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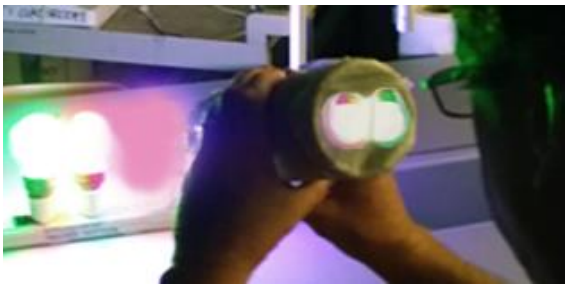
Poking fun at Science: Light Rays and Pinholes

Seeing the world in a new way



Recommended Grade Level: 3rd -12th

NGSS Science & Engineering Practices:
- Asking questions and defining problems
- Developing and using models
- Planning and carrying out investigations
- Designing solutions

Time: 5 minutes prep, 30 minutes activity

Materials and Assembly:
• Please refer to the activity entitled: **Poking Fun at Science: The Basic Set-Up** for materials, assembly and basic operation of your device.

Background Information:
- Discover one of the amazing optical phenomena caused by pinholes.
- A pinhole is not a lens and it's not a curved mirror, but it will invert an image. Use your apparatus from **Poking Fun at Science: The Basic Set-Up** to conduct investigations and experiments on the nature of light and pinholes.

To Do and Notice:

1. First set up your multi-colored light source with only **one or two** different colored bulbs.
2. Turn on the bulbs and turn off the room lights.
3. View the lights through the pinhole viewer by looking at the wax paper screen.
4. What do you see?
5. What? It's inverted, upside down and reversed!
6. Experiment and see if works all the time.
   Here are some possible things to try:
   a. Changing bulb colors
   b. Change bulb order
   c. Add an additional bulb
   d. Change bulb alignment from horizontal to vertical
   e. Change your viewing location, walk around the lights
   f. Rotate your pinhole viewer
   g. Block (shadow) one light at a time
   h. Move an object between the lights
      Move it from:
      i. Right to left, and left to right
      ii. Up to down and down to up
   i. Look at something bright outside. Look through a window or door
   j. Come up with our own experiment!

What's Going On?
Was your image upside down and reversed?
Light rays travel in straight lines and in all directions from a light source. However, your pinhole device limits the rays that can reach the wax paper screen. The aluminum foil blocks all rays accept those that pass through the pinhole. The geometry of how those rays pass through the pinhole is what causes the image to form upside down and inverted on the screen. Light rays from the top of an object pass through the pinhole and are projected onto the bottom of the device's screen. Likewise, light rays emanating from

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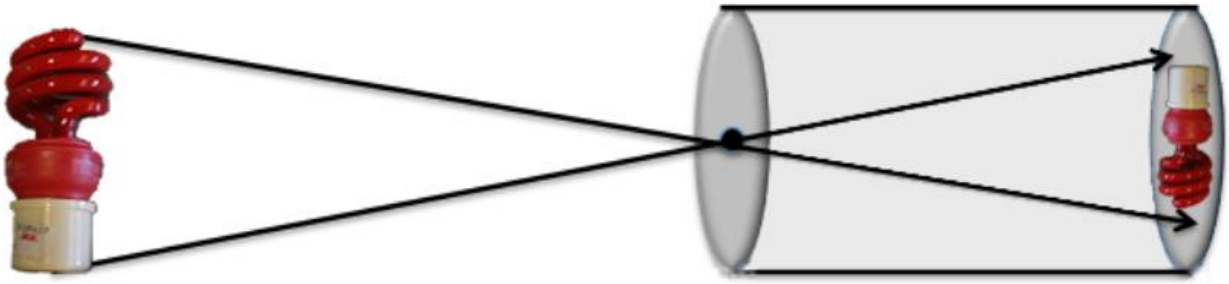
the bottom of the object pass through the pinhole and are projected onto the top of the screen. The same is true for rays of light traveling from the right and left side of the object, they are projected onto the opposite side of the screen. These inverted rays are what form the inverted image.



Going Further:
Can you improve your pinhole viewer design? Can you make your image larger? Sharper? Brighter? Will changing the material used in the device's construction help? How can you optimize this device?
Use your viewer as a launching point for a variety of engineering challenges.

What happens if you poke more than one hole in your pinhole?
Check out **Poking fun at Science: Math and Pinholes!**