Light and Shadow

A Family Inventors’ Lab Original
Look around you. Can you see things in the room?
What if you turn off the lights? 
Now can you see?

No, you need light to see.
Sources of Light

Where does light come from?

The sun is our main source of light, but light also comes from the stars, from flame, and from inventions like lightbulbs and flashlights.
Reflected Light

Rays of light move in straight lines. When a ray of light hits something, it bounces off again. The light is reflected back to you, helping you to see the object.
Try these experiments

1. Drop a ball straight down on a hard surface. The ball bounces straight back up.

2. Throw a ball down at an angle. It bounces up at an angle. (deflects)

3. Turn off the light. Shine a flashlight around—when you point the light at an object, the light bounces back (reflects) and you see the object.

4. Shine a flashlight toward a mirror, but at an angle. The light bounces off at an angle. (deflects)

5. Play with mirrors and flashlights in a dark room. Where can you bounce the light to?
Shadows

Light only travels in straight lines. If light hits a solid object, it can’t turn to go around it.

If you shine a light toward a surface (like a wall), all the light falls on the wall. But, if you put an object (like a cat) between the light and the wall, the cat blocks some of the light. Behind it, there is a dark patch on the wall—a shadow—shaped like the cat.
Try these experiments

Hold a tray (or book) in one hand. Drop a ball onto it. Does the ball go through the tray? No, the tray blocks its path.

Hold a tray and shine a light onto it. Does the light pass through the tray? No, the tray blocks the light, and makes a shadow below it.
Big things make shadows. Small things make shadows. The closer the light is to the object, the bigger the shadow is.

If the light is shining from above the object, it makes a small shadow. If the light is shining from beside the object, it makes a big shadow.
Try this experiment

Place a toy on a table in a dark room. Shine a flashlight on it to make a shadow. Move the light further away, then closer to the toy. Hold the flashlight above the toy, then hold it down low next to the toy. What’s the biggest shadow you can make?

When you have a perfect shadow, place paper where the shadow falls, and trace the shadow.
On a sunny day, there’s lots of direct light on you, so you cast a shadow.
Shade

On a hot sunny day, you may like to be in the shade where it’s cooler. Shade is a shadow made by a large object like a tree or a building. When you’re in the shade, you don’t make a shadow, because there’s no light shining directly on you.
Where is your Shadow?

If the light shines on your back, your shadow is in front of you. If the light is in front of you, then your shadow is behind you.

On a cloudy day, the clouds scatter the rays of light all over, and you don’t have a shadow.
Try these experiments

In a dark room, have a friend shine a light on your back... look for your shadow in front of you. Then have them shine a light on your front... look behind you. Then have two friends shine a flashlight from two different directions... you’ll have two shadows. Then turn on the lights, so there’s lots of light from all directions. Where did your shadow go?
Shadows change through the day

Remember how the shadow was smaller when we held the flashlight above your toy, and longer when we held it next to the toy?

The same thing happens with shadows from the sun. In the middle of the day, when the sun is high up in the sky, shadows are small.
At the beginning and end of the day, the sun is low in the sky, and shadows are very long.
Day and Night

In the day time, the sun is shining directly at our side of the earth. At night time, our side of the earth has turned away from the sun, and we are in the shadow cast by the earth.
Opaque

Most objects are opaque. They block all the light, and create dark shadows.

Translucent

Some objects are translucent. They let some light through, but not all of the light. They create pale shadows.
Transparent

Some objects are transparent. They let all the light through. They do not create shadows.

Diffusing

When a beam of light passes through a cloud of steam, or smoke, the light scatters.
Hand Shadows

You can use your hands to make different shapes of shadows. Set up a light so it shines on a wall. Then hold your hands in front of it so they cast a shadow on the wall. Try making these shapes:
Shadow Puppet Theatre

You can make shadow puppets by cutting shapes out of paper, and taping the shapes to a stick. Can you design a puppet show for your friends or family?

If you want, you can build a theatre for your shadow puppets with a cereal box and wax paper.
An optional (messy) activity:
Fill a spray bottle with diluted paint.
Have your child place their hand on the paper. Explain that you’re pretending the paint is light. When the “light” shines on their hands (i.e when you spray the paint), the back of their hand is covered, but the light / paint can’t get through to the paper because the hand blocks it.
So, when they move their hand, they leave a “shadow” behind.

Note to Parents and Teachers:
This book is intended to introduce children ages 3—6 to some basic scientific concepts. When you’re reading this book, pause and do the experiments described: you’ll need a ball, a flashlight or other bright light that you can aim, a mirror or two, and a tray (or book). Optional: some objects that are translucent, transparent, and diffusing. The puppet theatre project requires paper, popsicle sticks, a cereal box, and wax paper.

Have fun experimenting together!

If you’d like ideas for more hands-on STE(A)M activities for kids, check out my website, www.InventorsOfTomorrow.com

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