The Spark Magazine

PUZZLES, QUIZZES, OUTDOOR LEARNING

ISSUE No12

INVESTIGATE ILLUSIONS

EXPLORE COASTAL WILDLIFE

MAKE YOUR OWN RAINBOW

MEET THE VIROLOGISTS

With support from the Inspiring Science Fund – a partnership between UK Research and Innovation (UKRI) and Wellcome.

UK Research and Innovation

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GLASGOW SCIENCE CENTRE

Inside

This issue

WELCOME

Hello and welcome to another exciting issue of The Spark, crammed full of creative and curious experiments, puzzles, quizzes and facts.

In this summer edition, we'll be tricking our eyes and brains with weird and wacky illusions, helping scientists search for ticks and meeting some of the birds and animals of the Scottish coast.

Plus, we'll be making our own pinhole cameras, radiant rainbows and balancing birds.

Have a safe and sunny summer everyone!

Best wishes,
Glasgow Science Centre

SHARE YOUR PICS WITH US

If you try any of our activities this week, please show us how they turned out! Send your favourite pictures to **CLDteam@gsc.org.uk** or share with us **@TheBothyGSC on Twitter.** We'll share a selection of your pictures in the magazine.

ILLUSION

Look at the upside-down picture of Adele. Do you notice anything unusual?

Now, turn her image the right way up. Did you notice her mouth and eyes had been flipped?

Our brains are great at processing and recognising images of the human face - if we see them the right way up. When we turn it upside down and mess with the familiar pattern, our brains then focus on individual features like the mouth and eyes.

It's not until we turn this image the right way round that we process the face as a whole and realise that all is not as it seems!

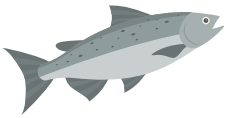
Turn to page 8 for more illusions.

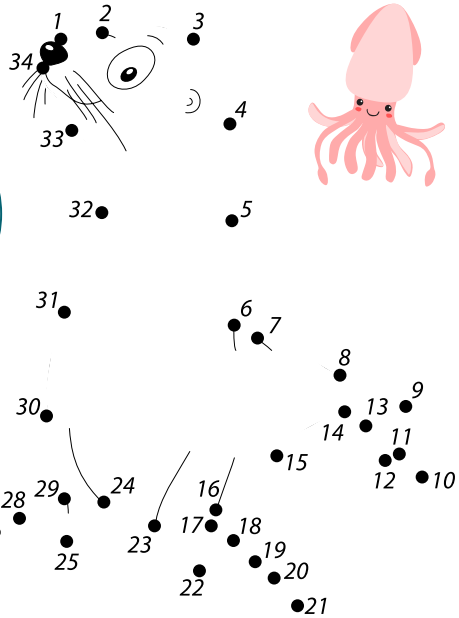
CONNECT THE DOTS

WHAT IS THE CREATURE?

HINT This animal lives on a diet of fish, squid, shrimp and other crustaceans.

They can eat up to 5 kilograms of food a day! That's roughly the same as 15 cheese pizzas!





Turn to page 10 to learn more about our coastal wildlife

FAMILY QUIZ

All questions linked to activities in this issue

Answers on back page

QUESTIONS

HINT You may find some answers throughout this magazine or in our #GSCAtHome videos.

Q1. What is it about a plane's wing that allows the plane to stay in flight?
A. The flaps that open and close **B.** The shape **C.** The colour

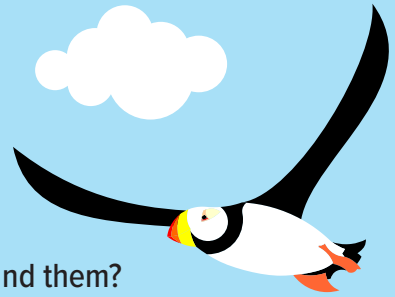
Q2. What is the last colour in a rainbow?

Q3. What is the largest seabird in Scotland?

Q4. True or **False**: Ticks are insects

Q5. How can you figure out how old a tree is?
A. Count how many leaves it has. **B.** Ask it politely
C. Measure the girth (circumference) of its trunk.

Q6. True or **False**: Our eyes see everything upside-down?



Q7. When was the first colour photo taken?
A. 1861 **B.** 1881 **C.** 1901

Q8. How tall is an adult puffin?
A. 70cm **B.** 30cm **C.** 20cm

Q9. How many planets in our solar system have rings around them?

Q10. How do dolphins communicate?

Q11. How many bones are in the human hand?
A. 7 **B.** 27 **C.** 47

Q12. True or **False**: Tomatoes are a fruit.

Q13. Where do Emperor penguins live?

Q14. How many moons does Mars have?

Q15. What species of animal can live on both water and land?

Q16. Who built the first aeroplane to take flight?

Q17. What is the scientific name for animals without backbones?

Q18. What is the fastest recorded speed for a land vehicle?
A. 428 km/h **B.** 828 km/h **C.** 1,228 km/h

Q19. What is the name for a scientist who studies dinosaurs?

Q20. What does GB stand for when talking about computers?

Tick Talk

Ticks are members of a group of animals called arachnids, making them a close relative to spiders. They are a type of parasite and feed on the blood of other animals, including sheep, dogs, birds... and even us!

Some ticks can grow up to 200 times their original size when feeding!

Most tick bites are painless and do little harm. But some ticks carry nasty viruses and bacteria which can make us sick, so it's important to protect ourselves from tick bites when we are spending time outside.

Why do some animals feed on blood? It may seem like a strange diet, but blood is full of nutritious proteins and fats!

CAN YOU SPOT THE TICKS

Ticks like to live in the leaf litter on the ground in the woodlands. Can you spot the 5 hidden ticks in this picture?

What Makes a Virus Tick?

We still don't understand how ticks spread disease, so at the MRC-University of Glasgow Centre for Virus Research, we are trying to figure this out.

FUN FACT

The oldest tick fossil is over **90 million** years old and shows ticks fed on feathered dinosaurs.

BRENNAN LAB TEAM

Please give a brief description of your job

Alex: I carry out lots of different experiments, using different types of cells, I'm hoping to figure out what makes viruses picky over what they're carried by.

What's your favourite thing about your job?

Mazigh: What I enjoy is that a researcher can do very different things on a single day, ranging from various experiments, writing papers, giving presentations, to even teaching! The bottom line is, I'm never bored.

What do you wish people knew about your job?

Ben: That our experiments fail 95% of the time and some take days to find out the result. You must be strong mentally to cope when things don't work out!

Have you always wanted to do the job you have now ?

Andrew: What initially got me so interested in viruses was the outbreak of Ebola virus. After that I knew I wanted to get into virus research to help us gain a better understanding of how to stop events like this from occurring.

Fancy helping these Scientists with their work?

If you see a tick, take a picture of it and send it to @VirusesTickCVR on Twitter or email the CVR team at virusestickcvr@glasgow.ac.uk

This will help the team do their amazing research and help save lives!

TOP TIP

You can see rainbows best with bright sunlight behind you. When the sun is lower in the sky (early morning or late afternoon), you will see more of the rainbow!

What is a rainbow?

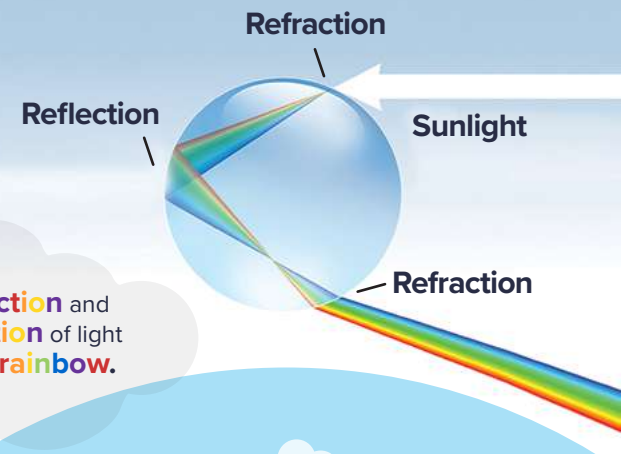
Where do rainbows come from? We need both sunshine and rain to see rainbows as they are made from sunlight and raindrops.

REFRACTION AND REFLECTION

Light from the sun is white, but it is made from a spectrum of many different colours mixed together.

When sunlight enters a raindrop it bends and separates into all the colours of a rainbow (called refraction).

It also bounces off the inside of the raindrop (called reflection).



Refraction and **reflection** of light make a **rainbow.**

A rainbow's colours usually appear in the same order: red on the outside, then orange, yellow, green, blue, indigo and violet on the inside.

Sometimes you might see a double rainbow – where there's a faint band of colour above the first rainbow. This is caused by light being refracted twice inside the raindrop. The colours of this rainbow are reversed!

If you were in an **aeroplane,** then you might see them as **a full circle.**

You might also see rainbows in the spray from a waterfall or in sea spray. Rainbows in sea spray are smaller because droplets of saltwater bend the light more.

ACTIVITY

Make your own rainbow

Watch the rainbows video on the #GSCAtHome Facebook or YouTube Page

What will you do?

In this activity you'll create your very own rainbow patterns by making a spectroscope. A spectroscope is a tool used by scientists which can split light into its different colour components – the colours of the rainbow!

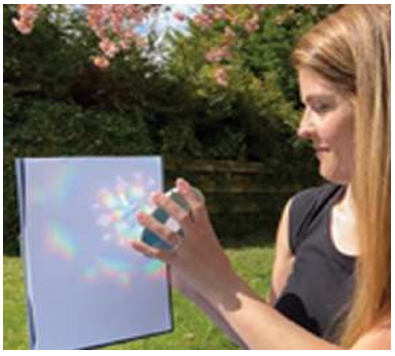
Make sure you have adult supervision before starting.

What will you need?

Paper, scissors, sticky tape or tack, a CD and sunlight.

Trace the shape of your CD on a piece of paper and cut it out.

Carefully cut a pattern out of the circle (a bit like making a paper snowflake).



Stick the paper to your CD using tape or tack.

Point your CD at the sunlight and aim the reflected light at a piece of paper

Can you see the colours of the rainbow? What happens if you move the CD further away or closer to the paper?

The surface of the CD is covered in millions of tiny grooves. When light hits the CD, it reflects off the grooves and splits the sunlight into the rainbow colours that make it up.

More to try

Next time you're watering the garden with a hose, angle it upwards and make sure the sun is behind you. Can you see a rainbow?

Hold up a glass of water in front of a sunny window. Can you spot a rainbow on the wall or floor?

This activity was made in partnership with students from the Centre for Doctoral Training in Applied Photonics.

Bend your brain **with optical ILLUSIONS**

Our brains are brilliant.

They take in lots of information from our senses and use it to understand the world around us...but they can be fooled!

Optical illusions are designed to make it more difficult for our brains to interpret and make sense of what we see.

Scientists believe this is due to our previous experiences in life. Our brains try to interpret an image based on what we've seen before, and what we expect to see, but our brains end up being tricked!

Optical illusions use patterns and colour to create images that can mislead our brain. They trick our brain into seeing things which may or may not be real.

DID YOU KNOW?

Humans have the largest brain of all vertebrates relative to their size.

Our brain takes up around 2% of our body weight.

CAN YOU TRUST YOUR BRAIN?

Test it out with these optical illusions.

Are the long lines running in parallel? Are they the same distance apart or are they closer at one end?

Believe it or not they're the same distance apart (get a ruler if you don't believe me)!

This is because the smaller lines create small or 'acute' angles which our brains have trouble processing. We end up perceiving the angles as bigger than they are, causing us to see the long lines as wonky.

How many colours do you see?

Most people see four colours but there are only three: yellow, blue and red.

How you perceive a colour is affected by the other colours around it.

This is called colour assimilation.

Say out loud the colour of each word, not what's written.

YELLOW BLUE ORANGE
BLACK RED GREEN
PURPLE YELLOW RED
ORANGE GREEN BLUE
BLUE RED PURPLE
RED YELLOW GREEN

Most people struggle with this because our brain receives conflicting information.

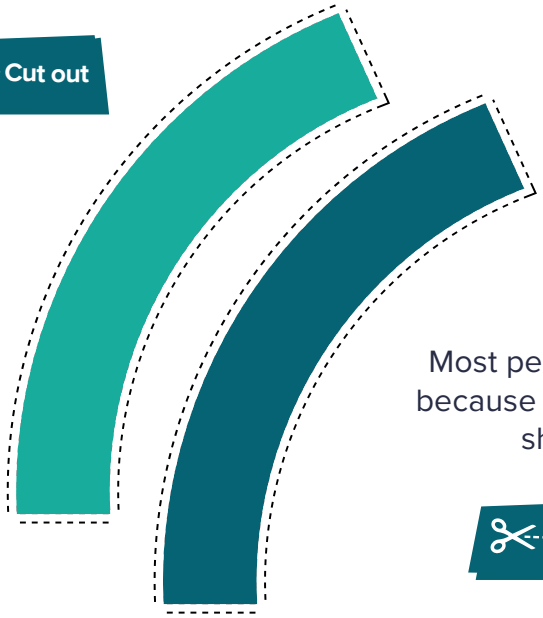
This effect is used in psychological tests to measure how quickly we process information.

ACTIVITY

Make your own optical illusions

Watch the Question of Perception video on the #GSCAtHome Facebook or YouTube page

Cut out

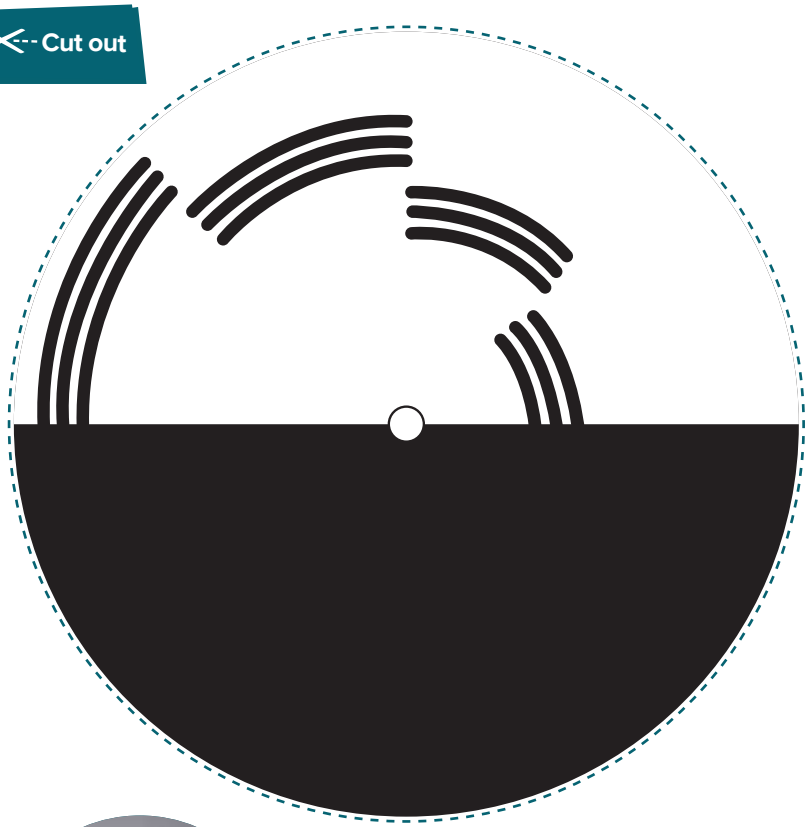


The Jastrow illusion

Are these two arches the same size? Cut them out and place them on top of each other. Do they still look the same?

Most people see the top shape as being smaller. This is because our brain compares the smaller edge of the top shape with the longer edge of the bottom shape.

Cut out



Create a spinning top illusion!

Make sure you have adult supervision before starting.

What will you need?

Cardboard, scissors, glue, pencil

Step 1. Cut out the template and glue it to a piece of cardboard

Step 2. Cut the cardboard to the same size as the template

Step 3. With help from an adult, carefully push a hole in the centre of your spinner with the pencil and push the pencil half-way through to make a spinning top. The pattern should be facing upwards.

Step 4. What happens when you spin the disc? Do you see any colours?

Experiment with your own designs to see what illusions you can make.

What happens to the pattern when you spin it?

Check out some of our favourite illusion exhibits in our Question of Perception Gallery on Floor 1 of the Science Mall.

Meet Scotland's **coastal wildlife**

If you are out exploring our coastline this summer you might be lucky enough to spot some of our seasonal visitors. Many birds make the Scottish shores their home during the breeding season.

Gannets

The world's largest colony of northern gannets is found in Scotland, on Bass Rock, an island off the east coast.

Bass Rock image © Phil Wilkinson

Watch the gannets on the live webcam: www.seabird.org/webcams

© Maggie Sheddan

During the summer, there are more than 150,000 northern gannets on Bass Rock.

The birds come here to nest and rear their young. You may see gannets flying and diving in the waters around the east and west coast.

DID YOU KNOW?

A young gannet is called a 'guga'.

The gannet is Scotland's largest seabird with a wingspan of almost two metres!

CONNECT THE DOTS

WHAT IS THE CREATURE?

Arctic Tern

Another bird you might see (or hear!) around our coast in summer is the Arctic tern - also known as 'sea swallows' because of their long tail streamers.

Arctic terns can be fierce defenders of their nests. They are known for angrily 'dive bombing' any intruders who get too close.

By migrating between the Arctic and Antarctic, the Arctic tern has the longest annual journey of any animal on earth – flying up to 95,000 kilometres every year!

Puffins

Puffins only have their colourful beaks during the spring and summer. Just before winter, they shed their bright outer beak, leaving a smaller and duller-coloured beak.

Puffins feed mainly on sand eels - not true eels, but small fish that bury themselves in the sand.

DID YOU KNOW?

Young puffins are called 'pufflings'.

The Atlantic puffin is sometimes called the 'clown of the sea' because of its bright beak!

DID YOU KNOW?

The young are fluffy and white before they moult.

It's important to keep your distance though, as seal pups are very vulnerable at this this time of year.

Grey Seals

You may spy some grey seals at the end of the summer. From September, they 'haul out' onto the shore to give birth to their pups.

Seals have four flippers, so are in a category of animals known as pinnipedia which means 'fin-footed'.

A seal's whiskers help it to detect prey in dark murky waters.

Rockpools

Despite looking like flowers, sea anemones are actually animals, similar to jellyfish.

Like jellyfish, their tentacles also have stinging cells that are used to immobilise pray before being gobbled up in its mouth, at the centre.

Hermit crabs

Hermit crabs aren't really crabs at all as they're more closely related to lobsters. Despite having a hard shell on the front, their tails are very soft, hence why they protect them with discarded shells.

They tend to live in huge groups, the largest consisting of over 100, which hardly makes them hermits. Could they be the most misleadingly named creature in the world?

Unfortunately, our wildlife is under pressure from threats such as climate change, pollution and unsustainable fishing. **You can learn more about this from the Scottish Seabird Centre: www.seabird.org/threats**

Gravity and **Balance**

ACTIVITY

Watch the Balancing bird video on the #GSCAtHome Facebook or YouTube page

How to make a **Balancing Bird Toy**

What will you do?

In this activity you'll create your own balancing toy bird by experimenting with its centre of gravity. The centre of gravity is the point where there's equal weight in all directions.

Make sure you have adult supervision before starting.

What will you need?

Card, glue, scissors, two paper clips or hair clips and colouring supplies (optional).

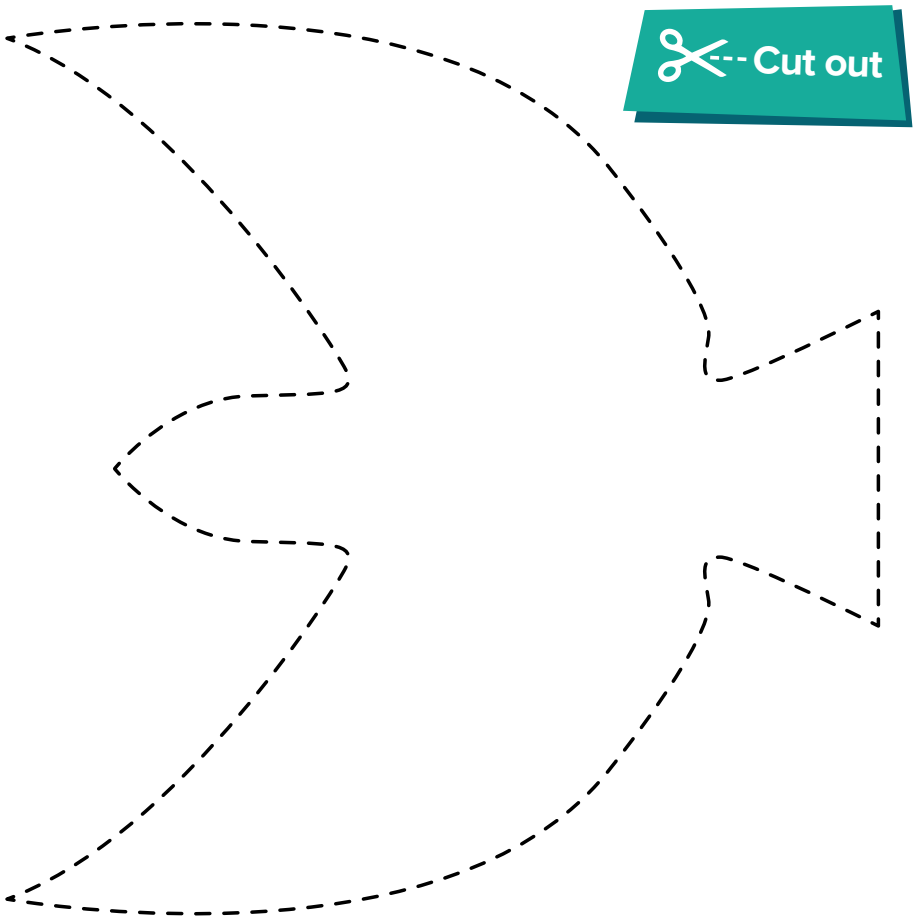
Step 1. Carefully cut out your bird and stick it to the card.

Step 2. Cut around the bird and colour it in.

Step 3. Fold your bird in half from beak to tail to make a crease.

Step 4. Unfold your bird and try and balance the beak on your finger. Does it balance?

Step 5. Add a paper/ hair clip to the tip of each wing and try balancing it again.



What's happening?

By adding weight to the wings, we move the centre of gravity away from the middle of the bird, towards the beak.

You can balance an object on the tip of your finger if you support it directly underneath its centre of gravity.

Try some of the challenges on the next page about centre of gravity and balance.

More to try

Find the centre of gravity of a broom

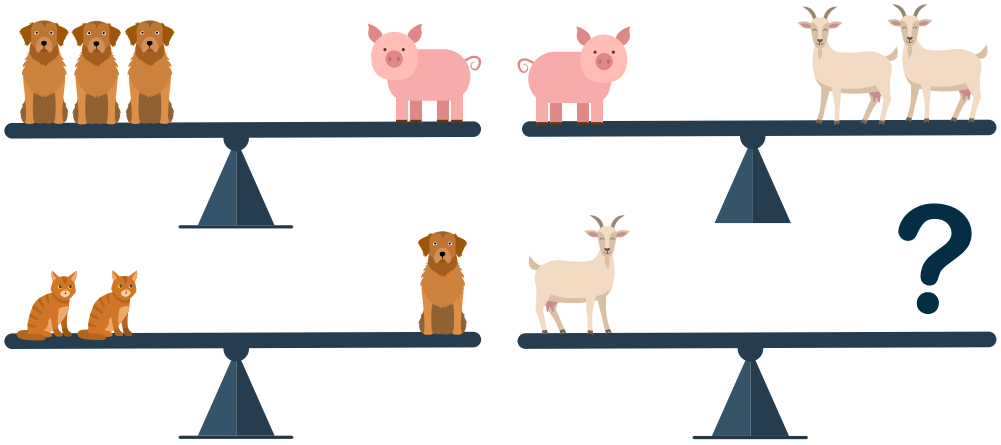
Lay the broom horizontally on your index fingers and slowly slide them together.

The point where your fingers meet - with the broom still balanced - is the centre of gravity.

Test your own balance - put a coin (or other small, flat object) on the ground 75 cm away from the wall. Stand against the wall with your heels together and try to pick up the coin without bending your knees.

Usually, our bottoms move backwards when we bend over to keep our centre of gravity over our feet. So in this experiment, most people won't be able to pick up the coin.

Brain Teaser **Tipping the scales**



What whole animal(s) must be added to balance the fourth scale?

Answers on back page

FUN FACTS

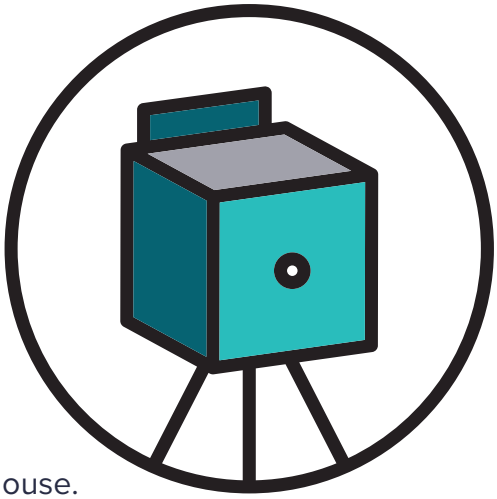
Your **eyes, skin, muscles and ears** all work together to keep you balanced. Our muscles, tendons, joints and our ears contain **stretch receptors – also known as 'proprioceptors'.**

These send information to our brain and **help us make sense** of where our body is and its movement.

Many **animals**, including squirrels, use their tail to **help them balance**. But did you know, rattlesnakes use their tails as a warning sign and chameleons use their tails like a hand, to grip tree branches.

ACTIVITY

Make your own Pinhole Camera!



What will you do?

Make a pinhole camera and use it to view objects around the house.

Make sure you have adult supervision before starting.

What will you need?

Cardboard tube, card, tin foil, pin or safety pin, baking paper, sticky tape, scissors, black card, ruler, pen

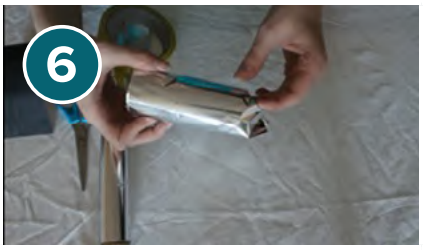
Make your aperture. Sandwich the tin foil between two pieces of card. Slowly twist the pin through the layers to get a smooth hole. Top Tip - the slower you go, the better the image will be

Mark a line around your tube, splitting it into one shorter piece and one longer piece. Cut the tube into these two pieces.

Place the tin foil over the end of the shorter piece, making sure the hole is in the centre, then secure it with tape.

Trace the other end of the short tube on the baking paper and draw four small tabs around the edge of this circle. Use the tabs to stick the paper circle to the tube.

Reassemble the tube so that the tin foil is at the end, the baking paper is between the two pieces, and the other end is open. Secure with tape.

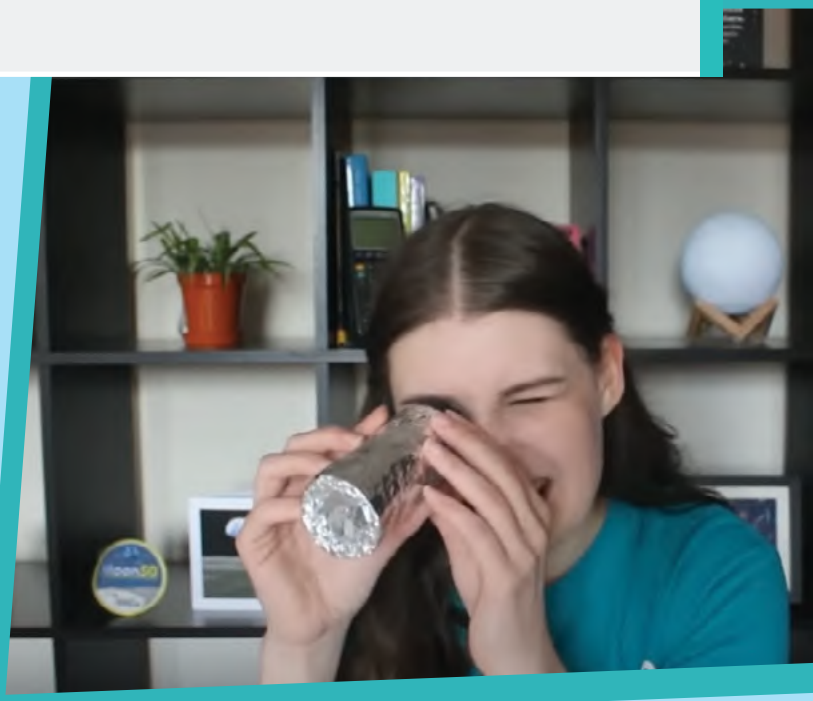


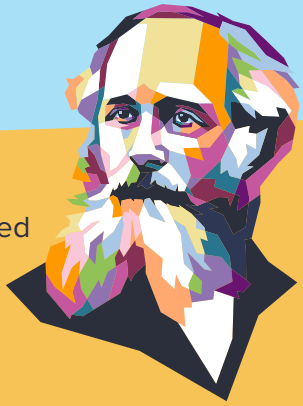
Cover the outside of the tube in tin foil, tucking the excess into the open end of the tube and secure in place with tape.

Roll a piece of black card and place inside the open end of the tube to create an eyepiece.

Look through the eyepiece and point your pinhole camera at a well-lit object or window. If it's blurry, try moving closer or further away from your object.

This is called focusing the camera.
What do you notice about your image?
Is it what you expected?





DID YOU KNOW?

Scottish physicist **James Clerk Maxwell** produced the world's **first colour photograph in 1861**. It was a picture of a **tartan bow**.

Today people capture as many photos in **under two minutes** as the **entire population** took throughout the **1800s.**

Watch the pinhole camera video on
#GSCAtHome Facebook or YouTube page

ABOUT US

Glasgow Science Centre is a 5-star visitor attraction located beside the River Clyde. We are home to hundreds of interactive exhibits where you can discover how the world works.

Glasgow Science Centre is a registered Scottish charity SC030809.

For more information and bookings, visit: glasgowsciencecentre.org

PUZZLE SOLUTIONS

Tipping the scales brain teaser.

Answer is: 3 cats.

CAN YOU SPOT THE TICKS

QUIZ ANSWERS

Q1. B. The shape of a plane's wings allow it to fly. The shape is an aerofoil which generates a lifting force when moving through the air.

Q2. Violet. The colours of the rainbow are: Red, Orange, Yellow, Green, Blue, Indigo, and Violet

Q3. The northern gannet is our largest seabird, with a wing span of almost 2m.

Q4. False, ticks are arachnids as they have 8 legs, like spiders. Insects have 6 legs.

Q5. C. Measure the girth of the trunk in centimetres, then divide by 2.5 to estimate its age. (Trees grow roughly 2.5 cm in girth every year).

Q6. True, our eyes see upside down and our brain then flips the image the right way up.

Q7. A. 1861. The first colour photograph was an image of a tartan ribbon.

Q8. C. An adult puffin is 20 cm tall.

Q9. Four planets have rings: Jupiter, Saturn, Uranus and Neptune. Saturn's rings are the biggest and brightest and easiest to see.

Q10. Dolphins communicate by clicking and whistling. Clicks are used to sense their surroundings through echolocation, while they use whistles to communicate with other dolphins.

Q11. There are 27 bones, 27 joints, 34 muscles, over 100 ligaments and tendons in our hands.

Q12. True, tomato seeds grow on the inside, like other fruit.

Q13. Emperor penguins live in Antarctica. (And there are no penguins in the Arctic.)

Q14. Mars has two moons, called Phobos (fear) and Deimos (panic).

Q15. Amphibians can live on land or water. They are a group of small vertebrates that include frogs, toads, salamanders, and newts.

Q16. Orville and Wilbur Wright built and flew the first plane in North Carolina on December 17, 1903.

Q17. Invertebrates are animals without a backbone. Vertebrates are animals with a backbone.

Q18. C. 1,228 km/h is the fastest recorded land speed, set in 1997.

Q19. A palaeontologist studies dinosaurs, and the fossilised remains of many kinds of organisms (plants, animals, fungi and bacteria).

Q20. GB represents a gigabyte - a unit of digital information equal to 1,024 megabytes (MB).

Competition Winners

Huge congratulations to our competition winners from Issue 11 of The Spark. Each winner received **£30 of science goodies**. Thank you for entering, enjoy your prizes, and keep reading The Spark!

Winners:

Ira, Glasgow

Dhuha, Glasgow

Amneet, Glasgow

Advik, Glasgow

WE WANT YOUR FEEDBACK

We would love to hear what you think!

We hope you liked this issue, but if you didn't, what could we change? What other things would you like to see? What topics are you most interested in?

You can send feedback and pictures to CLDteam@GSC.org.uk or message us on Twitter @TheBothyGSC

With support from the Inspiring Science Fund provided by BEIS, UKRI and Wellcome.

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KEEP IN TOUCH

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