Rich and Connected Read-Alouds

How we see objects which don't make their own light

The Aim of Rich and Connected Read Alouds

We have developed these short Read Aloud texts to be used to support **Rich and Connected** learning. Each text builds on the previous text to develop the ideas in the main science curriculum.

This pack contains 6 short texts (one each for weeks 1-6). Each text builds on the previous one. At the end of each lesson, the teacher takes 5 minutes to read the text aloud to the class. We have provided slides and suggestions of suitable interjections a teacher might make while reading (e.g. "Is this similar to what we read last week about cat's eyes? TTYP"). For this topic, the texts are:

1. **Why Do Reflective Jackets Glow?**
2. **Why Do Cats' Eyes Shine in the Dark?**
3. **Why Is Snow So Dazzling in Sunlight?**
4. **Why Can We See the Moon?**
5. **How Do Some Animals Avoid Being Seen in the Dark?**
6. **The Blackest Black: How Vantablack Absorbs Light**

Why Do Reflective Jackets Glow?

On a dark road, a worker's high-visibility jacket seems to glow when car headlights shine on it. But if you look at the same jacket in the dark without a light source, it looks just as dull as any other clothing. So what's happening?

Get a hi-viz jacket with the silver reflective strips and show children that they aren't particularly bright - just grey really. Then shine a bright light on it from different angles to see if you can make it reflect into pupils' eyes.

Think aloud - so the beads are transparent, but some light reflects back. Can you think of a time when glass reflects light?

(You might get answers about mirrors, or light reflections from mobile phone screens etc.)

The bright strips on reflective jackets are made of tiny transparent beads. When light hits them, the light bounces straight back toward the source. That's why a driver sees a glowing effect—the jacket is reflecting light from the headlights back into their eyes.

But without a light source, the jacket does nothing special. It doesn't make its own light, it only reflects it. That's why reflective clothing is useful at night, but only if there's something to shine on it!

Q: would a reflective jacket work if a driver forgot to turn the headlights on?

A: no - it would be really dangerous!

Why Do Cats' Eyes Shine in the Dark?

Have you ever shone a torch at a cat in the dark and seen its eyes glow? It might look like they are producing their own light like small green torches, but they're not—they're simply reflecting it.

Show an image of a cat's eyes in the dark.

Q: Do cats' eyes make their own light? Are they like torches?

A: No - they reflect, like the reflective jacket.

Cats, like many animals that are active at night, have a special layer in their eyes. This layer sits behind the retina and acts like a mirror, bouncing light back through the eye. This helps cats see better in dim light because their eyes get a second chance to detect the light.

Q: Why do cats' need good night vision?

A: They hunt and move around at night.

When you shine a light at a cat, the reflective layer reflects the light straight back, making its eyes appear to shine. But in complete darkness, without any light to reflect, a cat's eyes don't shine at all—just like a reflective jacket, they need a light source to be seen.

Turn and Talk: how are cat's eyes similar to a reflective jacket?

They don't produce light.

The light comes from somewhere else (e.g. a torch or car's headlights)

They reflect light into our eyes.

Why Is Snow So Dazzling in Sunlight?

On a bright winter day, snow can be almost blinding. But at night, the same snow looks dull and grey. What makes the difference?

Ask why people wear sunglasses in the snow (because the snow is reflecting sunlight into her eyes).

Q: Where is the light coming from?

A: The Sun.

Snow isn't really white at all - it is made up of tiny transparent ice crystals each with smooth surfaces that reflect light. Unlike dark surfaces, which absorb light, snow scatters sunlight in many directions. This is why it looks so bright in the daytime—almost all the light that hits it is reflected back.

Think aloud - isn't this a bit like the reflective jacket? That has tiny glass beads to reflect light - isn't that like the tiny ice crystals? (yes - it's the same thing!)

But snow doesn't produce any light on its own. In the dark, with no sunlight or streetlights to reflect, it loses its dazzling whiteness. Like a reflective jacket or a cat's eyes, snow only shines when there's a light source to illuminate it.

Turn and Talk: How is snow similar to the jacket and the cats' eyes?

Answers should include that they don't make their own light - they reflect light emitted from another light source.

Why Can We See the Moon?

The Moon shines brightly in the night sky, but when astronauts land on it, they don't find a glowing ball. To astronauts, the Moon's surface is dark, dull and grey. The Moon doesn't make its own light—it only reflects sunlight.

Look at a picture of the Moon.

Q: What colour do you think the ground looks to astronauts?

A: The rocks and dust of the ground on the Moon are a dull gray colour.

The surface of the Moon is covered in dust and rock, which scatter sunlight in all directions. When we see a full Moon, the Sun is shining directly onto it. When the Moon is a crescent, we are only seeing part of the sunlit side. During a lunar eclipse, when the Earth blocks sunlight from reaching the Moon, it almost disappears from view.

Q: When astronauts land on the Moon, do they usually land in the daylit part or the dark part?

A: usually the daylit part.

Without the Sun, the Moon would be invisible in space. Like snow, reflective jackets, or a cat's eyes, we only see it because of the light it reflects.

Q: How is the Moon different to the reflective jacket and the cat's eyes?

A: the cat's eyes and reflective jacket are very good reflectors - the Moon's surface isn't a good reflector: it looks bright because the night sky begins it is black.

How Do Some Animals Avoid Being Seen in the Dark?

Some animals survive by being seen as little as possible. Instead of reflecting light, their bodies absorb most of it, helping them blend into their surroundings.

Deep-sea fish, for example the black dragonfish, live in the darkest parts of the ocean. Some have skin that absorbs almost all the light that reaches them, making them nearly invisible. Some moths also have special wing textures that absorb light rather than reflect it, helping them hide from predators at night.

Unlike a reflective jacket, these animals don't reflect light from their bodies. The less light they reflect, the harder they are to see. In nature, staying hidden can be just as important as being seen!

Q: Have a look at a photo of a dragonfish - why might it be helpful for the dragon fish to be hard to see?

A: it is a predator.

Teacher think out loud: I wonder what's the difference between camouflage and absorbing light? (see the moth slide) - it's not well camouflaged on the white paper is it?

So, camouflage is about being the same colour as the background, whereas absorbing light is all about not being seen in the shadows.

Q: is it ever helpful to absorb light, instead of reflecting it?

A: if you don't want to be seen, absorbing light can make you hard to see, especially in the dark.

Q: Can you think of dark coloured animals? Why does being hard to see help them survive?

A: helps them hunt or avoid being hunted.

What is the main difference between a reflective jacket's strips and a black moth's wings?

A: The wings absorb light and the jacket reflects it.

Show pupils images of Anish Kapoor's vantablack art.

The Blackest Black: How Vantablack Absorbs Light

Most objects we see reflect some light, but Vantablack is different—it absorbs almost all of it. This special material is one of the darkest substances ever made, trapping 99.96% of the light that hits it.

Q: Do most black objects reflect some light? (look at some black objects e.g. a phone - can you see any highlights or reflections?)

A: Most reflect some light - they'd be invisible on a black background if not.

Visual: you could put a black object on a piece of black card… is it totally invisible? Probably not.

Think out loud: it's like a pile of miscrospic toilet roll tubes painted black

Vantablack is made of microscopic carbon tubes, which create a surface that light can't escape from. Instead of bouncing off, light gets absorbed between the tubes. This makes objects coated in Vantablack appear almost invisible because there's no reflected light to show their shape or texture.

Unlike a reflective jacket or the Moon, which we see because they reflect light, Vantablack is nearly impossible to see in normal lighting. Without reflection, our eyes have nothing to work with—proving that seeing an object depends entirely on light bouncing back to us.

Q: if you painted an object in vantablack and put it on a white floor - what would you see?

A: you'd see it easily, but it would look like a black hole in the floor.