Graphics

- **Graphics In General**
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Graphics in General

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Pixels

- **The Attributes of Pixels**
  An original colour or black and white photograph has **continuous tone**. This means there is a smooth transition between adjacent shades or colours. But computers cannot understand anything that is continuous. We have to break the information down into small units in order for the computer to understand. The pixel is that small unit by which graphic data can be measured. What we aim to do with computer generated graphics is to simulate the continuous tone that occurs in the real world by using these small noncontinuous pixels.
  Every pixel in a **raster** (more later) graphic has four basic attributes that help define resolution, each in a different way.
  - Pixel Size
  - Tonal Value
  - Bit (or colour) depth
  - Pixel Location

Pixels

- **Pixel Size**
  When an image is digitally captured the pixels are all the same size. An image scanned at 300ppi (**p**ixels **p**er **i**nch) means that the pixels are all 1/300 inches in size. Higher input resolutions generate smaller pixels. This means more information and potentially greater detail per pixel. This leads to a more continuous tone appearance
- **Tonal Range**
  Scanners assign a single colour or grey value to each pixel in a graphic. The illusion of continuous tone occurs when pixels are small and when adjacent pixels vary only slightly from one another in colour or tone. The dynamic tonal range of the scanner used to capture the image is thus also a factor. A quality scanner will have a broad dynamic range and a low noise factor thus able to create an image with a broad range of tones from light to dark.

Pixels

- **Bit (or Colour Depth)**
  Although a pixel can only have one value assigned to it, it is the bit depth of the scanner or digitising device that determines how many **potential** colours or tones that are available to assign to it. (more on bit depth later)
- **Pixel Location**
  A raster image is just a grid of pixels, each pixel has a horizontal and vertical position in the grid. The physical size of the grid, determined by the total number of pixels and by resolution, determines the relative position of pixels.

Resolution

- The term resolution refers to how well an image is resolved. To our eyes the more real, smooth, or full of colour an image is, the more resolved it is and we refer to that as high resolution.
- **Resolution and Pixels**
  Pixels are the dots on the monitor screen. You have a fixed number of pixels on your monitor and those pixels are a fixed size.
  You can change the resolution using the control panel settings and that does change the number and size of the pixels on the entire monitor, and it will affect how large or small everything appears on your screen. It does not actually change how well an image is resolved, that is determined by the number of colours which in turn is determined by the bit depth

Types of Resolution

- **Terminology**
  The word resolution is used in many different situations. It can be confusing but no matter in what context you hear it, it is concerned with the amount or density of digital information. The variations have to do with either the type of device being used to measure the density or the stage of the production process at which it is measured. The following is some of the common variations.
  - Input or scanning resolution
  - Output resolution
  - Optical resolution
  - Interpolated resolution
  - Image resolution
  - Monitor resolution
  - Printer Resolution

Types of Resolution

- **Input or scanning resolution**
  The amount of information that a scanner captures per inch. Input resolution can be set by the user for each scan and is only limited by the maximum optical or interpolated resolution of the scanner.
- **Output resolution**
  Expressed as the number of pixels or dots per inch at which the final image needs to be printed at. This applies to print projects only.
- **Optical resolution**
  The maximum resolution that the scanner can sample. Expressed as per horizontal inch
- **Interpolated resolution**
  In the input phase of image capture it refers to the maximum density of information the a scanner can simulate with the help of scanning software. **Avoid** using Interpolation as it always compromises image integrity.

Types of Resolution

- **Image resolution**
  The total amount of information in a digital image at any stage of the production process. Expressed in pixels (800 x 600)
- **Monitor resolution**
  Expressed as either the total amount of information that a monitor can display at one time (800 x 600), or the number of dots per horizontal inch of the monitor (72dpi). Monitor resolution does not affect the print quality of the image data.
- **Printer resolution**
  The number of horizontal and vertical dots per inch that a printer can generate. The higher a printer's resolution, the smaller the dots it can create, and the more continuous in tone the resulting images appear to be. Printer resolution limits the maximum number of discrete tones that can be produced in print.

Bit depth (pixel depth or bit resolution)

- Before you can attempt to understand colour technology, you need to understand what **bid depth** is. You need to understand what it means when someone says it's an 8 bit image or a 24 bit image, or when you talk about the limitations of a 1 or a 16 bit monitor.
  - **Simply speaking the higher the bit number, the more colours.**
- A bit is the smallest unit of information that a computer understands. A bit is one electronic pulse. The pulse can do two things, it can be on or off (0 or 1). Everything the computer does is built from these on and off signals.

  A computer screen is divided into tiny little dots called pixels. These pixels turn on or off.

Bit depth (pixel depth or bit resolution)

- A 1-bit monitor can only understand one bit of information. With only one bit of information, a pixel can be one of two colours (2^1), it could either be white or black (on or off 0 or 1)
- A 2-bit monitor means that the pixels can understand two bits of information at once. With two bits of information sent to a pixel, that pixel could be one of any four colours (2^2). It could have these choices 11; 00; 10 or 01. One of these colours is black and another is white. The other two are shades of grey (different combinations of black and white)
- A 4 bit monitor means that pixels can understand four bits of information at once. With 4 bits you can arrange the on off signals in 16 different ways (2^4). Depending on how they are arranged, the different combinations create different shades. The order in which the 1s and 0s are placed creates the different colours.. This is pixel depth.
- So an 8 bit colour graphic can display (2^8) colours = **256**

Bit depth (pixel depth or bit resolution)

- An 8 bit greyscale image can display up to 256 shades of grey
- The deeper the bit depth, the more colours can be displayed.
  An 8 bit graphic doesn't look any better on a 24 bit monitor than it does on an 8 bit monitor
  The more colours or shades of grey displayed, the more the eye is fooled into thinking an image is realistically resolved
- **Bit depth and file size**
  The deeper the bit depth, the more bits of information the computer has to send to each pixel, an thus the larger the file size. A large graphic created by an image editing application say 6 inches by 8 inches, with a deep pixel depth, such as 24 bit colour, will take up many megabytes of space on your hard disk.
- **Points to Note**
  A 300 dpi image will not look good on a monitor that can display limited colours. A 24 bit photograph will not look good on an 8 bit monitor.

Bit depth (pixel depth or bit resolution)

- **Pixels and bit depth**
  Sometimes when you change the number of pixels on the monitor, it might also change the number of colours (bit depth) that can display on the monitor. This is because the more pixels you have, the more memory it takes to send all those bits of colour information to each and every pixel.

Monitor Resolution Vs Print Resolution

- **Pixels per inch and the monitor display**
  Perhaps the most confusing thing about resolution is the way that a monitor displays images that have more pixels per inch than the monitor is set to display. If you create a 1 inch square using PhotoShop and give it a resolution of 288 pixels per inch, it appears on your monitor as a 4 inch square when viewed at 100 percent. That is because your monitor is probably set to display 72 pixels per inch. But since the square is 288 pixels per inch, PhotoShop has to make the image 4 times as large on the screen to show all 288 pixels. You might think, by looking at the images on the screen, that the pixels are smaller for the 288ppi image than for a 72ppi image. They're not. They can't be. The monitor displays a fixed number and a fixed size of pixels at any one time. The difference is not that the pixels are different sizes, the difference is that there are more or fewer numbers of pixels. The more pixels you have to work with the greater detail you can create. This translates directly into printing in that the more dots you print with the more detail can be shown.

Monitor Resolution Vs print Resolution

- **Monitor Resolution**
  A standard monitor might be set at 800 pixels across by 600 down giving a total of 480000 pixels on the monitor. Everything appears rather large. You could change the resolution to something like 1024 by 768. This displays a lot more pixels and every pixel is smaller. Some images look better (appear to be more resolved) when they are small, sort of like a bird's eye view.
- With a printer the higher the number of dots per inch the higher the resolution.
- The resolution on a monitor is completely different from the resolution on a printer. On a monitor how well an image is resolved does not depend on the dots per inch of the image, it depends on how much colour the monitor can display.

Computer Colour Modes

- Different types of graphic require different **colour modes**. Understanding what the different colour modes are, which one is right for a particular graphic and why some colour modes create file sizes that are much bigger than others will help you avoid many problems.
- **Bitmap mode**
  When referring to colour modes bitmap mode means the image (often called one bit images) is black and white. No grey tones or colour.
- **Greyscale mode**
  In a computer, greyscale is an 8 bit mode, which means there are 254 different shades of grey, plus solid black and solid white, for a total of 256 different tones.

Computer Colour Modes

- **RGB mode**
  RGB stands for red, green, and blue. Monitors use the RGB system to create colour, using light. Monitors have 3 guns inside that shoot red, green, and blue light to all the pixels on the screen. The computer blends these three beams together in varying proportions to create the other colours you see. One hundred percent of all three colours produces white, which is why RGB is called an **additive colour model**.
  When you mix colours in the real world for example paints, the light comes from a source like the sun or a lamp. The light bounces off the paint and reflects the colour back into your eyes. The physics of colour in a monitor (or a TV or lighting) is completely different: the light does not bounce off any physical object, it is **projected straight** into your eyes.

Computer Colour Modes

- **Index mode**
  Instead of limiting the channel to 256 tints of the same colour, the index colour mode can have many different colours in one 8 bit channel. Index colour is rarely used in printed documents, but it is one of the most popular modes for images on the web because you can limit the number of colours to just exactly the ones you need, fewer colours mean smaller file sizes, which is always an objective in web graphics.
  Index colour images are created from RGB files. When an RGB file is converted to index colour the 16.7 million potential colours in the RGB file have to be converted into a maximum of 256 colours. Thinking of a photograph that has been scanned in RGB mode for presentation on a web site, the millions of possible colours will have to be converted to a maximum of 256. Some of the colours would change dramatically, especially in blends. The computer will have to fake certain colours by combining little dots of two different colours together to give a close approximation; this process is called dithering

Computer Colour Modes

- **CMYK mode**
  CMYK stands for the semi-transparent process ink colours **C**yan, **M**agenta, **Y**ellow and a **K**ey colour which is usually black. Tiny dots of transparent colours overlap each other in thousands of different combinations creating thousands of different colours with just four inks. The computer CMYK mode is only used for images that are going to be reproduced on a commercial press. CMYK colours are called **process colours**. Because the press uses these four inks to create all the colours an image needs. Printing with CMYK is often called four colour printing or process printing.
  The CMYK colour model is based on what happens with light and objects in the real world rather than in a monitor. A light source such as the sun or a lightbulb sends white light down to objects around us; certain colours of the spectrum are absorbed by the objects and certain colours are reflected back to our eyes. In physics this is called the **subtractive colour model**. In theory one hundred percent of cyan, magenta, and yellow creates black but in reality it creates a dirty dark brown so we have a black (or key) colour to create pure black.

Raster Graphics

- The term raster refers to images (raster or bitmap images), monitor display and computer graphic techniques that use dots (on paper) or pixels (on the monitor).

Vector Graphics

- Vector images are collections of independent lines and objects, that are defined by mathematical formulas. Resolution does not apply to vector images, they carry their resolution around in the math formulas, they will resolve to the resolution of the output device. So if you output a vector graphic to a 300 dpi printer the graphic will be 300 dots per inch, if you output to a 600dpi printer the graphic will be 600 dots per inch.

Vector Graphics

- **Advantages of Vector images**
  - **Resolution**
    Vector images are resolution independent. You print a vector graphic at the resolution of the output device. This means that no matter how much a vector image is enlarged or reduced, it looks great, no jagged edges.
  - **Easily modified**
    Vector graphics are composed of individual objects, each of the objects can be moved, recoloured, or reshaped as often as you like with great ease.
  - **Smaller file sizes**
    The mathematics of vector art allow very large shapes to be described using small amounts of data. This means that file sizes of vector images are mush smaller than the equivalent raster images. The file size of a vector image is defined by X and Y math co-ordinates for it's starting point, width, and height. The colour is also defined using a set of instructions, not 3 channels of pixels (RGB), So the file size of a 1-inch vector square would only be 8K (approx.).

Vector Graphics

- **Problems with Vector images**
  - **Screen View.**
    Vector images are rasterised to display on screen so they may appear a little jaggy on screen but will print just fine.
  - **Printing to non PostScript printers.**
    Vector images are composed of mathematical outlines that must be turned into dots before they can be printed to any printer. This process of turning outlines into dots is called rasterising. A PostScript printer can rasterise a vector image. A non PostScipt printer cannot rasterise. So all the non PostScript printer does is print the screen preview which is not very good.
  - **Image limitations**
    If you are trying to create a realistic sort of image, such as a portrait , in a vector drawing application, you'll find it difficult to create contours, shadows and highlights that look natural. This would require hundreds of objects to create the image, each object coloured slightly differently. Best use a raster application for such images

Resizing Images

- **Changing Resolution**
  Changing resolution is probably the most misunderstood part of working with raster images. Raster images are often scaled (resized) up or down to change the dimensions of the image. As soon as you change the dimension of a raster image, you change its resolution. Some resolution changes are unavoidable and work out okay, but others can mean that a file that was scanned at the right resolution no longer looks so good.
- **Stretching pixels**
  Imagine a photograph printed on a balloon. Before the balloon is blown up the image looks fine. But if you fill it with air and thus stretch the rubber the photograph enlarges. An image that looked fine unstretched, doesn't look so good when stretched, it loses detail. That is what happen when you enlarge a raster image, whether you do it in an image editing program or on the page layout page. When you originally scan or create a new file, it creates a set number of pixels. If you later increase the physical dimensions of the file, the pixels have to stretch and the image gets the jaggies.

Resizing Images

- **Adding pixels from thin air**
  What if you could add more pixels instead of stretching them as you scale an image. In PhotoShop this is called resampling. When you resample up, the resolution stays constant as you increase the dimensions of the file.
  Unfortunately resampling up doesn't work. The application doesn't know what detail it's supposed to insert as it creates the new pixels. So it guesses.
  Unfortunately the guesses result in a fuzzy image rather than a detailed one (but at least no jaggies).
- **The best thing to do if you want to double or triple the size of an image is to rescan the original at the larger size.**

Graphics and Printing

- **Types of Printer**
- **Factors Affecting Print Quality**
- **Text and Printing**

Types of Printer

- **PostScript**
  PostScript is a special programming language created by Adobe systems, that describes the appearance of a printed page. If you type any letter of the alphabet using a PostScript font, the shape of the letter is contained in a PostScript file which gets sent to the printer. Software programs such as Adobe Illustrator use PostScript to describe their images. PostScript fonts and images look best when printed on PostScript printers. Printers can be described as either PostScript or non PostScript.

Types of Printer

- **Ink-Jet Printers**
  Rely on spraying tiny droplets of ink onto a page. They are inexpensive and can produce colours that look very rich. They are lightweight and can easily be transported by hand. However Ink-Jet printers are slow. Photographic images can take several minutes to print.
  Some ink-jet printers do not print basic text well as they are **non PostScript** (see fonts later).
- **Resolution on ink jet printers**
  Because the ink is wet, it tends to spread out as it hits the paper. Also since there are 3 or more different inks sprayed onto the paper, there could be a build up of ink if you print images in high resolution. For this reason the resolution of graphics for an ink-jet printer can be much lower than the resolution for laser printers. Epson recommend an image resolution of no more than one third the resolution of the ink-jet printer.
  Special glossy paper is often required for colour quality.
  Ink-Jet printers are continuous tone printers and thus a quality colour ink-jet is suitable for printing photographic images.

Types of Printer

- **Laser Printers**.
  A laser printer passes a laser beam across a drum which creates a negative charge on the drum for the white areas of the image. Laser printer toner, a special micro-fine powder, only sticks to the positively charged areas creating the black or coloured (with a colour laser printer) areas of the image. As the paper passes through, the toner is transferred from the drum onto the paper. Heat then melts the toner onto the paper, which is why laser printers get warm. The printing quality is excellent. They are fast. The top speeds of ink-jets might be 7 or 8 pages per minute where some laser printers can print 40 pages per minute.
  They are **PostScript** which means they are excellent for printing text or vector graphics but can only simulate continuous tone by varying the sizes of dots (**Halftoning**)
  They are more expensive than ink-jets and they are not portable. A Colour Laser printer could cost ten times as much as a colour ink-jet. A quality colour ink-jet can actually do a better job of reproducing a photograph (ink-jets are continuous tone), especially on glossy paper

Types of Printer

- **Printer Memory (RAM)**.
  There is RAM in PostScript printers. Without enough RAM it can take longer to print complex graphics or lots of different typefaces. Most non PostScript printers, like ink-jets, don't have any RAM or a very small amount. They use the processing power and memory of your computer to print pages

Factors affecting Print Quality

- **Resolution** as it applies to printing has to do with the size of the dots that make up the images of the printed piece. The resolution is usually expressed as **d**ots **p**er **i**nch. (dpi).
  - **The more dpi a printer is capable of printing at the higher the resolution and the better the quality.**
- In desktop printers (the only type we will consider), the size of the dot changes in relation to the dpi. A printer with a 600 dpi has a large dot, a 1200dpi printer has a smaller dot. This means that graphics output from a higher resolution printer (more and smaller dots) will produce more detailed artwork.
- Understanding computer resolution and the correlation between computer and printing resolution is important when working with digital photographs, art and scanned images. With the proper resolution images look good; with the wrong resolution images look blurry or jagged.
- When you scan artwork it is very important to know the resolution of the desktop printer you'll be using for the final production

Factors affecting Print Quality

- **Pixels and Print Resolution**
  The resolution of an image in pixels per inch is not what makes it look better on the screen. How good an image looks to our eyes, depends on how many colours the monitor has set to display. But there is a direct relationship between how an image resolves on screen and how well it resolves on paper. The ppi of an image transfers directly to dpi on a printer. A 72ppi image that looks great on a monitor with lots of colours will print at 72dpi on a page and will not look as good. A 300ppi image will print significantly better than a 100ppi image.

Factors affecting Print Quality

- **Line screen (or halftone screen)**
  Line screen is the number of halftone dots per linear inch in a printed image (see halftoning basics). Line screen expressed in lines per inch (**lpi**), has a great deal to with the amount of detail that can be reproduced in print. If the line screen of a printer is low the printed image can only contain a few halftone dots per linear inch. The result is a limited amount of detail. As the line screen increases, more detail can be reproduced. However higher lpi will not improve a poor quality original. The quality of the detail in the original limits the detail delivered by any halftone cell.

Factors affecting Print Quality

- **Tonal Range: Balancing Printer Resolution and Line screen**
  There are two factors that contribute to a laser printers ability to simulate continuous tones. One factor is detail (line screen) and the other is **tonal range** (the number of discrete tones that can be expressed accurately between solid black and paper white). The relationship between line screen and printer resolution determines the tonal range. The number of possible shades that a halftone cell can produce is limited by the resolution of the laser printer. Ideally we should be able to produce 256 shades but the relationship between printer resolution and line screen is an inverse one as defined by the formula
  - **(Printer resolution / Line screen)^2 + 1 = Maximum number of shades**
- The explanation is simple enough. As you cram additional halftone dots into each linear inch, fewer wee-dots (the fixed size printer dots) are available to each horizontal gridline in a halftone cell. As the line screen increases, the number of potential shades that each halftone cell can produce decreases geometrically

Factors affecting Print Quality

- **Examples of Tonal Range**
  A 600dpi greyscale laser printer can only reproduce 37 shades of grey at a line screen of 100 $(600/100)^2 + 1$. If you crank up the line screen to 150lpi, you get more detail, but the image is higher in contrast because it cannot express as many discrete tones $(600/150)^2 + 1 = 17$.
  By the same reasoning a 1200dpi laser printer can reproduce 145 shades of grey at a line screen of 100.

Text and Printing

- **Fonts (typefaces)**
  Every time you press a key on your keyboard to type a character the fonts that are installed in your computer are activated. There are two basic font formats for computers. You need to be aware of both formats and make conscious decisions about which ones to use. The most popular and professional font format is called **PostScript** Type 1 created by Adobe Systems. The other type of font format is **TrueType**, created by Apple and supported by Microsoft. Most of the fonts on PCs are TrueType.
  - **PostScript fonts are better for a professional publication.**

Text and Printing

- **Fonts and Printing**
  For a file to print correctly, the exact same fonts you used in the document must be installed on the computer where the project will be printed. This means that the font must be named exactly the same, must be the same format, and must be from the same vendor. Just because a font has the same name does not mean it is from the same vendor, and every vendor makes their typefaces slightly different.
  When you sent a document from a computer to a printer, the printer needs the fonts that were used in the document so it knows how to form the letters. Some printers have fonts installed inside, so when you print a page, the printer doesn't need to download the fonts from the computer. If the printer does not have a font that has been used in a document the computer sends the font along with the document to the printer. Having fonts installed in the printer speeds up processing time.

Scanning

- **Scanning Basics**
- **Factors Affecting Scan Quality**
- **Scanning Modes**
- **Halftoning Basics**
- **Scanning Originals**
- **Scanning And File Size**
- **Scanning Previously Printed Materials**
- **Scanner Settings**
- **Scanning Preparation**
- **Calibration**
- **Getting a Good Scan**

Scanning Basics

- **Scanning laws**
  There are copyright laws that protect the publication, artist, or photographer. Make sure you have the rights to use any images you scan.

Scanning Basics

- **Scanners**
  Scanners use RGB to capture colour images. A scanner captures the varying levels of all the red, green, and blue data in an image. Each set of colour information is called a channel. When the three channels of colour are combined, the result is the full colour image Each of these RGB channels contain 256 shades of colour. So there are 256 shades of red, 256 shades of green and 256 shades of blue. Each channel is 8 bit. The 3 channels put together create 24 bit colour (3 channels times 8 bits) or 16.7 million possible colours.
- **Scanning**
  An image is placed on a scanner surface and light passes over it. As the light hits the image, the light changes depending on what is in the image. Those changes to the light are then stored as a digital file called the **scanned image**. Most scanners (all accept the highest quality) use a technology called CCD (**C**harged **C**oupled **D**evices) to capture the changes in the light of a scanner. In a CCD scanner, thousands of small sensors react to the light and store the data. The more sensors in the scanner, the more information can be stored

Scanning Basics

- **Scanners and Scanning**
  Scanners are powerful tools for reproducing real-world images in digital form. Their plug and play technologies make the process of capturing visual data seem deceptively simple. Place the original face down on the scanner, lower the lid, click the button and a few seconds later a digitised image pops up ready for you place into your PageMaker file. **Well it just is not that straight forward.**
- There are many factors that you need to consider before you scan and many factors that will influence the quality of your scan. Understanding these factors will help you produce better quality scanned images.

Scanning Basics

- **Types of scanner**
  - Hand held and sheet fed scanners
    Inexpensive are not appropriate for professional printing. Excellent for quickly scanning images that you may want to trace. Small and portable.
  - **Flatbed scanners**
    Most common type of scanner. All flatbed scanners can handle reflective images and some can handle transparent images. A single pass scanner captures all the RGB colours in an image by moving the light source over the image once. A three pass scanner uses three passes (one for each colour) to capture the colour data. Single pass scanners are faster, but three pass scanners are generally more accurate.

Scanning Basics

- **Types of scanner**
  - **Slide scanners**
    Specially made for transparent art, such as slides. You can get a slide scanner attachment for many flatbeds, although it usually doesn't give as high quality an image as a dedicated slide scanner. Slide scanners are high resolution to provide enough detail so a 1 inch slide can be enlarged enough to fill a full page without the pixels becoming obvious.
  - **Drum scanners**
    Highest quality scanners but very expensive. To make a drum scan, the image is wrapped around a transparent cylinder. The cylinder rotates as the light is focussed on the image. Limited to images that can be mounted on a cylinder. As flatbed scanners are becoming more and more sophisticated the use of drum scanners gets less and less.

Scanning Basics

- **Original images**
  The sort of things you can put through the scanning process can be divided into two categories
  - **Reflective images are physical objects such as photographs, canvasses, paintings or objects. The scanner captures the light as it reflects off the original.**
  - **Transparent images includes film, slides. The scanner captures the light as it passes through he original. Some scanners need a special adapter to scan transparent images**

Factors Affecting Scan Quality

- **Scanner resolution**
  The optical resolution of a scanner refers to how much detail the scanner can capture. The optical resolution is expressed as two numbers, such as 600 x 1200 ppi. The first number is the number of pixels per inch of information the scanner captures in horizontal direction. The higher the number of pixels per inch, the more detail the scanner can capture. The second number is the number of steps the scanner head moves along the vertical direction. The actual resolution is the first number not the second.
- You may also hear the resolution of a scanner expressed as the **interpolated or enhanced resolution**. Interpolated resolution is much higher than optical resolution. The scanner software can interpolate or fake the true resolution of the image into a higher number. Interpolation doesn't actually increase the detail in an image it just means the image can be enlarged without any pixelation.

Factors Affecting Scan Quality

- **Bit depth**
  The bit depth of a scanner refers to how much colour information the scanner can capture. A 24 bit scanner capture RGB images. Most desktop scanners are 30 bit, while higher quality scanners are 36 bit. This means they can capture extra information about the colours of an image. This added bit depth about the image provides more information to use during the colour and tonal correction of an image. You will not notice it on the screen, but the computer knows it is there and can use it.

Scanning Modes

- **Evaluating the Original Image**
  The original image will determine what mode to use when scanning.
- **Scanning Modes**
  - **Bitmap mode**
    If you scan an image in bitmap mode, the scanner only captures black or white data. The type of art that should be scanned in the bitmap mode are pieces such as ink drawings, or logos and cartoons that should have crisp lines and edges (known as line art because the images tend to be made of clean lines)
    - **Threshold**
      When you scan an image in bitmap mode, any grey tones are converted to black or white. If there are various shades of grey, the scanner evaluates how light or dark they are: if a grey is above a certain level, it is converted to black: if a grey is below a certain level, it is converted to white. You can set the level to decide which greys are converted to black or white this is called the threshold. Lowering the threshold means only darker greys will convert to black, increasing the threshold means the lighter greys will also convert to black.

Scanning Modes

- **Scanning Modes**
  - **Greyscale Mode**
    images to scan as greyscale are black and white photos, any type of black and white sketchy illustration that has shades of grey in it, such as pencil or charcoal sketches, colour photos or drawings that you're going to reproduce in black and white.
    Do not scan greyscale any line art images that need to have smooth edges. The greyscale mode does not create perfectly smooth lines.

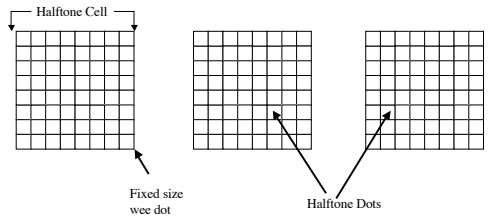
Scanning Modes

- **Scanning Modes**
  - **RGB Mode**
    Scanners use RGB to capture colour images. A scanner captures the varying levels of all the red, green, and blue data in an image.
  - **Use RGB for web pages, slides, computer presentations, video, television, anytime you are displaying the image on a monitor of any sort. You can also use RGB images in documents that you will output to a colour printer but never anything that will be reproduced on a commercial printing press.**

Halftoning Basics

- Laser printers cannot reproduce continuous tone artwork directly. Instead they use a process called halftoning to simulate continuous tones. In a commercial printing press halftoning involves the use of different sized dots to generate the different shades of an ink colour. Larger dots represent darker shades and smaller dots represent lighter shades. There is however a difference between commercial presses and laser printers (or other halftone printing devices). Laser printers can only produce **fixed sized** dots. To reproduce the different sized dots required to simulate continuous tone, these PostScript based printing devices group fixed sized dots (lets call them **wee-dots** to avoid confusion) together in a matrix called a **halftone cell**. The dot in each halftone cell reproduces exactly one shade of a process colour (or shade of grey). The density of that shade and the size of the halftone dot are directly related to the number of fixed sized wee-dots in each halftone cell, which in turn is determined by the numeric value assessed for each pixel. The number of halftone dots per linear inch in a printed image is called the **halftone screen frequency** or **line screen**.

Halftoning Basics Example



Scanning Basics

- **Halftone Screen angles**
  The interfaces of some scanners ask you to enter a halftone factor as one of the bases for determining scanning resolution. This applies only to scans that will be printed to a PostScript device. What the halftone factor tries to deal with is the issue of how many pixels (wee dots) worth of information are necessary to accurately determine the tonal value in one halftone dot. Scanning resolution is measured at a horizontal angle of zero degrees. But when a PostScript printing device such as a laser printer generates halftones, the halftone screens are rotated at an angle so that you don't see the screen patterning. This difference between the horizontal scanning resolution and the angles of the halftone screen is important because it determines the amount of information necessary to build each halftone dot in PostScript. The diagonal line (the line that represents the halftone screen angle) is 1.41 times longer than either the horizontal or the vertical line. We could do the Maths but this is not a Maths class. Basically we will use a factor of **1.5**. Using factors larger than this results in larger file sizes with less tonal range that are slower to print.

Scanning Originals

- **What determines the scanning resolution**
  The printer, conventions of halftoning, resolution of the chosen output device all together determine the correct output resolution for images.
  If you know the desired output resolution, halftone screen frequency, print dimensions and original dimensions you can calculate the correct resolution for an original.

Scanning Originals

- **Scanning Resolution for Laser printers**
  - **Scanning Resolution = Enlargement Factor X Halftone Factor X Line Screen**
- **Enlargement Factor**
  - **Desired final width / width of the original image**
- **Halftone Factor**
  There is much debate as to what the ideal halftone factor is. At the heart of the factor debate is **halftone screen angles** (see halftone screen angles)
  - **We will assume a Halftone Factor of 1.5**

Scanning Originals

- **Scanning Resolution for Continuous Tone Printers (ink jets)**
  - **Scanning Resolution = Enlargement Factor X Printer Resolution**
    This is not always the case. Because the ink is wet, it tends to spread out as it hits the paper. Also since there are 3 or more different inks sprayed onto the paper, there could be a build up of ink if you print images in high resolution. For this reason the resolution of graphics for an ink-jet printer can be much lower than the resolution for laser printers. Epson recommend an image resolution of no more than one third the resolution of the ink-jet printer.

Scanning Originals

- **Scanning Resolution for Line Art**
  When you scan an image in line art mode, all the pixels in the resulting image are either black or white. We are not really concerned with the tonal range. What we need is the detail which is determined by the resolution of the output device. We don't have to account for the halftone factor nor the line screen. The formula is thus simple.
  - **Scanning resolution = Enlargement factor X Printer resolution**

Scanning Originals

- **Scanning Resolution for Computer based Multimedia**
  The amount of information that computer monitors support is fixed. So is the aspect ratio of monitors (width and height relationship). You may have to crop the original either horizontally or vertically (before or after scanning) to make it fit. Scanning resolution for monitor based output.
  - **Scanning resolution = Vertical Monitor resolution / Narrowest dimension of original**

Scanning Originals

- **Scanning Resolution for the web**
  Although web graphics are computer based multimedia the rules for scanning are just a little different. Remember monitor resolution is determined by the number of colours that can be displayed. With a standard monitor setting we have 72 pixels per inch. This can be increased by using the control panels. Remember that increasing the resolution will increase file size and although some monitor settings will result in more than 72 ppi you will end up with larger file sizes that will take longer to download.
  - **Scanning resolution = 72ppi**

Scanning Originals

- **Scan at Integral resolutions**
  Always scan at resolutions that are evenly divisible by a scanners optical resolution. For example with a 1200ppi scanner scan at 1200, 600, 300, 150, or 75ppi. The reason for this is if you choose some other input resolution, a scanner has to to do some maths which will involve averaging, when determining colour values for a given pixel. This averaging will compromise tonal integrity of the original. If the use of integral scanning resolution generates less information than you need then scan at the next highest integral resolution. You can then downsample the image as a post-processing step. You will still incur some compromises though averaging but the downsampled image will provide all the information that the output device can use.

Scanning and File Size

- **Scanning and file size**
  The file size of an image will vary depending on what mode you scan an image at
  - **Bitmap File size = width (inches) * height(inches) * scan resolution^2 / 8**
  - **Greyscale File size = width (inches) * height(inches) * scan resolution^2**
  - **RGB File size = width (inches) * height(inches) * scan resolution^2 * 3**
  - **CMYK File size = width (inches) * height(inches) * scan resolution^2 * 4**

Scanning Previously Printed Materials

- **Scanning Printed art work**
  Sometimes all you will have is a print of a piece of work you wish to scan. This is different from having the original photograph. The rules for scanning printed artwork are slightly different from scanning originals.
- **Scanning line art**
  Scan as black and white at the resolution of the final output device
- **Scanning coloured line art**
  All line art is 1 bit but not all line art is black and white. Many line art images have been printed with solid colours. Scan as line art at the final target resolution (black and white or 1 bit) but increase the threshold to pick up the light colour. You can always use an image editing package to change the black colour to whatever colour you want.

Scanning Previously Printed Materials

- **Scanning Printed art work**
  The source image already has halftone patterns embedded in it. If a digitised image needs to be printed again, there's a risk that visual interference patterns called moiré patterns may occur. Most scanning software packages has a descreening control that removes previous halftone patterns.
  Scanning printed greyscale art
  The original grey areas have already been converted to a dot pattern. So all you have to do is capture the original dots by scanning as line art at the resolution of the output device (note not the linescreen)
- **Scanning Printed coloured art**
  Probably the hardest type of image to scan and have it look good. If you plan to reprint the image you need to scan as RGB colour, if you want to print to a professional press then you must also convert to CMYK and then make separations. You must also apply some sort of descreening to avoid a moiré pattern. **Do not expect high-end results when scanning previously printed greyscale or colour images.**

Scanner Settings

- **Evaluating Tonal Character**
  Both tonal character and exposure have a significant impact on the settings you choose during scanning. Most forms of output can't reproduce all the tones in the original. Given the limitations, you may have to pick and choose what's important in an original and scan in a way that will emphasise those details at the expense of compressing others. Understanding the tonal character of an original is important when choosing scanner settings.
- Tonal character of an original can be classified as one of three keys
  - **High key or snow images**
  - **Low Key or night images**
  - **Balanced or midtone images**

Scanner Settings

- **High Key images**
  The subjects to be emphasised appear in the highlight tones. The most important details are in bright, near white areas. These lighter tones are sometimes called **diffuse highlights**. Midtone and shadow areas of high key images contain relatively little detail of interest. Photos of subjects in snow during day light are good examples of high key images
- **Low Key images**
  The subjects to be emphasised appear in the shadows. The most important details are in shadow areas with less emphasis on subjects in the midtones and highlights. Photos of towns after dark are good examples of low key images
- **Balanced images**
  Details of interest are either evenly distributed from dark to light or are concentrated in colours and tones of medium brightness. These are by far the most common type of original you will come across.

Scanner Settings

- **Histograms**
  Analysing Tonal distribution can be tricky. Fortunately most scanner software comes with a histogram utility that analyses the tonal character of the original before you scan it. A histogram is a map of the tonal distribution throughout an image. Most scanning software allow you to prescan and then generate a histogram. You can use the information in the histogram to alter the image's tonal curve during scanning to emphasise the most important details.
  The horizontal axis of a histogram shows the distribution of tones running from dark (left) to light (right). The vertical axis shows how large a proportion of the image is assigned to each tone. High key images will show a large concentration on the vertical axis towards the right side of the histogram. Low key images will show a large concentration on the vertical axis towards the left side of the histogram. Balanced key images will have a higher concentration in the centre of the histogram. Blank areas at either side of the histogram indicate a complete absence of detail in the established highlights or shadows.

Scanner Settings

- **Highlight and Shadow Points**
  Sometimes called white point and black point the highlight and shadow points are the brightest and darkest tonal values in an image that still contain detail. Images that are to be printed (**other images do not get altered**) should have the original's white and black points reset during scanning. The brightest value in the image is set to darker than white and the darkest value to lighter than black. This process compresses the tonal range for printing purposes so that light details don't drop out to white and details in the darkest areas of the image don't become an undifferentiated black. Together press type and paper type determine the correct highlight and shadow points to assign to images for a particular print job.

Scanner Settings

- **Correcting the Gamma**
  Resetting the highlight and shadow points tends to flatten image contrast. To reset the contrast to something more pleasing you need to adjust the midtones, also known as **correcting the gamma**. When you correct the gamma of an original for scanning purposes, you're actually adjusting the brightness and contrast relationships for the entire image. Most scanner software offers multiple techniques for correcting the gamma. When using a numerical Correct the gamma when you want to:
  - **Intensify contrast and detail in a low key or high key image**
  - **Reintroduce contrast into any image that has been flattened by white and black point adjustments**
  - **Compensate for dot gain that occurs during the printing process**
  - **Compensate for exposure problems in an original. This can help to draw out detail in an underexposed or overexposed photo.**

Scanner Settings

- **Dot Gain**
  Refers to the tendency of halftone dots to spread and darken on the interaction between press and paper. Dot gain is usually measured at least in modern times in absolute terms (although you should always check with the printer that he is quoting in absolute terms not relative). Suppose you are preparing to scan an image for professional print and you have been quoted a 20% dot gain. What this means is that the 50 percent dot prints at 70 percent grey. If the original was a balanced key you would adjust the tonal curves of the 50 percent point down to a little above 30 percent to account for the dot gain. The scanned image will look lighter on the screen than the original but when printed the little above 30 percent dot will darken to 50 percent. A word of advice do not let dot gain rule your decisions on adjusting tonal curves. Let the tonal character of the original guide you. Remember you could always use an image editing application to make adjustments after the scan

Scanner Settings

- **Scanner Software**
  Scanners come with software which may allow you adjust the settings to get better quality scans.
  - **Setting the resolution**
    Most scanners let you set the resolution of the scan in one of two ways
    - **Set the actual resolution for the image**
      The benefit of setting the actual resolution is that you can break the halftone factor rule to take account for different images.
    - **Set the target output resolution. The software multiplies the output device resolution by the halftone factor (1.5).**
  - **Sharpening**
    Sharpening compensates for the slight blurring or softness in a scanned image by looking for differences between the colours of the image. The sharpening accentuates these differences, which makes the edges in the image more defined. Too much sharpening distorts an image and causes a glow. Most image editing applications have a sharpen command.

Scanner Settings

- **Scanner Software**
  - **Contrast and colour controls.**
    Most scanner software have some sort of controls for adjusting the contrast and colour of the image. Image editing software also has such features. There is little difference between them but it may be best to leave it to the image editing software unless you are sure what you are doing. You can always not save the changes in the image editing software but you would have to rescan if you got it wrong with the scanner software.
  - **Descreening controls**
    This is not perfect but what in theory happens is the dot pattern is blurred into a solid set of pixels. This often distorts and softens artwork so that it's obvious it's not an ordinary image.
    Usually listed as the line screen you are trying to blur. If you know the original line screen, choose it, if not trial and error. The lower the line screen amount you choose, the higher amount of blur. Descreening doesn't just apply to dots, but to the entire image, this softens the solid areas of the image as well.

Scanner Settings

- **Scanner Software**
  - **Tonal Curve**
    Many software packages that come with scanners allow you manipulate either the tonal curve or gamma value of the original. Both are designed to redistribute the existing tonal values in the original. The tonal curve lets you make adjustments graphically whereas the gamma value is numerical. A perfectly diagonal tonal curve represents a baseline, unaltered distribution of tonal values. Any alteration to the curve redistributes the tonal values. If the curve's horizontal values progress from light at the left to dark at the right (always check this) you would edit the prescan tonal curve as follows
    - **High key images**
      drag the curve upward from the centre and/or upper right to enhance detail in the highlights and midtones, compressing or eliminating the amount of detail in the shadows
    - **Low key images**
      drag the curve downward from the centre and/or lower left to enhance detail in the shadows and midtones, compressing or eliminating the amount of detail in the highlights
    - **Balanced images**
      The curve need not be altered. You can get a little more contrast by creating a near S shape which compresses detail in the highlights and shadows and lightens the midtones slightly

Scanner Settings

- **Scanner Software**
  - **Gamma Value**
    - **High key images**
      set the gamma to 1.2 or lower
    - **Low key images**
      set the gamma to 1.8 or higher
    - **Balanced images**
      set the gamma to around 1.5

Scanner Settings

- **OCR Software**
  Scanners take pictures of images they do not read text. There is special software called **O**ptical **C**haracter **R**ecognition that is often includes with scanners or you can buy it separately to use with your existing scanner. This software recognises shapes of letters and creates an editable text file from the page on the scanner. Depending on the clarity of the original text, it can take some time an effort to get all the text translated correctly. Depending on the volume of text to be scanned it may be quicker and more accurate to get it typed.

Calibration

- The task of making a final scanned image look like the undigitised original has several areas where it could go wrong.
  - **The differences in gamut between RGB and CMYK colour**
  - **Variations in the way scanners, monitors and printers interpret colour**
  - **The tendency of equipment to reproduce colour inconsistently over time**
- Calibration is part of the solution aiming to standardise colour representation along every step from input through output.
  - **The first step in calibration is matching the scanner to a standard for colour representation. Each input and output device should be calibrated frequently using an industry standard colour target.**
  - **The second step involves matching the colour characteristics in the production process to each other. This is harder than it sounds. Not only does each type of device reproduce colour to a different standard but variations also exist among multiple manufacturers.**

Calibration

- **Colour Management Systems (Kodak CMS)**
  Calibration needs help in the area of describing the colour representation characteristics of any device in a standardised way. A **C**olour **M**anagement **S**ystem (CMS) is a type of software that helps this description. The aim of a CMS is to achieve colour consistency throughout the production process by describing and recording the colour representation characteristics of various devices in a universal device independent way, and then using the recorded information to translate the colour characteristics of any one device to any other.

Scanning Preparation

- Preparing both the scanner and the original image before you scan can lead to far better quality scans. There are several areas that you should pay attention to:
  - **Clean the glass of the scanner**
    Make sure the glass of the scanner is kept as clean as possible. Dust scratches and fingerprints all adversely affect the quality of your scan
  - **Take care of the image**
    Handle photographs to be scanned carefully, avoid dust, scratches and fingerprints.
  - **Use glossy photos**
    Photos on glossy paper make better scans than photos on matte surfaces. The matte surface has thousands of small indentations in the paper that will affect the quality of the scan.
  - **Allow the scanner to warm up**
    If possible allow the scanner to warm up for a period of 30 minutes before you scan. The light sources in fladbed and transparency scanners brighten and change colour temperature after the equipment has been turned on for a while . The results are better quality scans and broader tonal range.
  - **Make sure the scanner has been calibrated**

Scanning Preparation

- **Positioning the original**
  Straighten the image. Make sure the image is aligned as straight as possible. The optical quality of the glass is better in the centre so try to place the image in the centre of the glass. You can often use image editing application to straighten scanned images but don't rely on rotating an image electronically because it forces pixels in the image to resample, which causes a loss of detail. It is much better to scan perfectly straight if possible.
- **Keep the image on the glass**
  Put the top of the scanner down on the image. This keeps all the portions of the image in focus.
- **Avoid vibrations and motion**

Scanning a 10 point guide

- I would recommend you follow the following 10 point procedure if you want a good quality scan:
  - **Evaluate the original image to determine the type of scan**
  - **Physically prepare the scanner and the original image for use**
  - **Position the original in the scanner**
  - **Switch the scanner on and activate the software**
  - **Select a scanning mode**
  - **Prescan the original**
  - **Crop and otherwise adjust the preview**
  - **Set resolution and sizing**
  - **Adjust highlight and shadow points, gamma and related tonal setting**
  - **Scan the image**
- Remember you can always use an image editing application to adjust settings you are not sure of. Sometimes you can get better quality by adjusting the settings before you scan but it may be costly on your time if you get it wrong.

Sharing Information

- **Graphic File Formats**
- **Native File Formats**
- **Non Native File Formats**
- **Types of Non Native File Formats**
- **Compression**
- **Choosing the right software for the job**

Graphic File Formats

- **Graphic File Formats**
  Every time you create a graphic (or any document) on the computer, the application saves that graphic with a particular file format. Some formats are raster, others are vector, some are high resolution, others are low resolution, some can be used by any application, others are application specific. Different file formats are good for different purposes. Some are good for high resolution printing, others are best for low resolution web graphics. Some file formats are used to translate from one graphic application to another.

Native File Formats

- When you save a document in the same format as the application you're working in, that document is in the application's **native file format**. Sometimes the native file format has a **.tag** after the name of the file (PhotoShop has a **.psd** tag appended to the name of the file). The native file format usually offers some advantages over other file formats when you're using the native application. For Example In PhotoShop you can work in layers and do special work with text which if you save in a different format you will no longer be able to do. You can print the PhotoShop file directly from within PhotoShop but if you wish to include the image in another non PhotoShop document say for example a PageMaker document you will have to save the file in a different format as page layout applications don't recognise the PhotoShop native file format.
  Some software companies like Microsoft and Adobe have created synergies between their various products which allow you to use native file formats in other applications. But just because there is a link between programs does not mean you get better print output, it only means it is easier to work with the files.

Non Native File Formats

- The type of file formats that each application can create or accept varies from application to application and from version to version. Some times a company may add a new file format to it's **Open file** or **Save As** capabilities. Other times outside companies may create filters that allow another program to read or write as new file formats. Some file formats are added so files can be transferred between Macintosh and Windows computers. If you save a file as anything other than the native format it is a **non native file format**.

Non Native File Formats

- **Exporting or saving as non-native file formats**
  Depending on the application you might have a number of choices of non native file formats that you can **Export** or **Save As** a file. There are slightly different techniques for doing so dependent on the application. In PhotoShop you can save in a number of different file formats and you can export as others. There are slight differences between exporting and saving, but both techniques create non native file formats. You should always check the help files or read a manual for details.

Non Native File Formats

- **Importing and opening non native file formats**
  When you bring a non native file into your document it's called importing. Most applications have an Import command (or something similar). Typically importing adds the file ,for example a scanned image to an existing document. Sometimes you can just open a non native file using the Open command.

Types of Non Native File Formats

- **TIFF**
  TIFF stands for tagged image file format and is a raster file format. Almost every image editing application can save as TIFF, and almost every other application can open or import TIFF. It was originally created for scanning. These files are extremely flexible. A TIFF can be CMYK, RGB, greyscale, index, or bitmap format, any bit depth and any resolution. TIFF is also the best format for files that need to go between Macintosh and Windows computers.
- **TIFF byte order**.
  You can save a TIFF as either IBM PC or Macintosh. One point a Mac can open a TIFF with a PC byte order but a PC cannot open a TIFF with a Mac Byte order. You can use PhotoShop to convert files from one file format to another.
- **LZW compression**
  You can save TIFF images with LZW compression, which is completely loss-less (see compression).

Types of Non Native File Formats

- **EPS files (vector)**
  Vector drawing applications such as Adobe Illustrator let you save files in the EPS format (Encapsulated PostScript). A vector EPS file will print at whatever the resolution of the printer is, and can be enlarged and reduced with no degradation of the image at all.
- **EPS files (raster)**
  Sometimes you might have a need to save a file as a raster EPS. EPS files can contain information that you can't save in TIFF, such as special halftone screens or line screens. You should never scan as EPS but PhotoShop will convert images to EPS files for you.
- **EPS Preview Options**
  When you save as EPS you have a choice of the type of screen preview for the file. Previews **do not affect what is printed to PostScript printers**. They are used only for the screen image. If you are working in a cross platform environment choose a TIFF preview but a JPEG preview leads to a smaller file size and is perfectly acceptable.

Types of Non Native File Formats

- **PICT files**
  The PICT format was created by Apple for images on the first Macintosh. A PICT file can contain both vector and raster information. Image editing applications export PICT files only in raster format. Vector drawing applications export PICT files in vector format.
  PICT files are old fashioned and use a very primitive language to encode its data. PICT files cause printing problems, especially on PostScript printers.
  PICT files are useful for screen presentations. They can be useful when printing to non PostScript devices such as ink-jet printers.

Types of Non Native File Formats

- **PhotoShop PICT**
  When you save a file in PhotoShop as PICT you have a choice of compression. If you choose JPEG you will degrade some of the information in the image. If you don't choose JPEG, PhotoShop will use RLE (run length encoding) compression, which doesn't degrade the information in the file.
  If you want to save as PICT (not really necessary nowadays) but the option is not available, try changing the files colour mode to RGB.

Types of Non Native File Formats

- **DCS files**
  Desktop **C**olour **S**eparation is a variation of EPS. The DCS format was developed by Quark to allow QuarkXPress to read and print CMYK files correctly. These files can only be printed to PostScript printers.
- **BMP files**
  Just like PICTs but for Windows machines. Fine for on-screen display but not for professional output.
- **WMF files (Windows MetaFile)**
  A vector format for use on the windows platform. It can be imported into page layout applications on the Macintosh. Like PICT and BMP files it should be limited to use in multimedia applications or in documents that will be printed to non PostScript devices.

Types of Non Native File Formats

- **GIF files** (**G**raphic **I**nterchange **F**ormat)
  The GIF file format is a compressed graphic format that can be displayed on any computer. It was originally created by CompuServe for transferring images via phone lines. Small files can be viewed on any computer, GIF images are found in large numbers on the WWW.
  A GIF image must use the Index colour mode which has a maximum of 256 colours (8 bit). To reduce the file size, you can reduce the number of colours to just the ones you need. In the format called GIF89a, you can also specify which area in the image should be transparent instead of opaque.
  GIF files are not used for professional printing. You can print a GIF file downloaded from the web but it won't look good because most web graphics have a low resolution of 72ppi. A GIF file does not have to be 72ppi but it will not look any better on screen if it is a higher resolution.

Types of Non Native File Formats

- **PNG files** (**P**ortable **N**etwork **G**raphic pronounced ping)
  Similar to GIF in that it is compressed. It was created as an alternative to GIF as the owners of the GIF format declared that any software that creates GIF files has to pay a royalty for the privilege. So PNG offers a royalty free web graphic format. PNG files can support 24 bit colour and transparency without the jaggy edges so common in GIF images.
  You need a modern browser to see PNG files on the web, and you might also need a special plug-in depending on the browser.

Types of Non Native File Formats

- **JPEG files** (**J**oint **P**hotographic **E**xperts **G**roup)
  The JPEG file format is a compression format that makes images into much smaller files. The JPEG format is used for photographic images instead of the GIF format because in a JPEG you have 24 bit colour.
- **JPEG compression**
  The JPEG format is lossy. When you save a file as JPEG, a certain amount of data is thrown away and you can't get it back. You can choose how much compression to apply to an image
  - **More compression = smaller file size but lower image quality**
  - **Less compression = larger file size but better image quality**
- How much compression you apply depends on how you are going to use the graphic. Sometimes you need a smaller file size like for the WWW. Other times you might need the quality, like in a computer presentation, more than you need the smaller file size. Never save a file with JPEG compression if you're going to print it.

Types of Non Native File Formats

- **PDF files** (**P**ortable **D**ocument **F**ormat)
  The PDF file format is a compression scheme that embeds all the necessary information to view a file or an entire publication; text, images, page breaks, fonts, etc. There is a common problem when transferring files from one machine to another in that not all computers have the same fonts, and graphics could go missing along the way. A PDF files solves this problem. It doesn't matter which computer you use or what fonts are installed, the PDF always looks great and it prints great. Many software manuals are now created in PDF so that you can print them yourself. In an open PDF file you can click on items in the table of contents, index, or even links on the individual pages to jump to those pages instantly.

Types of Non Native File Formats

- **PDF files** (**P**ortable **D**ocument **F**ormat)
  Several important uses
  - **Anyone on any computer can read the same file with the same layout and fonts.**
  - **You can make PDF files with Adobe Acrobat software and most applications have a facility to save as PDF**
  - **PDF files are compressed so they're very small, which means they are ideal for sending over the internet, or storing on a file server. Members of staff can view and print the file on their own computer.**
  - **You can put PDF files on web pages. If a PDF plug-in is installed, you can open and view the PDF on the web inside your browser, and be able to see a complete layout page as if it were in PageMaker.**
  - **You can send PDF files for printing and the printers do not have to have the original application that was used to create the file.**
  - **You can attach notes and comments to the PDF file, and even collect all the notes into one text file for printing.**

Types of Non Native File Formats

- **Tips on Which Format to Choose**
  - **Only TIFF and EPS should be used for professional printing.**
  - **Avoid using PICT or BMP**
  - **JPEG are best for photos to be displayed on the web.**
  - **GIF are fine for logos on the web but not so good for photos.**

Compression

- **Compression**
  The information in a file is squished so the file takes up less disc space. There are two generic types of compression, **lossy** and **loss-less**.
  - **Lossy compression means some of the data in the file is lost when it is compressed, so there may be less detail in the image. We are used to throwing away some information when recording sound, pictures and video, because analogue tape recording and photography are lossy processes. Useful for**
    - **Sound files**
    - **Images**
    - **Video**
  - **Loss-less compression means no data is lost when the file is compressed, so the image looks exactly the same when it s compressed as it does when it is not compressed. Useful for**
    - **Binary files**
    - **Text Files**
    - **Images which must be perfectly preserved**

Compression

- **Why Compress Data**
  Data compression makes it possible to speed up data transfer, by reducing the amount of space taken up by the information being sent.
- **Compression: How it works**
  Algorithms try to take advantage of redundancy in the data to reduce the number of bits required to store the file.
- **An Example**
  - **Imagine a raster image that is 8 bit but actually only contains 4 colours. Remember that an 8 bit image will have pixels whose values can be any number from 0 to 255 (any one of 256 colours or shades of grey see bit depth). The image when stored without compression would be 8 x 8 x 8 (512) bits long but because we only need 2 bits to store 4 colours we could use compression and end up with an image 2 x 2 x 2 (8) bits long.**
    OK this is a little simple and there are all sorts of algorithms. The point is we can reduce the file size
- The compression ratio any algorithm achieves will depend on the data.

Choosing the right software for the job

- **Many Different types of software**
  There are many different types of software package, each type is intended for a specific use. When you have a job to do it helps if you use a piece of software (application) that was designed for that purpose. Knowing what applications were designed for helps your decide which application is right for the job.
- **Types of Application**
  - **Page Layout (Adobe PageMaker)**
  - **Image Editing (Adobe PhotoShop)**
  - **Vector Drawing (Adobe Illustrator)**
  - **Word Processing (Microsoft Word)**
  - **Spreadsheet (Microsoft Excel)**
  - **Presentation (Microsoft PowerPoint)**

Choosing the right software for the job

- **Page layout applications (Adobe PageMaker)**
  A page layout application is the assembly area where all the parts of a job are put together.
- **Intended for:**
  - **Writing text directly in the application**
  - **Importing text from a word processor**
  - **Styling and formatting the text professionally**
  - **Importing graphics, then positioning them.**

Choosing the right software for the job

- **Some effects you can apply to graphics within a page layout program and what they can do to the final printing:**
  - **Significantly resizing graphics up or down will add to the print time. Bitmapped graphics from an image editing program will look jagged if you enlarge them much at all.**
  - **Rotating graphics can add to the print time. If you have many graphics that need to be rotated, it would be better to go back to the original graphic and rotate it in the application that created it.**
  - **Changing the colours or shades of graphics in the page layout application will also add to the print time. Again it is better to make the changes to the graphics in the image editing or vector drawing application.**

Choosing the right software for the job

- **Image editing applications (Adobe PhotoShop)**
  This kind of application creates images using pixels, the tiny dots on the screen, so the images are **raster** or **bitmapped** graphics (information is mapped to each pixel on the screen with bits of electronic messages). Each pixel can hold millions of colours. You can edit files in an image editing application pixel by pixel. You can use image editing applications to create special text effects, such as shadows or glows, that will be printed on paper. You can also use these applications to add text that's part of an image, like a headline that is positioned directly on top of a photograph. Image editing applications have hundreds of things that they are good for but for the purposes of this course it is more important to know what we should not use them for.

Choosing the right software for the job

- **Image editing applications. Some Things not to do:**
  - **Don't include unnecessary, large areas of solid white. For instance if two images have a lot of white space between them, it may be better to separate the images into two different files rather than one large file. This can reduce the file size of the graphic, which will then print faster and will take up less disk space.**
  - **Don't increase the size of the finished artwork. Do not place the graphic in a page layout application and then enlarge it. Because of the way a graphic is created in these applications, increasing its physical size makes it blurry and chunky.**
  - **Don't set plain text headlines in an image editing application (unless you are preparing images for the screen, such as on a web page or in a presentation). Setting text in these applications is not the same as setting text in a page layout application or even a word processing application. Headlines from image editing programs appear soft or blurry when printed on paper.**

Choosing the right software for the job

- **Image editing applications. Choosing Colours in RGB**
  You can never judge exactly what a colour on the monitor will look like when it is printed on paper. Computer monitors use RGB colours; pages that are reproduced on a commercial press use CMYK colours. There will always be differences because they use completely different physics to display colour (RGB uses light that goes straight to your eyes, CMYK uses reflected light bouncing off of a physical object) Some colours shift quite dramatically when they are converted from RGB to CMYK. Fortunately some applications (Adobe PhotoShop) indicate which colours cannot be printed in the CMYK process. These colours are called out of gamut. Adobe PhotoShop indicates out of gamut colours by an alert symbol and if you click on the alert symbol the out of gamut colour will be changed to the nearest possible RGB colour that will print properly.

Choosing the right software for the job

- **Image editing applications. Choosing Colours in CMYK**
  Similar to RGB mode, there is a channel in image editing applications for each of the four process colours in CMYK mode. The channels show the amounts of each process colour that will be printed. These are called the separations for the image. The combination of all four channels is called the composite image.
  The image you see on the computer is shown to you in RGB colours since that is what the monitor does.
  If you are creating a document for full colour printing do not choose colours by what you see on the screen you need to get a process colour book from a company such as Pantone. These guide are colour charts that for each colour tell you how much of the 4 process colours are required to print that colour e.g. C:20, M:40, Y:18 and K:12. You can then use your image editing application in CMYK mode and key in those values to use that colour. Remember what you see on the screen may not look anything like the colour from the guide but it will print correctly.

Choosing the right software for the job

- **Image editing applications. When to shift to CMYK**
  Scan using RGB. If you are going to print images in process colours (using a professional printing press), convert images to CMYK when you are ready to print them or are ready to place them into a page layout application in preparation for printing.
- Keep the image in RGB mode when working with it in image editing applications because:
  - **RGB images are smaller than their equivalent CMYK. So they will open and save faster then the CMYK versions.**
  - **Some effects and filters are only available in the RGB mode.**
  - **Converting back and forward between RGB and CMYK modes will cause loss of information in the image. Make the conversion the last thing you do.**

Choosing the right software for the job

- **Image editing applications. Converting to Index Colour**
  Index colour images are created from RGB files. When an RGB file is converted to index colour the 16.7 million potential colours in the RGB file have to be converted into a maximum of 256 colours. Thinking of a photograph that has been scanned in RGB mode for presentation on a web site, the millions of possible colours will have to be converted to a maximum of 256. Some of the colours would change dramatically, especially in blends. The computer will have to fake certain colours by combining little dots of two different colours together to give a close approximation; this process is called **dithering**
- An index colour file does not have to be 8-bit, it can be just about any bit depth from 1 to 8. The index mode is obviously not for photographs or painting, it is best used for graphics with broad areas of flat colour that are going to be put on the web.
- When you convert a graphic file from RGB to index colour, you throw away colours, colours that you won't get back. So if you are making graphics that you need in both print and on the web, first make your RGB graphic, then make a copy of it: in a low resolution index colour image.

Choosing the right software for the job

- **Vector drawing applications (Adobe Illustrator)**
  Vector drawing applications work in mathematical boundaries called vectors. Instead of a bitmapped image made of thousands of individual pixels, the separate parts of a vector graphics are each individual objects.
- **Advantages of working with vectors**
  - **You can make changes constantly to entire objects without having to make the changes pixel by pixel. Take for example a box. You can change it's colour or border pattern with just the click of a button. This is possible because each part of the box , the inside and the border are separate objects that you can alter with drawing tools. In a bitmapped graphic you would have to select all the individual pixels inside the box or in the border before you could change it. If you wanted to change the thickness of a border you would have to redraw it.**
  - **Unlike bitmapped graphics which should not be enlarged, there are no restrictions on enlarging or reducing vector images because you're not resizing pixels, you are just changing the mathematical formula that defines the object. This makes drawing applications ideal for creating artwork such as logos that need to be used at different sizes.**

Choosing the right software for the job

- Some drawing applications also have page layout features. This means that you can create artwork in the drawing application and also import text and other graphics to lay out single pages, package design, or posters. You can then print the page directly from the vector application.
- **Never**
  - **Use a vector drawing application to create complex projects such as books and magazines.**
  - **Try to edit something like a photograph because a photograph cannot be separated into individual objects.**
- **Examples of when to use vector drawing applications**
  - **Special type effects such as text that goes around a circle or follows a curved path**
  - **Special type effects where text is skewed or sheared to create different looks**
  - **Charts and graphs**
  - **Logos**
  - **Graphics that are composed of individual objects or shapes**
  - **Technical illustrations.**

Choosing the right software for the job

- **Word processing applications (Microsoft Word)**
  Intended for:
  - **Typing fast, checking spelling, automatic repetitive typing tasks, creating outlines easy, writing reports with footnotes, making tables of data, printing to desktop printers.**
- **Not intended for:**
  - **Creating or using graphics at a professional level. The graphics features found in word processors should not be used for high-end output.**
  - **Not very good at professionally formatting text, they just do not have the right features. If you want truly fine type, insert your word processed text into a page layout application such as Adobe PageMaker.**

Choosing the right software for the job

- **Guidelines for preparing text in a word processor that is to be inserted in a page layout application:**
  - **Do not use built in drawing or graphics features of word processing programs. They do not print as well as real graphics.**
  - **Do not insert graphics from other applications into a word processing document if you are going to transfer that document to a page layout application. Add the graphics directly into your page layout.**
  - **Do not use the table feature of the word processor. Tables contain formatting that will be removed when imported into a page layout program. Type tabular material as ordinary text with simple tabs inserted between the columns. If you really want a table in your document use the features of the page layout application.**
  - **Do not use automated formatting in the word processor such as drop caps; it will only have to be removed and reapplied using the page layout application**

Choosing the right software for the job

- **Spreadsheet applications (Microsoft Excel)**
- **Intended for:**
  - **Number crunching**
  - **Statistical analysis**
  - **Invoices and budgets**
  - **Mark sheets**
  - **Simple and complex forms**
  - **Spreadsheets have exceptional tables features that helps you to organise information into easy to read columns**
  - **Charts and graphs that can be coloured and formatted for presentations and printed directly from the spreadsheet application onto desktop printers.**
- **Not Intended for:**
  - **Information in spreadsheets do not import easily into page layout programs. This means you need to convert your tables to plain text or recreate the tables in other software to get professional level results.**

Choosing the right software for the job

- **Guidelines for inserting information from a spreadsheet into a page layout application:**
  - **Do not try and copy and paste charts or graphs from spreadsheet documents into page layout applications. This will cause printing problems.**
  - **Look for an export or save as feature in your spreadsheet application that lets you export charts as Encapsulated PostScript documents, which can be imported easily into a page layout application**
  - **If you can export the charts as EPS then do not waste time applying formatting as colours and line will have to be reapplied. Open the EPS file in a vector drawing program such as Adobe Illustrator and use this to reapply the colours and lines.**

Choosing the right software for the job

- **Presentation programs (PowerPoint)**
- **Intended for:**
  - **Slide shows**
  - **Special backgrounds on each page that blend from one colour to another**
  - **Textures**
  - **Special effects that add to the presentation**
  - **Sounds and movies**
  - **Animations**
- All these features give your document, when presented using a computer, a little more life.
- **Not Intended for:**
  - **Professional output. The backgrounds and textures are not in the proper format for colour separations nor are the graphics.**

Choosing the right software for the job

- Presentation documents can be output to desktop printers for plain paper copies but if you want presentations professionally output you can do one of the following
  - **The easiest way is to convert the presentation pages into a picture format such as TIFF which can then be modified in an image editing program so that it prints correctly. If you do this you will no longer be able to edit or change text. Also the text may look jagged or fuzzy on the final printed page.**
  - **The best way**
    - **Export all the text into a plain text file**
    - **Convert a page with just the background into a TIFF**
    - **Insert the TIFF into a page layout application**
    - **Insert the text into a page layout application creating one page per slide**