MOTION GRAPHICS BITE 3623

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FTMK, UTEM
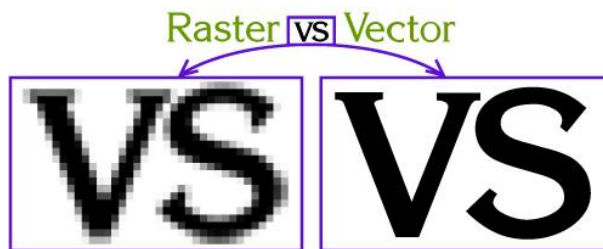
Lecture 1:
Introduction to Graphics

Learn critical graphics concepts.
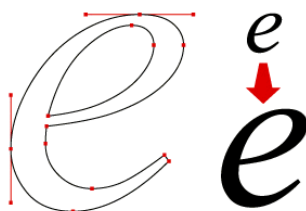
Bitmap (Raster) vs. Vector Graphics

Software

Bitmap Images

- **Bitmap** images, also referred to as raster images, are *pixel-based*

- Location and color information about the image is stored in individual pixels within a grid

- a type of digital image composed of individual pixels of various colors; also called raster graphics image, bit-map image, bitmap.

- A raster image may be put in many file formats such as GIF, JPEG, TIFF, BMP, PICT, and PCX.
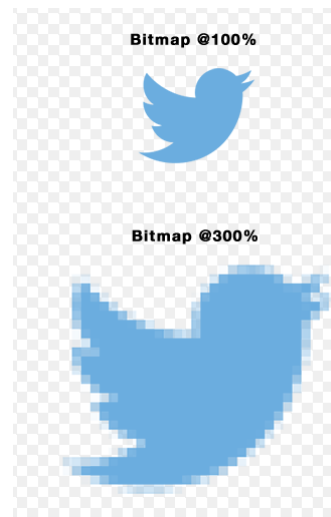
Bitmap Images

- NOTICE: Figure 1
Arrow image at original size

Figure 1: Arrow Image, Actual Size

- Figure 2 shows each pixel has an assigned color; some pixels are white, while other pixels are blue
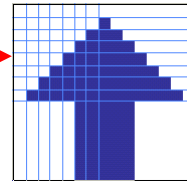
Figure 2: Magnified Arrow Image with Pixel Grid

The information stored in a bitmap image regarding pixel location and color is what forms the image. Bitmap images are edited at the pixel level…in other words… The color of any one pixel can be changed

Bitmap Attributes

- Bitmap images:
    - created and edited in "photo" or "paint" programs
    - 'mapped' to a grid
    - size is based on the image's resolution
    - not easily scalable
    - used for photorealistic images and may involve complex color variations

Bitmapped Images

1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1
1	1	1	1	1	1	0	1
1	1	1	1	1	0	1	1
1	1	1	1	0	1	1	1
1	1	1	0	1	1	1	1
1	1	0	1	1	1	1	1
1	1	1	1	1	1	1	1

• Ho

Bitmapped Images

1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1
1	1	1	1	1	1	0	1
1	1	1	1	1	0	1	1
1	1	1	1	0	1	1	1
1	1	1	0	1	1	1	1
1	1	0	1	1	1	1	1
1	1	1	1	1	1	1	1
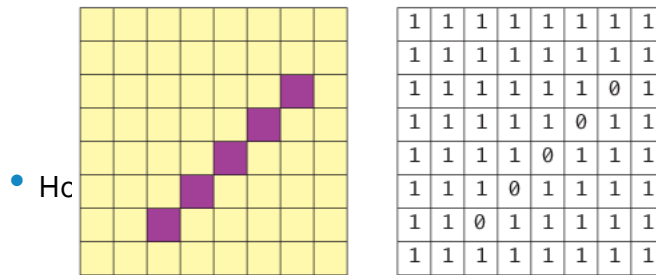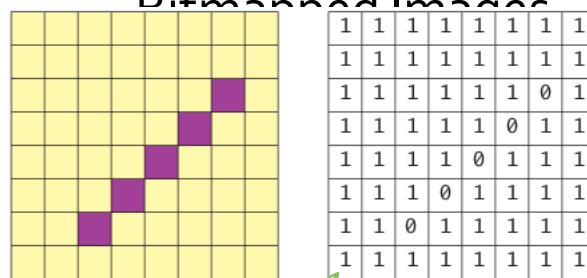
But now consider that instead of these being 1's and 0's, they are 24-bit, 32-bit, or 48-bit color codes.

5

Bitmaps → Raster Graphics

- Bitmapped images also are called *raster graphics*
- "rastering" refers to the way most video displays translate the images into a series of horizontal lines on the screen.

Bitmaps

- Bitmap image formats are the most commonly used in image-editing applications.
- However, bitmap appearance depends on the resolution of the output device
  - Bitmapped images can appear jagged and lose detail when they're scaled onscreen or printed.

Jagged images (or Jaggies)

• ousan
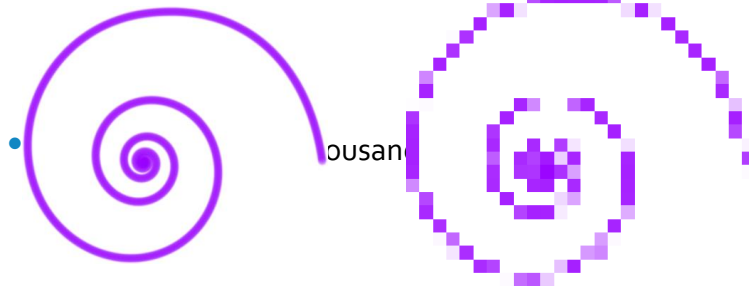
Alternative to Bitmaps

• Besides pixel by pixel representation, what other way could we store images digitally?

• Hmmm? Think about it.

• Math Power!

Vector Graphics

- **Vector graphics** is the use of geometrical primitives such as
  - points,
  - lines,
  - curves, and
  - polygon(s)
- …to represent images.

Vectors

- x, y coordinate

x_2, y_2

x_1, y_1
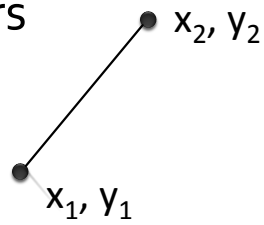
- points,
- lines,
- curves, and
- polygon(s)
- are all based upon mathematical equations.

Splines (not in book)

- A s   olynomial
  fur
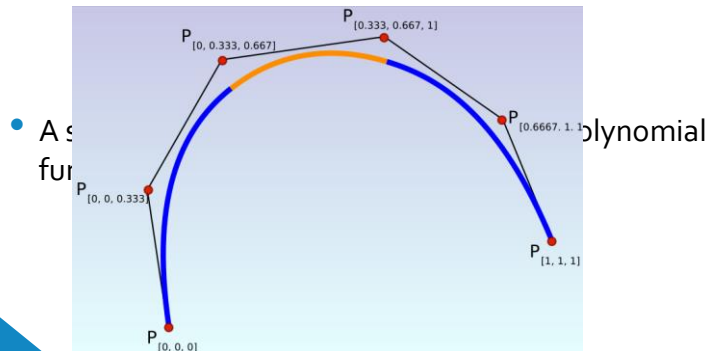
Fonts – The first vector images

(a) vectors still appear smooth at higher magnification

(b) rasterized graphic

(c) rasterized graphic with anti-aliasing

Fonts

Font magnification example:

g

g

Rasterization

Stored as vector

- Vectors are literally made up of mathematical formulas
- No pixels at all
- In principle, vectors can be rendered at limitless resolution

Displayed as scalable raster

- Monitors and projects still display using pixels.
- To display a vector image, software has to convert the vector information into a temporary raster image.
- Called rendering or rasterization

Aliasing (formal word for jagged)
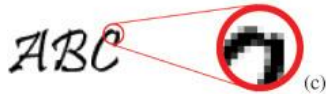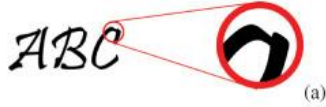
- Rasterized images will always appear jagged
  - You just have to zoom in.
- This jagged effect is called *aliasing*
- caused by under-sampling or over-maginfication.

Anti-Aliasing
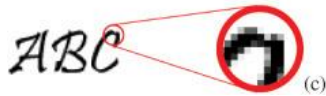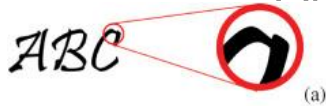
- Pixels with intermediary shades can be used to soften the jaggedness
- This technique is called *anti-aliasing*.
- Technique to make rasterization more smooth.

Raster (bitmap) and Vector formats

Vector

- GIF
- JPEG
- PICT
- TIFF

Raster

- SWF (Shockwave Flash)
- SVG (Scalable Vector Graphic)
- EPS (Encapsulated Postscript)
- AI (Adobe Illustrator)

Combo-format (not in book)

PNG (Portable Network Graphic) – Raster format but includes vector information when applicable.

Vector Images

- **Vector** images are *mathematically-based*
- All lines, shapes, etc. (also called *objects*) of a vector-based image are independent of one another

Vector @100%

Vector @300%
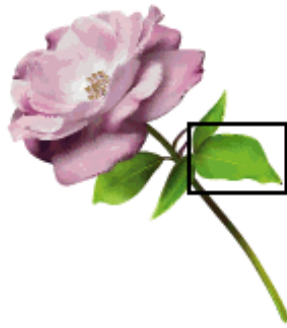
Vector Images

Figure 5.1-3: Rose sample   Figure 5.1-4: Rose Leaf with Handles
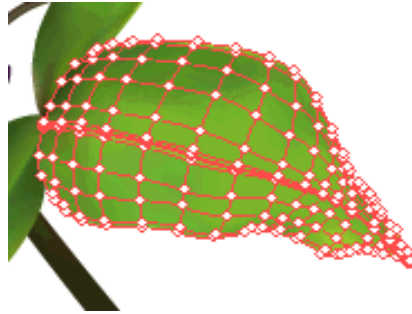
http://www.adobe.com/education/webtech/CS2/unit_graphics1/gb_print.htm

Vector Attributes

- Vector-based images:
  - are usually created and edited in "draw" or "illustrate" programs
  - have smooth edges
  - create curves or shapes
  - good for precise illustrations, but are not as good for photorealistic images
  - easily scalable, due to use of mathematic formulas

Advantages of Vector Graphics

- Vector graphics are resolution independent, which means no mater how much the artwork is enlarged or reduced, it looks great-no jagged edges
- This makes vector graphics idea for creating logos, maps, and other smooth-edged images that will be used at different sizes.

Vector Graphics can be easily modified

- Unlike raster images, vector images can be easily modified
- With a click of a button you can apply stroke and fill properties
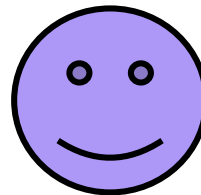
Vector Graphics have smaller file sizes

- The mathematics of vector graphics allow large shapes to be described as extremely small amounts of data

Examples of Vector Graphics
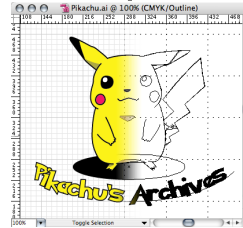
Logos, Business Cards, Cartoons, Animations

Bit Depth
vs.
Image Resolution

Bit

- A **bit** is the smallest unit of measurement regarding computer data
- Each bit is an electronic pulse that can either be *on* (represented by a 1) or *off* (represented by a 0)

Bit Depth

- **Bit depth** refers to the number of colors that can be displayed
- The higher the bit depth, the more colors used in the image, therefore, larger the file size

Bit depth	Formula	Number of Colors
1-bit	2^1	2
2-bit	2^2	4
3-bit	2^3	8
4-bit	2^4	16
5-bit	2^5	32
6-bit	2^6	64
7-bit	2^7	128
8-bit	2^8	256
24-bit	2^{24}	16,777,216

Bit Depth

- The next few slides demonstrate the most commonly referred to bit depths
- Notice how the file size   as the # of colors

*Look at what happens with the 24-bit image

Why is that file size smaller than the 8-bit image?

Bit Depth

- **Bit Depth = 1-bit**
- **Number of colors = 2 colors**
- **File Size = 2 KB**
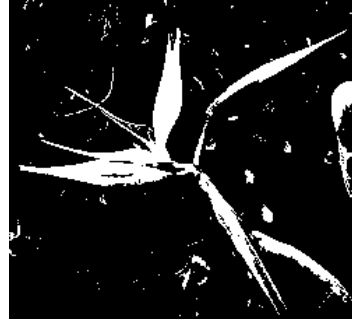
http://www.adobe.com/education/webtech/CS2/unit_graphics1/gb_print.htm

Bit Depth

- **Bit Depth = 4-bit**
- **Number of colors = 16 colors**
- **File Size = 21 KB**

http://www.adobe.com/education/webtech/CS2/unit_graphics1/gb_print.htm

Bit Depth

- **Bit Depth = 8-bit**
- **Number of colors = 256 colors**
- **File Size = 53 KB**

http://www.adobe.com/education/webtech/CS2/unit_graphics1/gb_print.htm

Bit Depth

- **Bit Depth = 24-bit**
- **Number of colors = 16.7 million colors**
- **File Size = 24 KB***

http://www.adobe.com/education/webtech/CS2/unit_graphics1/gb_print.htm

Image Resolution

- **Resolution** is the number of pixels (individual points of color) contained on a display monitor

- expressed in terms of the number of pixels on the horizontal and vertical axes

- The sharpness of the image on a display depends on the resolution and the size of the monitor
  - The same pixel resolution will be sharper on a smaller monitor and gradually lose sharpness on larger monitors because the same # of pixels are being spread out over a larger # of inches

Image Resolution

- Image Resolution = a measure of the output quality of an image

- Traditional print work requires high resolution images to display the image quality in magazines, brochures, and other print materials

- Images prepared for the Web do not require a high resolution

- Computer monitors are limited to an image resolution of 72 pixels per inch (ppi) or 96 pixels per inch

- High resolution images prepared for the Web waste a lot of valuable resources (i.e. bandwidth)

Image Resolution

- Images prepared for the Web at 72 ppi will not look good in print > Important to consider various ways images will be used when determining the resolution

- Trade-off to consider: higher resolution images used for print have a larger file size & require more bandwidth without displaying any better on a monitor; lower resolution images used for computer will not be sufficient for print

Graphic File Formats

File Formats

- File formats:
  - help to identify the kind of file
  - distinguished by the file extension
    (i.e. gif, jpeg, png, tiff)
- Most computer applications have a **native file format** (a default format for files created in that program)
- For example:
  - Adobe Photoshop = .psd extension
  - Adobe Illustrator = .ai extension
- Many applications allow users to save files in formats other than the native format

File Formats

- Three primary **graphic file formats** for Web images:
  - **GIF** (Graphic Interchange Format)
  - **JPEG** (Joint Photographic Experts Group)
  - **PNG** (Portable Network Graphics)
- Each format is cross-platform and uses some form of compression to be used on the Web

GIF	PNG	JPG
Quality: Good Size: 36.4 KB	Quality: Better Size: 30.2 KB	Quality: Best Size: 37.2 KB
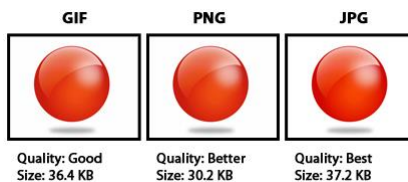
What Should You Use?

FILE TYPE	BEST USES
JPEG	• Still Images • Photographs • Many colors • Shading of light and dark
GIF	• Animations
PNG	• Web Images (PNG-8) Logos which involve transparency and fading • Images in the editing process (PNG 24) • Complex images like photographs if file size • is not an issue (PNG-24)

GIF

- GIF is the preferred file format for images with large areas of solid color
- For example:
  - Logos
  - Text as graphics
  - Cartoons
- The GIF file format supports 8-bit images (up to 256 colors)
- GIF images:
  - use a *lossless compression scheme* (images do not lose data when compressed and do not lose image quality)
  - allow for 1 transparent color
  - used to create simple animations
  - saved with a .gif extension

JPEG

- JPEG images:
  - preferred file format for photographic images
  - works well with subtle transitions in color
    - watercolors
    - pencil
    - charcoal drawings
  - supports 24-bit images (over 16 million colors)
  - saved with a .jpeg or .jpg extension
- JPEGs use a *lossy compression scheme* (data is removed from the image to make the file size smaller when compressed)
- JPEG images allow for various compression levels to provide for adjustment without losing quality
- NOTE: Edit only the original jpeg image not a jpeg that has been compressed

PNG

- PNG images:
  - New file format that has advantages over GIF and JPEG
  - Can be 24-bit or 8-bit
    (eliminating limitations of other formats)
  - Use lossless compression scheme
  - Supports 8-bit transparency
  - Saved with a .png extension

Optimizing Web Graphics

- Optimizing graphics for the Web involves eliminating unnecessary data from an image without significantly impacting the overall quality of the image
- Three ways to optimize graphics for Web:
  - Reduce overall image size
  - Use compression schemes
 - Reduce # of colors saved with image

Optimizing Web Graphics

- **Reduce the overall image size**
  - Create a thumbnail of the image
  - Crop the original image
- **Use compression schemes**
  (appropriate for images with complex color combinations)
  - Apply best compression scheme for image
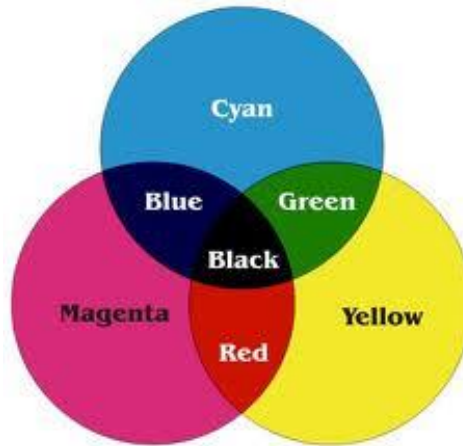 - Adjust compression levels

Optimizing Web Graphics

- **Reduce # of colors saved with image**
(appropriate for images with solid colors)
  - Images saved as an 8-bit image might only use 60 of the possible 256 colors available
  - Approx 196 additional colors are stored with the image, making the file size larger than necessary

Introduction to Color
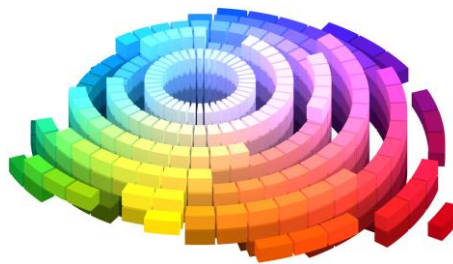
RGB vs. CMYK Color

RGB vs. CMYK Color Models

➢ The **RGB** color model is typically used when dealing with color viewed on a computer monitor.
➢ The **CMYK** color model is used on print material when printing in full color.

- Non-reflective
  - Light comes straight from the light source to our eyes

- Reflective
  - Light comes from a source, hits an object, and reflects from the object into the eye
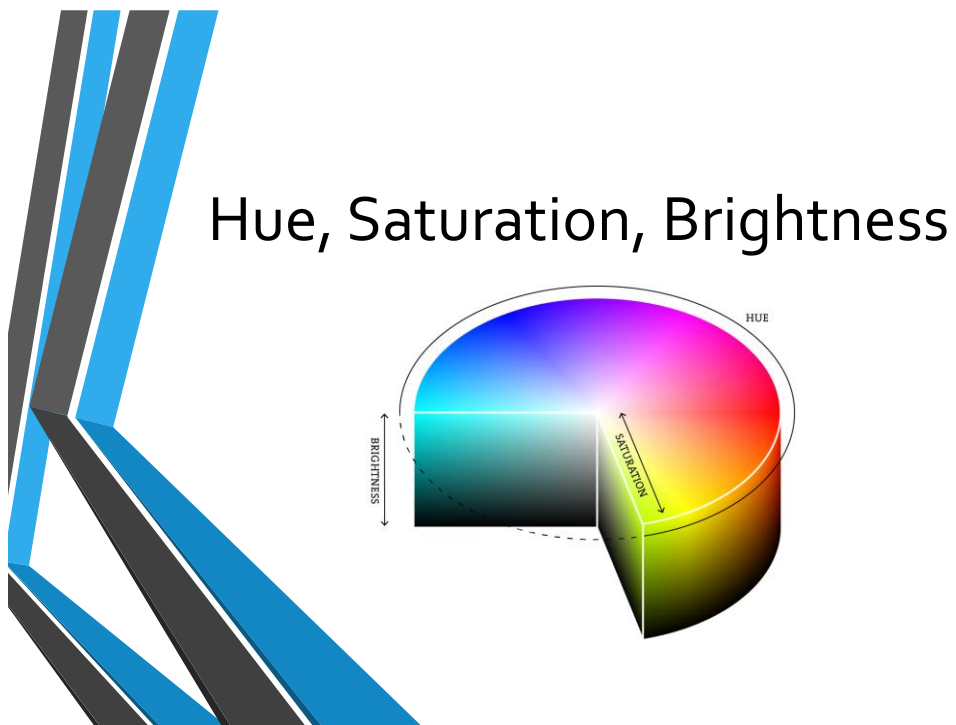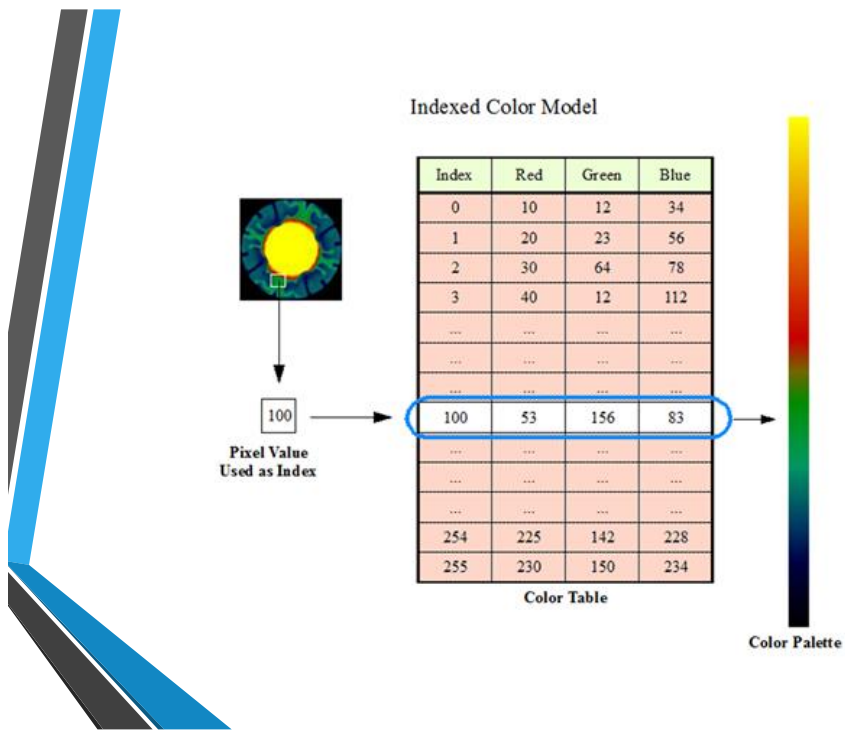
RGB vs. CMYK Values

- Each individual color has a value, or intensity, from 0 to 255
- The various combinations of the values produce different colors

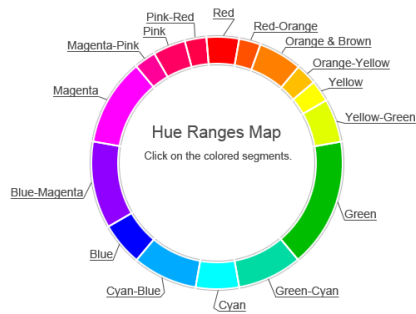- Images are separated into various values of the four colors

Indexed Color

- **Indexed color** is a *limited palette* of up to 256 colors
- When using a limited palette, the computer approximates a non-included color by combining the colors within the palette; this is called *dithering*
- The indexed palette can have *up to* 256 colors, but does not *require* that many
  - the palette can have any number of colors up to 256
- The fewer colors within the palette, the smaller the file size
- One way to optimize graphics for the Web is to reduce the number of colors saved with the image
- Using an indexed palette with only the colors used in the image is one of the best ways to limit an image's file size

Indexed Color Model

Index	Red	Green	Blue
0	10	12	34
1	20	23	56
2	30	64	78
3	40	12	112
...	...	...	...
...	...	...	...
...	...	...	...
100	53	156	83
...	...	...	...
...	...	...	...
...	...	...	...
254	225	142	228
255	230	150	234

Color Table

100

**Pixel Value
Used as Index**

Color Palette

Hue, Saturation, Brightness
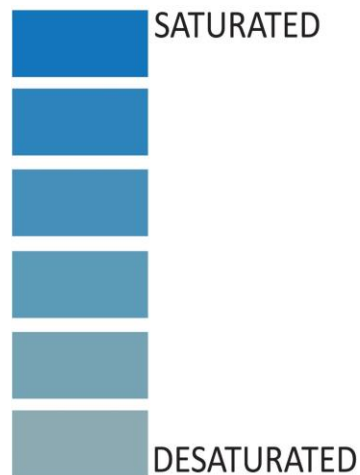
HUE

BRIGHTNESS

SATURATION

Hue

- Generic name used to describe color
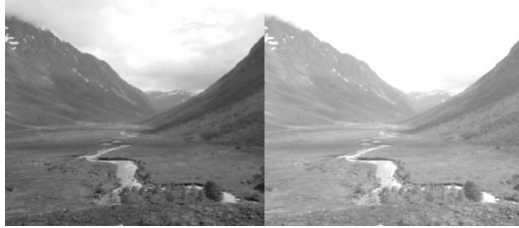 - Ex: red, green, yellow, orange, etc.

Saturation

- Purity of the color
  - A fully saturated color is the truest version of that color
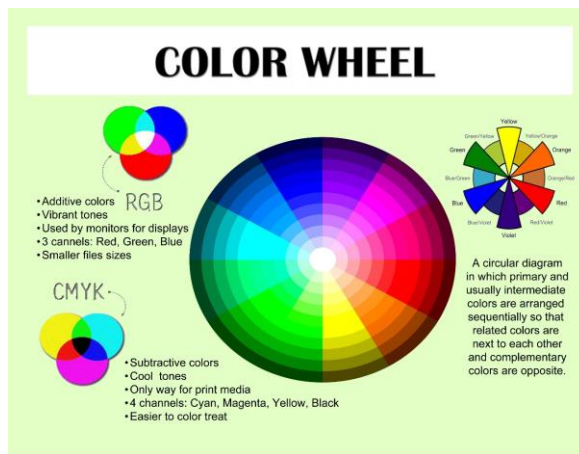 - Primary colors are fully saturated

Brightness

- Amount of white in the color

The Color Wheel

- A 360-degree circle of color
  - Red starts the circle at 0°

Types of Colors

- **Primary Colors** – Red, Yellow, Blue
  - true colors
  - don't involve blending colors together
- **Secondary Colors** – Orange, Green, Purple
  - result of blending 2 primary colors
    - Orange = red + yellow
    - Green = yellow + blue
    - Purple = blue + red
- **Tertiary colors**
  - Result of blending a primary & secondary color

Browser Safe Colors

- Play an important role when designing Web graphics
- Most monitors today can display thousands of colors
- Only 216 common colors recognized by browsers and computer operating systems using a 256-color display
- The limited common palette can result in a couple of potential problems:
  - The browser will convert colors not included in the common palette to the closest color it can find
  - The browser may attempt to mix the colors within the common palette to approximate the desired color (dithering)

Browser Safe Colors

RGB	Hex	%
0	00	0
51	33	20
102	66	40
153	99	60
204	CC	80
255	FF	100

- Can be represe... ...ercentages, or hexadecimal e...

Source: see note

Graphics Basics Questions

1. Explain the difference between Vector and Bitmap images.
2. What is the difference or correlation between Bit Depth and Image Resolution?
3. Name one type of file extension. Give an advantage and a disadvantage.
4. Why can a 16.7 million color photo have a smaller file size than the 256 photo?
5. What is special about Web graphics?

Introduction to Color

1. What is the difference between RGB and CMYK?
2. What is Indexed Color?
3. What is the difference between Hue, Saturation and Brightness?
4. Explain Browser Safe Colors.
5. How can Browser Safe Colors be represented?

References

- Adobe Web Tech Curriculum
  www.adobe.com/education/webtech
- WhatIs.com
  http://whatis.techtarget.com/
- Dictionary.com
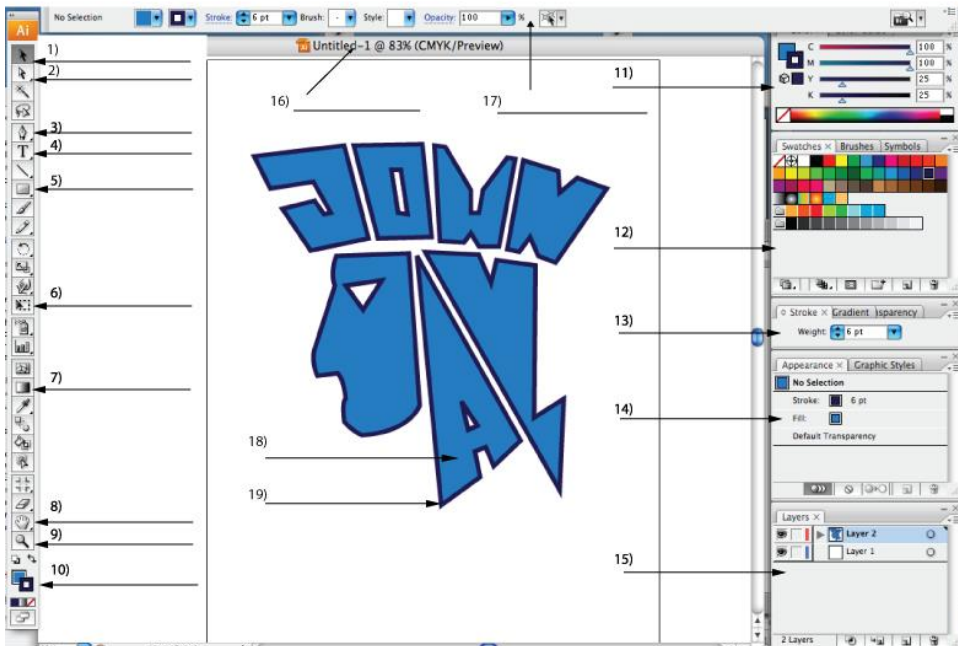 http://dictionary.reference.com/

Introduction to Adobe Illustrator

What is Adobe Illustrator?

- Adobe Illustrator is a Professional Vector Image production program.
- Used heavily in the Computer Graphics Industry
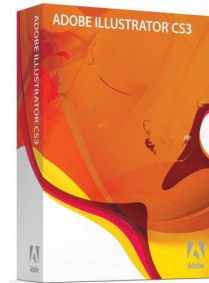
Directions: Next to each numbered blank, record the corresponding tool/description:

Adobe Illustrator Demo

- Open/Close Program
- Setting Up a Document
- Reset Pallet Locations
- Stroke & Fill
- Zoom In & Zoom Out
- Color Modes
- Type Tools
- Layers