



Compendium

# Graphic formats and resolution 2016

René Birkholm

## **Graphic formats and resolution,** René Birkholm

### **Content**

#### **Graphic formats and resolution**

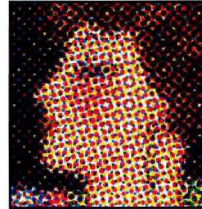
The Non Designers Web Book, Robin Williams et al., Third Edition,  
Peachpit Press, ISBN 0-321-30227-7 (p. 169-181, 185-193)

# CMYK color

The **CMYK** color model is what we use when printing in full color. It stands for **C**yan (a blue), **M**agenta (the closest thing to red), **Y**ellow, and **blacK**. In a full-color printed piece (which designers and printers call a “four-color process” piece), color images are separated into various values of these four colors, and the values are represented by little dots. These process inks are translucent, so when a light value of yellow has a light value of cyan printed on top of it, the result appears to be green. If you look at any printed color image with a magnifying glass (including the images in this book), you can see the four dots of the four colors. These four colors, in layers of dots, create every color you see in a full-color image.



*These are the four process colors. You won't see any dots in these boxes because they are printed 100 percent of each color. But the image on the right is a combination of each of these four colors. You can see the dots of each of the four colors in the enlargement.*



CMYK is sort of what we see the world in. That is, it's a “reflective” color model. The light comes from the sun or a light bulb, it hits an object such as a magazine page or a tree, and the color is reflected from the object into our eyes. You know that if you mix blue and yellow, you'll get green. Now, that's a very simple way of expressing a very complex color theory, but if you want a complex explanation, there are lots of very large books explaining it.

The important thing to understand is that reflective color is so very different from color on a monitor. On a monitor, the light comes directly from its source, through the screen, and straight into our eyes—it does not reflect off of any object. Therein lies the big deal about color on the web.

(In print, you may hear the term **spot color**. Spot color is not CMYK—it is ink straight from a can. That is, if you want green headlines, you get green ink from a can. When you print a flyer with two colors, such as black and green, you use spot colors. When you print a full-color brochure, you use CMYK. There is no spot color in this book. There is no spot color on the web.)






# RGB color

RGB stands for Red, Green, and Blue. Monitors, including television, video, and computer monitors, all create their images on the screen by emitting red, green, and blue light. These lights can be emitted in varying intensities. The colored lights overlap each other, which allows a monitor to display up to millions of different color combinations.

RGB color is not a reflective model like CMYK—the color comes straight from the light source to our eyes without bouncing off of any objects. Because of this, RGB color acts very differently from what we are used to. In RGB, red mixed with green makes yellow. Really. But you don't have to worry about that—just be aware of it.

## RGB values

As you work with images for the web, you will come across **RGB values** all the time. Each individual color has a value, also called an intensity, from 0 to 255. The combinations of these values produce the various colors. Take a look at these examples:

		
R 172	R 0	R 255
G 155	G 173	G 245
B 69	B 137	B 76

*[Of course, these RGB colors are being represented on the printed page in CMYK!]*

When you see three numbers like that, understand that those are the RGB values and they indicate a particular color. Many graphic software applications allow you to enter RGB values to create the colors you want. Other software might use percentages to describe the three values. We'll go into this in greater detail on pages 179–181.

## On the web

Web pages, of course, are always displayed on a monitor, so **every image you create for a web page should be saved in the RGB mode**. You will also see colors for web images described in *hexadecimal code*. Oh boy. In fact, the HTML code that describes your web page translates any RGB color you use into its hexadecimal code. It looks something like this: 66FFCC. You'll see it when you look at the source code for your pages.

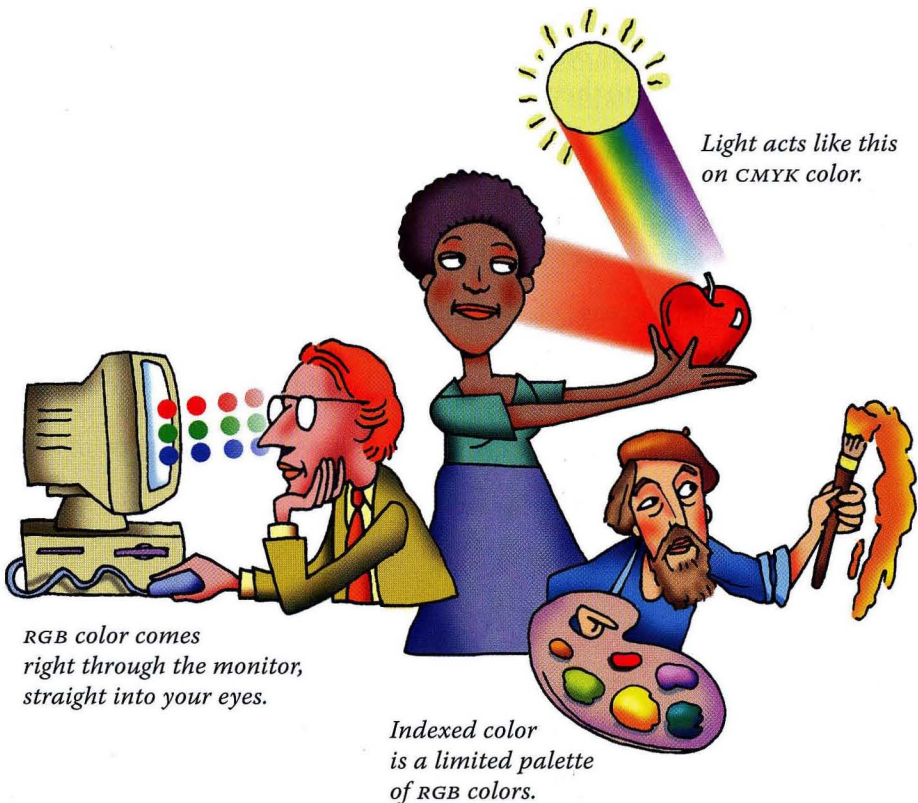


# Indexed color

You might hear the term **indexed color** in reference to web graphics. The indexed color mode is simply a limited selection, called a *palette*, of up to 256 colors.

An image in full RGB mode can display up to millions of colors. When you convert an image to indexed color mode in a program such as Photoshop, all but a maximum of 256 RGB colors are deleted from the image. If the image needs to display a color that is not in its limited palette, the computer uses the closest approximation or simulates the color as best it can from a combination of the colors that are available. If the image has to simulate a color from existing ones, that new color usually appears *dithered*, or kind of spotty, as you can see on page 174.

When you choose to index an image, you can choose the color palette. You don't have to have all 256 colors in the palette—for instance, if your image only needs 12 colors, you can limit the palette to 12. Limiting the colors makes the file size much smaller, which is better for displaying on the web (smaller files appear on the page faster). Step-by-step directions for how to decrease the number of colors in an indexed color graphic (a GIF) are on pages 210–212.



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## Bit depth

Before we go on to talk more about RGB colors and how to make sure you are using colors that are consistent on most computers, we need to talk about **bit depth**, which is also called *pixel depth* or *bit resolution*. Yes, it sounds really boring and technical, but you are going to hear that term all the time. It's not difficult to understand, and you will—we guarantee—feel really good about understanding it.

You might hear the terms **8-bit** and **24-bit** when people are talking about the web, as in, “You have to turn this into an 8-bit graphic,” or “Nobody has 8-bit monitors anymore,” “I’m really cool cuz I’ve got a 24-bit monitor,” and “I have utter disdain for people who won’t spend the money to upgrade to 24-bit.” So this is what it is:

A **bit** is the smallest unit of information that a computer understands. A bit is one electronic pulse. That pulse can do two things—it can be an on signal or an off signal. It can be a 1 or a 0 (that’s the basis of the binary system or the “ones and ohs” you hear people talk about in reference to computers). Everything a computer does is built from these 1s and 0s, these on and off signals. Amazing.

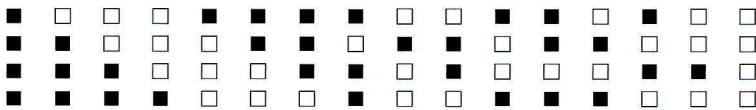
The computer screen is divided into tiny little **pixels**, or picture elements. These pixels turn on or off, white or black, depending on the **bits** of information that are sent to them.

Long, long ago, like 1985, our monitors had pixels that weren’t very smart. The monitors were called **1-bit** monitors because the pixels could only understand one bit of information at a time. With only one bit of information, a pixel could be one of two “colors”—either white or black, on or off.

Later, monitors and pixels got smarter. Let’s say you have a **2-bit** monitor. That means every pixel can understand two bits of information at once. With two bits of information sent to a pixel, that pixel could be any one of four “colors.”

It would have these choices: 11, 00, 10, or 01. The possible bit combinations are both bits on, both bits off, one on/one off, or one off/one on. (One of these colors is always black, and one is always white.)

So if you have a **4-bit** monitor, each pixel understands 4 bits of information at once. With 4 bits, you can arrange those 2 on/off signals in 16 different ways. In the illustration below, each column represents one pixel, each white box represents an on signal, and each black box represents an off signal. Each pixel can have a total of four bits. This is pixel *depth*.



*Each of these combinations of on/off signals represents a different color.*

There's a math formula to figure out how many different colors a pixel can display. You're going to see this formula often, so you may as well understand it: Each electronic pulse, each bit, can provide 2 pieces of information, a 1 or a 0, right? So that's 2. If it's a 4-bit monitor, let's say, then the formula is 2 (pulses) to the 4<sup>th</sup> (four bits) power, written as  $2^4$ . If you've forgotten your high school math (most of us have), this  $2^4$  means multiply 2 x 2, multiply that by 2, then multiply that by 2 (a total of four times).

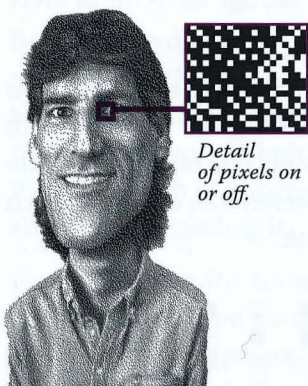
So, then, let's get to the point of this whole thing: How many colors can a pixel show if it is **8-bit**? Well,  $2^8$  is 256. So an 8-bit graphic is 256 colors. An 8-bit monitor can display only 256 colors. An 8-bit grayscale image (black and white) can display up to 256 shades of gray.

A **16-bit** graphic or monitor can display 65,536 colors. And a **24-bit** graphic image or monitor can display 16.7 million colors. That was easy, huh?

Please see the examples on the following page that graphically illustrate bit depth in color and in grayscale.

—continued





*Detail of pixels on or off.*

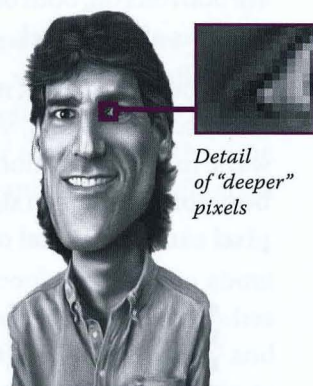
### **1-bit graphic (2 colors)**

*The spacing and sometimes the size of the black and white dots creates the illusion of image and shadows.*



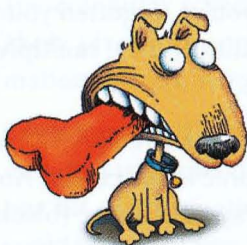
### **4-bit graphic**

*With only sixteen shades of gray, an image can show more detail, but it's still not smooth.*

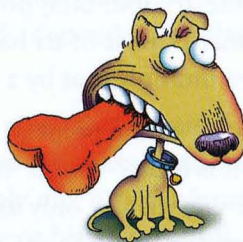


### **8-bit graphic**

*With 256 different shades of gray, an image shows well-resolved shadows and definition.*



*Same image, different bit depth.*



### **8-bit graphic (256 colors)**

*Notice how the graduated colors appear kind of spotty and the transitions are not smooth. That's because there aren't enough colors in the 256-color palette to blend effectively. This is called **dithering**.*

### **24-bit graphic (16.7 million colors)**

*A 24-bit graphic has plenty of colors to blend from one to the other smoothly. On the web, you will only see all the colors of a 24-bit graphic if your monitor can display 24-bit color (see next page).*

# Monitor resolution

Most of us are pretty familiar by now with the concept of **printer** resolution. We know that the greater the number of dots per inch (dpi), the cleaner the edges of the printed image—a 600 dpi printer prints smoother edges than a 300 dpi printer, and a 300 ppi (pixel per inch) image prints smoother than a 72 ppi image.

But **monitor resolution** is completely different from printer resolution—you will get yourself in trouble if you continue to think of them in the same way. How “resolved” an image appears on the screen is a combination of the bit depth of the image itself (see previous pages) and the settings of your monitor. You can change the number of **pixels** and the number of **colors** your monitor displays, and thus change the appearance of the resolution.

Use your control panel to change the settings for your monitor. On a PC, it’s called “Display.” On a Mac, it’s a system preference called “Displays.”

**Pixels:** The default number of pixels *per inch* on a Mac monitor is around 72; the default on a PC is usually 96. In your control panel you can choose to display a varying number of *total* pixels on your screen. For instance, you might have 1024 pixels across by 640 down, called “1024x640”. You might choose 1152x720 or 1280x800. You might have other options, depending on your monitor. When you choose the *default* setting for your monitor, you’ll see something like 72 or 96 or 100 pixels in one inch (it depends on your monitor!). If you choose any other setting, the actual number of pixels on the screen will change.

Now, if your default is “1024x640” and you change it to 1152x720, you have *more pixels*, right? If you have more pixels, they have to get smaller to fit onto the screen. More of them fit into one inch. If you change the setting to 1280x800, you get even more pixels, and each one is even smaller. Changing to a higher pixel count is often called setting your monitor at a higher “resolution” because we tend to think that the more dots or pixels per inch, the higher the resolution.

When the pixels are smaller, everything on your screen looks smaller. You are looking at the same images, but they are crammed into a smaller space. It’s like a bird’s-eye view. When things are smaller, they can *appear* to be more highly resolved. If you want to see everything on your monitor larger (and less resolved, or what *appears* to be in lower resolution), change the setting to fewer pixels, such as 1024x640. It’s like a close-up view. Whether you set it smaller or larger is your personal preference.

—continued

**Colors:** The most important setting, as far as how good a graphic looks on the screen (how highly “resolved” it looks), is the number of colors. If your monitor can only display 16 colors, then all of the graphics will appear to be “lower resolution,” even if you have millions of tiny pixels on your screen. Even if the *graphics* are 24-bit (we’re assuming you just read the section on bit depth so you know what “24-bit” means), the graphics will appear to be in low resolution because your *pixels* can’t display that color depth—the monitor has to fake it.

**The relationship between pixels and colors:** Now, how many *pixels* you have chosen to display on your screen directly influences how many *colors* you can display. The color depth also depends on how much **RAM** (megabytes of *memory*, not hard disk) you have installed in your computer.

You remember from reading the previous pages about bit depth (color depth) that the number of colors a pixel can show depends on how many bits of information are being sent to it, right?

Well, the more pixels you have on the screen, the more bits of information the computer has to send. Sending all of these bits takes *memory*. The bigger the monitor and the more pixels you choose, the more memory it will take to put lots of color in every single pixel.

**Experiment with your control panel:** Watch what happens to the number of colors available as you change the pixel setting. More pixels, fewer colors. If you add more RAM or video RAM (special RAM dedicated to your monitor), you can have lots of pixels and lots of colors at the same time.

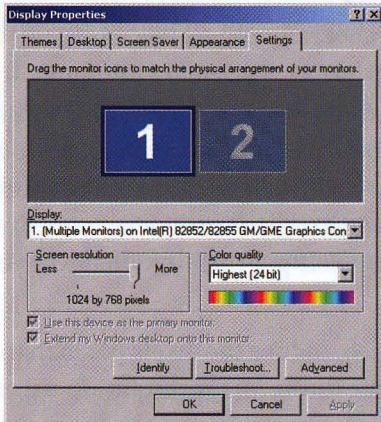
So the point is that **the number of colors your monitor can display is what gives you the *impression*, on the screen, of higher resolution.** On paper, a 72 ppi image looks awful, even if it’s 24-bit. On the screen, a 72 ppi image can look great if you have enough colors. Examples are on page 178.





*Windows: Right-click on the Desktop background, choose “Properties.”*

## Display



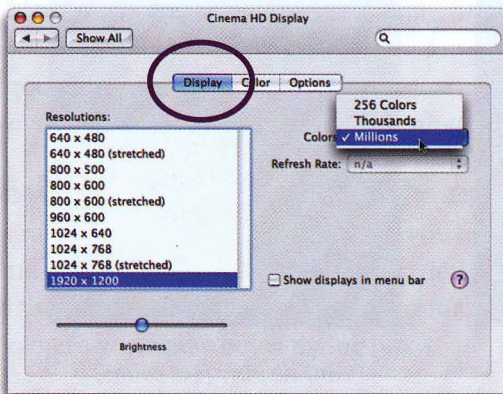
*Experiment with these settings. Watch what happens to each of them as you change the other. If you want more colors, you might have to settle for fewer pixels. If you want more pixels, you might have to settle for fewer colors. If you have enough RAM, you can have both.*

*On this computer with 768 megs of RAM, we can get 24-bit color at the higher pixel setting. With less RAM, we'd only get 16-bit. (PCs claim to have 32-bit color, which includes alpha channels.)*



## Displays

*Mac: From the Apple menu, choose “System Preferences....” Single-click on the “Displays” icon.*



*This is a 23-inch flat-screen monitor connected to a computer with 1.5 gigabytes of RAM. At a pixel setting of 1920 x 1200, we can get millions of colors for all those pixels on that huge screen.*

*If you don't have a lot of memory, especially video memory, choose “Thousands” and have more RAM left over for system stuff.*

## Resolution of images

Below are different screen shots (pictures of the display on the screen) of the same image. Glancing at the images quickly, which ones seem to be in the highest resolution? What is making those appear to be in higher resolution than the other two?

Read the captions carefully and you'll find that more pixels per inch in the *image* (such as 144 ppi as opposed to 72 ppi) does not mean the image looks better *on the screen*. On paper, yes, 144 ppi will look better than 72, lots better. But on the screen, the pixel count in the *image* itself isn't really a factor because the *monitor* can only display it at 72 or 96 pixels per inch (or whatever your pixel setting is at the moment).

So when you create final graphics for the web, reduce the pixels per inch to 72 ppi—your files will be much smaller and the lower *image* resolution will not affect how it displays on the *screen*. (We go into detail about the importance of file size on page 193.) The low image resolution does ensure, though, that if anybody “borrows” your graphics from a web page, they won't be able to make t-shirts or posters out of those 72 ppi images.



72 ppi image  
8-bit display (256 colors)



144 ppi image  
8-bit display (256 colors)



72 ppi image  
16-bit display (thousands of colors)



144 ppi image  
16-bit display (thousands of colors)



# Browser-safe colors

So now you know a lot about color on the monitor. You might hear the term **browser-safe colors**, also called **web-safe colors**. This was a serious issue years ago but is not such a problem today. Monitors only last a few years, and most of the monitors in use five or eight years ago have been replaced with newer models that are capable of displaying more than 8-bit color. However, if your market is toward the lower end or third-world countries or New Mexico, you might want to at least be knowledgeable about browser-safe colors and use them when you think it's appropriate. If not, skip this entire section! Or read it so you know what it is when you hear others talking about it.

\*\*\*\*\*

Even though almost every monitor today can display at least 8-bit color (256 colors), there are only 216 of these colors that are common to the browsers and operating systems of different computers. If you use any other color outside of the common 216-color palette, the browser will convert the odd color to the closest color it can find in the system palette, or it will “mix” several colors to try to match the odd one as closely as possible. When the browser mixes colors, you get a *dithered* look, where you can see the different colors trying to blend (shown on page 174 and more on page 182). Whether the browser chooses another color or dithers one for you, your graphics might not look so good. *This is only a problem with flat colors, as in graphics, illustrations, drawings, etc.; you can't do anything about the colors in photographs.*

## How to get browser-safe colors

There are several ways to make sure you are using web-safe colors. Here are some suggestions for getting color palettes or swatches from other places. On the following page are suggestions for creating your own web-safe colors anywhere you find a color dialog box.

- Open a web-safe swatch palette (shown on page 181) in your graphics program or in your web authoring software and choose only from those colors. The newest versions of the software almost all have browser-safe palettes built in.

If you don't have the newest version of the software you use, go to the software's web site, download the web-safe swatch palette for your program, and load it.

- In other paint programs that don't use swatches, open a GIF file that represents the colors and use the eyedropper tool to select a color from the palette. You can find GIF files on Lynda Weinman's web site ([www.lynda.com](http://www.lynda.com)). By the way, Lynda invented the term “browser-safe colors.”



## Creating web-safe colors

On the previous page are suggestions for finding ready-made palettes or graphics from which you can pick browser-safe (web-safe) colors. You can also make your own colors in most graphic software, including web authoring software, simply by entering the correct values for each color.

- The last page of this book is a web-safe color chart. On the printed page, of course, the RGB colors are represented by CMYK, but there's no way around that. At least you get an idea of the colors—they are going to look a little different from monitor to monitor anyway.

In your web authoring software, the color picker for your computer will most likely come up automatically when you choose to change the color of the background or text. In that dialog box, enter the values that will produce the color you want (shown on the opposite page).

If you're using Mac OS X, the Colors palette has a "Web Safe Colors" option (also shown on the opposite page). You can scroll through the colors, or search for one by typing in part of its hexadecimal code.

- The browser-safe (web-safe) colors can be represented by RGB values, percentages of each color, or hexadecimal code. Each of these representations of the same color are made from the same six different choices, as shown below, so it's actually very easy to look at the RGB values, the percentages, or the hexadecimal code and instantly tell whether the color is browser-safe or not. This is cool.

All RGB values are either 00, 51, 102, 153, 204, or 255.

All hexadecimal codes are either 00, 33, 66, 99, CC, or FF.

All percentages of color are either 0, 20, 40, 60, 80, or 100 percent.

The values are always listed in the same order: first red, then green, then blue. So it's easy to make a chart showing the different ways these values relate to each other.

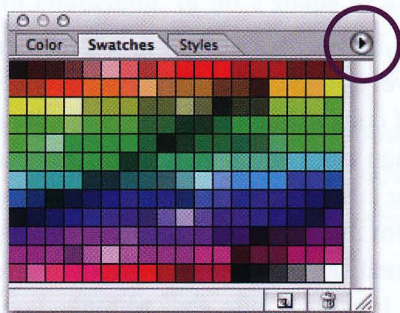
RGB	hex	%
0	00	0
51	33	20
102	66	40
153	99	60
204	CC	80
255	FF	100

*You can see that a color with the RGB values of 51:0:204 is web-safe.*

*The hexadecimal code for that same color would be 33 00 CC.*

*The percentage values for that same color would be 20/0/80.*

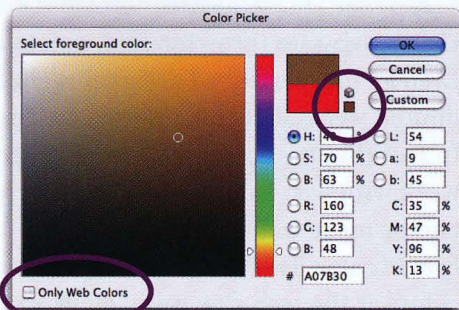
*Remember, they are always in the order of red, green, then blue.*



Photoshop comes with a web-safe swatch palette.

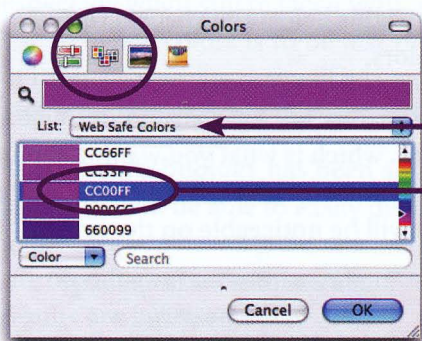
In Photoshop CS, it's in the "Color Swatches" folder, which is in the "Presets" folder.

From the Adobe.com site you can download a web-safe color swatch for any program that can load swatches: Store the swatch where you will find it again. In Photoshop, from the Window menu, choose "Swatches." Click the right arrow and choose "Load Swatches...." Find the swatch you want and click OK.



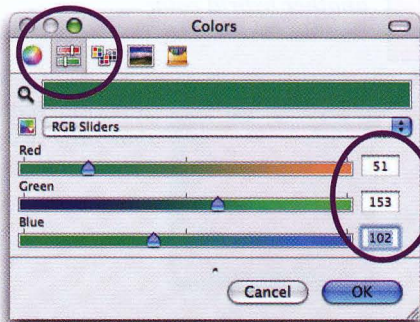
In Photoshop, convert any color to the nearest web-safe color: Select a color in the picker, then click the web-safe color cube icon at the right of the preview.

Or check the box for "Only Web Colors" before you pick your colors.



In the Colors palette in Mac OS X, one of the options is "Color Palettes." You can choose to list only web-safe colors, along with their hexadecimal codes.


This is the hexadecimal code that represents the color.



If your web authoring software gives you a place to type in RGB values, you can type in values you find in the chart on the last page of this book.

This example shows the color picker in Mac OS X.





# Graphic Definitions

you must know

You must learn the definitions in this chapter in addition to the color definitions in the previous chapter, because to make web pages you need to know the terminology of the graphics you will be making and uploading. If you are accustomed to working in print, you are perhaps accustomed to letting the printer take care of details for you—often you didn't have to be so careful because the printer would save you from yourself. But on the web, YOU are uploading files to the Internet for the world to see. YOU are responsible for the files you create, so YOU must know what you're doing!

**Beginners** (*this includes advanced HTML programmers who do not have a background in graphic design*): Use this chapter to look things up when you need them. If you are not familiar with graphic terms and technology, this chapter might be a bit overwhelming, so use it when you need it. But use it.

**Intermediate and Advanced users** (*including professional print designers who are now designing for the web*): Use this chapter to clear up those terms you've been hearing and don't quite know exactly what they mean. Find out how you should do things on the web differently from printing on paper.

Before desktop publishing, getting a job published was the work of a number of specialists. With desktop publishing, many designers became one-person shops, creating and producing the job, and only sending the work out for the final mass-production printing. Now we have taken it one step further—we each “print” or publish the job ourselves on the web. So we are all having to know more and more.

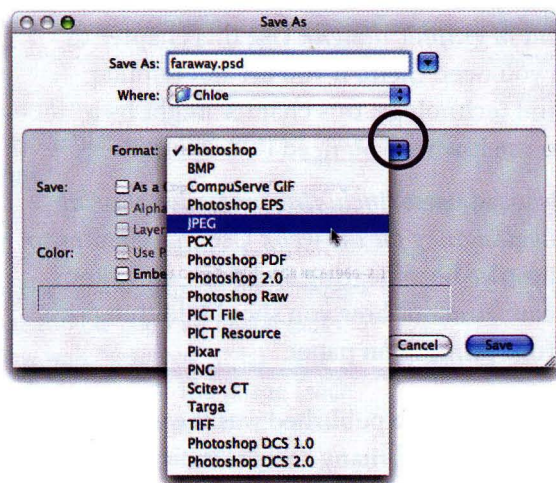


# File formats

Every file on your computer is in a specific **file format**. The file format is the internal information that tells the computer what kind of file it is—a spreadsheet, a word processing document, an Encapsulated PostScript file, a bitmapped graphic, etc.

When you save a document in any application, the default choice is to save it in the **native file format**, which is the format native to, or natural to, that program. For instance, when you save in Microsoft Word, the program automatically saves the file as a Word document. Adobe Photoshop automatically saves files as Photoshop files. In many cases, only that original application can open or use a native file format.

In many applications you have the option to save a file in other formats. The advantage is that other applications can then read or use that file. For instance, in Word you can save a file as a WordPerfect file; as Text Only (ASCII); for Macintosh, Windows, or DOS; for various versions of other programs; and many other file formats.



*Most applications have the ability to save files in formats other than their native formats. This makes our lives much easier.*

*To get the pop-up list of possible file formats, press on the little triangle next to "Save As," "Format," "File Format," or whatever label your software uses.*

## Terminology of graphic file formats

We are concerned with the various **graphic** file formats, specifically the ones that can be used on the web—GIF and JPEG. Before we discuss GIFs and JPEGs, though, let's define some of the terms you'll see over and over again.

There are two basic kinds of graphics: those whose structures are based on **pixels** (the dots on the screen), and those based on **mathematical formulas**. You'll hear them called these terms:

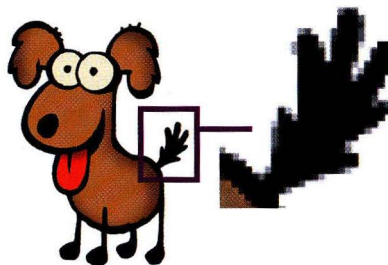
pixel-based	math-based
bitmap	outline, object-oriented
paint	draw
raster	vector

Applications that let you use tools like paintbrushes and erasers are usually **bitmapped**, or **raster**, programs. You can edit individual pixels, smudge colors, shadow edges, etc. If the application has the word “paint” or “photo” in the name, it is a bitmapped graphics program.

Applications that draw shapes with handles are **object-oriented**, or **vector**, programs. If you can select an object and then click a color to change it or grab a handle and change the object's size or shape, the file structure is based on mathematical formulas. If the application has the word “draw” or “illustrate” in its name, it is a vector graphics program.

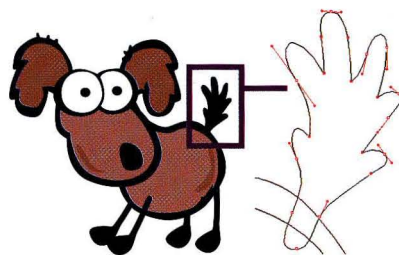
**Graphics on the web** (file formats GIF and JPEG) are usually bitmapped, or rasterized. Many designers create the original art in a vector program like FreeHand or Illustrator, then open it in Photoshop or something similar to “rasterize” it, or turn it into a bitmap. Some software lets you create vector art that can be displayed on the web, such as Flash (see pages 289–290).

*Bitmapped graphics are created by changing the colors of individual pixels on the screen (the “bits” of information are “mapped” to the pixels on the screen).*



*This enlargement shows individual pixels of a bitmap. The pixels can be edited one by one or as a group.*

*Vector graphics are generally smooth-edged because the shapes are mathematically defined instead of being mapped to individual pixels.*



*This enlargement shows one of the objects that makes the image. You can move the “handles” on the object to change its shape.*



# GIF file format

GIF is a graphic file format developed by CompuServe specifically for online use. It stands for Graphic Interchange Format. GIF is pronounced “giff,” not “jiff”—the “g” stands for the hard “g” in “graphic.”

There are two very important things about GIFs. One is that they are **cross-platform**, meaning all computers can view them. Many other file formats cannot be sent from one system to another, but people have been sending GIF files back and forth to each other over the Internet since 1987. And because all kinds of computers are being used to view web pages, it's critical that we are all able to view the same graphics.

The second important thing about GIFs is that they are **compressed**. Compression makes a file smaller—smaller in *file size*, not in dimensions. For instance, a 2x2-inch image in the graphic file format called TIFF might be 900K. The same 2x2-inch graphic in the GIF file format might be 5K.

Compression is important on the Internet because it allows files to be transferred quickly. If the graphics on a web page are small in file size, the page will download onto your computer quickly. You've probably been to web pages where it took a long time to see the page, and what did you do? You probably moved on without waiting for everything to appear. Large files are annoying.

The GIF compression scheme is described as “lossless,” meaning the image does not lose any quality in the process. Now, when we teach you to make your GIFs really small (in Chapter 11), we are going to go beyond the natural compression scheme and *manually* reduce the colors, which might degrade the image slightly. But the compression scheme itself will not degrade the image.

GIF images use **indexed color** (you read page 171, right?), which means they can have a maximum of **256 colors**, called an **8-bit graphic** (page 173–174). However, very few GIFs need all 256 colors, so part of your job is to reduce the number of colors in the image down to the very minimum necessary. Directions on how to do that are on pages 210–212. But first read about and understand this very important file format.

**The great advantage** of GIFs is that you can choose to have one color that is *transparent*. **Transparency** is a big deal. It's what lets the background color of a page show through part of an image. You can choose one color in your image to be transparent. Without transparency, most of the graphics on the web would be set in a big white box. The other most common graphic format that is used on the web, JPEG, cannot have any transparent areas.



Another important feature of GIFs is **interlacing**. Have you noticed that some web graphics appear in layers, each layer adding more clarity to the image? That's interlacing. It lets you get an idea of what the graphic is going to be, just in case you might want to skip it and move on to another page. It also allows you to scroll up and down and read any text that appears while waiting for the graphic to fully resolve itself. A JPEG file can be "progressive," which is similar to interlaced.

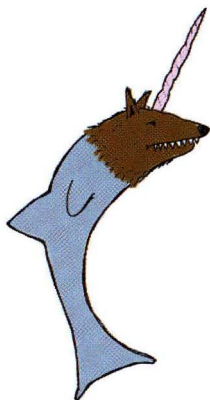
A third important advantage of GIFs is that you can create **animations** with them. These are simple and fun to do—directions are on pages 240–243.

## When to choose the GIF format

Because of the way GIFs are compressed, they are best used for images with large areas of solid, flat color, such as simple illustrations, logos, text as graphics, cartoons, etc., as opposed to photographs or watercolor, pencil, or charcoal illustrations. If there are subtle changes in colors, as happens in photos or certain illustrations, it's usually best to use JPEG (next page).

You certainly *can* save everything as GIFs if you want to. It's just that most photos look better as JPEGs, and the file sizes are smaller. The one exception is a very small photo (smaller than 1.5 inches)—the "overhead" in the JPEG compression scheme is such that a small photo can be compressed much better in GIF than in JPEG, and the results are about the same. Experiment with your images and see what works best in terms of both file size and image quality.

Also read the information on page 192 about aliasing and anti-aliasing. (Basically, an aliased graphic is jaggy on the edges; an anti-aliased graphic *appears* smoother on the edges on the screen.) If you anti-alias a graphic (smooth it), the GIF file will be a little larger because of the extra bits of color needed to anti-alias it. You need to choose which is more important—slightly smaller file size, but jaggy; or slightly larger file size, but smoother.



*This image, with its flat colors, would be best as a GIF file.*

*This image, with its subtle shades of colors, would be best as a JPEG.*



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# JPEG file format

**JPEG** (pronounced “jay peg”) is a graphic file format. The initials stand for Joint Photographic Experts Group. As its name implies, this format is best used for photographs or for images that have subtle color changes, depth, lighting effects, or other gradations of color or tone.

Like GIF images (previous page), JPEG files are also **cross-platform** and **compressed**. Unlike GIFs, however, the JPEG compression scheme is “lossy,” which means data is actually removed from the graphic image to make the file size smaller. It does a pretty good job at this, though, so if you do it right you generally won’t notice a significant difference in quality from the original.

You can’t make any part of a JPEG file **transparent**. Since all graphic files are rectangular, all JPEGs will appear with straight edges. Sometimes, however, you might put an uneven, oval, or rough border on a photograph. If you want the area outside the border to be transparent, you will need to save the photo as a GIF, which is just fine.

## Progressive JPEGs

A standard JPEG is not **interlaced**; that is, you have to wait for the entire photograph to slowly work its way down the page in its full resolution. This is a good reason to make your standard JPEGs as small as possible.

However, you can save an image as a **progressive JPEG**. The progressive JPEG uses a superior compression scheme (meaning you can make smaller files), it has a wider range of quality settings than the standard JPEG, and it is interlaced. Most software that lets you create a progressive JPEG lets you choose the number of steps (how many different resolutions) in the interlacing. You can make a progressive JPEG in Photoshop.

## Advantages of JPEGs

Whereas GIF files are limited to a maximum of 256 colors (called 8-bit), JPEG files can contain 16.7 million colors (called 24-bit). This is why they are better for photographs, watercolor images, pencil or charcoal drawings, and other such images where there are subtle transitions between colors or shades.



You can also choose from a variety of compression levels; the more compression, the smaller the file and the more degradation of quality. How much degradation occurs at a “low” setting depends on how that software interprets a term such as “low” or “high.” For instance, in Photoshop, the settings of low, medium, high, and max refer to *quality*, not to the amount of *compression*. Also in Photoshop, you can see a preview of the quality of the image as you change the settings. So experiment with your software. Experiment on a *copy* of the photo.

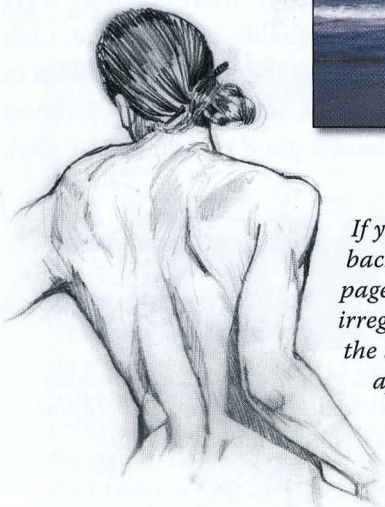
## When to choose the JPEG format

The JPEG format does not compress areas of solid color very well. It works best on photographs and those other kinds of images we keep mentioning. There are times when you might want to save a *photograph* as a GIF. You might want to animate it or make an area transparent. But there are few reasons to save a *graphic* (such as a headline or button) as a JPEG, unless there is a subtle blend of color or a soft shadow effect that’s very important to you. Generally, leave JPEGs to photos and similar images.

*This kind of image is usually best saved as a JPEG file because of its subtle gradations of tones.*



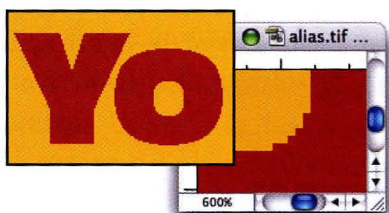
*If you have a white background on your web page, you can easily put an irregularly shaped JPEG on the background and have it appear to “float.”*



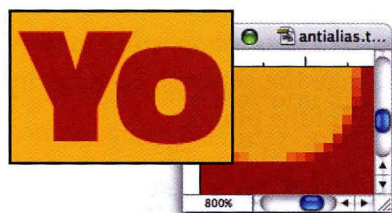


# Anti-aliasing

You'll often hear the term **anti-aliasing** when people talk about web graphics. It refers to the apparent smoothness of the edge of a graphic.



*These orange shapes (whether they are text or graphic objects) have not been anti-aliased. They have the “jaggies.” The inset is an enlarged view of an edge of the orange object. Notice the “stair-stepping.” This is aliasing.*



*To anti-alias an edge, the software (such as Photoshop) changes the colors of the pixels along the edges—it blends the color of the object with the color of the background. This tricks our eyes into seeing the edge as smoother.*

Because of the extra colors necessary to create the blend, file sizes of anti-aliased GIFs are a bit larger. Some designers believe it is better not to anti-alias graphics and text and thus keep the file size smaller. Other designers (especially in regard to most of today's computers) believe the slightly larger file size is a worthwhile trade-off to get a graphic that looks better on the screen. There are times when one or the other approach works better for a particular project.

Personally, we prefer anti-aliased graphics in almost all cases, except when creating very small type as graphics (see page 268–269). There are other ways to reduce the file size that don't compromise the quality of the image, such as reducing the physical size of the image, reducing the number of colors in the GIF to the bare minimum (see pages 210–212), and creating a common color palette for the entire site. Unless you have a good reason not to, click the “anti-alias” button whenever you see it.

**Yo**

*This type is not anti-aliased. It's mathematically defined, like vector graphics.*

**Yo**

*This type is anti-aliased because it's actually a bitmapped graphic (as explained on page 189).*

**Note:** Type printed on paper is not usually represented by pixels—the only time type is anti-aliased **for print** is when it is part of a larger image, such as type set within a photograph, or when type is created as a graphic to achieve a special effect, such as on the title page of this book.

# File size of images

When web designers talk about the “size” of a graphic, they’re usually not talking about the dimensions, such as 3 x 4 inches or 250 x 435 pixels. They’re usually referring to the “file size.” The file size is measured in kilobytes or bytes, and it refers to how much disk space the file takes up. The larger the file size, the longer it takes to send it over the lines, and the longer it takes to appear on the browser page.

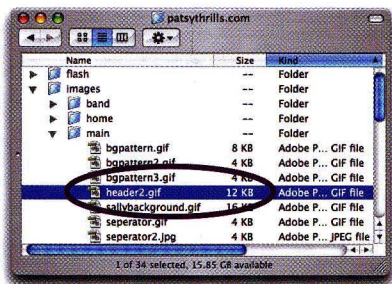
## A little lesson on bits and bytes

The smallest unit of information on a computer is a **bit**. One bit is one electronic on or off pulse. One bit doesn’t tell the computer much. But eight bits strung together make one byte. One **byte** of information can put a letter, such as “A,” on your screen. Put 1024 bytes together and you have a unit of information called a **kilobyte**. Put 1024 kilobytes together and you have a **megabyte**. And guess how many megabytes make a **gigabyte**? Our hard disks typically are anywhere from 30 gigabytes or so to 80 or 100 or more.

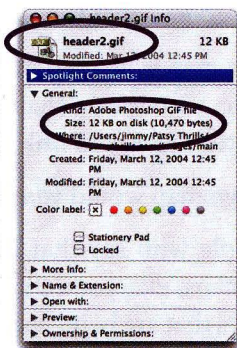
Most web graphics are measured in **kilobytes**. Small graphics such as buttons or small headlines might be only **byte**-sized (less than one kilobyte).

## How to find the correct file size

When you are making web graphics in a program such as Photoshop, don’t believe the file size it displays for your images. The graphic program is usually telling you how much space the program itself needs to work with that graphic, not the literal file size of the image. To find the real size of your files, see below.



*On a Mac, the size you see in the window is not the correct size of very small files. The Mac displays the size of the smallest “cubbyhole” on the hard disk that it can stick the file in—the bigger your hard disk, the bigger the individual cubby. To see the actual size of the file, select the file (click once on it). From the File menu, choose “Get Info.” The **Size** in **parentheses** is the true size.*



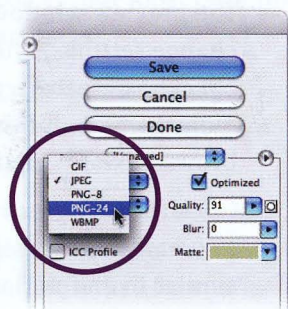
*In Windows, the size indicated in the detailed view or in the bottom right of the window is the actual size (or very close) of the selected file.*



## Other file formats & tips

The previous pages demonstrated the *basic* steps of creating GIFs and JPEGs, the most common image formats to use on web pages. Of course there are several books worth of Photoshop information, tips, and tricks that have been left out, but here's some additional information for those of you who are saying, "Why did they leave *that* out?"

You've no doubt noticed in Photoshop's "Save For Web" window (detail shown below) several image file formats other than GIF and JPEG: PNG-8, PNG-24, and WBMP. None of these are as common on the web as our favorites, GIF and JPEG, but here are brief descriptions of each.

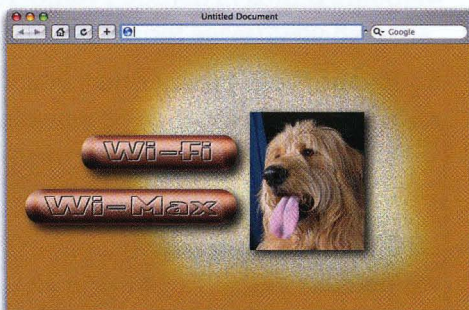


### PNG-8 and PNG-24

PNG (Portable Network Graphics) was developed as an alternative to GIFs. PNG-8 supports 8-bit color (GIFs also support 8-bit color, or 256 colors) while PNG-24 supports 24-bit color (millions of colors). GIFs and PNG-8 files can have one color that is transparent, but PNG-24 files can support many transparent colors, which enables effects such as the one shown below, where a graphic has a soft fuzzy edge that fades out to 100 percent transparency, allowing it to blend gradually with a web page background. PNGs are usually quite a bit larger in file size than GIFs, so they haven't become extremely popular for everyday use on the web.



*This PNG-24 graphic has a transparent background.*



*When placed on a web page, the advanced transparency capability of the PNG-24 file permits the web page background to show through without hard edges.*