

THE BIRTH OF ULTRASOUND: PRIMARY EDUCATION PACK

From Govan's Shipyards to Hospitals Around the World

WELCOME

Every day, millions of people around the world experience an ultrasound scan.

Parents catch their first glimpse of a baby before birth. Doctors use ultrasound to examine hearts, muscles and organs. Emergency teams rely on portable scanners to make life-saving decisions, while healthcare professionals use the technology in hospitals, ambulances and remote communities across the globe.

Few people realise that this remarkable technology has its roots in Glasgow.

The Birth of Ultrasound tells the story of how an obstetrician, Professor Ian Donald, and a shipyard engineer, Tom Brown, combined their knowledge to create one of the most important medical innovations of the twentieth century. Inspired by the ultrasonic flaw detectors used to inspect steel ships in Govan, they demonstrated that sound could safely reveal what could not be seen inside the human body.

This education pack accompanies the digital exhibition and invites pupils to explore that extraordinary journey through films, interactive activities and creative classroom learning.

More than a story about science, this is a story about curiosity, collaboration and creativity. It shows that some of the world's greatest innovations begin when people from different backgrounds work together to solve a problem.

About This Resource

This resource has been designed to support learning before, during and after visiting **The Birth of Ultrasound** digital exhibition.

Following the same five chapters as the exhibition, pupils will investigate how sound behaves, discover the connection between shipbuilding and medicine, explore Glasgow's pioneering role in the invention of ultrasound, hear the voices of the people whose lives were changed by the technology, and consider how innovation continues to shape healthcare today.

The activities encourage pupils to think like scientists, engineers, designers, historians and storytellers, while developing curiosity, critical thinking, creativity and empathy.

Suitable for learners across all primary stages, activities include lighter-touch adaptations, extension challenges and opportunities for interdisciplinary learning.

The Big Question

Throughout this learning journey,
pupils will investigate one overarching enquiry:

How did an idea from Govan's shipyards become one of the world's most important medical inventions?

Each chapter of the exhibition explores one part of the answer.

By the end of the programme, pupils should be able to explain not only how ultrasound works, but why collaboration, creativity and design were just as important as scientific discovery.

Learning Journey

The classroom activities mirror the visitor journey through the digital exhibition.

Rather than treating science, history and design as separate subjects, pupils explore how each discipline contributed to one remarkable invention.

Exhibition Chapter	Big Question	Website Experience	Classroom Learning
Chapter One – The Echo of Discovery	How can sound reveal what we cannot see?	Film 1, Metal Flaw Detector Simulator	Sound Detectives, Crack the Metal
Chapter Two – The Shipyard	What does shipbuilding have to do with medicine?	Film 2, Build a Prototype Ultrasound Machine	Build the Prototype
Chapter Three – The Birth of Ultrasound	What did the world's first ultrasound look like?	Film 3, Virtual Ultrasound	Ultrasound Through Time
Chapter Four – The Sound of Life	How did ultrasound change people's lives?	Film 4, Human Echoes, Interactive Timeline	Design Makes the Difference, Human Echoes Reflection
Chapter Five – Beyond the Echo	Where will ultrasound take us next?	Film 5	The Next Big Idea

As pupils progress through each chapter, they move from understanding the science, to exploring the history, to considering the human impact, before finally imagining the future of innovation.

Learning Intentions

Through participation in the exhibition and accompanying classroom activities, pupils will:

- Understand that ultrasound uses high-frequency sound waves and echoes to create images.
- Explore how engineering knowledge from Govan's shipyards inspired a breakthrough in medicine.
- Recognise that innovation often happens when people with different skills work together.
- Discover how industrial design can improve comfort, accessibility and trust.
- Reflect on the human stories behind scientific discoveries.
- Understand how a medical invention developed in Glasgow continues to improve healthcare around the world.
- Develop curiosity, creativity and confidence when solving real-world problems.

Curriculum for Excellence

The resource supports interdisciplinary learning across the Curriculum for Excellence.

- **Sciences**

  Learners investigate sound, waves, materials and scientific enquiry while exploring how evidence and experimentation contribute to discovery.

- **Technologies**

  Activities encourage pupils to investigate engineering, product design, innovation and problem-solving while considering how existing technologies can be adapted to meet new challenges.

- **Social Studies**

  Pupils explore Glasgow's industrial heritage and Scotland's contribution to international healthcare, considering how local communities can influence global change.

- **Expressive Arts**

  Creative activities encourage pupils to communicate ideas through drawing, storytelling, design and reflection, recognising creativity as an important part of innovation.

- **Health and Wellbeing**

  Through personal stories and oral histories, learners reflect upon empathy, relationships, patient experience and the importance of designing healthcare around people's needs.

- **Literacy and English**

  Throughout the programme pupils develop listening, discussion, observation and reflective writing skills while interpreting historical evidence, film and oral testimony.

Key Themes

Throughout the exhibition and classroom activities, four themes run consistently across the learning experience.

- **Curiosity**

  Every invention begins with someone asking a question.

  Pupils are encouraged to investigate, experiment and remain curious about how the world works.

- **Collaboration**

  The invention of ultrasound was only possible because doctors, engineers and designers worked together.

  Throughout the activities, learners explore how different skills and perspectives contribute to solving complex problems.

- **Creativity**

  Innovation is not only about technology.

  Creative thinking, design and imagination helped transform an industrial machine into a life-changing medical device.

  Pupils are encouraged to explore ideas through making, drawing, discussion and experimentation.

- **Compassion**

  Behind every scientific discovery are people.

  By listening to personal stories and reflecting on lived experience, pupils discover that successful innovation improves not only technology, but people's lives.

Using This Pack

The activities have been designed to follow the structure of the exhibition.

Teachers may choose to complete the entire learning journey or use individual chapters to support specific topics within science, social studies, technologies or expressive arts.

Each activity includes:

- Curriculum links
- Learning intentions
- Step-by-step instructions
- Discussion prompts
- Reflection questions
- Lighter-touch adaptations
- Extension challenges
- Opportunities for assessment and evidence of learning

Activities may be completed in sequence or selected individually depending on the needs of the class.

Before You Begin

Before starting the exhibition, introduce pupils to the **Big Question**:

How did an idea from Govan's shipyards become one of the world's most important medical inventions?

Encourage pupils to make predictions.

- What is ultrasound?
- Where do they think it came from?
- How might sound help us see something we cannot see?
- What jobs or skills might be needed to invent a new technology?

Explain that by the end of the learning journey they will be able to answer these questions for themselves.

Activity 1: Sound Detectives

Linked Exhibition Chapter

Chapter One: The Echo of Discovery

Associated Film: *Film 1 – The Echo of Discovery*

Associated Interactive: None (prepares pupils for the Metal Flaw Detector Simulator)

Time: 20-30 minutes

Organisation: Pairs, small groups or whole class

Big Question

How can sound help us discover things we cannot see?

Learning Intentions

We are learning:

- that sound travels and creates echoes.
- that different materials change how sound behaves.
- that scientists and engineers can use echoes to investigate objects.
- that asking questions and experimenting helps us make discoveries.

Success Criteria

I can:

- describe what an echo is.
- identify materials that reflect or absorb sound.
- explain how echoes can help us investigate something we cannot see.
- share my ideas with others using scientific vocabulary.

Teachers Note

> This activity introduces the scientific principle that underpins the entire exhibition.
>
> Before pupils discover ultrasound, they first investigate how sound behaves. Through simple listening activities, they explore how sound travels, bounces and changes depending on the material it meets.
>
> The aim is not to explain ultrasound in detail, but to encourage curiosity. By the end of the activity, pupils should begin asking the same question that inspired the invention of ultrasound:
>
> Could sound help us discover things we cannot see?

You Will Need

- A quiet classroom or corridor
- A hard surface (wall or table)
- A soft surface (blanket, cushion or fabric)
- Small whiteboards or paper (optional)
- Exhibition Film 1: **The Echo of Discovery**

Before You Begin

Watch **Film 1: The Echo of Discovery** together.

Ask pupils to listen carefully for one important idea.

How do echoes help us understand the world around us?

Activity

Step 1

Ask everyone to stand quietly.

Clap your hands once.

Ask pupils: What happened to the sound?

Did it disappear immediately?

Or did it seem to come back?

Explain that when sound bounces back to us, we call it an **echo**.

Step 2

Repeat the clap facing a hard wall.

Then repeat it facing a blanket or cushion.

Encourage pupils to describe any differences they notice.

Which sound seems louder?

Which one lasts longer?

Which one feels quieter?

Step 3

Working in pairs, pupils investigate different materials around the classroom.

For each surface they predict:

- Will the sound bounce back?
- Will the sound be absorbed?
- Why do they think that?

Then test their predictions.

Activity

Step 4

Bring the class back together.

Create two headings:

Echoes Stronger

Echoes Softer

Invite pupils to sort the materials they tested into each group.

Discuss any surprises.

Step 5

Introduce the key idea.

Scientists and engineers sometimes send out sounds they cannot hear.

Instead of listening with their ears, special machines measure the echoes that bounce back.

Those echoes can reveal things hidden inside objects.

Ask:

What kinds of things might people want to look inside without opening them?

Collect ideas before revealing the answer in the next activity.

Discussion Questions

- What is an echo?
- Why do some materials create stronger echoes than others?
- Why might scientists use sound instead of opening something?
- What objects might we want to investigate without breaking them?
- What questions do you have about sound?

Reflection

Complete the sentence:

Today I discovered that sound can...

Older learners may also complete:

I wonder if sound could help us...

Share responses with a partner or as a class.

Lighter Touch Adaptation

For younger pupils or learners requiring additional support:

- Focus on listening rather than recording observations.
- Use only two contrasting materials (hard and soft).
- Encourage pupils to respond through drawing or discussion.
- Introduce the phrase **"sound bouncing back"** before introducing the word **echo**.
- Use picture cards to sort materials into **Echoes Stronger** and **Echoes Softer**.

Extension Challenge

Ask pupils to become inventors.

Choose one object that people cannot easily see inside.

Examples:

- a tree
- a bridge
- a suitcase
- a ship
- the human body

Ask:

How could sound help us investigate it without opening it?

Pupils draw and label their ideas before sharing them with the class.

Evidence of Learning

Learners can:

Explain what an echo is.

Describe how different materials affect sound.

Suggest ways echoes might help us investigate hidden objects.

Ask questions that demonstrate curiosity about how sound might be used in science and engineering.

Looking Ahead...

You've discovered that sound can bounce back and tell us about the world around us.

In the next chapter of the exhibition, you'll discover how engineers in Govan used echoes to inspect steel ships without cutting them open.

Then you'll try it for yourself in the **Metal Flaw Detector Simulator**.

Next Activity: *Crack the Metal*

Activity 2:
Crack the Metal

Linked Exhibition Chapter
Chapter One: The Echo of Discovery

Associated Film: *Film 1 – The Echo of Discovery*

Associated Interactive: *Metal Flaw Detector Simulator*

Time: 30-40 minutes

Organisation: Pairs or small groups

Big Question

How can sound help us find something we cannot see?

Learning Intentions

We are learning:

- how engineers use sound waves to investigate objects without opening or damaging them.
- why hidden cracks can be difficult to detect.
- how careful observation and problem solving help engineers keep people safe.
- that the same scientific principle can be used in many different ways.

Success Criteria

I can:

- explain how sound can reveal hidden objects.
- use evidence from the interactive to locate hidden cracks.
- describe why ultrasonic testing is important.
- suggest other situations where this technology could be useful.

Background for Teachers

Long before ultrasound entered hospitals, engineers working in Govan's shipyards were already using ultrasonic testing to inspect steel.

Instead of cutting into a ship to look for damage, they sent high-frequency sound waves into the metal. When those sound waves met a hidden crack or weakness, they bounced back differently. By interpreting those returning echoes, engineers could identify problems hidden beneath the surface.

This activity introduces pupils to the scientific principle behind ultrasound through its original industrial application. The connection to medicine is deliberately left until the end of the lesson, encouraging pupils to think about how knowledge from one field can inspire innovation in another.

You Will Need

- Film 1: *The Echo of Discovery*
- Metal Flaw Detector Simulator
- Whiteboard or flipchart
- Pupil worksheet (optional)

Before You Begin

Recap the previous activity by asking pupils:

- What is an echo?
- What happens when sound hits a hard surface?
- Why do echoes change depending on the material they meet?

Explain that engineers discovered they could use these echoes to investigate things they could not see.

Today, pupils will become ultrasonic testing engineers working in Govan's shipyards.

Activity

Step 1

Watch the final section of **Film 1: The Echo of Discovery**, where ultrasonic flaw detection is introduced.

Ask pupils:

Why might engineers need to look inside steel without cutting it open?

Collect a range of ideas.

Step 2

Introduce the **Metal Flaw Detector Simulator**.

Explain that every pupil is taking on the role of a shipyard engineer responsible for checking whether a steel plate is safe to use.

Their task is to scan the metal and locate every hidden flaw using sound.

Step 3

Working individually or in pairs, pupils complete the simulator.

Encourage them to move the probe slowly and carefully, watching how the signal changes as it passes over hidden cracks.

Activity

Step 4

When everyone has completed the activity, ask pupils to compare strategies.

- Did everyone find the cracks in the same order?
- What clues helped them?
- Was moving slowly easier than moving quickly?

Record key words such as:

- observation
- patience
- accuracy
- problem solving
- attention to detail

Step 5

Reveal the bigger story.

Explain that engineers in Govan became experts at using sound to look inside steel.

Then ask one final question:

If sound can help us look inside a ship... could it also help us look inside the human body?

Don’t answer the question.

Tell pupils they’ll discover the answer in the next chapter.

Discussion Questions

- Why were the cracks difficult to find?
- How did the returning echoes help you?
- Why is it important to find hidden damage before a ship goes to sea?
- What skills helped you complete the activity successfully?
- Can you think of other things people might want to investigate without cutting them open?

Reflection

Complete one of the following sentence starters:

I discovered that sound can...

or

The most surprising thing I learned today was...

Encourage pupils to share their ideas with a partner before discussing them as a class.

Lighter Touch Adaptation

For younger learners or those requiring additional support:

- Complete the activity together as a class using an interactive whiteboard.
- Pause regularly to discuss what pupils notice.
- Focus on identifying whether the signal changes rather than interpreting why.
- Encourage pupils to use simple language such as *“the sound bounced back differently.”*
- Respond through discussion or drawing rather than extended writing.

Extension Challenge

Engineers use ultrasonic testing in many different industries.

Working in small groups, choose one object that might need to be inspected without being damaged.

Examples include:

- bridges
- aeroplanes
- railway tracks
- pipelines
- wind turbines

Create a short explanation or labelled drawing showing how sound could help keep people safe.

Evidence of Learning

Learners can:

- Explain how sound waves can reveal hidden flaws.
- Describe why ultrasonic testing is important.
- Identify the skills engineers use when inspecting materials.
- Suggest how the same scientific principle could be applied in different situations.

Looking Ahead...

You've discovered how engineers in Govan used sound to reveal hidden cracks inside steel.

But one person began to wonder whether the same technology could solve a completely different problem.

In the next chapter, you'll meet **Professor Ian Donald** and **Tom Brown**, whose unlikely partnership between medicine and engineering led to one of the greatest medical breakthroughs of the twentieth century.

You'll then build your own prototype of the world's first medical ultrasound scanner.

Next Activity: *Build a Prototype Ultrasound Machine*

Activity 3: Build a Protoype Ultrasound Machine

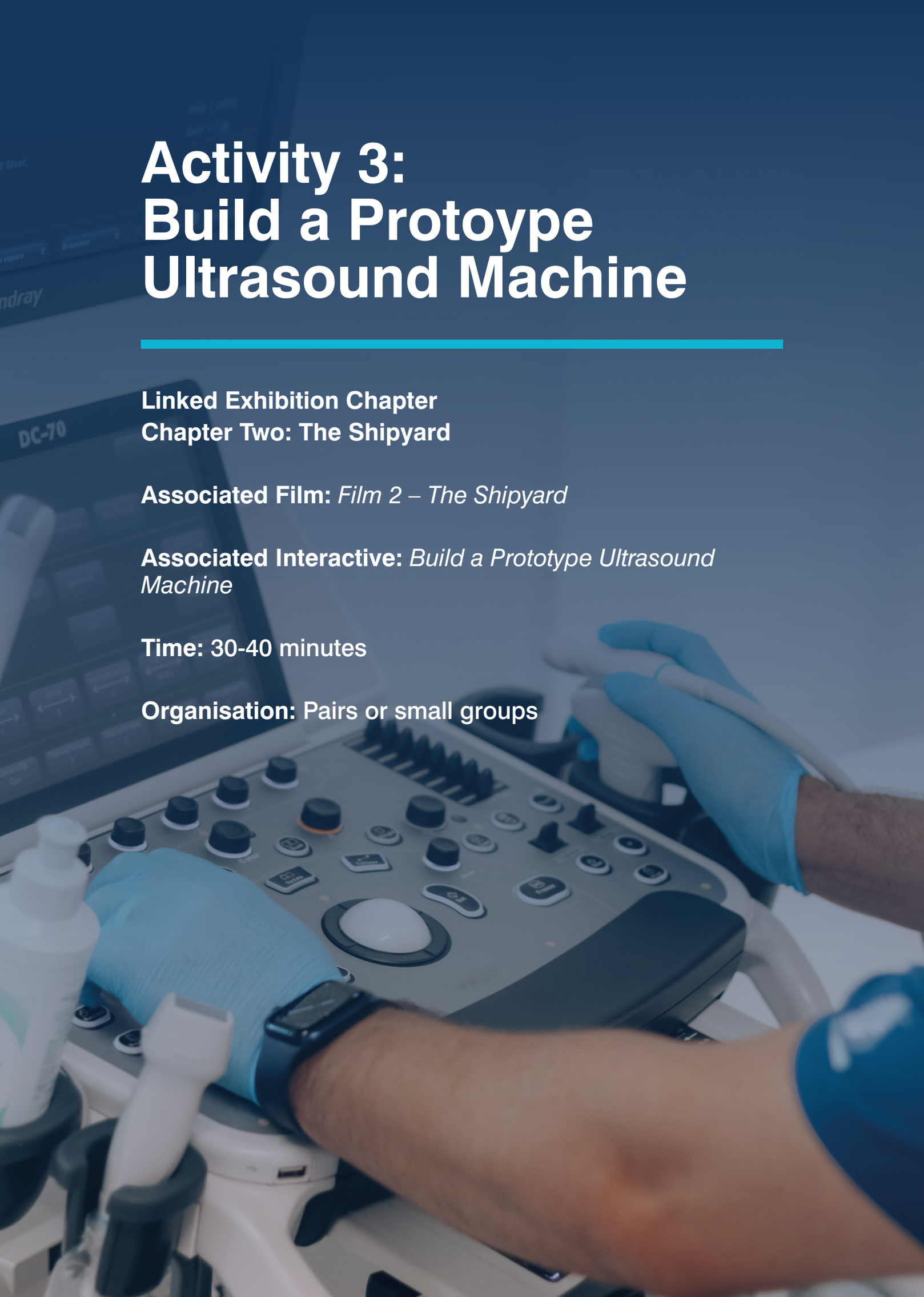
Linked Exhibition Chapter
Chapter Two: The Shipyard

Associated Film: *Film 2 – The Shipyard*

Associated Interactive: *Build a Prototype Ultrasound Machine*

Time: 30-40 minutes

Organisation: Pairs or small groups



Big Question

How did a shipyard machine become one of the world's most important medical inventions?

Learning Intentions

We are learning:

- how Professor Ian Donald and engineer Tom Brown adapted existing technology to solve a new problem.
- that innovation often happens by improving ideas rather than inventing something completely new.
- how collaboration between different professions can lead to important discoveries.
- how engineering, medicine and design work together to improve people's lives.

Success Criteria

I can:

- explain why engineers and doctors worked together.
- describe how industrial technology inspired the first ultrasound scanner.
- identify the main parts of an early ultrasound machine.
- explain why teamwork is important when solving complex problems.

Background for Teachers

> After recognising that ultrasonic flaw detectors could reveal hidden cracks inside steel, Professor Ian Donald believed the same principle might help doctors see safely inside the human body.
>
> To explore this idea, Donald partnered with engineer Tom Brown from Babcock & Wilcox in Govan. Together, they adapted industrial ultrasonic testing equipment into one of the world's first medical ultrasound scanners.
>
> Their work demonstrates that innovation rarely happens in isolation. It often begins when people with different knowledge, skills and experiences come together to solve a shared problem. This activity encourages pupils to think beyond invention, recognising that adapting existing ideas can be just as transformative as creating something entirely new.

You Will Need

- Film 2: *The Shipyard*
- Build a Prototype Ultrasound Machine interactive
- Images of the original ultrasound scanner (optional)
- Pupil worksheet (optional)
- Paper and pencils

Before You Begin

Watch **Film 2: The Shipyard** together.

After watching, ask pupils:

- What problem was Professor Ian Donald trying to solve?
- Why did he need help from an engineer?
- What did Tom Brown already know about using sound?

Explain that pupils are now going to become part of Donald and Brown's team by assembling the world's first prototype ultrasound scanner.

Activity

Step 1

Begin by revisiting the previous lesson.

Ask pupils:

“What did the flaw detector do?”

Discuss how it used sound to locate hidden cracks inside steel without causing damage.

Explain that Donald wondered whether this same technology could be adapted to look safely inside the human body.

Step 2

Introduce the Build a **Prototype Ultrasound Machine interactive**.

Explain that pupils must assemble the essential parts of the scanner in the correct order, just as Donald and Brown did when developing their prototype.

Encourage pupils to think carefully about the purpose of each component rather than simply completing the puzzle.

Step 3

Working individually or in pairs, pupils complete the interactive.

As they build the machine, ask them to discuss:

- Which part sends the sound waves?
- Which part receives the returning echoes?
- Which part helps create the final image?

Activity

Step 4

Once the prototype is complete, discuss how the machine differs from modern technology.

Show photographs of the original scanner if available.

Ask pupils what improvements they think would have been needed before doctors could use the machine every day.

Step 5

Challenge pupils to think like designers.

If they were part of Donald and Brown's team, what changes would they make to improve the scanner?

They might consider:

- making it smaller
- making it easier to move
- making it more comfortable for patients
- making the images clearer
- making it easier for doctors to use

Record ideas on the board and compare them with later developments in ultrasound technology.

Tell pupils they'll discover the answer in the next chapter.

Discussion Questions

- Why wasn't the flaw detector suitable for use in a hospital without changes?
- What different skills did Ian Donald and Tom Brown each bring to the project?
- Why is collaboration important when solving difficult problems?
- What improvements would you make if you were designing the next generation of ultrasound scanners?
- Can you think of other inventions that combine ideas from different industries?

Reflection

Complete the sentence:

One thing I learned about innovation today is...

Older learners may also reflect on:

Why do you think the best ideas often come from people working together?

Lighter Touch Adaptation

For younger learners or those requiring additional support:

- Complete the interactive together on an interactive whiteboard.
- Focus on identifying the purpose of three key components rather than every part of the machine.
- Use discussion instead of written responses.
- Provide picture cards showing the sequence from shipyard flaw detector to medical scanner.

Extension Challenge

Imagine you are an inventor in Glasgow in 1958.

Design your own improved ultrasound scanner.

Consider:

- What would it look like?
- How would patients use it?
- How could it make doctors' jobs easier?
- What new features would you include?

Present your design to the class, explaining how it improves on the original prototype.

Evidence of Learning

Learners can:

- Explain how existing technology can be adapted to solve new problems.
- Describe the partnership between Professor Ian Donald and Tom Brown.
- Identify the basic function of the main parts of an ultrasound scanner.
- Recognise that collaboration is an important part of innovation.

Looking Ahead...

Donald and Brown had proved their idea could work.

The next challenge was to discover whether sound could create useful images inside the human body.

In the next chapter, you'll explore the world's first medical ultrasound scans and experience what it was like to use this pioneering technology for the very first time through the **Virtual Ultrasound** interactive.

Next Activity: *Ultrasound Through Time*

Activity 4: Ultrasound Through Time

Linked Exhibition Chapter
Chapter Three: The Birth of Ultrasound

Associated Film: *Film 3 – The Birth of Ultrasound*

Associated Interactive: *Virtual Ultrasound*

Time: 30-40 minutes

Organisation: Pairs or small groups

Big Question

How did the world's first ultrasound change medicine forever?

Learning Intentions

We are learning:

- how the first ultrasound images were created.
- how ultrasound technology has developed over time.
- why ultrasound became such an important medical tool.
- how scientific discoveries continue to improve healthcare.

Success Criteria

I can:

- describe what an early ultrasound scan looked like.
- explain how ultrasound has changed over time.
- identify some of the ways ultrasound helps people today.
- recognise why the invention of ultrasound was an important moment in medical history.

Background for Teachers

By the late 1950s, Professor Ian Donald and Tom Brown had demonstrated that sound waves could be used to create images from inside the human body. Their first scans looked very different from the detailed images we recognise today, but they proved that ultrasound could provide doctors with vital information safely and without surgery.

The technology quickly evolved. Images became clearer, machines became smaller and easier to use, and ultrasound expanded beyond pregnancy into many areas of healthcare. Today it is one of the world's most widely used diagnostic tools.

This activity helps pupils understand that innovation is a journey. Every new technology builds on earlier discoveries and continues to improve through research, engineering and design.

You Will Need

- Film 3: *The Birth of Ultrasound*
- Virtual Ultrasound interactive
- Images of early and modern ultrasound scanners (optional)
- Timeline worksheet (optional)
- Paper and pencils

Before You Begin

Watch **Film 3: The Birth of Ultrasound** together.

Ask pupils to think about:

- What made the first ultrasound scan so remarkable?
- How do you think people reacted when they saw these images for the first time?
- How might the technology have changed since then?

Activity

Step 1

Discuss the first successful ultrasound scans shown in the film.

Explain that while the images appear simple by today's standards, they represented a revolutionary breakthrough in medicine.

Ask pupils why they think doctors were so excited by these first images.

Step 2

Open the **Virtual Ultrasound** interactive.

Working individually or in pairs, pupils perform a virtual ultrasound scan and observe how sound waves are transformed into an image.

Encourage pupils to take their time and compare what they see with modern ultrasound images they may already be familiar with.

Step 3

Bring the class together and discuss the experience.

Ask:

- What was easy?
- What was difficult?
- Why do you think doctors needed training to interpret these early images?

Activity

Step 4

Discuss how ultrasound technology has changed over time.

Ask pupils to identify improvements they think engineers and designers might have made.

Examples could include:

- clearer images
- smaller machines
- faster scanning
- portable equipment
- improved comfort for patients

Step 5

Working in pairs, ask pupils to create a simple timeline showing how ultrasound has evolved.

Suggested milestones could include:

- Industrial flaw detectors
- The first medical ultrasound scanner
- Improved hospital scanners
- Portable ultrasound machines
- Handheld scanners used today

Discuss how each improvement has made ultrasound more useful and more accessible.

Discussion Questions

- Why were the first ultrasound images considered so important?
- How has ultrasound changed since it was first invented?
- Why do you think technology continues to improve?
- Which improvement do you think has made the biggest difference?
- How might ultrasound continue to develop in the future?

Reflection

Complete the sentence:

The invention of ultrasound changed medicine because...

Older learners may also consider:

Why is it important that scientists and engineers continue improving existing technology?

Lighter Touch Adaptation

For younger learners or those requiring additional support:

- Complete the interactive together as a class.
- Compare only two images: an early scan and a modern scan.
- Use sequencing cards to place key events in order.
- Encourage pupils to explain changes using simple language or drawings rather than written descriptions.

Extension Challenge

Imagine you are living in Glasgow in 1958.

A newspaper has asked you to report on the world's first ultrasound scanner.

Create a newspaper front page announcing the discovery.

Include:

- a headline
- an illustration
- a short article explaining why the invention is important
- a quote from a doctor, engineer or patient

Evidence of Learning

Learners can:

- Explain why the first ultrasound scanner was a medical breakthrough.
- Describe how ultrasound technology has changed over time.
- Recognise that innovation continues through research, engineering and design.
- Explain how scientific discoveries improve people's lives.

Looking Ahead...

The invention of ultrasound transformed medicine.

But its greatest impact was not the machine itself.

It was the people whose lives it changed.

In the next chapter, pupils will explore the experiences of women, families, clinicians and designers who helped shape ultrasound into the caring, reassuring technology we know today.

They will also discover how good design can improve not only machines, but the experiences of the people who use them.

Next Activity: *Design Makes the Difference*

Activity 5: Design Makes the Difference

Linked Exhibition Chapter
Chapter Four: The Sound of Life

Associated Film: *Film 4 – The Sound of Life*

Associated Interactive: *Human Echoes*

Time: 30-40 minutes

Organisation: Pairs or small groups

Big Question

How can good design improve people's experiences?

Learning Intentions

We are learning:

- that successful inventions continue to improve over time.
- how design can make technology safer, easier and more comfortable to use.
- why understanding people's needs is an important part of innovation.
- that designers, engineers and healthcare professionals often work together to solve problems.

Success Criteria

I can:

- explain why the first ultrasound machines needed redesigning.
- identify ways that design improves people's experiences.
- suggest design improvements based on users' needs.
- explain why listening to people's experiences is important when creating new technology.

Background for Teachers

Although the first ultrasound scanner was a remarkable scientific breakthrough, it was never intended to be used in a hospital. It was large, heavy and based on industrial equipment.

Industrial designer **Dugald Cameron**, working with Professor Ian Donald and Tom Brown, helped transform the scanner into equipment that was easier for doctors to use and more comfortable for patients. His work demonstrated that successful innovation is not only about making technology work, but about designing it around the people who use it.

This activity encourages pupils to think like designers by considering how empathy, observation and creativity can improve everyday experiences.

You Will Need

- Film 4: *The Sound of Life*
- Human Echoes interactive
- Images of early and modern ultrasound scanners (optional)
- Paper
- Pencils and colouring materials

Before You Begin

Watch **Film 4: The Sound of Life** together.

Ask pupils to think about:

- How might someone feel before having an ultrasound scan?
- What could make them feel more comfortable?
- Is good design only about how something looks?

Explain that today's challenge is to think like a designer by improving an invention for the people who use it.

Activity

Step 1

Discuss how the earliest ultrasound machines looked and worked.

Ask pupils what they notice about the equipment.

Would it look easy to use?

Would it feel welcoming for patients?

Record their ideas.

Step 2

Explore the **Human Echoes** interactive.

Encourage pupils to listen carefully to the experiences of patients, families and healthcare professionals.

Ask them to think about the emotions they hear as well as the facts.

Step 3

As a class, create two lists.

What worked well?

What could be improved?

Discuss how listening to people's experiences helps designers create better products and services.

Activity

Step 4

Working individually or in pairs, pupils redesign an ultrasound scanner or scanning room.

They should think about:

- patient comfort
- accessibility
- privacy
- ease of use
- communication
- appearance

Encourage pupils to label their drawings and explain the purpose of each improvement.

Step 5

Invite pupils to present their designs to the class.

Rather than focusing on appearance alone, ask them to explain how their design helps people feel safer, calmer or more comfortable.

Discussion Questions

- What makes a product easy to use?
- Why is it important to think about people's feelings when designing something?
- How did Dugald Cameron improve the ultrasound scanner?
- How can listening to users help designers make better decisions?
- Can you think of another everyday object that has become better through good design?

Reflection

Complete the sentence:

Good design is important because...

Older learners may also consider:

How can designers make sure technology works well for everyone?

Lighter Touch Adaptation

For younger learners or those requiring additional support:

- Redesign only one part of the scanner or hospital room.
- Use discussion before drawing.
- Provide outline templates to annotate rather than creating a design from scratch.
- Encourage verbal explanations instead of written responses.

Extension Challenge

Choose another everyday object such as a backpack, bicycle, classroom chair or water bottle.

Think about how it could be redesigned to make it easier, safer or more enjoyable to use.

Create a labelled sketch explaining your improvements and who they would benefit.

Evidence of Learning

Learners can:

- Explain why design is an important part of innovation.
- Identify ways technology can be improved to meet people's needs.
- Demonstrate empathy when designing for others.
- Communicate and justify their design ideas using appropriate vocabulary.

Looking Ahead...

Behind every medical breakthrough are real people with real stories.

In the next activity, pupils will explore personal memories of ultrasound and discover how this remarkable invention changed the lives of women, families and healthcare professionals around the world.

Next Activity: *Human Echoes Reflection*

Activity 6:
Human Echoes

Linked Exhibition Chapter
Chapter Four: The Sound of Life

Associated Film: *Film 4 – The Sound of Life*

Associated Interactive: *Human Echoes*

Time: 30-40 minutes

Organisation: Pairs, small groups or whole class

Big Question

How did ultrasound change people's lives?

Learning Intentions

We are learning:

- that every scientific discovery affects real people.
- how listening to different perspectives helps us understand history.
- why personal stories are an important part of learning.
- that empathy is an important part of healthcare and innovation.

Success Criteria

I can:

- listen respectfully to other people's experiences.
- identify different emotions and viewpoints.
- explain how ultrasound changed people's lives.
- reflect on why people's stories are as important as historical facts.

Background for Teachers

The story of ultrasound is often told through the achievements of inventors, engineers and doctors. However, every medical breakthrough is also experienced by patients, families and healthcare professionals.

The **Human Echoes** interactive shares personal stories from people whose lives have been shaped by ultrasound. These voices help pupils understand that innovation is about much more than technology. It is about improving people's experiences, supporting families and providing reassurance during important moments in life.

This activity encourages pupils to develop empathy by listening carefully, reflecting thoughtfully and recognising that history is made up of individual human experiences.

You Will Need

- Film 4: *The Sound of Life*
- Human Echoes interactive
- Reflection worksheet (optional)
- Paper and pencils

Before You Begin

Watch **Film 4: The Sound of Life** together.

Ask pupils to think about:

- How might someone feel before an ultrasound appointment?
- Why do people remember important moments in their lives?
- What can we learn from listening to other people's experiences?

Explain that today they will explore real stories from people connected to the history of ultrasound.

Activity

Step 1

Explore the **Human Echoes** interactive together or in small groups.

Encourage pupils to listen carefully to each person's story.

Ask them to think not only about what happened, but also how the speaker might have been feeling.

Step 2

After each story, pause for discussion.

Ask pupils to identify words that describe the speaker's emotions.

Examples may include:

- excited
- nervous
- hopeful
- reassured
- surprised
- grateful

Discuss how different people can experience the same event in different ways.

Step 3

Working in pairs, pupils choose one person from the interactive.

Create a simple "Story Snapshot" including:

- Who is speaking?
- What happened?
- How were they feeling?
- What can we learn from their experience?

Share these with the class.

Activity

Step 4

As a class, discuss how listening to people's experiences can help improve healthcare.

Ask:

- **Why is it important for doctors and designers to listen to patients?**
- **How might these stories help improve future healthcare?**

Record ideas on the board.

Step 5

Ask pupils to reflect on the whole exhibition journey.

From shipyards and engineers to families and patients, how did different people contribute to the story of ultrasound?

Create a class mind map showing everyone involved.

Discussion Questions

- Which story stayed with you most? Why?
- What emotions did you hear in the different stories?
- Why is listening an important skill?
- How can personal stories help us understand history?
- Why do you think healthcare should be designed around people's experiences?

Reflection

Complete one of the following sentence starters:

One story that stayed with me was...

or

I learned that healthcare is about...

Encourage pupils to share their reflections respectfully with a partner or the class.

Lighter Touch Adaptation

For younger learners or those requiring additional support:

- Listen to one or two stories together as a class.
- Use emotion cards to identify how speakers might have been feeling.
- Encourage pupils to respond through drawing rather than writing.
- Focus discussion on kindness, listening and understanding others.

Extension Challenge

Choose one of the people featured in the Human Echoes interactive.

Write a short diary entry from their point of view describing their experience of ultrasound.

Think about:

- What happened?
- How did they feel?
- What would they remember most?
- What would they tell someone else about the experience?

Evidence of Learning

Learners can:

- Demonstrate empathy by responding thoughtfully to personal stories.
- Explain why lived experience is an important part of history.
- Describe how ultrasound has affected people's lives.
- Recognise that successful healthcare depends on understanding the needs and experiences of patients.

Looking Ahead...

Ultrasound began as an idea in Glasgow.

Today it is used every day in hospitals, ambulances, remote communities and emergency situations across the world.

In the final chapter of the exhibition, you'll discover how this remarkable invention continues to evolve and consider how the next generation of scientists, engineers and designers could shape the future of healthcare.

Next Activity: *The Next Great Idea*

Activity 7:
The Next Great Idea

Linked Exhibition Chapter
Chapter Five: Beyond the Echo

Associated Film: *Film 5 – Beyond the Echo*

Associated Interactive: *Interactive Timeline*

Time: 30-40 minutes

Organisation: Small groups



Big Question

What problem could your generation solve?

Learning Intentions

We are learning:

- that innovation is an ongoing journey.
- how collaboration helps solve real-world challenges.
- that good ideas begin with curiosity and empathy.
- how to apply what we have learned throughout the exhibition to our own ideas.

Success Criteria

I can:

- explain how ultrasound has changed people's lives.
- identify the qualities that make successful innovators.
- work with others to develop an idea that solves a real-world problem.
- communicate my ideas clearly and confidently.

Background for Teachers

Throughout this learning journey, pupils have discovered that ultrasound was not invented by one person working alone. It emerged through collaboration between medicine, engineering and design, and it has continued to evolve for more than sixty years.

This final activity encourages learners to apply the same design thinking process used by Ian Donald, Tom Brown and Dugald Cameron. Rather than inventing something for the sake of it, pupils begin by identifying a real problem before developing an idea that could improve people's lives.

The emphasis is on curiosity, creativity, empathy and teamwork rather than producing the "perfect" invention.

You Will Need

- Film 5: *Beyond the Echo*
- Paper or A3 sheets
- Pens and colouring materials
- Sticky notes (optional)

Before You Begin

Watch **Film 5: Beyond the Echo** together.

Ask pupils:

- How has ultrasound changed since it was invented?
- Why do inventions continue to improve?
- What challenges do people still face today?

Explain that every great invention begins with someone noticing a problem and asking, **"How could this be better?"**

Today, that someone is them.

Activity

Step 1

As a class, revisit the learning journey.

Ask pupils to recall:

- How did sound help engineers inspect ships?
- Why did Professor Ian Donald seek a new way to see inside the body?
- How did Tom Brown help solve that problem?
- Why was design important?
- How has ultrasound improved people's lives?

Record key words such as:

- curiosity
- collaboration
- creativity
- empathy
- innovation

Step 2

Working in small groups, ask pupils to identify a problem they would like to solve.

It could relate to:

- healthcare
- school
- transport
- nature
- accessibility
- the local community
- everyday life

Encourage pupils to focus on problems that affect real people.

Activity

Step 3

Groups design a new invention, product or service.

Ask them to think about:

- Who is it for?
- What problem does it solve?
- How does it work?
- Who would need to work together to make it happen?
- How will it improve people's lives?

Step 4

Groups create an "Innovation Board" showing:

- the problem
- their solution
- a labelled sketch
- the people who would use it
- the people who would help create it

Encourage pupils to explain their thinking as well as their design.

Step 5

Hold a class **Innovation Showcase.**

Each group presents their idea.

After each presentation, classmates are encouraged to ask questions such as:

- What inspired your idea?
- Who would benefit?
- Could it be improved?
- What skills would be needed to make it real?

Celebrate creativity and collaboration rather than choosing a "winner".

Discussion Questions

- What qualities helped Ian Donald, Tom Brown and Dugald Cameron succeed?
- Why is collaboration important?
- How can we make sure inventions help everyone?
- What challenges do you think future inventors will solve?
- Why is curiosity important?

Reflection

Return to the Big Question from the beginning of the project.

How did an idea from Govan's shipyards become one of the world's most important medical inventions?

Ask pupils to reflect on how their understanding has changed.

Complete the sentence:

The most important thing I learned during this project is...

Then ask:

If I could improve one thing in the world, it would be... because...

Lighter Touch Adaptation

For younger learners or those requiring additional support:

- Work together as a whole class to design one shared invention.
- Use drawing instead of written explanations.
- Provide prompt cards showing different everyday problems.
- Focus discussion on who the invention helps and why.

Extension Challenge

Research a Scottish inventor, engineer, scientist or designer.

Create a short presentation explaining:

- What problem did they solve?
- Who did they work with?
- How did their idea improve people's lives?
- What can we learn from their story?

Compare their work with the story of ultrasound.

Evidence of Learning

Learners can:

- Explain the story of ultrasound from discovery to global impact.
- Recognise that innovation is a collaborative process.
- Apply design thinking to solve a real-world problem.
- Present and justify their ideas confidently.
- Reflect on how curiosity, creativity and empathy can improve people's lives.

Glossary

The following words appear throughout the exhibition and classroom activities. Encourage pupils to refer to this glossary as they complete each chapter.

Word	Meaning
Collaboration	Working together to achieve a shared goal.
Design	Planning and creating something so that it works well and meets people's needs.
Echo	A sound that bounces back after hitting a surface.
Engineer	Someone who designs, builds or improves machines, structures or technology.
Innovation	A new idea or improvement that solves a problem or makes something better.
Medical Imaging	Technology used to look safely inside the human body.
Obstetrician	A doctor who specialises in pregnancy, childbirth and caring for pregnant women.
Patient	A person receiving medical care or treatment.
Prototype	The first working version of a new invention or product.
Reflection	Thinking carefully about what you have learned or experienced.
Scan	A way of creating a picture of something that cannot be seen from the outside.
Shipbuilding	Designing and constructing ships. Glasgow's River Clyde became one of the world's most famous shipbuilding centres.
Sonar	Technology that uses sound waves to detect or locate objects, often underwater.
Sound Wave	Vibrations travelling through air, water or solid objects that allow us to hear sounds.
Technology	Tools, machines or systems created to solve problems or make life easier.
Ultrasonic Flaw Detector	A machine that uses sound waves to find hidden cracks or weaknesses inside metal.
Ultrasound	High-frequency sound waves used to create pictures from inside the human body.

The Birth of Ultrasound Pupil Workbook

Before We Begin

The Big Question

How did an idea from Govan's shipyards become one of the world's most important medical inventions?

Before you begin the exhibition, write or draw what you already know.

What do you think ultrasound is?

Where do you think it was invented?

How do you think doctors can see inside the human body?

What would you like to discover during this project?

1. Sound Detectives Challenge

As you investigate sound, record what you discover.

Material	What happened to the sound?	Strong Echo / Soft Echo

What patterns did you notice?

2. Crack the Metal

What helped you find the hidden cracks?

Why is it important to find hidden damage before a ship goes to sea?

If sound can help us look inside steel...
What else could it help us investigate?

4. Build the Prototype

Label the parts of an ultrasound scanner.

Which part do you think is most important?

Why?

How would you improve the machine?

5. Ultrasound Through Time

Draw or write one important improvement for each stage.

Then	Now

Why do inventions keep changing?

6. Human Echoes

Choose one person’s story.

Who was speaking?

What happened?

How were they feeling?

What did you learn from their experience?

Draw one image that represents their story.

7. Design Makes the Difference

Imagine you are redesigning an ultrasound scanner.
Draw your ideas below.

My design helps people because...

Which feature are you most proud of?

8. The Next Great Idea

What problem would you like to solve?

Who would it help?

Draw your invention.

How does it work?

Who would need to work together to make it happen?

Looking Back

Return to our Big Question.

How did an idea from Govan's shipyards become one of the world's most important medical inventions?

Write, draw or discuss your answer.

Something new I learned...

Something that surprised me...

One question I still have...

If I could invent something to help people, it would be...

Certificate of Achievement

The Birth of Ultrasound

has successfully completed **The Birth of Ultrasound** learning journey.

Through curiosity, creativity and collaboration they have explored one of Scotland's greatest medical innovations and discovered how ideas from Glasgow changed healthcare around the world.

Date:

Teacher:

GLASGOW RIVERSIDE INNOVATION DISTRICT