Topic: Electronic Communication

Teacher Information

Time Allowance
50 min.

Background
Digital images are recorded and transferred as pixels. This is how probes send data and captured images back to researchers on Earth. The more pixels that are used, the better or clearer the image. This is often referred to as resolution.

Materials (per group)
Graph paper
Color pencils or markers
Student Sheets

Preparation
This activity requires students to work with a partner. Place students into pairs prior to starting the activity.

Discussion/Wrap-up:
- Have students share their "sender" and "receiver" images with the class and compare them. Discuss answers from Student Sheets.
- Ask students what benefits sending images in this way could offer for the future.

Imagery Activity

Student Sheet(s)

Digital Images

Student Worksheet

Background Information:

An image is a picture created by a camera on photographic film (called a photograph) or by a remote sensing detector, and displayed on a screen or on paper. A camera takes light energy and records it chemically on film. The film is then processed, and the image transferred to paper where we can look at it. This is called a photographic image. Most films have chemicals that are sensitive to visible to light energy. This means it will record the same images a human eye can see. Camera film can also be chemically sensitive to the "invisible" infrared energy, recording on the film images that the human eye cannot see.

Scientists have created very complex detectors that can sense many different wavelengths in the electromagnetic spectrum. These sensitive instruments record the reflected energy as numbers or digits. Digital images are recorded and transferred as pixels. The more pixels that are used, the better or clearer the image. This is often referred to as resolution. This digital information is often recorded on magnetic tape, like in a tape recorder or videocassette, or radioed back to Earth. Computers then put these numbers together and make pictures.

In an analog television, each line is a continuous signal that is shot onto the screen by an electron gun. When an electron hits the phosphorus that coats the screen, it will emit light. The gun shoots electron through three sets—red, green, and blue. There are magnets on each side of the tube, which move the electrons across the screen. There are also magnets on the top and bottom of the screen, which can move the electrons up or down rows.

High-Definition Television (HDTV) is more lines of resolution both horizontally and vertically plus digital audio. The basic concept behind high-definition television is actually not to increase the definition per unit area, but rather to increase the percentage of the visual field contained by the image. It takes more lines of resolution to achieve this wider field of vision, and this wider field of vision engages the viewer significantly more than does the old standard.

Portable ultrasound machines that can send images to doctors also use a similar concept. These machines have been tested on the International Space Station. While in space, the images from the ultrasound were transmitted to doctors on the ground. This will be useful on long-distance missions when astronauts are more likely to develop illnesses that need medical attention.

In this lesson, students will learn how digital images can be transmitted from

place to place.

Procedure

1. Choose one student to be the "sender." The other will be the "receiver."
2. The "sender" and the "receiver" should each take a sheet of graph paper and draw a square, 20 boxes by 20 boxes.
3. The "sender" should fill in boxes in the square to create a simple picture. The "sender" should not allow the "receiver" to see the picture.
4. The sender needs to "read" the picture to the receiver, using the digital code below.
5. If a square is blank, the sender says, "Zero"; if the square is filled in, the sender says, "One."
6. The sender, using the code, starts with the top row and reads from the left to the right.
7. The receiver, upon hearing the code, transfers the information to his or her square on the graph paper.
8. At the end of the first row, the sender says, "End row1." Repeat this at the end of each row.
9. At the end of the last row, look at the picture on the receiver's paper. Check the results to see how accurate the transfer was.
10. Switch roles and repeat steps 1 – 8.
11. Answer the following questions on a separate sheet of paper:
    _ What was the most difficult part of the activity to do?
    _ Can you think of a better way to transmit and receive information?
    _ Describe how a digital image is formed based on your experiment.
    _ Can you figure out how the information is coded electronically?