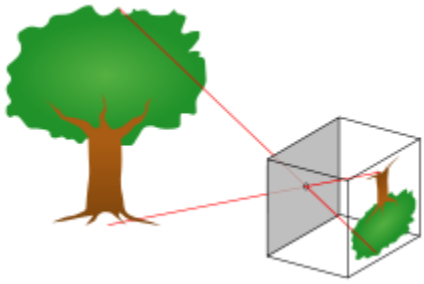
Pin Hole Camera

www.exploratorium.edu/light_walk

Names: _____

A camera without a lens!! No bending no reflecting, just straight light.



1. Poke a tiny hole in this paper with the tip of your mechanical pencil (remove the tiny flap of paper so that your hole is not covered). Create an image of the sun on your partner's paper or on the ground.

You've just made the aperture for a pinhole camera!

2. Now make a bigger hole – almost as big as your pencil. Can you make an image of the sun with this hole? What do you have to do to see it?

Observe the demonstration by your instructor.

The top right picture shows the images made by the sun through the leaves in a tree on a sunny summer day.

Images of the sun during two different eclipses made by the leaves in a tree.

The reason the sun shows up so well is that the sun is so bright. But actually, each hole also lets through a complete image of whatever is on the other side, including the sky, the houses, the people.

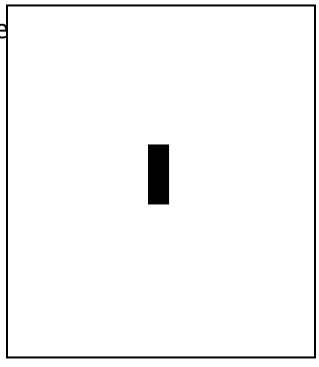
3. Now line up your pinhole, bigger hole or hole made by your hand with a fuzzy shadow from a distant object such as a tree. Describe the image and draw what you see.

Another way to think of it is this: When you put your eye somewhere, you can see everything around you: houses, trees, cars, people. Why? Because of the light that's coming right here into your eye. Now if I move out of the way, there's still light going through this little area in space, right there.

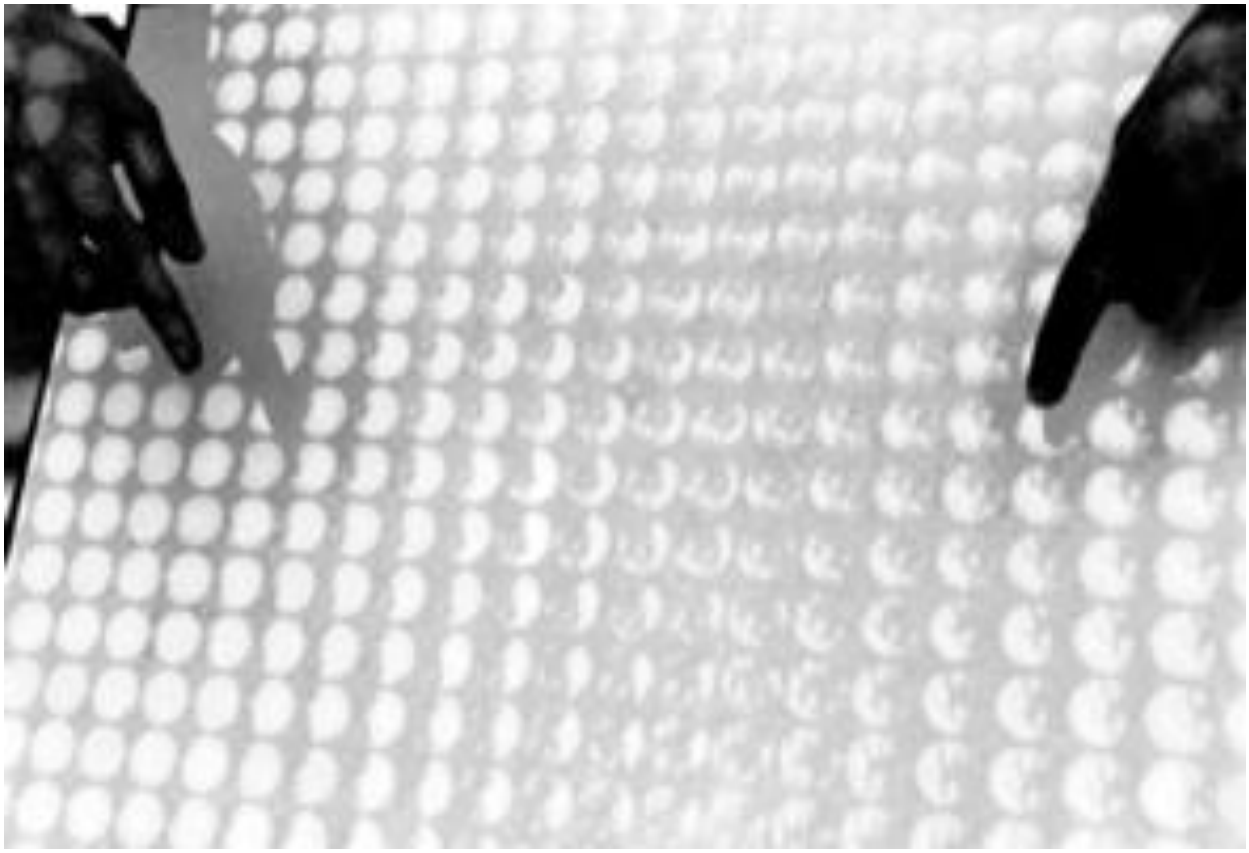
And it must contain all the information of the scene - the complete detail and color and everything - because otherwise I wouldn't be able to see it when I put my eye there. So that means that here, and here, and here - every little area in space - there is in the light all the information about the complete scene of where the light is coming from, whether it's being reflected or emitted from a lightbulb or whatever, even from behind you. If I turn 180 degrees around, I can see all the scene that's over there, too. And it's all contained in the light. The light that's invisible. You can't see it as it passes through this little area in space. All that information is encoded in the light, in the frequency - the different colors - in the brightness and in the direction it's traveling. And it's moving through there pretty fast - at 186,230 miles per second, in fact.

On the top right is the image created by a basic pinhole camera created in a shoebox with photopaper. The positive image was created digitally from the negative image.

4. Using your rectangular hole, create an image of a branch. Is the image long side of your rectangle horizontal or vertical or does it not matter?



Now there's a bare branch in front of the sun image, blowing in the wind. Here's a whole array of them through the pegboard. You can see that through every hole is a different image. Every hole is a slightly different viewpoint. From image to image, the changes are very slight, but from the right-hand side of the board to the left-hand side of the board, the images are very different. In fact, you can't see much similarity between what's on the right-hand side of the board and what's on the left-hand side of the board.



This is what a lens has to do. It has to take light from slightly different locations in space and focus them together into an image.

A pinhole image is pretty much always in focus even if you move your hole back and forth. But with a lens you are stacking all these tiny pin hole images on top of each other. You have to decide if you're going to focus on the sun or on the tree. This is "Depth of Field".