

Learning objective	Success criteria
To design a pop-up book.	- I can remember that input is the motion used to start a mechanism and output is the motion that results from starting the input. - I know that structures use the movement of the pages to work. - I know that mechanisms control movement. - I can design a book with a front cover and four pages, including a mixture of structures and mechanisms.
Before the lesson	
Watch Teacher video: Pop-up book page design Pupil video: Pop-up book design (part one) Pupil video: Pop-up book design (part two) Have ready - A selection of pop-up/interactive books and greeting cards (a selection per table – see Attention grabber). - A disassembled mechanism from a greetings card. - A demonstration model pop-up book (see Teacher knowledge). - Colouring pencils (a selection per table). - Sticky notes (approximately four each). - Link: Assessment – D&T Y5: Mechanical systems: Pop-up book (optional – see Attention grabber). - Link: Pop-up tutorial 16 - Automatic pull-strips on VideoLink.* - Link: Best pop-up books by Robert Sabuda on VideoLink.* * These are external websites and we do not have control over their content – please check before showing them to the children. Print in advance - Activity: Pop-up book design template (printed on A3 - one each). - Activity: Jack and Jill book assembly instructions (one set between two). - Resource: Knowledge organiser: D&T - Making a pop-up book (optional - see Teacher knowledge). - Resource: Key vocabulary (optional - one class set for display).	
Recap and recall	
Before starting this unit, check the children can recall: - Drawing a net can be used to create a structure. - All moving things have kinetic energy. - The shape of an object will affect how it moves. - Aesthetics refers to how an object or product looks. - A template is a tool to help draw the same shape accurately. - It is important to assess and evaluate design ideas and models against a list of design criteria.	

Attention grabber

Optional: provide each child with a copy of the Knowledge catcher (see link: [Assessment – D&T Y5: Mechanical systems: Pop-up book](#)) and ask them to complete it to the best of their ability. Explain that at the end of the unit, they will revisit it, adding more information in a different colour.

Explain the design brief to the class:

- Design and make a storybook for Year 1 pupils using a mixture of pop-up structures and interactive mechanisms.

Place a selection of pop-up/interactive books and greeting cards on the children's tables and ask them to identify examples of pop-up structures and mechanisms.

Show the completed demonstration model pop-up book (see Teacher knowledge) as an example of what the children should aim for.

Disassemble a greeting card or the demonstration model pop-up book to show the children the mechanism used as they are usually hidden.

Play the link: [Pop-up tutorial 16 - Automatic pull-strips](#) on VideoLink. Show the first section (0:35–2:18), which explains an automatic pull-strip and choose to show the second section (2:19–8:24), which demonstrates how to make one or the final section, which shows examples of pop-up mechanisms. Explore books using the link: [Best pop-up books by Robert Sabuda](#) on VideoLink for further inspiration.

Questions

- **What is an automatic pull-strip?** (A mechanism in a pop-up book that a structure can be attached to.)
- **How does a pull-strip make structures stand up in a pop-up book?** (The pull-strip is moved when the page opens, which makes the attached structure stand up.)
- **What do you think the terms input and output mean in the example of the pull-strip mechanism?** (The input is the motion used to start something happening, for example, turning the book's page. The output is the motion that occurs due to the input; for example, the structure stands up.)

Main event

Explain to the children that the pull-strip example in the tutorial video is an example of a structure. Structures are objects that use the movement of the pages to stand or pop up. Explain that the following videos demonstrate different mechanisms: the working parts used to control movement in pop-up books.

Show the children the *Pupil video: Pop-up book design (part one)* and *Pupil video: Pop-up book design (part two)*.

Pupil video: Pop-up book design (part one) Pupil video: Pop-up book design (part two)

Ask the children:

- **What is a slider mechanism used for?** (To create a linear movement, for example, up and down or from side to side.)
- **What are spacers?** (Small pieces of card which are raised to restrict the movement of a slider.)
- **What is a layer used for?** (To hide the mechanisms of the pop-up book.)
- **What is a lever mechanism used for?** (To create directional movement based on a point or pivot using a split pin.)

Hand out the *Activity: Pop-up book design template* (printed on A3 – one each). The enlarged size allows the children greater freedom with their designs and encourages the use of more mechanisms.

Ask the children to decide on a short story for the subject of their books based on well-known characters; this could be a story from their imagination, a section of a book they have read or a nursery rhyme such as Jack and Jill as used in the model. Arrange the children in pairs and ask them to discuss their ideas.

Explain the children should divide their chosen story into four key scenes, writing a story caption for each page. Use the demonstration model (made before the lesson) to explain how the story could be divided into simple sections:

1. Jack and Jill went up the hill.
2. To fetch a pail of water.
3. Jack fell down and broke his crown.
4. And Jill came tumbling after.

These captions are demonstrated in the *Teacher video: Using layers and spacers* in [Lesson 3: Using layers and spacers](#).

1. **Jack and Jill are walking up the hill** (turn the lever clockwise to walk them up – the lever will swing on a pivot).
2. **The pail of water comes out of the well** (move the slider up and down).
3. **Jill tumbles down** (move the lever anti-clockwise on the pivot).
4. **Jack sits upright** (open the page to a right angle to make Jack sit upright).

Explain that they may have one structure popping up from the central fold covering both pages but can also include other mechanisms elsewhere on the page. Ask the children to complete the design template clearly and in as much detail as possible using the checklist to guide them. Ensure the children have access to colouring pencils to use in their design.

Wrapping up

Ask the children to peer-assess the work of a partner. Instruct them to swap sheets with their partner and hand out sticky notes (approximately four each). Ask the children to write comments on the sticky notes and place them on each other's design templates. They should include comments about things that worked well and ideas for improvements.

Vocabulary

Design brief

A challenge that asks for something to be designed.

Input

The motion used to start a mechanism.

Lever

A mechanism where a bar moves around a fixed point or pivot.

Mechanism

A set of parts of a machine that work together.

Motion

The movement an object makes when controlled by an input or output (e.g. left, right, up or down).

Output

The motion that happens as a result of starting the input.

Pivot

A shaft or pin on which something turns.

Slider

A part of a mechanism which allows an object to move from side to side or up and down.

Spacers

Small pieces of slightly raised card used to restrict the movement of a slider.

Structure

Something which stands, usually on its own.

Assessing progress and understanding

Pupils with secure understanding indicated by:
producing a suitable plan for each page; naming each type of mechanism, input and output accurately.

Adaptive teaching

Pupils needing extra support

Could base their books upon the Jack and Jill nursery rhyme; could use the suggested mechanisms and

Pupils working at greater depth indicated by:
producing a plan to a higher level of sophistication,
particularly with more complex linkage systems.

structures in the demonstration mode book for each
page.

Pupils working at greater depth

Should include a range of different mechanisms and
structures on each page; should articulate how each
mechanism could be made.