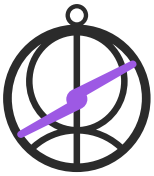
SPACE awareness

CAMERA OBSCURA

Build your own camera!

, Haus der Astronomie



Curriculum topic
Constellations, stars

Big idea of science

Keywords
Islamic Heritage

Age range
6 - 14

Education level
Primary School, Middle School

Time
1h30

Group size
Group

Supervised for safety
Supervised

Cost
Average (5 - 25 EUR)

Location
Indoors (small, e.g. classroom)

Core skills
Asking questions, Developing and using models, Analysing and interpreting data

Type of learning activity
Partial enquiry

BRIEF DESCRIPTION

Students will learn how to build a simple camera obscura, explore the inversion of images, and explore the fact that smaller pinholes lead to clearer images.

GOALS

By building and experimenting with a simple camera obscura, the students are going to explore the main characteristics of a pinhole camera.They will learn that sharper images can be produced with smaller pinholes, however on the expense of the brightness In addition, they will experience that the image is upside down. If the students produce cameras of different length, they will realise that the distance between the pinhole and the screen determines the size of the image.

LEARNING OBJECTIVES

After the activity, the students will be able to:

- describe the influence of the size of the pinhole on the image quality (brightness, sharpness).
- describe that the bigger the distance between the pinhole and the screen, the larger the image (if cameras of different size are available).

EVALUATION

- During the activity, the students experiment with different pinhole sizes. When working in groups, they can discuss the different observations they make. Afterwards, the working groups can exchange their results and list them on a blackboard or a whiteboard.
- The teacher may pick the shortest and the longest camera that was built (if applicable). The students observe the same object at identical distances. They describe the observation made with the two cameras.

MATERIALS

- Empty cereal box or a shoe box
- Empty cardboard tube
- Tracing paper
- Adhesive tape
- Scissors
- Bread knife or small hacksaw
- A pin or a needle

BACKGROUND INFORMATION

The earliest form of 'photography' and use of a pinhole was the camera obscura ('dark chamber'). It's a simple camera without a lense and with a single very tiny aperture called pinhole. Light from objects travels in a straight line through the pinhole, in such a way that the light from the top of the object passes through the pinhole, continuing in a straight line under an angle, and ends up at the bottom of the image. By employing a camera obscura Ibn al-Haytham explained the nature of light and vision and laid down the principles of cameras. From 1500 CE onwards lenses replaced the pinhole, but still resulted in inverted images.

Note that such a camera obscura is a safe tool for observing solar eclipses in projection.

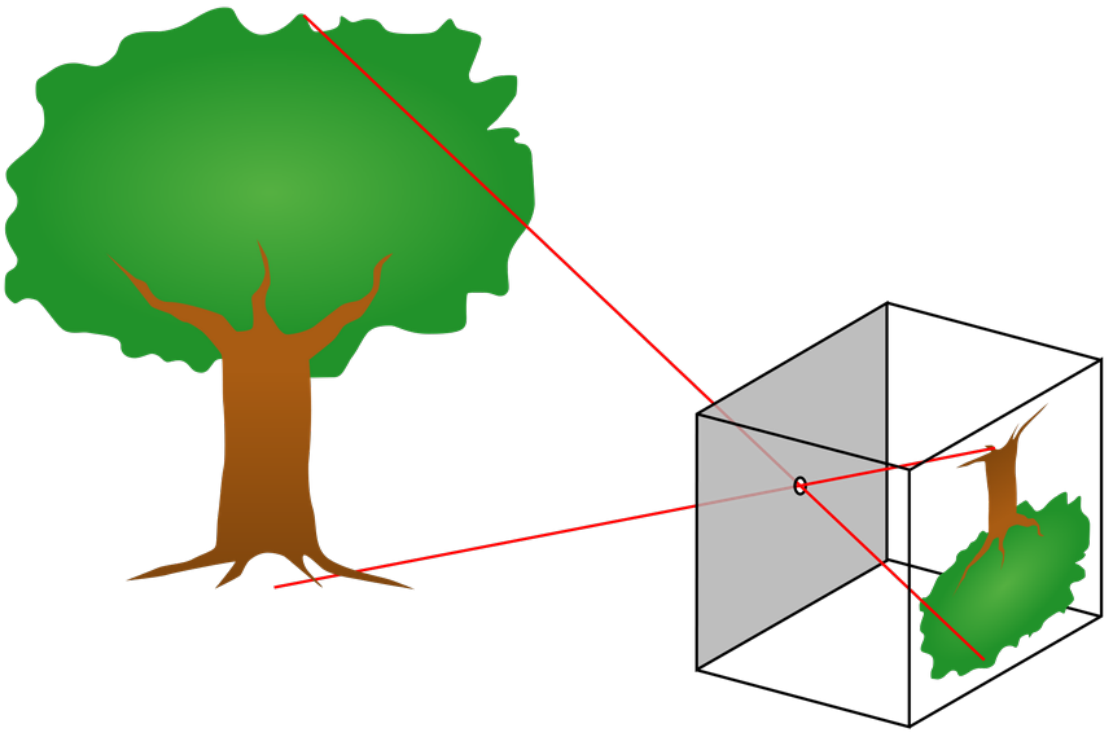


Fig. 38 Camera Obscura (Credits: aehistory.wordpress.com)

FULL ACTIVITY DESCRIPTION

A simple camera obscura

Instructions

1. Cut out a large aperture on the box and tape the screen (tracing paper) over the gap.
2. Use a pin to make a pinhole on the side opposite to the screen.
3. Hold the camera close to a light source to view the image of a bulb. You will see an inverted light bulb!
4. Experiment with different sizes of pinholes and observe the quality of the inverted image.





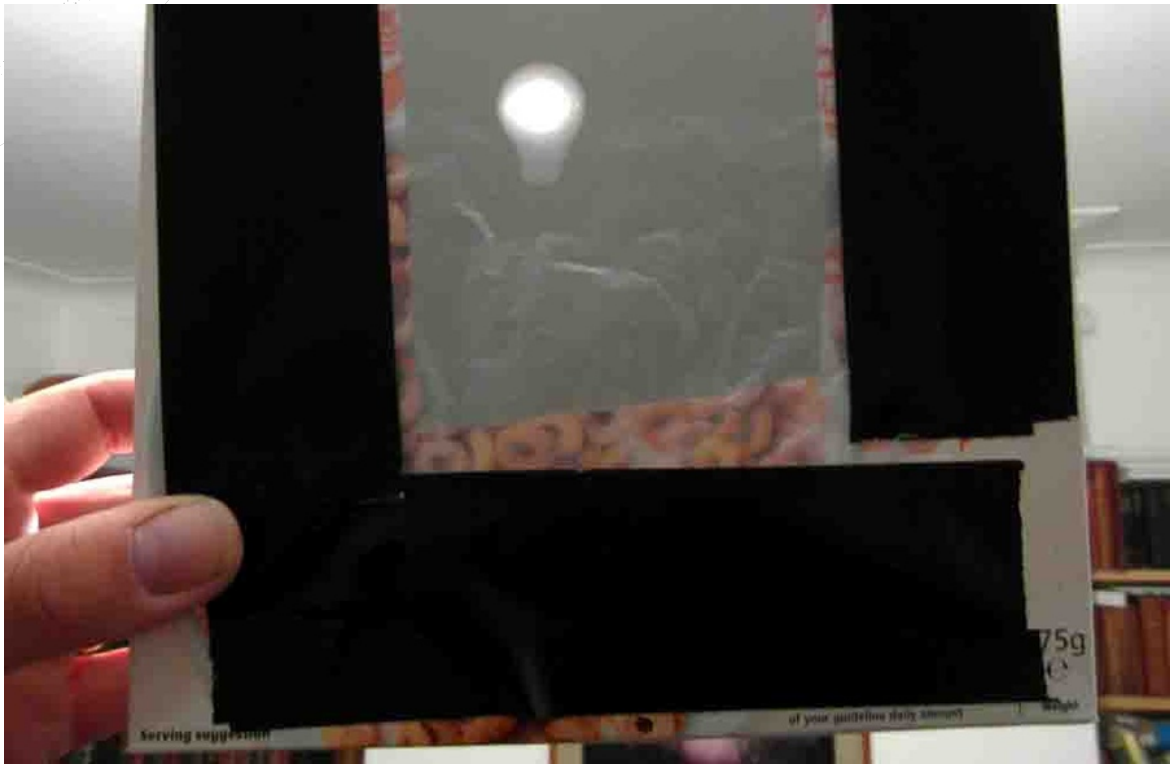


Fig. 39 Building a camera obscura (Credits: Justin Quinnell)

Another version of camera obscura: Tube Obscura

Materials:

- Empty cardboard tube
- Tape
- Tracing paper
- Tools: breadknife-hacksaw, scissors, pin.

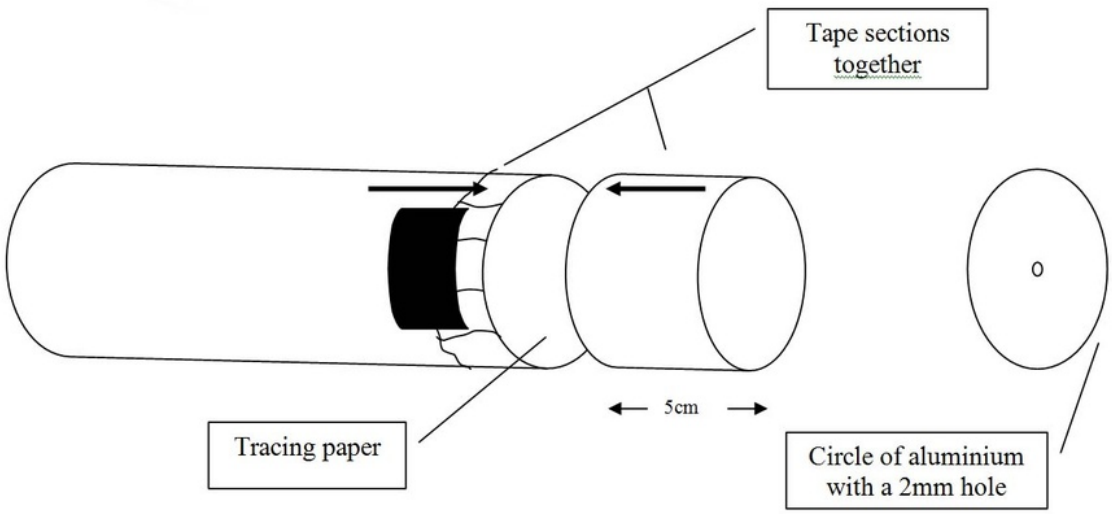


Fig. 40 A cylindrical camera obscura image (Credits: Justin Quinnell)

Instructions:

Cut the end of a cardboard tube (using a bread knife or small hacksaw) then tape some tracing paper tightly over the cut end of the tube. Reassemble the tube with the tracing paper inside (see figure 40). Use the same tube to trace a circle on a thin sheet of aluminium. (A flattened out drink can works well although thin black card will also work). Make a pinhole (the size of a drawing pin) in the centre of this circle. Cut the circle out with the hole in the centre and tape over the end of the tube. Look through with one eye whilst blocking the excess light with your hands.

CURRICULUM

Space Awareness curricula topics (EU and South Africa)

The journey of ideas, Constellations, stars

CONCLUSION

This activity deals with the concept of a camera obscura, a pinhole camera. After building their own camera, the students experiment with it to explore its characteristics as an optical tool. They will investigate properties of the image produced, like sharpness, brightness, and size. When studying the background information, they will learn that this concept is quite old and was transferred from the East to Europe.

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