



Bright Black (Draft)

It's all black and white?...or is it?

Introduction

Lighting and surrounding can affect your perception of what's light and what's dark. Compare shades of grey color samples to each other and to an image of the moon.

Tools and Materials

- Small cardboard box - in the neighborhood of 12 x12 x 6 inches (30 x 30 x 15 cm). For this Snack write-up, we will be using a standard Priority mail box from the USPS (12 x 12 x 5 ¾ inches)
- Knife or scissors
- Ruler
- Pencil (sharpened to a point)
- Duct Tape
- String
- Four Binder clips (medium size)
- ½ yard (.5 meters) black velvet or other black non-reflective fabric
- NASA image of the moon. Print the image located at end of document.
- Paper Paint Samples- 4 Shades of grey, from dark grey to bright white. Samples are available at most paint and hardware stores. Or, you can print the graphic located at end of document on photo quality paper (Note: the colors are in the order you will mount the samples onto your device).
- Bright LED Flashlight (The flashlight on most phones should work)
- A dark stand or table to situate your device



Assembly

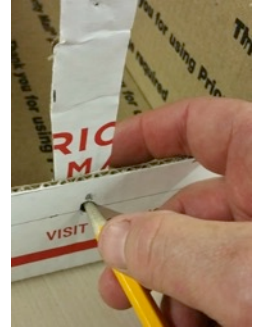
1. Assemble and tape the box. Leaving the top flaps open.
2. Cut off one side of the box, leaving 2 inches (5.5-centimeter) remaining. Remove the flap and part of the wall and keep this piece for later.
3. Tape the three remaining flaps so they stay upright.
4. Cut four - ¾ inch (2 cm) x 5 inch (12 to 13cm) straight strips from the leftover cardboard flap (from step 2).
5. Make a lever system with your strips. This is system is designed so that by pulling strings, you can lift the 4 paint samples, one-by-one from a hidden horizontal position to an upright and visible.



open.



- a. On the “cut side” of the box, center, measure and mark 4 points, 2 inches (5-centimeters) apart and 1 ½ inches (4-centimeter) up from the bottom of the box.
- b. Using your sharpened pencil, poke a hole through the box at each marking.
- c. Place the strips (from step 3) vertically and inside the box and continue each punched hole into the strip.
- d. Cut 4 lengths of string 1 foot long (30 cm).
- e. Pass a piece of string through each hole in the side of the box as well as through the strip. Anchor the string to the strip by tying multiple knots, make sure it doesn't pull out.
- f. Lay the strips horizontal, under each hole and adjacent to the wall of the box.
- g. Use tape to make a “hinge” that attaches the strip to the wall and bottom of the box. The example to the right shows a cut-away view of how this mechanism should work.



6. Label your strings 1 to 4, but not in standard order. From left to right, your strings should be labeled: 4, 1, 2, 3

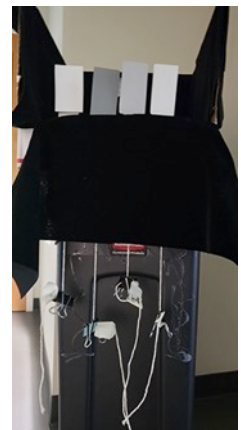


7. Cut your paint samples to an appropriate size.
 - a. Each sample should be about 1.5 x 2.5 inches (4 x 6.5 - centimeter)
 - b. Make sure there are no other colors or borders showing on the samples.

8. Center and attach the samples to each of the four strips.
 - a. The darkest sample should be mounted on the strip associated with hinged strip number 1. The other samples should be mounted in order of brightness, where the lightest sample is associated with hinged strip number 4.

Note: make sure you can't see the top of the cardboard strip.

- b. Attach a binder clip to the end of each dangling string. This will act as a counterweight and should keep your color sample in a vertical position after the string is pulled.
9. Test your mechanism:
 - a. Pull each string and make sure each color rises up to a vertical position.
 - b. Each shade of grey should stand next to each other in roughly parallel positions.



- c. Each sample should remain in a vertical position until you gently push it back into a reclining position.
10. Attach/tape a section of black fabric to hide the front of the box and lever mechanism. It should cover the bottle edge of the paint samples when they are in their vertical positions.
11. Drape and attach the black fabric to the interior walls of the box. Make sure the fabric doesn't interfere with the paint sample lifting mechanism.
12. Cut out and attach the image of the moon above and behind the samples.
13. Place your device on a dark table or stand at eye level or slightly above. Remember to place it so the strings are accessible.
14. Make sure your paint samples are in their hidden, horizontal position. You are now ready to see how well you and others distinguish shades of grey.

To Do and Notice

In a darkened room, sit or stand directly in front, a foot or two (30 to 60-centimeter) away from your "Bright Black" device.

Hold a bright flashlight just in front of your face, pointed at the front of the "Bright Black" apparatus.

Look at the moon. How does it look? Bright or dark? White or grey?

Pull the string labeled number 1. How does that paint sample look?

Pull each string in order. As you go, make judgments about each sample's appearance. How does it compare in color to the previously raised sample/s?



What's Going On?

Did the first paint sample look white or very lightly colored? Did it get darker as you successively pulled each string? Were you surprised?

The first card you saw was actually a very dark color; however, it was brightly lit by your flashlight. When it's the only color in the light, it may look light gray or even white. Our eye brain system makes a lot of comparisons and, compared to the dark fabric behind it, the sample seems much brighter. As you successively raised lighter and lighter samples, each new card made the previous card look darker by comparison.

A big part of our perceptual system is based on comparisons. We calibrate our view of the world according to these comparisons. Perception of an object can be profoundly affected by its surroundings or in this case, it's background and neighboring color samples.



Going Further [\[optional\]](#)

Our moon, is also a brightly lit, dark object, it's dark gray. But in the spotlight of the sun and contrasted with the darkness of outer space, it looks white. The paper cut out of the moon is also dark, but it too looks white when brightly lit against the dark background of the fabric.

Teaching Tips [\[optional\]](#)

Try other paint samples. Beside shades of grey, will other colors look white? Would a glossy coating work differently than a matte finish? Could you engineer a “Bright Black” contraption that displays more than 4 samples?

Resources [\[optional\]](#)

[More information on the color of the moon](#)

https://www.nasa.gov/mission_pages/LRO/multimedia/lroimages/lroc-20100910_color_moon.html

Related snacks (pick 3 that are on the site)

<https://www.exploratorium.edu/snacks/color-contrast>

<https://www.exploratorium.edu/snacks/sliding-gray-step>

<https://www.exploratorium.edu/snacks/gray-step>

Subject category (one or more from here: www.exploratorium.edu/snacks/snacks-by-subject)

[Perception](#)

[Light, Color, & Seeing](#)

[Optical Illusions](#)

Keywords

Contrast, Neurology, astronomy, perception, Exploratorium, Education, teacher, build, diorama, teacher institute, science, senses

Medium description

Lighting and surroundings can affect your perception of what’s light and what’s dark.

Short description

Is it all black and white?...or is it?

Staff contact

Eric Muller

Moon



https://www.nasa.gov/sites/default/files/styles/full_width/public/thumbnails/image/christmas2015fullmoon.jpg?itok=sAAVE1rv

Printable grey samples:

