

# Graphics for Web

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# Pixels



- The computer stores and displays pixels, or picture elements.
- A pixel is the smallest addressable part of the computer screen.
- A pixel is stored as a binary code representing a colour.
- The code for a pixel can have between 1 and 32 bits of binary code.



# Pixels Example



- Here is the Photoshop logo at normal size.
- ✓ Here it is enlarged 400% so that you can see the individual pixels.



# Pixel Depth

- Pixel Depth describes the number of bits used to store each pixel.
- The greater the pixel depth, the more colours a pixel can have.
- Colour graphics vary in realism depending on resolution and pixel depth.
- The greater the pixel depth, the bigger the file.

# Examples of Pixel Depth

## Monochrome

- Monochrome graphics have one-bit pixel depth. (pure black or pure white)



# Examples of Pixel Depth Gray-Scale

- Gray-Scale graphics have more bit-depth  
(No colours besides black, white and grey)





# Examples of Pixel Depth 8 Bit Colour

- 8 bits per pixel provides 256 colour choices  
(Typical of the web - that's why web graphics need some skilful preparation)



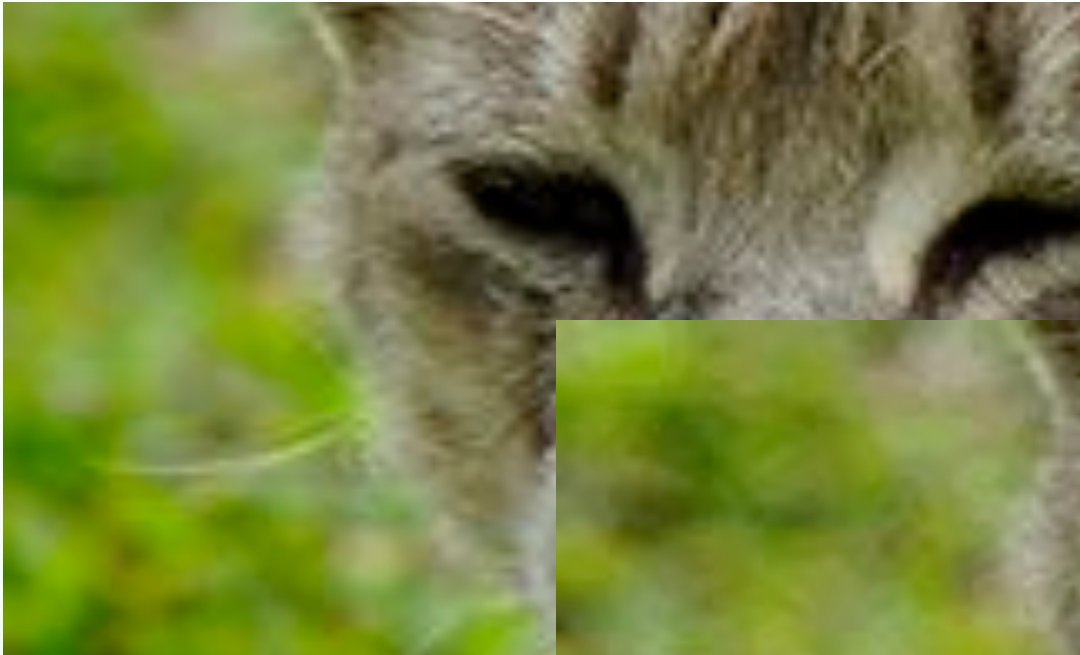
# Examples of Pixel Depth

- 24 or 32 bits per pixel provides thousands or millions of colour choices. (Typical of graphics and games software)





# 24-bit vs 8-bit



24-bit

8-bit



# Resolution

- Resolution refers to the density of dots on the screen or printed image and directly affects quality
- The higher the resolution, the less jagged the image.
- Resolution is measured in DPI (Dots per Inch)
- (The printing industry is largely unmetricated and still uses inches because printing measures such as the Point ( $1/72$ nd of an inch) do not easily convert to metric units.)
- The higher the resolution, the better the potential output.

# Typical Resolutions

- Screens generally operate at around 72-100 dpi
- Printed images range from 300 to 2400 dpi
- Resolution affects the file size of an image.
- The higher the resolution, the bigger the file.
- The visible resolution is limited to the maximum possible on the output device (screen or printer).
- No matter how high the resolution of a photograph, it will show at the resolution of your screen or printer.

# File Types

- There are many kinds of graphics file formats and this is a specialised area and a bit complicated.
- Examples : bmp GIF JPEG TIFF PICT Raw
- For most applications involving photographic images, use the JPEG file format (Joint Photographic Experts Group)
- For graphics or paint type files use GIFs (Graphical Interchange Format)

# JPEG

- The JPEG format can be used by most applications and all browsers
- It has very good compression algorithms
- It stores a good quality image in a remarkably small file with little or no loss of quality
- JPEG offers 10 quality levels with correspondingly smaller files and greater losses in quality



# GIF

- You should choose a GIF format instead of JPEG when
  - You have a graphic with only a few colours such as a logo or icon
  - You want to create an image with some transparent parts for a web page
  - You want the smallest possible file size with totally lossless compression
  - You want to combine a few images together into an animation
  - You want to save text as a graphic

# File Sizes

- A little knowledge is a dangerous thing!
- With a little knowledge, you can create files that are so large they are almost unusable
- With a bit more knowledge you can store the same image in a file that is a fraction of the size
- With little or no loss of quality
- You **MUST** understand this if you are going to use graphics effectively

# Example (without compression)

- A standard postcard is 6in by 4in in 8 bit colour (256 colours), the following is true
- At a resolution of 100 dpi the image is 600 by 400 dots so comprises 240,000 pixels. Each pixel is 1 byte so that's
  - 240000 bytes (240KB)
- At a resolution of 300 dpi it becomes 1800 by 1200 dots
  - 2160KB (2MB) That means it is now 9 times as big!
- At a resolution of 600 dpi it becomes 3600 by 2400 dots
  - 8640KB (8MB) - Now 36 times as big!
- And on screen you can't see any difference!
- Note - for 32 bit colour (millions of colours) the file sizes are 4 times bigger again!

# Compression

- The previous example is for uncompressed files and ignores the fact that some file formats compress the data using very clever algorithms.
- With a good compression system, file sizes can be significantly reduced with little or no loss of quality.
- JPEG has compression built in at 10 quality levels but is a “lossy” algorithm. (Some data is gone forever when you compress)
- PNG compresses files with a “lossless” algorithm and so no quality is lost.
- When a file has a large number of colours, a PNG will generally create a much larger file than a JPEG

# Example of JPEG compression

JPEG Compression Level 10  
194 kB



JPEG Compression Level 1  
157kB





# A Simple Rule of Thumb

- For use in any screen based application such as PowerPoint or the internet, a 72 to 100dpi medium quality JPEG 4 will usually suffice
- UNLESS
  - you plan to crop a part of the image, enlarge it and then use it at the larger size.
- Then
  - you would increase the original scanning resolution accordingly

# Web Graphics

Image Type	File Extension	Compression	Transparency	Animation	Colors
Graphic Interchange Format (GIF)	.gif	Lossless	Yes	Yes	256
Joint Photographic Experts Group (JPEG)	.jpg or .jpeg	Lossy	No	No	Millions
Portable Network Graphic (PNG)	.png	Lossless	Yes (multiple levels)	No	Millions

Interlaced (Interleaved) or Progressive?

# Image Optimization

- The process of creating an image with the lowest file size that still renders a good quality image—balancing image quality and file size.
- Photographs taken with digital cameras are not usually optimized for the Web
- Use a graphics application to:
  - Reduce image dimensions
  - Reduce size of the image file

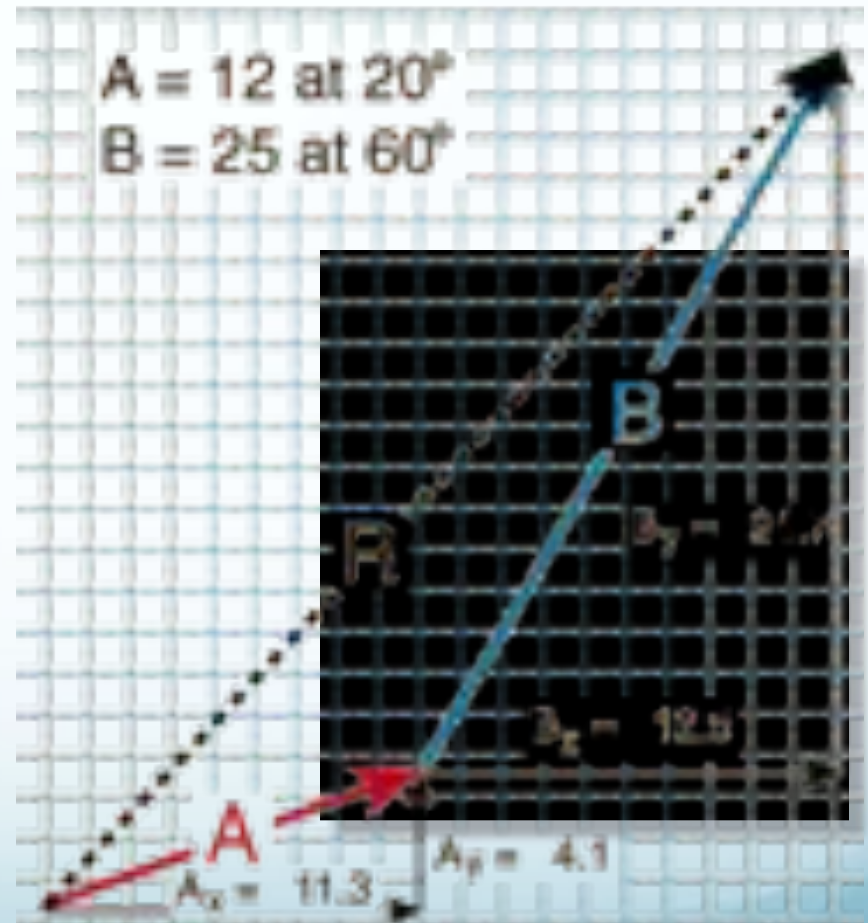


# Choosing Names for Image Files

- Use all lowercase letters
- Do not use punctuation symbols and spaces
- Do not change the file extensions (should be .gif, .jpg, .jpeg, or .png)
- Keep your file names short but descriptive
  - i1.gif is probably too short
  - myimagewithmydogonmybirthday.gif is too long
  - dogbday.gif may be just about right

# Vector Images

- Vector images (also called outline images) are images made with lines, text, and shapes. Text type is considered to be vector because it is composed of lines and curves.





# Advantages of Vector Images

- Vector graphics are resolution independent, which means they can be output to the highest quality at any scale.
- Vector graphic images normally have much smaller file sizes than raster-based bitmaps.
- Changing or transforming the characteristics of a vector object does not effect or distort the object.



# Advantages of Vector Images

- Vector images are not limited to rectangular shapes like bitmaps.
- An image can be enlarged or reduced without affecting the quality of the image.
- There is no background unless it is placed behind the image as a layer



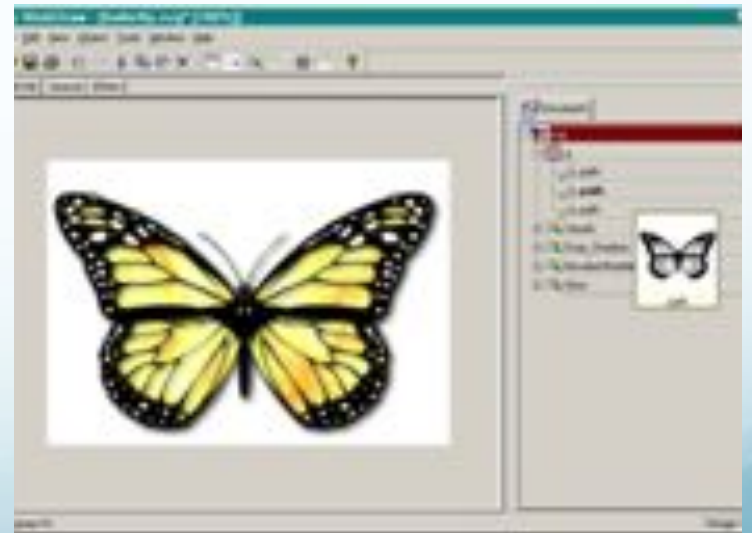
# Advantages of Vector Images

- Vector images have the appearance of artistic form such as cartoons.
- Vector images can be easily converted to bitmap images.
- Lines and curves are easily defined and will always be smooth and retain their continuity.



# Disadvantages of Vector Images

- The main disadvantage is they are not photorealistic.
- Vector images are usually filled with solid or gradient colors but lack in depth and appearance in the values and colors of a true continuous tone image.



# Bitmap Images

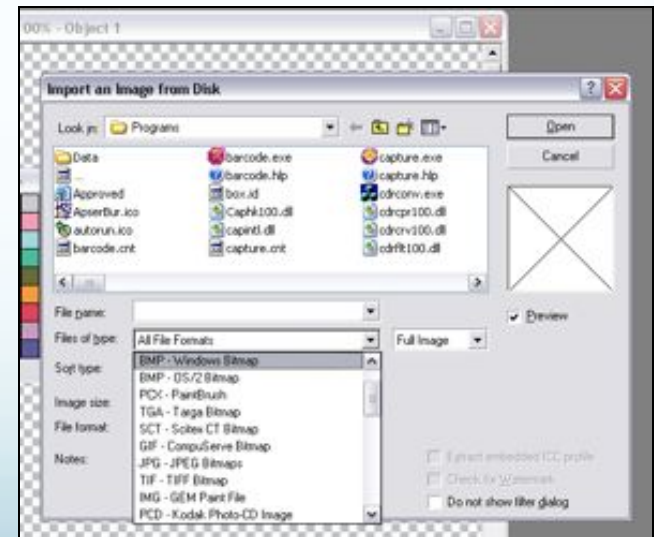
- Bitmap images (also called raster images) are made with pixels (picture element), which look like rectangles.
- All the pixels, when combined for visual images, are called continuous tone images (contones).
- Bitmap images are resolution dependent, and this must be taken into consideration when producing images of different size and quality.





# Advantages of Bitmap Images

- Bitmap images are easily converted to different formats.
- Bitmap images are easier to import into different software applications.
- Bitmap images produce a variety of continuous tone images.
- Bitmap images are better suited for most high quality renderings and web page graphics.



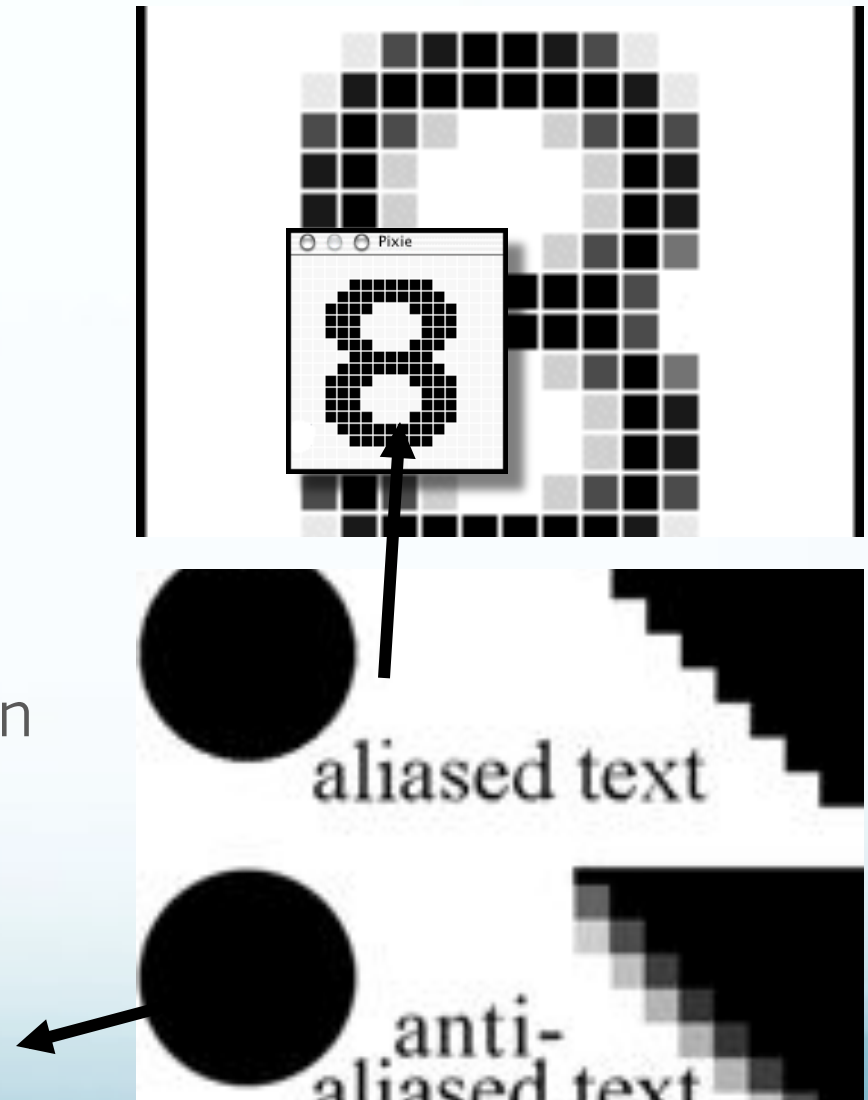
# Disadvantages of Bitmap Images.

- Bitmap images produce larger files sizes.
- Bitmap images have restrictions in regards to alterations and modifications such as scale, image distortion, and format conversion.
- There is a common appearance of blocked or jagged edges and blurriness in the image, which must be compensated for with sharpness filters.

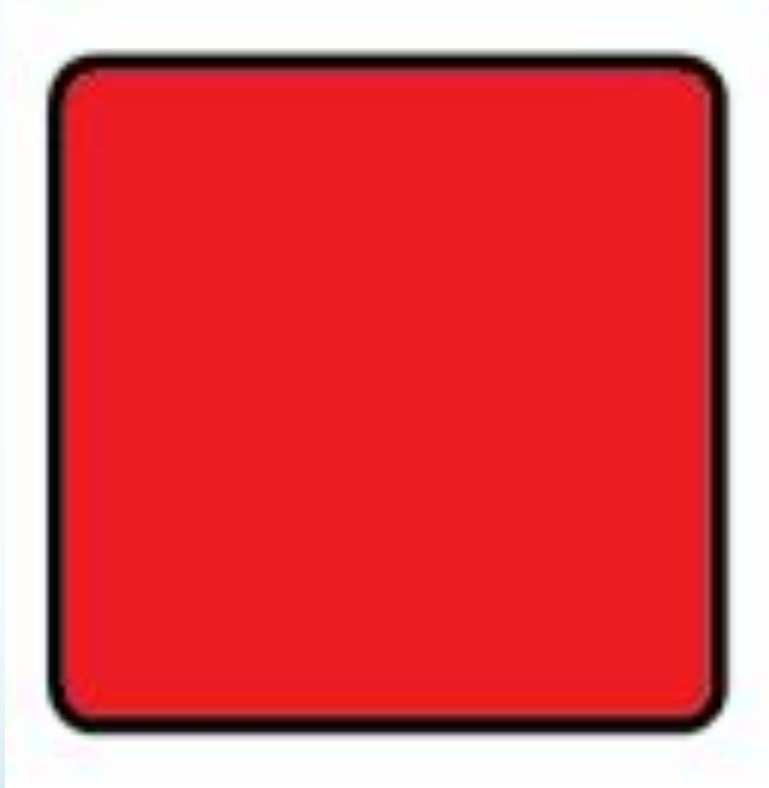


# Disadvantages of Bitmap Images.

- Substantial memory is required to work with bitmap images.
- When bitmap images are enlarged, jagged, stair-stepped edges called aliasing appear.
- Anti-aliasing is available in some programs to help smooth jagged edges.



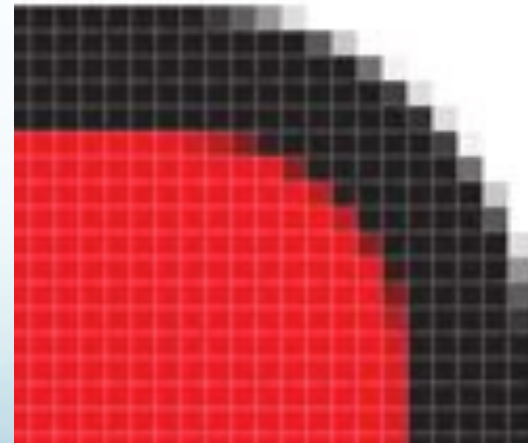
# Vector vs Bitmap (Raster)



Original size (100%)



Vector  
1200%



Bitmap  
1200%



Questions?