



ACTIVITY 10 | SECONDARY | ⌚ 50 MINUTES



Thinking boats

Design & pitch

KS3

Design and Technology, Science

Third or Fourth level

Sciences, Technologies

Thinking boats

Design & pitch

In this activity, students have the opportunity to test and develop some of Leonardo's designs. Taking on the role of Leonardo and following scientific testing, students will pitch their unique boat design to a patron, in the hope of securing an income.

In a 'Dragons' Den'-style activity, students will use Leonardo's unfinished designs for boats and observation drawings, along with scientific equipment, to create an innovative design for a boat.



IN THIS ACTIVITY PUPILS WILL:

EXAMINE three ways of powering a boat and assess the effectiveness of the designs.

DESIGN and carry out an investigation into boat design or suitable materials to build.

USE balanced and unbalanced forces to explain how boats move.

USE ideas about density to explain why boats float.

UNDERSTAND how to communicate scientific ideas effectively and write for a specific audience.



WATCH A SHORT FILM

See Martin Clayton talk about Leonardo's amazing talent for observation and research in the film titled [Leonardo is often described as a polymath. What is a polymath?](#)

Inspiration

Ask students to imagine what transport was like during Leonardo's life; there were no railways or cars, so boats were an important way to transport people and goods. Leonardo's sketchbooks show many inventions for different parts of boats, along with ideas for creations like life-rings and submarines.

Many of his designs were never constructed at the time and it took many years before people appreciated the insight that they showed.

His drawings show a variety of methods for how a boat could be powered and steered through water. In Leonardo's drawings, you can see how his designs developed and how different sections were redrawn. We now think of such observations and design developments as good scientific practice, but at the time this was not common place.

Leonardo also made many sketches of water, showing how it flows and moves; he was thought to have witnessed the river Arno bursting its banks and flooding Florence, which may have had an influence on his desire to harness the power of water.

As an artist Leonardo had to find a patron, someone with money to commission him. Competition to get work and secure a patron was hard; Leonardo would have needed to demonstrate his skill as an artist and painter and have been able to persuade someone to invest in him.



Listen to Martin Clayton, Head of Prints and Drawings at Royal Collection Trust, talk about Leonardo's amazing talent for observation and research, and remind us that many of his projects remained unfinished.

Watch the films [*Leonardo is often described as a polymath. What is a polymath?*](#) and [*There are many drawings of Leonardo's inventions. Did he make any of them?*](#)

NOW DISCUSS THESE QUESTIONS:

Why did Leonardo do these drawings if he didn't intend to make them?

What do they tell us about Leonardo's amazing brain?

How do we learn more about Leonardo's designs?

How can we turn Leonardo's designs into reality?

STEP 01

Perfect pitch

Students will play the role of Leonardo and create a boat design to pitch to a potential patron who is considering sponsoring an artist.

As a group, students should think of three areas that a pitch to a patron should include, beyond showing their own skills, for example: evidence of the need for the design, innovation, your investigations and the ability to clearly explain the science involved.

Think about a 'Dragons' Den'-style pitch and what the applicants say when they are asking for investment.



Use Leonardo's boat drawings for inspiration, then consider these questions:

Look carefully at the design of the boat, how was it powered?

How was the boat steered?

What was the purpose of these boats?

Why do you think Leonardo did this drawing?

STEP 02

Test and present

Split students into groups and give each group one of the drawings and a scientific research tray. Students need to use elements of whichever Leonardo's boat design they have been given. They could use the scientific research tray to investigate which shape and materials would be the most successful. Students should also think about forces that act on a boat, when it is moving and when it is still.

When students think they have a successful design and have completed some tests, they should use the 'Design Presentation Guide' sheet (ideally printed on A3) to present the new design to the patron. It is important to emphasise the need to communicate clearly and understand the science behind their design.

Invite a VIP or a teacher to be the potential patron and listen to each of the design pitches. Award your 'gold' medal and a contract to the winning design.

STEP 03

Develop and innovate

If Leonardo was here today, what boats would he be designing? What innovations would he be incorporating into his boats?

Ask students what we use boats for today. They may come up with boats built for speed or exploration, ships for carrying loads, scientific surveying ships and boats for leisure. They may talk about submarines, and you could discuss a drawing by Leonardo for a vessel that could go underwater.

Students could be challenged to think of ways to make their design more streamlined or hydrodynamic, to be equipped for taking scientific measurements, or to be able to carry more load.

Students should choose one of these design ideas and think about how Leonardo would adapt their boat for this different use.

Students can use 'Resource 2' as inspiration for how boats are used today.

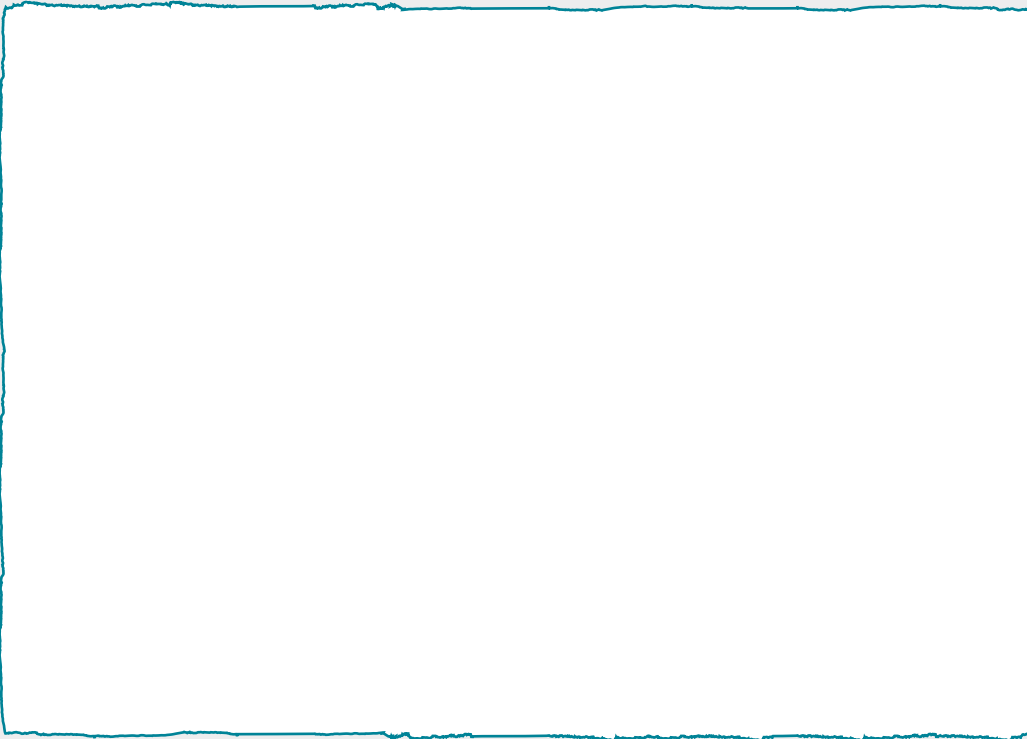
Design presentation guide

Create a drawing of your design on the A3 sheet provided. Annotate your design to highlight its key features, reading the prompts below.

Provide evidence

You can demonstrate your knowledge of engineering.

- Draw arrows on your drawing to show the different forces.
- You should label upthrust, weight, thrust, air resistance and water resistance.
- Make three rough sketches in this box to show the forces when the boat is accelerating, stationary and moving at a steady speed.



Investigate

You can show your patron that you can test a design.

- Describe the investigation that you did to ensure that your boat would float.
- What was your dependent and independent variable?
- What method did you use?
- What did your result show you?

Explain the Science

You would like to impress your patron with your scientific knowledge. Making use of textbooks and online resources:

- Explain the concept of density.
- Compare the density of solids and liquids.
- Describe how a boat is able to float.

Innovate

You need to justify your design to your patron so that they know it is good value for money.

- Why did you choose this design?
- What materials did you choose?
- How did you improve your boat's shape and materials throughout the design process?

Create a drawing of your design here. Annotate your design to highlight key features.

Engineering

Test Results

Science

Design

Modern-day boat design

If Leonardo was here today what boats would he be designing?

What innovations would he be incorporating into his boats?



Some boats are designed for speed. Look at the shape of this boat, why is it shaped like it is?



This is a fishing trawler; what features make it ideal for its job? How would Leonardo have incorporated these features into his designs?



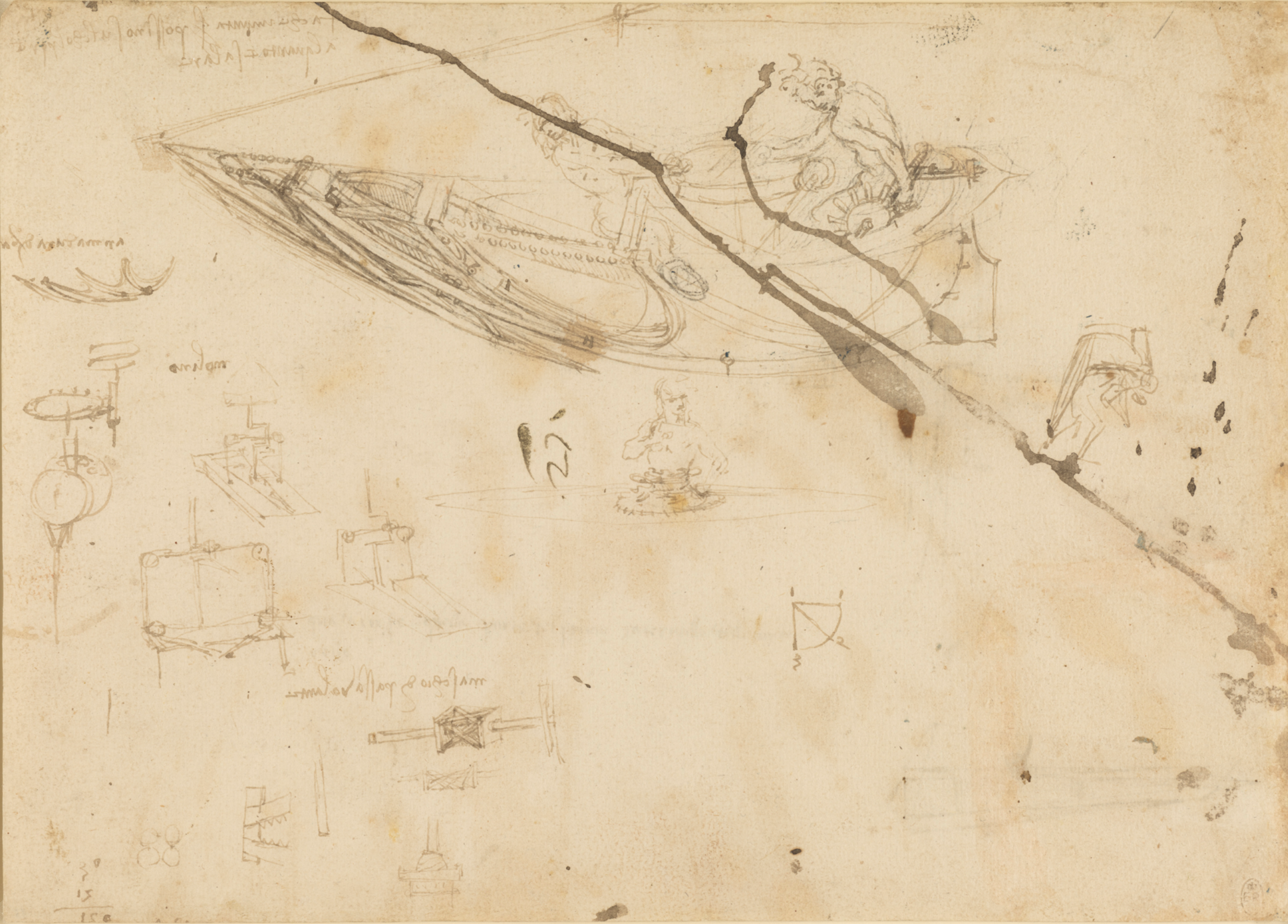
Some boats are designed for leisure. How is the design of this boat adapted for its role? Do any of Leonardo's designs use similar features?



This hovercraft design uses lots of ideas that we see in Leonardo's drawings. What would Leonardo like about this design?



Icebreakers are specifically designed to travel in water containing ice. Why would Leonardo not have found this difficult to test or build?



Designs for boats, and other machinery, c.1458 (RCIN 912649r)





Resources

EQUIPMENT

- Copies of the three Leonardo drawings.
- Science equipment and a tray, which can be filled with water to investigate the boat design.
- Science equipment should include plasticine, 10 x 10 g masses and mass hook, paper drinking straws, various materials with which to make sails and the base of the boats, for example cloth, paper, plastic, lolly sticks, stiff card, corks, thin plywood)
- Printed 'Resource 1' on A3 paper.
- Printed 'Resource 2' on A4 paper.
- Martin Clayton's [videos 3 and 5](#)

RESOURCE IMAGES...



[Designs for boats,
c.1485
\(RCIN 912650r\)](#)



[An allegory with a dog
and an eagle, c.1508–
10 \(RCIN 912496\)](#)



FANTASTIC FINISH

Students may like to perfect the model of their design and arrange a display of their designs, along with Leonardo's drawings and creations, for other classes to see.