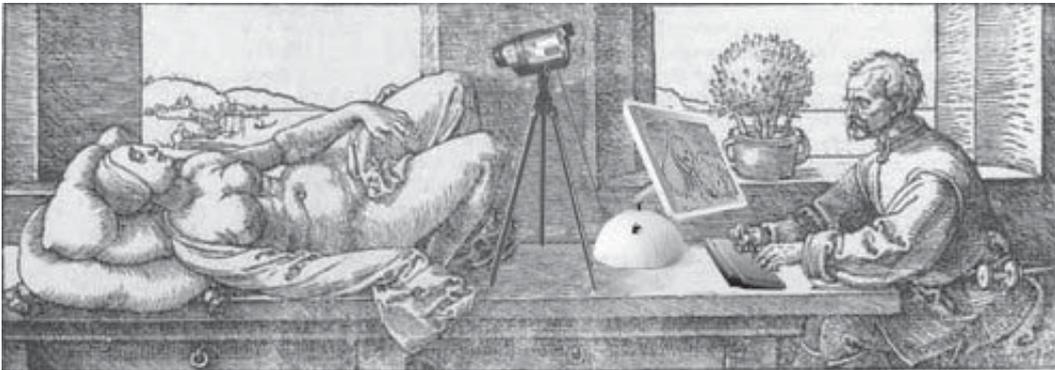# DIGITAL CANVAS

A presentation by Dermot McCabe for Wicklow Arts Network workshop on the topic of Computer Technology and the Visual Artist : Brockagh Resource Centre, Laragh, Co. Wicklow 1st Oct 2005

Digital Canvas

Can you believe your eyes

You have heard the phrase *Seeing is believing*. Whoever coined it might have thought twice if they knew anything about the physiology and psychology of vision. The fact is you cannot believe your eyes. A couple of examples should demonstrate this . The squares A and B on the checkerboard of fig 1 are exactly the same shade of grey. To prove it place a piece of paper over the drawing and cut out two small holes one over the A square and one over the B square.

Fig 1
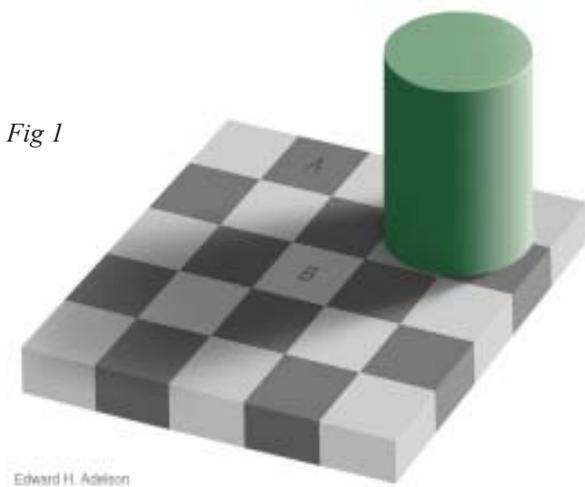
Edward H. Adelson

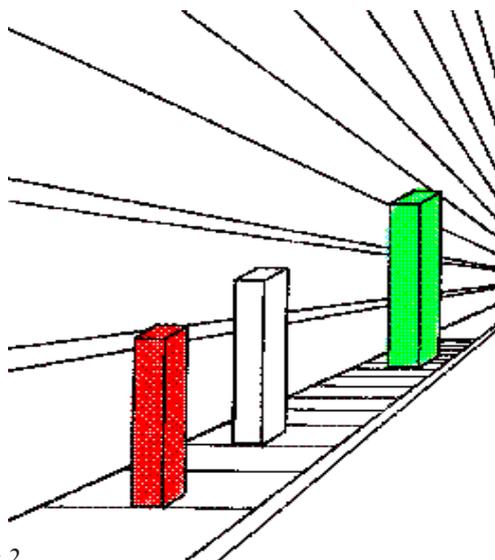In Fig 2 which is the tallest column?

Fig 2

Answer - the red column is the tallest.

Renaissance Technology

There is nothing new about these optical illusions. There are hundreds of them and they have been known about for centuries. In that remarkable period of human history the Renaissance when there was a great fusion of science, art and philosophy the likes of Leon Battista Alberti, Leonardo da Vinci and Albrect Durer were keenly aware of the shortcomings of unaided obeservation in drawing and painting. It is not surprising that these multi-talented men turned to mathematics, geometry, and practical technology to resolve the difficult problem of acurately representing the 3 Dimensional world on a the flat surface. Amongst those early technological aids for artists were Viewing grids or veils as Alberti called them, proportional calipers, pointing machines, Perspective tables, golden rule compass, pantographs, Durer's Glass, Camera Obscura, Camera Lucida.
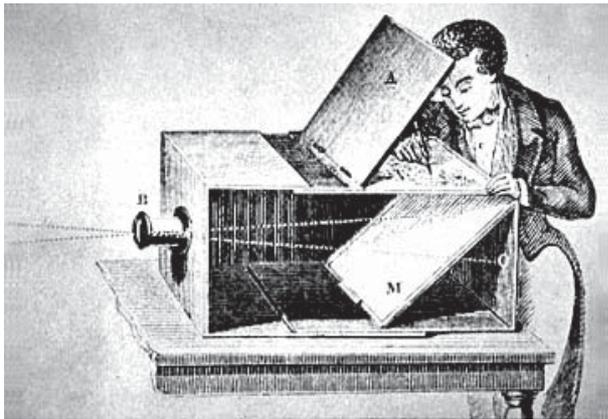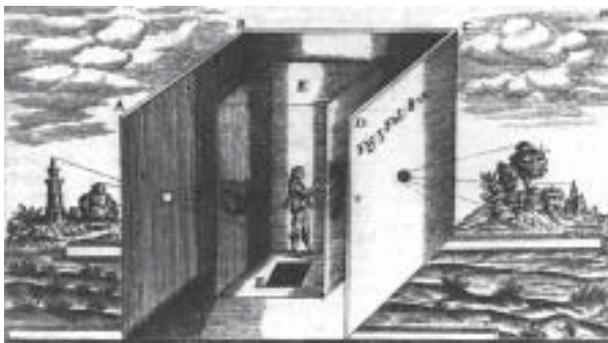

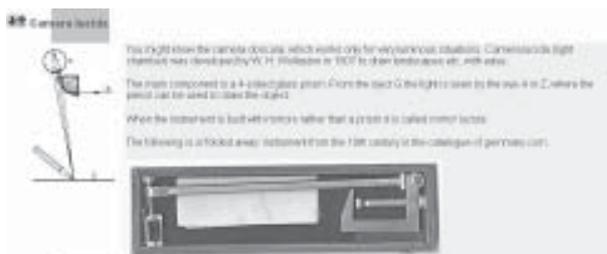*Durer Drawing Table 1*
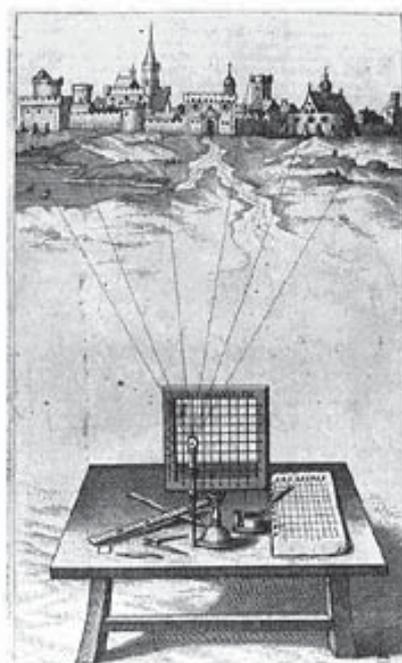
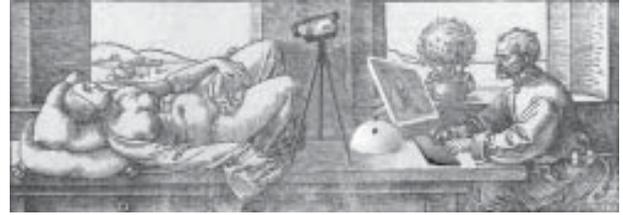*Durers Grid*
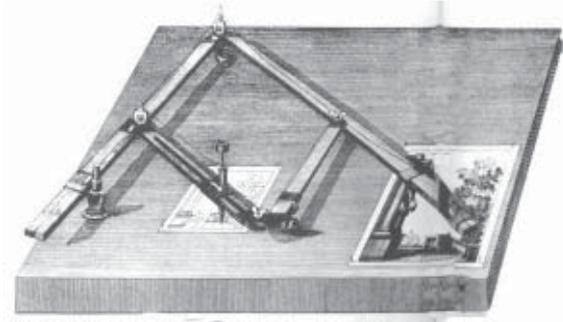
Pantograph

Camera Obscura

Very Large Camera Obscura

Camera Lucida

Albrecht and the Computer

It is not difficult to surmise that artists like Albrecht Durer and Leonardo da Vinci would have embraced the computer and digital technology.

Albrecht with his Macingtosh

The Multi-Purpose Artists Aid

The computer, with appropriate software and peripherals such as digital cameras, scanners, printers and plotters provides a plethora of tools and aids for the modern artist to

- ☐ Do the administrative work, schedules, correspondence, emails etc.
- ☐ Assist in all of the preparatory work such as capturing, processing, visualising and scaling preparatory drawings.
- ☐ Create art work from scratch.
- ☐ Copy, store, distribute,promote and sell artwork on the internet.

Turning Pictures into Numbers

Computers only understand numbers. They can add, subtract, multiply and divide millions of numbers at incredibly high speeds. In order for a computer to do meaningful things or processes, those things or processes must be converted into numbers.

For example the rules and procedures of an application such as Microsoft Word are encapsulated in a complex sequence of numbers that determine how the central processor (brain) of a computer responds to every key press and mouse click we make. This complex sequence of numbers is called a programme or software application.

In order for a computer to handle pictures, those pictures must be turned into numbers and that is done by converting a picture, using a camera or scanner, into a grid of pixels.This is called digitisation and the

picture is called a digital picture.

How Many Pixels make up a digital picture.

A good example is the standard computer screen. It comprises 1024 x 768 pixels which equals 786,432 . Tyically it would take 3 numbers to describe each pixel so a single picture on a computer monitor is digitised into 786,432 x 3 which equals **2,359,296** numbers to describe one picture.

Typically each of these numbers will occupy a byte of memory. So our picture occupies 2,359,296 bytes of memory. This is roughly 2.4 Megabytes.
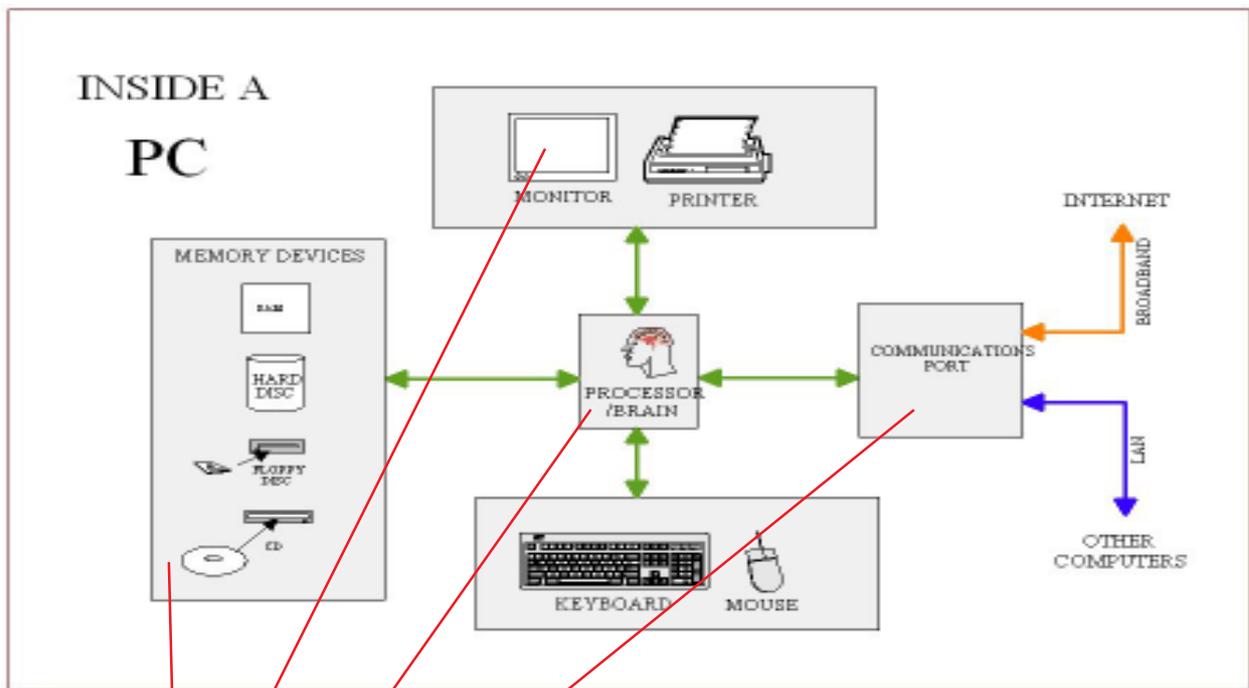
The bottom line is that digital images take up a lot of storage space on a computer. To give some sense of scale a large novel stored as a word document would only take up 1 Megabyte of memory.
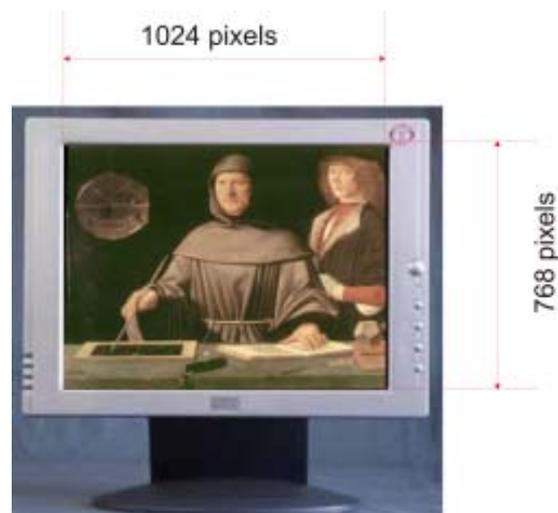
If we zoom in on a tiny part of the digitized picture we can see the pixels. Each pixel has a colour or hue and a brightness and these values are represented by a number. The total picture as far as the computer is concerned is an array or grid of pixels each with its own unique number/numbers. The computer can, if the right software application is controlling it, manipulate those numbers and by so doing manipulate the picture. For example if you double the number representing the brightness of a pixel then the pixel will be twice as bright.

Digital Pictures = System Overload?

Its really only the very latest computers that can handle digital pictures with relative ease. If we take a look (see drawing below) at a computer system we can see where these very large files cause problems or where the bottlenecks occur. We then begin to understand the unrelenting push for faster and higher capacity computer systems.

INSIDE A
PC

MEMORY DEVICES

RAM

HARD
DISC

FLOPPY
DISC

CD

MONITOR   PRINTER

PROCESSOR
/BRAIN

COMMUNICATIONS
PORT

KEYBOARD   MOUSE

INTERNET

BROADBAND

LAN

OTHER
COMPUTERS

Potential Bottlenecks
1   Memory/Storage
2   Graphic Displays
3   Processor
4   Communications

Tackling the Overload

Faster processors, larger capacity memory devices and faster communications technology all help to cope with the problem of very large files such as digital pictures. but the the single factor that has made the greatest impact in this area is **COMPRESSION !**

What is Compression ?

Compression comprises algorithms (arithmetical procedures) to reduce the data (numbers) describing a picture without impairing the picture or at least controlling the permissible impairment. There are a whole range of these algorithms that can be combined to compress picture files to a greater or lesser extent depending on the subsequent use of that picture file. The pictures below show the impact of different levels of compression.

**Original
200 Kbytes**

**50:1
Compression
100 Kbytes**

**100:1
Compression
10 Kbytes**

Compression Formats

The most common compression file formats are GIF , PNG, JPEG, PDF, TIF and RAW.

The 3 letter extensions are added onto the name of the file preceded by a full stop eg. Butterfly.gif, Portrait.jpg etc. If , using your mouse, you double click on on a file to open it, the computer checks the file extension and loads up an application that can handle that file type.

GIF (Graphics Interchange Format).

This format has been around for a very long time and because of its very small file size it has enabled images to be downloaded very fast over the network. Its main limitations is that it has a total palette of colours of 256. It is useful for logos and pictures with not too many details.


PNG (Portable Networks Graphics)

This format was developed because GIF is a licenced format from Unysis who announced in the 1990s that everyone should pay royalties to use it. PNG like GIF has very small file sizes but has a much wider range of colours. Like GIF it is best used for LOGO type pictures.

JPEG (Joint Photographics Experts Group)

Typically anyone dealing with scanned artwork, digital photographs and digital pictures of artwork will use JPEG. Invariably one will need to use compression of this type especially when sending images over the Internet. Because JPEG is a lossy compression

format it is important to view the compressed picture before deciding it is adequate for your purpose. For example if you are placing images on a web site they need to be compressed enought to allow fast downloading but also good enough for the potential buyer to have an adequate quality to assess your work.
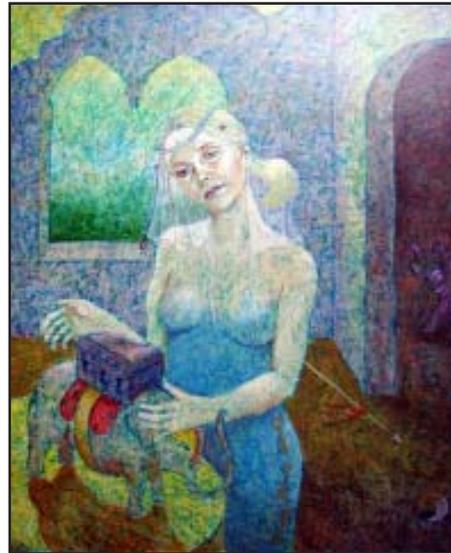
Painting by Doug Ross

The above painting would be a typical type of image where one would use JPEG compression to distribute it on the Internet.

WARNING!

If you are doing a lot of manipulations or editing on an image then you do those in an uncompressed format such as RAW or TIF before finally converting the image to JPEG. The reason for this is that every time you make changes and restore an image in JPEG it is compressed each time and the quality of the image is reduced each time you save it.

TIFF (Tagged Image File Format)

This is a standard in the printing and publishing industry. TIFF files are significantly larger than their JPEG counterparts and can be either uncompressed or compressed using lossless compression. Some cameras can produce TIFF files directly.

RAW

This file format is digital photography's equivalent of a negative in film photography: it contains untouched, raw pixel information straight from the digital camera's sensor. There is a

drawback with this format however; the RAW format is different for different camera brands and one usually requires a special application from the manufacturer to deal with their 'RAW' files. We will gradually see programmes like Photoshop supporting the RAW format from the main Digital Camera manufacturers.

PDF (Portable Document Format)

PDF was invented by Adobe and is a universal standard for the secure, reliable electronic document distribution and exchange. Adobe® PDF has been adopted by enterprises, educators, and governments around the world to streamline document exchange, increase productivity, and reduce reliance on paper.

Adobe PDF files will always reproduce exactly like original documents and preserve the fonts, images, graphics, and layout of any source file — regardless of the application and platform used to create it. A PDF file created on a Windows based PC will look exactly the same on a Macintosh and will look the same on all types of Printers. It is an ideal format for documents such as this one where there is a mix of text and pictures. When saving a document as a PDF file the options for high or low compression are offered depending on intended use. If you are publishing to the WEB then fairly high compression is required because you do not want your document to take an inordunate amount of time to download. Like JPEG PDF uses a range of algoritms to compress a file and like JPEG these are 'lossy' compressions so one must be careful not to diminish quality below acceptable levels.

Capturing Digital Images

Digital Cameras and Scanners

Both of these instruments are practically indespenisible to anyone who has to do a lot of work with Digital Pictures. It is not my intention in this document to go into any detail on the use of these instruments. Practically all Digital Cameras will permit you to download digital pictures into a computer. This is a very simple and straighforward procedure. Scxanners of course are specifically designed as a computer peripheral. When scanning a document you should be aware of certain settings on the scanner, especially the setting of dpi(dots per inch). The dots per inch setting determines the resolution or sharpness of the picture you capture. Unless you are intending to reproduce a very large high quality print of your picture a setting of **300 dpi** is adequate for most publications. There is no point in setting your scanner for a very high dpi because you are more than likely capturing and storing information that you simply cannot reproduce either on your monitor screen or printer; in other words you are storing useless information.

Scanning Text

When you scan a page of text and load it into a computer, what the computer sees is simply another digital picture which can be stored as a TIF, JPEG or any other picture format file. It is not possible for a Word Processor Programme to decipher this picture of a page of text because the scanned image is simply that, a picture, just like any other picture. A Word Processor using a universal code called ASCI code can store a full novel, at the very least, in the memory space that one such scanned page occupies.

If you want to convert a scanned image of text into ASCI code so that it can be handled by a Word Precessor you need to use an

OCR (Optical Character Recognition) application which will do that conversion. Practically all scanners come with some form of OCR software for this very purpose. Storing scanned pages of text without converting them using OCR is extremely profligate with computer storage space.

Colour Gamut

The last topic I want to cover is Colour Gamut. The colour gamut refers to the range of colours a capture or display device can handle. This is easy to understand using the C.I.E. chart (see next page)
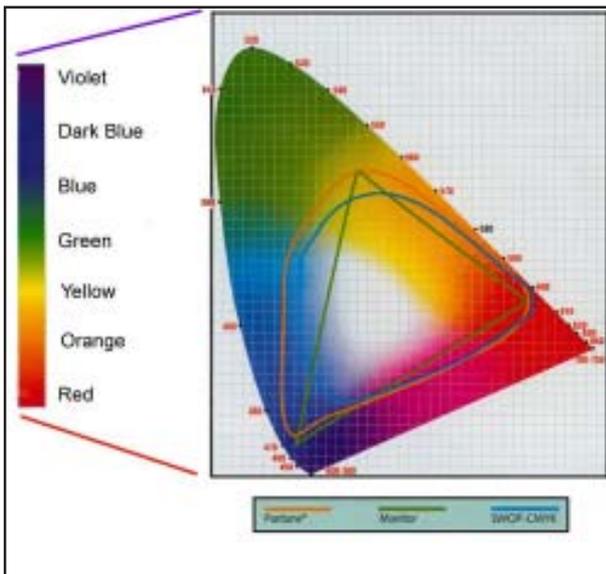
The full colour chart above represents the complete range of colours that can be seen by the human eye. The other areas of colour bounded by the orange, geen and blue lines represent the range of colours possible with Pantone Colours, a colour monitor and a certain type of printer. What this means is that the image you captured with your camera or scanner cannot be reproduced exactly as seen on your monitor, nor can the colours be exactly reproduced on a printer. So what happens when your camera can capture a certain colur that cannot be reproduced on you printer.

The answer comes under the heading of a very important topic in processing digital pictures; CMS (Colour Management System).

Essentially the colour management system ensures that a printer that is presented with a colour that is outside of its own gamut of colours will find the nearest match to that colour within its own gamut of colours.

Colour gamut is an important concept that clearly shows how colour reproductions no matter how good can never match the original.

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Sat 1st Oct. 20056