

# What color is that Shadow?

## **Materials: Per group (station) you will need a dark room!**

- 3- Night-lights with on -off switch (Dollar Tree or Wal-Mart) \$1.00 each
- 1- Swivel multi-plug with three outlets (Dollar Tree or Walmart\_ \$1.00 each
- 1- Set of Christmas tree light bulbs (red, green, blue, clear) (Wal-Mart during Christmas Season) Packages of 4 for \$1.00
- 1 - 6ft. indoor extension cord (Wal-Mart) \$.97 each
- 1- ½ sheet of white poster board (used as a screen)
- 1- Pencil or marker, Play Doh and tape



## **ACTIVITIES:**

*The Pencil or Marker is used as an object and the Play-Doh is to hold the object in place.*

1) Using the original clear bulb included with the night light, have students explore shadows. Begin with one Bulb. Ask students how many shadows are produced? Then how many shadows will be produced with two bulbs, three bulbs? Hand out additional clear bulbs.

*Students should recognize the relationship with one light source one shadow, two light sources two shadows and three light sources three shadows.*

2) What is actually causing the shadow? Have students predict which shadow will disappear when a light is turned off. Have them explain why?

### **Remove clear bulbs and hand Students one red bulb:**

- 1) Prior to turning the red bulb on, ask students what color will the shadow of the red light be?
- 2) Now, hand out a blue bulb and prior to turning it on with the red bulb, ask students how many shadows will there be and what colors will they be?  
*Students turn on the blue bulb and you will hear, WOW!*
- 3) Ask students, what's going on? Have them describe the background or screen color and the colors of the shadows. Have them explore which bulb is producing each shadow.
- 4) Ask students to predict the colors of the shadows if a green bulb is added with the blue and red bulbs.
- 5) Hand students the green bulb. **(It's best if the Green bulb is in the middle)**
- 6) Turn all bulbs on and let students discuss the number and color of shadows. What color is the screen or background? Where did the new colors of shadows come from?
- 7) Allow students plenty of time to explore with lights, turning off and on bulbs, predicting location of light source and shadow it produced.

### **What's going on?**

#### **Red+ Green + Blue = White**

When a red light, blue light, and green light, are all shining on the screen, the screen looks white because these three colored lights stimulate the three types of \*cones in your eyes approximately equal, creating the sensation of white. Red, green and blue are called the additive primary colors of light.

With these three lights you can make shadows of seven different colors: blue, red, green, black, yellow, cyan and magenta.

Red + Green + Blue – Blue = Yellow

Red + Green + Blue – Green = Magenta

Red + Green + Blue – Red = Cyan

Cyan, magenta and yellow are called the subtractive or secondary colors of light.

**More explanations and directions:**

If you block two of the three lights, you get a shadow of the third color: Block the red and green lights, a blue shadow is produced, etc, If you block all three lights, a Black shadow is produced. If you block one of the three lights, a shadow will appear that is a mixture of the two lights, blue and green mix to make cyan, red and green mix to make yellow and blue and red mix to make magenta.

**Other things to try:**

Remove one color bulb and add a clear bulb. What happens to the colors of shadows? Remember that the clear bulb is made up of all the colors of light. Shades of colors will begin to appear as you experiment with different colors of lights + clear.

Use different objects to create shadows. Place a clear container of water in front of the lights. Use the hole in a piece of notebook paper and hold it up in front of the lights.

Change the color of the screen from white. Use black, yellow, blue, etc,

The above activity is an adaptation of Exploratorium Science Snackbook, pp. 131-133. This version of the snack has a cost of \$5.00 per set-up. Without the Snackbook I would have never created the simplified version.

Kathy Holt – LIGO SEC  
[kholt@ligo-la.caltech.edu](mailto:kholt@ligo-la.caltech.edu)

These activities are perfect for Sixth grade exploration and compliment the National Standards for Science.

ATLAS of Science Literacy – Project 2061 p. 65 (6-8) grade

\*Cones – The retina, which covers the back of your eye, contains light receptors called rods and cones. Rods are used for night vision and peripheral vision, but only allow you to see shades of gray. There are millions of rods, but only one type. Cones are the color receptor and there are three types that respond to a wide variety of wavelengths. One type is more sensitive to long wavelengths (red end of the spectrum); one type is medium wavelengths (green or middle of the spectrum), and one to the short wavelengths (the blue end of the spectrum). With just these three types of cones we are able to see millions of different colors.