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Bringing Science Home

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Small, or far away?

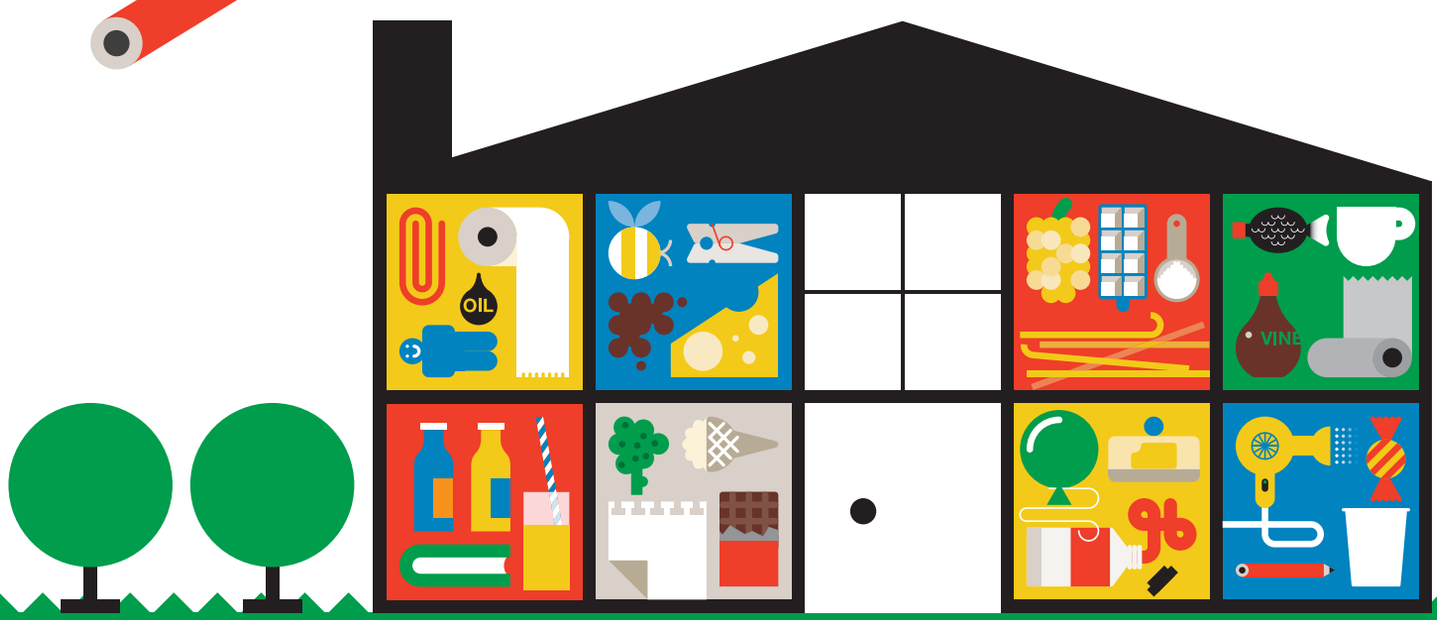
Small, or far away?

The activity

Make more three dimensional looking drawings and an Ames room illusion.

ExpeRiment with your ability to recognise how small or far away things are.

Learn how we make assumptions about size and distance based on experience.



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What you'll need

- Paper
- A ruler
- Pencils
- Ames room template printed on stiff paper or glued to card
- Scissors
- Glue
- Two small toys, lego figures are ideal

Special materials

Templates from rigb.org/experimental Ideally printed on card.

A toy of something real, like a car, can help start the conversation.

What to do

Introduction: If you have one, compare a small toy with it's real life counterpart in the distance. For example, compare a toy car up close with a real car far away. Talk to your child about how the car that is further away looks smaller than the toy car, even though you know it is bigger.

Activity: With a sheet of paper have your child draw a house. You can draw one too. Explain that you are going to show them a way to make their drawing more 3D by using the idea that things look smaller when they are further away.

The first thing you need to do is draw a line for the horizon. A straight line going from one side of the paper to the other and passes behind both your houses.

Now ask you child to choose a point somewhere along the line. This is the 'vanishing point'. You can explain this as the point where things are so far away they would be too small to see, and would 'vanish'.

Now you can add side walls to your houses by drawing lines from the corners of your house towards the vanishing point. Make sure they end relative to their starting position. For example, the bottom left corner of your house will be directly below the top left corner of your house, so the lines should end directly above and below each other.

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What to do (continued)

Being safe

It's best to have adult supervision when cutting out the template.

Join the ends up with any vertical or diagonal lines left and your house should look as if it is stretching off into the distance.

If you have two small figures, place them on the picture and talk about whether they look big or small compared to their surroundings. The closer to the vanishing point you place them, the larger they should look.

Follow up: Let your child know that now you know about things looking smaller when they are further away, you are going to make a room that tricks our brains into thinking something is actually changing size. This is called an Ames room.

The template can be found at rigb.org/experimental. Either print and clue onto card, or if possible print directly onto card. Cut out the shapes and glue or tape the tabs to their matching places on the other pieces. As the room comes together you will see it is a very strange shape, but when looked at through the peephole, it appears to be a square room.

Adding the two figures into the room in opposite corners will create the illusion of a change in size.

Questions to ask children

Before the activity:

Which is bigger, the furthest thing or the closest thing? (When looking at objects of the same size?)

What happens to my size if I walk away?

How big are the Moon and Sun? What about stars?

After the Activity:

What could we draw instead of a house?

How would it look if we drew something completely above the horizon line? What about completely below?

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Questions to ask children (continued)

Why do things look smaller further away?

Why do things, like an aeroplane in the sky, seem to move slower when further away?

The science

As things get further away, they take up less of our field of vision, making them appear smaller. Because we're so used to this we make assumptions when looking at 2 dimensional images.

With this train tracks illusion above, we assume that as the lines get closer, they must be travelling off into the distance, so the line across them at the narrow end must be bigger as it's "so far away". However, both lines are exactly the same length.

In the Ames room, the opposite happens. The lines of the room are actually getting wider as they get further from your viewpoint, but they are carefully designed to look parallel and make your eyes see a room that doesn't appear to stretch back into the distance. When you add two figures into the corners, one is further away and so looks smaller, but the surrounding clues of the room make us believe they are the same distance, so we believe the apparent change in size must be an actual change in size.

This is sometimes called "forced perspective" and is often used in movies to make something look bigger or smaller than it really is. For example having average height actors playing both tall wizards and short hobbits in the same scenes in the Lord of the Rings movies.

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Going Further

We're really good at compensating for the small images our eyes receive from faraway objects. So we know that something we can only really see as small, is actually really big. This actually makes it hard to judge how small the image really is. Next time you can see the moon, look down at the ground and make a gap between your finger and thumb of how big you think the moon looks, now hold your arm outstretched and see how close you were. It may look smaller than you thought.