



# MARCONI

AERIALS, RADIOS & VALVES

Key stage One and Two Activity Pack  
British Science Festival



# History

... with the odd pigeon

A long long time ago if we wanted to send a message to someone it would have to be written on a piece of paper and sent by post maybe travelling by train, boat, horse or pigeon even, which could take a long long time!

Then in the early 17th century some very clever people worked out how to send signals electrically through wires and a chap called Samuel F Morse invented a new language we know as morse code, a series of dots and dashes.

So now we could send messages through wires. But by the end of the 17th century there were a handful of inventors, designers and developers looking into the possibility of sending messages using invisible waves. So no wires! .... 'wireless'. How amazing would that be!

Have a look at our mobile phones. We now take it for granted that they give us the ability to talk to anyone in the world from wherever we maybe (as well as doing loads of other things, like playing games!), but to get to this point a lot of experimenting, trial and error and money was spent!

One of those inventors was Guglielmo Marconi, an Italian who came to England in 1896. He was an enthusiastic 22 year old who brought with him his wireless **apparatus** and the ambition to create a communication system for the mariner (that's someone who works on a boat). Up until then, if you were out on the ocean you were very much on your own with no way of communicating with other ships or anyone on land. Pretty scary if anything went wrong!

Marconi chose Chelmsford, I mean who wouldn't! He needed electrical power and we were already way ahead thanks to the **pioneering** work of **Crompton and Christy**. In a fairly short amount of time Marconi had established a factory, carried out numerous experiments, obtained **patents**, made the first ever transatlantic wireless communication to Newfoundland in Canada (that's a long way!) and made the first wireless entertainment broadcast in the UK, which started off what we now know as radio.



**Guglielmo Marconi**

**Apparatus** : Objects or equipment to be used for a special purpose. For Marconi this would be for experiments.

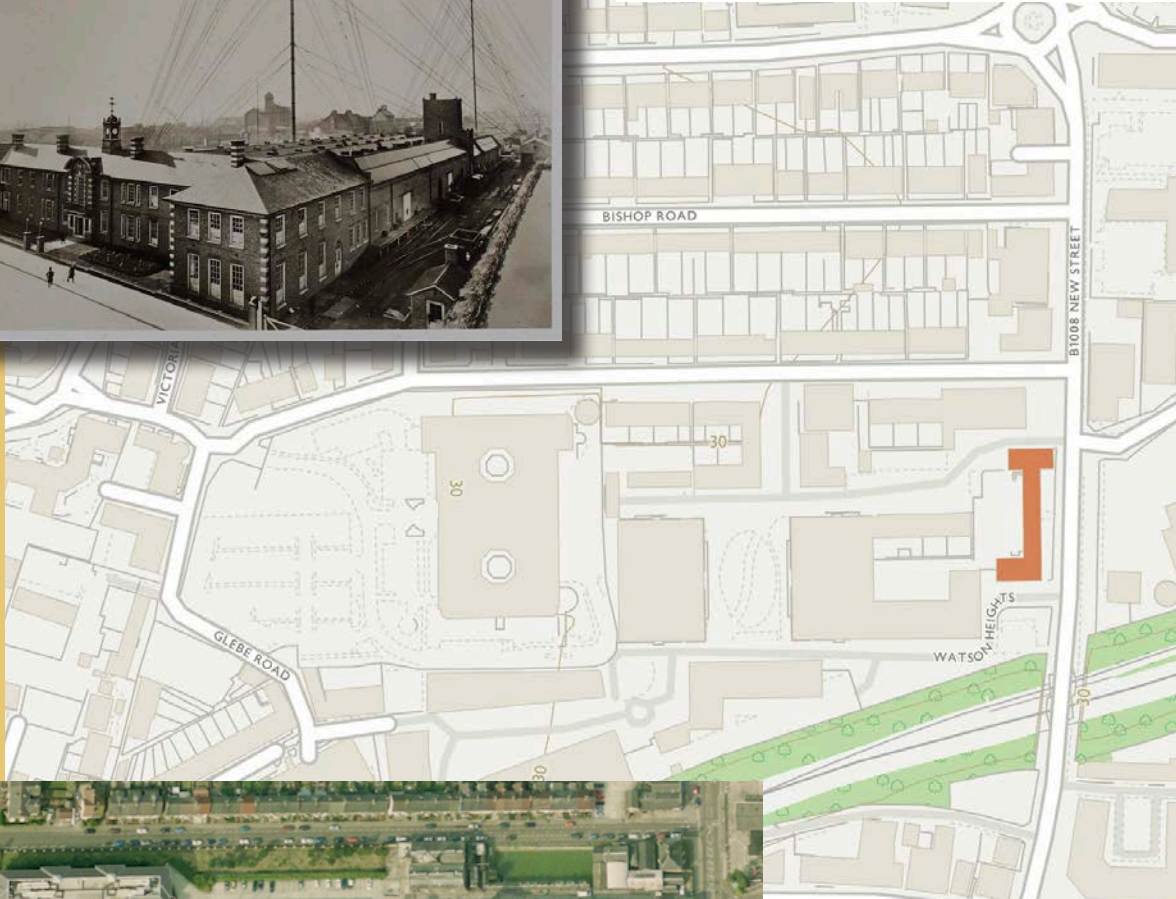
**Pioneering** : Using ideas and methods that have never been used before.

**Crompton** : Colonel Rookes Evelyn Bell Crompton was an engineer who pioneered electric street lighting and electric traction motors. He installed electric street lights around the town centre in 1888, making Chelmsford one of the earliest towns to have electric street lighting.

**Christy** : Christy Brothers and Company, an electrical engineering company founded in Chelmsford in 1883.

**Patents** : The official legal right to make or sell an invention for a particular number of years.

This photograph is of Marconi Works in New Street, Chelmsford in the early 1900s. Look at those amazing aerials! The building is marked on the map below in orange. A lot has changed in the last 100 hundred years, in fact in the last 20 years! This Marconi building is now the headquarters of a cosmetics company and the factories which were behind it are now new houses and flats.



2005

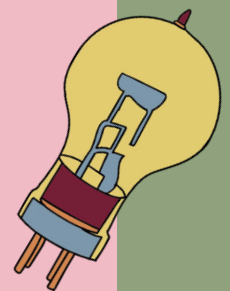
### Spot the Difference!

The satellite image on the left is from 2005 when all the factory buildings were still in place. Below is a Google Earth image from 2020 showing the new houses and a little pocket park in the centre.



2020

# Geography



# Art

This is the map of the Marconi site from the previous page for you to print out and colour if you have a printer. If not, see if you can find the River Chelmer, the railway station and Riverside Leisure Centre. It's really difficult!



# English

Marconi regularly wrote to his father, keeping him up to date with his progress, the people he'd met and experiments he was carrying out. He also asked his father for money as he began to set up his company. He would often ask how things were back at his home in Italy and always signed his letters 'your affectionate son'.

67 Talbot Road  
Westbourne Park  
London, W  
15th February 1898

*Dearest Father,*

*I have been busy for the last two weeks carrying out experiments off shore between a ship and the ports of the Isle of Wight. The results have been excellent, or I could even say beyond expectations, as I could transmit messages during storms and fog to a distance of about 28 kilometers.*

*I have been nearly two weeks on board a steam boat during the horrible season, but thanks to God everything went very well. Monday I will go back to continue these experiments.*

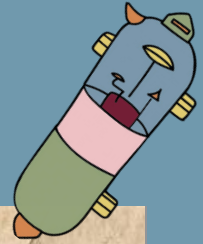
*Please let me know how the paperwork for villa Banzi is processing.*

*I have received so many letters from every part of the world, that I do not know how I will possibly ever be able to answer them all.*

*believe me always*

*Your very affectionate son*

*Guglielmo Marconi*



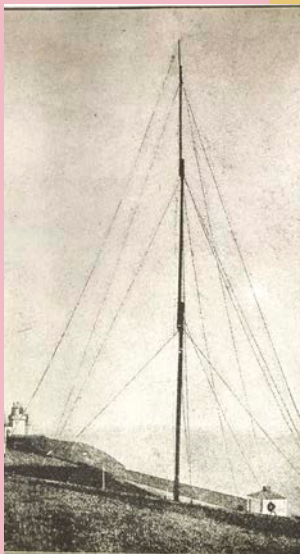
Imagine you've been working on a new invention, something that will change the future. You're very excited, but there is still much to do! Write a letter to your family to tell them what you've been up to. Write it in your own words and don't forget to sign it!

# Art + Science

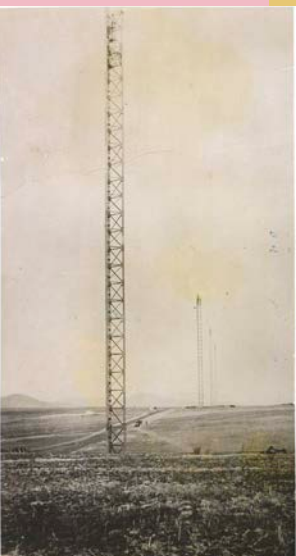
## Aerials



Remember those amazing aerials on the Marconi building photograph? There are more on the left and bottom of this page. They're crucial to Marconi's discoveries and invention of radio. So what do they do? Well, imagine holding out your hand and catching words that are passing by. That's kind of what an aerial does. The metal rod catches radio waves and turns them into electrical signals which are then fed into a radio.



It works the same for television and telephone systems, so hold your hand out again and catch some pictures and information! This is a receiver aerial. But we also have transmitters. They're a different kind of aerial that does the opposite job to a receiver. Transmitters turn electrical signals into radio waves so they can travel sometimes thousands of kilometers around the Earth. Or even into space and back! Receivers and transmitters are the key to nearly all forms of modern telecommunication. The discovery of wireless transmission all those years ago has made a huge difference to our modern lives!

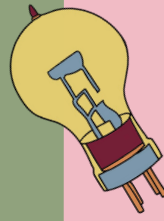


Let's have a go at creating a 2D aerial picture with found objects from around your home. We are going to be arranging our objects onto a flat surface. You will need to find a space to lay everything out. A table top or on the floor. If you have some plain paper you could put this down first, and arrange your objects on top.

OK, so what to use? You could use cutlery or other bits and pieces from the kitchen, maybe pegs? You could empty your pencil case and use pencils, pens, rulers, felt tips. You could use food (definitely get permission for this one!). Dried food is best like pasta or spaghetti. You are just going to arrange the objects laying flat, so no glue or tape, and no building high! Use the pictures on this page for ideas.

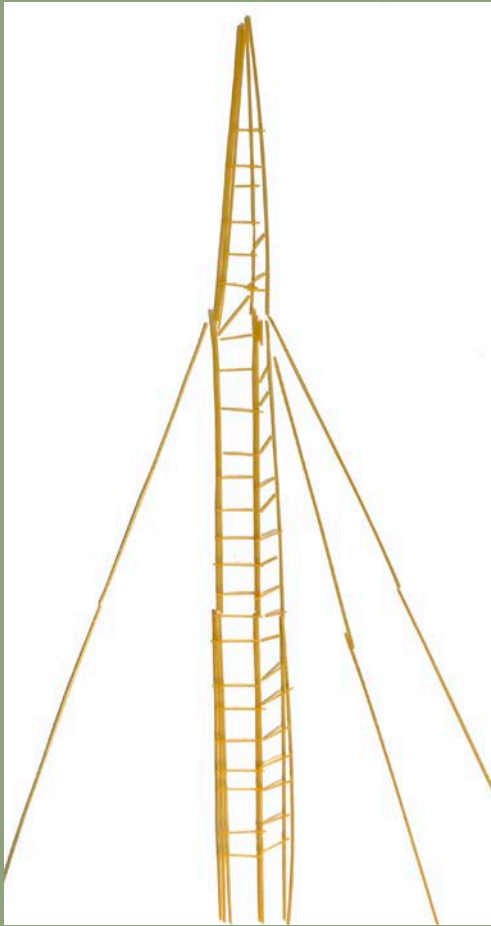
Once you've created your aerial, if you've got a phone or camera, take a photo of it. If not, have a go at drawing your creation. There's a few ideas on the next page. Enjoy!





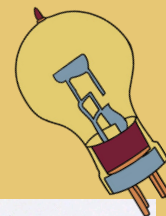
AERIAL CREATION  
IDEAS USING  
PASTA, PENCILS  
AND CUTLERY

# 3D Collage





# Art + Science Radios

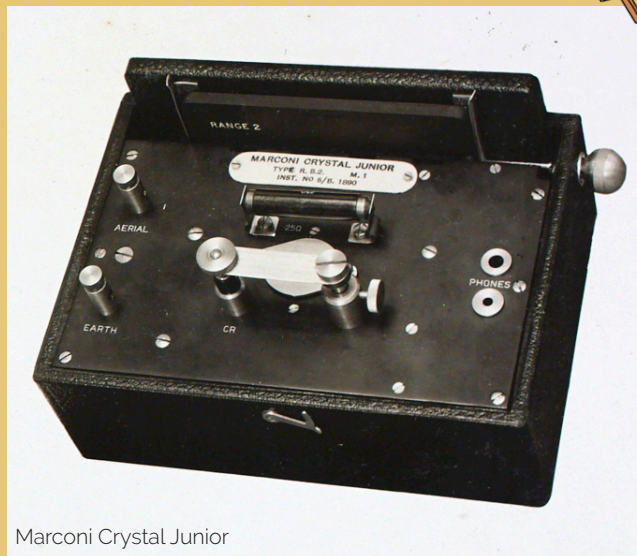


... and cat's whiskers

Marconi had started something big with his invention of radio and by the 1920s you could have a go at making your own radio with a piece of crystal and a cats whisker! (well not really a cat's whisker, a very thin bit of wire that looked like one).

A crystal radio is a very simple radio receiver that doesn't need batteries to work. A wire aerial collected enough of the radio signals from nearby transmitters to power the crystal which works to separate the signals and play them as sounds into earphones. Check back to page 6 for a reminder of what a receiver and transmitter is.

The Marconi Company made a crystal radio called the 'Marconi Crystal Junior' which could pick up a signal from a broadcasting station up to 25 miles away. Crystal radios can't be heard through loudspeakers so families would sit around their radios taking it in turn to listen through the headphones and ear pieces.



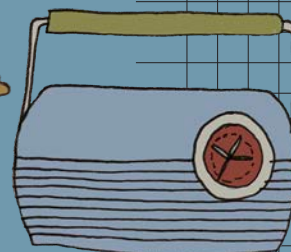
Marconi Crystal Junior



Family listening to a crystal radio

The radios we listen to have changed a lot throughout the last one hundred years. We can now listen to radio programmes in other ways too: through our televisions, on our computers, even using our mobile phones!

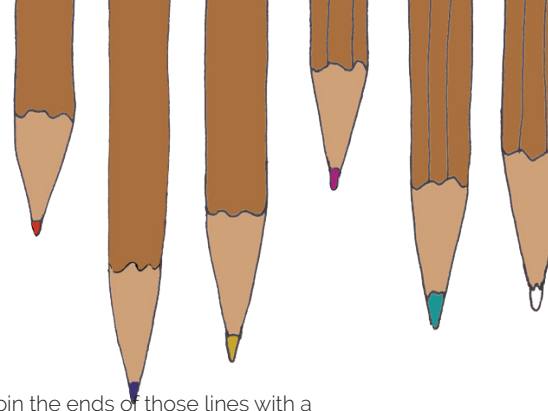
There are so many radio channels now too, from broadcasters like the BBC to small hospital radio channels and specialist internet radio stations. If you have access to the internet, Radio Garden is a website where you can travel the globe and listen to radio stations all over the world. Give it a go and see what you can find! <http://radio.garden>



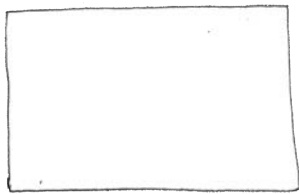


# Drawing

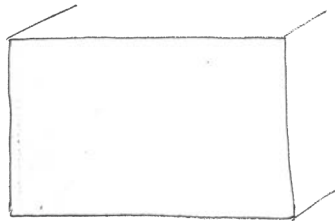
Let's have a go at drawing a 3D radio. Find a plain piece of paper and a pencil - make sure it's nice and sharp and don't press too hard when you're drawing - and some coloured pencils.



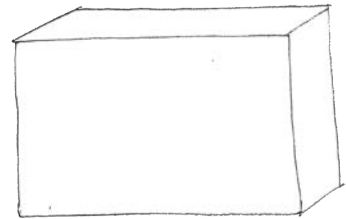
First draw a rectangle



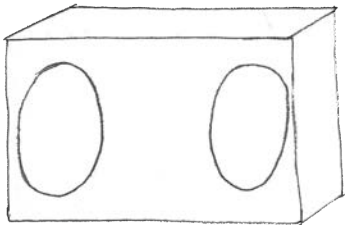
Now draw three lines at an angle from three of the corners



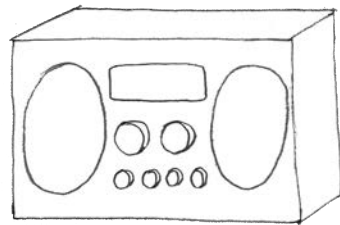
Join the ends of those lines with a straight line across the top and a straight line down the side



Draw two speakers, I've drawn oval speakers but you could draw circles or squares



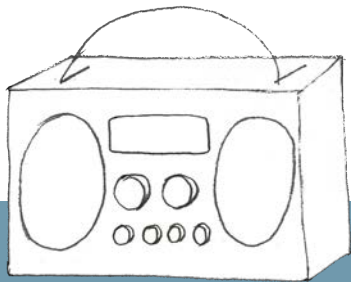
Now we're going to add some buttons and a little window to see what channel we've chosen



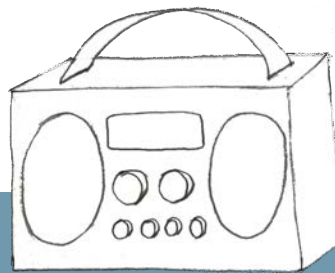
To make the buttons appear 3D simply draw a curved line following the circle from top to bottom, creating a sort of crescent moon shape.



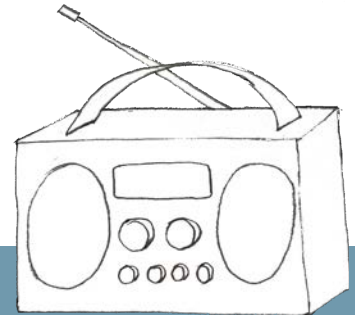
A handle next. Start by drawing two little lines parallel with the radio top edges and then draw an arch from one to the other



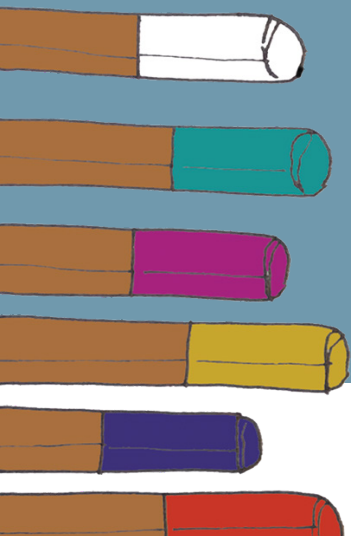
Now draw another arch from the other end of each line



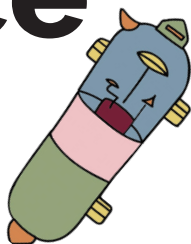
Lastly an aerial, I've drawn mine on an angle but it could point straight up or the other way



Add some colour and detail and there you go! You could add some extra wires or buttons and switches, make it look more futuristic perhaps!



# Art + Science Valves



In those early years of radio many inventors were working on new ideas, one of which was the invention of the diode and triode, little vacuum tubes that we call valves in Britain. They looked like little glass lightbulbs with pins sticking out the bottom and wires inside. They made a huge difference, helping to make voices and music much clearer and opening up the future of radio.

By then, the Marconi Company's radio factory had become a big part of Chelmsford employing a lot of local people manufacturing radios and all sorts of radio parts including these little valves.

On the right there are some black and white photographs of valves. They almost look like little characters from a future world! We are going to create our own futuristic world of colourful 3D valves.

We could even create a future family of valves with Mr. Victor Valve and Mrs. Valerie Valve and all their friends and family!

For this activity you will need playdoh, plasticine or clay, in any colour - the more colours, the brighter your new world! - and a piece of card as your base.

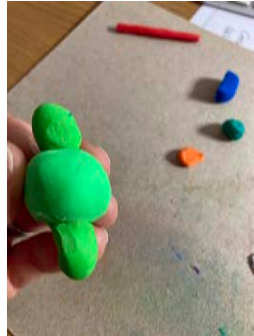
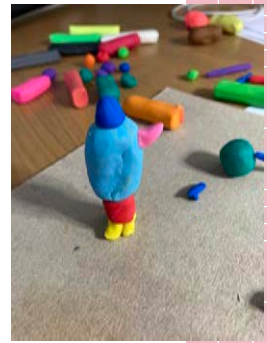
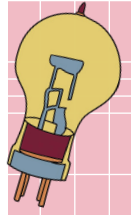
Follow the instructions on the next page and have fun!

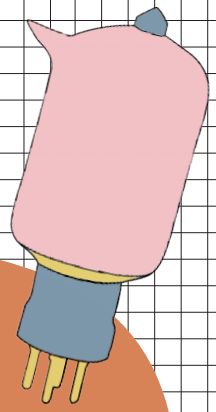
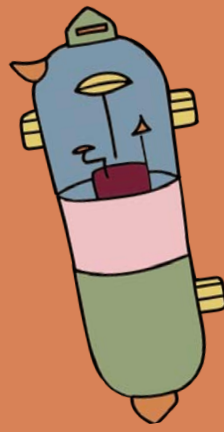
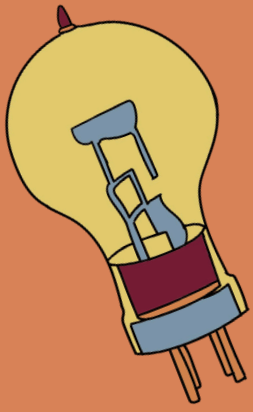


# Sculpting

Materials : plasticine, playdoh or air dry clay, a piece of cardboard to use as a base and a plastic or wooden knife. Make a start by rolling lots of thin sausage shapes and lots of different sized balls. Then roll some slightly larger sausages and cut them into little disc-like pieces. Add to that some chunkier sausage shapes and large oval shapes (these are the main bodies of the valves)

Below there are photo instructions for three different valves or choose one from the previous page or why not have a go at designing your own valve. Make as many as you like. Have a look on the next page to see a mini valve gathering!





We hope you've enjoyed making some new pieces of art. Hopefully you've learnt a few new things about Marconi and wireless communication too!

We would love to see the work you've created, so take a snap and post on social media. If you're posting on Instagram use @essexrecord, on Twitter it's @essexarchives and @EssexRecordOffice on Facebook.

This learning resource pack was produced by Elaine Tribble for Essex 2020: A Year of Science and Creativity in conjunction with the Essex Record Office and Chelmsford City Council.