

Digital Image Processing

Analogical vs. digital

- **An analogical image**, for instance a diapositiv or a paper image, includes colour surfaces and details with continuous tones.
- Density expresses details of darkness as well as transmittance values. These values can be measured and examined with a help of a densitometer.
- Densitometer is also used in printing offices to control quality. With the help of density values, the colour reproduction ability of the surface and press process can be measured.



A digital image consists of pixels (picture elements)

- **A digital image** is composed of picture elements, of ones and zeros.
- Converting an image into digital format can be done with a digital camera, a scanner, or by converting a moving image on a video tape into digital format. A number of digital minidv video cameras have an option to save still images on the camera's memory card.
- Digital images can also be created directly on a computer screen, for instance by drawing or vectorizing images in different programmes (Freehand, Illustrator, etc.)
- Digital image files can be processed in many ways on a computer screen. For instance, the solarization effect for photographs, which includes many stages and is normally done manually, only needs one filter in Photoshop (Filter - Stylize - Solarize).

Advantages of digital image:

- The processing of images is faster and more cost-effective. One needs less time for processing, as well as less film and other photographing equipment.
- It is more ecological to process images. No processing or fixing chemicals are needed to take and process digital images. However, printing inks are essential when printing digital images.
- When shooting a digital image, one can immediately see if the image is good or not.
- Copying a digital image is easy, and the quality of the image stays good unless it is compressed. For instance, saving an image as jpg format compresses the image. By resaving the image as jpg format, the compressed image will be recompressed, and the quality of the image will get worse with every saving.
- Fixing and retouching of images has become easier. In new Photoshop 7, it is possible to smoothe face wrinkles with a new Healing Brush Tool in a couple of seconds.

- The expensive reproduction (compared with rastering the image with a repro camera) is faster and cheaper.
- By changing the image format and resolution, the image can be used in a number of media.

Disadvantages of digital image:

- Misuse of copyright is now easier than it earlier was. For instance, images can be copied from the Internet just by clicking the mouse a couple of times.
- The value of the image will get worse? This has not necessarily happened everywhere. Images held in image banks still have reasonably good prices, inspite of the fact that downloading images through the net is fast and easy. The profitableness of digital photography has increased the number of images and photography in general.
- Old professions (such as maker-up, repro cameraman) vanish, and new ones do not necessarily appear. For instance in mid-1990s, the newspaper Aamulehti started using computerised make-up, and the traditional makers-up were left unemployed.
- Work has become more technical, which may not be a disadvantage for everyone.
- A digital file of a certain size cannot be enlarged with a good quality anymore. For instance, a good poster cannot be made of an image file of 500 kb. However, it is easy to make an image smaller.

Originals

The originals are usually divided into two groups: reflectives and transparences.

Reflectives are, for instance

(flatbed and drum scanners)

- drawings, illustrations, graphic drafts, etc.
- printouts and photos
- printed materials (When a printed image is being scanned, often a so called moiré-effect occurs in the new image, which means that the raster angle of the original image is visible in the new image. One can try to prevent the moiré effect by having the image at a different angle in the scanner or by using a digital image processing program.

Transparences are, for instance

(drum and dia scanners)

- diapositives and negatives
- other graphic film material

It is not recommended to enlarge a film negative with more than 800 per cent, since the grain size will become too large and the image will become unsharp. In posters and larger advertisements, it is common to use a large format dia or save the image in a digital form. In this way the image will maintain its sharpness inspite of the enlargement.

Standard formats and their usage

- 1/4 basic image 384 x 256 pixels, media use and low-res image in the printed matter
- basic image 768 x 512 pixels, digital display and tv screen. In PAL-system a tv screen has 720 x 576 pixels.
- 4 x basic image 1536 x 1024 pixels, printed matter (postcard, etc.) and media use.
- 16 x basic image 3072 x 2084 pixels, printed matter (A4) (high-res)

Sources of digital images:

Scanners

- Drum scanner. Best image quality, for demanding and large printed matters (posters, etc.), exactness of as much as 8000 ppi (pixels per inch), 8-14 -bit colour. Drum scanners are mainly used for reproduction in printing offices and in advertising agencies.
- Dia scanners. Image of good quality, resolution of 300-3000 ppi, 12-bit colour.
- Flatbed scanners. Relatively modest quality, resolution of 200-1200 ppi, 8-bit colour depth. Flatbed scanners are inexpensive also for ordinary consumers. Well suitable for small-scale image printouts and printing matters, as well as for images shown on the screen.

Digital cameras

The shooting resolution of digital cameras continues to get higher as new models are being developed.

- Professional cameras, advertisement and product pictures (at least 6.9 million pixels). Professionals also favour digital backs that can be attached to old studio and bulk cameras.
- Basic cameras of good quality, for print and media use (at least 5 million pixels)
- Pocket-sized amateur cameras that can nowadays have as much as 4 to 5 million pixels, although 2 to 3 million pixels is the standard. The use of pocket-sized digital cameras will increase from what it is today. It has been estimated that by the end of year 2003, a total of 5 to 10 per cent of all cameras in Finland will be digital cameras (source: Mikropc:n Digikuvaajan opas).

The problems of digital cameras have been different types of saving formats, small shooting resolution and high prices for memory cards. For instance, Canon cameras have mainly used CompactFlash memory cards. The largest cards are as large as one gigabyte, i.e. plenty of pictures fit in one card. However, the number of pictures also depends on the shooting resolution. Card prices have sunk during the last couple of years, but only some years ago a card of 128 megabytes cost around 1000 FIM. At the moment (October 2003) a card of 512 megabytes costs around 160 €.

In Olympus cameras, a SmartMedia memory card is commonly used. Different saving formats demand their own card readers. With the help of a reader, a memory card functions like any disc, i.e. it is easy to transfer images from the card to the computer.

Quality criteria of scanners and digital cameras include a good ability to distinguish different tones, as well as adequate sharpness and stability of use. Also a good objective is important in digital cameras.

Other sources

Drawing programs

- In most image processing programs it is possible to draw with different drawing tools (pen or brush tools, etc.)

- Vector based drawing programs are, for instance, Illustrator (Adobe) and Freehand (Macromedia). Also Flash-program can be used to make drawings, although the program is designed especially for Internet animations.
- It is easier to draw on the screen with a pressure-sensitive drawing tablet than with a mouse.

Animation programs

- For instance Flash and different gif-animation programs.
- Flash program can be used to draw vector graphics, and it is possible to bring single screens from animations to the image processing program.

3D programs

- For instance, 3D Studio Max, Bryce, AutoCAD, Maya.
- Used, for instance, in space design, product design, arts, animations, and games.
- With a 3D program, objects can be animated and 3-dimensional illusions can be created with the help of lighting
- An image produced by a 3D program can be edited in an image processing program or images can be attached to Flash program or equivalent.
- Programs are often expensive and difficult to use.

Digital videos

- It is possible to copy still images from digital videos. Image resolution is high enough to show images on a computer screen or on tv screen, but not on printed media.

Copying images from the Internet

- Click on the image with right mouse button and choose Save Image As to save the image on your own computer.
- Images are easy to save, but the copyright law is valid also for them.
- It is possible to add a digital identification for images, so that their use is easy to follow up and to find out if they are, for instance, published in the Internet without permission
- Images that can be used freely are often of bad quality and too much compressed.

Copying from the screen (screenshot)

- It is possible to copy windows from other programs, or even complete web pages (Print Screen)

Images from a photography shop directly to a CD Rom or to an image gallery in the Internet

- CD Roms are handy for preserving and filing material.
- Photography shops' pictures in the web are normally available only for a certain period of time.
- Scanning is sometimes done carelessly and the image resolution is often inadequate for printed matters.
- There can be colour errors in web pictures, for instance all images can be greenish.

Photographic agency

- Pictures can be bought on a CD Rom from photographic agencies either one by one, or grouped in themes. Royalty free pictures are relatively inexpensive, but they can normally not be used for commercial purposes.
- Photographic agencies on the web: Lehtikuva (<http://www.lehtikuva.fi/>), Compad (<http://www.compad.fi/>), and Magnum (<http://www.magnumphotos.com/>)

Copying pictures from the Internet or by using screenshot often violates the copyright law. A permission from the copywriter is always needed to use pictures.

Resolution

The concept resolution is used in three different connections: 1) in scanning, 2) in pictures, and 3) on screen.

1) Scanning resolution (ppi / dpi)

- In principle, the scanning resolution means the same as the image resolution. Images can, however, be scanned with a higher resolution than necessary in order to edit the images more easily. Image resolution can later be changed in an image processing program.
- ppi = pixels per inch or dpi = dots per inch
- The unit means the number of pixels in relation to a certain measure, normally an inch.
- The scanning resolution of an image is determined by the intended use of the image. For instance, an image shown on the web only requires 72 dpi, but it does not necessarily make sense to scan it directly to this resolution. If the picture needs editing on screen, it is smart to choose resolution 150 ppi.

2) Image resolution (ppi / dpi)

- A suitable standard for the screen resolution of an image is 72 ppi.
- In printed matters the resolution is often 300 ppi. When printing on a newspaper, a resolution of 180 ppi is enough.
- The bigger the resolution is, the more details the image has, and the larger the file size gets. The file size of a web picture is set to be as small as possible by optimizing the picture, i.e. by choosing the right image format (normally gif or jpg), and by compressing the image enough, but not too much.
- The unit for screen images is a pixel (or a dot), in printed matters a millimeter or a centimeter.

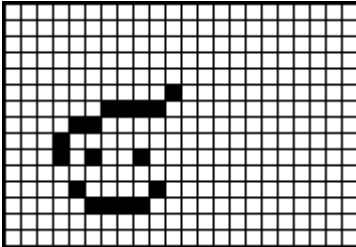
3) Screen resolution

- For instance, a recommended resolution for a 17 inch screen is 1024 x 768 pixels, and the maximum is 1280 x 1024 pixels.
- If too high a resolution is used, it makes the characters unsharp and strains one's eyes. Particularly when it comes to detailed image processing, too big a resolution is not suitable at all.

Bit map graphics

General

- A bit map image is a chart formed by pixels (or dots), where one pixel equals one square image element.
- In a 1-bit black and white image, a pixel can either be black or white.
- In a 24-bit full colour image, a pixel can have any of 16.7 million colours.
- The number of colours makes the image's file size bigger, but compression can be used to make the file size smaller again.



1-bit image

Image's bit depth and information

- The image's size is the total number of pixels (width times height), for instance $640 \times 480 = 307\,200$ or $800 \times 600 = 480\,000$.
- The bigger the number of pixels (density) is, the sharper the image gets.
- The bit depth of an image reveals how many tones the image has.
- 1 bit = 2 tones
- 2 bit = 4 tones
- 4 bit = 16 tones
- 8 bit = 256 tones, etc.
- A 24-bit RGB image is formed out of three 8-bit channels, each of which has 256 tones ($256 \times 256 \times 256 = 16.7$ million tones)

Size of the image file

width (pix) x height (pix) x bit depth / 8 = size of an image file in bytes

Example.

$300 \text{ (pix)} \times 400 \text{ (pix)} \times 24 / 8 = 360\,000$ in other words 360 kb (kilo bytes)

$800 \text{ (pix)} \times 600 \text{ (pix)} \times 24 / 8 = 1\,440\,000$ kb in other words 1,44 Mb (Mega bytes)

Interpolation

- When the resolution of an image is changed, or the image is rotated or scaled, one will have to interpolate the image in an image processing program, i.e. reorganise the pixels.
- Algorithm examines the surrounding pixels and re-evaluates them. Photoshop has the following algorithms to choose from: bicubic, bilinear, nearest neighbourhood.
- In Photoshop: Image size > Resample Image

Main types of digital image

Line-art, bitmap

- An image element consists of 1 bit; 1 = white and 0 = black.

- Suitable for the presentation of drawings, for instance, drawing ink works, black and white line graphics, and texts.
- Requires little saving space due to the lack of colours, but requires high resolution in order to show details accurately.

Grayscale image

- The image has 8 bits and 256 tones of grey; 1 = black and 255 = white.
- Requires 8 times more saving space than a line-art image.
- Suitable for presenting black and white photographs, for instance.
- Can be used in printing office.

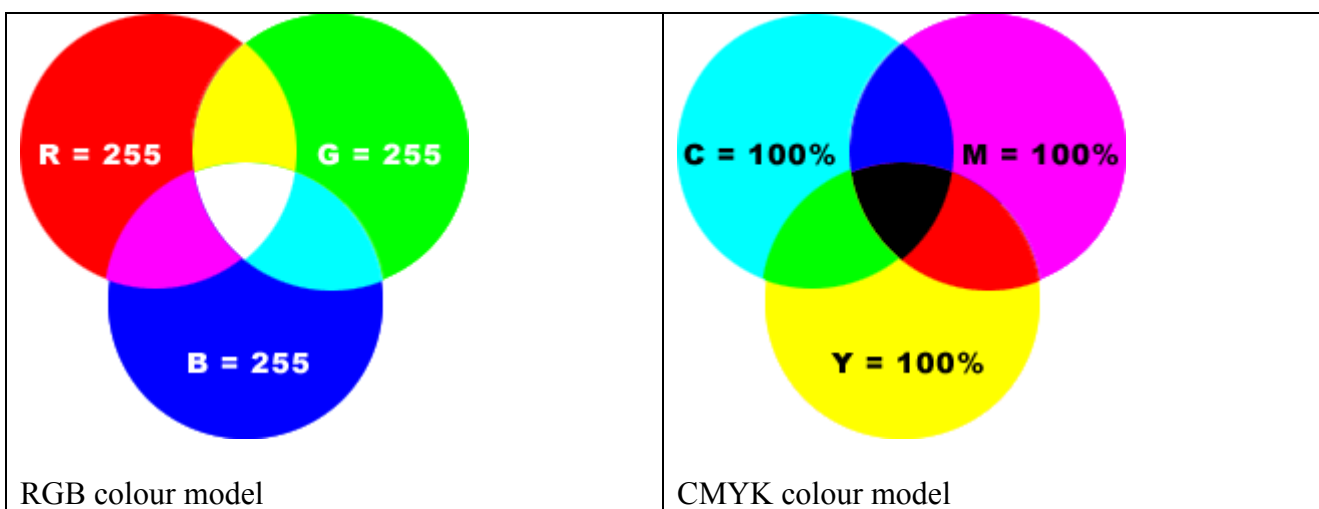
Colour image (RGB, CMYK)

- An RGB image has a 24-bit information (millions of colours)
- Channels Red, Green and Blue have 256 colours each.
- For screen images.
- A CMYK image has a 32-bit information
- Channels Cyan, Magenta, Yellow, and Black have 256 colours each.
- For images used in printing offices.

Indexed colour

- 8-bit image information. Availability of 256 colours.
- Suits well for coloured drawing graphics, but not for photographs.
- For screen images.

Graphics and colours



RGB and CMYK colour systems function in opposite ways. When all printing inks are superimposed in the press, the result will be black colour. However, when the highest values of the RGB colour system are put together on the screen, the result will be pure white.

RGB

Light is formed of three primary colours: red, green, and blue. RGB is an additive colour system for light. The more colours there are, the paler the colour becomes. Each colour (red, green and blue) has 256 different hues (0-255).

The functioning of a computer monitor, tv, or other appliance that mediates or filters light, is based on this colour system. RGB colours function in an opposite way of an eye. They (create and) reflect red, green and blue light.

This colour system is used with image processing on the screen, for instance in the Internet, CD Roms, and on tv.

CMYK (process colours)

CMYK is a subtractive colour system. When light hits an object, it absorbs some of the light and reflects the rest. The reflecting light is the colour that we see.

The colour system that is used in printed matters.

When cyan, magenta and yellow colours are superimposed, the result should be a pure black colour. In reality, the result will be grey or brownish, due to the fact that there are impurities in printing inks cyan, magenta and yellow. This has been corrected by adding black printing ink (Key).

Due to the fact that CMYK colours are pressed one at a time, layer by layer, printing inks have to be transparent, and opaque colours are being used only in exceptional cases.



Cyan and black



Magenta and black



Yellow and black



Black



All CMYK colours

HSB (hue, saturation, brightness)

Hue is a pure colour that is one of the rainbow colours.

Saturation indicates the pureness of colour. If the saturation value is 0, the colour is gray. White, black and gray colours have no saturation.

Brightness indicates the lightness and darkness scale. If the brightness value is 0, the colour is black.



HUE



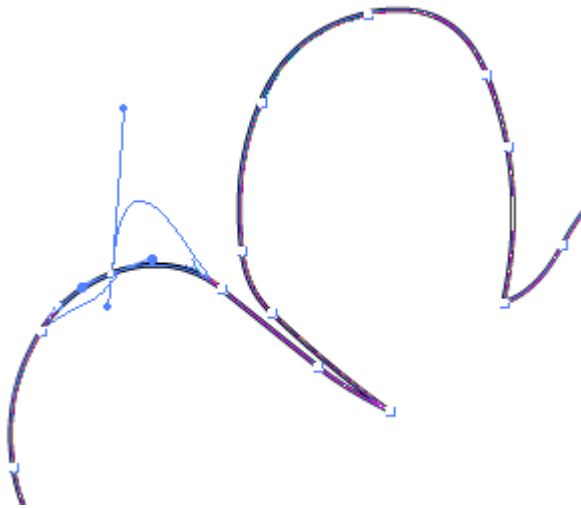
SATURATION



BRIGHTNESS

Vector graphics

- The exactness and sharpness of vector graphics is based on the utilization of mathematic curves (so called Bezier curves). Vector image can be zoomed infinitely, but the result is still always sharp.
- It is easy to edit an image with the help of curves.
- Vector-based drawing was originally designed for CAD applications.
- It is also called element graphics or object-oriented graphics.



A Bezier curve – forms can be changed after drawing

Usage of vector graphics

- Posters
- Graphics, where clear contrasts and colour surfaces have been used.
- Business graphics that can be used in different media, in different sizes and screen resolutions.
- Logos and text effects that require sharp and even borders. Fonts can be converted into vector paths and then re-edited.
- Brochures and advertising leaflets, which can include pictures, logos, and text.
- Spatial design (architecture), product design or other line drawings.
- With Flash it is possible to make impressive, but light vector graphics and animations for the web.

Advantages and disadvantages

- Files are small in size.
- It is possible to enlargen graphics, logos and font without worsening the quality of the image (cf. pixel graphics).
- The scaling of vector graphics requires fast counting capacity of the computer, because vectoring is based on mathematical values.

Skanning with a flatbed scanner

Scanners include a program for the actual scanning of a picture. With the scanner program, one can choose the type of original, for instance a colour picture, black and white picture, colour drawing, black and white drawing, etc. With the program, one can also adjust the contrast and intensity, rotate the picture, or change it to a negative. However, it is not recommended to do the fine adjustments and after-treatment before entering the image processing program, because there it is easier to cancel functions if necessary. When a cropped picture has been scanned, it cannot be enlargened anymore, but the picture will have to be rescanned.

Scanner can also be used directly in an image processing program. For instance in Photoshop choose File > Import > Twain.

Choosing the scanning resolution

The scanning resolution of an image is determined by the prospective use. An image only shown on the web, for instance, will not need more than 72 dpi, but it may not necessarily be smart to scan it directly to this resolution. It is considerably easier to edit and crop images with a bigger resolution. After processing it is easy to make an image smaller and optimize it to the right format.

When choosing the scanning resolution, it is also relevant to know whether the picture will be made bigger or smaller. If the picture needs to be 200 per cent larger than the original, it has to be scanned with at least twice the original resolution.

Scanning

1. Place the original image in the flatbed scanner the picture side facing down.
2. Open the image processing program and select File > Import > Twain, or an equivalent function.
3. Select Preview, and the scanner will take a quick pass of the image and display a rough version of it. Select the area you want to scan > leave some white edge around the image to make sure that the whole image will be saved.
4. Select the type of the original, for instance, Colour (photo) and the scanning resolution. It is worth scanning the images for the web with a slightly bigger resolution than necessary (for instance 150 dpi), especially if the image needs to be edited. After editing, change the resolution smaller to optimize it for the net (72 dpi).
5. If the colour/hues of the image need to be fixed and the program has suitable adjusting possibilities, do the needed measures (contrast, brightness, colour balance, colour depth, etc). But if the image looks reasonably good, it is better to do the adjustments in the image processing program.
6. Select Scan and save the image in a desired place in tif-format, for instance. You can later change the format and optimize the picture depending on how it will be used.

Choosing the printing resolution

Printer	Image resolution (dpi)
Image for the web or for the screen	72 – 75
Black and white laser printer	100 – 150
Newspaper	150 - 180
Colour laser	150 -180
Inkjet printer (600 dpi)	180 - 200
Inkjet printer (1200 dpi)	250 - 300
Four-colour printing	300 or more
.	
If you print on your own printer, it is worth trying also lower resolutions than the above mentioned	

list recommends. Also printing paper affects the printing quality.

The best way to compare different options is to print out the same image with different resolutions.

Note also that the enlarging or downsizing of an image changes the resolution.

If the resolution of a scanned image is, for instance 200 dpi, and the image is enlarged by 200 per cent, the resolution will then be 100 dpi. When downsizing the image, the effect is naturally the opposite.

Scanning of text

When scanning text with a scanner program, it will usually become an image, which cannot be further edited in a text processing program. If a text is edited in a text recognition program (OCR programs = Optical Character Recognition), it can be saved, depending on the program, in a form that is recognisable by different text processing programs.

If the text recognition program does not have a spelling checker in itself, the first thing to do in the text recognition program is to use a proof reading program to check if there are errors (the better the text quality, the less errors), and then to start the actual text processing.

The text recognition program does not actually recognise text/words, but characters, which also can be taught to the program. Problems with recognition may occur with the dots in Nordic characters, and if the text quality is bad.

Scanning of text without the OCR program

1. Place the picture on the flatbed scanner, picture facing down. (check that the picture is straight)
2. Select Drawing as the scanning type
3. Select resolution 300 dpi.
4. Preview the image and crop the area to be saved.
5. Select Save command and the desired file format.

Scanning of text with the OCR program

1. Place the picture on the flatbed scanner, picture facing down (check that the picture is straight).
2. Scan the text.
3. Read the text with the OCR program and save the text.
4. If the OCR program does not have a spelling checker, do the proof reading and editing in the text processing program.

Screen resolution

The size of the screen is affected by the physical size of the screen (for instance 17 inches), the resolution rate, as well as the graphic adapter. The graphic adapter forms the picture on the screen.

Sharpness of the Screen

All resolutions cannot be used on screens of all sizes, but it is recommended to use a certain resolution on a certain screen. The table includes normative resolutions for the most common screens.

Screen size	Optimal	Maximum
15"	800 x 600	1024 x 768
17 "	1024 x 768	1280 x 1024
19"	1280 x 1024	1600 x 1200

Using a too high resolution will make the characters on the screen confused and strains one's eyes. Especially with detailed image processing, too big a resolution is not suitable at all.

The quality of the screen is also affected by the updating frequency, which expresses how many times per second the picture on the screen is being updated. If the frequency is too low, the screen will flicker. Also the graphic adapter affects the choice of frequency. The recommended minimum updating frequency is 72 Hz. Both the resolution and updating frequency can be changed through the Windows Control panel (Screen icon).

Number of screen colours

When forming colours, a computer screen uses three primary colours: red, green and blue, i.e. the previously mentioned RGB colour system.

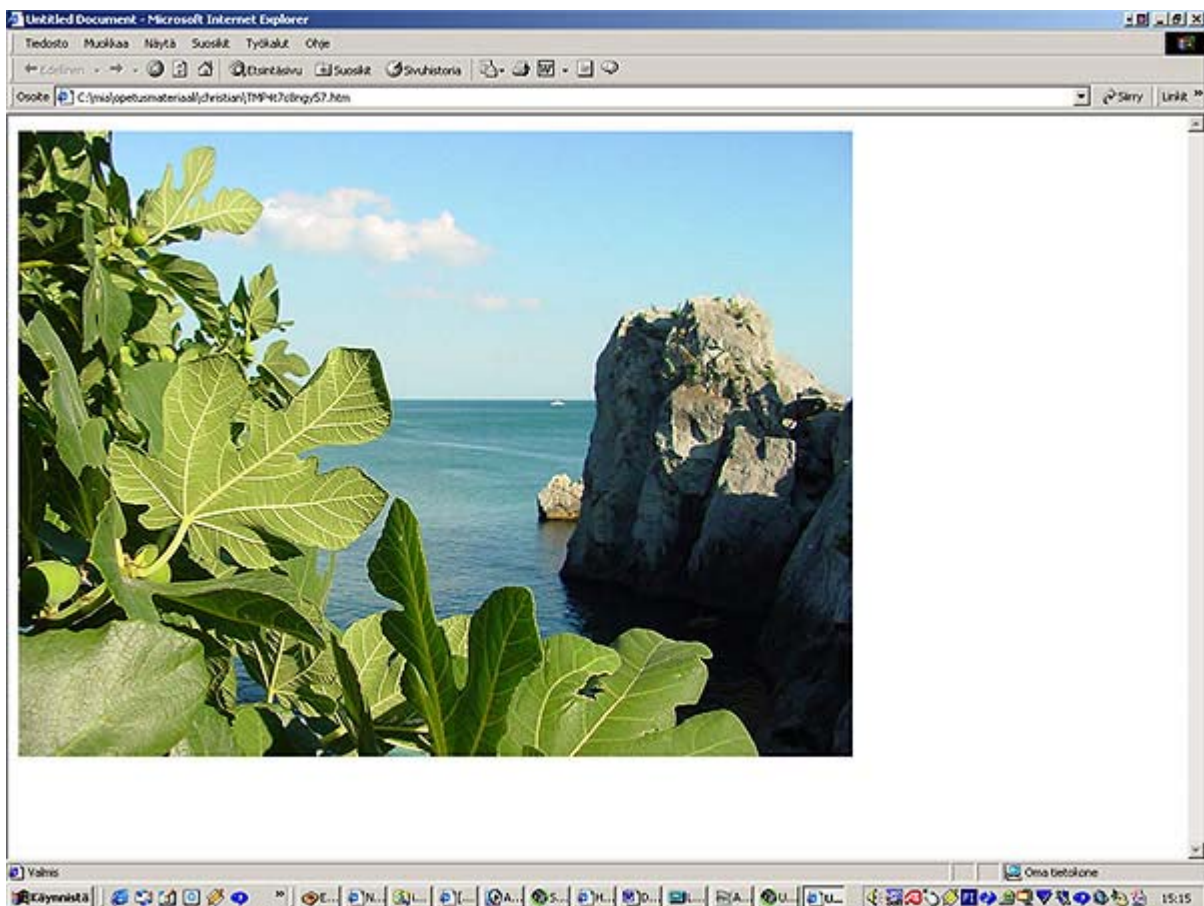
Screen resolution and web pages

The biggest problem with web design is that different users have screens of different sizes and quality. How should a web page be designed to work well with different screen resolutions?

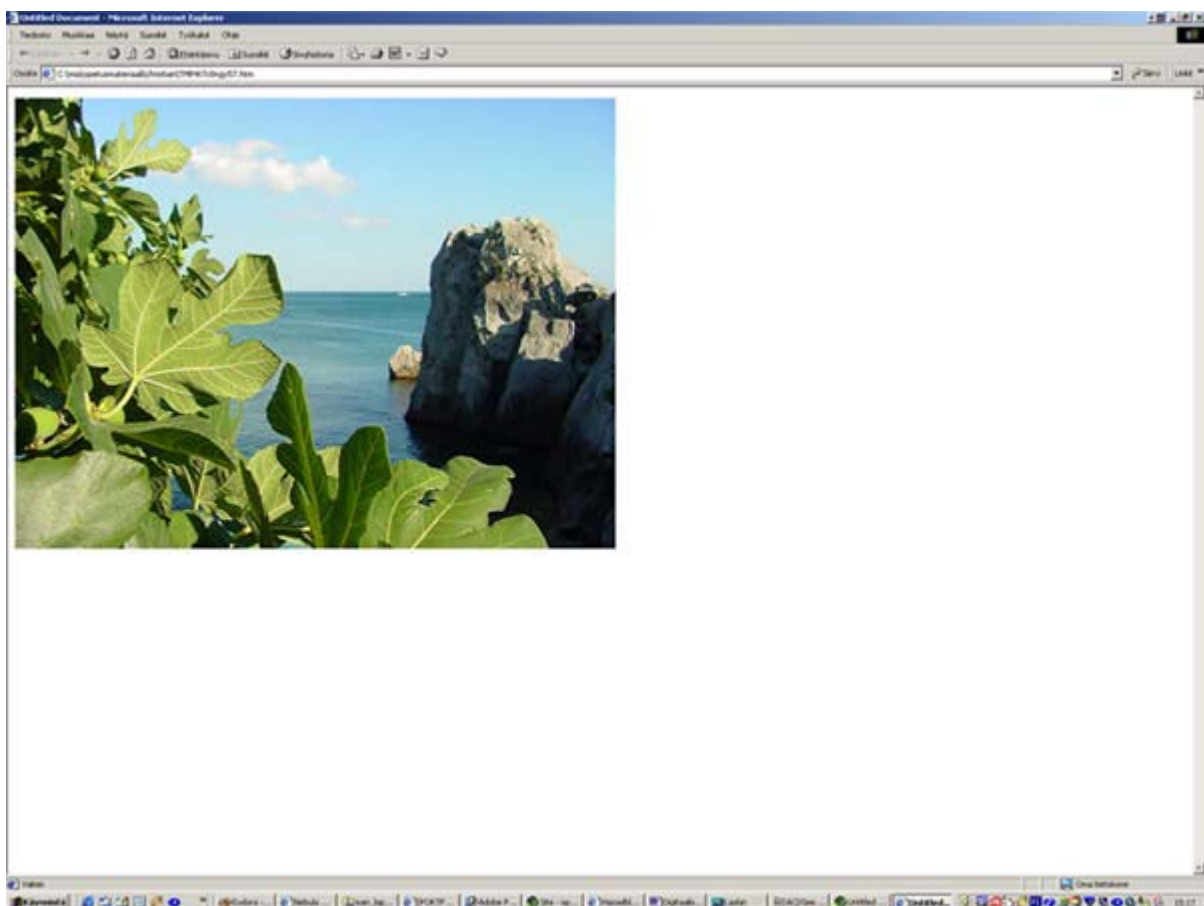
During years 1995-1997 most of the screens had size 14 or 15 inches, and the resolution usually was 640 x 480 or 800 x 600 pixels. Usually the smallest resolution users may have, which in this case was 640 x 480 pixels, has to be taken into consideration. Although 17 and 19 inch screens have become more popular since the year 2000, web pages are still usually designed for resolution 800 x 600. The resolution problem can be solved by defining the tables, frames, and other elements on the page in relation to each other, i.e. in per cents, and not in pixels. With relative definitions the page is scaled to fit the screen. However, it is difficult to create impressive and carefully finished layouts, because the pictures, texts, and other elements on a scaling page move in different ways on different screens.

The same problem occurs also in image design. If a photographer wants to have a photo on the screen and wants it to fill half of the screen, it turns out to be an impossible task. On a screen sized 800 x 600, the picture would be 400 x 300 pixels. But all screens do not have the same setups. Image and page design for the web is full of compromises.

Compare the examples of an identical picture on two different screen resolutions:



A picture of 800 x 600 pixels on a screen with resolution 1152 x 864.



A picture of 800 x 600 pixels on a screen with resolution 1600 x 1200.

Most common image formats

Formats designed for different programs have increased the total number of file formats. Only very few programs support more than 10 formats. Pictures saved with a new program version do not necessarily open in an older program version, although the old version supports the file format in question.

raw

- A standard bit map format between different programs and computer systems.
- Used as a format for cell phone logos, for instance.
- Supports most colour formats (RGB, CMYK, grayscale, etc.)

bmp

- Bit map format
- A standard for bit map images developed by Microsoft and IBM
- Only functions in IBM compatible PC computers.
- Common in Windows systems.

tiff -> printed matters

- Tagged Image File Format has been developed together with the Aldus scanner technique, and is one of the eldest commonly known file formats.
- There are at least three versions of the Tif-format (4.2, 5.0 and 6.0).
- Can utilize the effective LZW compression.
- A common saving format for scanning, because Tif images usually open in programs supporting this format.
- Image can be saved in RGB or CMYK formats
- PCs and Macs use different bit formats

eps -> printed matters

- Encapsulated PostScript
- Both vector and pixel images can be saved in this file format
- The file consists of a printing and a screen module.
- File sizes can be large.

jpeg -> web

- .jpg or .jpeg
- Joint Photographic Expert Group.
- An image compressing file format which suits well for photographs on the web.
- The way of compressing does not limit the number of colours, i.e. millions of colours are available.
- An image can be compressed as much as to 1/100 of the original.
- Browsers support this format without plug-in.

- Compressing merges pixels to hues that are most similar to them, but does not change the intensity.
- This way of compressing destroys information, and therefore resaving must be avoided.
- Compressing the image too much makes it confused.
- Well suitable as the web format of photographs.

gif -> web

- Graphics Interchange Format
- A file format for transferring images, developed by CompuServe.
- Availability of max. 256 colours.
- Functions best for drawings, logos, coloured graphics and icons, but not for photographs.
- Browsers support this format without plug-in.
- Supports Interlacing technique. An image on the screen is first coarse and gradually gets sharper.
- Can be animated (gif animations).
- Supports only Indexed Colour
- Desired colours can be turned transparent, as a result of which graphics can be embedded on the web page without unpleasant borders.
- Suitable for drawings and other web graphics.

psd -> PhotoShop's working file for additional editing and for saving the master

- Adobe Photoshop's own file format.
- Saves information, for instance, of the used colours and layers.
- File sizes can become large if many layers have been used in image processing.
- A psd file saved in PC can be opened in Mac.
- The format of a psd image is eventually changed according to its intended use, for instance a tif format or an eps format is used in printing offices.

png -> web

- Portable Network Graphics
- Supports the Interlace and Background transparency functions.
- Includes an alpha channel.
- Can have as much as 48-bit colours, in which case image files can become very large.
- Compressing method does not destroy information.
- Compresses image 10 to 30 per cent more effectively than gif.
- Does not function in Netscape or Explorer –browsers without plug-in. For this reason the format has not gained more popularity.

pdf -> web or printing office

- Portable Document File is a PostScript-based format for transferring, viewing and printing, and is not dependent on the operation system.
- May include vector graphics and bit map images.
- It is possible to embed fonts.
- May include active links.
- Requires Acrobat Reader for reading, and Distiller for making changes.

Saving images on the web

It is recommendable to save a duplicate copy of the completed image. One often has to revert to the image and do some minor changes to it. The master should be saved in PhotoShop's own psd-format so that all layers, alpha channels and other elements are kept unchanged.

When saving the image (and naturally already when starting the work), one has to be aware of where the image will be used. If the image will be shown on the web or on a CD Rom, it has to be optimized to the smallest possible file size.

Transparent gif images

Transparent gif images (and png images, more rarely!) are often used on web pages if a picture needs to be embedded in the background of a page or, for instance, a table. The best results will be gained if the colour surfaces at the background are even. It is almost impossible to embed a transparent gif image on a multicoloured background. In such a case, it is worth considering whether it could be done differently, for instance by using image collage as such, or by optimizing the whole image.

Saving as gif image by using Photoshop's Gif89a Exportia

1. Take a duplicate of the original by selecting Image - Duplicate.
2. Flatten image on one layer by selecting Layer - Flatten Image. After this no changes can be made on the layers.
3. Check that the resolution is 72 pixels per inch.
4. Select Image - Mode - Indexed Color. The number of colours will now decrease to 256 colours, but usually it is still too much for the web! More colours still need to be taken out.
5. Select for instance Palette – Adaptive, and a 6-bit image. Note! Normally only graphics that are drawn or otherwise done manually will be changed into gif format. A photograph is usually saved in jpg format (unless you want transparent elements in the picture).
6. Once you have indexed the image and decreased the number of colours so that the image still looks good, you still need to save it by selecting File - Save as. If you want to have transparent elements in the image, you need save it by selecting File - Export - Gif89a Export.
7. Now you may only see a part of the image on a small screen. You can remove colours / make colours transparent by clicking on the image or colour boxes below it with the pipet. The transparent areas will turn grey. If you want the image to get downloaded gradually (from unsharp to sharp), tick the box Interlace! Select OK.
8. Name the image.

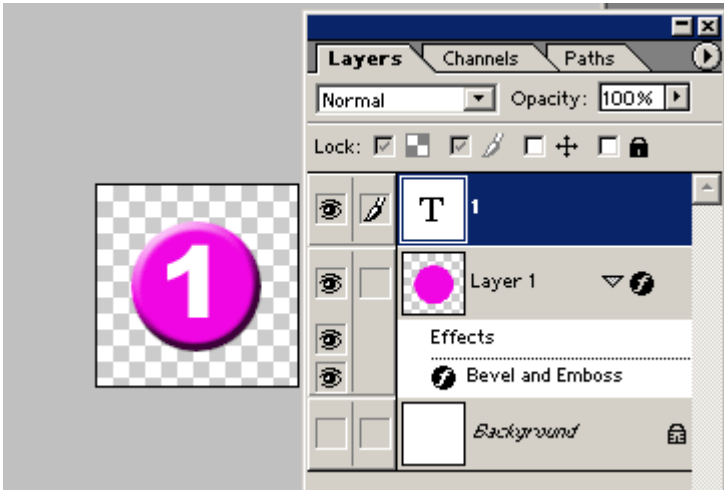
Saving as gif image by using Photoshop (versions 6 and 7)

Sharp-edged transparency

Sharp-edged transparency is a term for a finished image, where the edges of pixels look sharp and the picture no longer has an antialiasing character. The term antialiasing character means that the edges of pixels fade into the background with the help of partially transparent pixels.



A psd-original with a white background colour. However, the the aim is to embed the image in a gray background.



Make the background layer invisible by ticking.



Save the image - Save for Web. Check that Transparent has been ticked. When saving an image in this way, the edges of the image are sharp, but the image can be used on backgrounds of any colour.

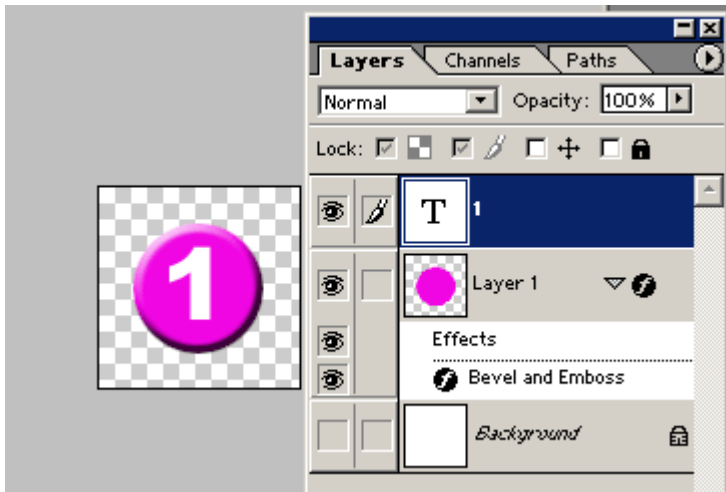


In the right size, the image does not look as "reckless" as it does in the enlargement above. On the right, the gif image is in its final form embedded in the gray background in Dreamweaver.

Transparency in relation to a desired background colour



The starting point is the same as above, i.e. open the psd original with a white background colour. The aim is to embed the image in gray background in Dreamweaver.



Make the background layer invisible by ticking the box, and select Save for Web. Check that you have ticked Transparent, and then tick Matte to select the correct hue of gray. You can choose a colour by using a pipet, or by selecting Custom in Matte menu, where you can choose the exact colour you want.



Matte-colour will come visible at the edges of the picture. This helps to embed the picture in a more beautiful way than with the previous method.



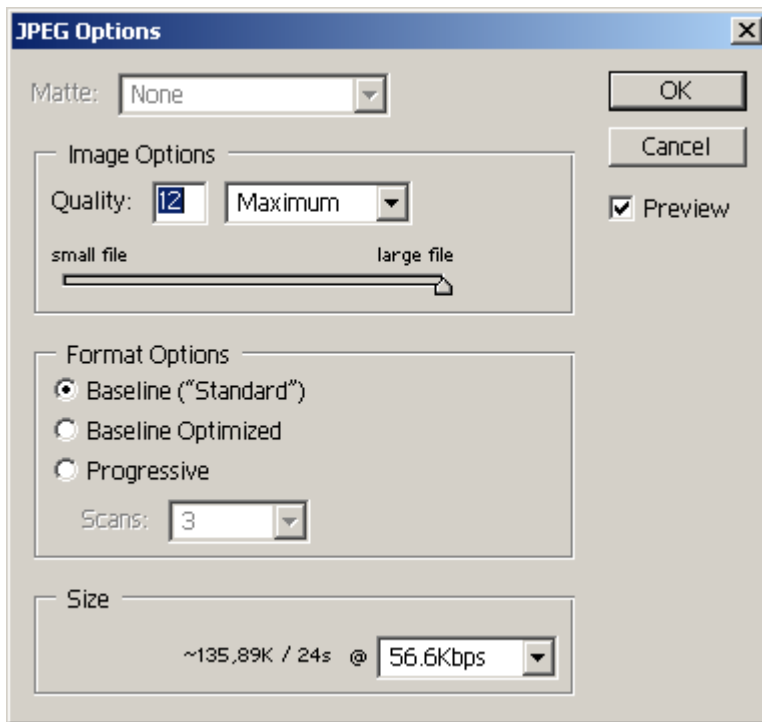
The result is an elegantly embedded transparent gif picture.

NOTE! A picture can be saved in gif format also by using the **Save for Web** -command. Then the picture can conveniently be optimized by using preview (for instance 4-up). Pay attention to the quality of the picture in relation to its file size.

Saving an image in jpg format

Leave a jpg image in RGB format. Check the size and resolution of the image.

1. Select Layer - Flatten Image
2. Select File - Save as and choose JPG format
3. Name the image and click Save.



A jpg image can be compressed with different compressing rates. Naturally, it is recommended to use the best quality (Quality – Maximum), although this format is often used to make the image size smaller. Jpg algorithm evaluates an image in blocks of 8 x 8 pixels in size, and combines pixels with the same colour. A jpg image that has once been saved should not be resaved, because then a compressed image would be recompressed. This advice should be followed at least when the compressing grade of an image is high (quality 5, for instance).

There are three option buttons in a jpg dialog box. It is recommended to use the baseline (Standard) –setting. Progressive –setting is not suitable for printing images. When you have chosen this alternative, the image is downloaded gradually with the following principle: the more scanning you have done, the faster you will see the preliminary image on the screen.

NOTE! An image can be saved in jpg format also by using the Save For Web –command. In this way the image can smoothly be optimized by using preview. Pay special attention to the quality of the image in relation to its file size. Too small a compressing quality makes the image unsharp.

Compressing rates in Photoshop 7 if you use the command Save for Web for saving:

- low (0–29)
- medium (30–59)
- high (60–79)
- maximum (80–100).

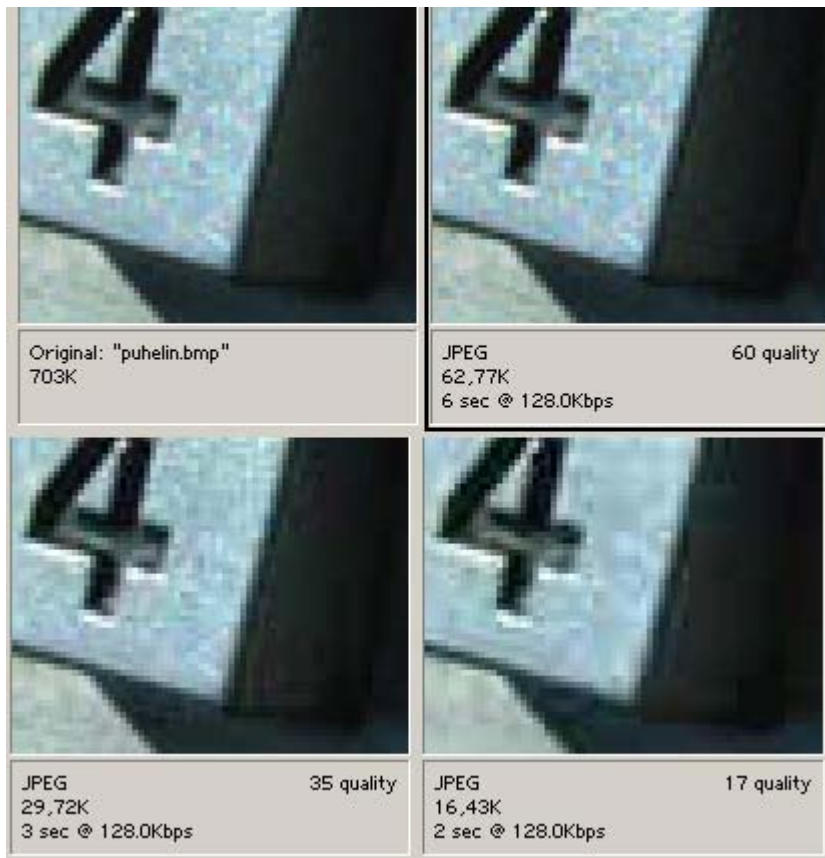
When you use the command Save As for saving, the compressing rates 0-12 are as follows:

- low (0–4)
- medium (5–7)
- high (8–9)
- maximum (10–12).

You can regulate the compression more carefully when using the first alternative.

For instance, the colours and hues of the original, and the purpose of the image affect the choice of compressing rate. The principle is: choose compression that diminishes the file size as much as possible, but still keeps the quality good. In Photoshop, it is possible to compare quality in dialog box Save For Web, because it can show three compression rates in addition to the original. The numerical values for compressing rates are different in different programs. For instance, in Mac computers the compression is 0 - 4 and not 0 - 100. When talking about a compressing rate or a compressing ratio of a jpg image, also the program version that has been used for compressing needs to be taken into account.

A compressing rate of 75 is often considered as the boundary for noticing conspicuous changes in the image. The largest possible compression for thumbnails can be, for instance, 5-10 grades, because the mere size makes it unnecessary to show a more detailed image. If the compressing rate is 30-50, changes can be noticeable, but still not necessarily disturbing. The final result depends on the original image. Images that will be published in the Internet can have a compressing rate of 30-50. After all, it might be better to stint on the downloading time instead of the quality of the image. On the other hand, also the physical size of the image can be made smaller.



The enlargement shows clearly how a large-scale compression merges pixels. The pixels are merged in a block of 8 x 8 pixels, which causes artifacts, i.e. disappearance of colour blocks and contrasts in edges.



The image has been saved in jpg format and compressed with the best possible quality. The file size is 285 kilo bytes.



The image has been saved in jpg format and compressed with 50 per cent quality. The file size is 55,5 kilo bytes. Compared with the previous image, there are no conspicuous differences in quality, and hence it is recommended to choose this compressing rate.



The image has been saved in jpg format and compressed with 2 per cent quality. The file size is 18,6 kilo bytes. Now it can clearly be seen how the image has become unsharp as a result of compressing it too much. See, for instance, the sea and the contours of the leaves and the rock.

Image's file size

According to the most general guidelines for web usability (for instance Jakob Nielsen's guidelines), web images should be small in size or, if possible, their use should be avoided completely. Every kilo byte delays the downloading of a page, and every second an end-user has to wait decreases the number of users. The use of images should be carefully considered, and the image's file size should be small enough.

It takes around 10 seconds to download an image of 26 kilo bytes with the slowest modem (28,8 kbs). With a fast ISDN connection, downloading of the same image takes around three seconds. There can be a number of images on one page, so the downloading time can be many seconds, even minutes. One alternative is to use so called thumbnail images, which can be enlarged by clicking on them.

A general guideline is that it is not worth making a page bigger than 100 kilo bytes. Within the public sector the maximum page size can be 50 kilo bytes. This essentially decreases the possibility to use pictures and graphics.