CGT 141/CPT 141 Lecture 5 Wk 3
Images Formats: JPG, GIF, aGIF and PNG

Graphic Interchange File Format (GIF, pronounced "jif", like peanut butter) and Animated GIF

- Two "flavors"
  - GIF 87a and 89a
    - GIF 87a features
      1. 8-bit (256 colors), called a palletized or indexed image
      2. Permits interlacing
         - Writes the file in such a way that the file can be opened before all data is downloaded.
         - Looks like a camera focusing when image loads.
         - Gives the perception in the browser that the image loads faster; when in reality the file takes just as long, whether interlaced or not.
         - Interlacing and progression (or progressive as it relates to JPG) are conceptually similar (although the details are different).
      3. Uses lossless compression – meaning an exact replica of the file is created when the file is uncompressed.
         - Compression rations at about 5:1
         - Compression used is called Lempel-ZivWelch (LZW)
         - LZW is part of a family of compression algorithms called the LZ family, developed by Abraham Lempel and Jakob Ziv
         - The LZ family of compressors is used in a variety of ways, including ZIP, Arc, z, and tar files.
         - While working for Unisys, Terry Welch created a special type of compression for working with indexed raster images (LZW), specifically designed for use by CompuServe on their online service/
         - UniSys, who had threatened to "suit anyone distributing GIF file", patented LZW compression. Generally, an empty threat as it relates to the end user and web developer, but was one of the reasons for the emergence of the PNG format.
    - GIF 89a features
      4. Adds the ability to assign one or more pixel colors as transparent; allowing the background of a web page to show through the image.
         - Limitation: each pixel color assigned as transparent must either be 100% opaque or 100% transparent. There is no partial transparency.
         - Many image editors support the creation of transparent GIF images (Photoshop included).
      5. Adds the ability to store multiple images in a single file. Although not originally intended for it, this capability is what permits animated GIF (aGIF) images.
         - Because animated GIFs contain multiple images, file size is the biggest drawback to their use.
         - Animated GIFs can be created in a variety of packages: http://members.aol.com/royalef/toolbox.htm
           - Or visit download.com and search for GIF animators

    - They can be optimized in Adobe ImageReady, once they are created.
        - Many of the GIF animation packages above also provide optimization mechanisms.
        - The main optimizations that take place include:
            - Looping
            - Amount of time to display each frame
            - Amount of time in between each frame
    - GIF animation is not a function of the GIF file format.
        - The GIF file format itself does not create the animation. An animation software package is required to stack the frames and set the optimization parameters.
- Using them:
    - Use GIF images on abstract or vector generated raster images.
        - Raster images generated from EPS, WMF, EMF, AI, FHX or other vector environments.
    - Use whenever you are trying to match an HTML color to a color in a raster image.
        - For example, placing an image in a web page where you want the background color of the image to match some existing background color on a web page. JPG will never, never match, even if the backgrounds are white!
    - If your audience is viewing in greater than 8-bit (256) color mode:
        - Use an Adaptive palette in Photoshop or other editor. This creates a palette of colors specifically for the image.
    - If your audience is viewing in 8-bit (256) color mode:
        - Use a web-safe color palette. In Photoshop, choose the Web option when you palletize the image.

Joint Photographic Experts Group (JPG, JPEG, pronounced “j - peg”)

- First, JPEG is actually a compression scheme not a file format; the actual format is called JFIF or JPEG Interchange File Format.
- For whatever reason, the de facto standard evolved as JPG and eventually became the official standard.
    - What does that mean: if you see the extension .jpg, .jpeg, .jif or .jfif they all contain the same data. You could change the extension to any one of these and open the file into an application (assuming the application was programmed to understand all three.)
    - The same type of data is in all three and any of the three extensions is correct. However, to permit portability through all applications, always use .jpg as it is the most common.
- JPEG Features
    - Near 24-bit color fidelity
    - Compressed format
        - Various compression schemes available in the JFIF format, JPEG most common; all we will discuss here.
        - Compression ratios from 200:1 to 10:1
        - Based on the fact that humans are much more aware of small changes in brightness (luminance) than small changes in color (saturation).
        - 3 step process:

1. Color mode conversion from current color scheme to YC_bC_r most often simply called the YCC color system or color model.
    - Y is luminance
    - C_b and C_r are color scales
    - This may slightly shift colors from one hue (color) to another.
2. Data reduction via subsampling.
    - This ignores luminance while averaging the color values, that is, a single color is produced from an interpolating the two existing color values
    - This reduces the image to two-thirds its original size, with little noticeable degradation as original luminance is maintained.
3. Image analyzed in 8x8 pixel blocks: Discrete Cosine Transform (DCT) and quantization applied to each block.
    - In each 8x8 block, the differences in luminance and color of each pixel are analyzed. Outlier colors are rounded off – forcing them to be more alike the surrounding pixels.

- JPEG trades color accuracy for smaller file sizes (better compression); the more a file is compressed, the more quality is lost.
- Overall, compression is affected by the verity of color; specifically in JPEG, it is affected by the amount of data removed during subsampling and how aggressively rounding occurs in quantization.
    - For more info see:
        - http://members.aol.com/judinorth/gifs.book/jpegs/jpeg.html
        - http://dynamo.ecn.purdue.edu/~ace/jpeg-tut/jpegtut1.html

- Progressive JPEG images
    - Similar to interlacing in GIF.
    - Permits image file to be opened as it is downloaded.
    - Differs slightly in technical aspects than interlacing (progressively higher quality images are downloaded, as opposed to “focusing camera”).
    - No size difference between progressive and non-progressive images.

- Using them:
    - JPEG images work best on natural images (photographic) images, where there are many gradient levels, however where specific image accuracy (as compared to an exact standard) is not crucial.
        - Remember: you will never get a JPEG image to perfectly match an HTML color!
    - A slider in most imaging applications controls subsampling and quantization, which affects the quality to file size ratio.
    - The data removed is gone forever! Know what the intended purpose for the image is.
    - Most recent applications permit “playing with compression” prior to saving.
    - Should not use JPEG for high quality images (such as those for print) or for long term archival, EVER!
    - JPEG images in the browser must be “RGB JPEG.” When converting printed documents to web documents, watch out for images created in CMY color. When CMY JPEG images are displayed in the browser, image appears with lines in it (visibly noticeable error).

Portable Network Graphics Format (PNG, pronounced “ping”)

- Created in response to the need for a “patent-free” image format and designed specifically for the web.
    - “The PNG image format was designed in 1995 specifically in response to the patent problems with the LZW algorithm used in GIF. To the best of the PNG group's knowledge, PNG was then--and still is--completely patent-free.” – PNG Home Site
- For additional information on the PNG image file format, including an faq site, visit this web site (this site has moved several times, but is currently located at):
    - http://www.libpng.org/pub/png/
- Features
    - Several “flavors”
        - PNG-24
            - Truecolor (24-bit) up to 48-bit (medical imaging). Designed so that it is capable of replacing TIFF [Tagged Image File Format], which is predominantly used for high quality images for print or archving.
        - PNG-8
            - 8-bit/palettized version
            - Supports 8-bit transparency; meaning it overcomes the limitation of transparency in GIF files (e.g., a pixel can be a percentage of transparency, as opposed to 100% opaque or 100% transparent)
    - Lossless compression similar to GIF(LZ family compression, but not LZW)
    - Interlacing is possible (via “Adam7”).
        - Interlaced in 7 steps/series.
        - Named for creator, Adam Costello.
    - Other features:
        - Proposal in the works of MNG (Multiple-image Network Graphics) to permit animation similar to GIF. May die a quite death due to penetration of Flash and other vector tools for the web.
        - Gamma correction data: refers to the overall brightness setting of the monitor, so as to control the color accuracy of images on screen.
            - Technical: adjusts the nonlinear relationship between voltage (in monitor) and light intensity (in surrounding environment)
            - Gamma is used to calibrate monitors by adding neutral (gray) to R, G, and B components.
            - FYI: PC gamma 2.2, Mac gamma 2.2, Unix gamma 2.3-2.5; these are part of the reason for color differences between systems.
        - Inclusion of vector data (text)
        - Myriad other features that can be included.
- Using them:
    - Not all browsers support PNG, nor do they all support all features.
    - Remember that PNG will almost always be bigger than JPG (when comparing PNG-24 to JPG) and near the same size to GIFs (when using PNG-8).
    - Primary advantage to using them: 256-level transparency.
    - Only time will tell if PNG truly becomes a widely used format. However it will likely be supported in future browsers. Support of features of PNG will always be sketchy.