1.4 PERCEPTUAL BIASES OF THE EYE/BRAIN RELATIONSHIP

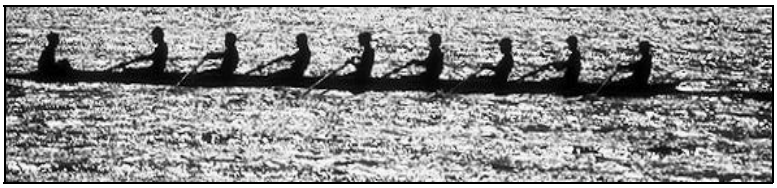

Figure 1.41 *What and how we see can be influenced by both biology and psychology*

[Man] does not see the real world. The real world is hidden from him by the wall of imagination.[10]

George Gurdjieff
Russian mystic, author

Specific Curriculum Outcomes

Upon completing this section, students will be able to:

- describe the biological and perceptual biases of the eye/brain relationship
- describe the subjective nature of sight
- demonstrate an understanding of the psychological and cultural factors affecting perception
- create images which utilize the perceptual biases of the eye/brain relationship.

Introduction

When you see, you cannot help but be involved in perception; an act that involves your brain. But what you see can be affected by several factors. One of them is biological. There are some things your eyes cannot see, such as gamma waves, x-rays, radio waves, infrared waves. Your eyes are capable of seeing only those wavelengths of light that fall within what is called the visible spectrum. You see images only when they are positioned in front of the face; some species can see in front and behind at the same time. People do not see well in low light, but owls, cats, and dogs do. Some of the things you see—and do not see—are the result of the unique physical characteristics of human vision.

Another consideration is psychological. Some of the things you see—and do not see—are the result of the interaction between your eyes and your brain. You might pay more attention to some things than others because you are interested in them. You might find black depressing

[10] The Concise Columbia Dictionary of Quotations, 1990. Columbia University Press.

because you associate it with funerals. Many perceptual biases exist that depend on the society, culture, or group to which you belong. Some of those biases may be unique to you, depending on your own personal history, background, and experience.

What impact do these perceptual biases have? They influence the way you look at the world, and the sense that you make of it. They direct your attention in some areas, and reduce it in others. They may lead you to different conclusions about things than someone from a different culture, society, or group. But they are perceptions, and perceptions can be learned—or changed.

Sometimes, all of society can share the same perceptions. These can be due to people's beliefs, such as their religion, or faith in something, like their political system. In Western society, technology has become one of the most important transformers of perception. Before mass communications media such as radio, television, the telephone, and the computer, people's way of looking at the world was different. As the result of familiarity with television, and its constantly changing images, attention spans are shorter now than ever before. With the advent of new media such as computers, computer networks, and high-speed communications, how will our perceptions change in the future?

Discussion

Students should be engaged in a discussion about the ways in which people's view of the world has changed over the past hundred years. Does living in an age of instant communication mean that they look at the world differently from their parents, or great-grandparents?

Projects

1. Look at music videos, either individually or in groups. What contributes to their style? Consider lighting, editing, and camera angles.

2. Using a stopwatch and a notepad, follow television programs and commercials. Count the number of times images are changed (a new image, or a change in camera position). Record how long the camera remains in the same position. Now rank the things you saw in terms of your interest in them. Is there any relationship between the frequency of change and your level of interest?

3. As a group, discuss your attitudes towards a variety of visual issues. Does a politician, or a policeman look honest and competent to you? How much of your opinion is based on fact, and how much on appearance? Name people you think are role models. Why? How much of your admiration for them is based on what you know to be true about them, and how much is based on appearance? Do you base some of your opinions about others on the way they dress? Why? Try to examine how much of your everyday opinions are based on perceptions, rather than reality.

4. Create a series of images, in any one of a variety of media, on the theme of perception. Some ideas include writing a performance with costumes, and recording it on video; the creation of an animated film using a computer animation program; a series of collages using images from the media; or a large mural in the hall.

1.5 OPTICAL ILLUSIONS

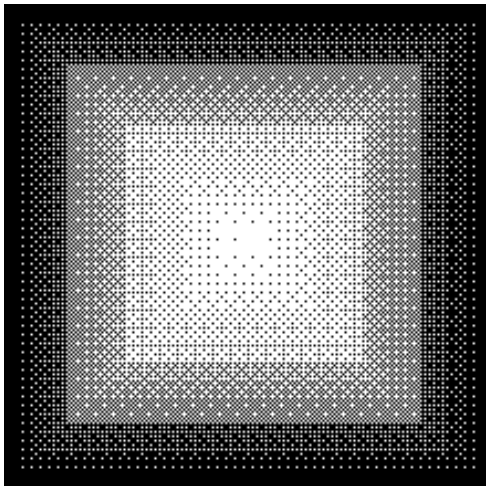

Figure 1.51 *Optical illusions fool the eye and brain into believing that depth - for example - is present on a flat page*

What is called a sincere work is one that is endowed with enough strength to give reality to an illusion.[11]

Max Jacob
Art Poétique [1922]

Specific Curriculum Outcomes

Upon completing this section, students will be able to:

- illustrate and describe how optical illusions occur
- provide examples and demonstrate common optical illusions in the environment and in art works
- create images which demonstrate an understanding of optical illusions.

Illusion

1(a). An erroneous perception of reality.
(b). An erroneous concept or belief.
2. The condition of being deceived by a false perception or belief.
3. Something, as a fantastic plan or desire, that causes an erroneous belief or perception....[12]

11 Bartlett's Familiar Quotations, 1980. Little, Brown and Company, Inc.

12 The American Heritage Dictionary and Electronic Thesaurus, 1987. Houghton Mifflin Company.

Introduction

What are illusions? According to the Academic American Encyclopedia, "illusions are systematic, characteristic errors in perception"[13]. In other words, illusions happen again and again. They are fundamental to your perception of the visual world. It is the nature of your sight, and the relationship between your eye and brain, that cause optical illusions to occur.

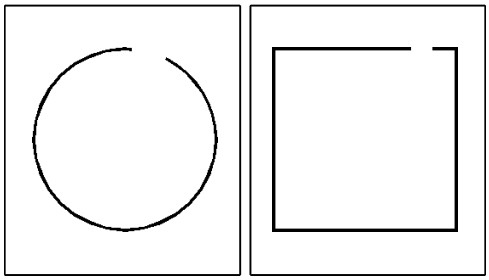

Figure 1.52 *Two examples of closure*

What are the types of optical illusion? One of the more common can be seen by holding a stick half in, and half out of a bucket of water. If you hold it at a slight angle, you will see that the part of the stick that is under the water, and the part of the stick you are holding, do not seem to meet. This illusion is caused by the bending or refraction of light.

Another common illusion is your eye and brain's ability to fill in the missing details of an image. This is called closure. The ability to fill in missing details accounts for our ability to see movies as continuous motion, rather than a jerky series of still images[14].

Figure/ground is another common optical illusion. In it, the difference between an image and its background are ambiguous. Your eye can jump back and forth, sometimes seeing the figure as the figure, and sometimes seeing the background as the figure. A classic example of this is the figure 1.53. If you look at it one way, it appears to be two faces looking at each other. Looked at from another perspective however, it appears to be a vase.

Figure 1.53 *A figure/ground illusion*

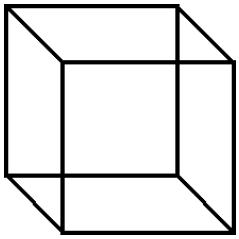

Figure 1.54 *The Necker Cube*

There are many other common optical illusions. One is the famous Necker cube (figure 1.54). With a little practice you will find it easy to see the front of the cube as the back and vice versa.

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13 The Academic American Encyclopedia, online edition, Grolier Electronic Publishing, Danbury, CT, 1993.

14 The Academic American Encyclopedia, online edition, Grolier Electronic Publishing, Danbury, CT, 1993.

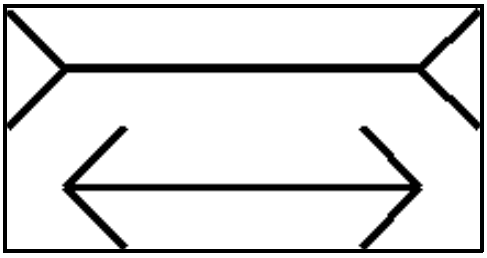

Figure 1.55 *An example of convergence and divergence*

A common illusion of size is based on the optical principles of convergence and divergence (figure 1.55). The two lines seen below are the same size, but the arrows at each end of the two lines fool you into thinking the lines are different sizes. The lines at each end lead your eyes either inwards or outwards, modifying your perception of the length of the lines.

The use of linear perspective in works of art is another example of a powerful optical illusion. When you see a road or train tracks receding into the distance, they appear to get narrower, the further away they are from the eye. By duplicating that phenomenon on a piece of paper or canvas, an artist can fool your eye into thinking that there is depth in a picture, even when you know it has been produced on a flat surface. Figure 1.56 is a good example.

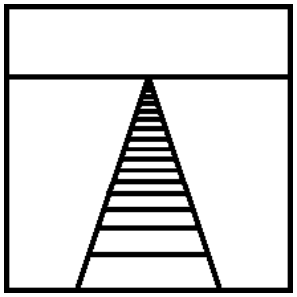

Figure 1.56 *An example of the use of linear perspective to create the illusion of depth*

What about other kinds of illusions? Brightness contrast occurs when you go from sunlight into a dark room. After the brightness of sunlight, the dark room will appear darker than it actually is.

Simultaneous contrast is an illusion involving the perceived tone, value, or colour of a figure and ground in an image. If you surround a neutral grey square with a black square, it will appear light. The same grey square suspended within a white square will appear dark. Place the two enclosed squares beside each other and the centre grey squares will appear different, even though they are the same. A similar effect occurs with colour. A neutral grey square placed in a larger red square, takes on a slightly greenish tint (the opposite colour of red). The same grey square, in a larger green square, will take on a slightly reddish tint (the opposite colour of green).

A *negative afterimage* is a similar illusion. If you look at a coloured square, such as yellow, for approximately one minute, then look at a white wall, you will see a ghost image of the square you were just looking at. The colour of the square will not be yellow, it will be purple. Again, purple is the opposite (or complement - see chapter 2.6) of yellow.

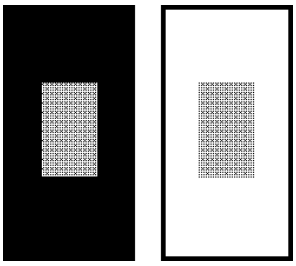

Figure 1.56 *An example of Simultaneous Contrast*

It is important to remember that optical illusions are everywhere around you. The television screen is flat, yet, through a variety of means, it appears to have depth. Movies and television programs appear to have continuous motion, yet are made up of a sequence of still images. Paintings, posters, magazine covers, advertisements, all operate at one time or another on the basis of illusion. It is almost impossible to look anywhere in the world without being subject to some kind of illusion at

work. Special effects in the movies and on television fool our eyes into thinking that intergalactic space flight is possible, that people can fly, that magic is real, that robots made of liquid metal can exist. All of these are illusions, but are so skillfully created that they appear to be real.

Illusions are common, but that does not make them ineffective. They are useful for communication and entertainment. Learning how to create and manipulate optical illusions is one of the key skills of the artist, craftsperson, or designer.

Discussion

What kinds of optical illusions do we encounter every day? Students should investigate optical illusions on their own, and bring examples of what they have found to class for discussion. What kind of illusion is present? How does it work? Is it effective?

Projects

1. Search out different kinds of illusions in both still (newspapers, magazines, etc.) and motion (commercials, videos, etc.) media. Create a collage of illusionistic images from your collection.

2. Use a computer drawing program to create an image made up of several shapes. Use features in your drawing program to create the illusion of depth. Create several variations in the organization of these shapes. Use overlap to make one shape appear as though it is in front of another. Change the order so that other shapes are in front and behind.

3. Using any one of a variety of media, create images that incorporate some or all of the optical illusions presented in this section.

4. Create an image, in any one of a variety of media, entitled “Life is an Optical Illusion”. Interpret the title in the finished work.

1.6 PERCEPTION AND TECHNOLOGY

Figure 1.61 *What will the future hold as the human imagination interacts with new technology?*

The virtue of the camera is not the power it has to transform the photographer into an artist, but the impulse it gives him to keep on looking.[15]

Brooks Atkinson
American critic, essayist

Specific Curriculum Outcomes

Upon completing this section, students will be able to:

- demonstrate an understanding of the historical relationship between perception and technology
- provide examples of how optical devices and technology have influenced human perception and explain how this has occurred
- create images that explore the relationship between perception and technology.

[15] The Concise Columbia Dictionary of Quotations, 1990. Columbia University Press.

Introduction

Up to this point in the course, human perception has been the focus, and some of the special characteristics it possesses. Now it is time to examine perception from another viewpoint—technology.

Technology is, above all, a human method of problem solving. For good or ill, humans invent tools to solve a variety of problems. There are many examples of technology in the visual world. Whether you realize it or not, most of them have changed the way you—and society at large—perceives the world. The following is a list of significant visual inventions.

Inventions and Discoveries

105	Paper	Lun	Chinese
1447	Type, movable	Gutenberg	German
1590	Microscope, compound	Janssen	Dutch
1608	Telescope	Lippershey	Neth.
1609	Telescope	Galileo	Italian
1611	Telescope, astronomical	Kepler	German
1758	Lens, achromatic	Dollond	English
1780	Bifocal lens	Franklin	U.S.
1792	Gas lighting	Murdoch	Scottish
1816	Photography	Niepce	French
1817	Kaleidoscope	Brewster	Scottish
1829	Braille printing	Braille	French
1835	Photographic paper	Talbot	U.S.
1835	Photography	Talbot	English
1835	Photography	Daguerre	French
1838	Pen, ballpoint	Biro	Hungarian
1838	Stereoscope	Wheatstone	English
1845	Printing press, rotary	Hoe	U.S.
1847	Lamp, arc	Staite	English
1852	Engraving, half-tone	Talbot	U.S.
1865	Printing press, web	Bullock	U.S.
1867	Typewriter	Sholes, Soule, Glidden	U.S.
1878	Cathode ray tube	Crookes	English
1879	Lamp, incandescent	Edison	U.S.
1884	Linotype	Mergenthaler	U.S.
1884	Pen, fountain	Waterman	U.S.
1884	Photo film, transparent	Eastman, Goodwin	U.S.
1887	Monotype	Lanston	U.S.
1888	Camera, Kodak	Eastman, Walker	U.S.

1889	Kinetoscope	Edison	U.S.
1892	Photo, color	Ives	U.S.
1893	Photo film, celluloid	Reichenbach	U.S.
1894	Movie machine	Jenkins	U.S.
1908	Lens, fused bifocal	Borsch	U.S.
1909	Lamp, neon	Claude	French
1911	Lamp, Klieg	Kliegl, A.&J.	U.S.
1912	Lamp, mercury vapor	Hewitt	U.S.
1913	Lamp, incand., gas	Langmuir	U.S.
1913	X-ray tube	Coolidge	U.S.
1923	Television, iconoscope	Zworykin	U.S.
1923	Television, (mech. scanner)	Baird	Scottish
1924	Lamp, incand., frosted	Pipkin	U.S.
1927	Movie, talking	Warner Bros.	U.S.
1927	Television, electronic	Farnsworth	U.S.
1928	Teletype	Morkrum, Kleinschmidt	U.S.
1931	Microscope, electronic	Knoll, Ruska	German
1938	Lamp, fluorescent	General Electric, Westinghouse	U.S.
1944	Computer, automatic sequence	Aiken et al.	U.S.
1948	Camera, Polaroid Land	Land	U.S.
1951	Microscope, field ion	Mueller	German
1952	Movie, panoramic	Waller	U.S.
1955	Fiber optics	Kapany	English
1960	Computer, mini	Digital Corp	U.S.
1969	Cassette, videotape	Sony	Japanese
1972	Disk, video	Philips Co	Dutch
1972	Video game ("Pong")	Buschnel	U.S.
1973	CAT scan	Hounsfield	English
1975	Video home system (VHS)	Matsushita, JVC	Japanese
1979	Disk player, compact	Sony, Philips Co	Japan, Dutch[16]

Technology does not change just the things you see. It changes the way you see. Much of the way you perceive the world is learned—from your parents, friends and community; from your society and culture; from your moment in time. One of the most important technological developments that has helped to shape the way we see is the lens.

[16] The World Almanac and Book of Facts, 1992. Pharos Books.

Optical Devices and Lens Technology

Although technology in the visual world is thousands of years old (brushes, pencils, paint and paper are all examples of older technology), much of the technology that has shaped our perception of the contemporary world began in the 18th century.

LENS

1(a). A carefully ground or molded piece of material with opposite surfaces either or both of which light rays are refracted so that they converge or diverge to form an image.

(b). A combination of two or more such pieces, sometimes with other optical devices such as prisms, used to form an image for viewing or photographing.[17]

People have been curious about looking at the world in different ways for hundreds—or perhaps thousands—of years. Most of the early experiments were to extend the capabilities of our senses. In the case of the visual world, it was to make distant objects appear nearer (the telescope), and small objects to appear bigger (the microscope). All of the optical devices, such as the telescope, the microscope, and the camera, use lenses.

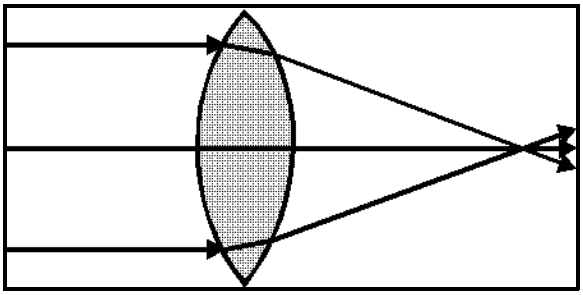

Figure 1.62 *The basic operation of a lens*

The image created through a lens has always interested people. Not only does it sometimes bring distant objects closer, or make small objects larger, it also changes the way things look. Nature, for example, looks different when seen through a lens. It is sharper, clearer, and simpler. A device that has a lens transforms images. It edits and simplifies the world into a series of small images that can be appreciated for their perfection and beauty. Those images were there all along, but an optical device separates them from the general view of nature.

Society's fascination with images seen through lenses began around the time of the Renaissance, in Europe. It was at that time that the telescope was invented. Suddenly, it became possible to see distant objects as though they were much closer. The type of image seen through a telescope is also different from something seen with the eyes. It has sharper

[17] The American Heritage Dictionary and Electronic Thesaurus, 1987. Houghton Mifflin Company.

edges, and everything is in focus with a narrow depth of field. By the late 18th century, people—particularly artists—became fascinated with the way optical devices changed the perception of nature. Eyes keep a relatively small area of the visual field in focus; areas outside of the cone of vision are blurred. Optical devices can keep much, if not all of their visual field, in focus at all times; they accentuate edges, making the image appear crisp and distinct.

In the early 1700's two devices were in common use among artists: the Camera Obscura and the Claude Glass. The camera obscura was "...a lightproof box with a lens at the front that produces an image reflected by an inclined mirror onto a glass screen on top. The image can then be traced onto light translucent paper and transferred to heavier paper or canvas, or it can simply be appreciated for itself."[18] The Claude Glass (named after the French landscape painter Claude Lorraine), was a convex piece of glass, which was darkly tinted. The viewer would face away from the scene she wished to contemplate, and consider its reflection in the Claude Glass. Both of these optical devices had one thing in common. They produced simple, dramatic images. They reduced contrast, and simplified visual structures. It came to be believed that somehow they presented a vision of the environment that was beautiful and compelling. Some even preferred their view of nature to human vision![19]

People at that time were amazed by these optical devices, and loved the way they could alter the way nature looked. They liked the way optical devices could create "scenes". Think about looking through the viewfinder of a camera. When you do, it places a frame, or border around the image you are viewing. This image might be called a "scene." The limit is the size and shape of the film in the camera. Generally, this is an image longer than it is tall. The frame simplifies nature by making it smaller. As the person using the camera, you can choose which parts to keep in the picture, and which parts to omit. If you see a scene and want to take a picture of it, but do not like the house to your left, you can move the camera so that the house is not in the picture. The ability to edit a scene is one of the special features of optical devices. Your eyes show you the world around you; an optical device allows you control over what image you choose to see.

Besides the Claude Glass and the Camera Obscura, there were other early devices that changed the way people looked at nature. One was the Camera Lucida, that allowed the user to trace a scene onto a sheet of paper using a series of lenses. Another was the Patent Graphic Telescope. Within a few decades, the camera, halftone printing, and photoengraving all followed.[20]

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[18] Ibid., p. 18

[19] Ibid., p. 19

[20] Ibid., pp. 20-21

There was a spirit of investigation in the air. New ideas and inventions were being discovered at a rate the world had never seen before. The challenge was there: to produce—and reproduce—images. Gutenberg, with the invention of the printing press had made the dissemination of books possible. The technology of reproducing images in a basic form had existed since the fourteenth century, when woodblock, and other forms of relief printing had been developed. Senefelder, in the 18th century, developed the process of colour lithography, a printing technique that is the root of many of our current printing technologies.

The invention of photography was the culmination of the desire to produce images identical to nature using optical technology. It produced striking images that had a visual appeal. But the photograph was a different visual experience from a painting. It was looked at differently, and appreciated in a different way. " Photography further encouraged the eye to accept the lens as the mediator of objectivity and, to expect an optical clarity of edge, and a fixity of image within its frame that, unaided or untrained, the human eye, itself constantly in motion and constantly changing its depth of field, simply cannot convey." [21] Society's preference for the optically "enhanced" image is still with us. Today it seems hard to imagine, but one hundred years ago people did not have experience looking at photographic images the way you do now. It was a strange and new experience for them. People today are brought up looking at photographic images: on calendars, on television, in books and magazines, in the movies, on videotape, and on computer screens. Looking at a painting and looking at a photograph can be two very different experiences:

> *The instant of a photographic glance is not the same as the contemplative time in which the painter moves and which is shared by the trained viewer of paintings."...this aspect of time related to apprehending images has changed with photography...we now expect to apprehend images at a glance.*[22]

In the past seventy years our experience of the photographic images has changed again. Television made it possible to transmit visual images from one part of the world to another. Movies made it possible to see photographic images that appeared to move like real life, and they could show us things that were not possible in real life. In the past few years, computers have made it easier than ever to create, duplicate, distribute, and view images from anywhere in the world. These images can be still or moving, and can combine images with sound. The idea of looking at the world through an optical device is not just an interesting idea any more, it is probably the most common way we have of looking at images.

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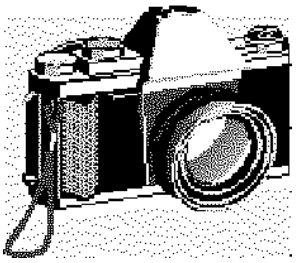
21 Ibid., p. 22

22 Ibid., p. 24

Today, we are on the threshold of a telecommunications revolution. The near future promises even more fundamental change in the way we communicate and the way we create and manipulate images. The technology of the artist is evolving to meet the demands of this new age. New tools not only alter the way things are done, they alter the type of images that are made.

The Camera and its Impact



The camera, and the technologies related to it, are at the core of the changes we have seen in image making in the visual world. At its simplest, the camera is easy to understand, and bears remarkable similarity to the function of the human eye. A camera consists of a lightproof box with a hole in it, much like the inside of the human eye. Inside the box is placed film, which is very sensitive to light. At the opposite side of the lightproof box, there is a hole to admit light, much like the pupil in your eye. The amount of light entering the hole can be controlled two ways. One is called a shutter, which is something like a door that can be opened and closed very quickly. The other is by controlling the width of the hole. A device called the aperture controls the size of the hole. When working together, the shutter speed and aperture work to provide just enough light hitting the film to ensure a good image. In the early days of photography the length of time that the shutter was open, and the size of the aperture were left to the experience of the photographer. Now, light meters and small computer chips in cameras can decide what amount of light is necessary, and adjust everything automatically.

Different Types of Cameras

Most people use single-lens reflex or rangefinder cameras that use negative film. Some use a Polaroid camera, which does not require separate processing of film. Digital cameras save images on a computer chip installed in the camera. When you want to see the picture, the camera is attached to a computer and the images are viewed using an image-editing program.

Why is the camera so important in the creation of contemporary visual images? Because most of the images we see in our society have been created with cameras of one kind or another, or rely on processes that began with the camera. Not only does photography rely on cameras, but so does the film industry, the advertising industry, television, the sports industry, news; in fact, just about every human activity.

Movie film consists of hundreds of thousands of still images, on a long continuous strip of film. A movie camera takes roughly 24 pictures per second. That speed is fast enough to create the optical illusion of motion, so you believe that what you are seeing is people moving, when in fact they are not. Video cameras do much the same thing,

but they create 30 images—or "frames"—per second. A lot of animation, from morning cartoons to special effects similar to those used in the movie, Titanic, use the technique of many still images seen rapidly.

The Computer

Computer technology is in the process of transforming our lives. Once, many of the processes used to create visual images were difficult to master, requiring talent, dedication, motivation, and many years of formal study. The computer has brought new techniques into this world; now it is possible for people to do things that previously were only possible for a specialist. Using a computer, people who lack skill in drawing can create images. Animation is possible without the use of a film camera, or a costly special effects studio. Music can be added to visual presentations, whether recorded, or created at home.

What is a computer? Without going into too much detail, a computer is like a strange combination of two things: a high speed calculator, and a huge filing cabinet. Computers can do a several things very well. They can store, retrieve and manipulate data, and they can perform mathematical calculations very quickly. All of the special effects you see coming from computers can be traced back to those basic abilities. Computers consist of a few important parts: a keyboard, where you can type in information or commands; a mouse, so that you can perform commands by clicking a button, or to use it as a drawing tool; a monitor—like a television set—so you can see what you are doing; a printer, so you can print out what you have done, and a big box with a few buttons or switches on it. Inside the box is the computer's memory, or memories (it usually will have a hard drive, where data is stored, and RAM—random access memory—which it uses to manipulate data from the hard drive and the keyboard/mouse), a "motherboard" which houses its processor, and a number of "cards" that are used to connect other things to a computer, like sound, a scanner, or a CD-ROM drive. All of these tools make it possible to create your own images, animation, and sound effects without costly equipment (other than the computer), or specialized skill. Of course, as computers and software grow in complexity, just using one to produce images is becoming a specialized skill in itself!

All of the technologies we have discussed create images of reality that are different from those seen with the eyes. All of these technologies transform people's view of the world, nature, and the human body. Our ability to change the speed of motion pictures to include high speed and slow motion images changes our perception of time. The ability to transmit images across the world in fractions of a second affects our perception of time. The ability to see what appears to be impossible, happening on a television or movie screen, affects our perception of reality and movement. And the ability to create false images through collage or other techniques, and make them appear to be real, affects ideas about content. The end result is that our ability to fathom visual images is challenged. People cannot know with certainty, about scale,

content, original subject...all of us wander in a land of fleeting images of uncertain reality.

Discussion

How has the advent of photography, movies, and special effects changed our definition of reality? We can see things that are impossible, but they can be made to seem real. Does that change your definition of reality?

Projects

1. Investigate how new technologies in the arts can manipulate reality. Research a particular tool, such as a computer scanner, or an image-manipulation or paint program. Create an image with that tool that represents how it can transform the perception of reality.

2. Using any one of a variety of media, create an image which has as its theme, "The Relationship of Perception and Technology".

3. Build a camera obscura. Conduct research to discover how they were made, and build it, based on your findings. Produce a number of drawings based on the images seen in it.

4. Using a camera, take a series of photographs on the theme of "Scenes". These scenes should point out the ability of the camera to edit and manipulate reality.

5. Research the use of optical devices by artists from the 18th to the 20th centuries. Present the results of your findings, including examples of their work, in class.

6. Using video, create a short film that explores the optical capabilities of the video camera.

7. Explore the image-making capabilities of the computer. What can it do with images that were impossible before its invention?