Gerald's Column by Gerald Fitton

Last month I related the experience of my (second) grandson, Sam, and I making a movie using my twelve year old digital video camcorder, a Panasonic NV-DS5. This morning I was reminded of its age because the BBC teletext page 143, "On This Day", announced that it was the twelfth anniversary of the Grand National which failed (in 1993). Jill and I were in the shop buying the camcorder whilst this horse race (that wasn't) was being shown on what seemed like a wall of (identical?) TV sets.

Last month I told you that I have a second means of making video clips and that it was one which I was sure that Sam could handle. Tantalisingly I asked "What is my second means of creating video?" If you look at the picture below you'll see the answer.

The FujiFilm FinePix F700 digital camera

This camera is about 4.5 inches wide by 2 inches high. It uses the Fuji xD memory card.

Some of the Olympus range of digital cameras also use this xD card. Although xD is the most expensive memory card, I believe it to be the fastest. By "fastest" I mean that the camera is ready for another shot more quickly than any of the other cameras I have tried.



I have been told that the F700 is no longer available, having been replaced by a 16:9 wide screen version sporting a higher number, first F710 and now the F810. My 4:3 aspect ratio F700 has a 6 MP (MegaPixel) chip (which gives a resolution of 2832 x 2128 pixels) and an optical zoom of about 3 or so.

If you choose to take your pictures at 1 MP instead of 6 MP then you can combine the 3x optical zoom with the 2.2x digital zoom (over 6x when used together) in such a way that, in the 1 MP picture, every pixel corresponds to a pixel on the imaging chip. Contrary to popular belief, the use of the digital zoom this way does not imply that the picture will suffer from 'pixellation'. The F700 does not allow you to use an amount of digital zoom which would cause pixellation; no digital zoom is available at 6 MP resolution.

The LCD viewing screen is 2 inches across the diagonal. This is a useful size for viewing the pictures you have taken. Many digital cameras have smaller screens.

Movies

So much for still pictures. What about movies?

Unlike many cheaper digital cameras this FujiFilm FinePix F700 takes movies with sound! Not only sound but also pictures at a resolution of 640 x 480 pixels!

Many digital (snapshot) cameras advertise that they can take movies. When I have investigated further I found that they take silent movies at a resolution of 320 x 240 pixels! I don't regard this sort of low resolution, silent movie as a 'real' movie!

Of course, 640×480 is a lower resolution than the 720×567 pixels of my old camcorder, but, whether seen on a TV screen or on a computer, there is a good chance you won't notice the difference unless you know exactly what you should be looking for. I shall return to this question of resolution later but I shall do so in terms of the difference between 640×480 and 320×240 pixels rather than the 720×567 pixels of my camcorder.

What Movie

I think it was during a day trip when I stopped at a motorway service station and my (lady) companion said "There is smoke coming out your engine!" that the thought first crossed my mind. No! Not thoughts about the advisability of continuing my liaison with The Attractive Lady in my passenger seat (but who was critical of my car) nor about finding us a hotel for the night!. My thoughts were moving away from my attractive companion in a completely different direction. I think it was when she voiced her concern that I first realised that my wonderful, faithful, ten year old Rover 820 SLi hatchback was not going to live forever. Although the "smoke" was steam from a damaged radiator and nothing terminal I knew the time had come for us to part. By this I didn't mean The Lady and me but that my beloved Rover was coming to the end of its days.



So, I bought a new (to me) car. 'The Lady' likes it and so I might regard it as 'a good investment' for the future of our relationship!

My new car would form the ideal subject for Sam's First Video. I would clean and polish it and Sam would take the film.

This picture of my new car has been extracted from one of Sam's video clips. I shall tell you the resolution of this picture later in this article when I discuss resolution. In the meantime, below the picture of the car I have included a couple of pictures of the rear wheel of my new car. The one on the right is more pixellated than the one on the left.





Two Minutes

I plugged a blank 256 MB xD memory card into the F700 camera and set the resolution to 6 MP per shot. The camera announced that Sam could take approximately 171 pictures at this resolution. I turned the dial to 'movies' and the resolution to 640 x 480 pixel mode. It told us (on the LCD screen) that this card would hold 223 seconds of video (with sound). I make this about 1.15 MB per second.

Sam took half a dozen clips (at this 640 x 480 resolution) varying in length from 5 to 50 seconds. The total was about 150 seconds. We decided to make a two minute video from this miscellany of clips.

From Camera to Computer

The technique for transferring video from the F770 digital camera to a computer is different from that used to transfer from my camcorder to the computer.

When transferring from a camcorder to a computer we used the FireWire DV terminal to transfer from the DV tape (in the camera). This FireWire transfer takes place in 'real time'. The transfer of a movie file from the F700 digital camera to the computer is not done in 'real time'. If you are not sure what I mean by "real time" then please read on.

At the side of the F700 there are a couple of sockets. One is for the power supply, the other socket is marked as a (small) USB socket labelled as "A/V OUT". You can see these two sockets in the photograph.

It is possible to connect this camera directly to a printer (for printing pictures) without using a computer at all; such a connection is called a PictBridge connection.

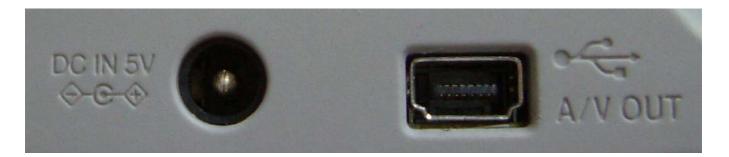
The same socket can be used with a suitable lead to connect directly to the yellow and white sockets of, say, a TV for a slide show or for playing back the movies. The USB socket on the camera can be connected directly to the USB socket of a computer.



Sam and I didn't do any of these things. We placed the camera in a cradle. The picture below shows the 'Docking Station' with a small plug clearly visible. This plug connects with the small socket in the camera. It carries all the connections including power to charge the Li-ion battery.



At the rear of the cradle (see the next picture) is a power connection for recharging the camera battery and a small USB socket identical to the one on the camera. When this socket is connected with a cable to the USB socket of a computer, the memory card of the camera appears as a 'Storage Device'; to the computer it looks like an auxiliary drive. The file is transferred from the camera to the computer exactly as you can any other file from one storage device to another. You will know the process as 'Copy and Paste'.



Copy and paste does not take place in real time (by 'real time' I mean that it would take two minutes to transfer two minutes of video). File transfer takes place at the speed of operation of the USB connection. I have a USB-2 connection which runs at about 5 MB per second.

It took about 30 seconds to transfer the 150 seconds worth of video.

File Size

Although Sam's clips of me cleaning my car added up to about 150 seconds, the total size of all these files were well under the 400 MB which the camcorder generated for a two minute video. Indeed, when we had assembled our two minute masterpiece the file size was close to 140 MB, about one third of the 400 MB size of the camcorder video!

So how do we account for this substantial difference in size?

Well part of it has to be due to the change in resolution from 720 x 576 pixels to 640 x 480 pixels. By my reckoning this would reduce the file size from 400 MB to about 300 MB. There is still a factor of 2 to account for!

I don't know the reason for this and I would welcome suggestions from anyone who can explain it. Could it be something to do with the fact that the F700 video runs at 30 frames per second whilst the camcorder runs at 50 frames per second?

Polishing

Let's have a short digression.

My new car is just under two years old. It is a 2.2 litre Vauxhall Vectra Elegance four door Saloon. The colour (admired greatly by the person whom I shall call my 'Friend who is a Lady' rather than my 'Lady Friend') which you won't be able to see in the printed version of the Archive magazine but you will on the Archive CD, is called Oyster.

It is 'sort of' silver metallic with a golden tinge. This thin layer of paint is protected with an even thinner layer of lacquer! My research has lead me to the conclusion that this lacquer must be protected with a further layer of wax polish. A question I put to my son, David, some years ago was, "How could I know whether I had enough wax on the car?" Then he described to me what became known as the "Rain Water Test". Look at the two pictures below.





These are pictures of water droplets on the car at two different resolutions. Just like the two pictures of the wheels, the resolution of one is double that of the other. It is unlikely that you can see the difference within this Fireworkz document so I suggest that you have a look at the files in the JPEG directory. One picture is 640×480 and the other is 320×240 pixels.

Certainly you will be able to see the difference if you have access to the two picture files and show them at full scale on your computer.

However, enough discussion of this resolution topic. Let's get back to the digression!

The "Rain Water Test" is to apply enough polish to ensure that the water droplets do not soak into the layer of paint. Unlike a wax layer, all paint is slightly porous. The surface tension of the water (or is it something to do with angles of something or other?) ensures that a water droplet sitting on a layer of wax will look like the droplets in these pictures. If there is no wax then the water does not form droplets but spreads out into a smooth layer.

To my great surprise Sam knew all about the "Rain Water Test" because his dad, my son, David, had taught him this 'knowledge' essential to life in the 21st Century. He insisted that we do the test and that he should film it for the record!

Editing the Clips

We transferred the half dozen clips to a movie editing program and chopped bits out, moved sections around and produced our two minute video. During this process we kept everything at the 640 x 480 resolution and saved the part work as an AVI file. We did this in order to preserve, as far as possible, the fidelity of the composition.

The Final Product

For our final product we saved Sam's Video as a WMV format file with a resolution of 640 x 480 pixels. Although the original clips were 30 frames per second, we saved in a format which runs at 25 frames per second. We chose a streaming rate of 1 Mbps (1 Mega bit per second). Note that we retained the 640 x 480 frame size throughout the editing procedure. We retained it for all the intermediate saves in AVI format and, for our final save which was in WMV format.

Don't get confused between MB (Mega Bytes) and Mb (Mega bits).

The original clips were recorded in the camera and appeared on the computer in an AVI format streaming at about 1.15 MBps. Our masterpiece, which demonstrated my ability to wash and polish the car in such a way that it passed the "Rain Water Test", was saved in a format which streams at one tenth of this speed, namely 1 Mbps. Our final 1 Mbps WMV file has been compressed considerably (roughly by a factor of ten) when compared with the original AVI format clips.

Resolution

I can not demonstrate the effect of compression in a Fireworkz document so you will have to accept my word for it that, in my opinion, the difference between 640 x 480 pixels and 320 x 240 pixels is greater than the difference generated by compressing the file by this factor of ten. It would be interesting to me and perhaps to other readers, to know what others think about using compression to reduce file size (and hence streaming rates) when dealing with movies rather than choosing to reduce the the number of pixels.

The picture of my new car (earlier in this article) is a snapshot from the AVI file. The resolution of this picture is 640 x 480 pixels. Having done this I zoomed in closely on the rear wheel and then cropped it to include only the rear wheel at a resolution of 640 x 480 pixels. Then I reduced the resolution of this same picture to 320 x 240 and saved the result. You should be able to see the difference in the two wheels.

However, because the two "Rain Water Test" pictures are not magnified I doubt if you will be able to see the difference between the two of them.

320 x 240

Using the high resolution, uncompressed AVI file as our master, we Saved Sam's Video again in 320×240 format. The highest streaming rate we could select for 320×240 is 512 Kbps, half the streaming rate of the 640×480 version. This is the format we used and which compared with the 1 Mbps 640×480 file.

The file which streams at 1 Mbps is 13 MB. This is close to double the size of the 7 MB, 512 Kbps file that we created using a resolution of 320 x 240 pixels. Both these files are larger than the 4.5 MB file, 'Pigs in Baskets', which we created with the camcorder.

As a by-the-way, Jeremy Nicoll has written to me to tell me that 'North of the Border' (meaning in Scotland) 'Pigs in Baskets' are known as 'Kilted Sausages' with the bacon representing the tartan kilt. It was a mutual decision not to take the analogy as far as discussing what might be represented by the sausage!

Testing

We tested both files using the DeskTop machine.

We uploaded both to my website and tested the download.

Both required buffering before the video started up. The 1 Mbps file being larger and streaming at a higher rate needed more buffering than did the 512 Kbps, smaller file. After the buffering they ran perfectly.

iPAQ Testing

The display on the h4150 iPAQ is 320 x 240 pixels. The 320 x 240 file ran perfectly. The software converted the 640 x 480 to 320 x 240 during transfer and then it ran perfectly.

The 320 x 240 file on the website ran on the h4150 iPAQ via the broadband and 2.4 GHz Wireless connection. It did so 50 yards down the road from the house.

The Puzzle

I asked you to work out (as did Sam and I) how long it was before last month's film started playing. Here are the figures I asked you to use for this sum. The clip runs for 120 seconds. The download rate is exactly 300 kbps. The clip runs at 340 kbps.

I asked you to send your answers to gerald.archive@ntlworld.com.

Up to now I have received only one reply. Tim West calculated that the delay was 16 seconds. This is indeed close to the actual measured delay we experienced using a 340 Kbps streaming rate with my 300 Kbps broadband. We timed the delay at about 20 seconds. It did vary by about a couple of seconds from run to run but Tim's calculation is essentially correct. The extra few seconds is a margin built into the system.

Summary

I suppose that the most important thing to report is that "Sam had his 'treat'!" Indeed, he was so thrilled with the results he spent the next week telling and retelling his story to his elder brother, Craig, and his ever patient parents!

However, I suppose some summary of the technical details might be of interest as well.

The two minute DV (Digital Video) file on the camcorder tape ('Pigs in Baskets') was downloaded to the computer as an .AVI (Audio Video Interleaved) 400 MB file having a display size of 720 x 567 pixels. This was compressed to about 4.5 MB partly by reducing the display size to 320 x 240 pixels and partly by using a lossy compression technique.

The two minute file which we created using the FujiFilm FinePix F700 digital camera ("The Rain Test") finished up in two formats with file sizes of 7 MB and 13 MB.

There is no doubt that the streaming rate (we used 340 Kbps, 512 Kbps and 1 Mbps) is the only factor which affects the file size.

What is more difficult to assess are the effects of compression and resolution.

My personal view is that I prefer the 640 x 480 pixel resolution to the 320 x 240 when both are delivered at the same streaming rate.

The same streaming rate implies the same file size for the same running time. By saying my preference is $640 \times 320 \text{ I}$ mean that I can tolerate more compression (which results in a slower streaming rate and smaller file size) than I can tolerate the loss of resolution. Mind you, I am talking of looking at the video on a computer screen with a resolution of 1280×960 and not on the 320×240 screen of the h4150 iPAQ.

I would like to know the opinion of others.

Communication

I shall retain the Abacusline website at http://abacusline.demon.co.uk for a while as my 'public' website. I am still experimenting with my NTL website. However, I would like you to email me at my new NTL Broadband address, <gerald.archive@ntlworld.com> and not at the 'abacusline.demon' address. Your email will reach me more quickly at the NTL email address.