ACTIVITIES 4

CROSS-CURRICULAR EXTENSIONS

1. **MATHEMATICS** Use the documentation for spreadsheet software to find out about other mathematics calculations that can be made besides addition, subtraction, multiplication, and division.

2. **SCIENCE** Make a display of electronic computer components and label each part using word-processing software.

3. **COMMUNICATION** Make a database of the favorite movies, sports teams, school subjects, and so on of your friends. Sort and place the results in a display.

EXPLORING CAREERS

As computers evolve, people who produce, operate, and repair them must become more knowledgeable. The following careers are important in the computer industry.

Technical Writer Technical writers create the user manuals that come with new computers or peripherals. Other technical writers create the words that appear on your computer screen. Technical writers need excellent writing skills. If they don't understand the technology, they must ask questions until they figure it out.

Computer Support Specialist
Computer support specialists take care of calls from customers who are having trouble with their computers or software. These specialists may also visit a site to help install computers or troubleshoot problems. Customers must be satisfied and treated well, so being able to work with people is important for this job. To be successful, specialists must keep up with current technology.
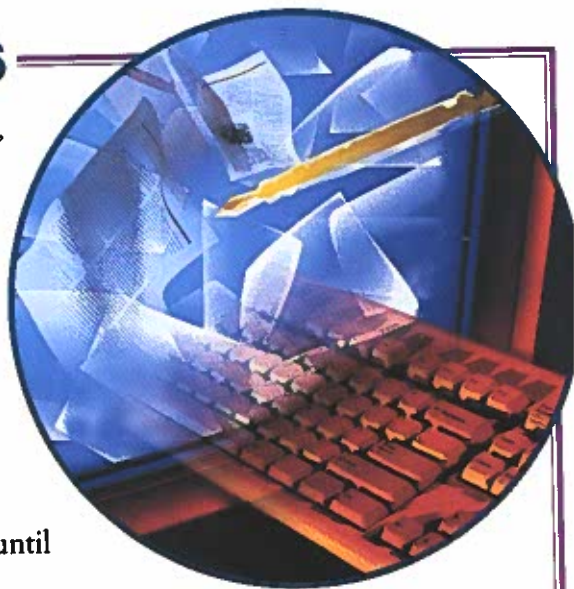
ACTIVITY

Write exact instructions for a person to use when placing a long distance phone call. Then ask a classmate to follow your instructions. Were your instructions clear?

CHAPTER 5

Using Computers

Beyond the Basics

THINGS TO EXPLORE

- Identify real-world uses for the computer beyond the basic word-processing, database, and spreadsheet applications.
- Explain how the computer has changed the way we do photography.
- Describe a use for computer simulation.

Techno Terms
digitizing
simulate
video conferencing

The computer is a very important tool in today's high-tech world. Beyond the basic applications of word processing, spreadsheets, and databases, you can use computers to do all kinds of things. For example, computers can be used to control input from temperature sensors in a research lab, train pilots, program robots, or access information from anywhere around the world.

Putting the Computer to Work

Computers have changed the way we do photography, the way we simulate, or model, real-world situations, the ways we communicate, and many other things.

In Photography You know that computers are good at number crunching (calculating numbers). It turns out photos can be changed into number values easily with a process called digitizing. **Digitizing** means to change into *digits*, or numbers. With a digital camera, you can capture still photos or video on a disk, memory card, or tape instead of film. Fig. 5-1. Because the photo or video is in digital form, you can use a computer to change it, print
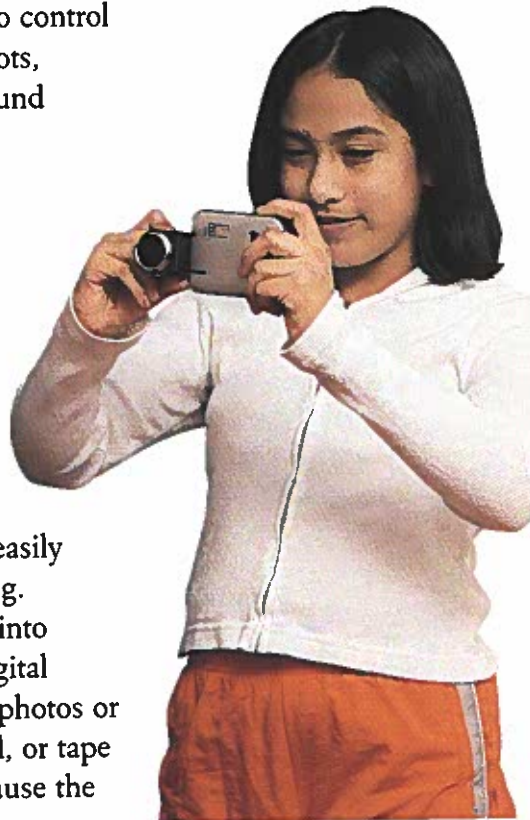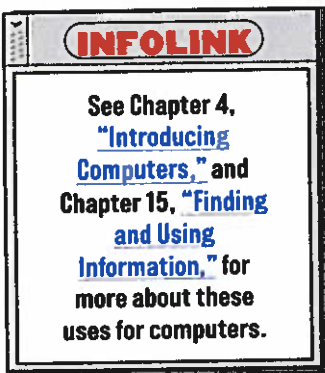
Fig. 5-1. Photos taken with a digital camera can be input into a computer. Compare the design of this camera with cameras used in the 1800s. How do they differ?

OPPOSITE Computers are creating excitement at the movies! By using computers, filmmakers can create almost anything they can imagine.

it, or send it electronically to another location. Another advantage is that you don't have to wait until an entire roll of film has been developed to see one particular picture. You can view the images instantly on a television, computer, or LCD (liquid crystal display). The LCD can be a separate monitor or a display attached to a digital camera.

In Simulations Computers are so good at manipulating images that they are often used to **simulate** (imitate) real life. People can create and test computer models and prototypes to decide whether a product will fit their needs before they spend a great deal of time or money building the real thing. For example, airplanes, cars, and buildings can be modeled as three-dimensional images on a computer. You can even test your performance on a product using computer simulations. Flight simulators, for example, can be used to train pilots to fly and to handle emergency situations. Race car drivers can make a practice high-speed run on a simulation to check their responses to different situations that might occur in a real race.

Fig. 5-2. These workers are holding a meeting with workers in another office far away. The two groups are connected by means of a computer network. What advantages do you think video conferencing offers to companies?
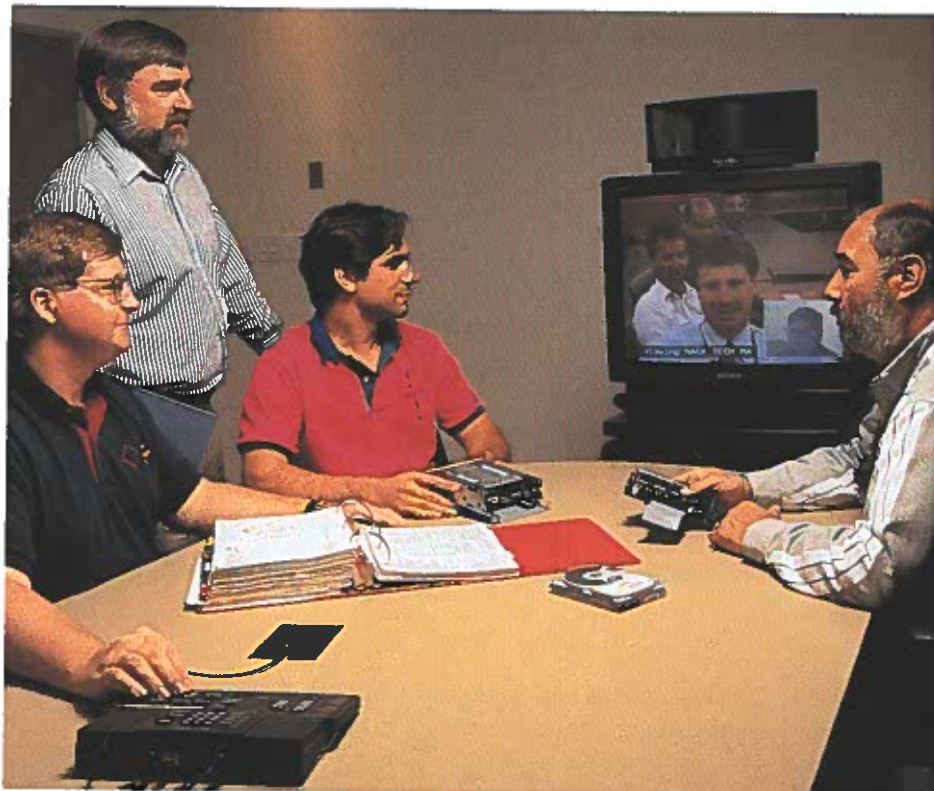
In Communications You can access high-quality pictures, animations, video clips, information, and computer simulations on the Internet (a worldwide network of computers). You can send and receive e-mail. Computers also are used in **video conferencing,** where video cameras hooked to the computers in a network allow people from all over the world to talk with each other at the same time. Fig. 5-2.

Throughout this book, you will have opportunities to use the computer in many activities. In this chapter, you will learn more about how computers are used in drawing, digital photography, and animation.

SECTION 1
TechCHECK

1. Name three ways computers are used beyond the basic applications of word processing, spreadsheets, and databases.
2. What does *digitizing* mean?
3. What is a simulation?
4. **Apply Your Knowledge.** Find out what kinds of simulation programs are available in your school.

John

are still a meeting going on tonight?

- 10:43 AM

Drawing with a Computer

THINGS TO EXPLORE

- Describe the advantages in using computers to design and draw.
- Explain how CAD and other graphics software programs are used in drawing and designing.
- Create a graphic using CAD or other graphics software.

TechnoTerms

clip art
computer-aided design (CAD)
computer-aided manufacturing (CAM)
graphics
pixel

The old saying "a picture is worth a thousand words" is really true. Adding pictures, or **graphics,** to your words makes a document more meaningful and exciting. Fig. 5-3.

Using Graphics

Drawing is an important form of communication. Engineers use drawings to show the circuits in computers or television sets. Architects make drawings to show contractors how to build structures and what materials to use. Technical illustrators make drawings to illustrate how to hook a video game to a television.

Traditionally, most drawings and sketches were done on paper. The work was often time consuming and difficult. Now the computer, along with graphics software, makes it easy to draw and design.

Fig. 5-3. This teen is creating her own graphics using special computer software. Try designing a holiday greeting card using a graphics program.

Graphics software programs allow you to make drawings using a mouse, a keyboard, or other input devices. You don't have to be an expert artist to use graphics software. There are many levels of graphics programs, from ones that let you use **clip art** (pre-drawn images) to very complicated **computer-aided design (CAD)** software.

The best part about drawing with a computer is that it is very easy to modify (change) your drawing. Not only can you erase easily, but you can also change the size or shape of things you have drawn.
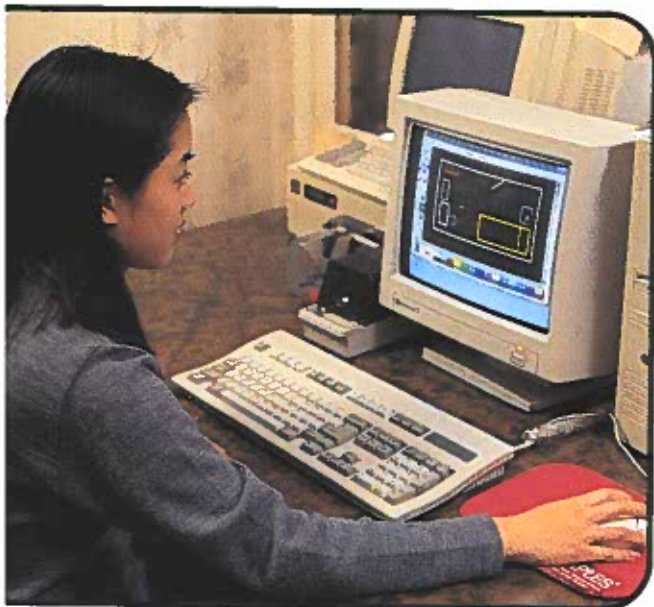
Fig. 5-4. CAD software provides users with many time-saving and other useful features. Here it is being used to create architectural details.

Using CAD

Today, many designers use computer-aided design, or CAD, software for product designs, technical illustrations, or architecture plans. There are many types of CAD software available for all users, from beginners to those who have had lots of specialized training. Fig. 5-4.

CAD has several advantages over traditional drawing or drafting. You can make drawings more quickly. For instance, if you are designing a home that needs the same door in several places, you can design the door once. Then you can copy the door graphic to any part of your design. You can also make your CAD drawing more accurate and neater than you can a hand-drawn design. CAD drawings can be accurate to more than 1/10,000 of an inch. That would be tough for a person to match!

CAD software also lets you see an object in three dimensions (height, width, and depth). This is an advantage to designers, architects, and engineers. For example, architects may design a floor plan for a house. A floor plan shows the house from above, as if you were looking down on a house that had no roof. It is difficult to picture in your mind how the house will look when you have only a flat drawing of it. With CAD software, you can see the rooms on the computer monitor as if you were standing inside or outside them. Some programs actually let you "walk" through the house! Fig. 5-5.

TechnoFact

PIXELS The images on a computer screen are made of tiny rectangles called pixels. The word *pixel* stands for "picture element." Each pixel can have its color changed or can be erased using software. A common computer screen might be 1024 pixels wide and 768 pixels high. That makes 786,432 little rectangles on your screen. Imagine having to change each of these pixels by hand!

Fig. 5-5. Architects help clients visualize how a house will look by creating a CAD simulation. In what ways do you think this benefits the architects themselves?

Fig. 5-6. This plotter is used to produce large drawings. What kinds of drawings might need to be this large?

TechnoFact

PLOTTERS Early plotters had many small pens. Instructions sent from the computer directed the movement of the pens. Today's plotters are actually large ink-jet or laser printers.

CAD drawings and other graphics can be saved to a computer file, added to other documents, and printed. Fig. 5-6. When a CAD drawing is sent directly from the computer to automated machines that make parts, the process is called **computer-aided manufacturing (CAM)**. The combination of CAD and CAM makes it possible to produce products quickly and inexpensively.

SECTION 2
TechCHECK

1. What is one advantage in using a computer for drawing?
2. What is CAD?
3. How can CAD help a designer?
4. **Apply Your Knowledge.** Ask a local architect who uses CAD if he or she will talk to your class.

ACTION ACTIVITY

Computer-Aided Design (CAD)

Real World Connection

Even if you can't draw a straight line with a ruler and a pencil, you can make very complicated drawings easily with a computer. Computer-aided design (CAD) or other graphics software makes it easy to draw lines and shapes. In this activity you will make a drawing with CAD or another graphics software program.

Design Brief

Make a drawing using CAD or other graphics software and a computer. You might choose one of the following ideas for your drawing or think of your own:

- Design and draw a school logo. A *logo* is a symbol that represents a product or company or, in this case, your school.
- Design and draw a floor plan for a house or school of the future.
- Design and draw a sign that reminds people to recycle waste materials such as aluminum, glass, or plastics.
- Design and draw a cover for a report. This cover might include a drawing of something related to science, social studies, mathematics, or art.
- Design and draw a cover for a CD or tape.
- Or better yet, think of your own!

Be sure to fill out your TechNotes and place them in your portfolio.

Materials/Equipment

- computer with CAD or other graphics software
- printer or plotter

SAFETY FIRST

- Follow the safety rules listed on pages 42-43 and the specific rules provided by your teacher for tools and machines.
- Avoid eye strain. Look away from the screen often. Refocus your eyes on distant objects.
- Avoid strain on your neck, back, arms, or wrists. Stretch frequently. Get up and walk around at least once an hour.

Procedure

1. Boot a computer with CAD or other graphics software.

2. Start your design using one of the suggested topics, or get your teacher's permission to do your own.

3. Experiment with erasing, moving, and resizing part of your design until you are happy with the way it looks.

4. Ask a friend to check your drawing. Look for things that will make the drawing better. Watch for overlapping corners, rough "freehand" curves, and so on.

5. Make any final corrections to your drawing.

6. Save your drawing.

7. Print or plot your design.

Evaluation

1. If you used clip art for your project, explain why.

2. Is it easier to change a drawing on paper or on a computer? Explain.

3. When you get used to drawing with CAD software, do you think you will go back to traditional methods? Explain.

4. **Going Beyond.** Use the documentation (instructions) for the software to find out how to make a scale drawing, duplicate objects, and use clip art images with your design.

5. **Going Beyond.** Do you think that great works of art will ever be made on a computer? Explain.

6. **Going Beyond.** Ask your teacher to show you the traditional tools used for drafting. Fig. A. Try to compare tools like T-squares, triangles, and compasses with their CAD counterparts. Which are easier and faster to use?

Fig. A.
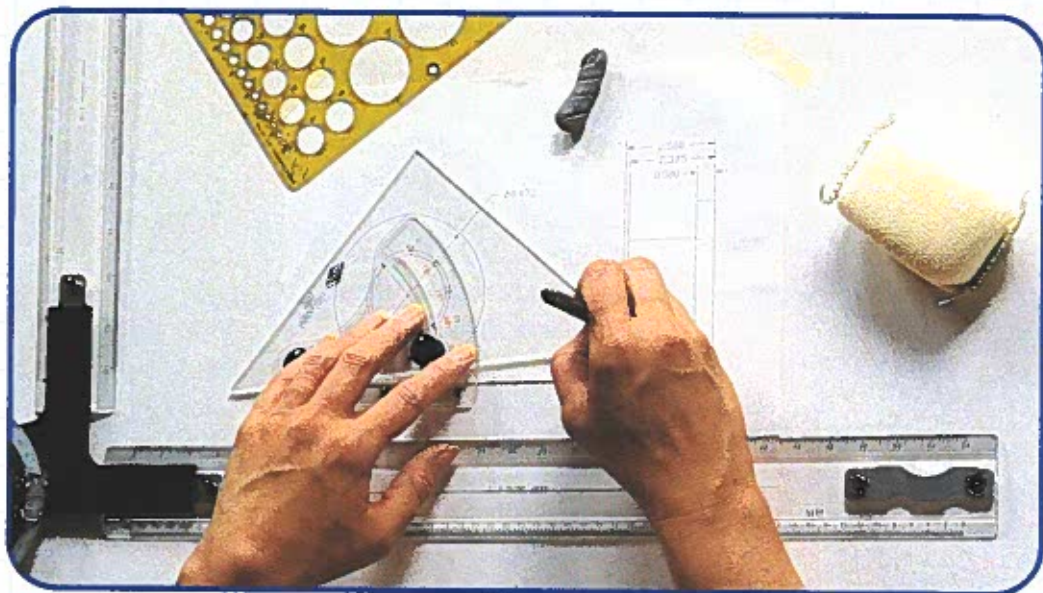
Using Digital Photography

- Explain how digital photography has changed the way newspapers are produced.
- Tell how digital photography works and how you can use it.
- Take digital photographs.

Techno Terms
cropped
download
negative
print

Today's news media want instant high-quality photos that can be **downloaded** (sent electronically) over phone lines using a modem or direct Internet connection. Computer technology has made it possible for still pictures to be transmitted electronically at incredible speeds. Thanks to digital photography, we can have "on-the-spot" pictures in today's newspaper from events happening around the world right now. Fig. 5-7.

Graphic Arts versus Desktop Publishing

Before digital photography, newspapers used a traditional graphic arts process to lay out each page of a paper. It took a lot of time. Photographers would use cameras to expose a light-sensitive film. The film had to be developed into a **negative** (reverse image) in a series of chemicals and then dried. **Prints** were then made by shining light through the negative onto light-sensitive paper. The photographic paper was then developed in another series of chemicals. Fig. 5-8. The finished print was dried and pasted onto a page along with the words for news stories. Another photograph was

Fig. 5-7. Digital photography makes it possible to download photos into a computer and print them out. Why do you think newspaper photographers are in a hurry to get their photos to the paper?
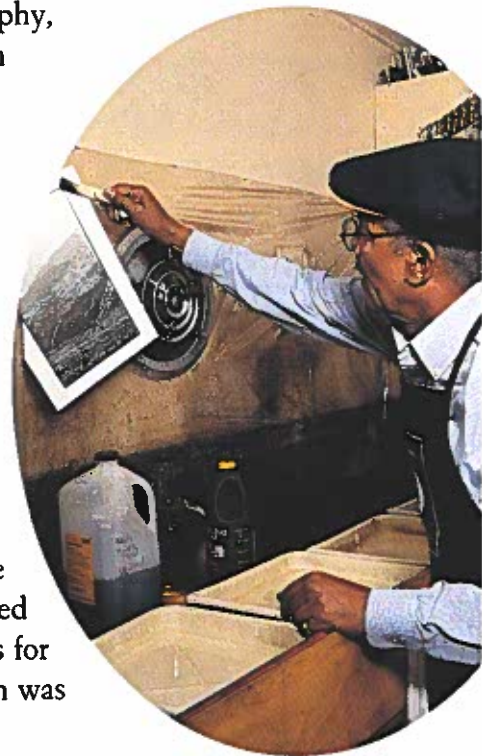
Fig. 5-8. Traditional photographic prints are made by placing the exposed paper in a series of chemicals. (Note the trays in this photo.) The finished print is then hung up to dry. Find out which chemicals are used and how they work. Report your findings to the class.
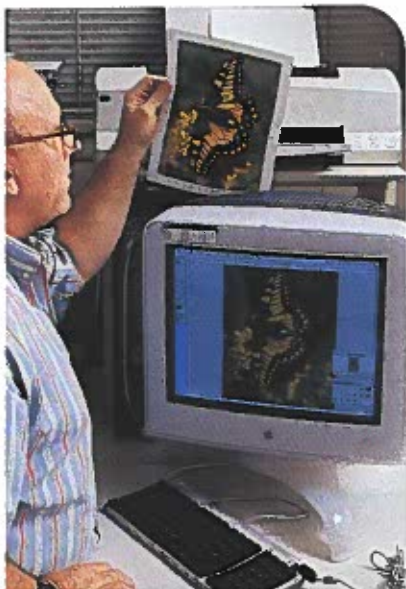
Fig. 5-9. The digital camera on the right can be hooked up to the computer. The photos can be downloaded directly into a page layout. **Using special software, such as Photoshop, make changes in a sample photo so it can be used in a greeting card.**

taken of the "camera-ready" page by a process camera and developed into a negative. Finally the negative was used to expose a printing plate for use on a printing press.

Compare that process with today's methods. Digital photography is all electronic. Instead of having light expose film, the light is focused on a light-sensitive chip called a CCD (charged coupled device). Digital photographs can be **cropped** ("cut" to remove unwanted background) on the computer. The finished digital photo can be electronically pasted into the page along with the news stories created by word processing. Finished printing plates are made directly from the computer file. This entire process, called desktop publishing, takes much less time. Fig. 5-9.

> **INFOLINK**
>
> See Chapter 4, **"Introducing Computers,"** for more about desktop publishing.

Digital Photography and You

If you have a digital camera, you can send photographs through electronic mail or post them to a website for others to enjoy. You can easily change them, and you can add them to cards or letters. Your yearbook team can even make a digital yearbook. Yearbook photographers can provide the school pictures on CDs. The digital pictures can then be put into a yearbook using desktop publishing software.

SECTION 3
TechCHECK

1. How has the use of digital photography changed the way newspapers are produced?
2. What is a CCD?
3. How can you use digital photography?
4. **Apply Your Knowledge.** Check with your local newspapers to see how they use digital photography.

ACTION ACTIVITY

Digital Photography

Real World Connection

Digital photography is changing the speed with which still images and video are recorded and edited. This is important to the news media who need information and photos as quickly as possible. In this activity, you will learn to take digital photographs. Fig. A.

> Be sure to fill out your TechNotes and place them in your portfolio.

Design Brief

Use a digital camera to take photographs. Download the digital photos to a computer. Select the best one and adjust the photo using computer software. Print the finished photo.

Materials/Equipment

- digital camera/cables
- computer
- graphics software

SAFETY FIRST

- Follow the safety rules listed on pages 42-43 and the specific rules provided by your teacher for tools and machines.
- Using a digital camera isn't dangerous, but you need to be careful to prevent damaging the expensive equipment. Use the neck strap to avoid dropping the camera accidentally. Use a tripod to steady the camera. Be careful not to trip over the tripod legs.

Fig. A

Procedure

1. Ask your teacher to demonstrate the controls on your school's digital camera. Be sure you know how to do the following:
   - Turn the camera on and off
   - Focus, use flash, and zoom
   - Preview the photographs you have taken
   - Delete (erase) unwanted photos
   - Download to a computer
2. Take a series of 5 to 10 photos that demonstrate your ability to compose a good photo. Remember to fill the frame with the subject. Use a tripod to steady the camera.
3. Download your photos to a computer. Using graphics software designed to work with pictures, do the following to your best shot:
   - Crop unnecessary background, or outline the subject of the photo
   - Adjust the brightness and contrast of the photo to increase its quality
   - Use special effects to create a more interesting photo
   - Correct the color if needed. Fig. B.
   - Print the finished photo

Evaluation

1. What does it mean to download a photo?
2. What does it mean to crop a photo?
3. Can you use all the functions of the camera your teacher wants you to use?
4. **Going Beyond.** Use graphics software to cut and paste people from one photo to another.
5. **Going Beyond.** Find out how your school yearbook is made. Could digital photos be used in your yearbook?

Fig. B

Color Balance

Original

More Green   More Yellow

More Cyan   Current Choice   More Red

More Blue   More Magenta

Animating with Computers

THINGS TO EXPLORE

- Define persistence of vision and explain how it is used in animation.
- Describe the difference between making a traditional animated movie and making a computer-animated movie.
- Create framegrabs to make a claymation.

TechnoTerms

cell
claymation
frame
in-betweening
persistence of vision
tweening

D id you know that when you watch TV you are looking at thirty still pictures each second? The individual still pictures in live TV or on videotape are called **frames**. Each frame is a complete picture that is scanned onto the inside of a cathode ray tube (CRT)—sometimes called a picture tube—in computer monitors as well as TVs.

Use a stopwatch to try to count to thirty in one second. Can't do it? Don't feel bad; nobody can. Your brain is unable to process the information fast enough. When you watch TV, you can't see the individual still pictures because they are changing so fast. Your brain thinks you are watching moving pictures. This effect is called **persistence of vision**. Persistence of vision is also what makes animation possible.

In animation, the characters are drawn a little differently in each frame, or **cell.** When the cells are displayed quickly, the characters appear to move.

This artist is working on a computer-animated figure of a bird. Most animation today is done with computers.

Animation Today

Animations, like Disney's *Snow White,* used to be handmade by many artists drawing thousands of high-quality images. To make the process go faster, artists drew the characters with larger than normal movements. Other artists, called "in-betweeners," filled in the steps needed to make smooth motion. The finished paintings, called cells, were photographed one at a time using movie film.

"Bunny" © 1998 Blue Sky Studios, Inc.

Fig. 5-10. This scene was not created using real figures. It is completely computer generated. Have you seen a completely computer-generated film? What elements made it look real?

Today, we can use the power of computers to do the same process much faster. The basic cells are drawn on the computer by the artist. Then software is used to automatically create the cells needed in between. This process is called **in-betweening,** or just **tweening**. Artists who use animation software can transform drawings into images that look incredibly real. Fig. 5-10.

COMMUNICATION CONNECTION

Talking Tech

Computer technology is sometimes confusing because many acronyms and abbreviations are used. An acronym is a word made from the beginning letters of other words. Here is a list to help you.

bit	=	binary digit
byte	=	eight bits
CAD	=	computer-aided design
CAM	=	computer-aided manufacturing
CD-ROM	=	compact disk read only memory
CD-RW	=	compact disk read and write
CIM	=	computer-integrated manufacturing
CPU	=	central processing unit
DTP	=	desktop publishing
DVD	=	digital video disk
Gb	=	gigabyte (1024 megabytes)

What Is Claymation?

One specialized form of animation called **claymation** uses clay figures that seem to come alive. You have probably seen claymation used in commercials for TV. It takes many hours for artists to adjust the scenes and characters by small increments (amounts). A computer can be used to store and quickly play back the individual pictures, called *framegrabs*.

SECTION 4
Tech CHECK

1. What is persistence of vision?
2. How is computer animation different from traditional animation?
3. What is claymation?
4. **Apply Your Knowledge.** Watch for television commercials that use claymation. Record them and share them with your class.

IC	=	integrated circuit
K	=	kilobyte (1024, or 2^{10}, bytes)
Mb	=	megabyte (1024 kilobytes)
MIDI	=	musical instrument digital interface
modem	=	modulator/demodulator
PC	=	printed circuit (also, personal computer)
RAM	=	random access memory
ROM	=	read only memory
WYSIWYG	=	what you see is what you get

ACTIVITY

Make your own acronyms for things or events around school. Share them with the class.

ACTION ACTIVITY

Computer Animation

Real World Connection

You have seen animated cartoons, but have you ever thought about the technology behind making them? In this activity you will make your own claymation sequence. Fig A.

Design Brief

Plan and produce a claymation animation using computer and video technology. Your claymation should last about ten seconds and have a backdrop and movable characters.

Materials/Equipment

- computer with VIDEO IN and OUT
- animation software
- colored paper rolls
- modeling clay or plastic models
- markers
- lights
- camcorder and tripod

SAFETY FIRST

Follow the safety rules listed on pages 42-43 and the specific rules provided by your teacher for tools and machines.

Fig. A

Procedure

1. Work in small groups of two to four students. Plan your animation to last about ten seconds.

2. Use colored paper or other props to make a backdrop for your characters.

3. Make your characters out of modeling clay, or use plastic action figures that have moveable arms and legs.

4. Set up a camcorder and a tripod. Connect the camcorder's VIDEO OUT to VIDEO IN on your computer.

5. Adjust the lights to make realistic shadows. Check with your teacher to find out which lights to use and how to set them up.

SAFETY FIRST

You will need to use bright lights to make your animation. Lights can get very hot and could cause burns. Be careful not to touch the hot lights or trip on power cords.

6. Create the first scene. Use software to take each picture, or framegrab. Save all of your framegrabs in one folder or directory. Ask your teacher how many framegrabs you can save. You can save time by using the in-betweening feature of animation software.

7. Use animation software to assemble all of your framegrabs into a movie. Play your movie and make adjustments as needed.

Evaluation

1. Why is it easier to animate using a computer than using hand-drawn cells? Fig. B.

2. How many framegrabs did you record when making your claymation sequence?

3. If you were going to do this activity again, what would you change?

4. **Going Beyond.** Add sound to your animation.

5. **Going Beyond.** Design, plan, and animate a science fiction story using plastic models and black paper for a background.

6. **Going Beyond.** Use computer graphics software to add special effects to your animation.

Fig. B

REVIEW &

CHAPTER SUMMARY

SECTION 1

• Computers can be used for many jobs beyond the basic applications of word processing, spreadsheets, and databases. Digital photography, simulations, and video conferencing are some of these other uses.

SECTION 2

• Graphics software makes it easy to draw and design.

• Computer-aided design (CAD) is an important tool used by engineers, architects, technical illustrators, and others.

SECTION 3

• Digital photography uses a CCD and is all electronic.

• In desktop publishing, a finished digital photo can be electronically pasted into the page along with the news stories created by word processing.

SECTION 4

• Persistence of vision is what makes still pictures appear to move.

• Animations, like Disney's *Snow White,* used to be handmade by many artists drawing thousands of high-quality images. Today, computers make the animation process much faster.

REVIEW QUESTIONS

1. How do computer simulations help in testing products?

2. Why is a computer a good tool to use in digital photography?

3. Why might an architect use CAD?

4. Why does the traditional graphic arts process take longer than desktop publishing?

5. What are the individual still pictures in live TV or on videotape called?

CRITICAL THINKING

1. If it is so easy to change photos, how can you be sure that what you're seeing in any photo is real? What effect do you think this technology has had on photographic evidence used in court?

2. Describe the process of in-betweening in animation.

3. List as many uses for computers as you can.

4. Why do you think using digital cameras makes it easier to do commercials and news shows?

5. Why do newspapers need photographs and information faster now than they used to?