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# Technology and You—An Introduction



**Better by  
Design**

## Designers make life better

The Better by Design page in each chapter features designers who have developed products to make people's lives better. Study the products presented in each chapter. Have these designers succeeded?





**Compare and Contrast** As you read this chapter, make a list of tasks you perform every day that require the use of technology. Think about how your life would be different without this technology. Then use the Reading Target graphic organizer at the end of the chapter to organize your thoughts about what you have read.

*designing  
engineer  
engineering  
green technology  
hypothesis  
science  
scientific method  
scientist  
technologist  
technology*

**Key Terms**

**Reading Target**

**Objectives**

- After reading this chapter, you will be able to:
- Describe how technology affects daily life.
  - Recognize the broad range of technological products.
  - Recall examples of technology in various historical periods.
  - Explain the relationship between technology and science.
  - Describe the benefits and disadvantages of technology.

**Useful Web sites:**

[www.inventors.about.com/od/timeline/Timeline\\_of\\_Invention\\_and\\_Technology.htm](http://www.inventors.about.com/od/timeline/Timeline_of_Invention_and_Technology.htm)  
[www.historyoftechnology.org/](http://www.historyoftechnology.org/)  
[www.scientificmethod.com/](http://www.scientificmethod.com/)

Designing and making products has long been one of the most important human activities. See [Figure 1-1](#) and [Figure 1-2](#). In the last 100 years, people have invented air conditioning, the electric guitar, television, jet planes, the microwave oven, cell phones, digital cameras, e-mail, and the Internet. Technology has completely changed the way we live. As new products are invented, they change society and create new needs and wants. The products people design and make are often good solutions to problems. Sometimes, however, the solutions are barely adequate, and other times they fail entirely.

## Understanding Technology

*Designing* is the creative process for generating and developing ideas for new and improved products and services that satisfy people's needs. *Technology* includes the tools, materials, and processes used to make the designed products. These products allow us to do things we could not do without technology. They help us lead more comfortable and productive lives. When new products are developed to solve specific problems, the process is often called *engineering*.



**Figure 1-1.** Well-designed products focus on the user. Explain why one bottle is a better design than the other.



## One Day without Technology

Imagine that you are living thousands of years ago. You wake up when the sun rises. There are no alarm clocks to ring. You would crawl out of your bed—a pile of animal skins spread over branches cut from trees. Your animal skin clothing hangs loosely around your body. There are no zippers, Velcro™, or even strings to fasten them. Leaving your cave, you find that a pile of fallen rocks has partially blocked the entrance. You move the rocks by hand. There are no carts, and the wheel has not yet been invented. What about breakfast? Want to make waffles or pour a bowl of cereal? No chance! There might be a leftover bone from yesterday's kill, but no microwave oven to reheat it. If your mouth still tastes of breakfast, too bad. Toothbrushes and toothpaste do not exist. You scrape congealed sap off the bark of a tree and chew it to freshen your breath. The day is warm and sunny, and you feel like taking the day off. Unfortunately, you can't if you want to eat. Your entire family spends most of each day collecting enough food to survive. Are you starting to appreciate the comforts and conveniences provided by modern technology? Technology plays a crucial role in our lives. Almost everything we do depends in some way on the products and services that form our technological society. These products and services are frequently the result of very complex technologies. Often we take them for granted. It is only when we stop to consider what we do each day that we realize how important technology is to us.

**Figure 1-2.** Function is another important design consideration. Look closely at the bottoms of these cups. Why is one cup a better design than the other?



## One Day with Technology

How important is technology to you? How much do you depend on it? Think carefully about some of the items you encounter during a typical day. See Figure 1-3.

Your day might begin when your digital alarm clock/radio comes on. The music you hear is transmitted (sent) from a station a distance away. You stumble out of bed into a hot shower. The flow and temperature of the water can be adjusted. You style your hair and clean your teeth with plastic brushes. Your clothes are made from a mixture of natural and synthetic fibers.

In the kitchen, Figure 1-4, you prepare your breakfast using a variety of appliances. Toast is ejected from the toaster. The electric kettle shuts off when the water boils. A microwave oven cooks your bacon for a preselected period of time.

Before leaving the house, you dress in clothing made from waterproof synthetic fibers. As you leave, the timer built into the thermostat automatically lowers your home's temperature. If you live in an apartment building, you press a button to summon an elevator. Pressing a second button takes you to the ground floor. Once there, the doors open automatically. You leave the building through a front door controlled by an electromagnetic lock.

You may use a bicycle, bus or subway train to travel to school. See Figure 1-5. Your classroom uses electric lighting and may be heated by natural gas. The tables, desks, chairs, and cabinets have been made in a factory and transported to the school. The room is probably equipped with a computer, data projector, DVD player/recorder, and public address system. Normally, we give little thought to these technological products and services on which we rely. However, think about them for a moment. How do they influence your life and the environment in which you live?



**Figure 1-3.** Even within the last 10 years, technology has changed the way we live and work. What products do you use for communication throughout your day?



**Figure 1-4.** Kitchen appliances help us prepare meals faster and with less effort. What products do you use to prepare food throughout your day?

**Figure 1-5.** Transportation technology makes it possible to live, go to school, and work farther away from home. What products and services do you use for transportation throughout your day?



Are you starting to recognize your dependency on the products of technology? Today, most people lead very “technological” lives. You have seen that, even during the first few hours of your day, technology is basic to your comfort and way of life. Are there any activities that do not depend on technology?

## Technology's Effect on Health

Your health depends on medical technology. For example, dentists use a variety of tools and equipment to repair, replace, straighten, and keep your teeth in the best possible condition. See **Figure 1-6**. Surgeons replace damaged heart valves with valves made of metal and plastic. Diabetics can wear a tiny, computer-controlled infusion pump. The pump delivers a timed supply of insulin to the wearer. See **Figure 1-7**. Such advances in medical care help us lead healthier and happier lives.



**Figure 1-6.** Most people pay an occasional visit to the dentist. Technology also provides other health care products you use every day. What products and services do you use to maintain your health throughout your day?

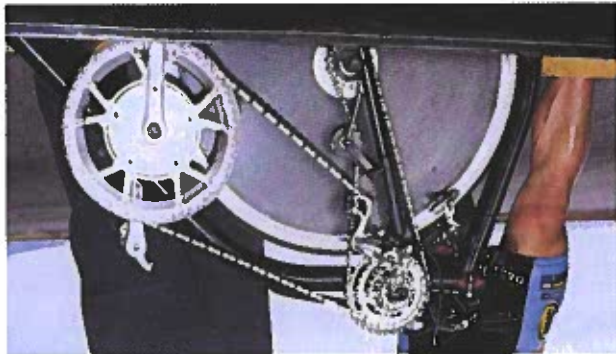


**Figure 1-7.** Some advances in technology allow people to manage diseases more easily. What does the designer need to think about when designing new medical equipment?



## Technology for Leisure

Even in your leisure time, the products of technology surround you. Using a cell phone with wireless Internet access, you may decide to check movie listings, verify bank funds, or buy gifts, all while traveling home on a bus. Computer-designed tennis racquets made of fiberglass, graphite, or ceramic have replaced the older laminated wood. Recumbent (lying back) road-racing bicycle frames like the one in Figure 1-8 are made of epoxy-glued aluminum or carbon fiber. They have a mass of less than half the average steel bicycle frame. Jogging and ski suits are made of fabrics that keep out wind, rain, and snow, yet allow perspiration vapor to escape.



**Figure 1-8.** This recumbent bicycle is designed for speed. What factors reduce its wind resistance?



# A Brief History of Technology

Before humans designed and made technological products, their world must have appeared to be very small. For example, their view was limited to the height of the trees they could climb. Travel was limited by the distance their legs could carry them. Communication was limited by the distance their voices could carry.

Then, about two million years ago, humans made the first tools. They discovered that when a large pebble is struck with great force against another stone, pieces flake off. The sharp cutting edges formed in this manner could be used in axes, clubs, spears, and scrapers. See **Figure 1-9**.

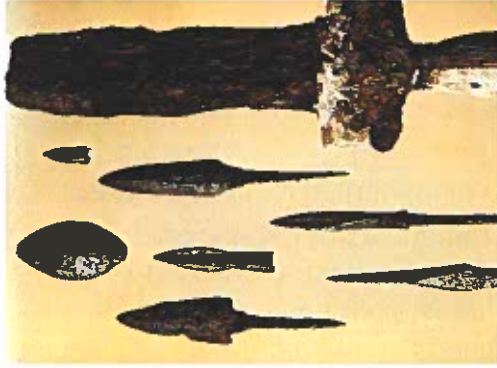
Early hunters followed bison and mammoth across the frozen Bering Strait into North America, where they settled the Great Plains nearly 15,000 years ago. They were nomadic, obtaining their food by hunting and gathering. In 6000 B.C., they developed agriculture and domesticated animals. Stone tools became highly refined. About 2000 B.C., stone tools gradually gave way to tools cast in copper and bronze. See **Figure 1-10**. Later still, about 1000 B.C., iron began to replace copper and bronze. Iron was repeatedly heated and hammered to make ornaments, tools, and weapons.

Simple pulleys and levers were first used in Egypt and Mesopotamia. Later, Greek and Roman engineers developed these machines further. In the period AD 1–1399, many of the technological products with which we are familiar were first developed, including clocks, pants, porcelain drinking cups, skates, and pens.

Beginning around 1450, a great explosion of scientific and technological creativity took place in Europe. This came about partly due to Gutenberg's use of movable type in printing that made books more readily available. At around the same time, it became acceptable to use everyday languages, rather than Latin, for writing and communicating ideas.



**Figure 1-9.** A spear point made from flint. Chipping away stone from both sides shaped the edges.



**Figure 1-10.** About 4000 years ago, humans learned how to cast tools from metal. These are examples of their craft.



## Science Application

### The Scientific Method

Sir Francis Bacon developed a method of inquiry in 1620 that is now known as the **scientific method**. This method has influenced every scientist since its publication. In the scientific method, scientists collect masses of facts by observing and experimenting. Then they analyze the facts and state a **hypothesis**—a guess or suggestion to account for the facts. Finally, they try to verify the hypothesis by further investigation, eventually forming a theory.

The scientific method can be applied to just about any type of technology. For example, you could use the scientific method to develop and attempt to verify a theory about something related to cell phone use. Have you observed how some people seem to act differently when they acquire a cell phone? Cell phones can cause people to change their habits in a number of ways:

- Freedom for the user (a person is not tied to a landline)
- Time and space (contact can be made at any time from almost any place)
- Sense of community (groups of “cyber friends” can extend connections)
- The way people interact with friends (there is less face-to-face communication)
- Sense of privacy (phone conversations happen in public and private spaces)

### Science Activity

Follow these steps to create and test a theory using the scientific method:

1. Decide on a topic that is specific to cell phone use. Choose something that you have seen, but you are not sure if the actions of a few people are typical of the general population. What have you observed related to cell phone use?
2. Make a hypothesis that could explain what you think is generally happening.
3. Decide how you will organize a controlled experiment so as to reach a conclusion. Where will you find the information you want? How will you record it?
4. Carry out your experiment and record the results.
5. Analyze your results. Were you able to verify your hypothesis? If not, don't be concerned. It sometimes takes scientists many rounds of hypotheses and testing to prove or disprove a theory.



In the 1700s, the number of inventions increased dramatically. Many of these inventions were machines run by a new power source, the steam engine. This led to the Industrial Revolution. Applied to railways and ships, steam power completely changed transportation.

The start of the twentieth century also marked the first time most people saw or used automobiles, airplanes, telephones, radios, and electricity. The rate at which inventions appeared continued to increase. By the end of the twentieth century, inventions included nuclear reactors, synthetic fibers and industrial robots, suspension bridges and hydroelectric dams, telephones with storage memory, compact discs, microwave ovens, digital sound systems, portable computers, DVD players, and space shuttles.

Some of the most important inventions are summarized in **Appendix A**. What conclusion can you draw about the rate at which inventions have occurred? Remember that human evolution has developed over about 4 million years or 50,000 generations, but television and computers have been around for only 2 generations. What might happen in the next 10 generations?

## How Science and Technology Are Related

Science and technology are often confused with one another, but they are very different. *Science* is the study of the laws of nature. *Scientists* (such as biologists, chemists, physicists, and oceanographers) try to discover and understand the natural world. See **Figure 1-11**. While some scientists gaze into microscopes, others record the songs of dolphins, look for undiscovered stars or planets, or piece together dinosaur skeletons. Scientists ask the questions: Why is the natural world as we see it? How did it come to be?

Technology, on the other hand, is concerned with the human-designed world. *Technologists* (designers, inventors, *engineers*, and craftspeople) design and make products and services that improve the designed world and fulfill human needs. See **Figure 1-12**. The products include everything from kitchen knives to jumbo jets. They range from the products we all use, such as toothbrushes, to products such as a dentist's drill that few people use. Services also range from small to large. A service may be as small as giving instructions for assembling furniture or as large as maintaining an airport system.

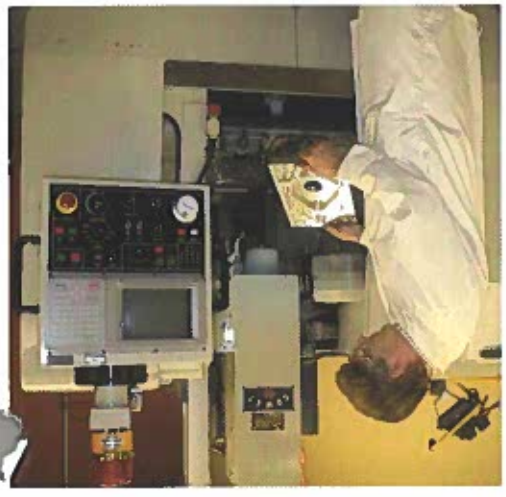
People often assume that scientific knowledge came before technology. This is not true. Many technological advances came before the understanding of the principles behind them. For example, the wheel and axle were used long before humans understood the physical principles governing levers.

- These examples will help you to understand the relationship between technology and science:
- Technologists invented and built the early telescopes. Scientists used these telescopes to observe and calculate the distance from Earth to the planets. In turn, these scientific observations were used by technologists in the design of space vehicles.
  - Scientists study the flow and formation of rivers. Technologists design and build dams across rivers.
  - Technologists built the first steam engines. Scientists studied these engines to develop the laws of thermodynamics.
  - Scientists study the causes and control of diabetes. Technologists design and build portable, computer-controlled insulin pumps for diabetics.
  - Technologists shape glass into tubes, bottles, and flasks. Scientists use these objects in experiments to analyze the chemical composition of substances.
  - Scientists study atomic theory. Technologists use atomic theory to build nuclear power stations.

**Figure 1-11.** Scientists work to provide reliable knowledge of natural processes and events.



**Figure 1-12.** Technologists use tools and materials to make products that improve people's lives.





## Think Green

### Green Technology

In recent years, people have become more aware of the impact of technology on our environment. *Green technology* is a general term for technology that is environmentally friendly or that helps conserve resources. It includes the development of both processes and materials. Throughout this book, we will be looking at several examples of green technology.

As you read the section “Technology: For Better or Worse?,” think about environmentally friendly alternatives. Can you come up with ideas that might allow us to keep the benefits of technology while removing or reducing the negative impacts?



## Technology: For Better or Worse?

For the most part, technology has improved the quality of our lives. We live longer, healthier lives, and we have more goods and services. However, no matter what the benefits of any new technology, history shows that technology can also cause problems. See **Figure 1-13**. Technology is neither good nor bad. However, the ways in which humans use the product can have good or bad effects. For example, some of the most important technologies of the 20th century were electricity, the telephone, and the internal combustion engine. But not all of the changes they brought about were beneficial.



**Figure 1-13.** As world demand for oil increases, wells are being dug in controversial places.

Some benefits we can probably agree on. Almost all of us like the comforts these technologies bring: electricity to warm or cool homes according to the season, a phone to call our friends, and quick transportation to stores or movie theaters. But these comforts have a cost. Pollution is caused by burning coal to generate electricity, the constant ringing of telephones can disrupt our quiet times, and car accidents can result in injury or death. In the end, people have to decide whether the positive effects of a specific technology outweigh the negative effects.

Take a moment to think about some of the technologies you use each day. For example, you may use a cell phone, television, video games, computers, and the Internet. These devices often replace real-world experiences. Does this mean that our modern world is becoming a society detached from reality? Are we living in a virtual world? What are the advantages of meeting a friend face-to-face, sharing a favorite drink, or watching a campfire, rather than accessing Facebook or Twitter? Over the last few decades, obesity has become more common in all age groups. Might this be because people spend long hours connected to computers or televisions, with snacks at hand? See **Figure 1-14**.

**Figure 1-14.** Technology influences the way we spend our leisure time. What are the positive and negative effects of the technologies we use for fun?



Technology has been around as long as humans. Even the very earliest humans tried to make their world better by designing tools and processes to meet their needs. Over hundreds of years, people have continued to build on earlier ideas to create new or improved products.

Tomorrow, who knows? Technology holds the keys to many world challenges. Throughout your life, you will share the exciting opportunities for designing new products. Remember, though, that you also share the responsibility to create and use those products wisely.

End  
Note



- Write your answers to these review questions on a separate sheet of paper.
1. What is technology?
  2. What is the relationship between technology and the "designed world"?
  3. What areas of human behavior and activities have been changed by technology?
  4. How might engineering and technology affect social and cultural values?
5. What do you consider to be the most important product designed in each of the following time periods? Explain why you think each product is important.
- A. 500,000 to 10,000 B.C.
  - B. 10,000 B.C. to 1 B.C.
  - C. AD 1 to 1400.
  - D. 1401 to 1700.
  - E. 1701 to 1850.
  - F. 1851 to 1900.
  - G. 1901 to 1945.
  - H. 1946 to 1999.
  - I. 2000 to present.

# Test Your Knowledge

Task	With Technology	Without Technology
Example: Wake up in time for school	Use alarm clock	Let the sun wake me up

**Compare and Contrast**  
 Copy the following chart to a separate piece of paper. In the Task column, list tasks you perform every day that require the use of technology. In the remaining columns, explain how you use the technology and what you would do if you did not have that technology. Add rows to the chart as necessary to list the tasks.

- The products and tools of technology greatly enhance our daily lives.
- The broad range of technological products affects every aspect of human activity.
- Over the last few centuries, the number of technological changes has increased dramatically.
- Science and technology are very different, but they often depend on each other.
- Technology itself is neither good nor bad. Human use of technology, however, can have good or bad effects.

## Summary

## Reading Target

## Test Your Knowledge *(continued)*

6. What statement can be made about the number of objects invented during different periods throughout history?
7. Briefly describe the relationship between science and technology.
8. List three examples of how technology has impacted society, individuals, and the environment.
9. What are the major advantages of technology?
10. What are the biggest disadvantages of technology?

## Critical Thinking

1. Choose a product you use every day. Think about the effects of this product on society in general. Consider social, cultural, political, economic, and environmental impacts. Write a one-page report on these effects. In your report, explain why you think the product's value to society does or does not outweigh its disadvantages. Be sure to use technical terms correctly.
2. Think about inventors you have learned about in other courses. How many were scientists? How many were technologists? Could any of them be considered both scientists and technologists? Explain your answer and give specific examples.

## Apply Your Knowledge

1. Make a model of a tool that might have been used in the first century B.C.
2. Select what you consider to be the most important product ever invented. Make a scrapbook to show its impacts, both positive and negative, on society.
3. Make a list of five products that have been designed and made since you were born. Is the number of products increasing or decreasing each year? Explain your answer.



# STEM Applications



1. **MATH:** Create a timeline to show a pictorial history of technological advances in one of the following categories:

- Food
- Shelter
- Clothing
- Transportation
- Communication
- Health

Use one or more poster boards or a long sheet of roll paper to allow space to place pictures of the items at their proper locations on the timeline. For each item you include, find out the year or century (for older items) in which the item was invented. Then decide on a scale for the timeline. For example, you may decide to allow 10 inches (25.4 centimeters) for every 10,000 years. Label the timeline accurately according to your scale. Place the items at their correct locations on the timeline.

2. **TECHNOLOGY:** Name five technical objects you believe will be invented 20 years from now. For each object, describe:
- A. How it will work.
  - B. Who will benefit from its use.
  - C. What potential problems may occur as a result of using it.

# Generating and Developing Design Ideas

The Aquaduct could help people in developing countries transport clean drinking water to their homes.

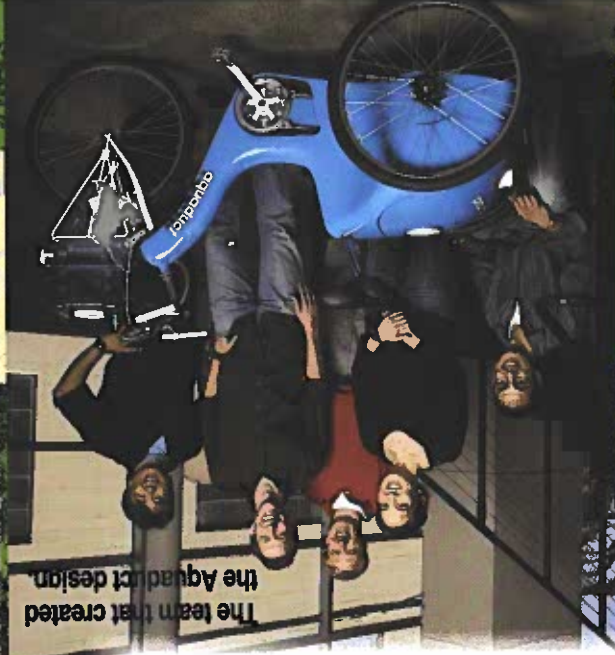


The IDEO team uses brainstorming to generate ideas quickly

In developing countries, people often carry heavy vessels over long distances every day to collect water. The water then has to be purified before it can be used. So the team at IDEO designed the Aquaduct, a cycle that allows a person to transport and sanitize water simultaneously. As the rider pedals, a pump attached to the pedal crank draws water from a large tank, through a carbon filter, and into a smaller, clean tank. The clean tank is removable and is closed for contamination-free home storage and use.

Where did the team get this good idea? The best way to have a good idea is to have a lot of ideas. The team used brainstorming to generate dozens of ideas for possible solutions very quickly. **Brainstorming** is a group problem-solving method of generating new ideas in which everyone's ideas are welcome—no idea is too crazy.

The team that created the Aquaduct design



"Designers can get good ideas by looking at existing products, books, and magazines, and by sitting quietly thinking, doodling, and sketching." —Tom Kelley, IDEO



Designers brainstorm at the start of a project.

Better by Design

CHAPTER 2