Listening to Our World: Past, Present and Future in Hartlepool

Primary Education Pack

Sound Mirrors

Known as 'listening ears', Sound Mirrors were giant, concrete dishes which collected and amplified sound waves during the first world war (WW1). By picking up sound waves from approaching German airships (Zeppelins), they gave early warning of attacks to coastal towns.

Sound Mirrors were placed on high land, far enough away from the sea to prevent sound interference from the waves. The curved dish pointed out to sea, allowing it to collect and focus sound waves into a microphone placed in front of the mirror. An operator sat in front of the mirror with headphones, listening to the sounds that came through the microphone.

Sound Mirrors came in different shapes and sizes. Watch this video to learn how the shape of sound mirrors helped detect and amplify sound waves from approaching airships.


these listened for enemy aircraft
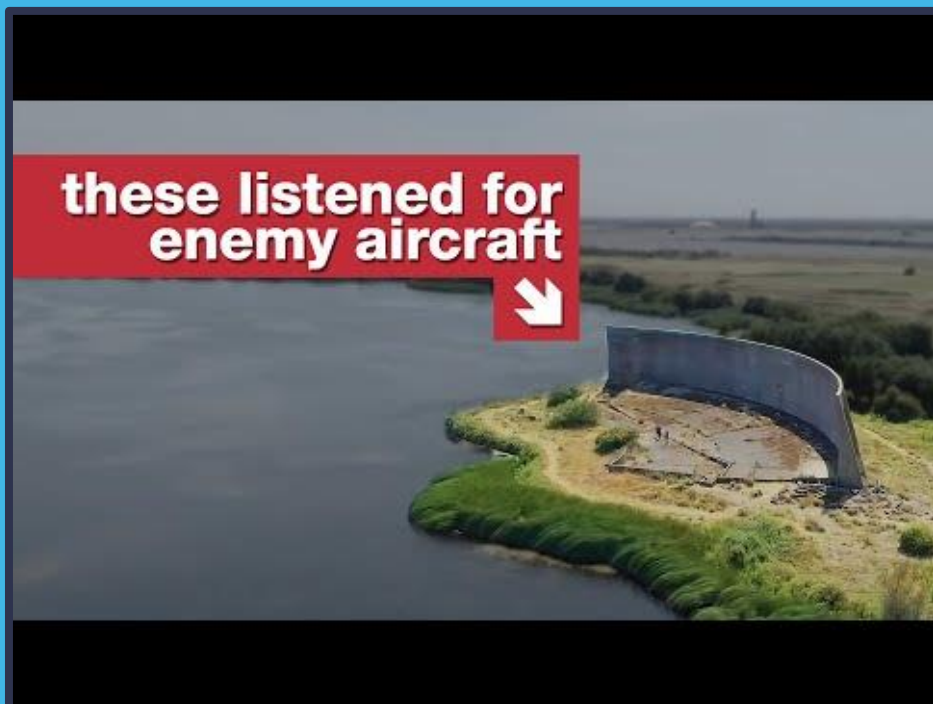
North East Sound Mirror Chain

Clavering Sound Mirror was located in Clavering, Hartlepool. It was one of a chain of five sound mirrors located along the North-East coastline, in response to German Zeppelin attacks on the North-East during WW1.

A typical German Zeppelin was 150 metres long, contained 28,300 cubic metres of hydrogen gas and could travel at up to 85 miles per hour. They were a formidable sight, especially as many people had never seen air transport before. The sound mirrors provided time to prepare for and counter a Zeppelin attack before it reached the coastal towns and cities.
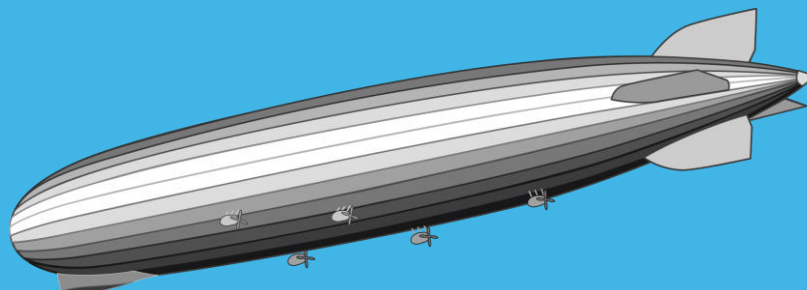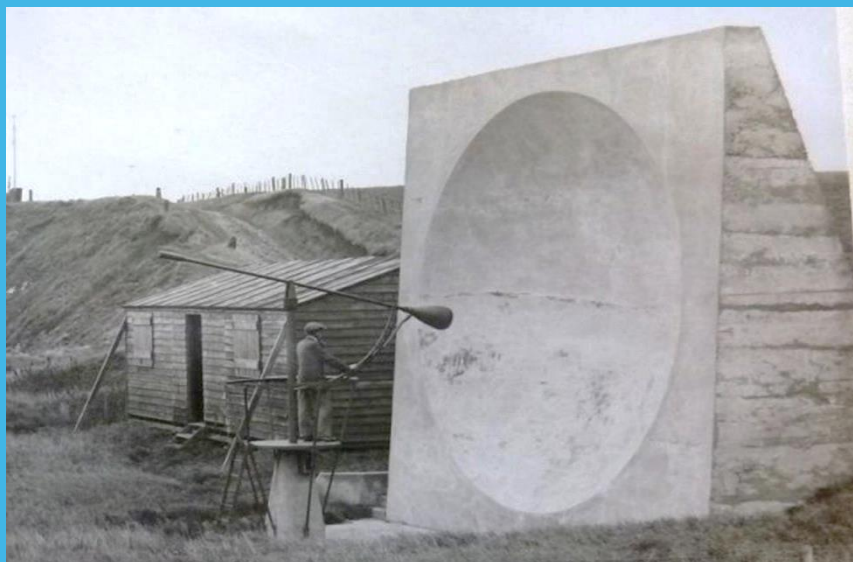
Clavering Sound Mirror

There were three German air raids on Hartlepool in WW1; August 1916, November 1916 and March 1918. The sound mirror in Clavering was built in 1916, after the second attack, to help Hartlepool be more prepared for future attacks. It could detect Zeppelins up to 6.5 miles out of to sea. It was manned by soldiers who reported any detection of Zeppelin intruders by telephone to their HQ in Middlesborough. With the average speed of an attacking Zeppelin being 45mph, the early warning time was roughly 8 – 10 minutes.

Clavering Sound Mirror

Aerial photograph of the site in 1948 © Historic England

Clavering sound mirror was a concave shape, designed to reflect sound to a central point about 3 metres away from the mirror. A conical trumpet was mounted on an am set on a pole at this point and could be swung around to pick up the strongest sound from the mirror. The arm was moved by one person, while another person would listen through a stethoscope connected to the trumpet.

A sound mirror in use © Crown

Clavering Archaeological Dig

Clavering sound mirror was demolished in the late 1960s. In October 2022, an archaeological dig was carried out in Clavering to look for remnants of the sound mirror.

Three trenches were dug at the site. Local residents and school children visited the site to take part in the dig and some listening activities, as well as sharing their memories of the sound mirror.

Some concrete fragments were found during the excavation, along with glass, pottery, coins and pipes from the 19th and 20th centuries.
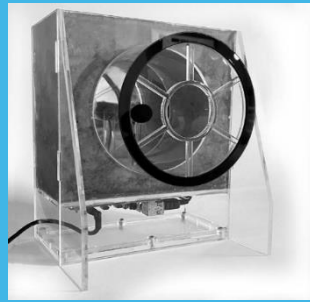
Soundmirror Digital Arts Project

Soundmirror is a digital arts project, by local artist Rob Smith, that listens to and reflects the sounds of coastal environments, such as Clavering, that are located on the sites of former First World War Sound Mirrors. *Soundmirror* was commissioned by SeaScapes Co/Lab creative engagement project, part of SeaScapes: Tyne to Tees Shores and Seas and funded by the National Lottery Heritage Fund.

Sound level monitors were installed at three locations:

- Clavering Primary School
- Heugh Battery Museum
- Local residents' gardens near Fulwell Sound Mirror

The sound level monitors record the levels of sounds at each location, which feed into a digital sound mirror artwork:

https://soundmirror.xyz/index.html

During the project, Rob also carried out workshops with local residents and school children. Through these activities, local residents and school children were able to listen to sounds at the sites today and were encouraged to think about how these sounds would have differed to sounds at the site in the past.

Education Pack

The following activities are aimed at Key Stage 2, but some of them could be adapted for Key Stage 1.

Historical Evidence

We can no longer see the sound mirror as it was demolished in the early 1970s. What type of evidence could we find to show that the sound mirror was located in Clavering?

Maps

Photographs

Physical remains – artefacts and objects

Historical accounts – people's memories

Zeppelins

Sound mirrors provided an early warning for Zeppelin attacks. For many people, seeing a Zeppelin during a Zeppelin attack was the first time they had seen a form of air transport. They must have felt a mixture of fear and awe as the huge Zeppelin travelled overhead.

What do you think it would have been like to see a Zeppelin for the first time?

Zeppelin Measuring

Resources: Trundle wheel

On average, Zeppelins were 150 metres long. To help the children understand the scale of these huge airships, go into the school grounds, or a local greenspace. Choose a couple of children to be the measurers, then ask the rest of the children to go and stand where they estimate 150m away to be. Once the children have chosen a place to stand, give the measurers the trundle wheel and begin measuring out 150 metres, counting out loud as they go. If the measurers pass where any of the children are standing, they can join in the walking and measuring too. Once 150m has been reached, stop. Ask the children to look back at where they have walked and imagine an airship of that size floating above them in the sky. Is it bigger than they thought? How would they feel? Did any of the children manage to estimate the distance correctly?

Zeppelin Above

Accounts

Examine the accounts and images of Hartlepool residents seeing the zeppelins or being caught in an air raid:

Appendix 1 – Historical Accounts and Images

Descriptive Language

Imagine you had just seen a Zeppelin for the first time. How would you describe it to your friend who has never seen one? Encourage the children to use descriptive and emotive language.

Creative Writing

Write a piece of creative writing, such as a newspaper article or a diary entry, describing seeing a Zeppelin for the first time.
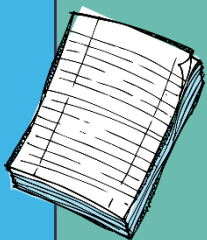
Historical Evidence

How has Hartlepool changed over time and why?

Using maps (appendix 2) and an aerial photograph (appendix 3) explore the following questions:

What has changed in Hartlepool over time? *More housing, less farmland, no sound mirror, more roads, less railways, etc.*

Why do think these changes to Hartlepool have occurred? *Different industry, increasing population, change in types of transport, etc.*

How would these changes have influenced what sounds you could hear at the time? *More / less bird song, more vehicle engines, etc.*

Changing Sounds

Split the children into pairs or groups. Ask them to make a list of sounds that you can hear today that you would not have been able to 100 years ago (*e.g. phone, cars, alarm clocks, computer sounds, washing machines*). Then ask the children to make a list of sounds that you might hear in Hartlepool in the future.

Listening to Our Local Landscape

The sound mirror was a technological device that would listen out for the sound of approaching Zeppelins to provide an early warning. Today we have lots of different technologies to 100 years ago which we can use to collect information about the sounds around us.

Cup your hands to your ears.

Think about different sound levels. What is the quietest sound that you can hear? What is the loudest sound that you can hear?

Close your eyes and point to sounds.

Count different sounds for 30 seconds – 1 minute. Place your hands up in fists then close your eyes. Lift a finger up for each different sound that you hear. Did you count the same number as other pupils?

Sound Scale

Give each child two small pieces of paper. Ask them to write down one quiet sound that you might hear in the local area (e.g. a mouse squeaking) and one loud sound that you might hear in the local area (e.g. an aeroplane flying overhead). Split the children into groups and ask them to order their sounds from the quietest to the loudest. Ask each group to share their sound scale with the rest of the class.

To support the sound map activity below, the children can fill in a sound scale (Appendix 4).

Sound Map

Plan a route around the local area, or school grounds, ideally including a variety of different areas which will provide different types and volume of sounds. Visit OS Maps and print off copies of your chosen area.

Give each child or pair a copy of the map, a pencil and a clipboard. As you follow the route ask them to record where they are walking on their map. Stop at different points along the way and listen. Ask the children to record a number from 1 – 100 on their map for each location, with 1 representing very quiet sounds and 100 representing very loud sounds. At each location, after listening, encourage the children to share what sounds they heard and explain their choice of number.

If the children completed a sound scale in the above activity, they could use this to support their choice of number.

Program a Zeppelin Detector
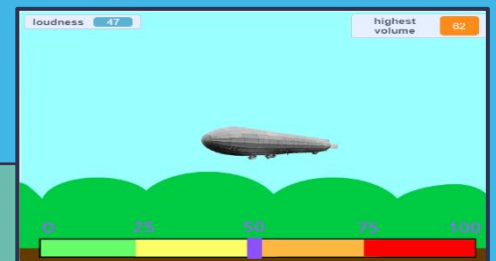
This activity will enable children to program a Zeppelin Detector (sound level monitor) using an iPad, tablet or computer with a microphone. To create a Zeppelin Detector, children will use Scratch, a simple drag and drop programming platform.

As the sound volume level changes, the picture of the Zeppelin will get bigger and smaller. When the sound level goes over a certain threshold the image will change and say ZEPPELIN!

Appendix 5 provides detailed instructions on how to create a Zeppelin Detector. An example of what can be made can be found here: https://scratch.mit.edu/projects/740192242/. Click on the green flag icon to see how it works, and click 'see inside' to see the programming.

Appendix 1: Historical Accounts and Images

27.12.1916

Dear Bessie,

Just a line to let you know we are alright after such an escape, as few had, as the Zepp appeared to be just over our house and such awful noise with bombs and gun firing and then it burst into flames just when over our street and it went over Beaconsfield Street and over moor and sank in sea just opposite grand stand. I shall never forget the awfulness of it. The damage in West Hartlepool is a good deal all about Middleton Road and windows are out. Some wounded and some killed. Folks have been looking all over today for any bits of the wrecked Zepps.

Love to all,

Frances

I was having breakfast with my brother when our mother said: "the wind is getting up. It will be a fine day for washing." But it wasn't the wind. It was the sound of German shells as they hurtled from the North Sea towards Hartlepool.

The kitchen windows were rattling slightly. Soon the rattling became louder and faster and they soon became ear-splitting crashes. As we ran out of the house, the windows were blown in by the terrible concussion. Outside, people were gathering in an open patch of ground at the end of Turnbull Street. A naval battle was taking place outside the harbour.

We ran to dene street and there came a crash and I was knocked to the ground. Both my eyes became so swollen I could hardly see. Shells were bursting all around us.

- Account from W.H. Larkin, Survivor.
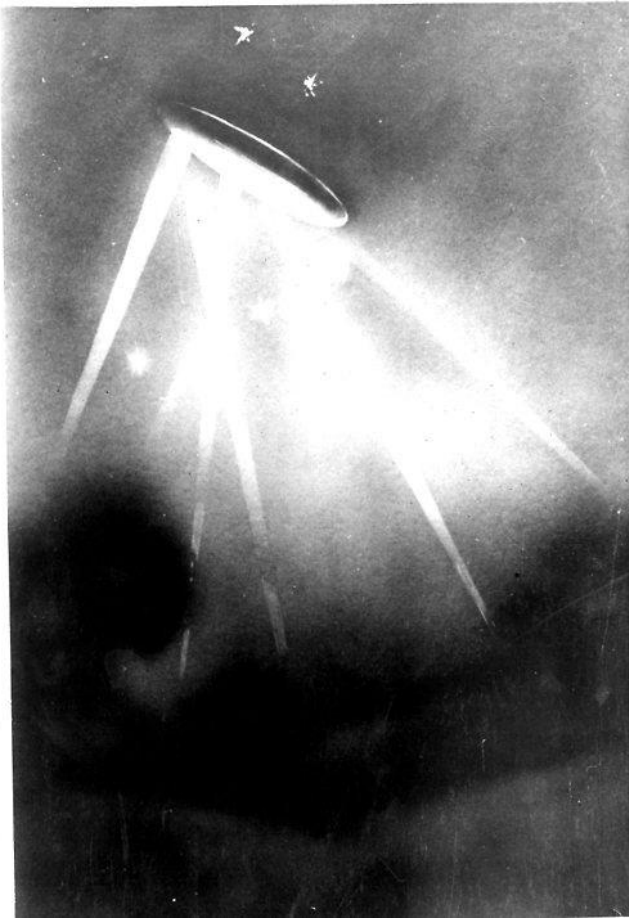
A Zeppelin caught in search lights in an air raid on Hartlepool in 1916 © Hartlepool Library Service.

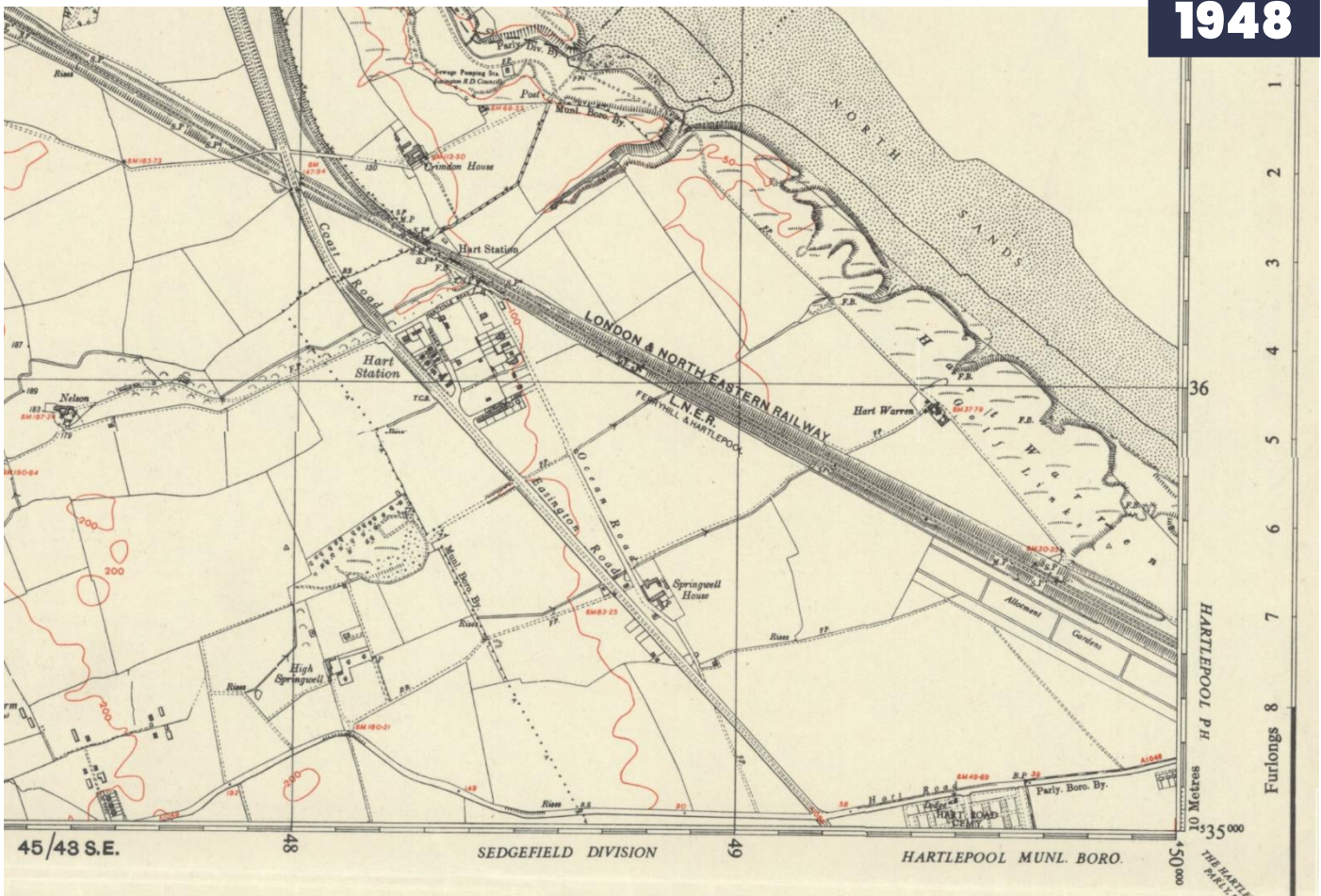Damage to a house in Blake Street © Hartlepool Borough Council.

Damage to Moor Street © Hartlepool Borough Council.

Unexploded German shells found after the Hartlepool Bombardment © Hartlepool Borough
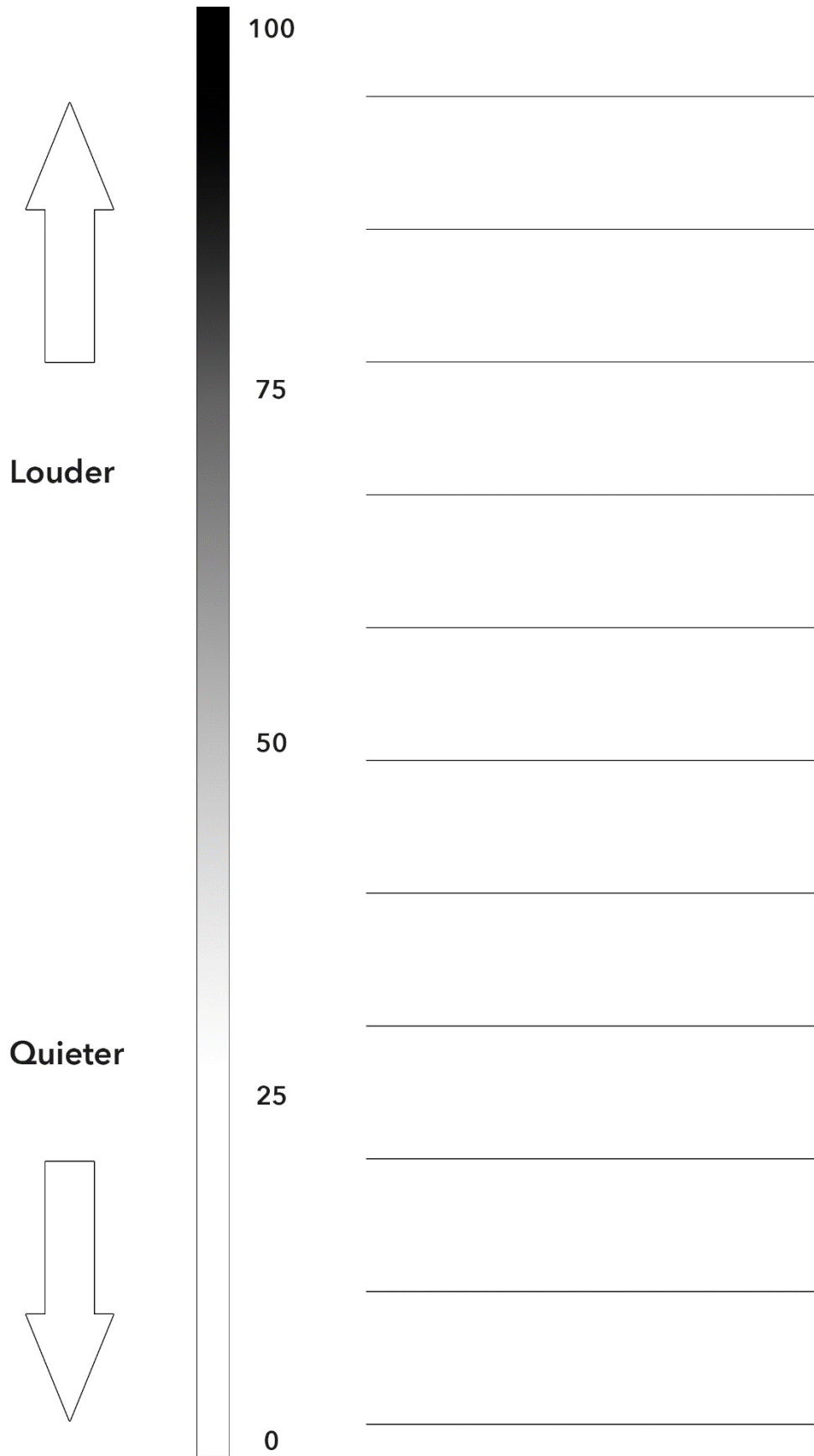
Appendix 2: Maps of Hartlepool

Appendix 3: Aerial Photographs of Clavering Sound Mirror


1965

Appendix 4: Sound Scale

100

↑

Louder

75

50

Quieter

↓

25

0

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Appendix 5: How to Program a Zeppelin Detector

To access Scratch open https://scratch.mit.edu in your browser.

Click **CREATE** in scratch menu bar to start a new project.
You do not need an account to make a project but if you do have an account then you can save your projects online. Alternatively, you can save projects to your device using file > save to computer (this is good practice in case things go wrong).
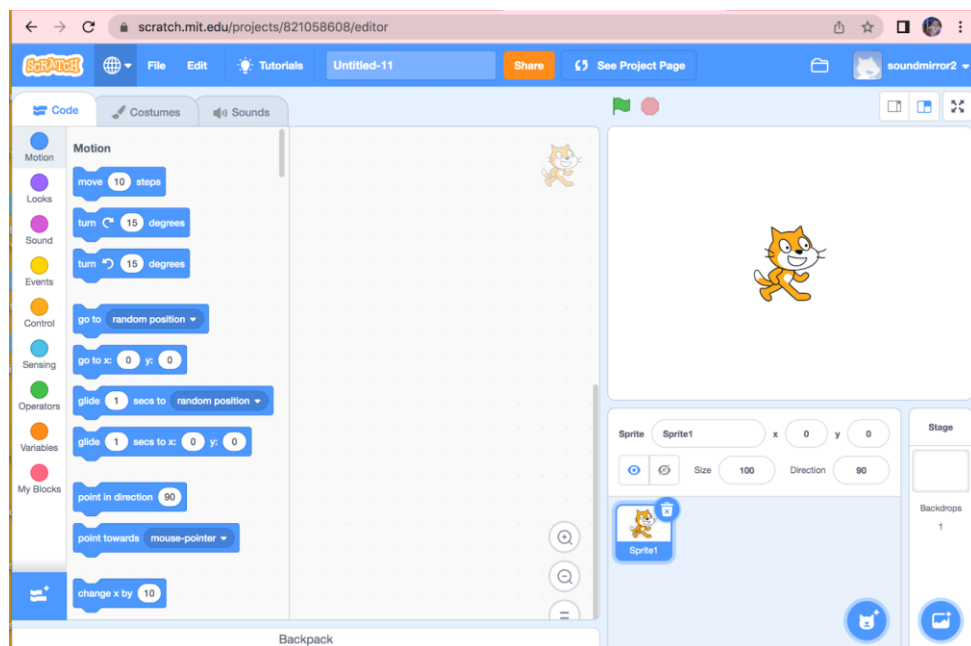
Starting simple: Make the Cat Sprite on the Stage Get Bigger:

1- Click on **events** in the far left panel to see the event list and drag the **'when green flag clicked'** block into the coding panel.

2-Click on looks in the far left panel and drag the **change size by 10** block into the coding panel.

3- Connect the change size block to the when green flag clicked block.

4- Run the program by pressing the green flag above the stage. The cat should get bigger each time you click the flag.
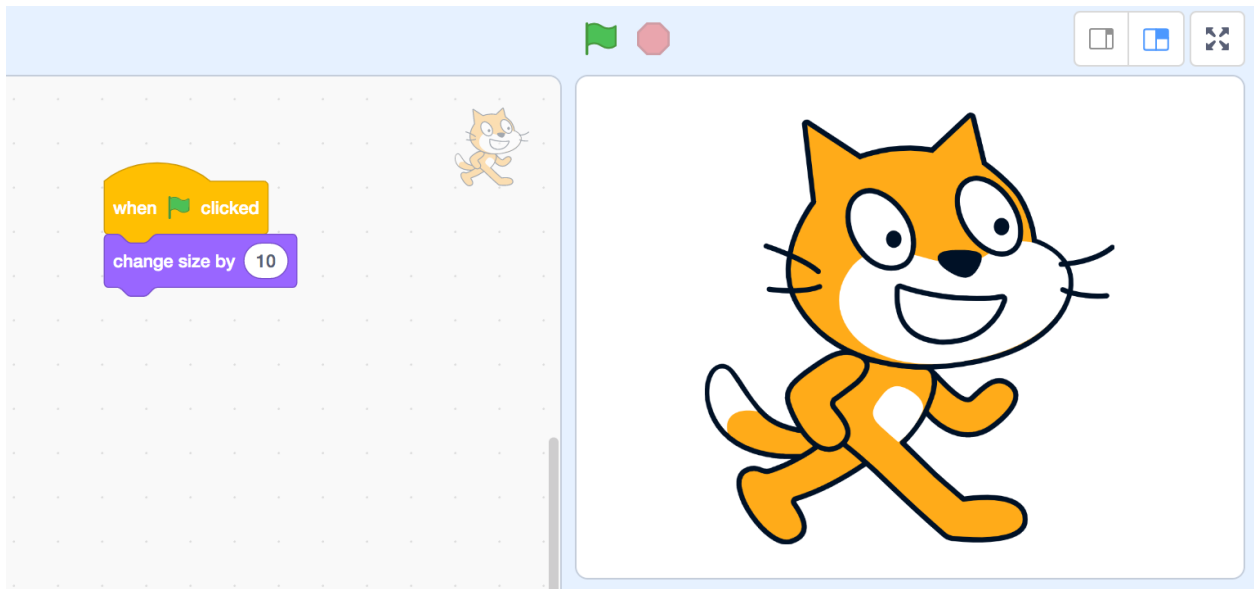
Questions:

How would you make the cat get smaller? Put a negative number in the change size block. How Can you change the size to faster or slower?

Automating things:

Pressing the button lots of times is hard work! Luckily, we can make our program run in a loop, so the computer does the pressing for us.

1 - Click control in the far left panel and select the **Forever** block and drag it into the coding panel.

2 - Connect the loop **forever** block to the **when green flag clicked** block.

3 - Put the change size block inside the forever loop. Your code should now look like this:
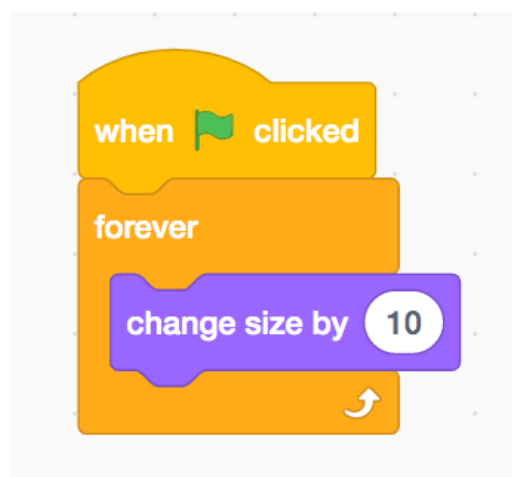
4 - Press the green flag and watch the cat get bigger by itself. This is because the forever block repeatedly does whatever is inside it when the green flag is clicked. Again, changing the number will in the change size block can make the cat smaller again or make it change more slowly.

Connecting the microphone:

To make the sprite in our program change size with sound levels we need to connect the microphone to our program. This should be simple, but you will need to make sure the computer has permission to use the microphone.

1 - Click on sensing in the far left panel.
2 - Choose the loudness block and click the tick-box next to it.
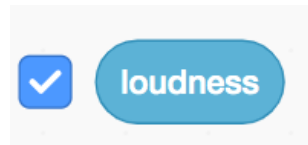
3 - This activates the microphone and the browser will probably ask if you would like to give the microphone permission to be used on this webpage - say yes!

4 - You should now see a loudness box on the stage with a number that gets bigger and smaller when you make sounds near the computer.
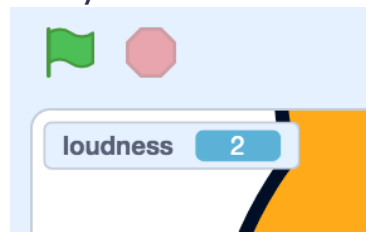
## MICROPHONE TROUBLESHOOTING (If Loudness Says -1 and Does Not Change)

This is most likely because the microphone does not have permission to run. In the browsers address bar there should be a microphone icon click this and check the permissions.

On Apple iOS and Android, you may need to give the browser permission to use the microphone in the App settings. In system settings, find the settings for your browser and click the button that allows it to use the microphone.

If you do this and the loudness number still does not change then you might need to refresh the web page and it will ask for permission again. Remember to save your work first before refreshing the browser.

Connect the Sound Level to the Cat Sprite:

1 - Drag the loudness object onto the coding panel. You will see it is an oval shape not a block this is because it provides a number value and does not do anything like an action.

2 - You can insert the loudness into the **change size by** block where the number is and press the green flag but this will only make the cat sprite get bigger so we will use a different method.

3 - Take the change size by block and drag it out of the forever block and drag it into the left panel so that it goes away

4 - From the looks panel select the **set size to block** and drag that into the forever loop of your program.

5 - Now add the loudness object to the number of the **set size to block so** that it looks like this
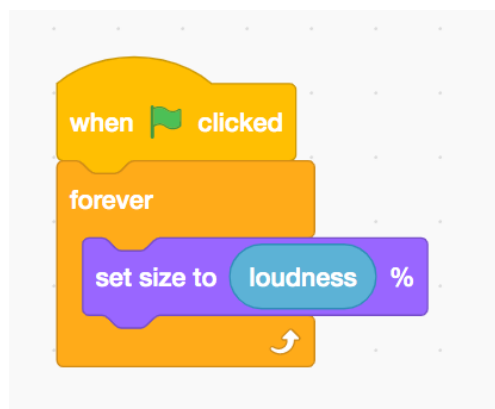
6 - Click the green flag again and now you will see the cat goes quite small but does change size with the changing sound levels.

Making the Cat Sprite Larger:
The cat is too small! We know that the bigger that loudness number is the larger the cat appears on the stage so we can add a multiplier to the volume to make it bigger.

1 - Click on operators in the far left panel. This gives a list of mathematical functions that we can work with in scratch.

2 - Select the **multiplication object** (this is the * because this is how programmers write the multiplication symbol) and drag it into the coding panel.

3 - Drag the **blue loudness lozenge** to one side of the multiplication object and type 10 into the other side. Like this:

4 - Drag this into the **set size to block.**
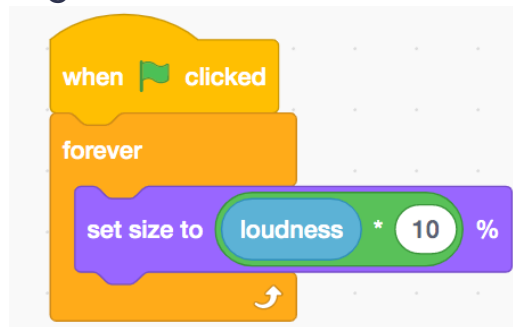
5 - Press the green flag and the cat should go from very small to very large with changes in the volume.

Questions:
Why did we use the multiply operator and not the addition operator to make the number bigger?
What is a good value to multiply the loudness by?

Time to swap the cat for a Zeppelin.

Now we have the basic programming working we can swap the image of a cat for a Zeppelin. It is also a good time to **SAVE YOUR WORK!**

1 - make sure you have sprite 1 selected in the bottom write sprites box. See image:
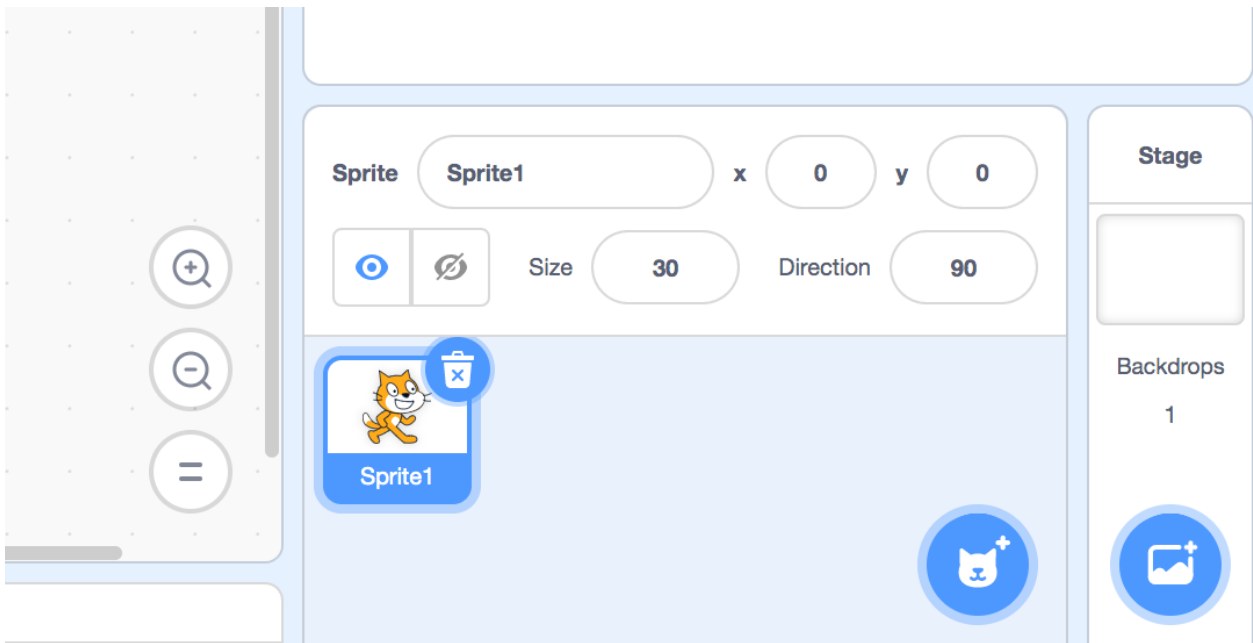
2 - click the costumes tab in the top left to open the editor for the 'costume' for the sprite so screen looks like this
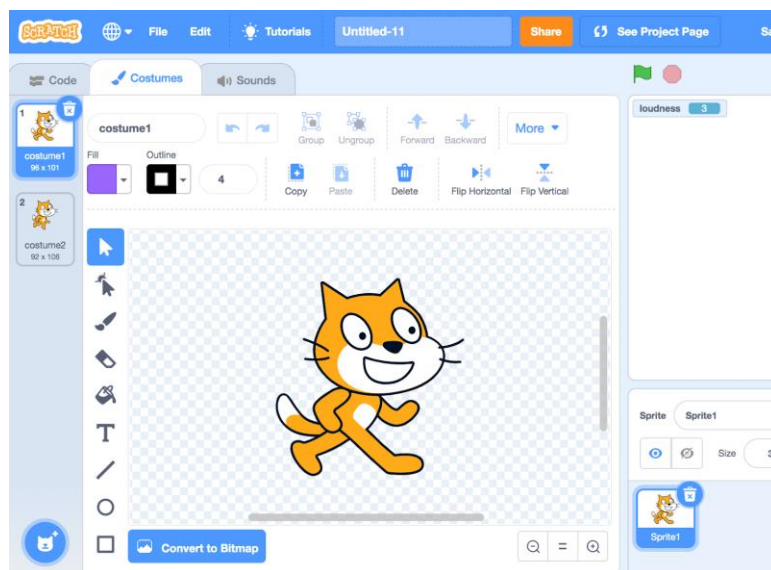

3 - drag a box around the cat to select it all and press delete (bin icon above cat) The cat will then disappear and you have a blank canvas to draw a zeppelin. **BE CAREFUL** not to delete sprite1 from the sprite window bottom right because that has your code attached to it and deleting that will lose your programming.

4 - Use the drawing tools to paint in a zeppelin. The circle tool can make a good template to start as it can be used to make an ellipse/oval.
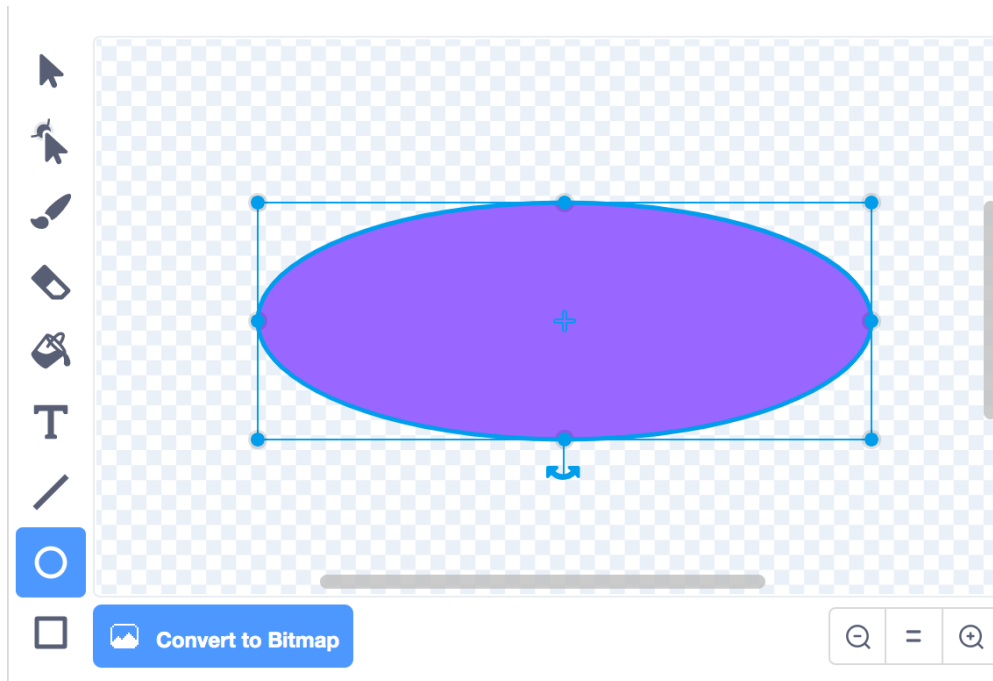
A finished zeppelin made using a combination of shapes and free hand drawing with the paint brush tool. **Remember to save your work regularly.**
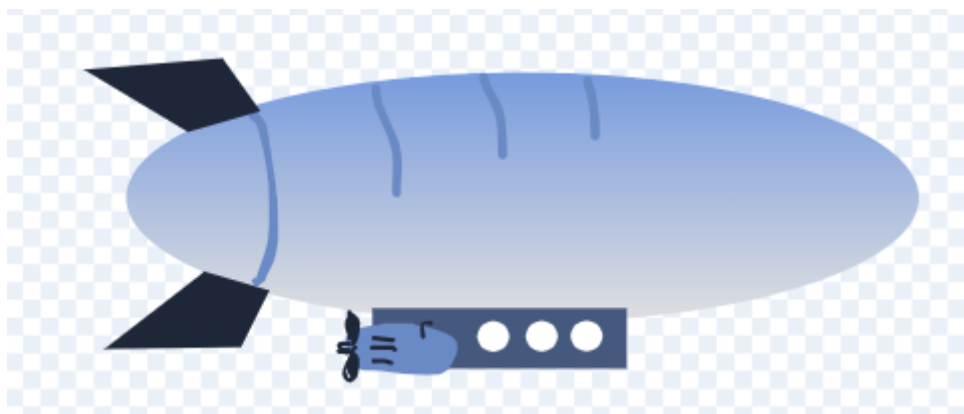

When you are done click the green flag and check your zeppelin still changes size. If not click back to the coding tab and check your code is there.

ADDING A BACKGROUND:
You might want to add a background or landscape to the stage. Perhaps you could imagine what the landscape where you are looked like during the First World War.

1 - Click on the stage/backdrops panel in the bottom right and select **backdrop 1**

2 - In the backdrops tab you should now have a painting window as before to draw a landscape into.
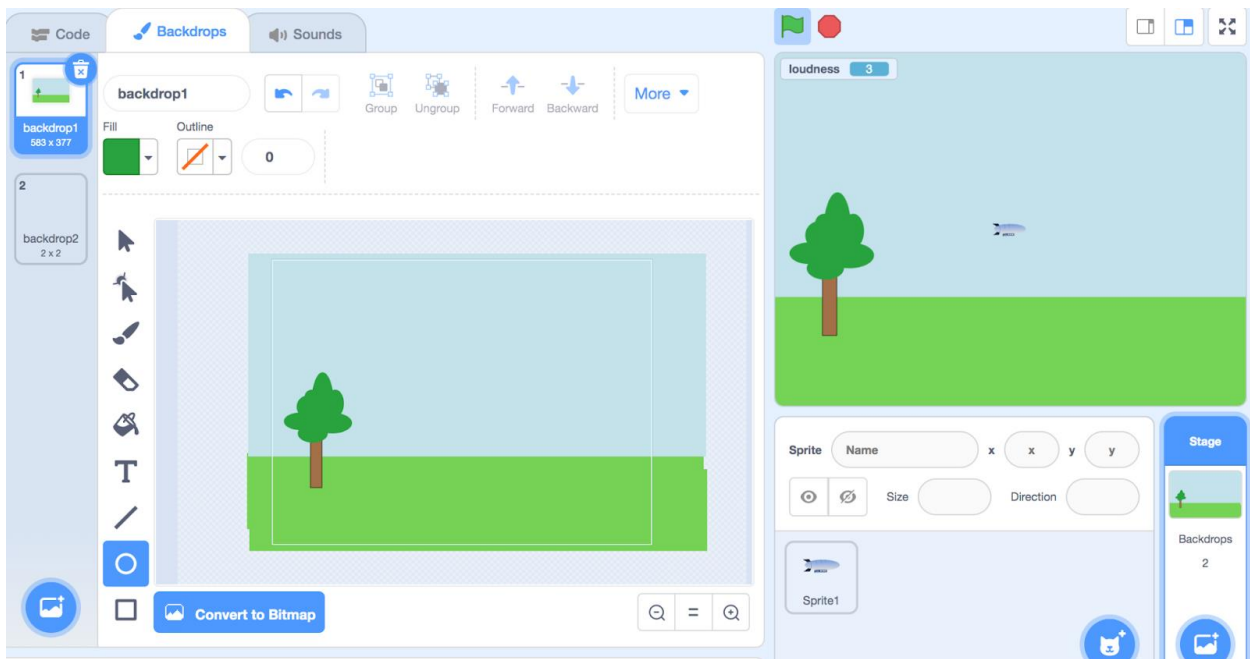
Extending the Basic Programming:

Now we have made a zeppelin that changes size we can change our program into a zeppelin detector like the sound mirror. We will now add some code so that when the sound level reaches 65 it will tell us there is a zeppelin!

1 - Click back onto sprite 1 in the sprites panel and then click the code tab in the top right so that we can see our code from earlier.

2 - From the control section of the code blocks we will choose the block that says **if then** and drag it underneath the **set size to block** inside the forever loop.
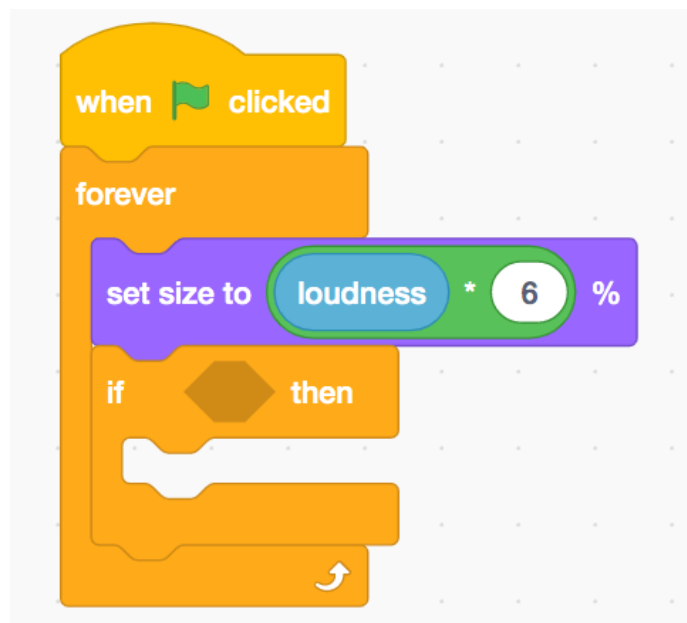
3 - We now want to tell the computer that **if** the loudness is greater than 65 **then** do something. We need to select the greater than > operator from the operators panel we used earlier and drag a new loudness object into the left hand side of it like this:

4 - Change the number 50 to 65, or whatever threshold you would like to set, and add this to the hexagonal box in the **if then block.**

5 **-** We can now tell our program to play a sound when the level you have set is reached. Click on sound in the far left panel and drag the **play sound until done block** into the **if then block** we added earlier.
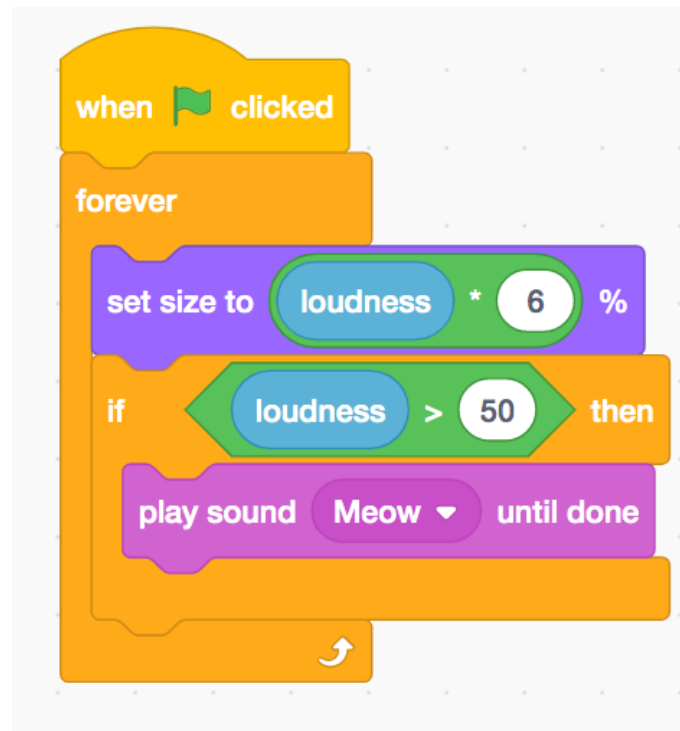
6 - Press the green flag and make a loud noise like clapping your hands near the microphone. Now if the loudness value is greater than the level that you set the computer should play a meow sound.
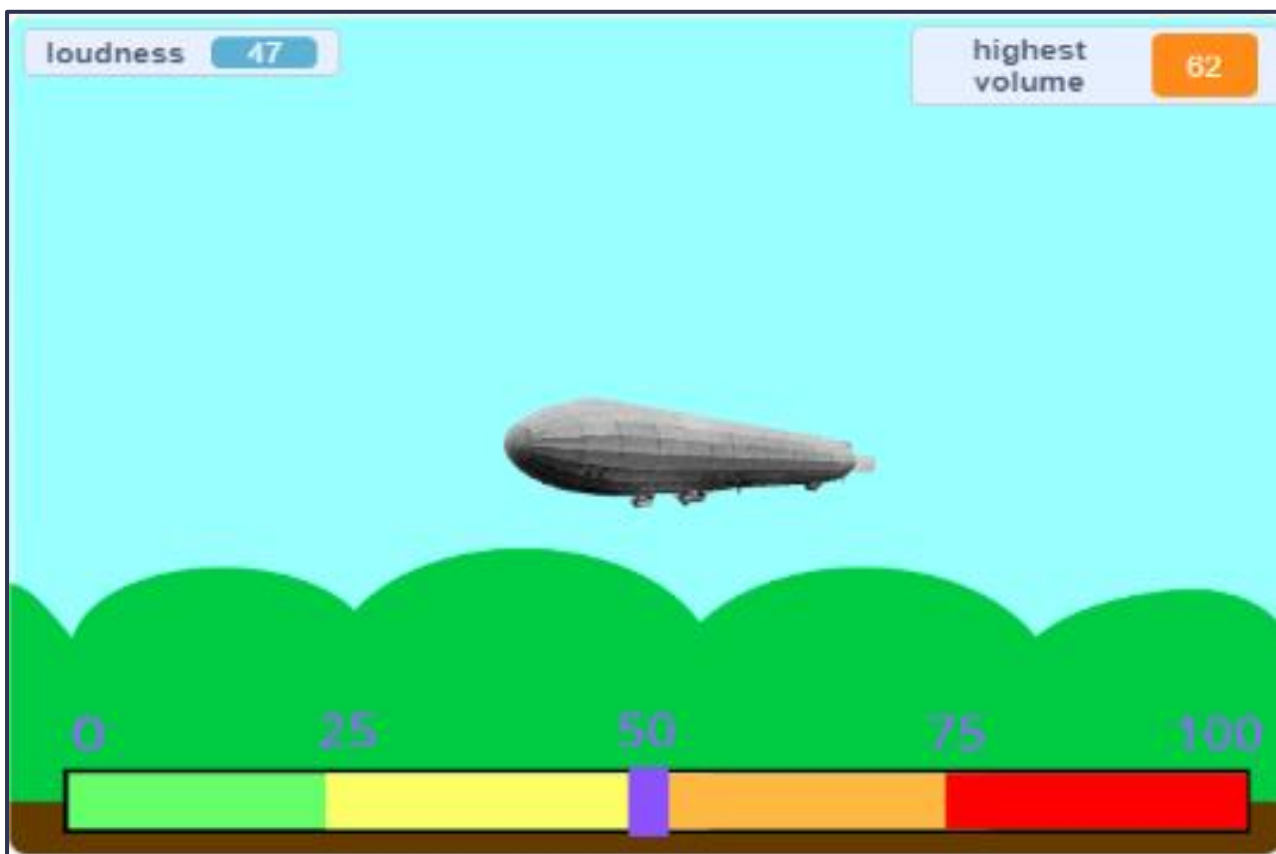
7 - By pressing the down arrow next to where it says Meow you are giving the option to record your own sound. You could try adding an alarm sound or shouting Zeppelin!

USING YOUR ZEPPELIN DETECTORS

Now that we have programmed a working sound level monitor that tells us how loud or quiet things are, we can use this to think about the local environment and measure how loud it is.

Take your Zeppelin Detectors outside into the playground - what number is the volume reading outside the classroom compared to inside?

Can you find a noisy thing in the school? Is it as loud as a zeppelin?