

Chapter 8

Digital Media

Computer Concepts 2014



Chapter Contents

- Section A: Digital Sound
- Section B: Bitmap Graphics
- Section C: Vector and 3-D Graphics
- Section D: Digital Video
- Section E: Digital Rights Management

Section A: Digital Sound

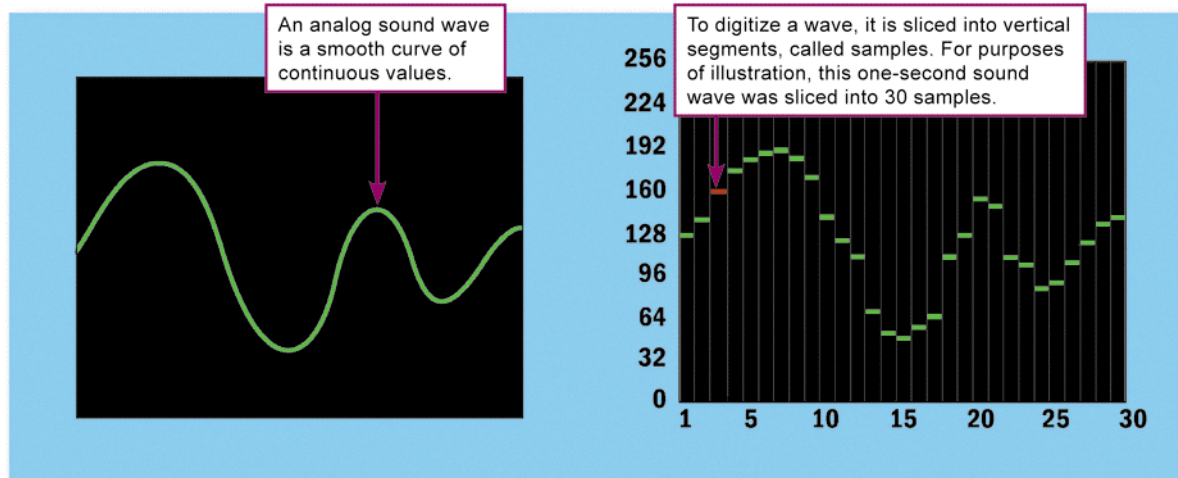
- Digital Audio Basics
- Digital Audio File Formats
- MIDI Music
- Speech Recognition and Synthesis

Digital Audio Basics

➤ Sampling a sound wave

FIGURE 8-1

Sampling a Sound Wave



Sample	Sample Height (Decimal)	Sample Height (Binary)
1	130	1000010
2	140	1000110
3	160	1010000
4	175	1010111

The height of each sample is converted into a binary number and stored. The height of sample 3 is 160 (decimal), so it is stored as its binary equivalent—1010000.

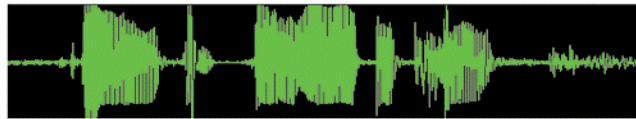
Digital Audio Basics

- Sampling rate refers to number of times per second that a sound is measured during the recording process

FIGURE 8-2

A higher sampling rate produces more true-to-life sound quality. Use your interactive eBook to compare the quality of these audio clips, which were digitized at different sampling rates. You'll have to listen carefully to notice the differences.

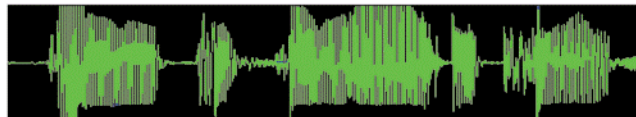
Low sampling
rate: File size =
66 KB



Medium sam-
pling rate: File
size = 124 KB



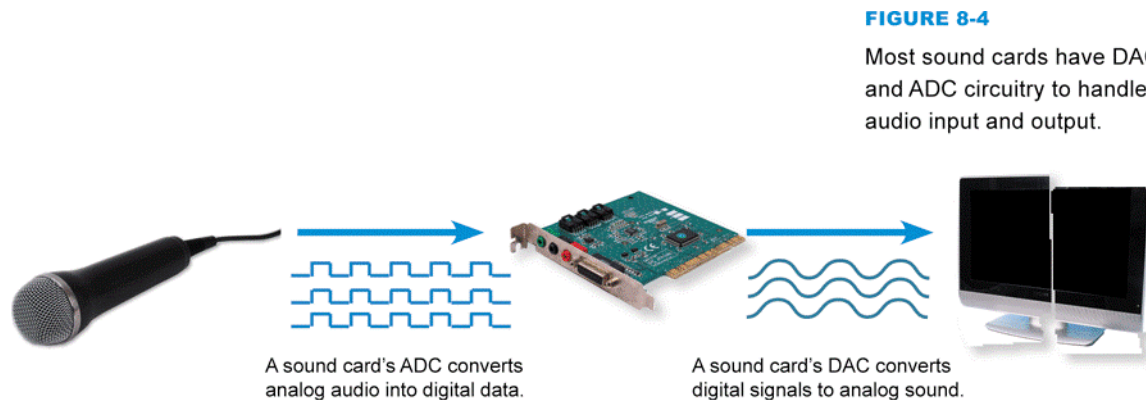
High sampling
rate: File size =
235 KB



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Digital Audio Basics

- A sound card is a device that contains a variety of input and output jacks, plus audio-processing circuitry
 - Integrated audio
 - Digital-to-analog converter
 - Analog-to-digital converter

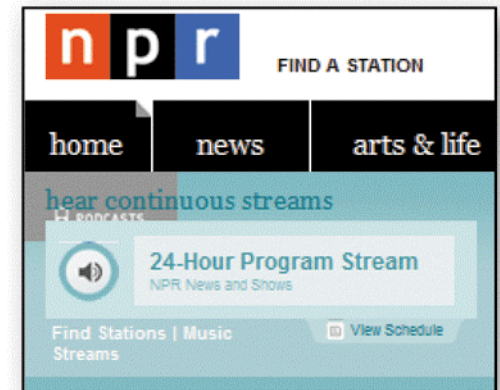


Digital Audio File Formats

- Popular digital audio formats: AAC, MP3, Ogg Vorbis, WAV, and WMA
- You can embed digital audio files into a Web page using the HTML5 <audio> tag
- Streaming audio plays as its file is downloaded

FIGURE 8-6

Streaming audio provides the technology for real-time Internet radio broadcasts, podcasts, and voice chat sessions.



MIDI Music

- MIDI (Musical Instrument Digital Interface) specifies a standard way to store music data for synthesizers, electronic MIDI instruments, and computers
- MIDI-capable sound cards contain a wavetable
 - Set of prerecorded musical instrument sounds
- Does not produce high-quality vocals

MIDI Music

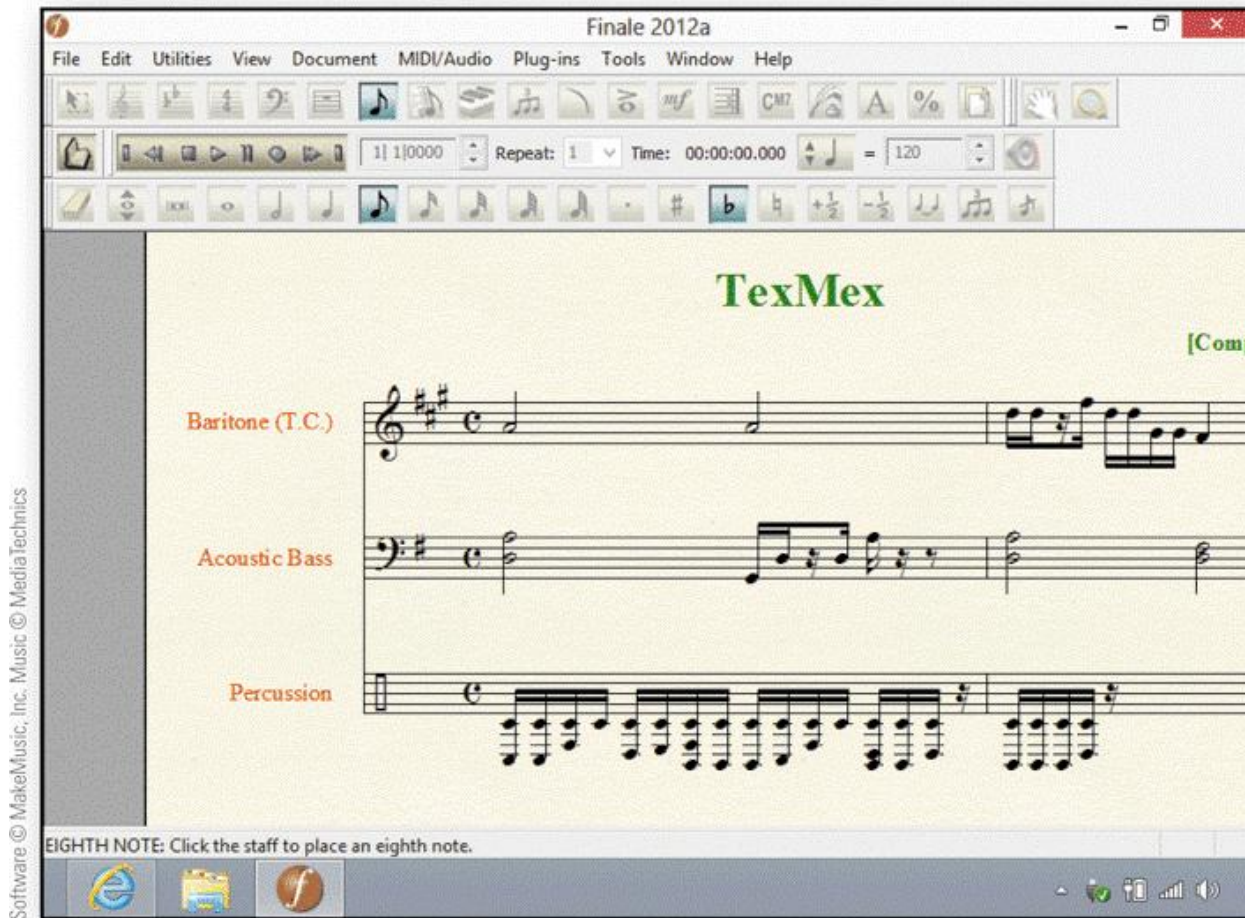


FIGURE 8-9

Music composition software provides tools for entering notes, specifying instruments, printing sheet music, and saving compositions in formats such as MIDI. You can use your interactive eBook to take a tour of music composition software and see how the TexMex music was created.

Speech Recognition and Synthesis

- Speech synthesis is the process by which machines produce sound resembling spoken words
 - Text-to-speech software
- Speech recognition refers to the ability of a machine to understand spoken words
 - Speech recognition software

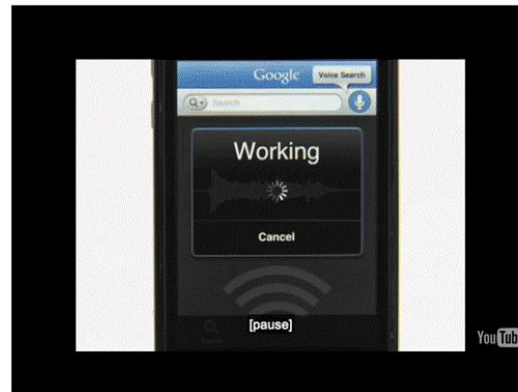
Speech Recognition and Synthesis

FIGURE 8-10

The Windows Speech Recognition Wizard displays short text passages. As you read each passage, the computer listens to the way you pronounce each word and stores it in your speech profile.



Norman Pogson/Shutterstock.com



Web site and video © 2012 Google

You can voice surf with a handheld device, too. ▶ Find out how Google Voice Search works.

Section B: Bitmap Graphics

- Bitmap Basics
- Scanners and Cameras
- Image Resolution
- Color Depth and Palettes
- Image Compression

Bitmap Basics

- Composed of a grid of dots
 - Color of each dot is stored as a binary number

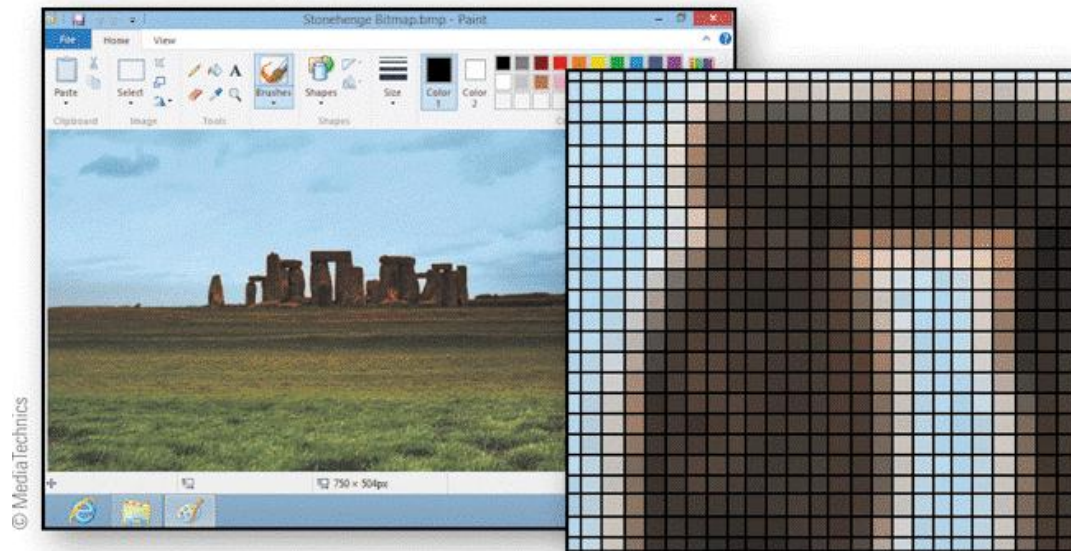


FIGURE 8-11

A bitmap graphic is divided into a grid of individually colored pixels. The color number for each pixel is stored in binary format. ▶ Learn how to use Windows Paint to create bitmap graphics and see how to work pixel by pixel to edit an image.

Bitmap Basics

FIGURE 8-12

Bitmap Graphics Formats

	Format	Use
	<p>BMP, pronounced “bee-em-pee” or “bump,” is the native bitmap graphics file format of the Microsoft Windows environment. Microsoft Paint, included as part of Microsoft Windows, creates BMP graphics files. The BMP format supports True Color and can be used for a wide variety of graphics applications, such as photographs, illustrations, and graphs. BMP files are often too large for e-mail attachments. BMP graphics are not supported by most browsers, so they are not used on the Web.</p>	<p>Graphical elements, such as buttons and other controls for graphical user interfaces</p>
	<p>RAW image formats contain the unprocessed pixel data generated directly by a digital camera's sensor. Up to 12 bits of data can be stored for each of the red, blue, and green values for a pixel, so RAW files are very large. Cameras that offer a RAW format also supply proprietary software to convert RAW data to JPEG or TIFF.</p>	<p>Photographic images before they are stored in other formats</p>
	<p>TIFF (Tagged Image File Format), or TIF, is a flexible and platform-independent graphics file format supported by most photo-editing software packages. Scanners and digital cameras commonly store bitmaps in TIFF format because it supports True Color and can be easily converted into other graphics file formats.</p>	<p>Desktop publishing and any projects that require high-resolution graphics; not supported by browsers</p>
	<p>JPEG (pronounced “JAY-peg”), which stands for Joint Photographic Experts Group, is a graphics format with built-in compression that stores True Color bitmap data very efficiently in a small file. The JPEG format is popular for Web graphics and for photos attached to e-mail messages. When creating a JPEG or converting an image to JPEG format, you can control the level of compression and the resulting file size. The compression process eliminates some image data, however, so highly compressed files suffer some quality deterioration.</p>	<p>General use, such as desktop publishing or Web pages, where flexibility in file size is important</p>
	<p>GIF (Graphics Interchange Format), pronounced “GIF” or “JIFF,” was specifically designed to create images that can be displayed on multiple platforms, such as PCs and Macs. GIF graphics are limited to 256 colors, but the format supports simple animations. Once a popular format for Web pages, GIF is being replaced by JPEG and PNG.</p>	<p>Web graphics and simple animations</p>
	<p>PNG (Portable Network Graphics), pronounced “ping,” is a graphics format designed to improve on the GIF format. A PNG graphic can display up to 48-bit True Color (trillions of colors). Unlike JPEG, PNG compresses bitmap files without losing any data, so compressed images retain the same high quality as the originals. PNG was developed as a public domain format without any restrictions on its use.</p>	<p>Web graphics and other general uses</p>

Scanners and Cameras



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FIGURE 8-13

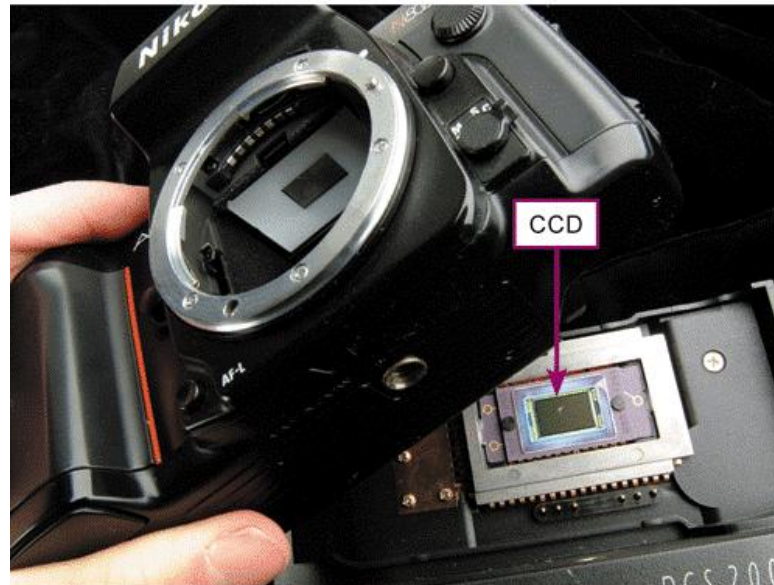
To scan an image, turn on the scanner and start your scanner software. Place the image face down on the scanner glass, and then use the scanner software to initiate the scan. The scanned image is saved in RAM and can then be saved on your computer's hard disk.

▶ Learn the difference between scanning an image and scanning a document into an editable word processing file.

Scanners and Cameras

FIGURE 8-14

A digital camera's CCD converts the image captured by the camera lens into a grid of colored pixels, which are stored as bits. ▶ Watch the video for this figure in your interactive eBook for an overview of digital camera features, file formats, and the process of transferring photos from a camera to your computer.



Courtesy of Learning Technology Services, University of Wisconsin-Stout

Scanners and Cameras

- Digital cameras use storage medium
 - Solid state memory cards
- Transfer images using:
 - Card readers
 - Direct cable transfer
 - Infrared port
 - Media transfer
 - Docking station
 - E-mail

FIGURE 8-15

Card readers can be connected to your computer's USB port, built into a computer system unit, or built into a photo printer.



Scanners and Cameras

- Graphics software is used to modify or edit bitmap graphics
 - Modify individual pixels to:
 - Wipe out red eye
 - Erase rabbit ears
 - Retouch photographs
- Require a bit of storage space

FIGURE 8-16

Bitmap graphics can be easily modified. Many graphics software products include wizards that help you retouch photographs.



Before



After

Courtesy of MediaTechnics

Courtesy of MediaTechnics

Image Resolution

- Expressed as the number of horizontal and vertical pixels
 - Higher resolutions contain more data (larger file size) and are higher quality
- Bitmaps do not have a fixed physical size

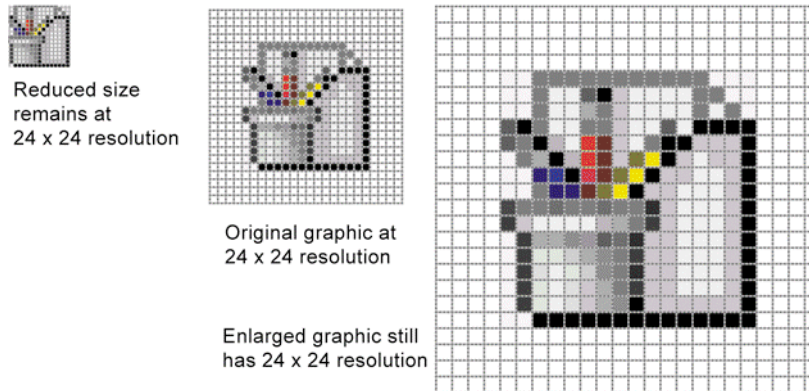


FIGURE 8-17

When a bitmap graphic is enlarged or reduced in size, it still retains its original resolution—24 x 24.

8

Image Resolution

- File size of bitmaps can be reduced by cropping
- Bitmaps are resolution dependent

FIGURE 8-18

When viewing an image larger than the screen, you must scroll to see all parts of the image or set the zoom level of your graphics software to less than 100%. You should understand, however, that changing the zoom level stretches or shrinks only the size of the image grid. It has no effect on the printed size of a graphic or the graphic's file size.



Image Resolution

- When you increase the resolution of a bitmap, pixel interpolation may occur
 - Some images may appear pixelated



The figure above has a resolution of 130 x 130. The figure at right was enlarged to a resolution of 260 x 260, but it has a rough, pixelated appearance.



FIGURE 8-19

When you increase the resolution of an existing graphic, the file size increases, but the quality might deteriorate.

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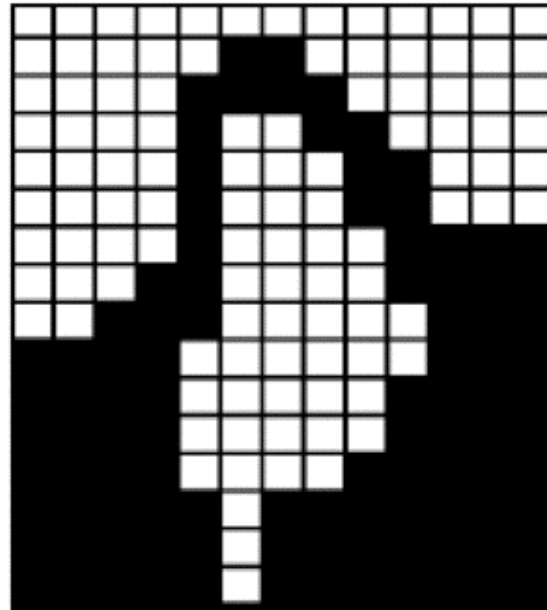
Color Depth and Palettes

- Color depth is the number of colors available for use in an image
 - Monochrome bitmap
- Increasing color depth increases file size
- Color palettes are used to control color depth
 - Grayscale palette
 - System palette
 - Web palette

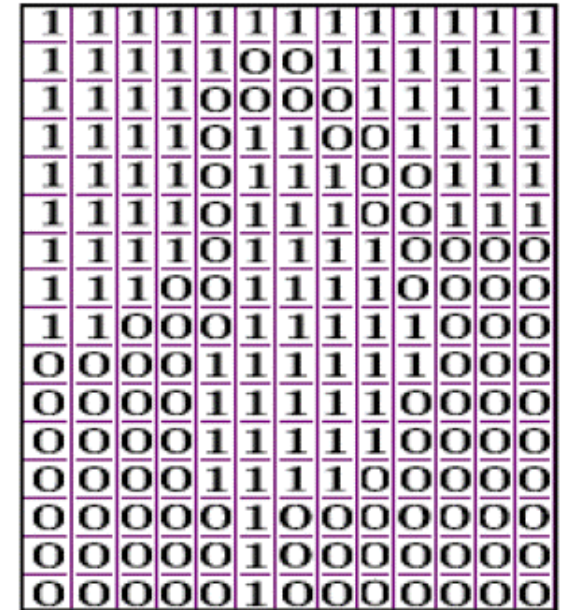
Color Depth and Palettes



1. This image originated as a black-and-white silhouette.



2. The computer divides the picture into a matrix.



3. If a cell is white, it is coded as a 1. If a cell is black, it is coded as a 0.

Image Compression

- Any technique that recodes data in an image file so that it contains fewer bits
 - Lossless compression
 - GIF, PNG, TIFF
 - Lossy compression
 - JPG

FIGURE 8-25

JPEG compression can slightly adjust the colors of adjacent pixels to make them the same. These like-colored pixels can then be compressed with RLE.



Non-compressed JPEG image



JPEG image with 35% compression

Section C: Vector and 3-D Graphics

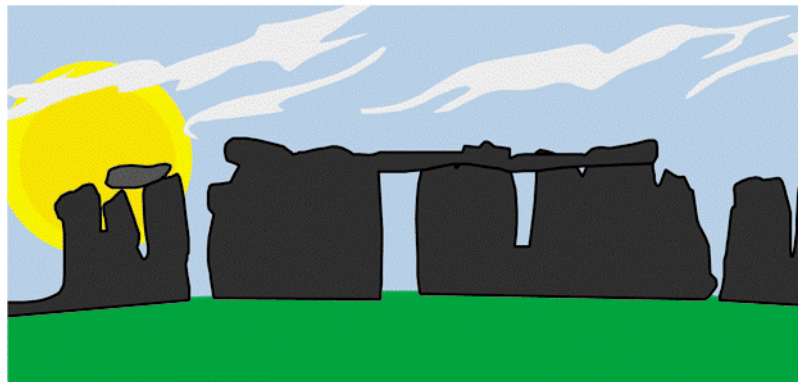
- Vector Graphics Basics
- Vector-to-Bitmap Conversion
- Vector Graphics on the Web
- 3-D Graphics

Vector Graphic Basics

- Contain instructions for re-creating a picture

FIGURE 8-29

The parts of a vector graphic are created as separate objects. This image was created with a series of roughly rectangular objects for the stones and a circular object for the sun. The objects are layered and can be manipulated individually. This characteristic of vector graphics gives artists flexibility in arranging and editing image elements.



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Vector Graphic Basics

- Vector graphics resize better than bitmaps
- Vector graphics usually require less storage space than bitmaps
- Vector graphics are not usually as realistic as bitmap images
- It is easier to edit an object in a vector graphic than an object in a bitmap graphic

Vector Graphic Basics

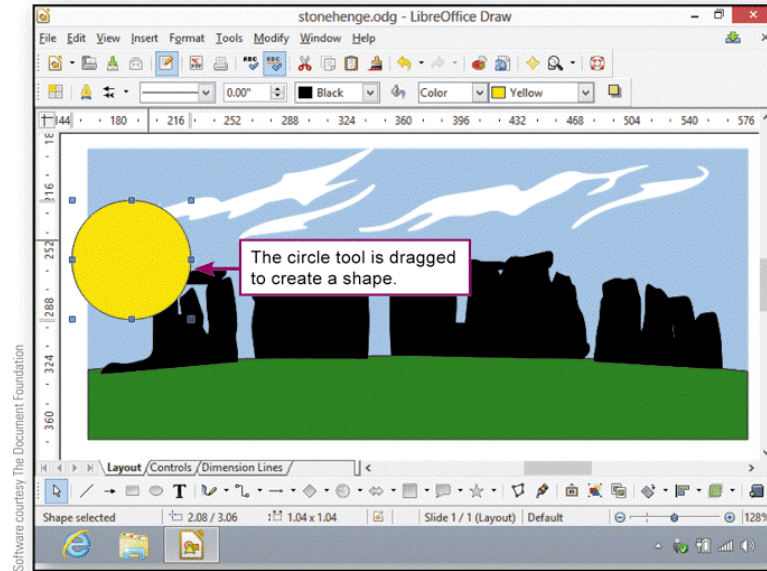
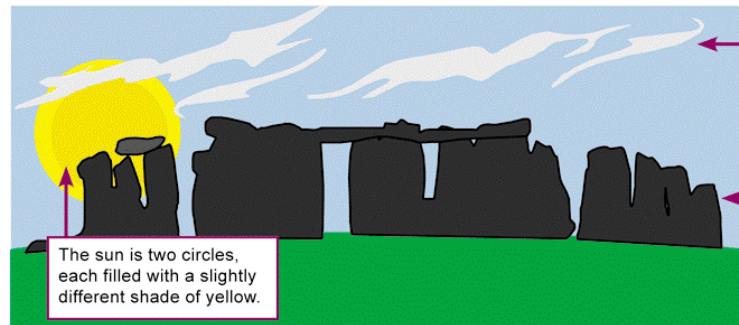


FIGURE 8-32

To draw a circle, select the filled circle tool, and then drag the mouse pointer to indicate the circle's location and size. A color palette allows you to select the circle color. After you create the circle object, you can move it and change its size or color. You can also create irregular shapes for objects, such as clouds, by connecting short line segments. ▶ Learn the basics of drawing vector images by accessing this figure in your interactive eBook.

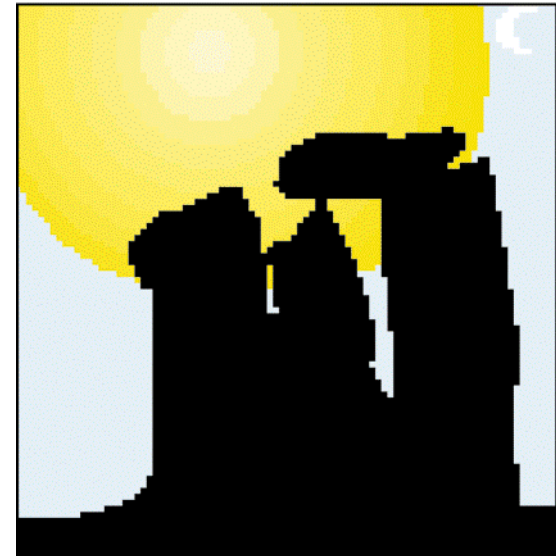


Vector-to-Bitmap Conversion

- Rasterization superimposes a grid over a vector image and determines the color for each pixel
- Tracing software locates the edges of objects in a bitmap image and converts the resulting shapes into vector graphic objects

FIGURE 8-34

When vector images are rasterized, they become bitmaps and can't be enlarged without becoming pixelated.



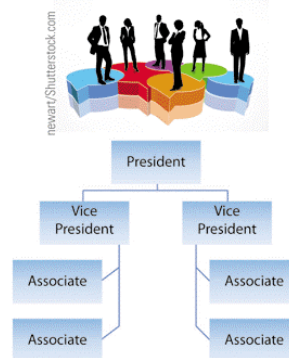
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Vector Graphics on the Web

- SVG (Scalable Vector Graphics) and Flash are vector graphic formats for the Web
- Advantages of using vector graphics
 - Consistent quality
 - Searchable
 - Compact file size

FIGURE 8-35

The two most pervasive vector formats on the Web are SVG and Flash.



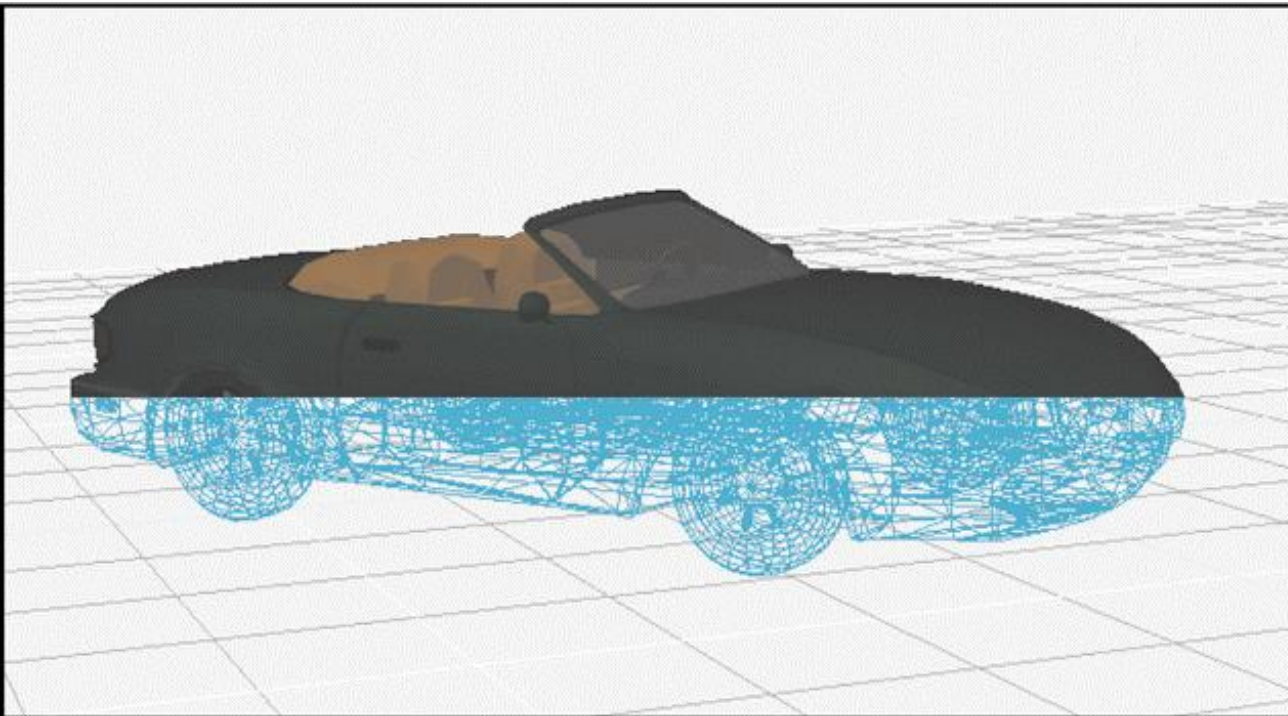
SVG is supported by most modern browsers without requiring a plug-in. It supports gradients, drop shadows, multiple levels of transparency, and animation effects, along with portability to other platforms, such as handheld computers and cellular phones.

Adobe's Flash software creates vector graphics that are stored in files with .swf extensions. Flash graphics can be static or animated. Flash was once the dominant technology for vector graphics and animation, but its use has declined since Apple announced that Flash would not be supported on iOS devices.

3-D Graphics

- Stored as a set of instructions
 - Contain locations and lengths of lines forming a wireframe
- **Rendering** covers a wireframe with surface color and texture
- **Ray tracing** adds light and shadows to a 3-D image

3-D Graphics



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FIGURE 8-36

3-D graphics are based on a wireframe, which can be rendered into a bitmap image that looks three-dimensional.

3-D Graphics

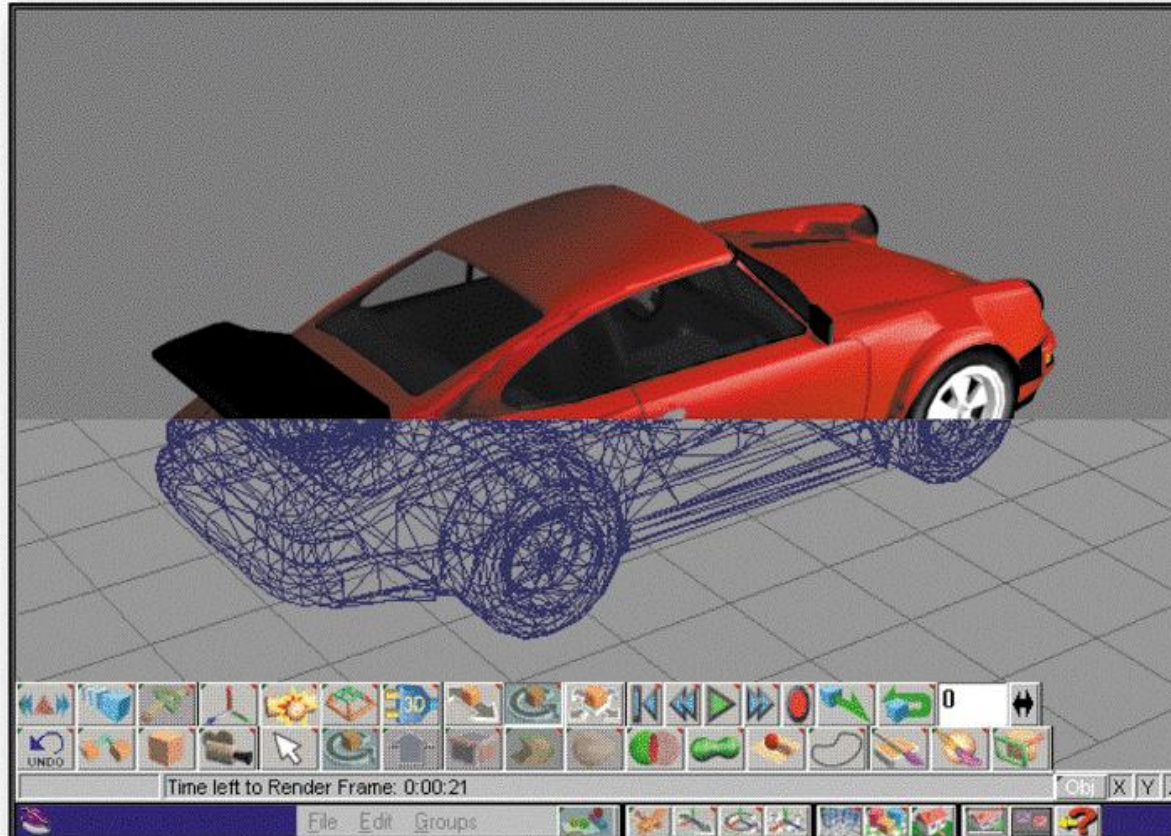


FIGURE 8-38

3-D graphics software provides tools for drawing a wireframe and then specifying colors and textures for rendering.

▶ Watch a wireframe being rendered and animated in your interactive eBook.

Section D: Digital Video

- Digital Video Basics
- Producing Video Footage
- Video Transfer
- Video Editing
- Video Output
- Web Video
- DVD-Video

Digital Video Basics

- Uses bits to store color and brightness data for each video frame
- Footage for digital videos can be supplied from a digital source, or from an analog source that requires conversion

FIGURE 8-40

A video is composed of a series of bitmap graphics, each one called a frame.



8

Producing Video Footage

Use digital or analog video camera to shoot video footage

- Digital video cameras store footage as bits
- Analog video cameras store video signals as a continuous track of magnetic patterns
 - Convert analog video to digital using a *video capture card*

FIGURE 8-43

A Web camera can be built into a computer display device or can be attached as shown. It is designed mainly for “talking head” applications, such as online video chats and video-conferences.



Andreas/Shutterstock.com

Video Output

FIGURE 8-49

Popular Digital Video Formats

Format	Extension	Platform	Description and Use
AVI (Audio Video Interleave)	.avi	PC	A format sometimes used for storing digital clips from video cameras; used for desktop video on the PC platform
MOV (QuickTime Movie)	.mov	PC, Mac, UNIX, Linux	A popular format for desktop video and streaming Web videos
MPEG (Moving Picture Experts Group)	.mpg or .mpeg	PC, Mac, UNIX, Linux	Versions include MPEG-1, MPEG-2, and MPEG-4; used for desktop video and streaming Web video
WebM	.webm	PC, Mac, UNIX, Linux	Royalty-free, high-quality open format for use with HTML5
ASF (Advanced Systems Format)	.asf or .wmv	PC	Container format for Microsoft's Windows Media Video (WMV) desktop video and streaming Web video
Flash video	.flv	PC, Mac	Popular for Web-based video; requires Adobe Flash Player
VOB (Video Object)	.vob	Standalone DVD player, PC, Mac, Linux	Industry-standard format for standalone DVD players
Ogg Theora	.ogg	PC, Mac	A non-proprietary container (Ogg) and video codec (Theora)

8

Video Transfer

- Remove the SD card from the camera and insert it into a card reader on your computer
- Connect firewire or USB cable between devices

FIGURE 8-45

After it has been installed in your computer, a video capture card can be connected to the video-out and audio-out ports on an analog camera, a television, a VCR, or a DVD player.



Video Output

FIGURE 8-47

Different compression ratios can have a remarkable effect on video quality and file size.



Bitrate: 90 Kbps
Frame rate: 10
File size: 359 KB



Bitrate: 448 Kbps
Frame rate: 15
File size: 1177 KB



Bitrate: 928 Kbps
Frame rate: 30
File size: 2448 KB

8

Web Video

- Streaming video – stored in file but you watch it as it is being downloaded
- YouTube is a video-sharing Web site that encourages members to upload, view, and rate video clips

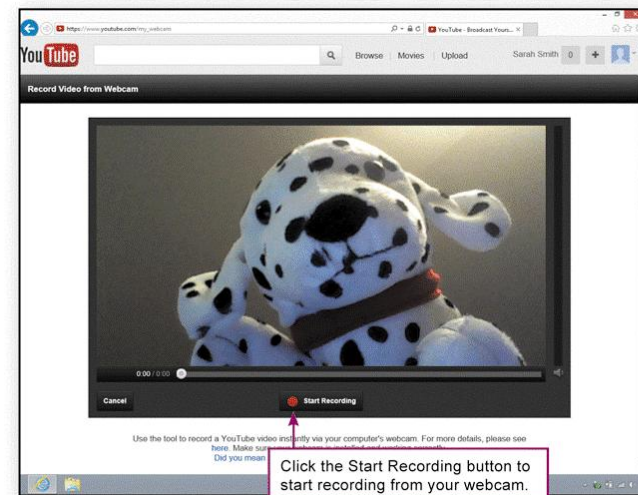


FIGURE 8-50

You can use YouTube to capture footage on your computer's webcam and upload it to the YouTube Web site.

Web site © 2012 YouTube, LLC. Photo © Media Techniques

Web Video

Embed video in a webpage:

➤ HTML5 `<video>` tag supports several video formats

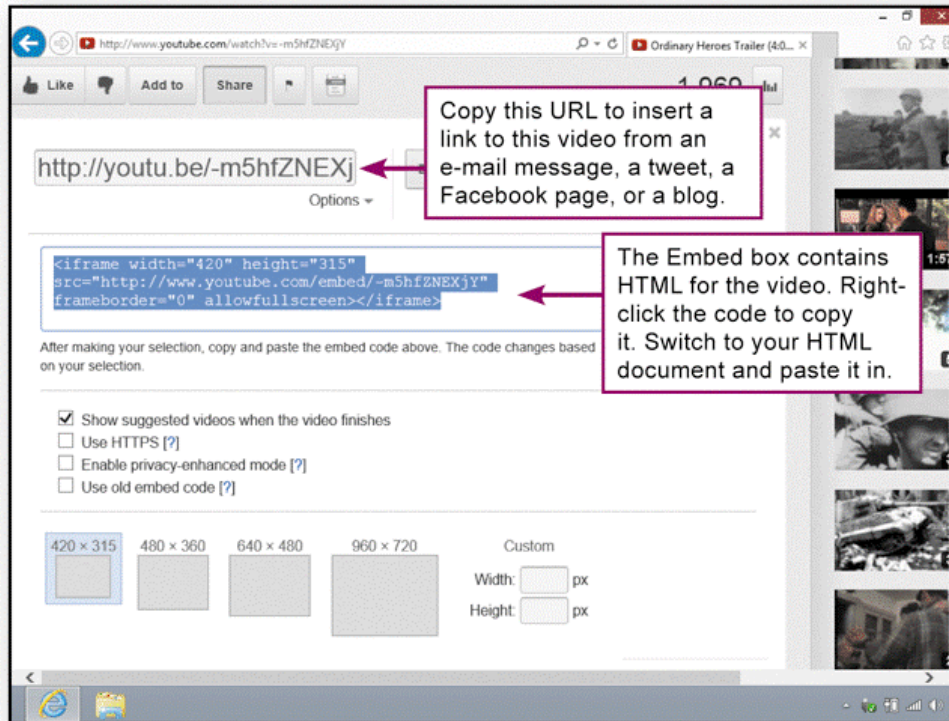


FIGURE 8-51

YouTube provides source code for embedding a video into your own Web page or sharing links on Facebook, Twitter, and other social networking sites.

Section E: Digital Rights Management

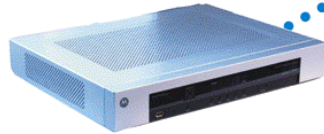
- Content Basics
- DRM Technologies
- Music DRM
- Movie DRM
- Ebook DRM
- Enforcement

Content Basics

- Media content (or simply content) includes television shows, movies, music, and books.
- Digital content is a term used for movies and other content that is stored digitally
- Consumers expect to be able to manipulate media content so that they can use it on multiple devices at a convenient time and place
 - **Time shifting**
 - **Place shifting**
 - **Format shifting**

Content Basics

- ▶ **Time shifting** is the process of recording a broadcast, such as a television show, so that it can be played back at a more convenient time.



myscissors/Shutterstock.com

FIGURE 8-54

Consumers want to be able to engage in time, place, and format shifting.



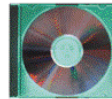
- ▶ **Place shifting** allows media that originates in one place to be accessed from another place without changing the device on which it is stored.



Place shifting is often achieved using computer networks, as when you stream a movie from your computer to your Wi-Fi equipped DVD player to your Wi-Fi equipped HDTV.



- ▶ **Format shifting** is the process of converting media files from a format suitable for one device to a format suitable for a different kind of device.



A common use of format shifting is ripping audio tracks from a CD and converting them into MP3 format for playback on a portable media device, such as an iPod.



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DRM Technologies

- Digital rights management (DRM) is a collection of techniques used by copyright holders to **limit access to and use of digital content**
 - Apple's FairPlay
 - Microsoft's Windows Media DRM
- **Authentication** is a very simple form of digital rights management that allows content to be accessed only by authorized individuals
- A **digital watermark** is a pattern of bits, inserted at various places in an image or a content stream, that can be used to track, identify, verify, and control content use

Music DRM

- Between 2000 and 2005, the recording industry produced copy protected CDs that did not play correctly on computers or when copied
- Ripping tracks from these CDs is difficult, but not impossible
- It is easier to protect streamed content than downloaded content

Movie DRM

- CSS (Content Scramble System) is a digital rights management technology designed to encrypt and control the use of content stored on DVDs
- The primary DRM technology for Blu-ray discs is AACCS (Advanced Access Content System)

Movie DRM

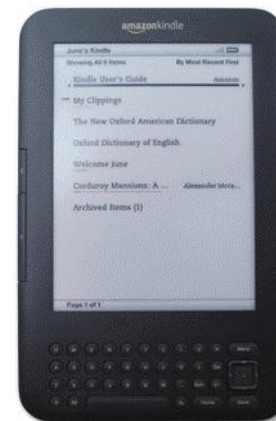
- Movie downloads tend to have more rigorous DRM protection than music downloads
- Streaming movie DRM technologies
 - Encryption
 - HDCP
 - HDCP (High-bandwidth Digital Content Protection) is a hardware-based DRM technology that requires compliant devices for content playback

Ebook DRM

- Early DRM efforts for ebooks tied books to dedicated ebook readers
- In response to consumer demand, ebook distributors expanded the platforms on which digital books can be read

FIGURE 8-61

Ebooks can be displayed on a dedicated reader, such as the Kindle, which handles digital rights.



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8

Enforcement

- Digital content has copyright rules!
- The copyright owner is entitled to recover monetary damages resulting from infringement, and any profits made from illegal sales of the work

Last week isohunt.com was shut down and settled to pay \$110 million.

<http://www.vancouversun.com/business/Vancouver+pirate+website+isoHunt+shut+down+owner+ordered+million+fine/9053780/story.html>

Chapter 8 Complete

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