

*Activity 1: Grades 5-8***Red-Eye Reducer**

Producing computer-designed objects is a reality in this MIT lab. Not limited to paper printouts, this laboratory system sends computer-assisted design files to a high-tech cutting machine. The machine reads the files and uses waterjet technology to cut designs into sheets of building material. The cut material can then be used to make devices from custom bicycles to red-eye reducing camera attachments.



This activity page will offer:

- Insight into the eye's anatomy
- A chance to model red-eye reflection
- A critical examination of red-eye elimination

Red-eye Model

In this activity, you'll create a model of an eyeball. By examining the structure of this body part, you'll create an understanding of why red-eye occurs. You'll even explore the angles of incoming light that may reduce this annoying byproduct of flash photography.

Materials

- Round balloon
- Paper mache paste (non-toxic paste obtained from art teacher)
- Scrap newspaper
- Non-toxic red paint
- Paint brush
- Gloves
- Safety goggles
- Scissors
- Paper
- Flashlight

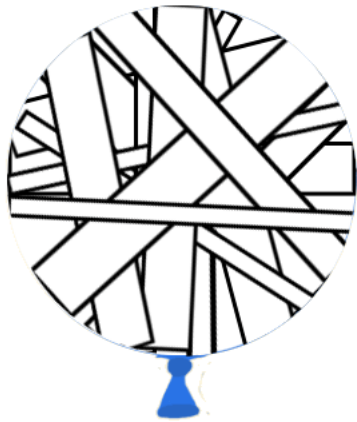
TEACHER NOTE: Scissors are sharp. Caution the students when using these tools. Review proper classroom behavior and techniques when using paper mache.

Steps

1. Blow up a round balloon so that it is about 5 inches (about 12.5 cm) in diameter.



2. Use scissors to carefully cut pieces of scrap newspaper into thin strips.
3. Put on gloves and safety goggles. Soak the strips in paper mache paste. Review safety concerns associated with this step.
4. Cover the balloons with two layers of soaked paper mache strips. Let dry. Then, add two more layers of soaked strips. Wait one day.



5. Have your instructor poke a small hole into the dried paper mache covering. Remove the balloon through this hole.
6. When the balloon is removed, have your instructor insert scissors into the hole and cut the dried paper mache cast in half, forming two hollow hemispheres.
7. Then have the instructor use scissors to carefully cut out a coin-sized circular hole in the center of one hemisphere.
8. Wearing both gloves and eye protectors, paint the inside of the both hemispheres red.



9. When the paint has dried, use tape to secure these halves back into a complete sphere.



10. Aim the beam of a flashlight directly into the opening. What do you see?
11. Aim the beam at different angles into the eye. How does the angle of the light affect the observed red eye artifact. Which angles produce less red-eye reflection?

Questions

1. Why was the inside of the eyeball model painted red?
2. What does the coin-sized opening represent?
3. How did the angle of the incident flashlight beam affect the red-eye property of the model?

Critical Analysis

Why does the angle of incident light affect the appearance of red-eye?

Anti Red-eye Strategy

One strategy for reducing red-eye uses a burst of flashes that occur just

before the actual image is captured. Why would a burst of bright flashes reduce red-eye? Think about it and then present your ideas to the class. You may wish to share your understanding using your paper mache model.

Sell, Sell, Sell

Suppose you were in charge of marketing a red-eye reduction device that could be attached to any camera. How would you market this tool? How much of the science would you share with your audience? With access to computer graphics software, create a magazine ad that addresses the benefits and simplicity of your invention. If resources are available, script and shoot an "infomercial" that markets this device to the general public.

Web Connection

[Anti Red-Eye Flash Photography](http://www.triz-journal.com/archives/2001/07/f/)

<http://www.triz-journal.com/archives/2001/07/f/>

The physics of anti-red-eye photography as presented by a Mechanical Engineer.

[Anatomy of the Eye](http://www.macula.org/anatomy/)

<http://www.macula.org/anatomy/>

An introduction to eye anatomy that includes a QuickTime journey into the eye.

[Waterjet Cutting](http://www.mfg.mtu.edu/cyberman/machining/non_trad/waterjet/#Theory)

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A primer on the science, history and application of waterjet cutting.

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**Questions**

1. Why was the inside of the eyeball model painted red?
(The red represented the blood vessel-rich inner surface of the eye).
2. What does the coin-sized opening represent?
(The pupil)
3. How did the angle of the incident flashlight beam affect the red-eye property of the model?
(When the flashlight beam and observer's vantage were at the same angle, the red-eye effect was greatest. When the beam and viewer were at different angles, the inside of the eye that the observer could see was not illuminated and so appeared less red.)

Critical Analysis

Why does the angle of incident light affect the appearance of red-eye?
(If the light beam strikes the retina and reflects directly back at the camera, then the reflected light is red. If the beam is angled so that the reflected light doesn't travel back to the camera, then the region of the retina that the observer can see is not illuminated and therefore appears dark.)

CURRICULUM LINKS
Life Science :

Form and function of the eye

Physical Science :

Behavior of light

Reflection and color

NATIONAL SCIENCE STANDARDS (Grades 5-8)

Science as Inquiry- Content Standard A

Students will explore causes for effects using models and observation.

Physical Science - Content Standard B

Students will examine reflective properties of a material.

Students will investigate light energy and its interaction with matter.

Students will understand that light must be reflected off an object into the eye to be seen.

Life Science - Content Standard C

Students will explore the structure and function of an organism.

Science and Technology - Content Standard E

Students will examine the relationship between science and technology.