

# JUNIOR SCIENCE

*BOOK OF*

# LIGHT



ROCCO V. FERAVALO

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# JUNIOR SCIENCE BOOK OF LIGHT

*by*

Rocco V. Feravolo



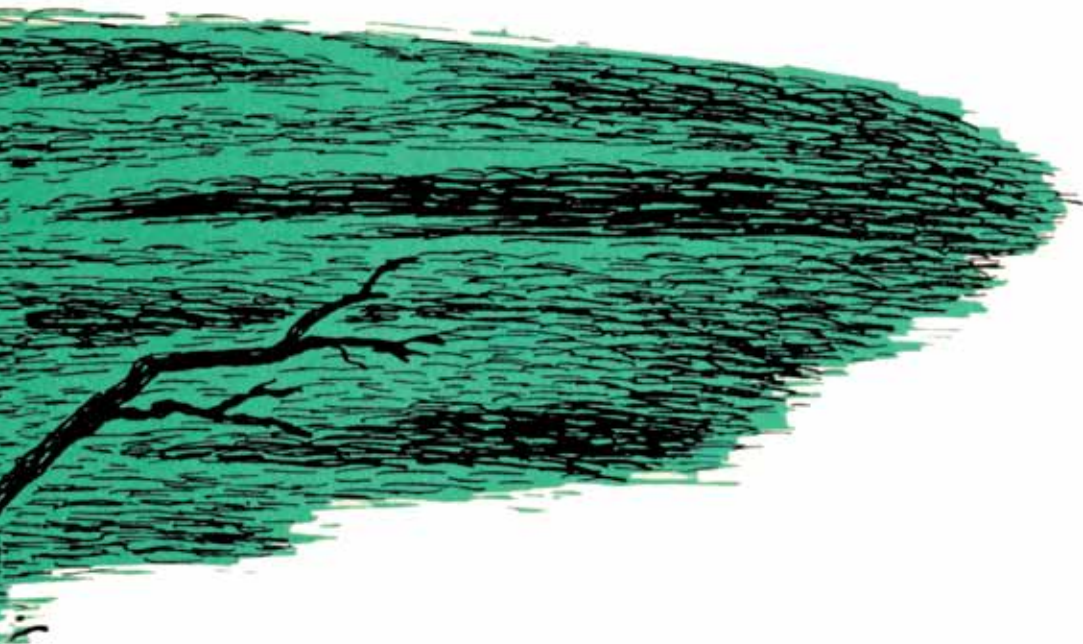




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## In the Beginning

Long ago, the only light came from the sun and the stars. At night the earth was dark—except when there was a moon. There were no candles, no lamps, no street lights, no neon signs.

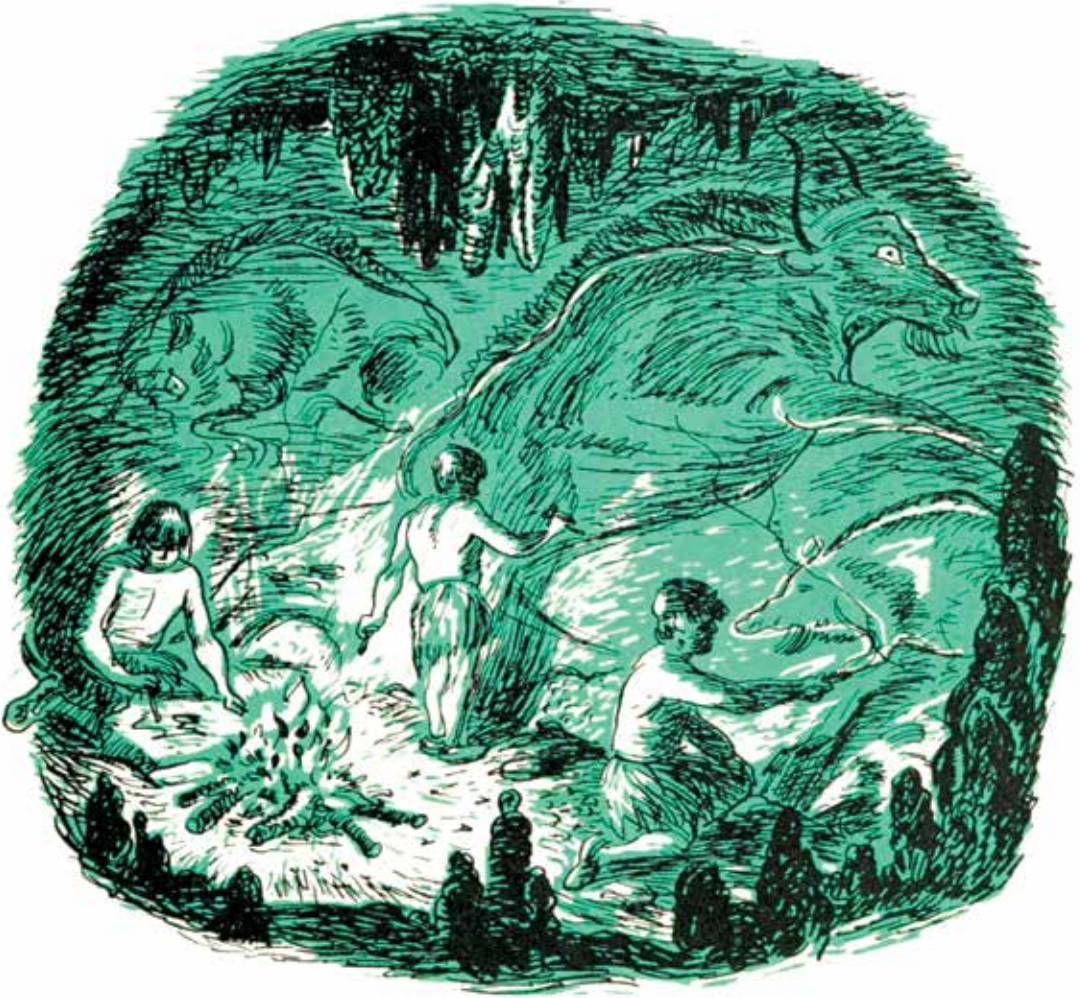
When the sun went down, the first people went to sleep in caves or trees. When dawn came, they went forth to look for breakfast.

Finally, the cave men learned how to use fire. Where did they get fire? One Indian story is that fire came from the buffalo. When herds of buffalo galloped across the plains, their hoofs struck sparks from the rocks. The sparks set fire to the brush. Another story is that a huge panther made sparks as his claws struck stone.

Most of the early fires came from lightning. Lightning often sets fire to trees. Probably cave men took burning sticks and made their own fires. Then they had light during the dark nights. The light scared off wild animals.

Fires also warmed the caves in winter. And the cave men discovered that roasted meat is better than raw meat.

Of course, there were no matches. There were no flints or steel, either. So the cave men kept



CAVE MEN HAD TO WORK BY FIRELIGHT.

their fires going day and night, year after year. In some parts of the world, that is still done.

By firelight, the cave men painted pictures on the rock walls of their caves. They made simple tools of stone and bone.

After many more years, man learned how to carry light with him. First he used torches of pine. Later he made lamps that burned candles or oil. Today we use a flashlight or the headlights of an automobile.

Now it is easy to get light anywhere. We even have electric lights in refrigerators. Baseball and football are played outdoors at night. Huge lights make the field almost like day.

Chicken houses have lights so the hens will wake up early and lay more eggs. Airplanes carry lights to prevent collisions at night.

All of us depend on light—day and night. We can't imagine living without it.



## Some Objects Make Their Own Light

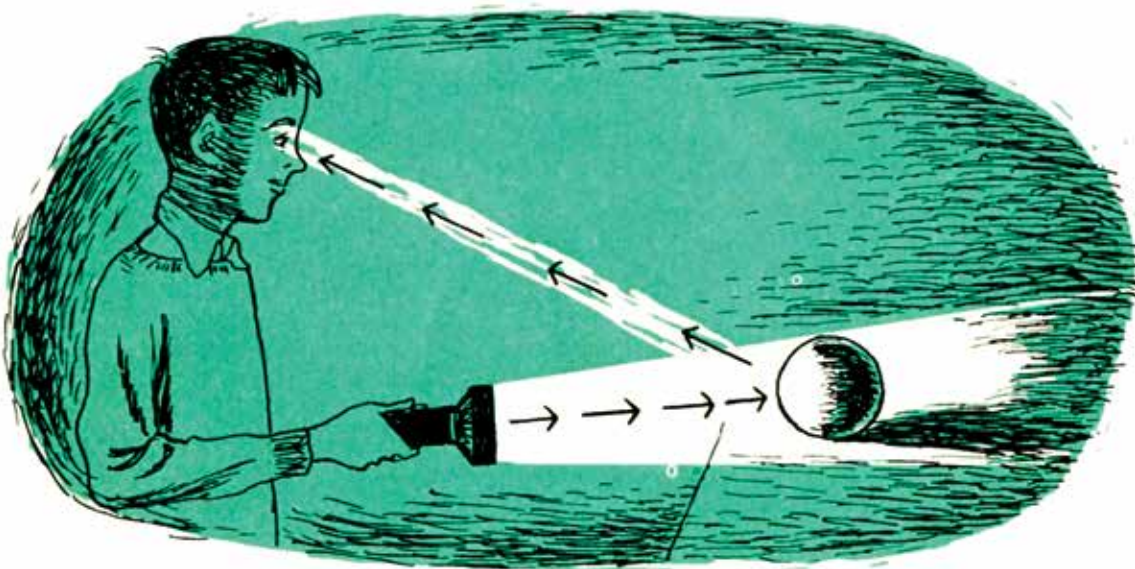
The cave man got most of his light from the sun. So do we.

The sun is really a star—a huge ball of glowing gases. The sun and other stars are called *luminous objects* because they make their own light.

A burning match is a luminous object. So is a traffic light. So is a firefly.



Things that don't make any light are called non-luminous. The moon is a *non-luminous* object. It has no light of its own. You can see the moon only because sunlight reflects from it. It's like turning a flashlight on an owl in an oak tree at night. You can see the owl very plainly because your light shines on it. But the owl is a non-luminous object, like the moon.

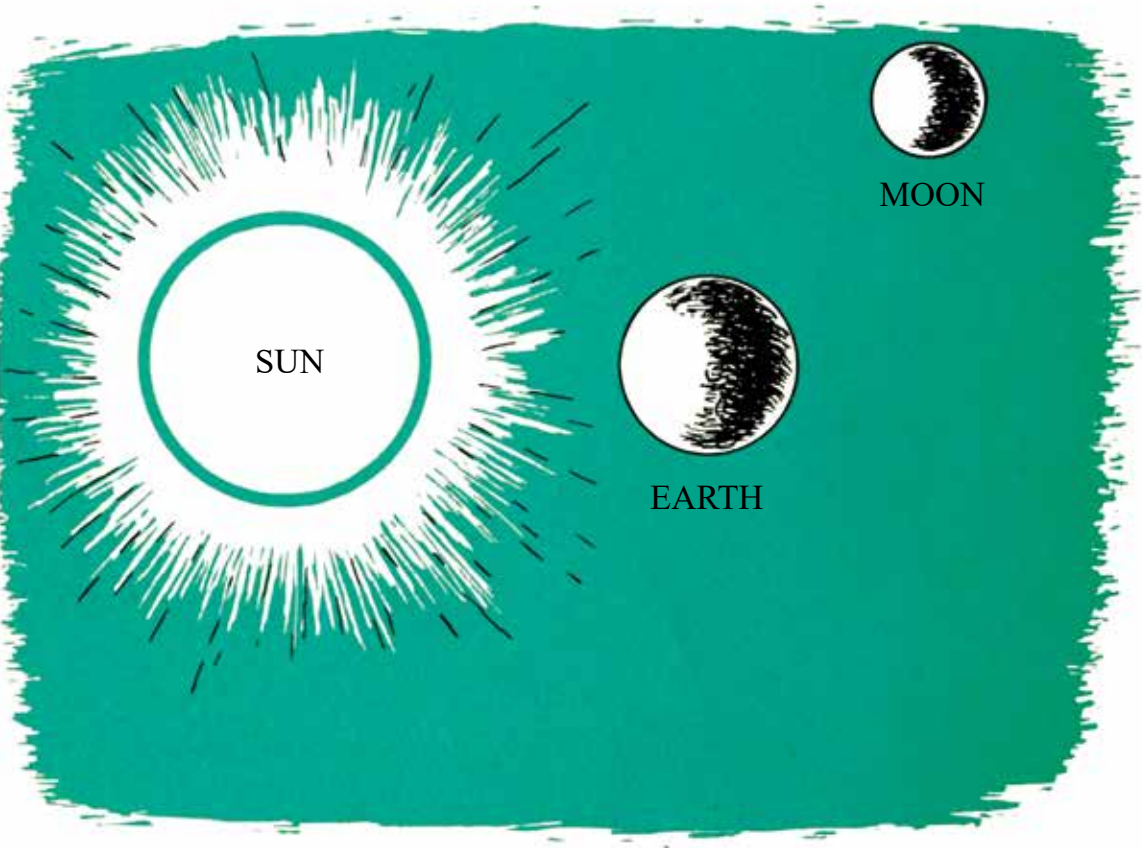


LIGHT FROM THE FLASHLIGHT HITS THE BALL. THEN IT IS REFLECTED TO YOUR EYE.

Take a flashlight and a ball into a dark room. Be sure there is no light at all. Put the ball on a table. Step back. You can't see the ball because it has no light of its own. It is non-luminous.

Turn your flashlight beam on the ball. Now you can see the ball plainly. Light goes from the flashlight to the ball. Then it bounces back from the ball to your eyes. We say the light is *reflected* from the ball.

The sun is like your flashlight. It shines on the moon. Like the ball, the moon has no light of its own. But it can reflect the sun's light to us. Then we can see the moon.





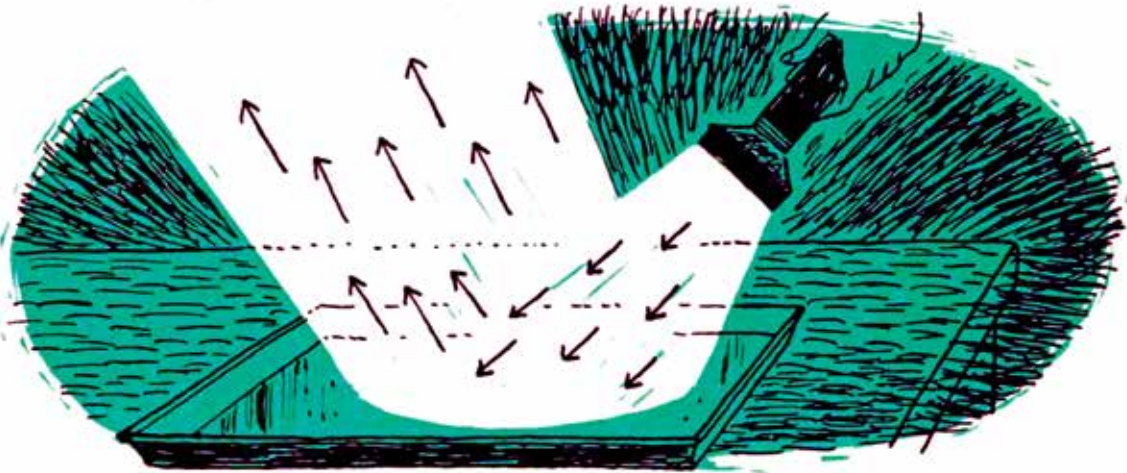
## How We See

We see non-luminous things because of reflected light.

Go into a dark room and try to read this book. Of course you can't because the book has no light of its own. Turn on the light. Now you can read. The book reflects the light of the bulb to your eyes.

Lay a mirror on a table in the dark room. There should be no light in the room at all. Shine the beam of a flashlight on the mirror.

Notice how the mirror reflects the light. The reflected light seems almost as bright as the beam from the flashlight.



MIRROR

Put a smooth piece of aluminum foil on the table. Again, be sure the room is completely dark. Turn the flashlight on the foil. A lot of light will be reflected. The flat foil works



SMOOTH FOIL

almost as well as a mirror. From a smooth surface, light rays bounce back in the same direction.

Now crumple the foil into a ball. Open up the ball, but don't make the foil smooth and flat. Just lay it on the table, full of crinkles. Turn your flashlight beam on the rough foil. The light bounces off in all directions.



CRUMPLED FOIL

Rough surfaces do not reflect light as evenly as smooth surfaces.



## How Light Travels

Sound can travel 1,100 feet in one second.

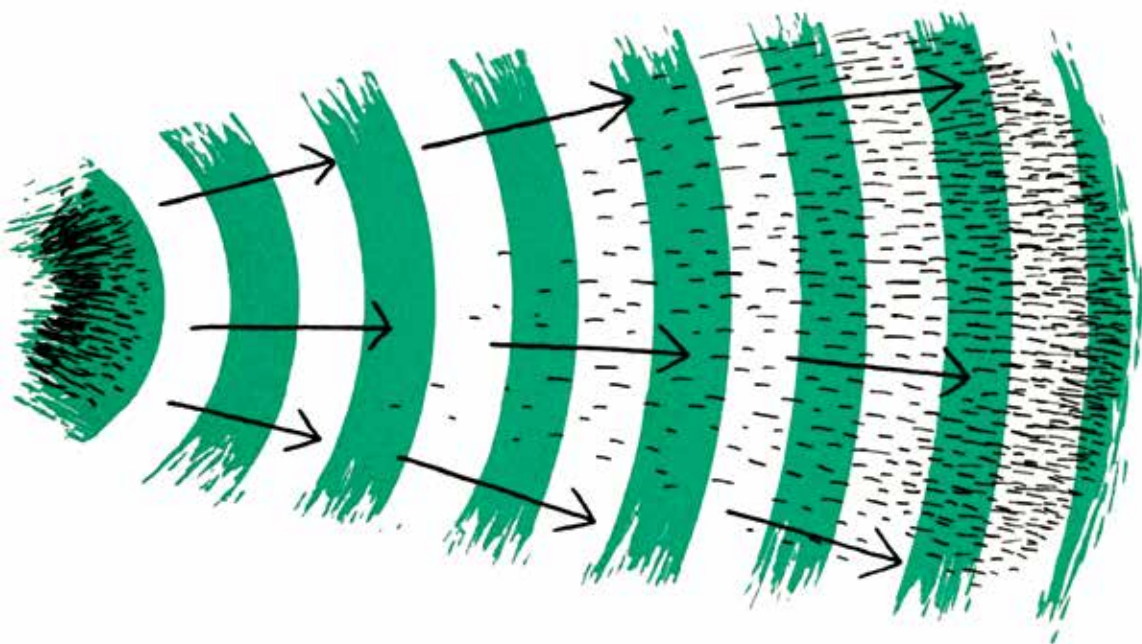
A rifle bullet will go three times that fast.

But light travels 186,000 miles in just one second. If a rocket ship could travel that fast, it would go around the earth seven times in a second.

Aim a strong flashlight at a tree some distance away. Press the button. The light seems to get there instantly.

Most scientists say that light is a series of waves. The waves spread out into space. The brighter the light, the farther the waves travel. The light from a match will not go far. The light from a bonfire can be seen a long way off. The light from the sun travels millions of miles.

Light waves are tinier than you can imagine. Look at one inch on a ruler. In that inch there is room for about 200,000 light waves.



LIGHT TRAVELS IN WAVES LIKE RIPPLES ON A POND.

Light travels in an almost straight line. It stops when it hits an object it can't go through. It may bounce back as reflected light.

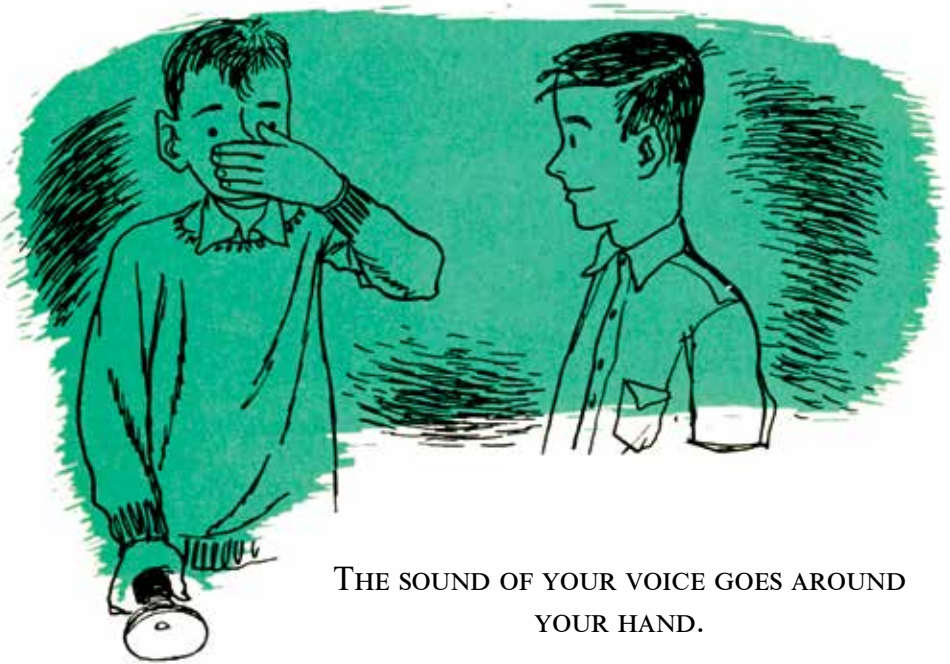
Go into a dark room again with a flashlight. Take another person and ask him to stand away from you. Aim the flashlight at him. Hold your hand in front of the flashlight. Some light shines out from the side of your hand.



YOUR HAND STOPS THE BEAM OF LIGHT.

But your friend won't be able to see the beam.  
Your hand has stopped it.

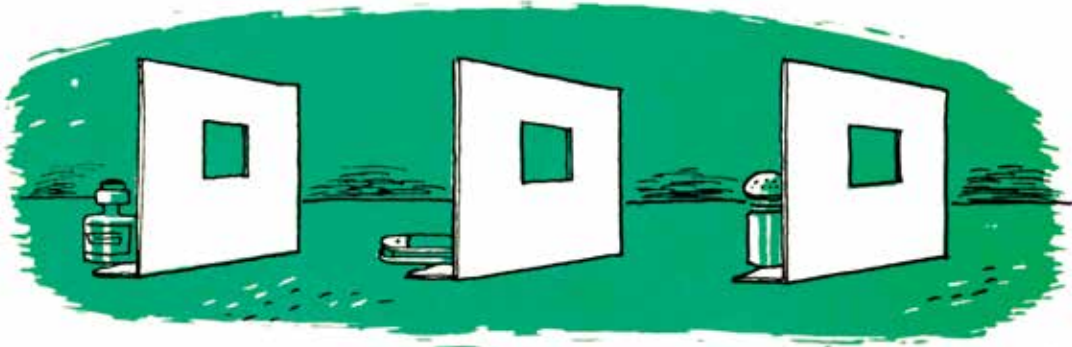
Now hold your hand in front of your mouth, without touching it. Say something. Your friend will hear you. The sound of your voice will go around your hand. Sound waves can turn corners.



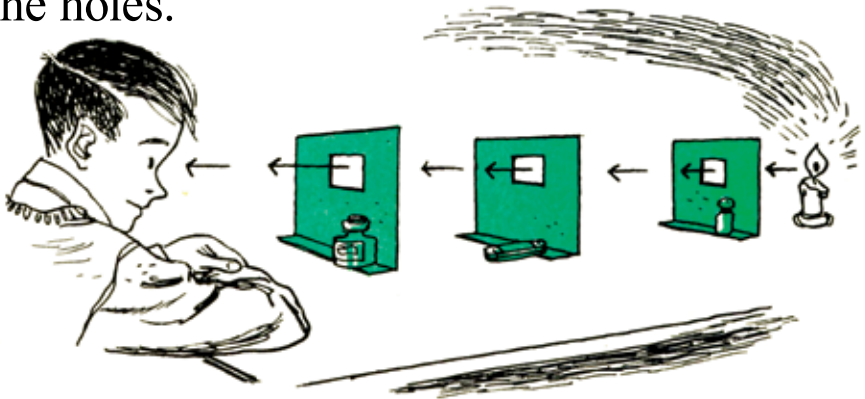
THE SOUND OF YOUR VOICE GOES AROUND  
YOUR HAND.

Actually, light waves can bend slightly, too. But they bend so little that only scientists can measure the bending.

Try Another Experiment. Take three pieces of cardboard about 6 inches square. Cut a hole about an inch square in each piece. Fold over an inch at the bottom and line up the three pieces. Use a weight to keep each piece from falling over. A pair of scissors, a pocket knife, or a small rock will be heavy enough.

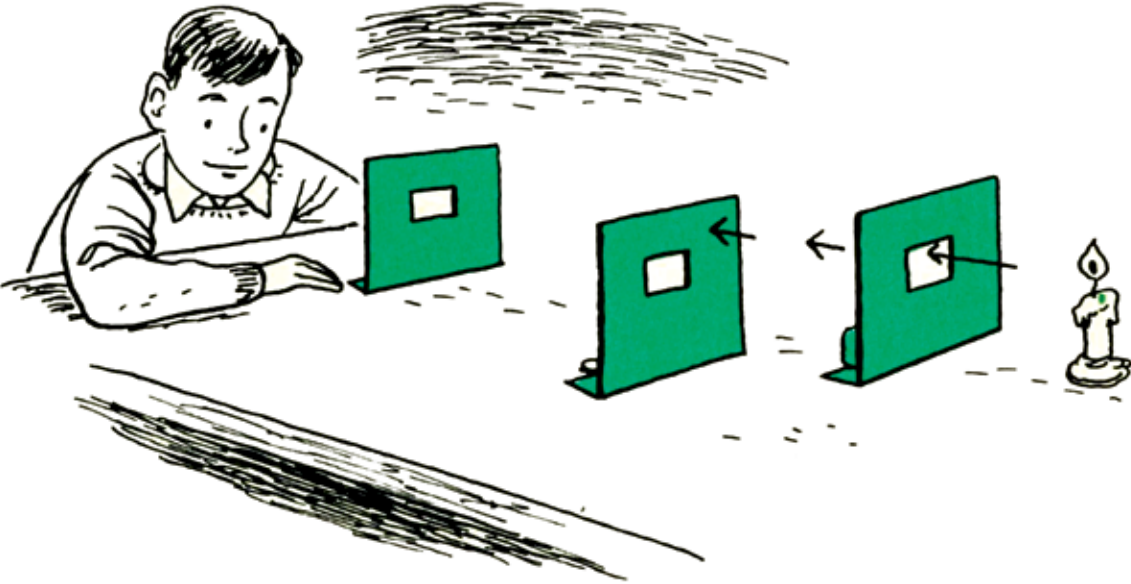


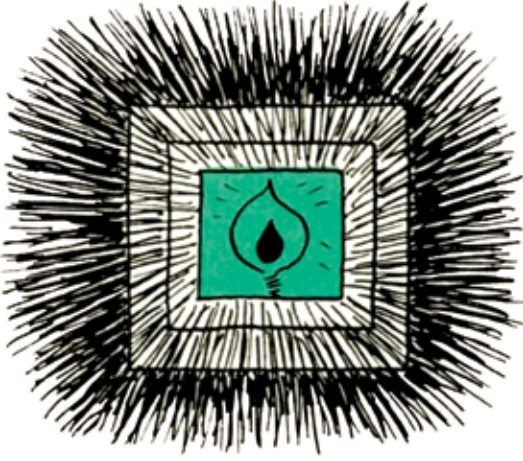
The holes must be in a straight line. Now put a lighted candle at one end and look through the holes.



You can see the candle because the light travels in a straight line.

Now move one piece of cardboard an inch to one side. You cannot see the candle flame. Light won't turn a corner.



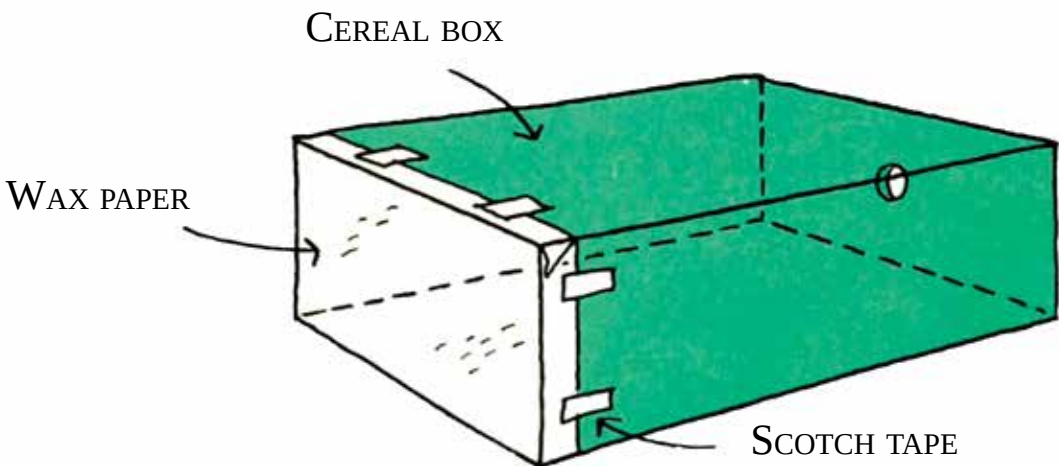


## A Pinhole Camera

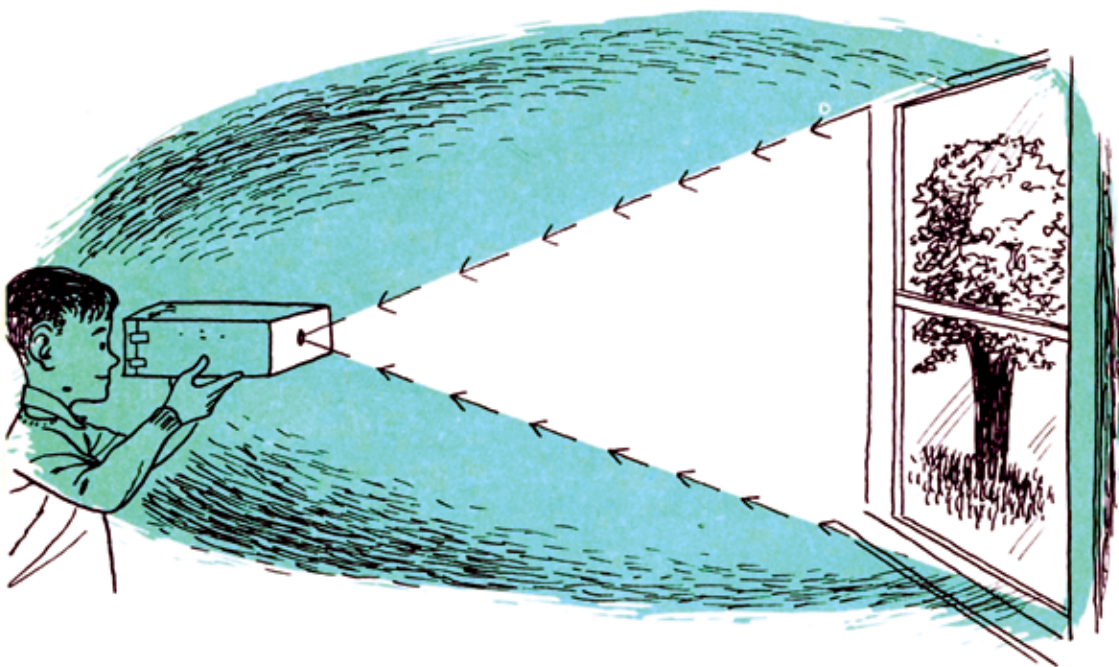
A simple pinhole camera will show that light travels in a straight line.

Cut off the top of a cereal box. Cover the hole with wax paper. You can fasten the paper with scotch tape.

With a pencil or big nail, punch a hole in the bottom to make a pinhole camera.



Hold your camera in front of a window. You want to see the blue sky and some of the ground. Point the small hole toward the window.



On the wax paper of your camera, the ground is at the top. The blue sky is at the bottom.

The earth and sky appear upside down because light travels in a straight line.