

# Reflections and Shadows

## Science for 3–5 year-olds



We gratefully acknowledge the financial support of the Province of British Columbia through the Ministry of Education.

**CAREGIVERS, PARENTS AND PRESCHOOL EDUCATORS** provide many creative opportunities for young children to explore their world. That's why we've created *Big Science for Little Hands*, an evolving suite of science resources for teachers and caregivers of 3- to 5-year-old children. Our aim is to develop activities that inspire further exploration and discovery. We hope that these resource materials complement what you are already doing and offer additional ideas to inspire further exploration.

The activities have been designed for experiential learning. The intent is for children to experience each concept, rather than simply talking about it. Each activity can serve as a starting point for further exploration.

The activities are divided into the following categories.

**Introductions**—These could be used to set the stage for the topic, or to find out how much the children already know. They're low-preparation, low-mess activities for a large group to do together.

**Explorations**—These require a bit more set-up and clean-up. They work best with small groups of children. They're intended to be open-ended, with a teacher or other adult available to pose questions and expand the activity as required.

**Make This**—These explorations result in a product that children can take home or display.

**All Together**—This big whole-group activity would make a great wrap-up to the topic.

**Connections**—Ideas for extending the topic in cross-curricular ways.

You know your group best! There is no perfect way to order or arrange these activities. They can be combined to spend an entire day on one theme, or used one at a time over several weeks. Please pick and choose, expand or contract as makes sense for your group of children.



Check for more resource packages coming soon:  
[scienceworld.ca/preschool](http://scienceworld.ca/preschool)

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Science World British Columbia  
TELUS World of Science 1455 Quebec Street, Vancouver, BC Canada V6A 3Z7  
t 604-443-7440 f 604-443-7430 w [telusworldofscience.com/vancouver](http://telusworldofscience.com/vancouver)

### Topics Now Available:

#### Round the Circle

Activities to explore round things and things that roll.

#### Wet & Dry

Activities to explore being wet and dry.

#### Sticky Stuff

Activities to explore stuff that sticks.

#### Size Matters

Activities to explore things that get bigger and things that get smaller.

#### Mysterious Mixtures

Activities to explore dissolving, separating, mixing and combining.

#### Super Sleuths

Activities to practice science process skills such as observing, comparing and contrasting and using tools like magnifiers.

#### Reflections and Shadows

Activities to explore light, mirrors, reflection and shadows.

#### Amazing Me

Discover the amazing things your body can do, both inside and out.

# Reflections and Shadows

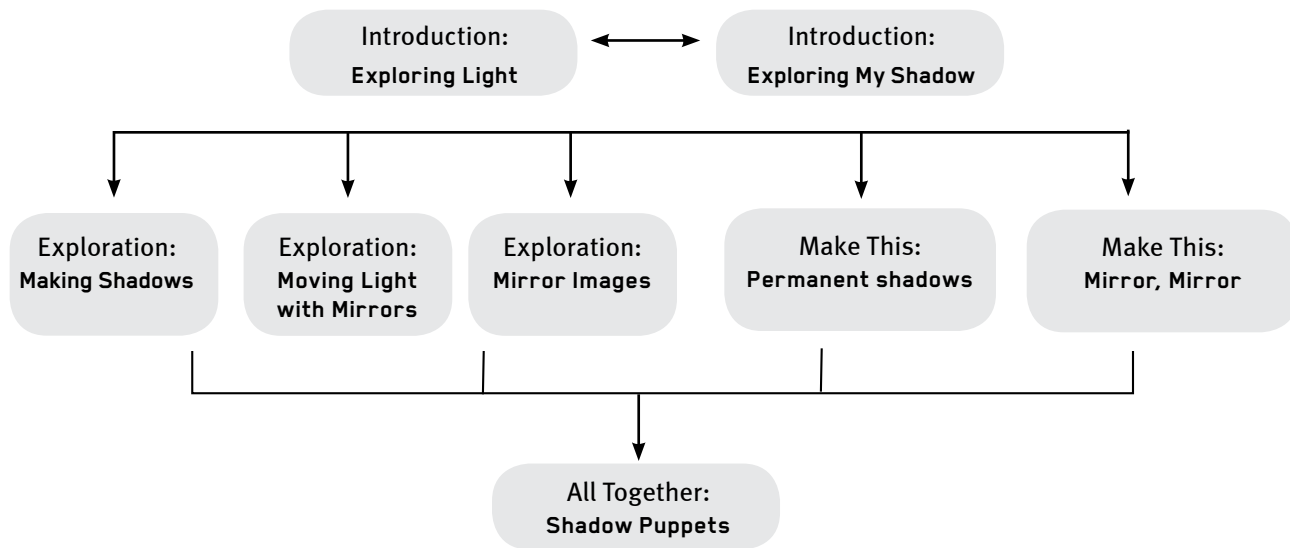


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## A Path Through *Reflections and Shadows*

Here's one possible way to put the activities in this resource together.

- Do one or two *Introductions* at circle time in a large group.
- Have the children work on *Explorations* and *Make This* activities in smaller groups at stations around the room.
- Try *All Together* just before the end of the school day, or at the end of working on the topic.



*Big Science for Little Hands* supports the learning goals outlined in the British Columbia Early Learning Framework, particularly those in the area of Exploration and Creativity.

To promote exploration and creativity, adults provide an environment where young children can do the following:

- explore the world using their bodies and all their senses
- build, create and design using different materials and techniques
- actively explore, think and reason
- identify and try possible solutions to problems in meaningful contexts and situations
- be creative and expressive in various ways
- develop a sense of wonder for natural environments
- express a zest for living and learning

(BC Early Learning Framework: [bcded.gov.bc.ca/early\\_learning/](http://bcded.gov.bc.ca/early_learning/))

## Share with us!

Please send us your feedback, suggestions and ideas.

Email [bslh@scienceworld.ca](mailto:bslh@scienceworld.ca) or visit [scienceworld.ca/preschool](http://scienceworld.ca/preschool) and fill in an online survey.

*Thank you to the children and families around British Columbia who assisted with the testing of the activities in this package. Thank you to The Canadian Children's Book Centre for recommending many wonderful children's stories.*

# Reflections and Shadows: Introductions



## Exploring Light

Light travels in straight lines. As a beam of light travels away from a flashlight, it spreads out. You can see this by looking at the light spot that the flashlight makes on a wall or another object. The farther away the light spot is, the larger and dimmer it is.

We see things when light bounces off them into our eyes. In a dark room we can bounce the light from a flashlight onto objects so that we can see them.

### What you need

- Several flashlights (one per child if possible)
- A slightly darkened room

### Hands-on

1. Practice controlling the beam of light by shining it on specific objects, the walls and the ceiling.
2. Explore how the light moves when you move the flashlight.

### Questions to ask

- Where is the light coming from?
- What do we use flashlights for? When have you used a flashlight before?
- What happens when you move the flashlight?
- Does the spot of light always look the same? Can you make it bigger or smaller?
- What happens if you put an object in the path of light?
- Can the light go around a corner?

### What next?

Play “Simon Says” with the flashlights. Have the children point their flashlights as directed, e.g. “Simon says shine your flashlights at the door.”  
In a very dark room, make objects “appear” by shining the flashlight at them.

### Notes for next time

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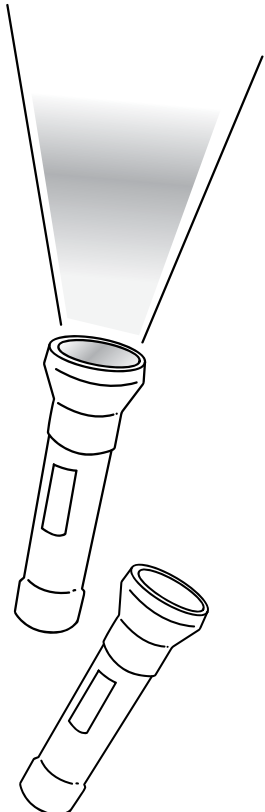
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### Where to next?

- INTRODUCTIONS**
  - ▶ *Exploring Light*
  - Exploring My Shadow
- EXPLORATIONS**
  - Making Shadows
  - Moving Light with Mirrors
  - Mirror Images
- MAKE THIS**
  - Permanent Shadows
  - Mirror, Mirror
- ALL TOGETHER**
  - Shadow Puppets
- CONNECTIONS**
  - More Ideas



# Reflections and Shadows: Introductions



## Exploring My Shadow

Light can pass through some objects and is blocked by others. Where the light is blocked we see shadows. Our bodies are opaque; light cannot travel through them.

Explore the placement of your shadow on the ground at different times on a sunny day. Because the earth is rotating (once every 24 hours) the sun shines on us from different directions over the course of a day. Our shadows appear in different places. When the sun is directly overhead our shadows are shorter; when it is rising or setting our shadows are longer.

### What you need

- Sidewalk chalk in a variety of colours
- A sunny day

### Hands-on

1. Go outside on a sunny day with sidewalk chalk.
2. Stand on a line and have a friend draw the outline of your shadow on the pavement. Draw the outline of your feet as well so you know exactly where you were standing.
3. Name your shadow or mark it with your initials and note the time you went outside.
4. Come back later in the day. Stand on the same spot and re-draw your shadow on the pavement, using a different colour chalk.
5. Come back again (if possible) and re-draw your shadow again with a third colour.
6. Compare your two (or three) shadows.
7. Repeat as many times as is fun.

### Questions to ask

What is creating our shadow?

Are all your shadows the same size and shape?

Do all your shadows point the same way?

How are they different? What is different about them?

At what time of day was your shadow the biggest? At what time of day was your shadow the smallest? Why do you think that is?

### What next?

Go outside on a cloudy day. Where is your shadow? How come?

Find other shadows outside e.g. birds flying overhead, shadows of trees, playground equipment, etc.

Put toys or furniture in the sunlight and trace the shadows. How do the shadows change if you turn the object? How do they change over the course of the day?

Can you find a way to make your shadow disappear?

Explore making different sized shadows indoors by changing the angle at which the light from a flashlight hits an object.

Play shadow tag: try and step on your friends shadows, without them stepping on yours.

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► *Exploring My Shadow*

#### EXPLORATIONS

Making Shadows

Moving Light with Mirrors

Mirror Images

#### MAKE THIS

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Mirror, Mirror

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Shadow Puppets

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# Reflections and Shadows: Explorations



## Making Shadows

Using a flashlight or overhead projector, explore what makes a shadow and what doesn't. We call an object transparent if we can clearly see through it. It lets most light pass through and doesn't make much of a shadow. We call an object translucent if it lets some light through. We can't see through a translucent object and it makes a pale shadow. We call an object opaque if it doesn't let any light pass through. It makes a dark shadow.

### What you need

- An overhead projector (or a desk lamp, or a strong flashlight)
- A transparency or cellophane scraps
- Tissue paper
- Cardboard pieces

### Hands-on

1. Set up the projector, lamp or flashlight so that various materials can be positioned between it and a plain wall.
2. Put the transparency or cellophane between the light and the wall, so that light shines on it.
3. Next put the cardboard between the light and the wall.
4. Finally try the tissue paper between the light and the wall.
5. Experiment with other objects from around the room.

### Questions to ask

Does the light come through the transparency/cellophane? Does it make a shadow on the wall?  
Does the light shine through the cardboard? Does it make a shadow on the wall?  
Does the light shine through the tissue paper? Does it make a shadow on the wall?  
What else could we check? Does light shine through these things?  
How are shadows made?

### What next?

Try different colours of cellophane to create spots of light of different colours.  
Put transparent, translucent and opaque objects on an overhead projector and project the image onto paper. Invite children to draw or trace on the paper.  
Try shining more than one light source on the same object. How many shadows do you see if you have two flashlights?

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#### EXPLORATIONS

- *Making Shadows*
- Moving Light with Mirrors
- Mirror Images

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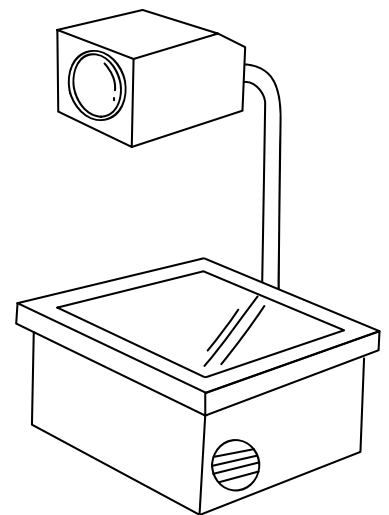
- Permanent Shadows
- Mirror, Mirror

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# Reflections and Shadows: Explorations



## Moving Light with Mirrors

We can see objects because they reflect (bounce) light into our eyes. Most objects scatter the light they reflect. We see only the object. Mirrors and other shiny surfaces are different. The light that hits a mirror reflects back at exactly the same angle. That's what allows us to see our reflection in a mirror.

### What you need

- 2 or 3 mirrors
- A flashlight

### Hands-on

1. Start with just one flashlight and have the children find the light spot.
2. Introduce one mirror. Shine the light onto the mirror. Challenge the children find the light spot.
3. Challenge the children to move the mirror to get the light spot on to different items.
4. Using a second mirror, shine the flashlight first on one mirror and try and bounce the light spot off the second mirror. Challenge the children to move the light spot to a specific location.
5. Repeat by moving the light spot to various locations around the room.

### Questions to ask

- Where is the light shining?
- What did you notice when you shone the light in the first mirror?
- How did you make the light move in different directions?
- What happened when you added the second mirror?

### What next?

Can you see your reflection in other objects around the room? Do these objects have anything in common? What happens when you reflect the flashlight off them? Try reflecting the light off the surface of a bowl of water onto the ceiling?

Can something be transparent and reflect, too? Try reflecting light from a piece of glass or a transparency.

Try adding a third mirror. Has anything changed? What does the light spot look like now?

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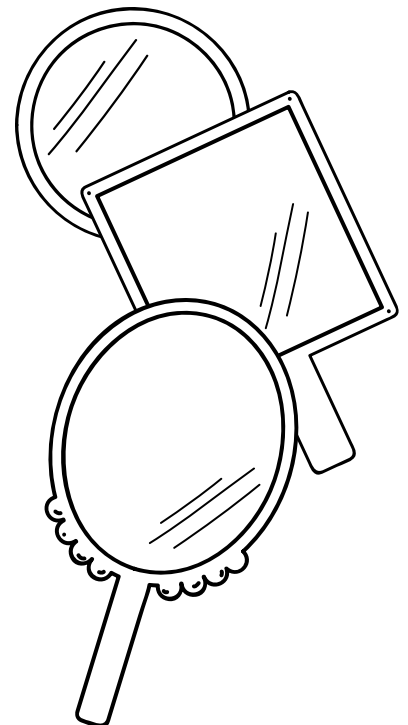
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# Reflections and Shadows: Explorations



## Mirror Images

A mirror reflection is backwards to the way we are used to looking at an object. Explore what happens to shapes, letters and other drawings when they're reflected in a mirror.

Mirrors also help us find lines of symmetry of an object. If you put the mirror on a line of symmetry, the mirror reflection will complete one whole image of the object.

### What you need

- A mirror
- Drawings of shapes on paper
- Pencil, felts, crayons, etc

### Hands-on

1. Have the children look at themselves in the mirror. What do they see? Can they see things behind them? Do they notice anything different about the objects they see in the mirror?
2. Challenge the children to explore pre-drawn shapes (circle, square and triangle) with the mirror.
3. Now have the children draw pictures or words on a piece of paper.
4. Put the mirror on the table near the paper. Encourage the children to explore looking at their pictures and words in the mirror from varying angles and positions.

### Questions to ask

- What can you see in the mirror?  
Can you move the mirror and shape to see two copies of the shape, half of the shape, etc?  
Can you turn the square into a rectangle or a kite shape? Can you turn the triangle into a square or a rectangle?  
What does your picture look like in the mirror? Is it the same? What is different?  
Are there some letters or shapes that look the same in the mirror?  
How does the picture change when you move the mirror?  
Can you make your picture upside down?  
Can you make two pictures side-by-side?

### What next?

Explore the symmetry of objects with a mirror.

Tape two small mirrors together along one edge to make a mirror "book". Stand the book on its edges and put small objects or drawings in between the two mirrors. Open the book wider or close it tighter to see what happens. How many reflections do you see?

Make symmetrical art by placing different colours of paint in the middle of a piece of paper and fold the ends together. Open the paper and see what happen.

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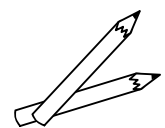
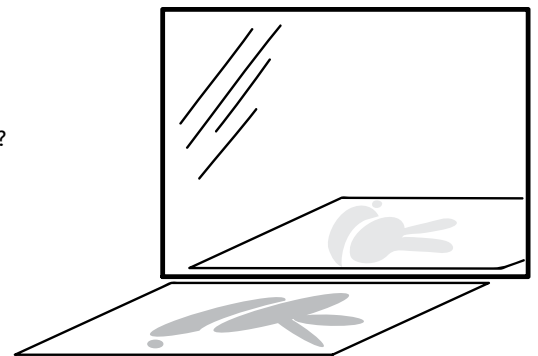
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# Reflections and Shadows: Make This



## Permanent Shadows

There's more to sunlight than the light that we can see. One part of sunlight that we can't see is called ultra-violet light. Ultra-violet light is what causes sunburns.

UV-sensitive paper is paper that is sensitive to this type of light. You can use it to make permanent shadows on paper. When you put opaque objects on the paper, the objects block the UV rays in sunlight, creating the "shadows." This type of print is called a Cyanotype. It was one of the first forms of photography.

We see a similar effect when our clothes block the sun and create tan lines on our skin.

### What you need

- Solar Print (UV sensitive) paper or dark-coloured construction paper
- Hint:** solar print paper can be purchased from boreal.com "Sunprint Kit" or teachersource.com "Nature Print Paper." If you don't have solar print paper, you can create a similar effect using dark-coloured construction paper. It will work, but will take a few hours for the colour change to be obvious.)
- Leaves, small toys work well
- Shallow pan of water
- Sunlight

### Hands on

1. Have the children decide what shapes or items they want to put on their paper and how they want those items arranged.
2. Place the paper in a sunny spot – outside on the ground or inside on a window sill.
3. Have the children place their items on the paper. Leave for 2–3 minutes.
4. Remove objects to reveal the dark 'shadows' on the paper and immediately place in water in order to 'fix' the paper.

**Note:** If you are using construction paper, then leave the paper in the window for a full day. You do not need to 'fix' the paper with water.

### Questions to ask

What colour is the paper when you start? What colour is it when you are finished?  
What happened to the paper after it was in the sunlight?  
What happened after you put the paper in water?  
What made the shadow?

### What next?

- Can you identify the objects you used from their shadows?
- Try different types of paper to see how the sunlight affects them.
- What kinds of shadows do you get from translucent or transparent objects?
- Experiment with heat-sensitive paper.
- Explore UV sensitive beads.

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# Reflections and Shadows: Make This



## Mirror, Mirror

Have you ever looked in a window and seen your reflection? The light that hits a mirror or another shiny surface reflects back at exactly the same angle. This allows us to see a reflection. Dull or rough surfaces also reflect light, but the reflected light is scattered in many different directions.

The mirrors in this activity are made with paper behind a shiny transparency. Some light is reflected from the shiny surface and the rest is absorbed or reflected by the paper. The darker the colour of the paper, the more light is absorbed. This results in a clearer reflection.

### What you need

- Mirrors
- Overhead transparencies
- Construction paper or card stock in a variety of colours—more dark than light colours
- Glue sticks or tape
- Scissors
- Stickers, paint, felts, etc

### Hands-on

1. Cut the construction paper or card stock to the shape you wish the mirrors to be.
2. Try putting transparencies on top of different colours of paper to explore the effect of different coloured backgrounds.
3. Cut the transparencies to match the shape of the background, but slightly smaller to leave a border to use as a frame.
4. Glue or tape the transparencies to the background.
5. Explore what the children can see in their mirrors.

### Questions to ask

- What do we use mirrors for?
- What do you think will happen when you put the construction paper and the transparency together?
- What do you see?
- Which colour of construction paper gives the best reflection?

### What next?

- Decorate the frame with felts, stickers etc.
- Experiment with bending your mirror in different ways to change the shape and orientation of your reflection (e.g. can you make your image upside down?)
- Use your homemade mirror to try the activities in Mirror Images.

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# Reflections and Shadows: All Together



## Shadow Puppets

Shadows are created when the pathway of light is blocked by an opaque object.

### What you need

- Translucent paper for use as a screen
- Cardstock or light cardboard to make cut-outs (e.g. cereal boxes)
- Straws or sticks
- Projector, strong flashlight or desk lamp

### Hands on

1. Cut cardboard into various shapes to make puppets (e.g. people, animals, etc.).
2. Attach the puppets to a straw or stick.
3. Make a screen using an old sheet or tissue paper, hung from the ceiling or from a clothesline.
4. Shine the light behind the sheet and put the puppets into the light beam between the light and the screen. Have the “audience” sit on the other side of the screen.

### Questions to ask

How are you making the shadows?

What happens when you move the puppet closer to the light? Further away?

What happens when you turn the thin side of your puppet to the light?

Can you make the shadows of items from around the room look like something else? Perhaps a rabbit or a dog?

Make a bigger screen using an old white sheet and let the children explore their own shadows.

Can you make shadows of different shapes using just your hands?

**Hint:** check these websites for some hand shadow suggestions:

<http://www.gutenberg.org/files/12962/12962-h/12962-h.htm>

<http://video.about.com/familycrafts/How-to-Make-Shadow-Puppets.htm>

### What next?

Experiment with adding transparent and translucent materials to your shadow puppet. Feathers, cellophane (coloured or clear), and recycled plastic containers are good things to start with.

Leave the shadow puppet theatre up in the classroom “drama” area for children to explore during free play.

Investigate shadow puppets around the world. Shadow puppetry is a complex art form particularly in various parts of Asia. This might be a good place to start:

[http://en.wikipedia.org/wiki/Shadow\\_play](http://en.wikipedia.org/wiki/Shadow_play)

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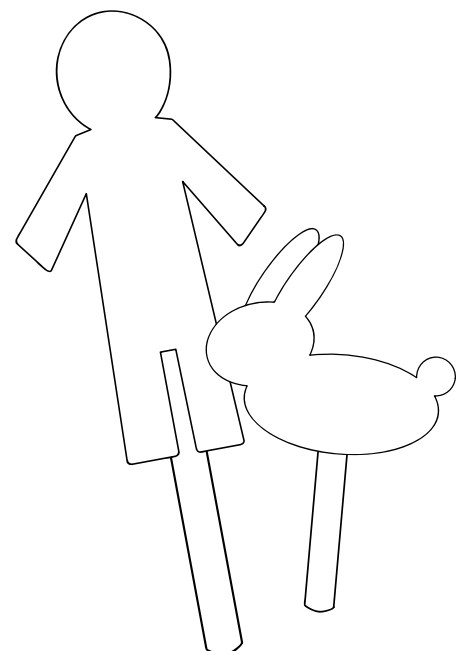
Mirror, Mirror

#### ALL TOGETHER

► *Shadow Puppets*

#### CONNECTIONS

More Ideas



# Reflections and Shadows: Connections



## More Ideas

### Reflections and Shadows Songs, Rhymes and Circle Games

- *Mr. Sun*
- *You Are My Sunshine*
- *See My Shadow (tune of Frere Jacques)*
- *Five Groundhogs*
- *Mirror, Mirror on the Wall*

### Shadows Snacks

- Each child gets two cookies and they decorate them in a mirror image, or one light and one dark (shadow)
- Find the symmetry in food during snack – cutting fruit to find the mirror image, decorating a pizza so that each side is the mirror of the other, cutting sandwiches to find the symmetry.

### Children's Books about Reflections and Shadows

- *Chalk* by Bill Thompson
- *Night Lights* by Susan Gal
- *Moonbear's Shadow* by Frank Asch
- *Amy's Light* by Robert Nutt
- *The Gruffalo's Child* by Julia Donaldson, Axel Scheffler
- *How to Catch a Star* by Oliver Jeffers
- *Mirror Mirror* by Suzy Lee
- *Shadow* by Suzy Lee
- *Round Trip* by Ann Jonas
- *The Dark* by Robert Munsch 🍁
- *The Dark, Dark Night* by M. Christina Butler, Jane Chapman
- *Kitten's First Full Moon* by Kevin Henkes
- *Shadow Night* by Kay Chorao

### Resources for teachers

- *Mirror Mirror on the wall* by Welmoet Damsma (available on the web at <http://www.nsta.org/elementaryschool/connections/200912TeacherGuide.pdf>)
- *Science in the Early Years* by NAEYC (available on the web at <http://www.naeyc.org/yc/pastissues/2009/november>)
- *Worms, Shadows and Whirlpools* by Karen Worth
- *Why it Works: Light and Dark* by Anna Claybourne
- *Science in Seconds for Kids* by Jean Potter
- *Hand Shadows to be Thrown Upon the Wall* by Henry Bursill (available on the web at <http://www.gutenberg.org/files/12962/12962-h/12962-h.htm>)

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#### EXPLORATIONS

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