestingly, I also talked to a spokesperson from Nikon recently about the modest 2.74 megapixel resolution of its D1 professional digital camera. He argued it was more than adequate for typical photojournalist users, and that if it was any higher and they'd have difficulty getting images back to the office.



Enlarged portions of a tree photographed with the Kodak DC290 camera at its optical resolution of 1,792 x 1,200 pixels and reproduced here at 180ppi; if the full image were shown it would fill the page. The left-hand image is taken with the highest-quality compression, resulting in a 911KB JPEG image. The image on the right is taken with the heaviest compression, resulting in a 196KB JPEG. Note that the original uncompressed image would have measured 6.16MB, so both settings have done a good job. Note, however, that the heavier compression has resulted in blurring and some patchy areas, particularly where the tree touched the sky. Looking carefully, the image has also split up into many small blocks

Interpolation

Scanner manufacturers play an interesting numbers game with interpolation. The optical resolution refers to the actual resolving power of the CCD and the limiting amount of detail than can be captured. However, if you compare two dots side by side and see that one is yellow and the other is red, it may be fair to insert an orange one in between. This is interpolation and, when done well, will increase the apparent resolution, and smooth some edges, although not actually create detail that wasn't there in the first place.

Digital camera manufacturers have now realised interpolation could make their resolutions seem bigger than they really are. Epson and Agfa were early pioneers of this technique on cameras, and now Kodak is boasting a 3.3 megapixel camera. Its DC290 is in fact a 2.1 megapixel model with 1,792 x 1,200 pixel resolution, but with a bit of internal calculation it'll produce 2,240 x 1,500 pixel images.

We photographed a pillarbox at 3.3 megapixel (interpolated), then 2.1 megapixel (optical) resolution both using the highest quality JPEG compression offered. For reference, we also photographed it as a RAW uncompressed TIFF file. We've enlarged the same portion of all three images to see if the interpolated one really looks any better than the optical – remember, it's occupying more file space.

Compression

Of course, high resolutions are all very well, but the more pixels you capture, the more memory you'll need to store them. Today, most digital cameras use expensive flash memory cards, that cost around £45 for 16MB. A single 2.1 megapixel 24bit colour image measures over 6MB in size. Most digital cameras are sold with four to 20MB of flash memory – you do the maths.

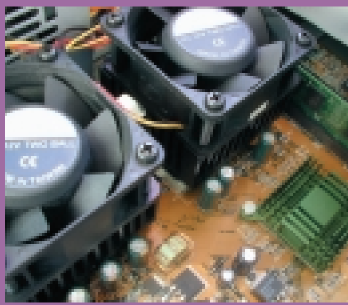
Unless you're happy with getting one or two images per card, you're going to need to use some kind of compression. JPEG is the favoured technique, and most digital cameras offer it in varying levels of quality. The better they look, the more space they occupy, so it's up to you to find a balance; fortunately you can chop and change resolution and compression settings on the same card.

As our example images show, a little JPEG compression produces results indistinguishable from the real thing, with plenty of memory saved. However,

Latest news on dual-Celeron systems

Back in January's issue I described how to build a cheap dual-processor system using an Abit BP6 motherboard and a pair of Intel Celerons. Many thanks to everyone who has written in to comment, especially those who've actually built their own and resolved my overheating problems!

Stuart Booth recommended I invested in a tube of Heat Transfer Compound to spread in between my chips and heatsinks – it's done wonders for his 366s overclocked to 572MHz each using a 104MHz FSB. He's a software developer and describes his dual-Celeron system as absolutely worth its weight in gold: 'When using a single-processor machine, the C++ compiler sucks up 100 per cent CPU usage, effectively rendering it useless as the entire UI becomes frustratingly slow. On the dual-processor machine, you can carry on working while doing a build in the background, or compile in half the time using two instances of MSDevStudio.'



Overclocked chipsets get warm too. For increased reliability you may want to attach a 486 fan to the BX chipset's green heatsink

Fraser Glass also suggested I looked into the thermal paste, and put me onto a trick he found on a site dedicated to the Abit BP6. At (www.bp6.com/bx/) the writers describe how the poor old BX chipset can get a bit warm when running a pair of overclocked processors. I investigated their solution further.

One visit to Maplin later and I'd bought a tube of heat transfer compound for £1.99 and a 486 heatsink and fan (part LX51) for £5.99. I removed the BX chipset's green heatsink (sadly having to remove the motherboard first), applied a very thin layer of paste (thinner is better), then popped the heatsink back. I separated the 486 fan from its heatsink, and screwed it into the top of the existing BX heatsink – a perfect fit!

I also removed the thermal pad from my upgraded CPU heatsinks and applied a thin layer of paste instead. Previously my CPUs ran at 39°C when normally clocked, or a frightening 48°C when overclocked. I'm now pleased to report that both stay between 38 and 41°C when overclocked even after processing for over 24 hours.

One final snippet: Wilfred of 'hardware-one' has it from a reliable source that Abit is working on a BIOS update and physical socket adaptor that will allow the BP6 motherboard to use FC-PGA socketed Pentium IIIs afterall. Fingers crossed!

www.bp6.com
www.hardware-one.com
www.overclockers.co.uk
www.maplin.co.uk

turn up the compression and the cracks begin to show. Notice how sharp edges are blotchy and smooth gradients can become stepped. Again it pays to experiment, particularly with your desired output device. A high-quality printer may reveal the poor results immediately. Then again, a cheaper inkjet could gloss over the results of high compression, or you may have wanted the image as small as possible for use online anyway.

Ironically, after citing the long life and reliability benefits of solid state memory, we're beginning to see a return to conventional spinning disks on digital cameras. IBM has produced a 340MB hard disk in the CompactFlash II form factor that should work in any camera with a suitable CF II slot – Kodak, Nikon and Canon favour CF, and the latter even offers a smaller CF hard disk with its ageing PowerShot Pro70 camera. Iomega too is pitching its 40MB Clik media for portable devices, and it has already fitted one in Agfa's ePhoto CL30 1.5 megapixel digital camera. Iomega also hopes to see it used in future MP3 players, although to get a whole album on a disk you'll need to use low rates of around 96Kbits/sec.

Connection

Bigger images, even when compressed, mean longer download times. It still pains me to see new digital cameras released without fast USB interfaces. Kodak has been fitting USB for ages, but it's taking everyone else a long time to follow suit. Sure, you can buy a USB card reader or floppy adaptor for around £50 which doesn't need your camera or its batteries to be present and correct, but that's not the point. Check the numbers: USB transfers images around 10 times faster than traditional serial. High-quality 2.1 megapixel JPEG images on a Kodak DC290 took as long as a minute to transfer over serial, compared to three to seven seconds on USB. An uncompressed 6MB TIFF took 50 seconds over USB and we gave up over serial.

Alternatively, check out Lexar Media's USB-enabled CF memory cards. These come with USB cables which connect directly to the card, ready to squirt images to your PC or Mac – neat stuff.

The whole picture

We've pushed digital cameras to their limits in this article, but it shows how far they've grown in a matter of months that we can fairly compare them to their film counterparts in terms of quality and features. Now we can sit back and wait for the prices to drop.

PCW CONTACTS

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