

Computer Graphics

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Introduction to Computer Graphics

Graphics are commonly used in Web pages, desktop publishing, authoring programs, tutorials, presentations, and games. The type of graphics that you choose for your website requires knowledge about file sizes, compression rates, resolution, and other specifics.

A graphic can be a chart, a drawing, a painting, or a photograph. It can be solid black and white; in grayscale, which uses many shades of gray ranging from white to black; or it can use the full spectrum of colors. Some pictures are still pictures, and some use animation. Graphics can illustrate or demonstrate procedures, clarify data, convey ideas, and tell stories. Sometimes, they serve simply as a decorative element, adding visual appeal to information and helping to keep readers interested.



The expression "a picture is worth a thousand words" is as true today as ever.

Visualizations can be an important part of the communications process and graphical images can be used to add emphasis, direct attention, illustrate concepts and provide a background for content.

Computers create images by arranging tiny dots of light, called pixels, on a monitor. Pixel means "picture element." If you look very closely at your monitor or use a

magnifying glass, you might be able to see the individual pixels. A digital image does not have a physical structure. The particular way in which the computer stores the image data is called the image format.

Types of Images

Raster Graphics

Raster graphics, also known as bitmap graphics, store information about color and location on a rectangular grid of the pixels that make up the graphic. The dimensions of a raster graphic are the number of pixels in the rectangular grid. We measure the quality of a raster graphic in the number of pixels per inch or dots per inch. Another name for image quality is resolution.

Raster graphics, also known as bitmap graphics, store information about color and location on a rectangular grid of the pixels that make up the graphic. The dimensions of a raster graphic are the number of pixels in the rectangular grid. For example, if an image is 800 x 600 pixels, the image contains 800 times 600 pixels (or 480,000 individual pixels).

We measure the quality of a raster graphic in the number of pixels per inch or dots per inch. Another name for image quality is resolution. When you increase the size of a raster graphic, the same number of pixels takes up more space, and you have fewer pixels per inch. The result is that the image will be less detailed (lower in resolution). When you decrease the size of a raster graphic, it has the opposite effect—the resolution of the image increases.

When you enlarge a raster image, the pixels become stretched. The two suitcases on this Webpage are the same image file; however, the suitcase on the right has been enlarged using the html width attribute. The suitcase on the right has a fuzzy appearance because the pixels have been stretched in order to make the picture larger. We refer to this phenomenon as "pixelated."

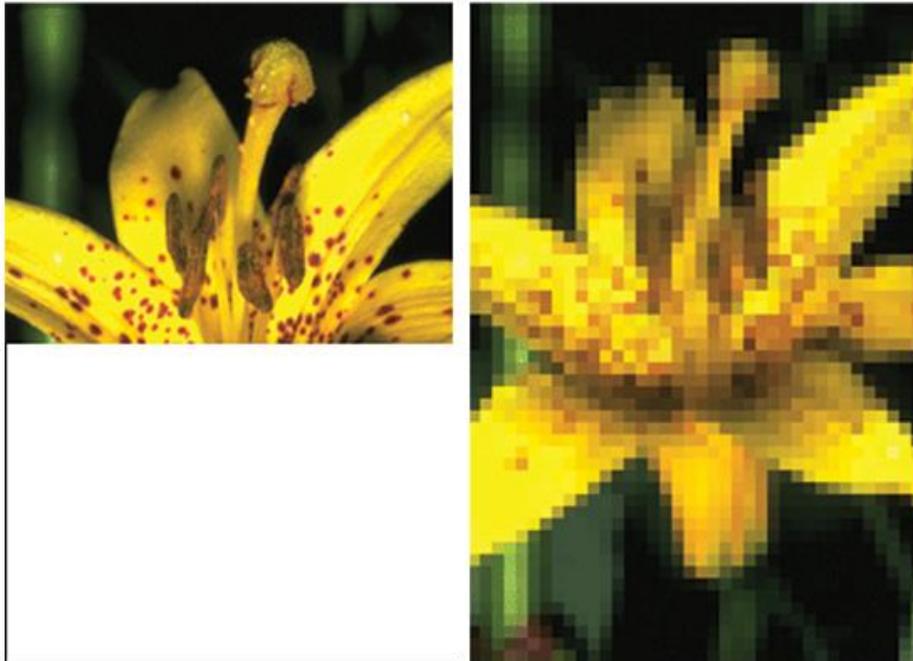
Two very popular raster based graphics are the .GIF (pronounced Jiff or Giff) and .JPG (pronounced j-peg).



How Images Load

Interlaced: An interlaced image will appear completely, but it will be highly pixelated. As the data transfers, the picture will begin to get clearer and clearer as the complete pixel fills in until the full resolution becomes apparent.

Non-Interlaced: A non-interlaced image loads pixels from the top left corner across the width one line at a time. This often gives the user a blank image until at least 25% of the data has been transferred from the server to the client.



Can you tell which flower is interlaced and which is not?

GIF Files—Graphics Interchange Format

- Most commonly used image format on the Web
- Limited to 256 colors
- Noninterlaced—appears one line at a time
- Interlaced—image fades in
- Transparent color—a color from the image doesn't display when the image appears in the browser
- Allows animation

JPEG or JPG—Joint Photographic Experts Group

- Uses 16.7 million colors
- Commonly used for photographs
- Images can be compressed
- Cannot animate, transparent, or interlace

Computer programs that help you create raster graphics include Adobe Photoshop, Microsoft Paint, and any sort of digital camera or photo editing program.

Vector Graphics

Have you ever copied an image from the Internet and found it to be too small for your needs? When you made the picture bigger, the image probably distorted and pixelated like the suitcases above. To solve this problem, the vector graphic was created and a major advantage of vector graphics is that they do not pixelate. You cannot stretch pixels because there are no pixels. Vector graphics are sometimes referred to as draw-type graphics. Designed specifically for the use on Webpages, vector graphics represent an image as a geometric shape made up of straight lines, ovals, and arcs

Vector graphics store information about images using lines, shapes, and colors represented by mathematical equations. Because they use shapes and math to describe images, you can make vector graphics larger or smaller without affecting the image quality. Vector graphics work great for illustrations, logos, buttons, shapes, and even some more complicated types of graphics and text. What they don't work well for is photographs. This is because photographs contain so much detail that it's not economical, from a file-size perspective, to convert them into lines and shapes.

Computer programs that work with vector graphics include Adobe Illustrator, CorelDraw, and any illustration application.

Scalable Vector Graphics (SVG)

Raster graphics used to be the only game in town when it came to the Web—but no more! The latest generation of Web browsers (including Chrome, Safari, and most mobile browsers) contain built-in support for Scalable Vector Graphics (SVG). SVG is a widely-deployed royalty-free graphics format developed and maintained by the W3C SVG Working Group. SVG is an XML vocabulary that you can use to describe computer graphics. A computer program (such as a browser) that knows how to interpret SVG uses the code to display images.

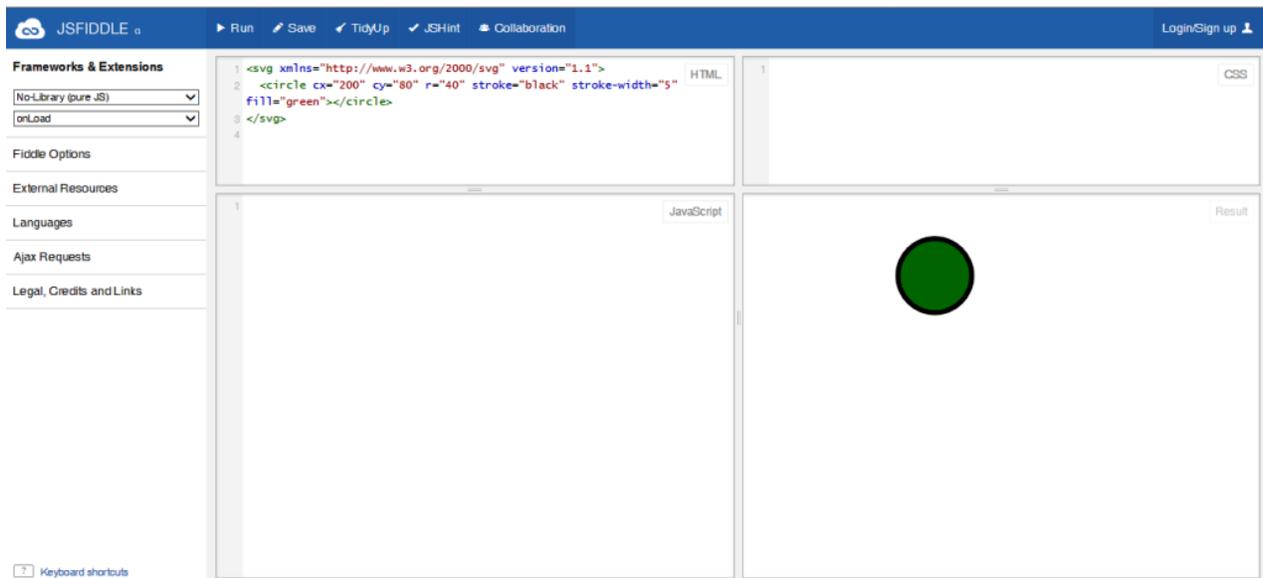
Try Me

1. Open your Web browser to www.jsfiddle.net.
2. Type the code below into the top-left, pane labeled HTML:

```
<svg xmlns="http://www.w3.org/2000/svg" version="1.1">
  <circle cx="200" cy="80" r="40" stroke="black" stroke-
width="5" fill="green"></circle>
</svg>
```

3. Press the run button just above the HTML pane.

If you typed everything correctly, the lower-right pane of jsfiddle.net will display a circle with a black border and green on the inside. Try changing some of the values in the element and pressing Run again. For example, make the value of r (the radius) larger or smaller. Or change the fill and stroke colors or the position of the circle.



SVG is resolution-independent, uses less bandwidth, and renders color more accurately. Other advantages of SVG include:

- text-based
- open source
- written in XML
- an official W3C graphics standard
- accessible for people with visual disabilities
- searchable
- dynamic and updateable

- cross-browser compatible

You can learn more about creating SVG at [W3Schools - SVG Basic](#). Visit [What is SVG](#) at About.com to learn more about Scalable Vector Graphics.

Assignment: Image Comparison Chart

Directions: Let's compare the pros and cons of each type of image formats. Create a chart (or table) of the types of images (similar to what I have displayed below). You may use your lesson, the Internet, or other resources that you have available to you. I've even included a few image formats that we didn't cover in the lesson.

For each format, list at least 3 advantages (pros), 3 disadvantages (cons), and an example of an image displayed that each particular file format. Download the template for itsLearning.

Image Compression

Images, video, and sound all contribute to the size of a Webpage which translates to load time. Google's research has found that a half-second longer load time for search results decreased traffic and ad revenue by 20%. Amazon found that its revenue increased by 1% for every 100 milliseconds faster the site loaded. In 2001, a study found that the longest a typical user would wait for a webpage to load is eight seconds. Today, this number is way too long for most Internet users. A much higher percentage of users have high-speed Internet connections. More recent studies have found that most broadband users won't wait **four** seconds for a page to load.

Raster (bitmap) images and video account for a large percentage of the data that travels over the Internet every day. In fact, network equipment maker Cisco Systems has predicted that video alone will soon make up 90% of all Web traffic. Compression is the process of making files take up less digital storage space by reducing the amount of digitized information needed to store a visual image electronically. Files are compressed to:

- Smaller files open and display from hard drives more quickly.
- They transfer over the Internet more quickly.
- They use less memory.
- They use less storage space on computers.

Lossy Compression

Lossy compression works by discarding aspects of an image that are insignificant. For example, if a photo contains 30 different shades of black, lossy compression will get rid

of some of those shades. It is referred to as "lossy" because lossy image compression results in a loss of image fidelity. When used correctly, it's difficult or impossible for most people to detect. Lossy compression:

- method which loses some of the data that is indiscernible to the eye
- saves as a smaller size which equals shorter download time
- repeatedly compressing and decompressing a lossy file will cause it to progressively lose quality

Lossless Compression

Lossless compression compresses images in such a way that they can be exactly reproduced from the compressed file—with no loss of fidelity. Lossless compression works great for icons, clip art, logos, buttons, and the like. The most popular lossless compression formats on the Web are GIF and PNG because of the limitation in colors. Lossless images:

- allows the exact original data to be reconstructed from the compressed data
- used in cases where it is important that the original and decompressed data be identical or where deviations from the original could be damaging

You can read more about image compression in Cameron Chapter's blog, [*Everything You Need to Know About Image Compression*](#). The blog includes create visual examples and is worth reading.

When to use

GIF?

JPG?

PNG?

Which image type to use?

Click on the picture to read the presentation



Click on the picture to read the presentation

Assignment: Question for Thought 1

Directions: Describe how image file size can affect the download time of a Webpage and ways that image file size can be reduced. (~150 words). Post your essay directly to the itsLearning textbox. Do not submit a separate document and be sure to proofread before submitting.

Assignment: Comparing Image Compressions Worksheet

Directions: Download the Comparing Image Compressions Worksheet and the Yellowstone.jpg image from itsLearning and complete the worksheet.

Image Acquisition & Copyright

Copyright cannot be stressed enough. We've talked about the benefits of images in our Webpages and multimedia presentations. They most certainly engage the visitor and enhance the presentation. Users have come to expect a visually pleasing experience that can only be achieved with the use of images. The World Wide Web has made it easy to share images and to purchase images through stock photographs and photo-sharing Websites. You can also create original images using image-creation software. You can scan hard-copy images (with copyright permission) or take your own images.



Stock Photography

Stock photography is images that you can purchase the rights to use in printed material or on a Website. Professional and amateur photographers file their images with an agency that acts as a go-between to negotiate licensing fees on behalf of the photographer. Stock photo images are licensed from the agency. Many modern stock photography distributors offer still photos, video and illustrations. Millions of photos are available for licensing, and all images on stock photography Websites are easily searchable by keywords. Stock photography can be sold with a royalty-free license that allows the buyer to use the image without having to pay a royalty each time the image is used. Stock photography can also be obtained with a rights-managed license. A rights-managed license permits the purchaser to *rent* an image through negotiation of a specific price for a specific use.

Free images

Some Websites offer digital photos for personal and commercial use free of charge, with restrictions such as:

- Maintaining the domain name of the Website where the photo was obtained.
- Cannot resell the photo.
- Cannot add the free photo to a collection to bundle and sell on a Website
- The photographer retains the original copyright.

There are many free images offered through the creative commons copyright. Be sure to read the fine print of any restrictions that are associated with the creative commons copyright.

Photosharing

Another possible source for free images is photosharing Websites, although photographs on these Web sites are copyrighted to the photographer and you must

contact the photographer or owner of the photo to obtain permission to use the images. For example, I could place my picture of the Thunder Bay River that I took with my smartphone Photo-sharing Web sites where you would be allowed to upload, organize, view, share and download the photo and other image files. Some sites are free, whereas others offer subscription-based services. Free sites generally rely on advertising or the selling of prints to make a profit. These sites often feature online advertisements. Some sites offer subscriptions for their premium services, and a scaled down version with fewer features as their free package.

Assignment: Wordle

Directions: Wordle is a toy for generating “word clouds” from text that you provide. The clouds give greater prominence to words that appear more frequently in the source text. You can tweak your clouds with different fonts, layouts, and color schemes. You can also emphasize a word or two by repeating (multiple times) the word in your list. The images you create with Wordle are yours to use however you like. You can print them out, or save them to the Wordle gallery to share with your friends.

Create a Wordle of at least 10 words that have significance to you. You cannot save a Wordle but you can screen shot it (press your print screen key next to F12 in a Windows PC) and paste it into your word processing program. If you have Microsoft Word 2010 or higher, right click on the picture and you can save it as a picture and crop out any parts of the computer screen that you do not need). Drop it in the unit drop box and tell me in the message box why you chose those 10 words to create your Wordle. Upload your Wordle to itsLearning.

Image Editing

There are many tools that can be used for creating and editing images. Use can use graphics software to:

- Create your own graphical images
- Edit pictures
- Modify digital photos
- Create animations
- Draw or paint images

Adobe Fireworks (formerly Macromedia Fireworks) is a bitmap and vector graphics editor. It was originally developed, using parts of xRes, by

Photo Editing

Dithering & Anti-aliasing

Dithering: Dithering scatters different colored pixels in an image to make it appear as though there are intermediate colors in images with a limited color palette.

Anti-aliasing: Smoothing the jagged appearance of diagonal lines in a bitmapped image. The pixels that surround the edges of the line are changed to varying shades of gray or color in order to blend the sharp edge into the background. This technique is also called "dithering," but is usually known as anti-aliasing when applied to diagonal and curved lines.

Macromedia, which Adobe acquired in 2005, and aimed at web designers (with features such as: slices, the ability to add hotspots etc.) for rapidly creating website prototypes and application interfaces (Wikipedia).

The newer version of Adobe® Photoshop® CS6 software redefines digital imaging with breakthrough tools for photography, superior image selections, realistic painting, and more (Adobe.com).

Fireworks
Pixlr
Photoshop

[Pixlr.com](http://pixlr.com) is a free online photo editor just waiting to edit, adjust, and filter your images. Reviews compare it closely to Photoshop.

Other popular image-creation applications include:

- Adobe Illustrator (www.adobe.com)
- The GIMP (www.gimp.org)
- Picasa (<http://picasa.google.com/>)
- Inkscape (www.inkscape.org)

creating & editing images

PART 1 – Layout of the Workspace

creating & editing images

PART 2 – Size, Display, Color Modes

[Click on the presentations to read them](#)

Assignment: Been There; Seen That

Directions: Create a postcard of 2 places you have visited around the world that includes pictures and text descriptions. Address the postcard to Mrs. Rush. You may use any image editing program (such as Photoshop) that you choose.

The project instructions are available in itsLearning. Please upload your completed assignment there.

Assignment: Currency Remix Project

Directions: Create 1 paper currency design (front & back) & 1 coin currency design (front & back) for a country of your choosing. Research this country's current design and then create an updated version for both coin and paper currency for your country. You may use the layout of the current currency but just changing colors around will not suffice. Countries are usually known for something... structures, famous people, geography, political involvements, etc. Use your country's history to help you in designing their new and improved currency. These designs should be created using Image Editing Software. This project should be taken seriously... no pictures of explosions, convicts, anything questionable, etc. Once complete, compile the four images on a Word document to be graded. You will be graded on originality, craftsmanship/technical skill, composition, & following of directions.

The project instructions and rubric are available in itsLearning. Please upload your completed assignment there.

Assignment: Digital Design & Promotion

Directions: You are on the staff of a large marketing firm in New York City and Miles Stanish has hired your firm. He is opening a bicycle store in New York and plans to name it Cycle Fitness. Your firm is to design a new logo for this new shop and as well as for future locations he plans to open. Cycle Fitness plans to hold free seminars on bike safety, cycling for fitness, what to look for when buying a bicycle, choosing the right bike, choosing a bike for a child, and creating a cycle group that will be doing monthly cycle trips. Your firm must design the new logo, a grand opening postcard for mailing, a business card, a rack card that will sit on the counter in a holder indicating all the seminars offered, and a quarter-page advertisement. You may use any graphics and software programs to create your logo and documents.

The project instructions and rubric are available in itsLearning. Please upload your completed assignment there.

Review

Resources

If you are having problems viewing this page, opening videos, or accessing the URLs, the direct links are posted below. All assignments are submitted in itsLearning. If you have having problems, contact Mrs. Rush through the itsLearning email client.

Dithering and Anti-aliasing Pixel Art video:
<https://www.youtube.com/watch?v=g7xVhjblXt8>

Pixlr: <http://pixlr.com/> (note: MyScrapNook navigation bar is *just* an advertisement)

Review: <https://www.examtime.com/p/1064479-Images-Review-quizzes>

Transcript: <http://mrsrush.net/graphics/index.pdf>

Credits

Vintage Suitcase image: dryicons

Interlace/Non-interlace flowers image: *Web Style Guide*
<http://mason.gmu.edu/~acarrott/index.html>

[Transcript of this lesson](#)