The science in our skies

Super Hearing

This worksheet accompanies our **'The Science in our Skies'** module.

To watch the videos, **sign in** to the S4 portal:

www.s4scienceportal.co.uk

And click on the 'Online Science Workshops' button!

What are we learning?

Owls are the most common nocturnal birds of prey. Hunting at night can be difficult, so owls have developed specially adapted hearing to hunt their food.

A barn owl's sense of hearing is so good that it can hear a mouse's heartbeat from 8 metres away!

Why do you think good hearing is important for hunting at night?

Owls have a flat feathery circle on their face called a "**facial disk**". The facial disk funnels sound towards an owl's ears, capturing as much noise as possible. Owls can even adjust the feathers of their facial discs to focus on sounds at different distances.

Nocturnal owls have one ear higher up than the other, helping them pinpoint where a sound has come from.

The difference in position means one ear hears the sound just before the other. This time difference indicates the direction and height of a sound's source to the owl.

Tell me more!

Owls can detect a time difference between a sound reaching their left and right ears as small as 0.000003 seconds (30 millionths of a second)!

Owls also have a highly developed **medulla** – The part of the brain that analyses **auditory** (sound) information.

The medullas of owls are more complex than in other birds – Barn owl medullas are three times larger than a Crow's!

When hunting:

1. The medulla **combines** the information sent by the ears to work out the **location** of prey.
2. The owl then flies towards it, keeping its head in line with the source of the sound.

If the prey moves, the owl will hear it and make corrections to its flight path until it catches its prey.

True or false?

Are the following statements true or false?

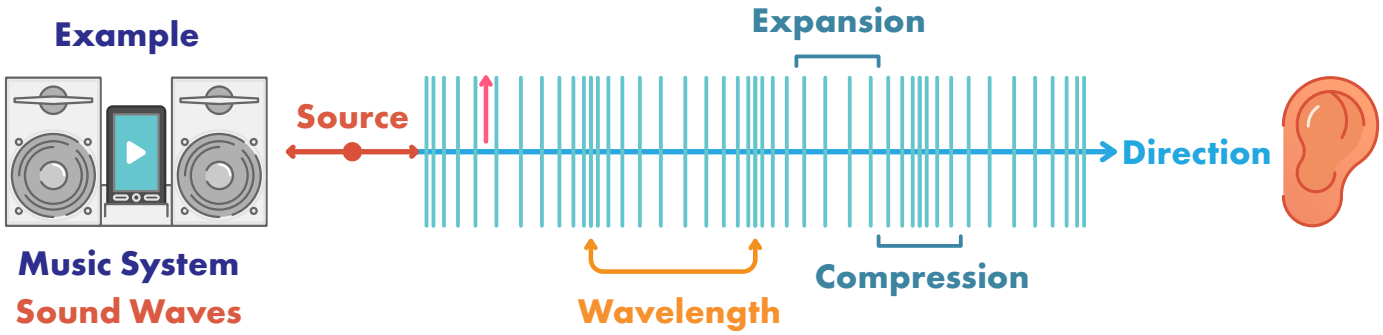
	TRUE	FALSE
Owls' facial discs are an adaptation to improve their sight.	☐	☐
Owls see in black and white.	☐	☐
Hearing is very important for nocturnal owls to locate prey.	☐	☐

Notes & doodles

Owl facial plates are parabolic reflectors

Sound travels in waves. Sound waves are carried by vibrations of the molecules of whatever they travel through (whether a solid, liquid or gas).

Sound waves are alternating compressions (moving together) and expansions (spreading out) of the molecules as the vibrations pass through them. Different sounds will produce different patterns of compressions and expansions.



Parabolic reflectors are used a lot in engineering. They are curved dishes that are very good at reflecting and focusing energy, such as sound waves (or other waves, such as radio waves), onto a specific point. A common example of these is a satellite dish attached to the side of a house.

If you attached a parabolic reflector to a microphone, it can be used in the same way as an owl's facial disk. It would focus and amplify the sound waves so that it can be detected more easily by the microphone and its source pinpointed.

Parabolic reflector

What do you think would happen to the incoming sound waves if the owl's face was completely flat?

Activity

How to hear like an Owl!

ACTIVITY SHEET

In this activity, you can make your own parabolic reflector to focus sound into your ears and hear like an owl!

You will need:

- A sheet of A3 laminated card
- Sticky tape

Safe science:

Listening to loud sounds is bad for your hearing. Hold the sound funnel at least a few centimetres from your ear to ensure a comfortable volume. If the sound becomes uncomfortable then stop using the funnel.

What do I need to do?

You're going to make a hearing cone.

1. Roll the A3 sheet into a cone, starting at one of the corners. Try to make the larger end as wide as you can but make sure to leave a small hole at the pointed end. Use the sticky tape to hold your cone together.
2. Without using the cone to begin with, listen to your surroundings. What sounds can you hear that you can't see the source of?
3. Choose one of these sounds. Try to work out the general direction from which the sound is coming.
4. Hold the pointed end of the sound funnel up to your ear. Point the wider end in the direction of the sound. Does this improve your ability to pinpoint the sound's source?
5. Scan your surroundings with the sound funnel. Can you identify any other sounds that you didn't notice before?
6. If you can hear a bird singing in a tree but you can't see it, use your sound funnel to help you to spot it.

Questions

What you have experienced is similar to how an owl uses its facial disk. Why do you think owls have a facial disk but other birds of prey, for example eagles or hawks, do not?

What adaptations do owls have to help them to pinpoint their prey using their hearing?

How is your sound funnel similar to a parabolic reflector?

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Teacher information

Curriculum links

Key Stage 3 Science (Interdependence of organisms): 1. the basic structure and function of some cells, tissues, organs and organ systems and how they support vital life processes

Key Stage 3 Science (Interdependence of organisms): 4. the interdependence of organisms and their representation as food webs, pyramids of numbers and simple energy-flow diagrams

Key Stage 3 Science (How things work): 4. the forces in devices and their relationship to work done and power

Area of Learning and Experience: Science and Technology: The world around us is full of living things which depend on each other for survival

- The role of owls as predators within a food web.
- How owls are adapted to successfully hunt at night and camouflage during the day.
- The adaptations of owls, including the ears, brain and facial disc, to enhance their sense of hearing.
- The properties of sound waves and how these behave when they come into contact with a parabola.
- How parabolic reflectors have been designed and deployed by engineers.

Resources to be sourced:

- Parabolic microphones – something like the iXium® Parabolic Microphone Bionic Ear for Long Range Listening Device up to 300 FT 8X Magnification Monocular Sound Amplifier
- Batteries

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