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Lesson Proper for Week 4

Images are a media type displayed as visual information. They can be drawings, paintings or photographs. Images are used to create interest and provide information. Photographs and other types of graphical data are designed specifically for display. An image on a screen is made up of dots called pixels. A pixel is the smallest part of the screen that can be controlled by the computer or other device. The total number of pixels on a screen is called its resolution. (ie New iPad has Retina display, 2048 x 1536 resolution). An image can be represented in two different ways. Either a Bitmap or a Vector. Typical file formats for a bitmap can be JPEG, GIF, PNG and BMP. Vector images can be SVG, WMF and EMF.

Attributes of Image

Size: The digital size of an image, measured in kilobytes (K), megabytes (MB), or gigabytes (GB). File size is proportional to the pixel dimensions of the image. Images with more pixels may produce more detail at a given printed size, but they need more disk space to store and may be slower to edit and print.

For instance, a 1-by-1-inch, 200 dpi image contains four times as many pixels as a 1-by-1-inch, 100-dpi image and so has four times the file size. Image resolution thus becomes a compromise between image quality (capturing all the data you need) and file size. Another factor that affects file size is file format--due to varying compression methods used by GIF, JPEG, and PNG file formats, file sizes can vary considerably for the same pixel dimensions. In the same way, color bit-depth and the number of layers and channels in an image affect file size.

Color: Think of a channel as analogous a plate in the printing process, with a plate applying each layer of color. In addition to these default color channels, channel called alpha channels, can be added to an image for storing and editing selections as masks, and spot color channels can be added to add spot color plates for printing.

An image can have up to 24 channels. By default, Bitmap-mode, grayscale, duotone, and indexed-color images have one channel; RGB and Lab images have three; CMYK images have four. You can add color channels to all image types except Bitmap mode images.

Depth: Bit depth--also called pixel depth or color depth or only depth-measures how much color information is available to display or print each pixel in an image. Greater bit depth (more bits of information per pixel) means more available colors and more accurate color representation in the digital image.

For example, a pixel with a bit depth of 1 has two possible values: black and white. A pixel with a bit depth of 8 has 2^8 , or 256, possible values. And a pixel with a bit depth of 24 has 2^{24} , or roughly 16 million, possible values. Common values for bit depth range from 1 to 64 bits per pixel.

Image resolution: The number of pixels displayed per unit of printed length in an image, usually measured in pixels per inch (ppi). In Photoshop, you can change the resolution of an image; In Photoshop, image resolution and pixel dimensions are interdependent. The amount of detail in an image depends on its pixel dimensions, while the image resolution controls how much space the pixels are printed over. Now let us see an example, you can modify an image's resolution without changing the actual pixel data in the image--all you change is the printed size of the image. On the other hand, if you want to maintain the same output dimensions, changing the image's resolution requires change in the total no. of pixels. Increasing the resolution of lower resolution image only spreads the original pixel information across a greater no. of pixels; it rarely improves image quality.

Relationship with Image size, color depth and file size

Image size- is size of image in pixel or in inch (72 pixels is normally 1")

Color depth- is range of colors available for pixel.

File size in bytes= (Image size in pixel X color depth in bit)/8

Image size in pixel	Screen size	Color depth in bits	Number of available colors	File size in bytes (Approx.)
640x480	Full screen	8	256	300,000
320x240	Quarter screen	8	256	77,000
1024x768	Full screen	24	16.7 million	2,400,000

Sources of Graphic Images

Clip art, stock photographs and fine arts: some program come with clip art and stock photographs, but these are often limited or of poor quality. Photodisc, a leader in digital stock images, provides more than 50,000 photographs that can be purchased on CD.

Video images: pictures from video sources such as VCRs, video discs and video camera can be transferred to a computer using video capture card.

Still images: digital cameras can be used to capture images in a digital form are useful in generating graphics. You can take picture as you would with any still camera. Then the camera is connected to a computer and the images are transferred from the camera to the computer.

Scanner Images: Using scanner you can scan pictures from a book, magazine etc. you can adjust color, brightness, contrast. You can crop, zoom and rotate image.

Screen Capture Program: whatever graphics appear on screen can be captured in both Mac and windows computers.

Software for creating and editing graphics

Graphics programs can be categorized as drawing, paint and image-editing programs:

1. **Drawing programs-** these provides facility for free hand drawing as well as geometric shapes and are useful in creating designs where precise dimension and relationship are important.

E.g. CorelDraw, adobe illustrator for 2d drawings, AutoCAD for 2d and 3D drawings

2. **Paint programs-**these are the programs who provide the tools brushes, pens, spray paint used by artists e.g. paint shop pro, Microsoft paint

3. **Image editing programs-** these are useful for making changes to existing images, such as manipulating the brightness or contrast, or applying textures or patterns.

E.g. Photoshop, photo paint

Digital Image

A digital image is represented by a matrix of numeric values each representing a quantized intensity value. When I is a two-dimensional matrix, then $I(r,c)$ is the intensity value at the position corresponding to row r and column c of the matrix.

The points at which an image is sampled are known as picture elements, commonly abbreviated as pixels. The pixel values of intensity images are called gray scale levels (we encode here the "color" of the image). The intensity at each pixel is represented by an integer and is determined from the continuous image by averaging over a small neighborhood around the pixel location. If there are just two intensity values, for example, black, and white, they are represented by the numbers 0 and 1; such images

are called binary-valued images. If 8-bit integers are used to store each pixel value, the gray levels range from 0 (black) to 255 (white).

Digital Image Format

There are different kinds of image formats in the literature. We shall consider the image format that comes out of an image frame grabber, i.e., the captured image format, and the format when images are stored, i.e., the stored image format.

Captured Image Format

The image format is specified by two main parameters: spatial resolution, which is specified as pixelsxpixels (eg. 640x480)and color encoding, which is specified by bits per pixel. Both parameter values depend on hardware and software for input/output of images.

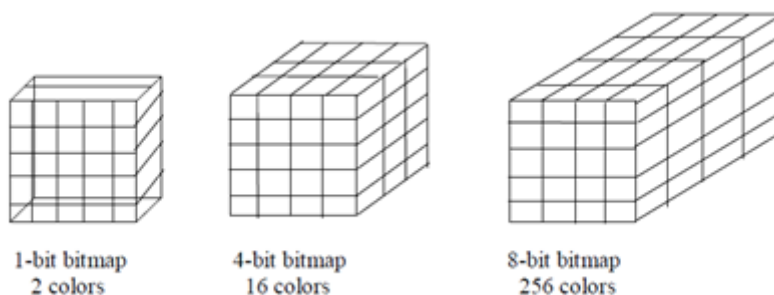
Stored Image Format

When we store an image, we are storing a two-dimensional array of values, in which each value represents the data associated with a pixel in the image. For a bitmap, this value is a binary digit.

Bitmaps

A *bitmap* is a simple information matrix describing the individual dots that are the smallest elements of resolution on a computer screen or other display or printing device.

A one-dimensional matrix is required for monochrome (black and white); greater depth (more bits of information) is required to describe more than 16 million colors the picture elements may have, as illustrated in following figure. The state of all the pixels on a computer screen make up the image seen by the viewer, whether in combinations of black and white or colored pixels in a line of text, a photograph-like picture, or a simple background pattern.



Where do bitmap come from? How are they made?

Ø Make a bitmap from scratch with paint or drawing program.

- Ø Grab a bitmap from an active computer screen with a screen capture program, and then paste into a paint program or your application.
- Ø Capture a bitmap from a photo, artwork, or a television image using a scanner or video capture device that digitizes the image. Once made, a bitmap can be copied, altered, e-mailed, and otherwise used in many creative ways.

Clip Art

A clip art collection may contain a random assortment of images, or it may contain a series of graphics, photographs, sound, and video related to a single topic. For example, Corel, Micrografx, and Fractal Design bundle extensive clip art collection with their image-editing software.

Multiple Monitors

When developing multimedia, it is helpful to have more than one monitor, or a single high-resolution monitor with lots of screen *real estate*, hooked up to your computer. In this way, you can display the full-screen working area of your project or presentation and still have space to put your tools and other menus. This is particularly important in an authoring system such as Macromedia Director, where the edits and changes you make in one window are immediately visible in the presentation window-provided the presentation window is not obscured by your editing tools.

Making Still Images

Still images may be small or large, or even full screen. Whatever their form, still images are generated by the computer in two ways: as *bitmap* (or paint graphics) and as *vector-drawn* (or just plain drawn) graphics.

Bitmaps are used for photo-realistic images and for complex drawing requiring fine detail. Vector-drawn objects are used for lines, boxes, circles, polygons, and other graphic shapes that can be mathematically expressed in angles, coordinates, and distances. A drawn object can be filled with color and patterns, and you can select it as a

single object. Typically, image files are compressed to save memory and disk space; many image formats already use compression within the file itself – for example, GIF, JPEG, and PNG.

Still images may be the most important element of your multimedia project. If you are designing multimedia by yourself, put yourself in the role of graphic artist and layout designer.

Bitmap Software

The abilities and feature of image-editing programs for both the Macintosh and Windows range from simple to complex. The Macintosh does not ship with a painting

tool, and Windows provides only the rudimentary Paint (see following figure), so you will need to acquire this very important software separately – often bitmap editing or *painting* programs come as part of a bundle when you purchase your computer, monitor, or scanner.

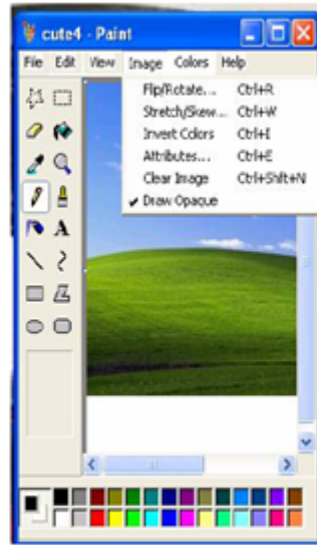


Figure: The Windows Paint accessory provides rudimentary bitmap editing

Capturing and Editing Images

The image that is seen on a computer monitor is digital bitmap stored in video memory, updated about every 1/60 second or faster, depending upon monitor's scan rate. When the images are assembled for multimedia project, it may often be needed to capture and store an image directly from screen. It is possible to use the *Prt Scr* key available in the keyboard to capture a image.

Scanning Images

After scanning through countless clip art collections, if it is not possible to find the unusual background you want for a screen about gardening. Sometimes when you search for something too hard, you don't realize that it's right in front of your face. Open the scan in an image-editing program and experiment with different filters, the contrast, and various special effects. Be creative, and don't be afraid to try strange combinations – sometimes mistakes yield the most intriguing results.

Vector Drawing

Most multimedia authoring systems provide for use of vector-drawn objects such as lines, rectangles, ovals, polygons, and text.

Computer-aided design (CAD) programs have traditionally used vector-drawn object systems for creating the highly complex and geometric rendering needed by architects and engineers.

Graphic artists designing for print media use vector-drawn objects because the same mathematics that put a rectangle on your screen can also place that rectangle on

paper without jaggies. This requires the higher resolution of the printer, using a page description language such as PostScript.

Programs for 3-D animation also use vector-drawn graphics. For example, the various changes of position, rotation, and shading of light required to spin the extruded.

How Vector Drawing Works

Vector-drawn objects are described and drawn to the computer screen using a fraction of the memory space required to describe and store the same object in bitmap form. A *vector* is a line that is described by the location of its two endpoints. A simple rectangle, for example, might be defined as follows:

```
RECT 0,0,200,200
```

Color

Color is a vital component of multimedia. Management of color is both a subjective and a technical exercise. Picking the right colors and combinations of colors for your project can involve many tries until you feel the result is right.

Understanding Natural Light and Color

The letters of the mnemonic **ROY G. BIV**, learned by many of us to remember the colors of the rainbow, are the ascending frequencies of the visible light spectrum: red, orange, yellow, green, blue, indigo, and violet. Ultraviolet light, on the other hand, is beyond the higher end of the visible spectrum and can be damaging to humans. The color white is a noisy mixture of all the color frequencies in the visible spectrum. The cornea of the eye acts as a lens to focus light rays onto the retina. The light rays stimulate many thousands of specialized nerves called *rods* and *cones* that cover the surface of the retina. The eye can differentiate among millions of colors, or *hues*, consisting of combination of red, green, and blue.

Additive Color

In additive color model, a color is created by combining colored light sources in three primary colors: red, green and blue (RGB). This is the process used for a TV or computer monitor

Subtractive Color

In subtractive color method, a new color is created by combining colored media such as paints or ink that absorb (or subtract) some parts of the color spectrum of light and reflect the others back to the eye. Subtractive color is the process used to create color in printing. The printed page is made up of tiny halftone dots of three primary colors, cyan, magenta and yellow (CMY).

Image File Formats

There are many file formats used to store bitmaps and vectored drawing. Following is a list of few image file formats.

Format	Extension
Microsoft Windows DIB	.bmp .dib .rle
Microsoft Palette	.pal
Autocad format 2D	.dxf
JPEG	.jpg
Windows Meta file	.wmf
Portable network graphic	.png
Compuserve gif	.gif
Apple Macintosh	.pict .pic .pct

GIF format:

The graphics interchange format (GIF) was invented in 1987 by CompuServe to allow images to be displayed. This format allows for 256 colors, compressions, interlacing and animation. This is very powerful form, suitable for various types of images. GIF uses LZW (Lampel Zev Welch) compression algorithm. There are two GIF standards are available GIF87a and GIF89B. The GIF89a allow multiple images to be included in a single file.

Advantage/Feature:

Very powerful format

It provides the option to specify how many number of colors will be saved, which to decrease the size of an image.

Files are compact it uses transparency concept and supports streaming of image. You can get rid of rectangular border of image.

It allows interlacing and animation.

Uses a non-lossy compression technique.

Suitable for on-line transmission and interchange of graphics data.

GIF file format is independent on computer hardware and operating system.

Disadvantage/Limits:

Decompression is slower than RLE.

It uses only palette colors and has no provision for 24-bit RGB color files.

It has no provision for 4 or 8 bit gray scale and no grayscale or color correction data.

PCX format:

Also known as PC paint brush file format. This format was created by ZSoft (Zsoft packbits format). This is widely used for storage of images. PCX supports 256 colors. The current version of PCX format has the ability to store 24 bit color images. It is widely used on scanners, fax and softwares like Photoshop and PageMaker. It supports index and RGB color model.

·Bitmaps may be black and white, 16 colors, grayscale (8-bit), paletted (8-bit), or RGB

color (24-bit).

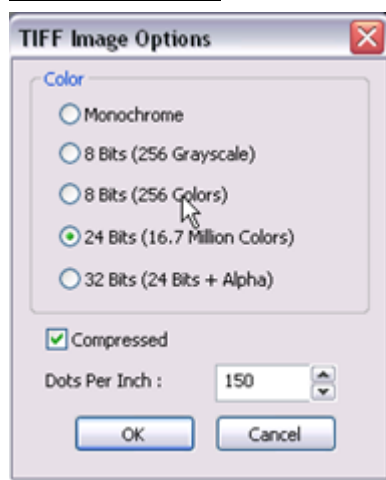
- Run-length encoding (RLE) compression is supported, and the maximum image size is 64,535 x 64,535 pixels.

- These files may contain one, two, or four color planes.

BMP format:

A bitmap file (BMP) contains an exact pixel by pixel mapping of an image, which can then be reconstructed by rendering application on the display surface on an output device. It can't be compressed. If image is resized quality of image drops drastically. BMP files are Microsoft Windows bitmap files. These files can be created in and read by Windows Paint; all Windows applications can import them.

TIFF format:



It is acronym for tagged image file format. Almost every graphics application can read and write TIFF files. There are many variations of TIFF, considering that TIFF supports six different encoding routines and three different image modes: black and white, grayscale, and color. Uncompressed TIFF images may be 1, 4, 8, 24, 32 bits per pixel. TIFF images compressed using the LZW algorithm may be 4, 8, or 24 bits per pixel. TIFF files can save RGB, CMYK, and Lab color mode information, but not duotones.

Advantage/Feature:

TIFF applies lossless compression of file.

JPEG/JPG format:

It uses compression technique to store image which is lossy. It may use wrong color choice after compression. It supports Gray, RGB color models. JPEG is a standard format developed by the Joint Photographic Experts Group, allowing the transfer of files between wide varieties of platforms, using superior compression techniques. JPEG supports 8-bit grayscale and color depths up to 32-bit CMYK.

EPS format:

It is a vector file format. It also stores bitmap information on MAC computer it uses

PICT graphics and on PC it uses TIFF graphics.

TGA (Targa) format

The Targa (TGA) graphics format is a format for describing bitmaps. It supports various compression systems and is capable of representing bitmaps ranging from black and white to RGB color.

High end computer graphics uses this format. It uses several types of compression algorithm. It is useful to display AT & T true vision images.

Alpha is a type of data, found in 32-bit image files, that assigns transparency to the pixels in the image. RGBA is 32-bit True Color. RGB is 24 bit True Color.

PNG (Portable Network Graphics):

The Portable Network Graphics (PNG) file format is an excellent file format for lossless, portable, and well-compressed storage of bitmaps. It takes up a minimum amount of disk space and can be easily read and exchanged between computers. The Portable Network Graphics format provides a replacement for the GIF format and can also replace many common uses of the TIFF format.

The Portable Network Graphics format is designed to work well in online viewing, such as on the Web, and it's fully stream-able with a progressive display option. You can export images to the Portable Network Graphics file format if you want to use transparent backgrounds, image interlacing, image maps, or animation in your Web pages.

Exporting drawings to the Portable Network Graphics format converts them to bitmaps that can be used in desktop publishing programs. You can also edit Portable Network Graphics in paint programs such as Corel PHOTO-PAINT and Adobe Photoshop.

For Internet use, you can also save images to the GIF and JPEG formats. If you want to publish an image to the Web and you are not sure which format to use,

Portable Document Format

The Portable Document Format (PDF) is a file format designed to preserve fonts, images, graphics, and formatting of an original application file. Using Adobe Acrobat Reader and Adobe Acrobat Exchange, a PDF file can be viewed, shared, and printed by Macintosh, Windows, and UNIX users.

You can import an entire PDF file, individual pages from the file or multiple pages.

EPS (Encapsulate PostScript Format)

An encapsulated PostScript (EPS) file is a metafile supported by most illustration and page layout programs. It supports raster and vector graphics along with text. To view or print an EPS file, you must have a PostScript printer installed. It supports lab, CMYK, RGB, Indexed color, Duotone, Gray Scale and bitmap color modes. It does not support alpha channel.

Macintosh PICT/ Windows PCT

The Macintosh PICT file format was developed for the Macintosh platform by Apple Computer Inc. It is a native file format of QuickDraw and can contain both vectors and bitmaps. The Macintosh PICT file format is widely used in Macintosh applications where graphics are used.

Conversion of Graphics Format

Most of the popular graphics-image editing program allow saving an image from one format to other format. For example photoshop provides saving of image from one format to other format. To save image in different format we use file->save as command, when save as dialog appears we must choose file format in which we want to save.

After specifying file name and choosing file format one more dialog box appears where we have to specify different options for chosen file format then we have to click on ok.

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