Tricks Your Eyes Play On Your Brain - Optical Illusions

OBJECTIVES:
Students will observe a variety of optical illusions, learn how they are created, and how they trick our brains.
Students will create their own optical illusions.

MATERIALS:
Paper copies of the optical illusions presented OR Computer with screen projector for viewing the optical illusions saved to Power Point.
For the Kanizsa Illusion - four paper circles cut to look like pac mans and a display surface.
For the Jastrow Illusion - two curved shapes.

MATERIALS NEEDED FOR MAKING OPTICAL ILLUSIONS are listed with the illusions.

PRESENTATION
Do you know that your eyes can trick your brain into seeing things that may or may not be real? Let’s see if your eyes can trick your brain.

Ponzo Illusion - Here’s a drawing of a railroad track. Your mind thinks it can follow the track way into the distance because of the illusion created by the converging rails and also by the shrinking size of the railroad ties. Now look at the two green lines crossing the track. Which one is longer? The top one, right? Let’s measure them. Whoa! They’re the same length. Your brain is telling you that they look different, but they’re the same. It assumes this because the top line fills the space between the converging distant tracks, whereas the bottom line does not. So your mind reasons that the top line has to be longer. Your brain has been tricked. (Cognitive Illusion - Geometrical/distorting Illusion - distortions of the length, shape, size, curvature or position.)
Jastrow Illusion - This illusion is two curved shapes. They’re like the curved pieces of a toy train track. The top shape looks smaller than the bottom curve, right? Let’s rearrange the shapes a bit, move one exactly above the other. Which is the larger shape now? Do you think they look the same? Let’s measure them. Yes, you’re right. They are the same size. Wait, let’s rearrange them again. Isn’t the top shape shorter than the bottom one? Scientists can’t explain why our brains make this assumption. It’s something to do with lining up the long side (outside curve) of one shape with the short side (inside curve) that confuses our brains. But why, is a mystery. Cognitive Illusion - Geometrical/distorting Illusion - distortions of the length, shape, size, curvature or position.
These are two examples of optical illusions.

Optical illusions occur because our brains try to figure out what our eyes see and make sense of it. Our eyes take in lots and lots of information, more than our brains can keep up with. So our minds take shortcuts and choose what they think is the most likely picture of what we see. But, optical illusions trick our brains into seeing things that may or may not be true. You may think that you see with your eyes, but it's your brain that tells you what you're looking at.

**Kanizsa Illusion** - *(Live Demonstration.)* Here's another very simple illusion. Here are four circles cut to look like pac mans. I'm going to line them up on this board and you will see something that isn't really there. What do you see? Right, it's a square. But of course, there isn't a square there. When I take the circles away, the square disappears. *(Remove the pac mans.)* When I put them back, the square reappears. Your brain has been tricked again. Our brains tend to fill in missing information. While we're looking at the pac mans, our brains recognize four right angles arranged like the corners of four equal sides of a square. Our brains put all that information together and think they see a square. *(Phantom edge phenomenon) (Cognitive Illusion.)*

There are many kinds of optical illusions. I'm going to show you a few more different kinds before you make your own optical illusion. Maybe your brain won't get confused if it has more practice. Maybe it will keep up with the information your eyes send it.
There are some *literal* optical illusions that are images/pictures which are different from the objects used to make them. What do you see in this picture? An old man and an old woman looking at each other. Look at the man’s face - do you see it’s really a man wearing a sombrero, seated and playing a guitar. And the old man’s ear is really a woman standing in an arched doorway. Look at the woman’s face - do you see that it’s really another seated man with baskets on his head. The woman’s earring is a tall glass bottle. The space between the old man and woman is a vase. That’s pretty neat for an artist to think all this up to create this optical illusion that tricks our brains.
Is this a duck or a rabbit? If you have trouble seeing the rabbit, turn your head to the right. The duck's bill becomes the rabbit's ears. To see the duck, turn you head to the left and look at the tip of the rabbits ears. You can only see one of the animals at a time. This is really two pictures in one. Don't worry if you can't see both of them. Your brain can't see both pictures at the same time. It chooses one. Cognitive illusions, the results of unconscious inferences (brain makes the wrong decision) (Ambiguous image.) - Perception.
This drawing is titled “My Wife and My Mother-In-Law.” Can you see both women in the drawing? Our eyes can only see one of the women at a time. Which one do you see? The choker on the wife’s neck, is the mother-in-laws mouth. The wife’s ear is the old woman’s eye. The wife’s chin is the bottom of the old woman’s nose. *Ambiguous Image.*) Perception. Cognitive Illusion.
The most common types of optical illusions are images that are combinations of lines, colors or particular patterns that appear to break, warp, bend, and snake around in strange ways.

This optical illusion is called “Rotating Snakes.” Do you see them? The part of the illustration that you focus on (stare at) doesn’t move, but the snakes in your peripheral vision appear to spin. I just fooled your brain again. The contrast in the colors, trick the brain into thinking that the snakes are moving, but they’re not.

(Illusory motion is called peripheral drift.) A Physiological Illusion.
Do you see the black dots on this grid? They blink on and off (appear and disappear very fast at the intersections) behind the white dots. They’re really not there. Your brain has been tricked again. The white dots on the grid look very bright to your eyes, they overwhelm the message your eyes are sending to your brain about this illustration. Everything else in this illustration is gray or black so your brain thinks the white dots must be black too. (Lateral inhibition.) Hermann Grid

Example of a Physiological Illusion - the effects on the eyes or brain of excessive stimulation of a specific type - brightness, tilt, color, movement and so on. Afterimage.
What is it about Optical Illusions that trick our brains? Lots of scientists have worked very hard for many years trying to understand how optical illusions work. Some think that optical illusions happen from a glitch in our brain that does something strange when processing two-dimensional visual images, turning them into third-dimensional perceptions. But we still don’t know for sure exactly how our eyes and brains work together to create these illusions. We know that information that our eyes gather goes on a long, complicated journey as it travels to the brain. Information can get confused along that journey.

EXPLORATIONS IN CREATING OPTICAL ILLUSIONS

Students will create. The hand is supposed to look 3-D. Now it’s your turn to create some optical illusions. The first is the hand optical illusion.
A. How to Draw a Hand Optical Illusion

Here’s what you’ll need to make this illusion -
Materials: White copy paper, 12 inch ruler, pencil, 2 color markers.

1. Set the paper on the table in front of you with the long side in the horizontal position. Place your non writing hand flat in the middle of the paper. Spread your fingers slightly apart, but pointed up. Your thumb should be pointed up.
2. Trace your hand with the pencil. Be sure to hold your pencil straight up and down, not tilted. Draw carefully around the fingers, not under them. Take your time.
3. With the ruler put a small dot at each half inch on the left and right edges of your paper. With the ruler to guide you, draw straight parallel lines horizontally across the page (from the left edge marks to the right edge marks), from the dot on the left edge to the corresponding dot on the right edge. DO NOT DRAW STRAIGHT PARALLEL LINES where you drew your hand. When you get to the hand, draw a curve up and then down to meet the matching parallel line on the other side. The space between the curved lines should be the same width.
4. Repeat drawing the straight and curved parallel lines until you fill the paper.
5. Draw a straight line across the hand where your knuckles would be.
6. The lines across each finger will curve up from a parallel line and will come down parallel to the beginning of the curve. Draw straight lines between the fingers.

Talking through demonstration - straight line, curve; straight line, curve; straight line, curve; straight line, curve; straight line, curve; straight line. Keep the distance between these horizontal lines parallel as possible.
B. How to Make a Thaumatrope Optical Illusion
A thaumatrope is an optical toy that was popular in the 19th century. Your great and
great-great grandparents may have played with them. It’s a disk with a picture on each
side that is attached to two pieces of string. When the strings are twirled quickly
between the fingers the two pictures appear to blend into one. *(Due to the persistence
of vision.)*
Materials: White cardstock paper, hole puncher, pencil, scissors, plastic cup or glass,
ribbon, several colored markers or pencils or crayons.
1. Put the cup on the paper, open side down. Trace around the cup’s circle.
2. Cut out the circle.
3. With the hole puncher, punch out 2 holes opposite one another, about 1/4 inch from the circle’s edge.
4. Draw something on one side - a small fish in a fish bowl or a pumpkin face, whatever.
5. Flip the paper over and draw something related to your first drawing - something about the fish changes from the first drawing or the pumpkin faces winks. The second picture should be arranged upside down from the first one. *(Only have file cards with one unlined side at home - reason for 2 cards. Think the 2 cards may make the project simpler, need to test.)*
6. Color both drawings, etc.
7. Cut two Ribbons, 16 inches in length. Tie one ribbon (with a slip knot) in each hole.
8. Try it out. Twist the ribbons with help from your neighbor - one person holds the ribbons straight across by their ends, but not so tight to tear the paper. You turn the circle to twist the ribbon tight.
9. Release the circle. What is the spinning circle’s picture - that’s the optical illusion.

Here’s another type of Thaumatrope Optical Illusion - It’s a straw spinner.

1. Fold a 3 inch by 5 inch index card in two.
2. Draw a character or an object on one half.
3. Draw the same character or object on the other half but change it slightly.
4. Fold card, insert straw, and staple once at the top and bottom of the card, near the straw.
5. Try it out. Put the straw between your hands, rub your hands together to spin the straw. What is the spinning picture - that’s the optical illusion.
CONCLUSION:
In this exploration, you’ve learned that your eyes can trick your brain when looking at optical illusions. There are different kinds of Optical Illusions.

1. Optical Illusions can be pictures/images that are made with smaller picture/images of other things. *(Literal)* *(The picture of the old man and old woman facing each other.)*

2. They can be images created with combinations of lines, colors or particular patterns - shapes and lines that appear to break, warp, bend, and snake around in strange ways. *(Physiological)* *(Rotating snakes. Black dots on the grid.)*

3. Sometimes your brain adds information that it knows and assumes will complete an incomplete picture. Sometimes the way you look at a picture can affect how you see it. *(Cognitive)* *(Railroad track - Ponzo Illusion. Two curved shapes - Jastrow Illusion. Pac mans - Kanizsa Illusion.)*

4. Sometimes if there are two images in a picture, you can only see one at a time so your brain chooses one. *(Cognitive)* *(The rabbit and the duck picture. My wife and my mother-in-law picture.)*

INTRODUCTION TO ART EXPLORATION, Sunset and Pointillism
In the Art Exploration, “Sunset and Pointillism,” Ms. Maria will show you how to use colored lines arranged in patterns that cause your eyes and mind to work together to blend the lines into images. It’s an art illusion.