



This lecture will focus on web file formats and which one to use for compressing your artwork and designing your website. Compression is a method of making your images smaller. We compress images for the web so that they will download quicker and because those are the formats read by browsers. But getting images that look good and load fast is not as easy as it may seem. First you have to consider what kind of artwork you have. Next, you will determine the compression format needed. This may depend on the entire layout of your website. If this is a site where slicing will occur, it may be necessary to use a format that was not your first choice. We'll get to this later. For now let's discuss the planning process for your web page and the different types of artwork that may be involved in your web design.

PLANNING PROCESS FOR YOUR WEB ARTWORK

Here is a summary of the steps necessary when producing a website. This planning process will save you precious time later if you follow it. And you will be doing this for the Final Assignment.

STEP 1 Decide on the **layout** of the page. Will you use a grid design? Will it scroll horizontally or vertically? Here is an example of a horizontal site: <http://www.michaelcronan.com/> Do you know of any others?

STEP 2 Create a **storyboard or flowchart** that shows how the navigation of the site will work. This is the informational architecture of the site. Is it easy for the user to understand how to navigate from one page to the next? What graphics are being used to help this process? An example of this can be found in the Final Assignment. This could be a whole course. Read "Developing a Design Concept" pgs. 28-58 in Web Design.

STEP 3 Choose an on-screen **resolution** or pixel dimension that you will use to design your site. Type graphics and images should be designed at two or three times larger than the sized used and scaled down. Body text must be bigger than print type in order to be read at low resolutions. One problem with HTML body text is that the user can change the Preferences in the browser. For example, in Internet Explorer under Preferences > Language/Fonts, you can change the font size to a bigger or smaller size. There is no way to control this without fancy scripting.

STEP 4 Determine **Color Reduction, Image Compression and File Format** to be used for quick downloads and good looks. You can actually shift colors in existing artwork to reduce the overall number of colors.

STEP 5 Determine the **Color Depth** of your artwork, 8, 16 or 24 bits. This is like the Color Depth of your monitor but for your monitor it refers to how many color are displayed. Photographs are 24 bit images because they need millions of pixels to keep it look like a continuous tone image. In Photoshop each RGB channel is 8 bit which produces a 24 bit image. Line Art does not need to be 24 bit since there are not usually so many colors. Indexed images are 8 bit. We will be discussing color depth as we study optimization and color palettes.

STEP 6 Choose a **File Format**: gif, jpg, png with browser compatibility in mind.

STEP 7 Determine whether there will be motion graphics on your site such as gif animations, rollovers using JavaScript, image maps.

PREPARING YOUR ARTWORK FOR SPEED

When you design for the web you want great looking images that load fast . Image quality and speed work

against each other. The more detail and subtle color shifts in your artwork the bigger the files to maintain them, the more compression needed and the slower the download. But there are things you can do to minimize this compromise.

1. Keep your images small by reducing the size of them. If there is area around the image that is not needed, crop your image to reduce the size. You can also blur parts of the image to reduce its size.



This image has been cropped and the background blurred by selecting it and applying Filter > Gaussian Blur. Notice the distracting hand above the head was also removed using the Patch tool or Clone tool.

2. Avoid horizontal and diagonal gradients. Gif images use LZW compression. This compression method seeks out patterns along continuous horizontal path. It reads a image file from left to right pixel by pixel. This is called run-length encoding. If there are several pixels in a horizontal row next to each other that are the same color, it reads the first pixel and can quickly go to the next pixel color. This is also why flat-color is optimal for gifs and dithering does not create as small a file. For example, if there were color bars horizontally, the gif would read very quickly, but if the bars are vertical it must keep stopping to read the new color of the next bar. Diagonals and noisy or dithered images take even longer.



6K in size
horizontal



10K in size
vertical



48K in size
noise or dithering

3. Limit dithering. Dithering is a process where colors can be simulated. That is if you mix up red and yellow pixels your eye will see orange. You are using less colors which cuts down the file size, but the mixing process

or dithering increases file size because of run-length encoding described above. It does however maintain quality.



Pictured is an illustration of a spider at a 200% zoom. The image on the left has no dithering, The example on the right shows the same image with dithering.

4. Reduce color depth. This is how many pixels make up your image. (more on this in optimization and color palette lectures)
5. Use tiled backgrounds. (discussed in background lecture)
6. Use repeated elements. When a user opens a site, graphic elements are downloaded and stored in temporary memory called cache. Once an element is downloaded and in cache, it will load quicker. When the same element is used over multiple pages it is not necessary for it to be downloaded everytime resulting in a faster page. You may have seen this with your Web Photo Gallery.

Each page you design should be approximately 40 - 60 K in size. Of course a page with lots of photos will end up being more.

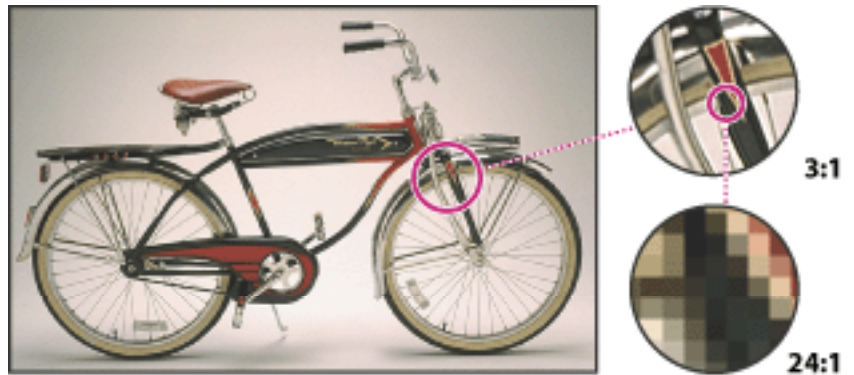
What effects speed on the web?

There are factors that effect speed on the web that are beyond your control such as a slow webserver connection speed, clogged arteries on the information highway due to router problems, large service providers like AOL, Earthlink, Geocities, that have so much traffic that site performance can be slowed down during heavy usage times, and sometimes the smaller local providers cannot offer fast connections because they don't have the resources to handle heavy traffic periods.

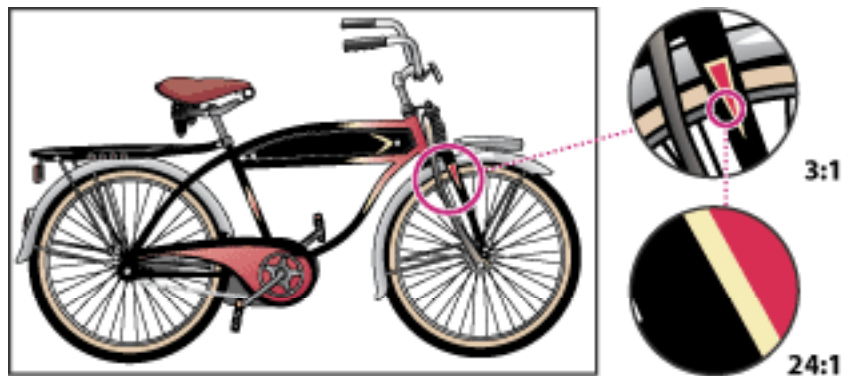
ARTWORK

Artwork is generally divided up into two types: Bitmap and Vector images. This is similar to how graphics are developed in Photoshop, using pixels or shape graphics. When you use the selection tools in Photoshop you are working with pixels. When you use the Shape Tool or Pen Tool you are dealing with vectors. Text is also vector based. However all these vectors can be rasterized. Rasterization is turning vector images into pixel images. Once a vector graphics is rasterized you can not edit it in the same way. Vector graphics are basic on mathematical calculations called algorithms. When you transform a vector graphics, for example enlarge your shape or text, it does not get pixelated or fuzzy. That is because vector graphics are resolution-independent and they can be scaled to any size and still print perfect. While bitmap images are resolution dependent and have a fixed number of pixels. As we saw when we talked about resolution, a bitmap image cannot be resampled up without losing clarity and certainly cannot be printed at any size.

Here is a comparison of a bitmap image versus a vector image. The top image is bitmap and bottom vector. They are shown with a portion of the image enlarged at different percentages, 3 to 1 and 24 to 1. These magnifications show how the two types of images vary. The top image is a photograph and the bottom a vector drawing of the bike. Notice the flat colors and less continuous ones in the vector drawing.



But you must remember that your monitor screen is pixel based. That means that any image you view on the monitor whether it be vector or bitmap will be represented by pixels. And when you create graphics for the web all your images must be rasterized, unless you are using a program such as Macromedia Flash. We will only be discussing how to compress and optimize images that will be used on a tradition web page where plug-ins are not required.



(from Adobe Photoshop online Help documentation)

To edit shapes made with one of the shape tools or the Pen tool we use the Path Selection Tool or Direct Selection Tool. To edit bitmap graphics we must make a selection first with one of the Selection tools such as the Marquee, Lasso, or Magic Wand. Text can be changed by double-clicking on its layer so that the color, font, spelling errors etc. can be edited. Once text is rasterized you can no longer correct these easily. It is easier to edit a vector graphics shape than a bitmap shape. Another advantage of vector images is that they take up less file space. Since they are mathematically calculated and there are no pixels they are stored in a special layer, either an adjustment layer or path. This adjustment layer or path holds information that must be calculated every time you make a change to it. Both Photoshop and ImageReady work with these two types of graphics. Understanding the difference between these will allow you to make educated decisions as to which is better for the task at hand.

What type of Artwork are you using?

Analyzing what type of artwork you have is an important step in optimization. It is also a good thing to know before you create new artwork. But don't let this knowledge force you into making design decisions that you aren't happy with. There are three types of artwork: Line Art, Continuous Tone Image and Hybrid.

LINE ART

Line Art is artwork that generally is flat-color without subtle changes in tone. Flat-color is one solid color representing each color such as red without any other colors in that color. It may be monochromatic, flat-color artwork created for print or flat-color artwork created digitally. Logos, cartoons, and illustrations fall into this category. These are usually vector-based art.

CONTINUOUS TONE IMAGE

A continuous tone image is a photograph or artwork with gradational tones. Photographs, artwork with gradients, glows and drop shadows fall into this category. These are usually bitmap images.

HYBRID

A hybrid image is one that incorporates both Line Art and Continuous Tone Image. For example, a photograph which has text written on it. The text is a solid color on a continuous tone image, or bitmap and vector images combined.

COMPRESSION AND WEB FILE FORMATS

Compression is either Lossless or Lossy. Lossless means there is no quality lost. The same data that is compressed is uncompressed. Gif is an example of a lossless compression format. Lossy means data is removed from the image in order to make it smaller. This data loss is usually not visible. The process tries to find unessential data to be reduced. JPG is an example of lossy compression format. Here is a comparison chart of the three major compression file formats.

JPG	GIF	PNG
Joint Photographic Experts Group	Graphic Interchange Format	Portable Network Graphics
lossy compression	lossless compression	lossless or lossy compression
24 bit (16 million colors)	8 bit (256 colors)	8 bit and 24 bit
no animation	animation	no animation
no transparency	transparency	alpha channel transparency
progressive, interlacing	interlacing	interlacing
	compares pixels horizontally	compares pixels horizontally, vertically, average, path, adaptive gamma correction to display image correctly
Primarily used for: Continuous tone images - Photographs, Gradations	Flat-color artwork - images with large areas of single color, ie. illustrations, logos, black and white images, line art, animations	Not supported by all browsers Difficult for programming

Looking at this chart you can see that jpgs are mostly used for photographs and gradation graphics because they need 24 bit information to keep the continuous tones. But what if you want to animate your photograph? There is no animation in a jpg, you would therefore be forced to go to a gif and lose color information. Or what if you

have a logo with many gradations and you want transparency around it? Again you would need to make it a gif and lose color information. All I am saying is there is no simple plug-in formula. It is a give and take solution. Look at your artwork and decide which file format fits it best, then decide what you need to do with it. That will dictate the file format you should use. Once you decide on the format, then you can work to make it look its best

What about png? The png format, pronounced ping, is supported by Photoshop but it is still not totally supported by all browsers. That means there is a chance your image will not be able to load under certain conditions. Older browsers won't support png at all and depending on how your png was prepared it may not load on current browsers. You will notice in the chart some the great benefits of png. It can look for pixel patterns both vertically and diagonally in addition to the horizontal direction of gifs. It can also produce transparency masking in grayscale where gifs are just black and white (on or off). Although a champion file format with lots of flexibility, it is still not used often. For that reason I will focus on jpg and gif formats.

HOW JPGS AND GIFS WORK

Jpg Compression works by reducing unessential data from an image. It uses an algorithm compression based on smooth shifts in color change. It is usually not visible unless you compress too much. If an image has abrupt color changes as in a very contrasty image, the algorithm has a harder time doing its job and results in a more blocky compression. This is also why blurring areas of the image decrease its file size. It is also why text does not jpg well. A missing letter just won't do.

You should never jpg a jpg! This will result in extreme degradation of your image. A jpg is shifting colors everytime you save it. If you have a jpg image you want to work on in Photoshop the best thing to do is save it as a psd and work on the file. You will of course have to compress it again when you are done, but at least you are not opening and closing the jpg and losing information each time.

Gifs are compressed using two methods: LZW Compression and CLUT (Color Look Up Table) A CLUT Compression is based on the number of colors assigned each pixel. By reducing these numbers you can increase your compression. We will make a CLUT in another lecture. I explained the LZW Compression method under Preparing Your Artwork for Speed. There is a more detailed, scientific approach to these methods in the Web Design book readings. Let's get back to optimization now.

OPTIMIZATION OF GRAPHICS

Understanding compression principles will allow you to make better decisions as you optimize your images for the Web. We will do all optimizations in Image Ready. You can do the same optimizations in Photoshop "Save for Web" but it is not as flexible as ImageReady. ImageReady was made for web graphics.

1. Always save the original artwork in its native format. That means if it is a Photoshop document save the original as a psd. Do all your optimization on copies.
2. Define your artwork: Line Art, Continuous Tone Image, Hybrid
3. Prepare your images for size, sharpening, color correction, etc.
4. Make your jpg and gif files.

JPEGS

Here are some ways to make your JPEG files smaller:

- Add more JPEG compression
- Add blur (see previous example)
- Decrease the contrast
- Decrease the saturation

GIFS

Here are some ways to make your GIF files smaller:

- Reduce the number of colors (Bit Depth).
- Reduce the amount of dithering.
- Add Lossy compression.
- Create images that have large areas of horizontal color.

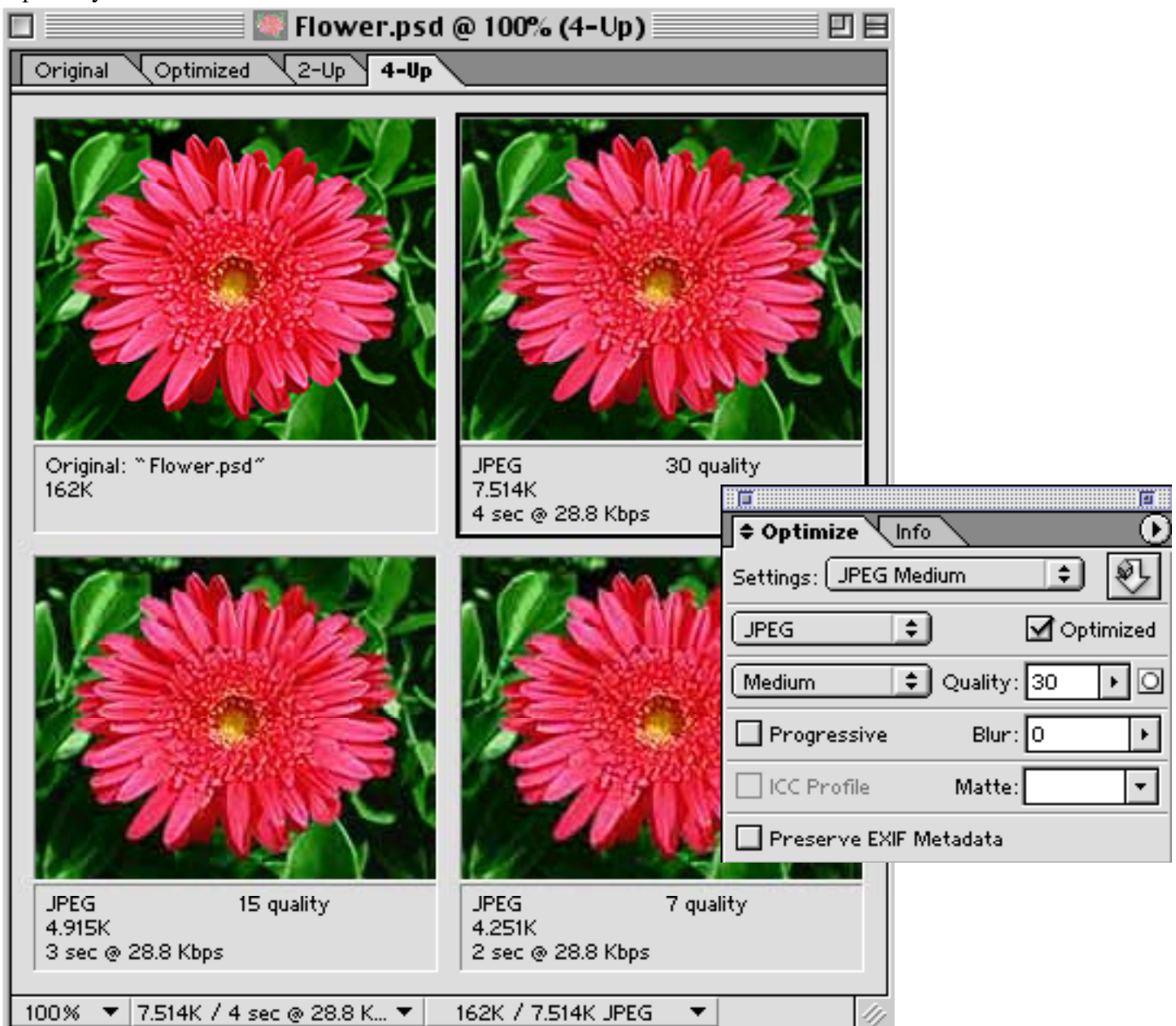
JPG OPTIMIZATION EXERCISE

Open Flower.psd in Image Ready

Go to 4-up view by clicking on the tab above the image.

Make sure the Optimize palette is open (Window > Optimize).

The first image will be the Original. Then you can try different jpg settings in the other three views by clicking on each one. In the Optimize Palette make sure you are set to JPEG since this is a photo. Changing the quality will change how your image looks and the file size of it. You can type in any number for the quality. Don't settle for the preset values, try to get the image as small as possible and still looking good. Use the four views to compare quality and check the recorded size. Notice at a quality of 15 the image has artifacts (blocky areas), especially in the leaf area.



The original image was 162K. The compressed size at 30 quality is 7.5K. You can get the image even smaller using other methods. In the Optimize Palette you can blur the image to 0.2 and reduce the file size to 7.14K. Another method is to selectively optimize the image. That means apply a different compression to a selected area of the image. You do this by first having a mask, vector shape, or vector text. In this example a mask was made in Photoshop for the flower. It can be seen in Photoshop in the Channel Palette. Channels don't exist in ImageReady and so this is a task where you can jump back and forth from Photoshop to ImageReady by clicking at the bottom of the Tool box (see picture). Making masks are an advanced feature of Photoshop. If you know how to do this, you will find this feature of optimization cool. If you do not know how to make masks, vector shapes and text will still be available to you in ImageReady and we will see another example using vector text.

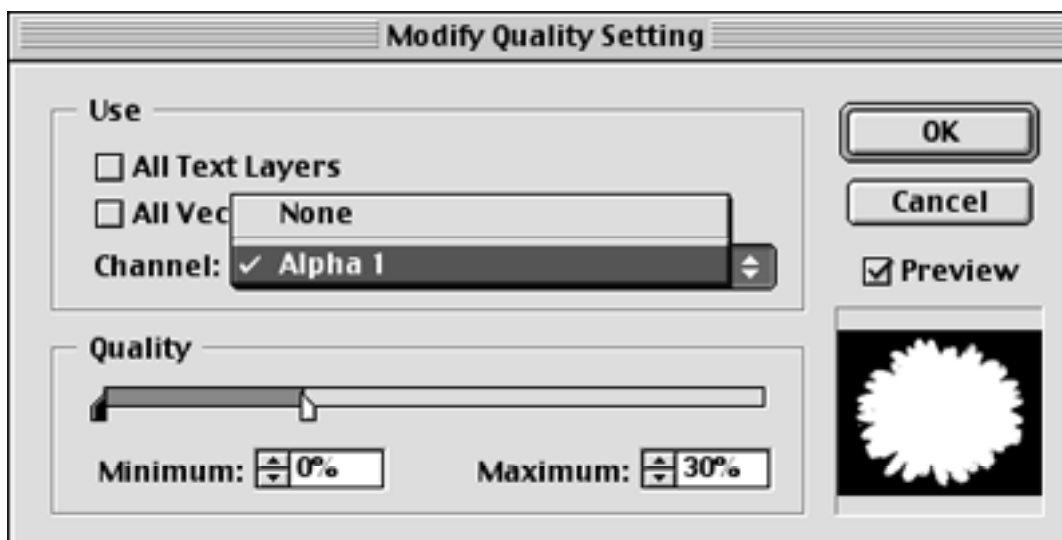


Photoshop Tool box allows you to jump to ImageReady



The Channels Palette in Photoshop showing an Alpha channel with a mask for the flower.

In ImageReady in the Optimize Palette to the right of Quality there is little square box with a circle in it. This is the symbol for a mask. Click on it and the Modify Quality Setting box will come up. Select Alpha 1 from the Channel pop-up menu. You can now adjust quality of the leaf area by adjusting the Min. sidebar (affecting the black part of mask) and the flower adjusting the Max. sidebar (affecting white part of mask. Move it around to see how it effects the image. At a Max. of 30% and Min. of 0% the file size decrease to 6.6K but the leaf area has bad blocky patterns (artifacts). For this example I wouldn't use this method because the Min. would have to be so high that the file size is larger than 6.6K.



There is yet another way to get your file smaller. If the leaves are not important in the image, you could blur them before starting your optimization. I used the Alpha Channel in Photoshop to do this. Go to the menu Select > Load Selection > Alpha 1. This selects the flower. To select the leaves go to the menu Select > Inverse. Now you are ready to blur the leaves. Go to the menu Filter > Blur > Gaussian Blur and adjust to your liking. When you are finished, jump back to ImageReady for optimization. Notice the file size is now down to 6K.



Once you are happy with a particular optimization in ImageReady, click on the view you want to save, then go to the menu File > Save Optimized As. You can save the Format as Images Only or Images and HTML.



BLACK AND WHITE PHOTOGRAPHS

What about black and white photographs? Black and white photographs are 8bit images because they only need 256 shades of gray to create the continuous tone image. They only have one channel, a gray channel. But when you go to compress them they work the same way as color photographs. ImageReady doesn't accept grayscale images. They must first be converted to RGB. It is strictly an RGB program. It would stand to reason then that grayscale images would be compressed better using Photoshop. However if you test a black and white image in both programs they will result in about the same file size. In fact ImageReady is even somewhat smaller. Let's try it with the bike.psd. Here is the bike image being optimized in Photoshop. The compression for the second view is at a quality of 25. Lower qualities resulted in blur and artifacts. Notice the Original image is 356K but in grayscale mode the image is only 122K. Photoshop Save For Web has increased the size to RGB.

You can preview this image in a browser by clicking on the icon at the bottom below the views (Explorer here).



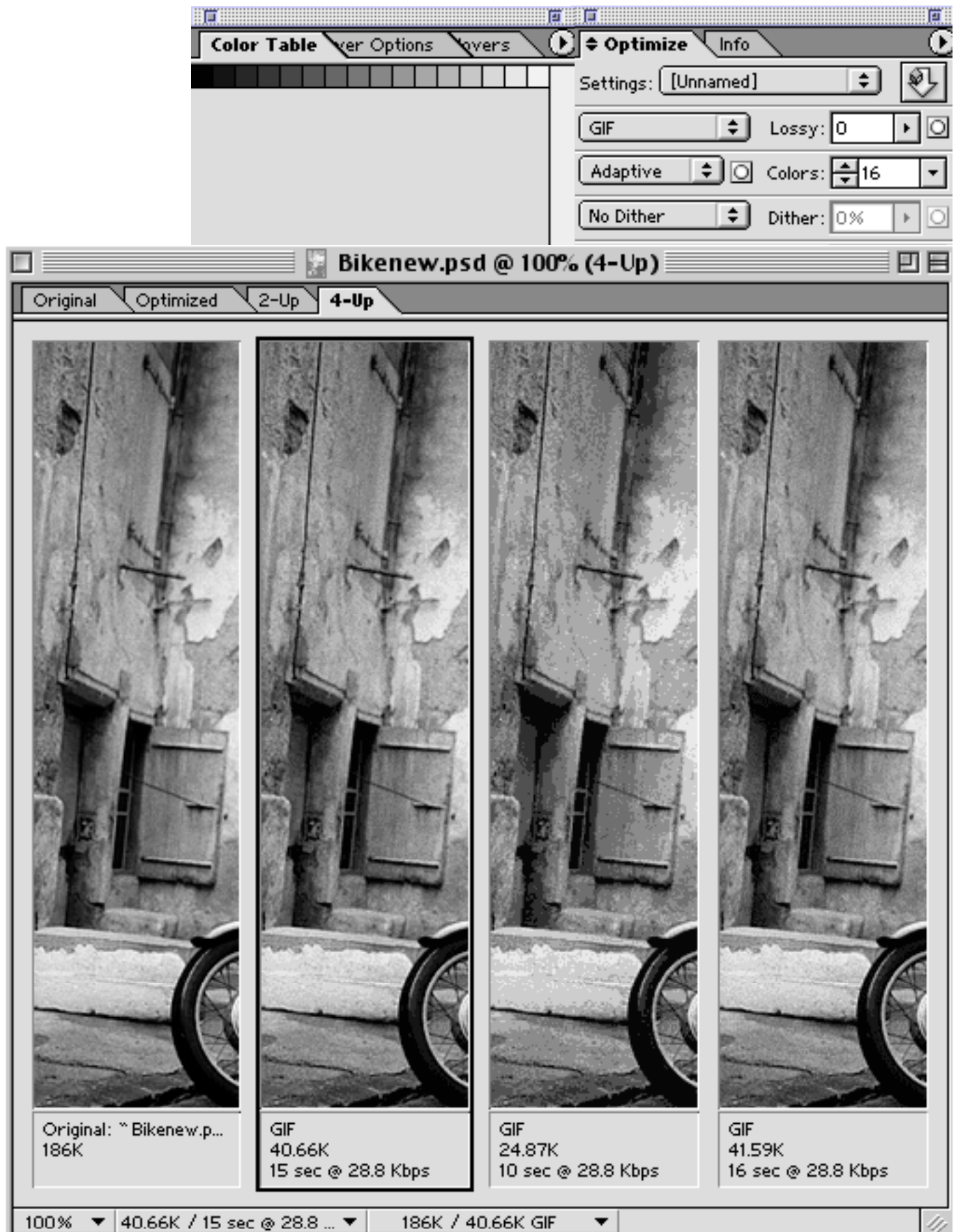
Here is the same image being optimized in ImageReady at the same settings of jpg, Low, Quality 25. Notice it is almost 1K smaller than using Photoshop. Also notice that ImageReady has started with an Original image of 186K even though the image size is 365K.



To view an optimized image in the browser in ImageReady, go to the menu File > Preview In. If you do not see a browser, open up the browser you would like to use or go to Other and find the browser on the harddrive.

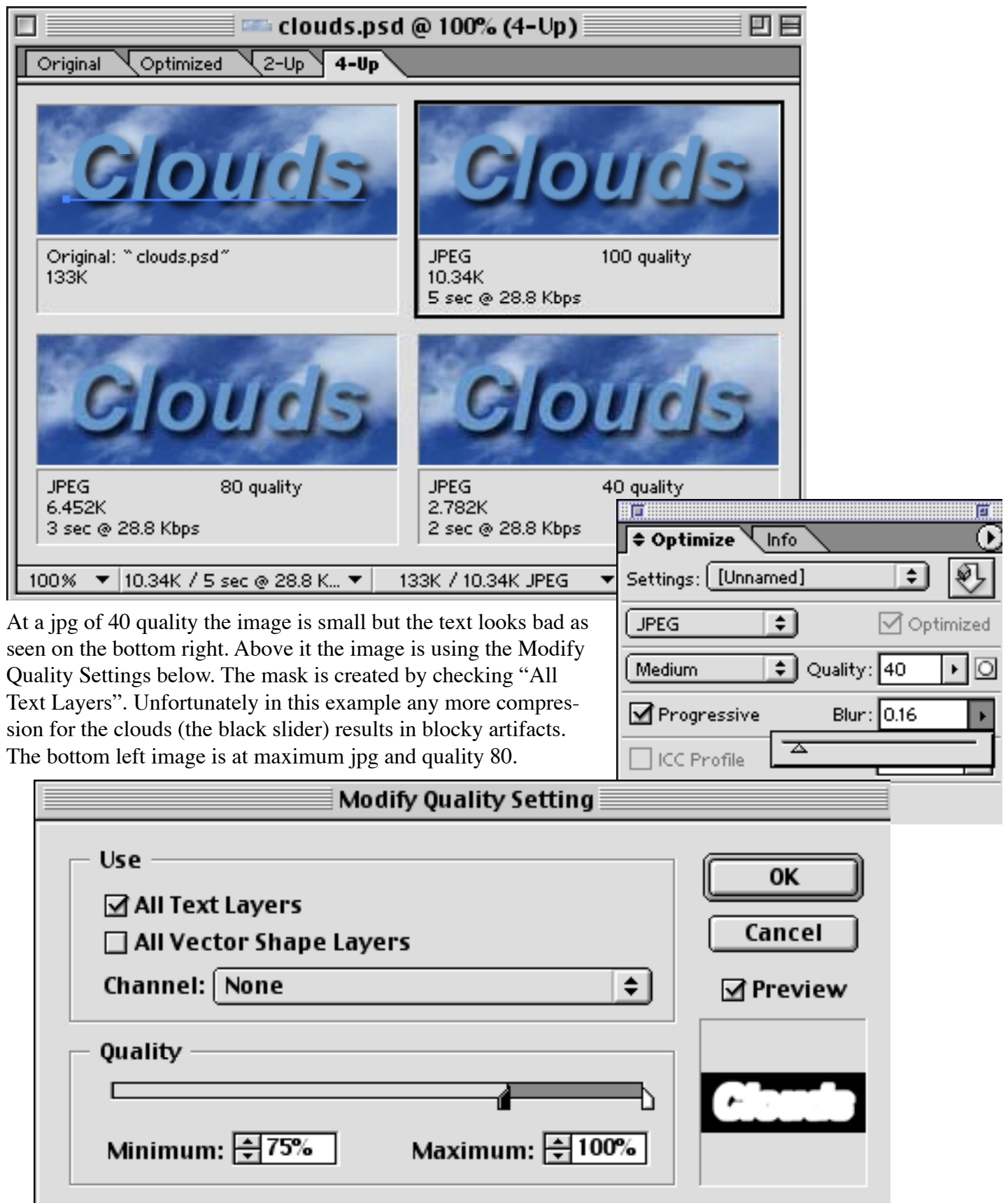
ImageReady also has other options for viewing your artwork. Under the view menu you can go to Preview and see how your image will look with Browser Dither (dithering that can occur from the browser), Standard Macintosh Color, Standard Window Color, or Uncompensated Color. These will give you an idea of what others will see. TIP: Make sure you are in Optimized for these to work.

Here is a comparison of the bike image being compressed using gif. Reducing the colors down to 16 still gave an acceptable image but the file size is double that of a jpg. Pictured is the Color Table showing the 16 shades of gray that are being used to make up the image.



HYBRID ARTWORK AND OPTIMIZATION

Here's another example using an image with text on top of it (hybrid art) and using a mask created by the vector text. The problem here is that the text looks dithered by the jpg compression. Using a mask you can apply no compression to the text and more compression to the background. However in this case the image is smaller and just as good looking using maximum compression at 80 quality.



This part of the lecture will cover optimization using the gif file format. Several exercises will be presented to demonstrate the many parameters of this type of compression.

GIF EXERCISE 1

Open Monkey.psd in Image Ready

Go to 4-up view by clicking on the tab above the image.

Make sure the Optimization palette and Color Table palette are open. Start with these settings:

Choose GIF format, 81 colors, Perceptual palette, 0 Lossy, 0% Dither, 0% Web Snap, No Transparency, No Interlacing.

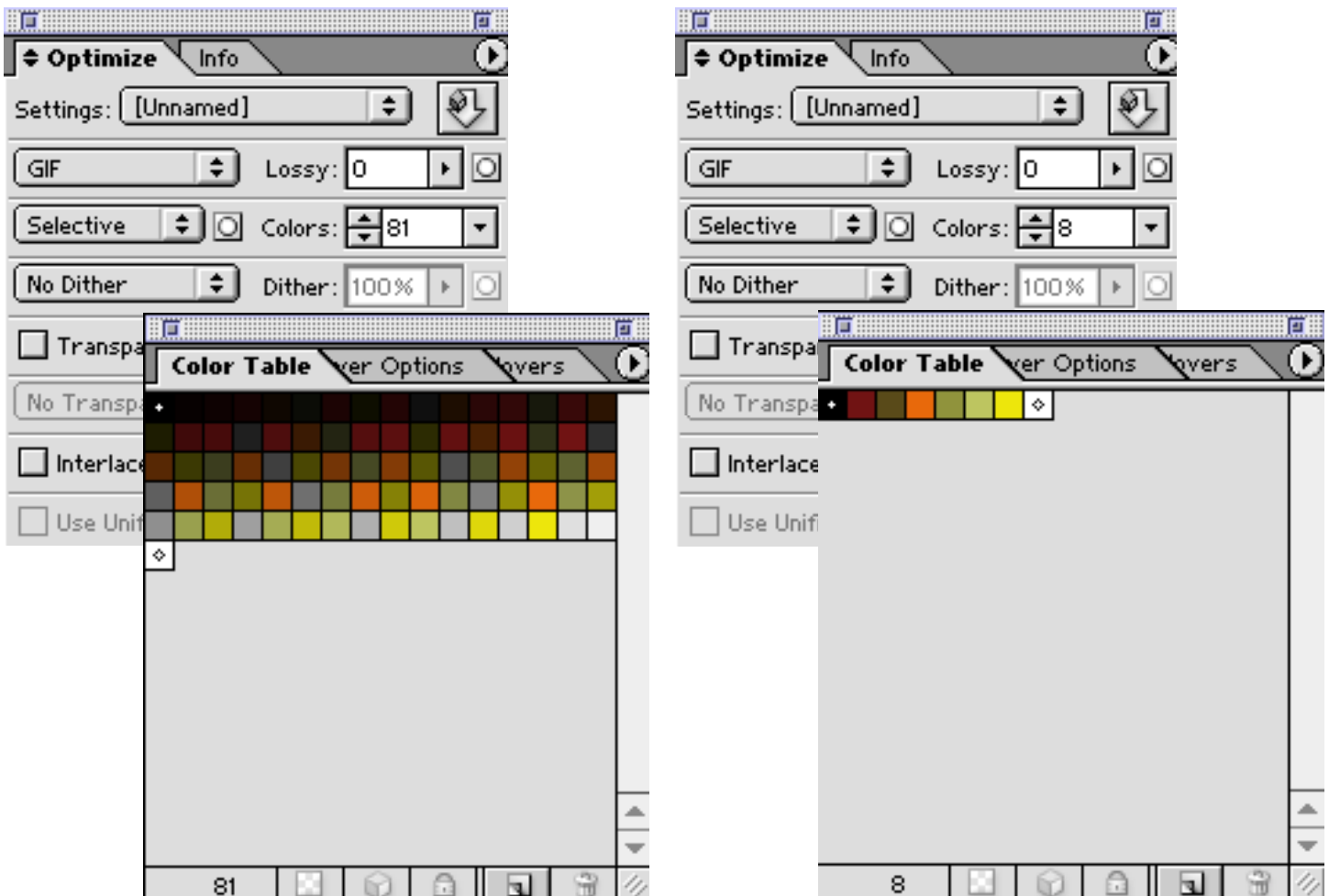


Selective - same as Perceptual except it preserves Web colors and creates slightly smaller files
Adaptive - samples colors from hues that are most common in the image and creates larger files
WEB - limits the color table to the 216 web-safe colors

In the Optimization palette set three different palettes, one for each of the Monkey. Always leave the first image as the original to compare. Which palette looks the best? Which palette creates the smallest file? You will see the Web palette creates the smallest file but changes the colors of the image. Selective is the most common palette used, unless you are generating your graphics using the web-safe colors.

REDUCING COLORS

In the Optimization palette lower the number of colors to 64. You will see the file size decrease. Compare the quality of this image with the original. Keep lowering the number of colors until you see the image quality weakening. You can try different amounts of colors on different views. I chose 8 colors. Notice if you go down to 4 colors the image begins to change colors. You can try 6 colors but notice the orange around the monkey's mouth, this is still not enough colors to represent this image.



TO DITHER OR NOT TO DITHER

Dither - creates the illusion of more colors by rearranging pixels of two or more colors tricking the eye to think it is another color. For example if you have red and yellow pixels and rearrange them to red yellow, red yellow, your eye will perceive the color as orange. Dither always increases file size.

Noise Dither - can reduce seams along sliced edges. It decreases file size and quality.

In the Optimization palette change Dither to 100%. Notice the file size increases.

GIF EXERCISE 2

Open a new file glow.psd.

In the Optimization palette choose GIF format, 8 colors, Selective palette, 0 Lossy, No Dither, 0% Web Snap, No Transparency, No Interlacing.

Notice the banding in the image. Even though the image is small it doesn't look good. This image would look better and be smaller as a JPEG but what if you need to use it in an animation?

Change the Dither setting from No Dither to Noise. The image should improve and the file size increase.

Sometimes you have to settle for a file that is a little bigger for better quality. If you would like to improve this further, try adding Lossy compression to it. Start at 10 and slowly increase it. I chose 27 but I also increased the colors to 16. It is a balancing act. Changing one setting may cause another setting to be adjusted. Try it. Now try Diffusion 100% Dither with 20 colors, it is even smaller.



GIF EXERCISE 3

LOCKING COLORS

You can lock colors in the color table so that they do not change. This will help you preserve important colors in the image.

Open dotcom2.psd

In the Optimization palette choose GIF format, 32 colors, Selective palette, No Dither, 0 Lossy, 0% Dither, 0% Web Snap, No Transparency, No Interlacing.

Lower the number of colors to 8. Notice some colors change. Even though this image looks like it doesn't have many colors in it, you can see a change as you reduce them.



Set t

Color Table, you should see that brown color highlighted (white line around it). Click on the lock symbol at the bottom of the palette to lock that brown color. Notice a small white square will appear in the bottom right corner of the color. It is now locked. Reduce the colors to 8 again and see how that color remains. Now, set the colors back to 32. Lock all the important colors. And then reduce the number of colors to 16. Does the image retain its quality?

Now try setting it to 100% Web Snap colors at No Dither. It is not as small a file as the previous method and if you try to reduce colors the image looks bad.

Web Snap changes all the colors to their nearest web safe color. It allows you to change some colors by the percentage you apply. If you apply 100%, then all the colors change to the nearest web safe color. You can tell a web safe color by a white diamond in the middle of the color. The cube icon at the bottom of the palette works similarly and will change a selected color to the nearest web safe color. We will talk about color and what web safe colors are in the next lecture. And no I did not forget about transparency. That is a lecture in itself too.

