MAKER SPACE

because the world needs people that do

Subject: Pinhole Cameras

- 35mm B&W Film or Harman Direct Positive Paper
- Focal Length: 17mm
- F-Stop: 103
- Pinhole Diameter: 16mm
- Exposure Time: ½-2 Seconds

Unit: N/A

Objectives

- Understand how light rays travel in straight lines are used in the processing of images.
- Use light rays to create a photographic image.
- Explain the basics of how a pinhole camera works.

Educational Standards

- NGSS: Next Generation Science Standards - Science
  - Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
  - Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.
- International Technology and Engineering Educators Association - Technology
  - Various relationships exist between technology and other fields of study.
  - Tools, materials, and skills are used to make things and carry out tasks.

Materials : Bill of Materials

- Empty Altoid Tins
- Graph Paper
- Ruler
- Pencil
- Scissors
- Black Permanent Marker
- ⅛" Drill Bit
- 100-200-600 grit sandpaper
- X-acto knife
- Vise
- Protective eyewear
- Masking tape
- Nitrile glove
- Black spray paint
- Extra-fine beading needle
- Aluminum sheeting
- Heavy black magnets
- Black electrical tape
- Fender washers
- Plyers
- 35mm film cassette

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Duration: Indeterminate

Student Capacity

- Depends on supplies - each student needs at least 1 altoid tin, 3-5 tins are best

Assembly Instructions

- Empty and clean the interior of the tin with soap and water. Wipe dry with a paper towel or cotton cloth .
- Measure and determine the location of the tin's center. You' ll need to make a template to do this. Place the tin facedown on a piece of graph paper and trace it with a pencil. When tracing, stay as close as possible to the edges of the tin. With a ruler and pencil, draw a rectangular box over the outline of the tin and draw two diagonals from the corners of the box to create an X. The center of the X should be the center of the tin. Once these marks are made, cut out the template with scissors and poke a small hole through the center of the template with a pencil.
- Place the template on top of the tin and use a black permanent marker to make a black dot on the center of the tin.
- Get a roll of film, and cut the curved leader off the end, leaving a gO-degree angle on the film. Center the leader on the short side of the tin, and with the black permanent marker, make two marks on the tin, one on either side of the film . Connect the two marks with a solid black line. This will help guide you when you cut the tin later. Repeat on the tin's other side.
- After the tin is drilled and cut, you're ready to mask and paint it.
- Using 1 in. masking tape, place a piece of tape around the inside edges of the lid and anywhere else you want to keep free of paint.
- Tape is cheap, so I tape up most of the camera to make sure I don't accidentally spray or touch parts of the camera during the painting process.
- When the tin is properly taped, it's time to paint. I usually paint outside, standing up, holding the tin in one hand (over a surface covered with newspaper), the paint in the other. Make sure to wear nitrile gloves. You can remove the masking tape when the paint is dry.
- I would recommend using photo paper
- There is a camera in the glass cabinet

Assessment

- Pre-Activity Assessment:
- Key Ideas Review: Discuss key ideas from the lesson again with the students.

    - How does light travel? What was the first camera called? See if any students would like to volunteer to draw a ray diagram on the board.
- Activity Embedded Assessment
    - How Can We Make it Better? Remind students of the importance of iteration in engineering design, and encourage them as they work with their cameras to ask themselves: "How can we make it better?" Encourage students to experiment with new ideas and to be kind and helpful to each other as they share ideas amongst themselves.
- Post-Activity Assessment
    - Class Discussion: Whose pinhole camera worked really well? Why? How does the size of the pinhole affect the brightness of the image on the paper? How does the size of the pinhole affect the sharpness of the image? (Answer: The bigger the pinhole, the blurrier the image.)
- Activity Extensions
    - Students should be encouraged to examine various cameras, inside and out, to see the lenses and how the film is placed to record the images. You may be able to obtain inexpensive old cameras at a local thrift shop, which the students can take apart in class.

Resources

- Instructables.com (14 Jan. 2009.). How to Make a Pinhole Camera. Instructables.com. Retrieved from http://www.instructables.com/id/How-To-Make-A-Pinhole-Camera/
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