Camera Obscura Project

By Susan Kilbride

http://funtasticunitstudies.com/

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Materials Needed

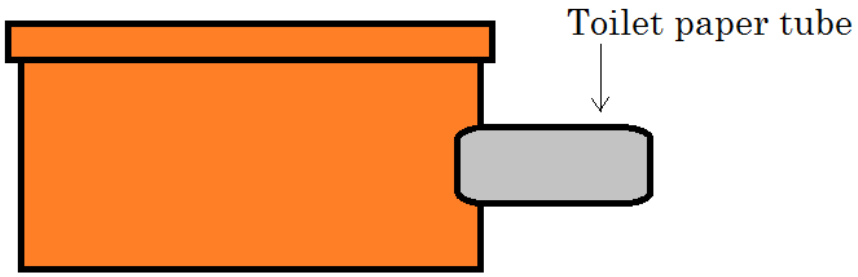
A shoebox
A toilet paper tube
Waxed paper
Thumbtacks
Blue painter's masking tape
Duct tape
X-acto® knife
Items such as black plastic, tinfoil, blankets, and towels to darken a room
Possibly a white sheet

The Project

Tell your students that a camera obscura a primitive form of camera. In fact, people have known how to make camera obscuras for over 2000 years. In more modern times, the images from small camera obscuras, called pinhole cameras, were projected onto film or photographic paper and made into photographs. You can make a pinhole camera without turning the image into a photograph by making a wax paper screen for the image to be projected on. You can also make a larger camera obscura, one that is room-sized, that will project whole scenes on a wall or screen.

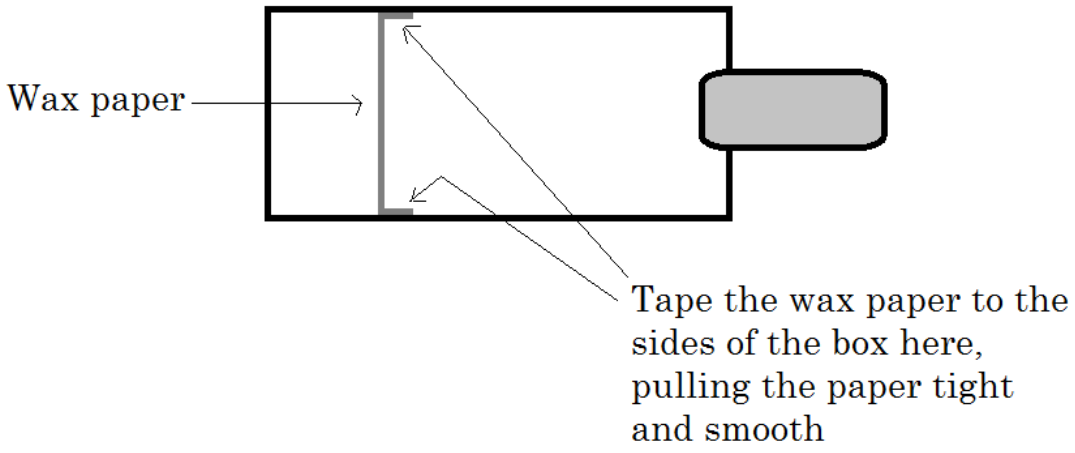
Activity:

Take a shoebox and, using an X-acto® knife, carefully cut a hole in one end just large enough to fit a toilet paper roll in (you can trace around the roll to mark how big the hole should be). An adult should probably cut the hole. Push the tube into the hole so that about 1 inch of the tube is inside the box. It is best if the tube fits tightly, but if there are any gaps around the tube, cover them with duct tape:

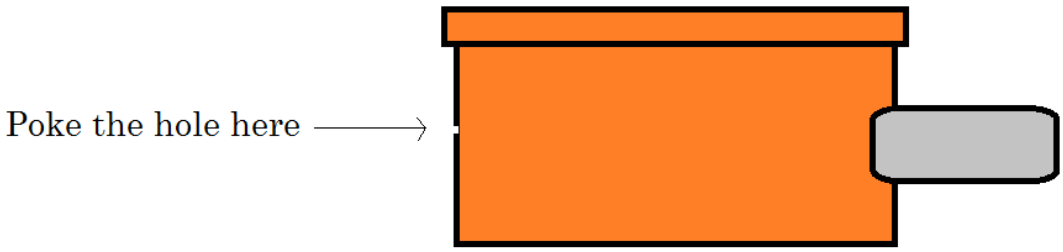


Now, cut a piece of wax paper so that it is the same height as the box and 3-4 inches longer than the width of the box. Open the lid of the box and tape the wax paper in the box so that it is about 2-3 inches from the end of the box that is opposite the tube:

View Looking down into the Box from the Top:



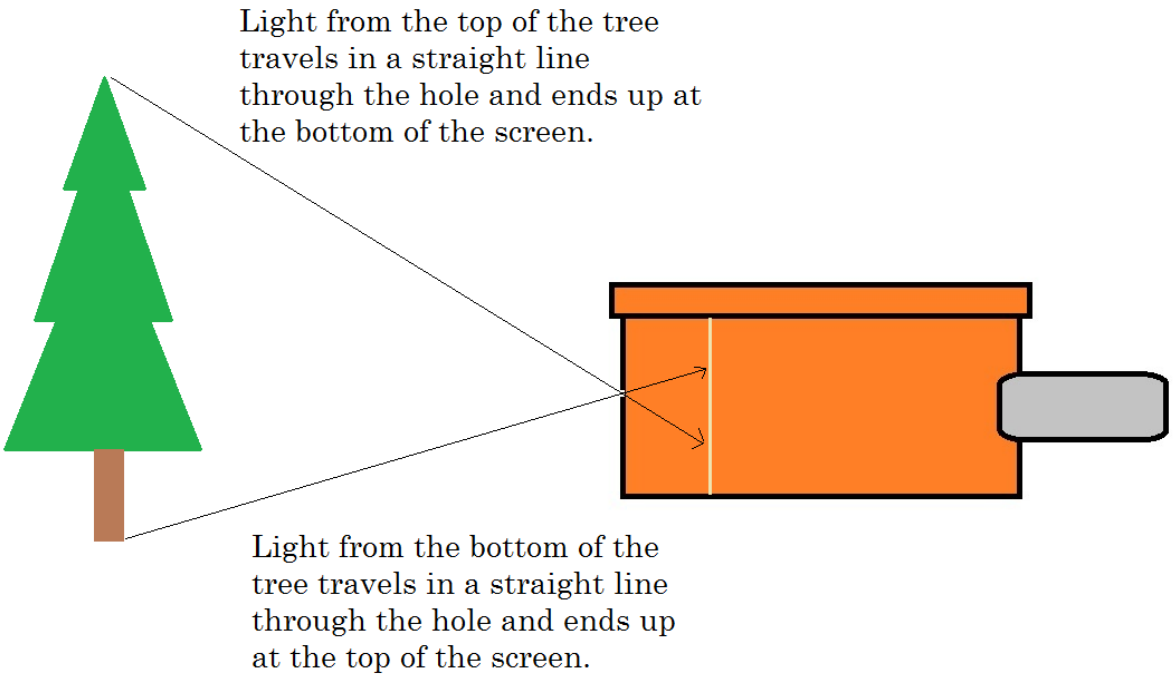
Next, seal up any cracks where light could get into the box with duct tape. (However, do not seal the open end of the tube!) Then put the lid on the box and poke a hole in the middle of the end of the box that is opposite the tube by pushing a pencil or pen into the cardboard. The hole should be about 1/8 of an inch in diameter:



You have now made a pinhole camera! Leaving the cover on, take it outside in bright sunlight and look through the tube while cupping your hand around the end so that no light can get into the tube while you are looking through it. Inside the box, you should see upside down shapes of the things around you that are projected onto the wax paper screen. If your hole is too small, you will only see a tiny dot, so you should enlarge it. If your hole is too big, the image will be too bright, and you probably won't be able to tell what you are looking at.

Tell your students that a pinhole camera works in a way very similar to their eyes. Objects that they see with their eyes have light bouncing off of them. When they see an object their eyes are actually seeing the light that is bouncing off of it. This light travels through the air and into the pupils of their eyes. Their pupils are like the hole in the pinhole camera that the light goes into. In the pinhole camera, the light is stopped by the wax paper screen and an image is shown on it. In their eyes, the retina acts the same way as the wax paper screen. In both their eyes and on the screen in the pinhole camera, the image is recorded upside down. Their brains know this and flip the image right-side up.

But why is the image upside down in the first place? This is because both our pupils and the hole in the pinhole camera are so small. Only a tiny bit of the light that is reflected off an object can go through them. Here's a diagram of how the light travels into the Pinhole camera and onto the wax paper screen:



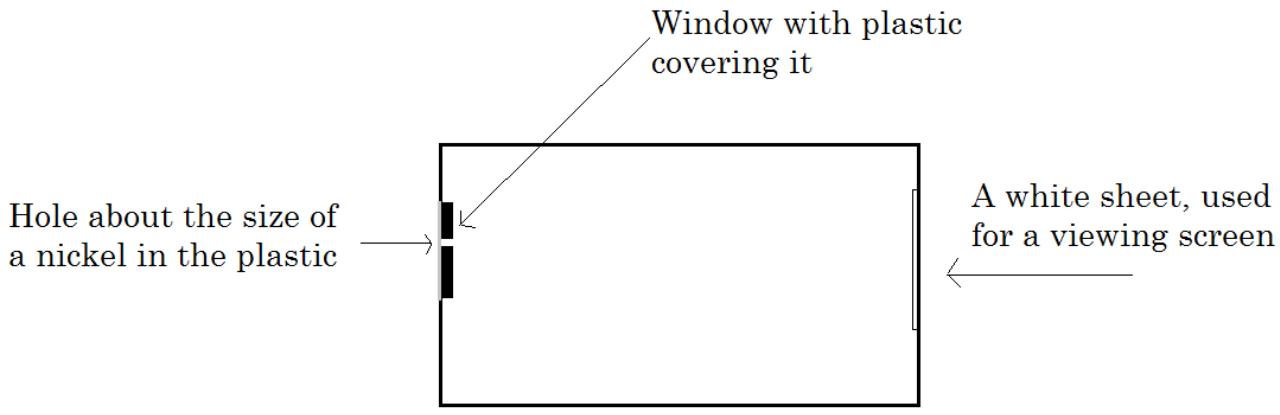
Activity:

Small camera obscuras are neat, but it is also really fun to make a room-sized one. Chose a room that is on the ground-floor and doesn't have too many windows in it. Then decide which window in the room has an outside view that might make an interesting projection onto a wall. You will need to make the wall in the room that is facing the window into a screen, so take that into consideration when you choose your window. If the wall is white, that will work well, but if it isn't, you can always hang a white sheet up so that it is directly across from the window. If the window has a window screen, take it off, or if only half of it has a screen, use the side without the screen when you make the hole for the light to go through at the end of the project.

Once you've chosen your room and window, you will need to make the room ***completely*** *dark. There are a number of ways to do this. You can hang double layers of dark sheets or blankets over doors and windows (but not over the window that you've chosen for your view), or you can cover them with black plastic. It helps to have blue painter's masking tape and thumbtacks handy. Stuff towels under the doors.*

You will need to cover the window that you have chosen with something that you can poke a hole in. Tinfoil works well, though it needs to be overlapped a lot. Black plastic could also work.

Once you have stopped up all of the light leaks that you can find in the room (this can take an hour or more), cut a hole the size of a nickel or a quarter in the middle of the covering that is over your chosen window. Don't look at the light coming in from the hole, but look at the wall that the light is shining on. It may take a few minutes for your eyes to adjust, but you should start seeing an upside down image of what is outside the window projected onto the wall. The longer you look at it, the better you will be able to see it, and if it is a bright sunny day out, you will be able to see some (or all) of the objects in color. You will also be able to see moving objects or people. The images won't be confined to your screen, they will be on your ceiling and floor also.



If you liked this project, you'll love Susan Kilbride's book, *Science Unit Studies for Homeschoolers and Teachers*

If you are looking for quality science units, but simply don't have the time to put a unit together, Susan's book is perfect for you. If you want to supplement your existing science program, I definitely recommend taking a close look at the book. Those of you who might be a little scared of trying to put together your own science lessons for fear you might get something wrong, fear no more....

--Jackie from Quaint Scribbles--

This collection of fun science lessons and activities are designed to offer hands on experiments that will satisfy the curious nature of children, while making it easier for parents to teach science.
--Kathy Davis of HomeschoolBuzz.com--

If you're looking for a science unit study homeschool program that is easy to use and is comprehensive and worth using, then you should check out "Science Unit Studies for Homeschoolers and Teachers." I recently read through the book and really liked what I saw.
--Heidi Johnson of Homeschool-how-to.com--

I think "Science Unit Studies for Homeschoolers and Teachers" is a good value and provides a lot of fun, hands-on science for homeschoolers.
--Courtney Larson, The Old Schoolhouse® Magazine--

....the conversational style and logical, easy-to-follow instructions certainly make this a recommended and useful tool for any parent; especially those that may be uncomfortable or unfamiliar with teaching science.
--Jeanie Frias of California Homeschooler--

The wealth of information included therein is amazing and the material is novice friendly. I would definitely recommend "Science Unit Studies for Homeschoolers and Teachers."
-- Bridgette Taylor with Hearts at Home Curriculum--

Susan's book is full of so many activities that one would have a very full study of general science over the course of a school year if every activity was completed. I teach a General Science class at a local homeschool co-op and I am implementing a lot of the activities in this book into my class this year....I highly recommend this book for any science teacher or student. It really makes the teaching of science quite simple and fun. Overall I give Susan's book 5+ stars.
--Heart of the Matter Online--

Science Unit Studies for Homeschoolers and Teachers is available online at Amazon.com:
http://www.amazon.com/Science-Unit-Studies-Homeschoolers-Teachers/dp/1463549156/ref=sr_1_1?ie=UTF8&s=books&qid=1310266925&sr=8-1