NATIONAL SCIENCE & ENGINEERING WEEK

Message Makers

Part of the British Science Association's National Science & Engineering Week Activity Pack Series.

For further information visit
www.nsew.org.uk

BIS
Department for Business Innovation and Skills

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About this pack

CREST ★ Awards

All activities can count towards a CREST★ Investigator Award if you would like to accredit the pupil's work, they are suggested activities for these awards.

For the CREST ★ activities (aimed at 5–7 year olds) pupils discuss, solve problems and share experiences. In CREST SuperStar activities (aimed at 7–11 year olds) children work independently, discuss ideas and how to test them, solve simple problems and decide how to share results.

The pack is split into two sections one with the 3 CREST Star accredited activities, one with the 5 CREST SuperStar accredited activities; indicated by the logos on those activity pages.

Older children

This pack is developed for 5–11 year olds. However, for older children there is a section which gives ideas that could be used to develop the activity further. See section 'For older children'.

How to use this pack

This pack includes pages for teachers to help explain the activity to the children and organiser's notes. Some activities take a while to set up, others are open to interpretation based on the ability of your group. Make sure you read the activity pack well in advance of National Science & Engineering Week (March) in order to ensure the activities can be done during that time.

Acknowledgements

Many thanks to all those who helped in the production of this pack.

Activity 4 (Secret Message Maker) and Activity 5 (Message Machine) were provided by the Learning Team at Porthcurno Telegraph Museum. www.porthcurno.org.uk
Activity 7 (Animal Talk) was provided by Future is Wild. www.thefutureiswild.com

General information on how to use the pack:

1. First familiarise yourself with the activity.
2. Check the resources list and make sure you make time to prepare anything you need. See the background information on each activity.
3. Make sure the students understand their task. You can give them the page describing their activity or use it to describe the task to them directly.
4. Give the students time to think about the activity. The idea is that they look at the problem and come up with potential solutions themselves. You can help with suggestions and tips.
5. Give them the equipment needed to do the activity.
6. Encourage them to discuss the results and why they saw what they did.

Activity 1:
The Sound Squad

Star

Sound is all around us and nearly everything can make its own unique sound.

Every sound around us is different, from a motorcycle engine to a chirping bird, sounds can tell us a lot about where they come from and what they are for. Sounds can communicate – like a dog barking or your teacher telling you a new fact, or they can be the result of an action – like hot bubbles popping in a boiling kettle or the roar of an aeroplane's engines.

What sound is around you?

Your challenge:

Be really quiet and listen carefully... what sounds are around your school or classroom? In groups walk around your school and write down what you can hear, where is it coming from and how is it making the sound it makes. Think about whether it's a loud or quiet sound. You'll need to listen very carefully though.

Can you hear the clock? Wind? Talking? Breathing? Cars? Airplanes? Footsteps? Animals? See what interesting noises everyone can hear!

Talk about:

- All the different things you think you will be able to hear in your classroom and around your school.
- Why can't you hear these sounds all the time? Do other sounds stop you from being able to hear things properly?
- How you hear sounds.

Here are some ideas to get you started:

- Are the sounds natural or man-made?
- Why are the sounds different volumes - is it to do with how far away they are? Think about how loud they would be if they were closer.
- What are the loudest sounds you can hear, how do they compare to the quietest?
- What sounds are to communicate (like a chirping bird)?
- Did you hear what you expected to hear?

Sharing your ideas:

Make a sound map of the sounds you heard with the information you recorded on your trip around your school. What was your favourite sound?

For older children:

Take sound recorders with you round the school and record the sound levels (decibels) in different places. What is the loudest and quietest part of your school? How much louder is your playground during break-time compared to lesson-time?

The Sound Squad Organiser's Notes

This activity shows pupils that sound is all around us and that some sounds communicate while other sounds are the result of an action.

What do I do?

- Familiarise yourself with the activity sheet and make sure the pupils understand their mission – to seek out sounds around the school and report back in groups.
- Read the challenge together.
- Discuss the 'talk about' questions – pupils might like to discuss these with a buddy first.
- Select which areas of the school grounds you are going to investigate.
- Send the groups around the school, supervised if possible, to listen and record which sounds they can hear in specific places.
- Afterwards, talk about the results – were there any surprises?
- Advanced groups might want to take a decibel meter with them to test the sound levels in these places around the school.

Background Information:

- This activity concerns differentiating between different types of sounds – sounds to communicate and sounds that are a result of an action. Communicative sounds can include people talking, a siren, a bird singing, a dog barking, a ticking clock, telephone ringing etc. Other sounds include a plane or car engine, a kettle boiling, air-con unit blowing air, sounds of people's fingers on a keyboard.
- Sounds can either be natural or man-made, natural vocal sounds generally are to communicate whilst man-made sounds are multipurpose.

Suggested materials:

- A worksheet for pupils to record sound and place
- Pens, pencils, crayons and A3 paper for making posters

How can they share their ideas?

Pupils can share their ideas by making a poster or wall display

Safety:

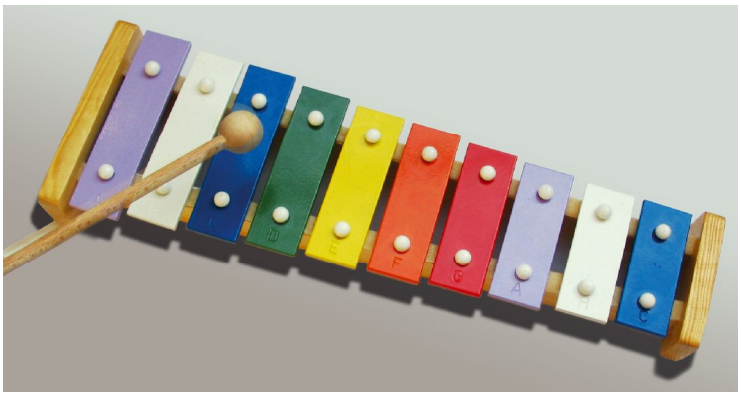
If exploring the school grounds pupils might need to be supervised.

For older children:

If decibel detectors are available, these could be taken on the trip around the school grounds. Talk to the children about noise pollution and discuss whether there is noise pollution in your school.

Activity 2:
Sound Slides

Have you ever wondered why some sounds are high, why some are low and some are slidey?



Your challenge:
Investigate what makes some sounds high and some sounds low and why. Can you build your own musical instrument that makes low, medium and high sounds, and one that makes slidey sounds? You've got lots of different things to make your sounds with – which one makes a sound like a voice?

Talk about:
- Making high sounds and low sounds, can you make a sound like a monkey call? Why do you think you can do it?
- What is pitch?
- What musical instruments can you think of that make slidey sounds more like your own voice or a monkey call?

Here are some ideas to get you started:
- Look at the two sets of materials your teacher has given you, in groups plan what you are going to build.
- Which instrument do you think will make a slidey noise?
- How will you test how well this works? Can you match your voice to the different sounds your instruments are making?

Now you can build your two instruments in groups.

Sharing your ideas:
Which of your two instruments sound the most like an animal? Can you make different types of animal sounds with your instrument? Do you think this is like your own voice?

For older children:

Come up with your own musical instrument that makes sounds of different pitches from just rubber bands and two sticks.

Sound Slides Organiser's Notes

This activity is about pitch and how voices, like instruments, can change pitch.

What do I do?

- Read the mission sheet and make sure you understand what you are asking the pupils to do.
- Check the resources list making sure you have everything you need. How are you going to record the sounds and the animal noises the pupils make – you could record them or put on a show in assembly.
- Make the pupils understand their activity – to investigate what makes slidey sounds and why.
- Give the children time to think about the different types of sound, explaining what vibration (wobbles) and pitch (high and low) are. Talk to them about what sorts of sounds different instruments make.
  5. Encourage the children to make different animal sounds and why they think they can make high and low sounds.
- Allow the children to make their two types of instruments:
  - a slidey blower
  - sound water jars
- Let the children play their instruments, which are slidey like a voice and which go boing boing? Talk to them about our own voice boxes and why vocal chords allow us to make sounds with a variety of different pitches.

Background:

- Pitch is a difficult concept for young children to understand, so using your hand with your voice to show high and low might make this easier. Play some example sounds to them, like a monkey call and a note on a keyboard, to show that some sounds have different pitch to others.
- Pitch is when sounds wobble through the air into your ear at different speeds, so high-pitched sounds wobble faster than low-pitched sounds.
- Your voice also does this by changing pitch with your vocal cords – your chords stretch and shrink to produce high or low sounds.
- Having more water in the glass jar will lower the pitch – why does this happen?

Suggested materials:

To make a slidey blower:

- 2 large craft sticks
- A straw
- A wide rubber band
- 2 small narrower rubber bands
- Scissors

To make sound water jars:

- 5 jam jars
- Water
- A wooden spoon

Slidey blower:

- Place a wide rubber band lengthwise over one of the craft sticks.
- Cut two small pieces of straw, about 2–3 cms.
- Put one of the small straw pieces underneath the wide rubber band, about 1/3 from the end of the stick
- Place the second craft stick on top of the first

- Wrap one of the small rubber bands around the end of the stick a few times, about ½ inch from the top, on the same side where you placed the piece of straw. Make sure this pinches the sticks tightly.
- Put a second small piece of straw in between the two craft sticks, on the opposite end, approximately 1/3 of the way down from the top of the stick. This time place the straw on top of the rubber band in the middle of the two sticks.
- Wrap a small rubber band around this end of the craft stick, about ½ inch from the end. The two ends should then be pinched and there should be a small space between the two craft sticks created by the two pieces of straw.
- Put your mouth in the middle and blow through the sticks – move the straws together to hear the sound change.

Straws:

Just blowing on a tapered straw at the same time as cutting the end off will make the sound change.

Water jam jars:

- Pour water to different levels in 5 jam jars.
- Tap the jars with a wooden spoon to make different sounds.

Can your slidey blowers make sounds at the same pitch as the water jam jars? Your pupils might like to make up a song about animal noises with their instruments.

For older children:

Rubber bands, or strings, of different lengths will produce sounds at different pitches.

Activity 3:
Big Ears

Sometimes it's better to be able to hear really quiet sounds from far away, especially if you are an animal.

Your challenge:
Investigate how you to hear quiet sounds from far away. What is it that helps animals to be able to hear really quiet sounds and why do they need to do this? Build yourself some new ears.

Talk about:
- What animals need to hear sounds from far away and why do they need to do this?
- The types of ears that these animals have.
- How quiet-a-sound you think you might be able to hear if you had special hearing.

Here are some ideas to get you started:
- Your teacher will give you some resources to help you hear really quiet sounds. In groups discuss how you could find the answer to your challenge and talk about what your ears will need to look like.
- How will you do the investigation and how will you test how effective your new ears are at helping you hear quiet sounds. Which ears are the best?

Now you can make your own massive ears and test your hearing with and without them.

Sharing your ideas:
What did you find? Which new design of ears helped you to hear better and what was the quietest sound you could hear?

For older children:

Discuss why having different sized ears will affect your ability to hear. Investigate what other senses do animals have to detect danger in the wild.

Big Ears Organiser's Notes

This is a nice quick activity that shows pupils that bigger ears help to hear sounds better, and gets them thinking about the shapes of ears in nature.

What do I do?

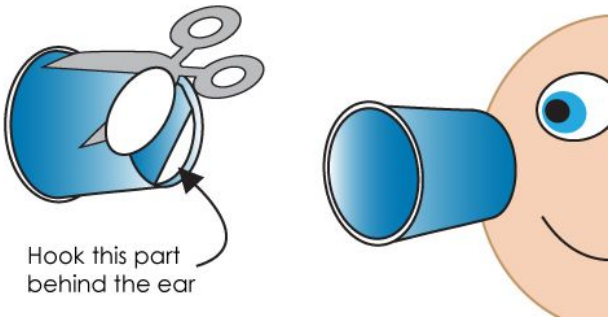
- Familiarise yourself with the activity sheet and make sure the pupils understand their mission – to build bigger ears for themselves and see what happens
- Read the challenge together.
- Discuss the 'talk about' questions – pupils might like to discuss these with a buddy first.
- Hand out the resources and discuss what the pupils could make.
- Facilitate the pupils in testing their ears once they have made them. They could stand a certain distance from a CD player and investigate whether their new ears are sensitive enough to hear the quietest level of sound.
- Afterwards, talk about the results – were there any surprises?

Background Information:

- Animals like elephants have evolved to have big ears, they have done this to adapt to their habitats.
- We have ears to help us hear better, the visible part of the ear is called the pinna. It is the shape of the pinna that acts as a receiver to the vibrations made by sound. The shape and size of the pinna changes how well you can hear.
- If a sound is very quiet or far away having big ears will help you to hear the sound.

Suggested materials:

- Cardboard
- Paper cups
- Scissors
- Glue
- Selotape
- CD player with a variable volume.



How can they share their ideas?

- Pupils can share their ideas by presenting them

Safety:

Be careful with scissors and avoid paper cuts.

For older children:

Advanced groups might want to talk about how their designs work and what other senses animals might have to detect danger.

Activity 4:
Secret Message Maker

SuperStar

One of the first ways of sending messages around the world used a code called Morse code.

Morse code uses a mixture of dots (short sounds) or dashes (sounds three times as long as a dot) for each letter of the alphabet.

Look at the Morse code alphabet on the right. The letter A is made by sending a dot followed by a dash, B by a dash and three dots and so on.

So the word science would be:

s: •••
c: —•—•
i: ••
e: •
n: —•
c: —•—•
e: •

a	•—	n	—•
b	—•••	o	———
c	—•—•	p	•——•
d	—••	q	——•—
e	•	r	•—•
f	••—•	s	•••
g	——•	t	—
h	••••	u	••—
i	••	v	•••—
j	•———	w	•——
k	—•—	x	—••—
l	•—••	y	—•——
m	——	z	——••

Morse code sounds were sent using electricity or radio waves, but you can use anything to make a sound and send a message in Morse code.

Your challenge:

Imagine that you and your friends want to send secret messages to each other. You don't want your parents and teachers to understand. You could use Morse code, but you need a way of making short and long sounds to make the dots and dashes. You need a secret message maker.

Talk about:

- What is sound?
- What materials can be used to make short and long sounds?

Here are some ideas to get you started:

- In groups look at the materials that you have been given to build your secret message maker. Plan what you are going to make that will make short and long signals.
- What materials are best to use?
- How will you test how well your secret message machine works? Which secret message maker is the loudest?

Sharing your ideas:

What did you find? Which secret message maker is the loudest for sending messages? Which one let you send the message over the furthest distance? Which is the most secretive?

For older children:

Investigate sending secret messages with silent objects – e.g. light

Secret Message Maker Organiser's Notes

This activity is about making sound and understanding what it is. Pupils learn that communication isn't always about speaking.

What do I do?

- Familiarise yourself with the activity by reading the 'Mission' sheet.
- Check the suggested materials. Give the children a range of materials so they can make a range of different secret message makers.
- Make sure that the pupils understand their mission. It may be helpful to check they understand how Morse code works by singing or saying different letters in Morse code to them, or getting them to use Morse code to spell out their name.
- Let the pupils see the materials and allow time to talk about what sound is and how they can use the materials to make the short and long sounds needed for Morse code. Encourage them to think about the different materials and how they can be used to make the message makers.
- The pupil's ideas could include drums, shakers, scrapers or even deflating balloons!
- Take pictures of the secret message makers or record the message made by each one. The pupil might want to make up a song that contains a secret message.

Background

- Sound is a series of waves that moves through air or other materials. These sound waves are created by the vibration of an object, like an elastic band or material stretched over a pot
- Whenever an object in air vibrates, it causes waves in the air. These waves move away from the object as sound
- The waves move away from the object and into your ear and your eardrum vibrates as the sound waves hit it. This sends messages to our brain which we then hear as a sound
- The back and forth movement of the sides of a deflating balloon, a loudspeaker cone or violin string result in compression waves of sound. When you speak, your vocal cords also vibrate, creating sound.

Suggested materials

1. Plastic/metal/cardboard food containers with and without lids. (It's best to avoid empty tin cans unless you are sure that they have no sharp edges. Similarly, avoid glass containers in case of breakage).
2. Plastic bottles with ridges
3. Cardboard & plastic tubes
4. Cloth
5. Elastic bands
6. String
7. Balloons
8. Rice, gravel, sand
9. Pencils to use as rods for scraping or for beating drums

Activity 5:
Message Machine

Communication is all about sending and receiving messages, what happens when we can't?!

Today we can send messages using telephones and the internet. We can talk to someone on the other side of the world and the messages travel very quickly.

Long before people had telephones and the internet they needed a way of sending messages a long way quickly. They used very long wires and simple circuit equipment like batteries, switches, buzzers and bulbs.

Your challenge:

Imagine that there has been a massive storm and there is no electricity. No telephones, mobile phones and the computers aren't working. You need to send a message from your home to your school and back again.

The only things you can use are batteries, switches, long wires and buzzers or bulbs. Use this simple circuit equipment to send and receive messages. How will you do it?

Think about and discuss:

- How could you use a bulb or buzzer to send a message?

Here are some ideas to get you started:

- You have a range of simple circuit equipment you can use. Think about all the different ways that you could use this to send a message.
- What equipment do you need for each method?
- When and how and what will you measure to test which method is the best?

Sharing your ideas

After the experiment, what did you find? What method of sending messages using electricity was the best? How did you know this? Is there one method which is best or are several just as good as each other?

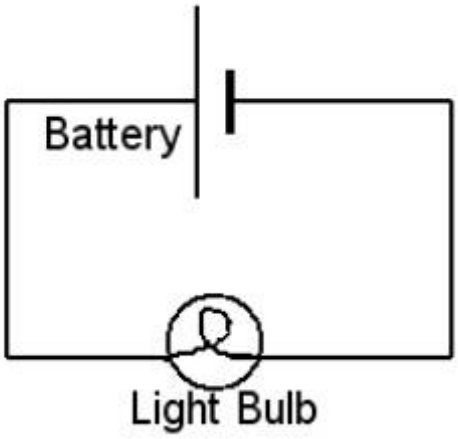
For older children:

Discuss what other ways can you send messages without using sound?

Message Machine Organiser's Notes

What do I do?

- Familiarise yourself with the activity.
- Check the suggested materials.
- Give the children their equipment and run through the safety points.
- Make sure that the children understand their science mission – to investigate how they can send messages using electricity. The first part of the challenge will be to talk about how to get the bulb to work, this can be done using the following circuit diagram:

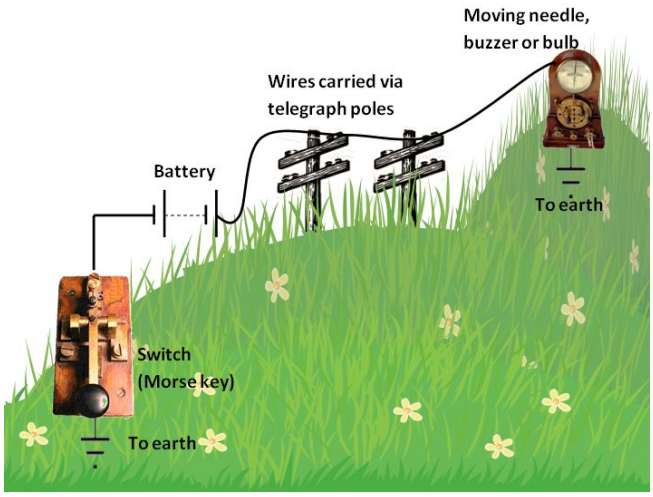


- Allow the children planning, building and experimentation time. Encourage them to think about how they will compare different ways of sending messages and how they will make it a fair test.
- Then give them time to talk about other ways of sending messages without using electricity and how they might send messages using only a buzzer or bulb.

Background

The electric telegraph – a brief introduction.

- The electric telegraph was a way of sending messages over a long distance using electricity. The word telegraph means just that – *tele* means distant and *graph* means writing, just as t*elevision* involves pictures which travel over a distance and the *telephones* transmit sounds over a distance.
- In essence, the early electric telegraphs used simple circuits with long wires, switches, batteries and something which moved, like a needle, made a sound, like a buzzer, or flashed on and off, like a bulb. The switch was at one end of the circuit and the needle, buzzer or bulb at the other (in another town). The switch was used by the person sending the message to turn the needle, buzzer or bulb on and off in a particular pattern. A code, like Morse code, was agreed in advance so that the person receiving the message knew what the on/off pattern meant.
- Note that the circuit was completed by the earth, so 'return' wires weren't necessary. This can be demonstrated very easily using a bucket of damp soil to complete the circuit.
- The first electric telegraph messages were sent in 1837. By 1870 virtually all Post Offices in Britain were connected to the telegraph network. The wires were carried by telegraph poles. For the cost of one shilling for twenty words, anyone who could afford it could send a message pretty much anywhere in Britain – fast, long-distance communication had reached the masses.
- People would go to the Post Office, fill out a telegram form with the message they wanted to send and pay for it. The message was then sent out through the telegraph network to the Post Office nearest its destination and hand-delivered to the correct address.
- Lots of different codes and ways of sending telegraph messages were tried, but Morse code was accepted as the international standard code in 1866.
- Note, light bulbs were not patented, by Thomas Edison, until 1880.



Children could come up with a number of ways to send a message using the buzzer or light bulb.

- They could use a simple code where 1 buzz is A, two buzzes are B and so on, but will probably realize quickly that this is impractical.
- Some may be familiar with Morse code and come up with a similar code involving dots and dashes.
- They may decide to use a particular number of buzzes to send a whole phrase. This method is useful for a small number of phrases, but quickly becomes unworkable.
- Children may decide that the buzzer is easier to detect than the bulb, but only in a quiet environment. Lots of buzzers going at once make it much more difficult. They may decide to use both for that reason.
- They may come up with a set of 'rules' like how to get someone's attention or how to show they've reached the end of a sentence or message
- You could encourage the children to demonstrate their message machine or create a short piece of drama to show what they have found out.

Suggested materials:

1. 1 x 1.5 V battery in holder per group
2. 3 x crocodile leads (or similar) per group
3. 1 x buzzer per group
4. 1 x light bulb per group (1.5V)
5. 1 x switch per group

Safety:

Take care that children do not short out the batteries by connecting the negative to the positive directly with a single wire and nothing in between. The wires and battery are likely to become quite hot.

Activity 6:
Sound Detectors

Sound is invisible, we can hear sound with our ears but we can't see it.

Sometimes you can see the effect of sound, other things vibrate when a loud sound is near them. If an opera singer sings loud enough they can make a window break or smash a glass! But that is very difficult to do.

How can we detect sounds?

Your challenge:
Your challenge is to find out how sound moves out from different vibrating objects. To do this you will need to build your own soundwave detectors.

Talk about:
- How can you detect a sound through hearing and touch?
- Do sounds travel through solids and liquids?
- What will make a sound travel further?
- How will you detect how sound moves out from an object?

Here are some ideas to get you started:
- What is the best and easiest way to build a soundwave detector, which materials are most effective?
- What will make a loud enough sound to detect with your own detector?
- Discuss how you will record your results and test your ideas.

Now you can start to investigate how sound moves out from an object and build your soundwave detectors.

Sharing your ideas:
What did you find out? Talk about what happens to the grains of salt when you make noise close to the sound wave detector. Why do you think the salt grains act in this way when you make noise near the detector?

For older children:

Test how sounds travel through different media. If you put your sound detector behind a wall or behind glass does it vibrate more or less? What do you think would happen if you used a vacuum? Or were under water?

Sound Detectors – Organiser's Notes

This activity is about learning how sound travels out from an object through vibrations, and building a device to turn that sound into something you can see.

What do I do?

- Familiarise yourself with the activity sheet and make sure the pupils understand their mission – to build a soundwave detector
- Read the challenge together.
- Discuss the 'talk about' questions – pupils might like to discuss these with a buddy first.
- Hand out the resources and discuss what the pupils could make.
- Facilitate the pupils in testing their soundwave detectors at different distances from the soundsource. Which materials work best?
- Afterwards, talk about the results – were there any surprises?

How to build a sound wave detector:

You will need:

- Empty plastic/polystyrene cup or coffee jar
- Plastic wrap and greaseproof paper.
- Rubber band
- ¼ teaspoon of salt
- Empty carton or jug
- Pencil or ruler

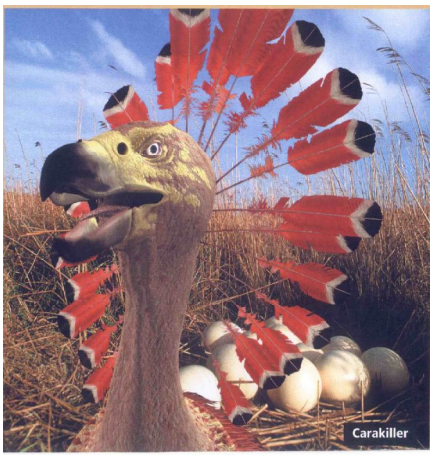
1. Stretch the plastic wrap across the top of the empty plastic cup or coffee jar
2. Secure the plastic wrap with a rubber band making sure it is stretched tight.
3. Sprinkle salt on the plastic wrap
4. Stand close to your sound wave detector, bang on an empty carton or sound-making device a few times with a pencil or ruler to make sound vibrations
5. Watch the grains of salt closely.

Background Information

- Sounds are made when objects vibrate, you can not always see the vibrations but if something is making a sound part of it is vibrating.
- Sounds make the air around it vibrate, if a sound is load enough you can feel the air vibrating and it can make other objects vibrate like the sound detector.
- Different objects make different sounds and these sounds are different volumes. A loud sound will create more vibrations and the wave detector will vibrate more. Different objects will make different types of sounds and the detector will vibrate differently.
- Sound vibrations can travel through different materials. The vibrations don't only travel through air they can travel through water, metal, and other solids. Sounds cannot travel through an empty space (a vacuum) as there is nothing to make the vibrations.

Activity 7:
Animal Talk

Animals don't talk like we do, some communicate with actions.



Imagine you are an explorer in a new world far ahead in the future – you've just found two new creatures. Your future land is a dry place in South America and killer birds (carakillers) are hunting small monkeys (babookari)! This does not normally happen today.

Your challenge:
Invent a way of communicating for these creatures of the future.

Talk about:
- Silent signals. How many ways can animals communicate silently
- How do humans communicate silently? Facial expressions, hugs, nods and smiles are one way. What is 'body language'? How do humans use it? Try body language for 'I'm bored', 'I'm really interested', 'I must go'.
- How do the babookari and carakillers communicate? What methods do they use? How do they signal danger, follow me, or I'm hunting?

Here are some ideas to get you started:
- Ask a friend to go to the end of the room. Signal them to come to you, without using your hands, or making a sound.
- Imagine you were a babookari. What signals would you need? Use an artist's brush as a tail. Invent some signals that would work in long grass.
- Now you are a carakiller. You have a row of head feathers. What signals would you need now? Again, invent some signals to alert other hunters.

Make a phrase book for babookari and carakillers. Draw and label a range of signals.

Sharing your ideas:
Put on your own play for your class imagining you are babookari and carakillers using a communication system you have developed for them.

For older children:

Invent your own creatures of the future, make a head-mask of your creature and come up with a communication system. What will it use to communicate other than sound?

Animal Talk Organiser's notes

This activity is about communication through body language and is based on an activity developed by Future is Wild (www.thefutureiswild.com).

Earth – 5 million years in the future:

A special group of scientists from Future is Wild predict that there will be another ice age (Earth will be a much colder place). Humans and natural changes have destroyed our biggest rainforests and the whole of South America is covered by savannah grass land. From time-to-time, forest fires will spread across it destroying all the trees and plants in its path.

Today, South American rainforests are home to the uakari – a monkey that eats most things and is at home both on the ground and in trees. A new type of monkey called the babookari evolved from the uakari, it l has a long tail like a paintbrush. Groups of babookari use their paint-brush tails to signal to each other above the grass. The caracara is a present-day Amazon falcon. It adapted into a flightless hunter over two metres tall. Carakillers hunt babookari in packs, signaling to each other with their long plumes.

What do I do?

- Read the activity sheet and familiarise yourself with the activity. If you look up www.thefutureiswild.com you will find a wealth of useful information; look especially at 'The Amazon Grassland', the education pages and 'Your Pages' where you will find examples of student work.
- Decide on the media you would like the children to use for their creations. The children can use pencil and paper, art materials, computer art programs etc. Provide scrap paper for rough sketches.
- You will need some artist's brushes as babookari tails. You could bring in some clean feathers for the carakiller plumes.
- You could use a sequence from the Future is Wild website to introduce the activity. Emphasise that these are the ideas of scientists, and the children's ideas could be just as good.
- Allow discussion time and share ideas as appropriate. Confirm that all ideas are welcome, and emphasise that no ideas are 'silly'. Remind them that they must have a basis in science! Note that, forbidden all other ways of communication, humans will often use eyebrows to signal!
- Encourage children to create their ideas alone, in pairs or in groups. Encourage sketches and discussion. This is how all scientists work.
- Finally, ask the children to answer the question in their own way. No answer is 'wrong' and probably, no answer will be 'right'. It's the richness of ideas that counts.

What is the Future is Wild?

- The Future is Wild is a science-based project that uses our understanding of evolution to imagine the future. It exists as a CGI documentary series (a second one is in development), DVDs, books, exhibitions and educational resources (available from www.wildgoose.ac). It imagines the Earth in three future time zones: five, one hundred and two hundred million years from now. It takes present day plants and animals, and projects their evolution to meet changing conditions. There are twelve habitats in the original project, four in each time zone. One of them is the Amazon Grassland, five million years from now.

Activity 8

How Fast is Sound?

Your challenge:

Sound travels from where it was made to your ear. Your challenge is to find out how fast sound travels and come up with a way of measuring it. Have a go at measuring the speed of sound in your school playground – what do you notice?

Talk about:

- Does sound travel at a constant speed or does it vary?
- Do you think sound travels at the same speed in different mediums – i.e. water or air?
- Will sound travel in space?

Here are some ideas to get you started:

- What are you going to use to test and measure the speed of sound?
- How will you carry out your experiment?
- How and what will you measure? How will you make sure that your sound speed test is fair?

Now you can start measuring the speed of sound. You might need to work in pairs to note down your results. What have you noticed about the speed of sound?

Sharing your ideas:

Talk about what you have learnt about the speed of sound – is it the same or slower than the speed of light?

For older children:

Use what you have learnt about the speed of sound to calculate how far you are standing from a wall. Can you hear the sound echoing off anything else around you? Calculate how far away that is.

Discuss the speed of sound in both air and water – how can you measure the speed of sound in water and what underwater animals use sound to navigate? How has this knowledge been used in medicine?

How Fast is Sound Organiser's Notes

This activity asks pupils to measure the speed of sound and demonstrates that sound is slower than light.

What do I do?

- Familiarise yourself with the activity.
- Check the suggested materials.
- Give the pupils their equipment.
- Make sure the pupils understand their mission – to investigate the speed of sound. Talk to them about how sound travels.
- Allow the pupils time to plan their investigation. Encourage them to think about how they will measure sound in the playground and how they will make it fair.

Background information:

- There are lots of ways to measure the speed of sound, the simplest equation is:
  Sound (m/s) = $\frac{\text{distance (m)}}{\text{time}}$
  For example… a car travels 100m in 10 s – what is the speed?
  100/10 = 10m/s (m/s means metres per second)
- The easiest way to measure the speed of sound involves measuring the time taken for an echo to return from a tall building?. You can try using a sports whistle, metal dustbin lid and a wacker or cymbals.
- Assemble the children about 200 metres from a large wall and distribute stop-watches. Time the sound as it goes from the wall until it returns. Check that the pupils know that the sound has travelled 400 metres.
- Allow the pupils to calculate the speed of sound (you might need to calculate it for them if they struggle with the equation).
- Ensure that there are no errors in timing – discuss what impact errors of timing will have on the reliability of the result, since we are dealing with a time internal of just a second or two. Measure the distance to the wall with a tape measure.
- The accepted speed of sound in air is 330 metres/second (in water this is 1500 metres/second). Light travels much much faster than the speed of sound, which is why the difference between hearing something and seeing something is so large over a relatively small distance. The speed of light can be calculated using the same equation, and it is known to be 299,792,458 metres/second. The speed of light is given the unit 'c'.

Suggested materials:

- Sports whistles/metal dustbin lid and hammer/cymbals (you could distribute them all and encourage pupils to determine whether different sounds travel at the same speeds).
- Stop watches
- Tape measure
- A large wall

Safety:

Pupils making extra loud sounds might be damaging to sensitive ears.

For older children:

Encourage the pupils to use the equation and their time data to measure how far they are standing from the wall.

Thank you for using Message Makers

We hope you enjoyed the activities within this pack. To help us to continue to provide new activity packs, we'd like to ask you to tell us a little about what you did for National Science & Engineering Week.

Please take a few minutes to fill in this form. If you used this activity pack for NSEW, send in this completed form and we will send you a National Science and Engineering Week Certificate.

Organisation: _____

Address: _____

_____

Postcode: _____

Tel: _____

Fax: _____

Email: _____

Which dates did you do National Science and Engineering Week activities on? _____
What did you do?

Please make any comments about this activity pack, National Science & Engineering Week and/or other possible topics for future packs (feel free to continue on a separate sheet of paper).

☐ Tick this box to be added to our mailing list. This will keep you up to date with NSEW, including grants, resources and activities. Your contact details will not be passed onto third parties.

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