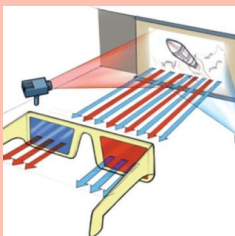


Activity #3: Stereoscopic Images

Have you been to a 3D movie before? How do they imitate a 3D object from a 2D image?

We are able to see in 3D normally because our two eyes see two slightly different images. For example, hold your finger a few inches from your nose and close one of your eyes at a time. Your finger seems to move relative to what's behind it. Our brain perceives the difference between the two images and understands it as depth perception!



This process allows us to see *stereoscopically*. We can imitate actual depth by artificially creating two images that differ in the object's position, and this is what 3D images and movies do. Among other methods, movies send each eye a different image with polarized light and polarized glasses, or by using two colors and colored glasses.

Let's explore and make some 3D drawings with two colors — *anaglyph* 3D images.

Materials provided in the kit:

- Blue/red 3D glasses
- Blue and red marker
- 3D cube printout

Frazer Churchill (1970 -) Visual Effects Artist

Visual effects (VFX) artists manipulate live film footage with digital or other effects to enhance the video in ways that are otherwise not possible. They create many fantastical illusions in the movie that make us perceive the effects as real. In recent years, VFX artists rely heavily on digital techniques, and Frazer Churchill was part of one of the early teams working with digital VFX. Churchill is now a VFX supervisor, and his team has worked on VFX for movies such as *Scott Pilgrim vs. the World* (2010), *Miss Peregrine's Home for Peculiar Children* (2016), *Wonder Woman* (2017), and *Tom and Jerry* (2021).



Activity #3: Stereoscopic Images

Materials you'll need to find:

- Paper to draw on
- Optional phone apps that convert images to 3D (*Makelt3D* or *3D Photo*)

Instructions:

1. Put on the 3D glasses and look at the 3D cube printout. It looks like it is coming out of the page!
2. Notice some things about the cube drawing without the glasses: you can see a red cube and a blue cube, but one is slightly **shifted** from the other. The parts of the cube that appear closer to you are separated more than others.
3. Now let's draw our own 3D images! First just draw a line with the red marker and the blue marker.
4. With your glasses on, close your right eye. You only see the red filter, and which marker line do you see on the page? Close your other eye and see the other marker line.
5. Start with drawing a word first - maybe your name. Write it out in the blue marker. Then, write the same word exactly the same, but slightly shifted to the left. Does it look 3D?



Exploration:

1. Try a few words. Once you feel comfortable writing words in 3D, try drawing a picture! You could draw a tree and a house, in the same way as the word.
2. The greater the shifts between the red and blue drawing, the closer the drawing will appear. But there is a limit - at some point they will just look like two images. Can you find where that starts to happen?
3. You can start adding different objects in your drawing at different distances, by using different amounts of shift between the red and blue. Keep drawing and playing with the 3D drawings!
4. There are some fun phone apps that take 2D photos and convert it into anaglyph photos too! You can try *Makelt3D* on Android or *3D Photo* on iPhone.

Not all smoke and mirrors

activities about our optical perception



Activity #1: Stroboscopic Pinwheel

Have you ever used or seen a strobe light? Maybe when you've used one, you noticed that movement looks different as the lights flash on and off. This is the stroboscopic (strobe-o-scope-ic) effect. The strobe light flashes on and off at regular intervals, and so we perceive the movement only at these intervals. If the frequency of the *movement* is the same as the frequency of the *light flashes*, the movement will look stationary. And if the frequencies are mismatched, the movement can even appear to go backwards!

Let's explore this effect, not with a strobe light, but with a pinwheel!

Materials Provided in the kit:

- Printed pinwheels, with horses and blank one
- Pencil with eraser
- Push pin

Materials you'll need to find

- Glue stick or tape
- Scissors
- Mirror



Anne Treisman (1935 - 2018) Psychologist

Dr. Anne Treisman was one of Psychology's leading pioneers in the areas of object perception, memory, and attention. She is most famous for her theory of feature integration in visual perception. This theory explained how different aspects of an object (such as color, texture, and shape) are 'integrated' through attention to allow us to perceive objects as a unified entity. In 2013, she received the prestigious National Medal of Science in from President Barack Obama.



Activity #1: Stroboscopic Pinwheel

Instructions:

- Cut out the pinwheel circle with **horses** on it. Make sure to cut out the thick black slits (between each horse).
- Insert the push pin through the center of the printed pinwheel. Then, push the pin at an angle into the pencil eraser so that the disk stays in place. Make sure the disk is able to spin freely and you are able to look through the slits as you hold the pencil.

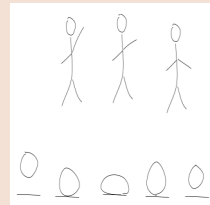
Exploration:

- Stand facing a mirror, and hold the disk in front of you. Be sure the disk is mounted on the pencil so that the horses are facing the mirror. Close one eye, then spin the disk and watch its reflection in the mirror through one of the slits. Concentrate your attention on one of the horses, and you will see it gallop!
- As the pinwheel rotates, a series of open slits moves rapidly past your eye. Each time a slit passes your eye, you see a glimpse of the scene on the far side of the disk. Each open-slit image lingers in your eye and brain long enough to merge with the next image (called the *persistence of vision*). This phenomenon uses the *stroboscopic effect* to combine the glimpses in such a way that your brain perceives continuous motion.
- Try spinning the disk faster, then slower, then in the opposite direction. Compare your results.



Instructions Continued:

- Now take the blank pinwheel. It's your turn to make a moving picture! In each blank space between the slits, draw a picture that moves slightly. Just like how the horse's legs changed between each picture. Maybe try a ball that bounces, or someone waving "hello".



Have a cool project to show?
Learn something new from
these activities you want to share?
Tell us about it here →



Activity #2: Benham's Top

Did you know you can make color out of just black and white? In 1894, the toymaker C.E. Benham found that you could produce the illusion of colors from a top with certain patterns of black lines. There are a few biological and psychological theories as to why this happens, but none of the theories completely explain the effect — the reason for the illusion remains unsolved!

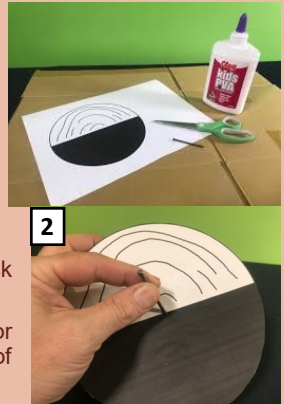
Make your own Benham's top and see the color for yourself!

Materials provided in the kit:

- Benham's disk pattern

Materials you'll need to find:

- Penny or toothpick
- Scissors



Instructions:

- Cut out the Benham's disk circle.
- Insert either a penny or toothpick into the middle of the disk, to make it a top.
- Place the disk on the table, balancing it on one side of the penny and spin it using the edge of the penny sticking up as a grip. Make sure to do this under bright light, preferably sunlight.

Exploration:

- Notice the colored bands that appear on the disk. Look at the order of the colors. What color do you see at the center? What about the next few bands? Reverse the direction of rotation and compare the order of colors again, from the center of the disk to the outer edge.
- Try varying the speed that it spins at, and compare the results with your initial observations.

Check out our project page for more information, like:

- A blog sharing finished projects by other kids
- Interviews with artists and scientists who study perception!
- And more!



kohlerfellows.illuminatingdiscovery.wisc.edu/perception-connection/