Paper Engineering – Lesson 3

Bringing paper to life, from 2-Dimensional to 3-Dimensional

WMG
THE UNIVERSITY OF WARWICK

Project Learning Objectives:

To create a 3D pop-up book suitable for a small child.

Week 1	Week 2	Week 3
Analysis of Pop-up books. Have a go at some basic pop-up techniques.	Explore the essential techniques for accurate pop-up. Continue to have a go. Introduce variations of pop-ups.	Using knowledge learnt so far, introduce mechanisms. Know the difference between them.
Week 4	**Week 5/6**	**Week 7/8**
Discuss key criteria for a good story or pop-up book. Plan the story using a storyboard.	Evaluate the story plan so far. Start to make the pop-ups and mechanisms for all the pages.	Finish the pages, with text and decoration. Create the cover and assemble the finished book.

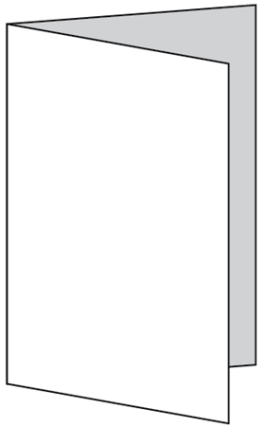
Success criteria:

- (SC1) I can explain advantages and disadvantages of pop-up books
- (SC2) I can identify advantages and disadvantages of making 3D shapes from flat sheets.
- (SC3) I can describe how folding a flat (2D) sheet of paper makes it a 3D object.
- (SC4) I can describe how different cuts and folds can make different 3D shapes.
- (SC5) I can make a pop-up designs following instructions.
- (SC6) I can make a pop-up designs from a blank piece of paper.
- (SC7) I can identify the difference between pop-ups and mechanisms
- (SC8) I can create a short, fun story and make it into a pop-up book.

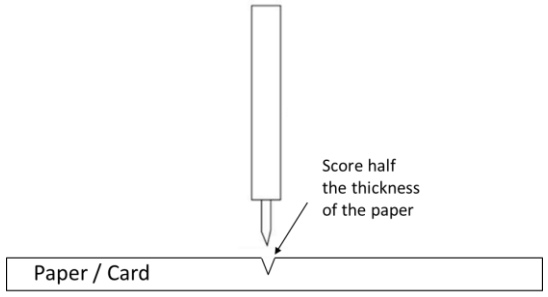
Introduction

Last lesson we looked at the essential techniques for accurate pop-up making:

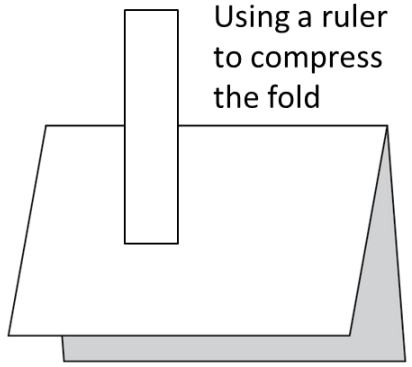
FOLDING



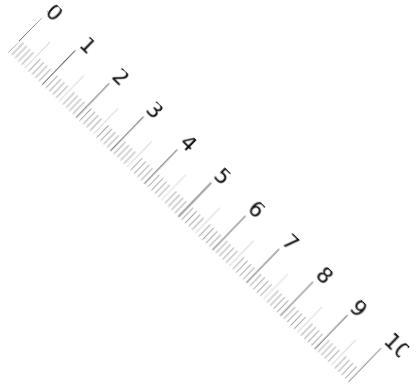
SCORING



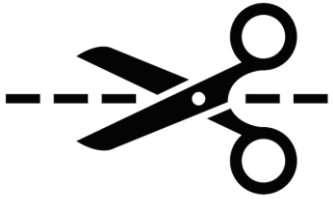
CREASING



MEASURING



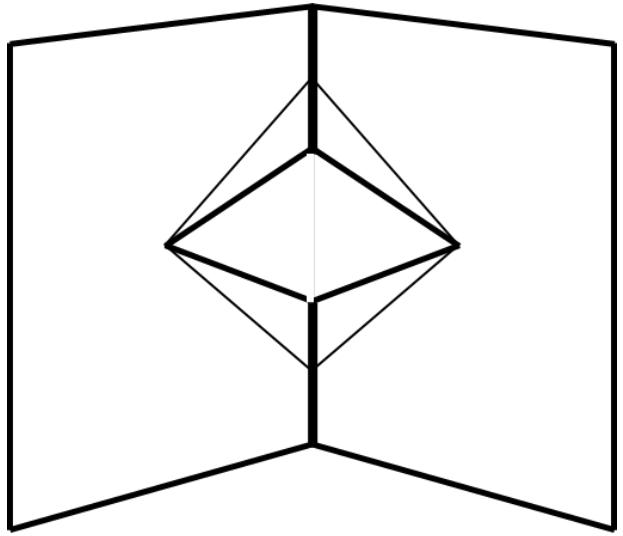
CUTTING



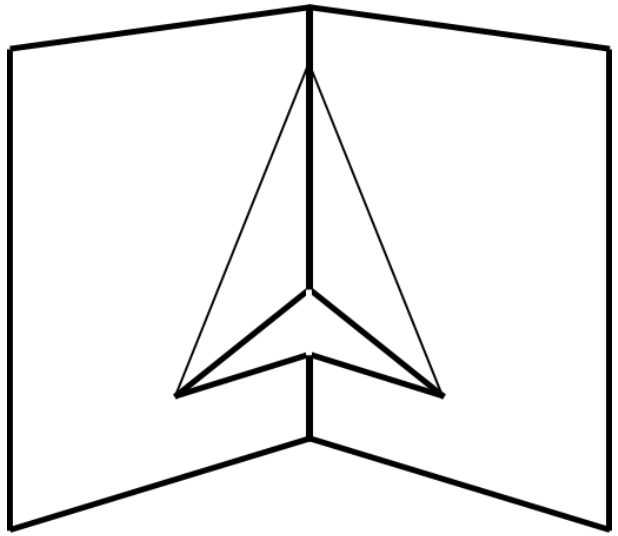
Can you remember how to do these techniques and why?

Introduction

Last lesson we also had a go at variations of V-Fold and Box Fold Pop-ups:

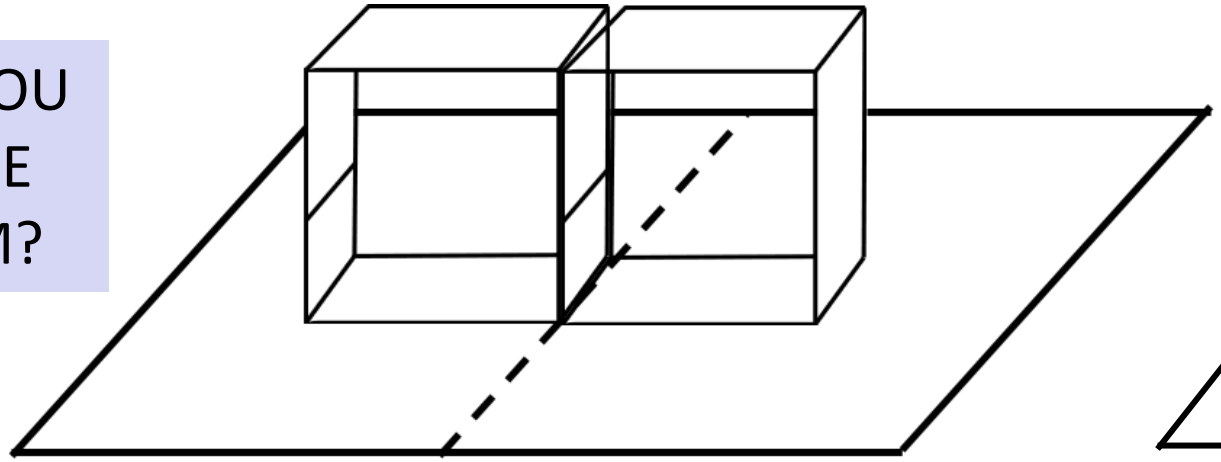


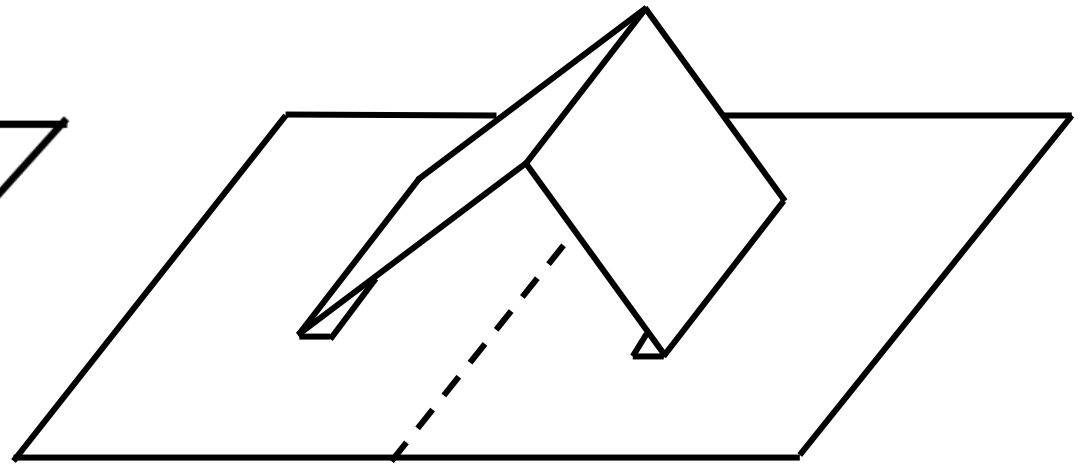
WHAT TYPE ARE THEY?



HOW COULD YOU USE THEM?

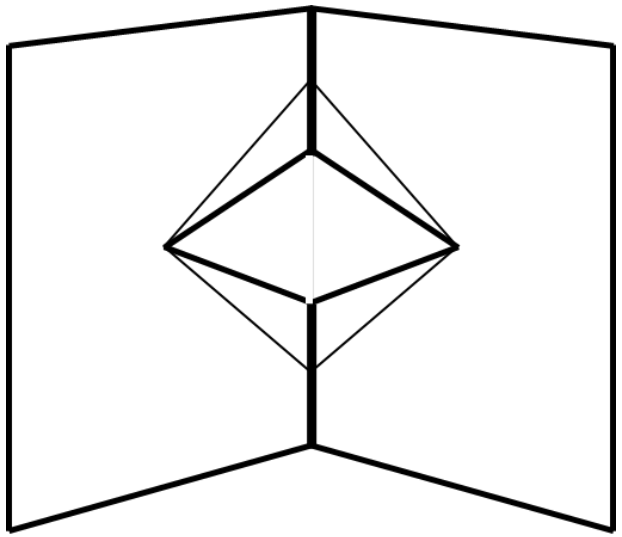
CAN YOU NAME THEM?

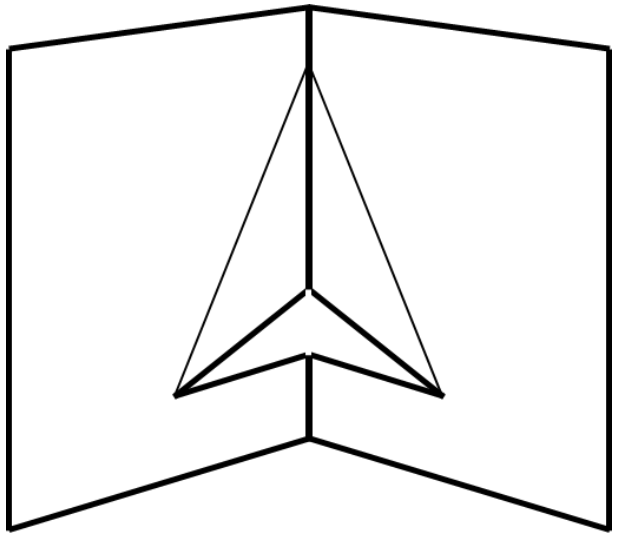


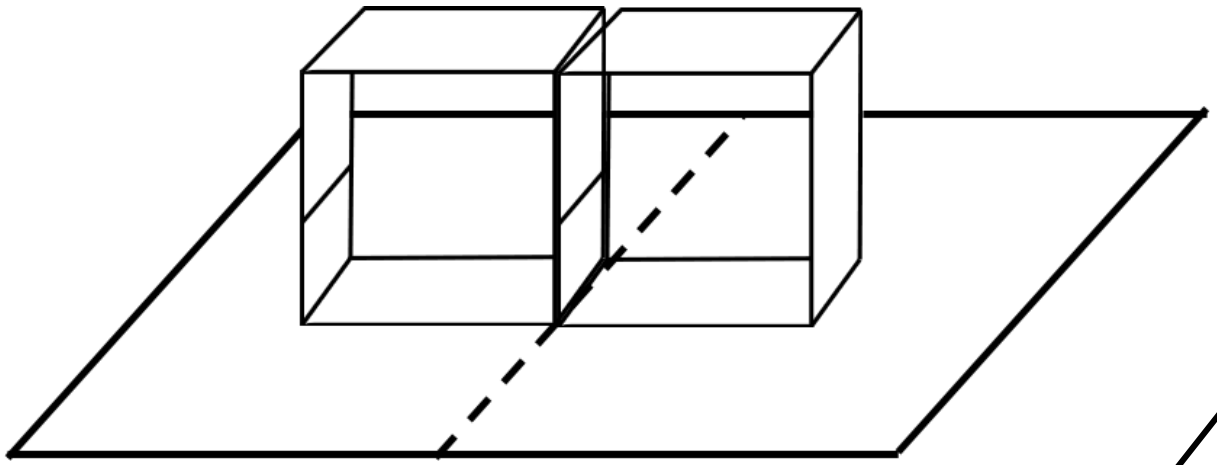


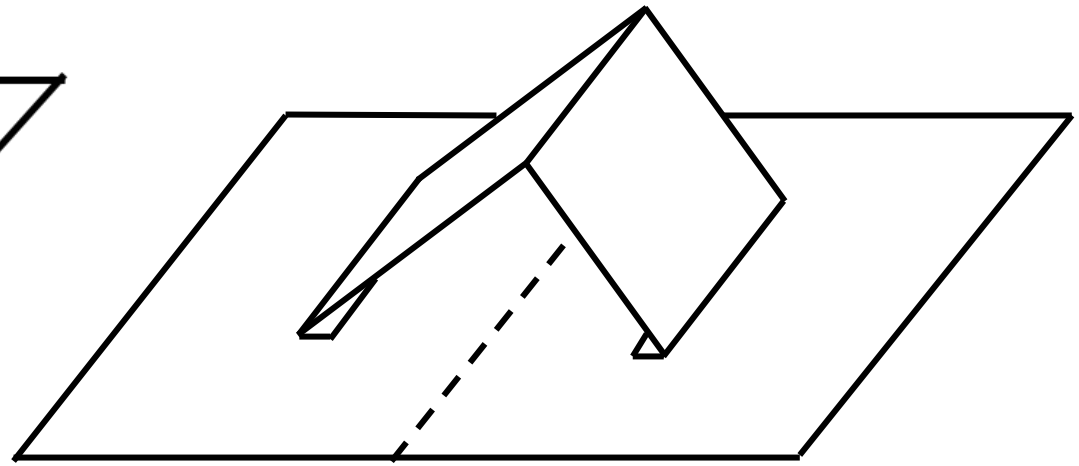
Have a go….

Last lesson we had a go at variations of V-Fold and Box Fold Pop-ups: If you didn't make some, have a go today





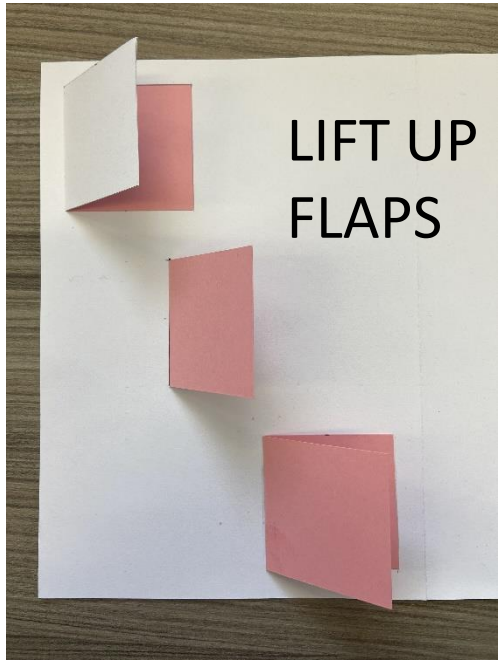


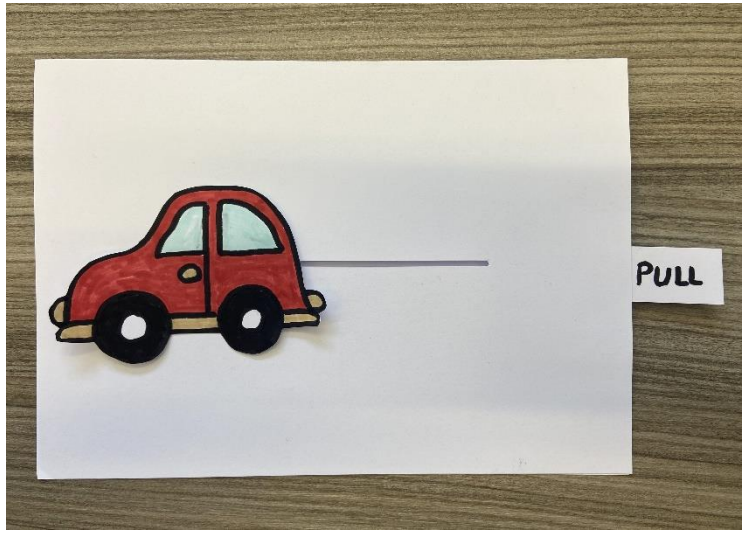


Mechanisms

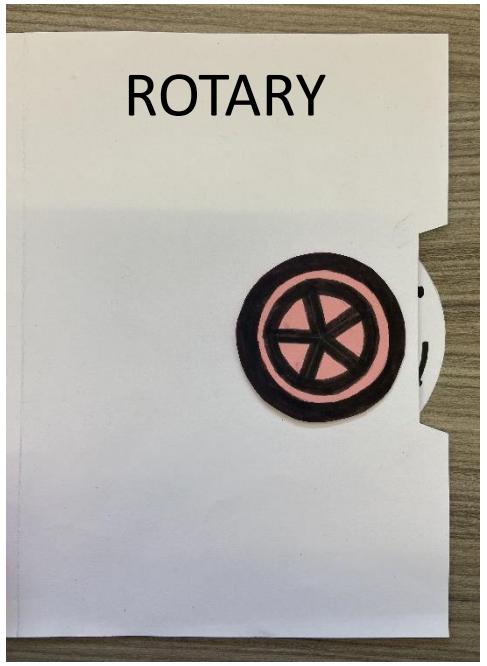
You will have seen mechanisms in the Pop-up books that you looked at in lesson 1. Where Pop-ups do exactly that, as the book opens, mechanisms don't, they can be a slide, a rotation or a flap of paper.

We will look at these three mechanisms today and have a go…..



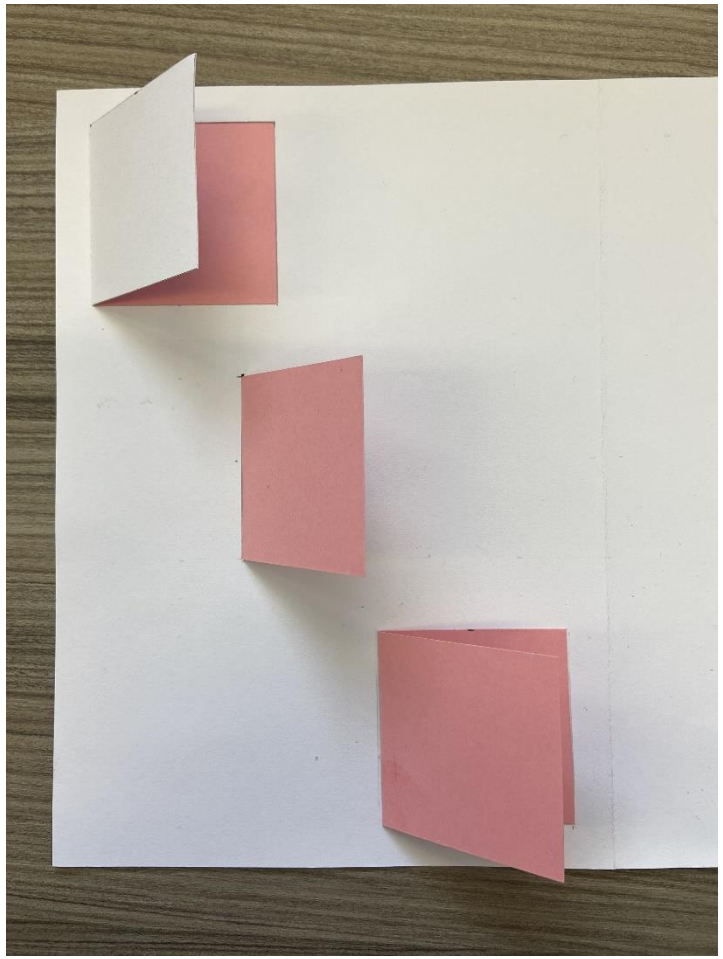


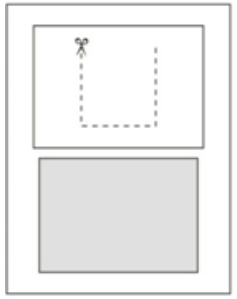
PULL SLIDERS



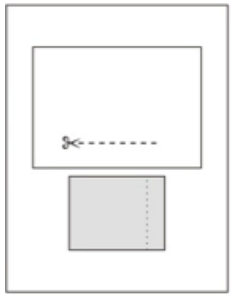
Mechanisms: Lift-up Flaps

Let’s look at different ways you can add a lift up flap into your Pop-up book

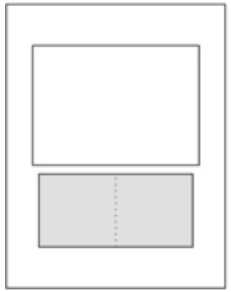




Option 1: By cutting out a door on the top piece of card and placing the reveal on a piece of card behind this



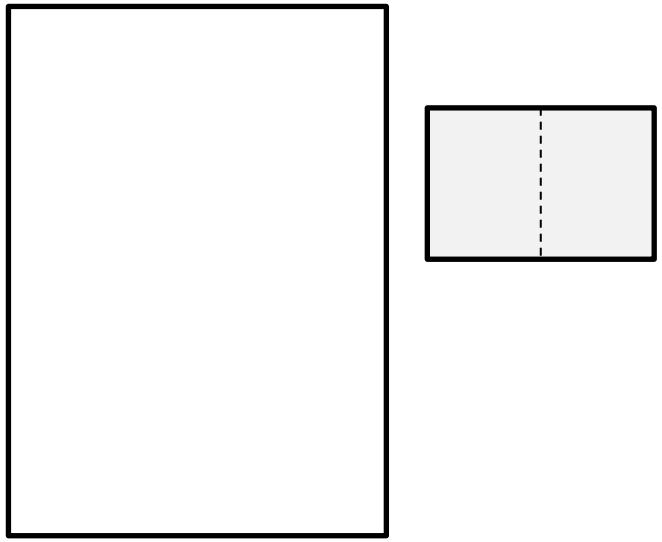
Option 2: By adding an extra piece of folded card, but slotting half through a slot, so one half of the folded card becomes the flap.



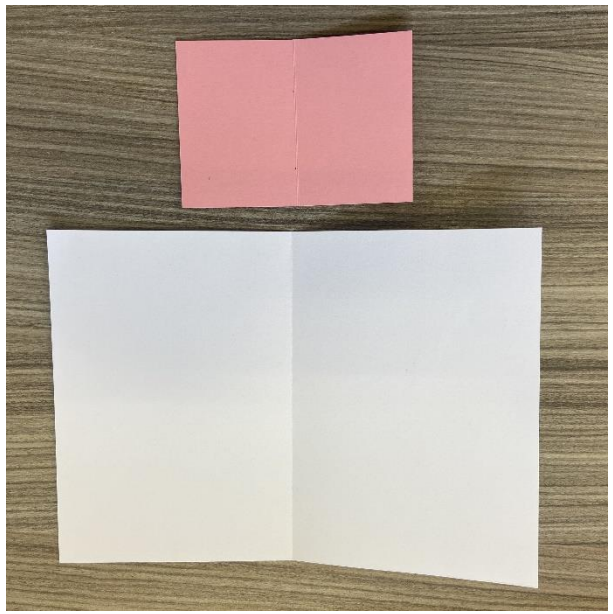
Option 3: By adding an extra piece of folded card

Mechanisms: Lift-up Flaps

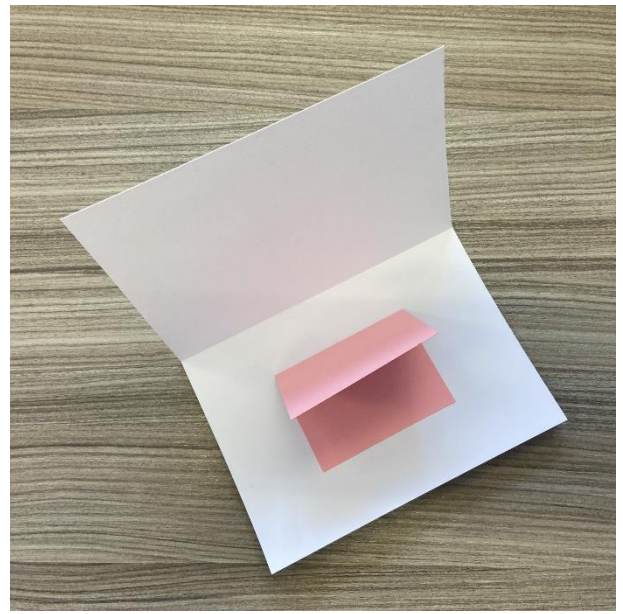
How to instructions for Option 1: You will need 2 pieces of card (1 A4)



1: One card (A4) is for the outer card; the other is for the lift-up flap, size is determined by what you want to ‘hide’



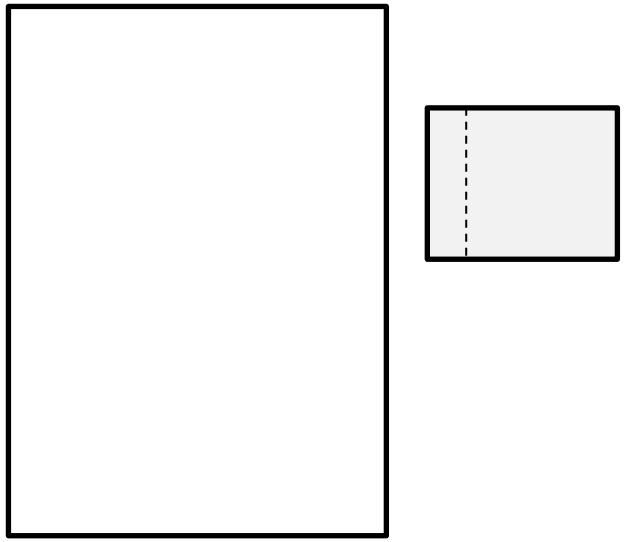
2: **Fold** both pieces of card in half down the centre. Use a ruler to press along the **fold**, to reinforce it.



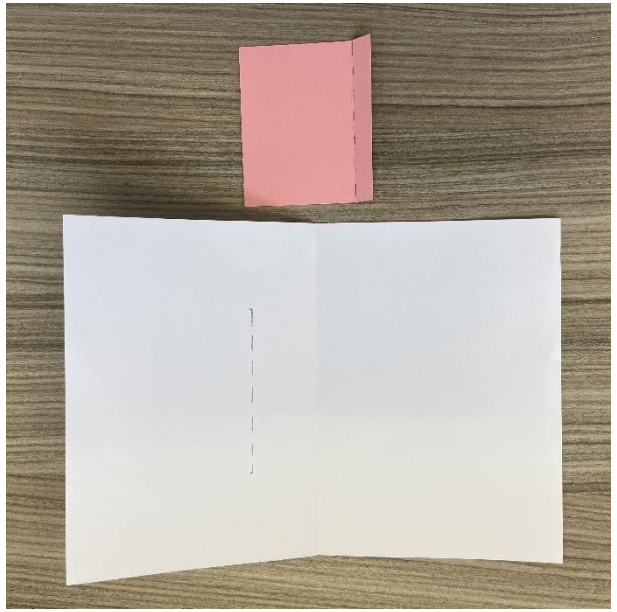
3: Glue the lift-up flap into place on the outer card.
Add decoration to the inside.

Mechanisms: Lift-up Flaps

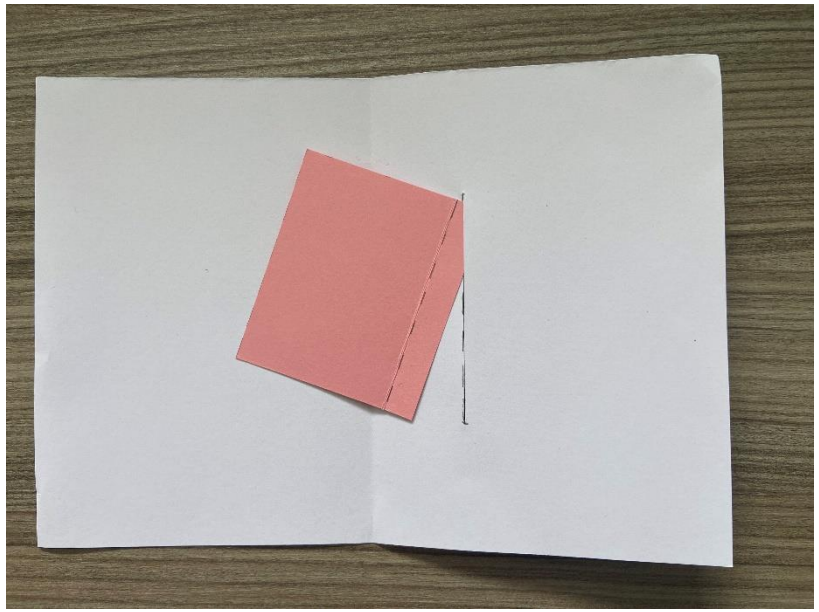
How to instructions for Option 2: You will need 2 pieces of card (1 A4)



1: One card (A4) is for the outer card; the other is for the lift-up flap, size is determined by what you want to ‘hide’



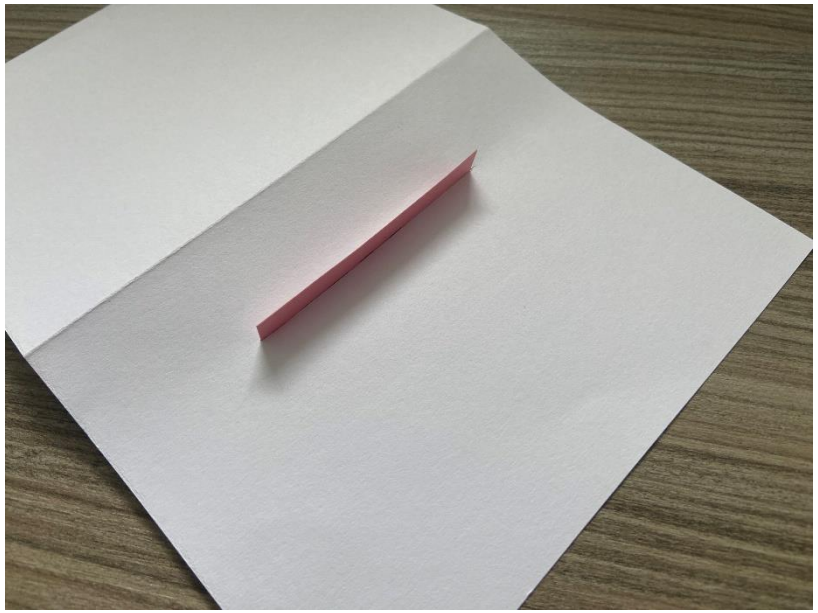
2: **Fold** the A4 card in half and the smaller piece along the dotted line. Use a ruler to press along the **fold**, to reinforce it.



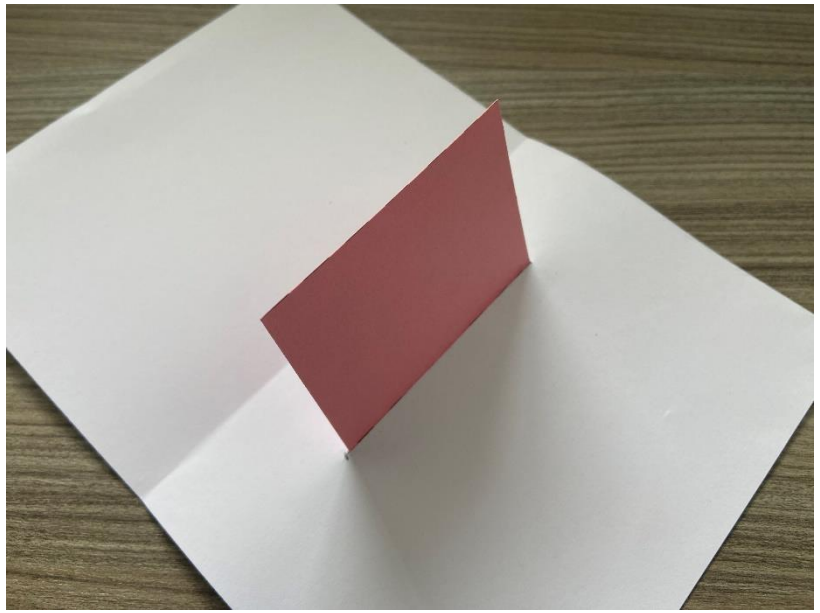
3: Mark a line for the slot on the main piece of card the length of fold of the smaller piece of card. Carefully cut along this line.

Mechanisms: Lift-up Flaps

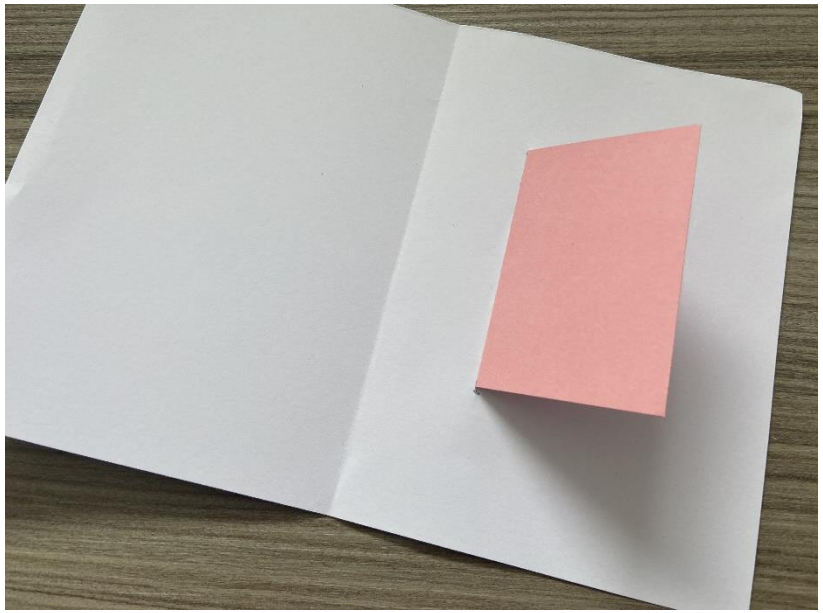
How to instructions for Option 2: Continued



4: Slide the lift-up flap piece of card through the slot that you have created.
Add some glue to the tab and stick down.



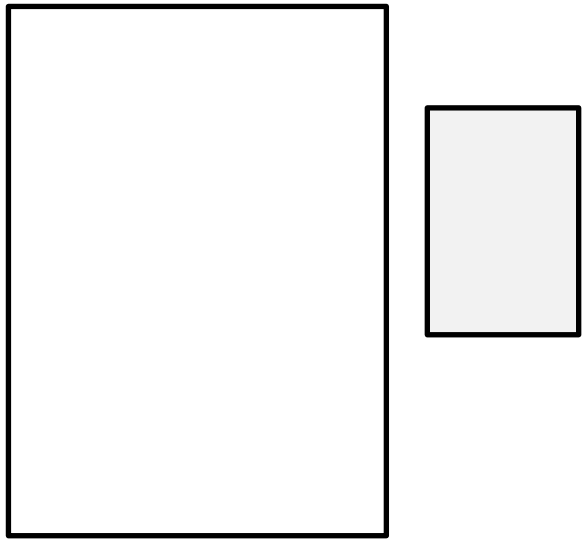
5: Turn the card to the right side and **fold** the lift-up flap down.



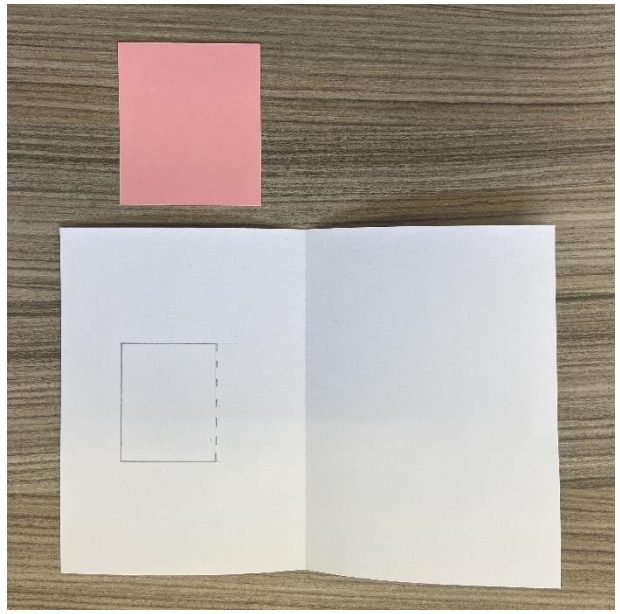
6: Decorate underneath the lift-up flap

Mechanisms: Lift-up Flaps

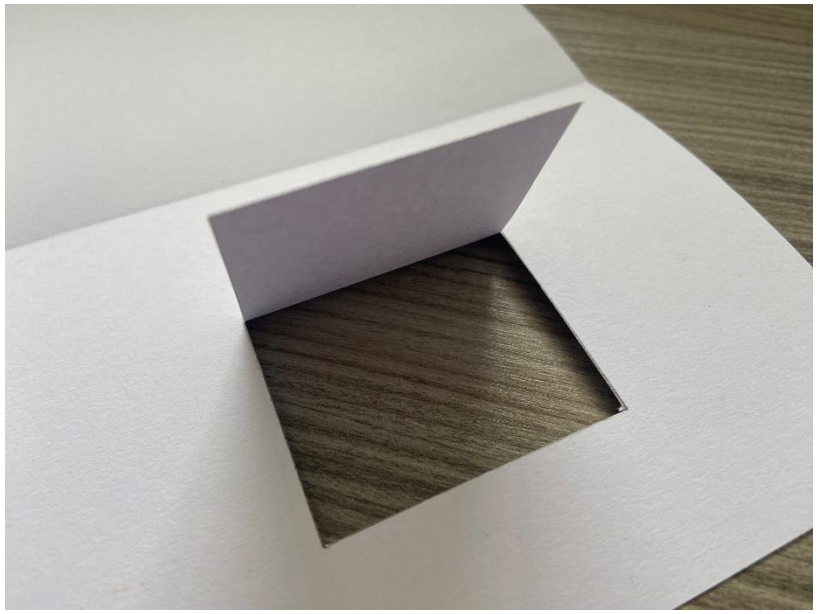
How to instructions for Option 3: You will need 2 pieces of card (1 A4)



1: One card (A4) is for the outer card; the other is for the back piece of the aperture of the door created by the lift-up flap.

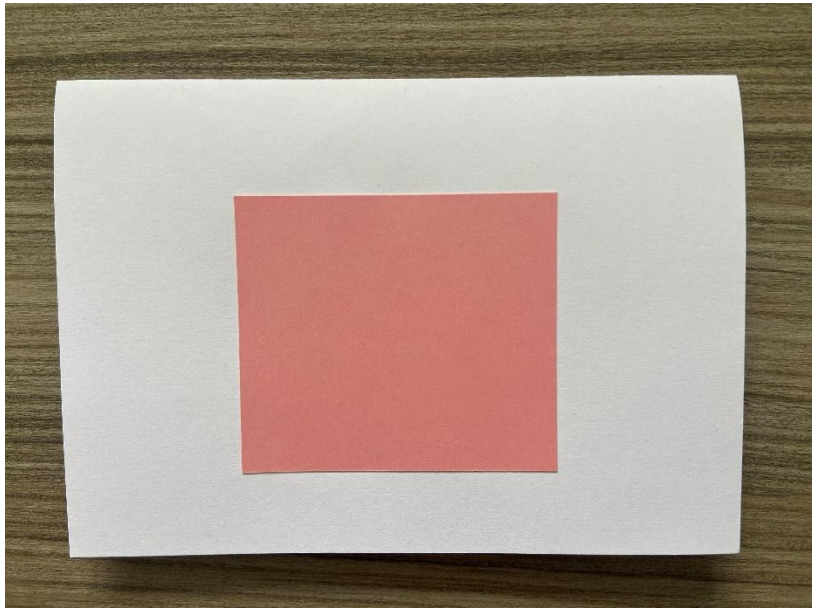


2: **Fold** the A4 card in half. **Mark** the size of the window that you want on the main card, this needs to be a bit smaller than the smaller piece of card.

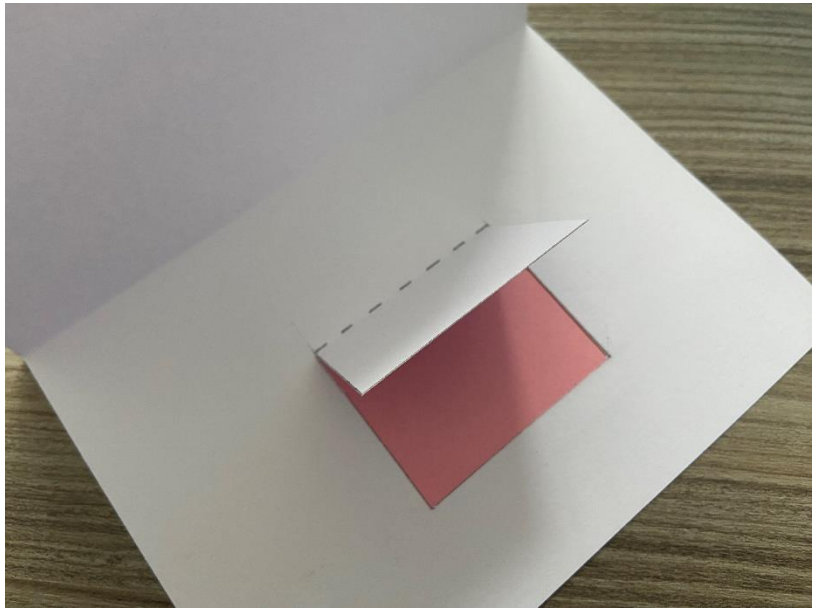


3: **Cut** three sides to the aperture and **fold** and **score** along the remaining edge.

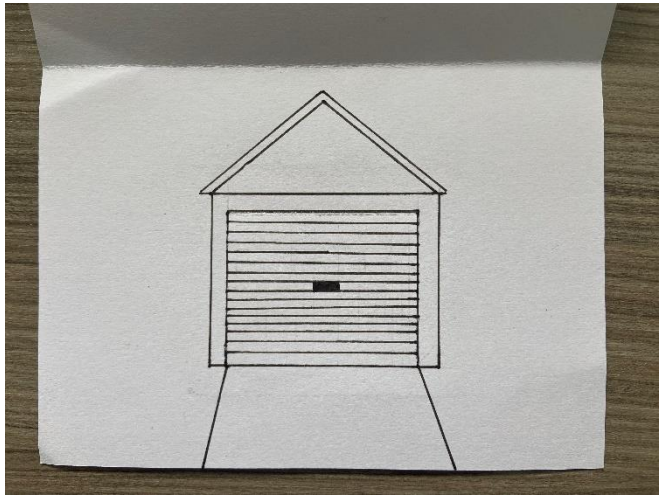
Mechanisms: Lift-up Flaps



4: Glue the extra piece of card to the back of the main card, behind the window

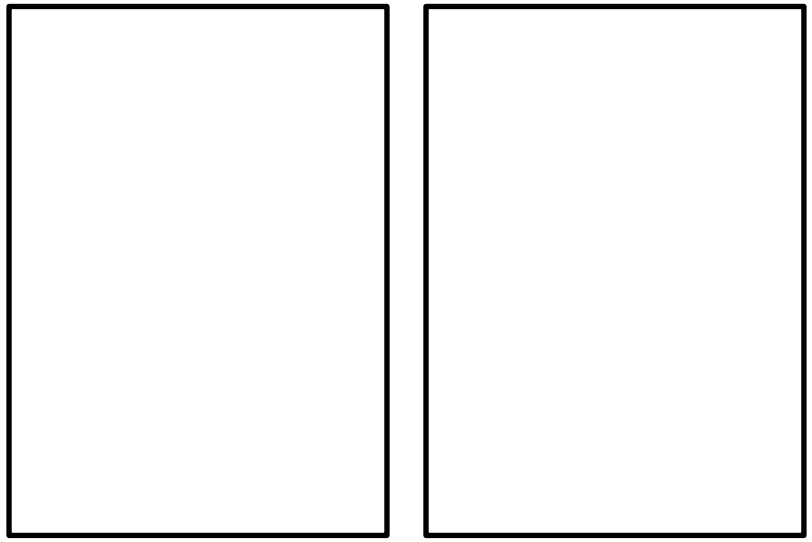


5: Add decoration to the extra piece of card, under the flap of the window

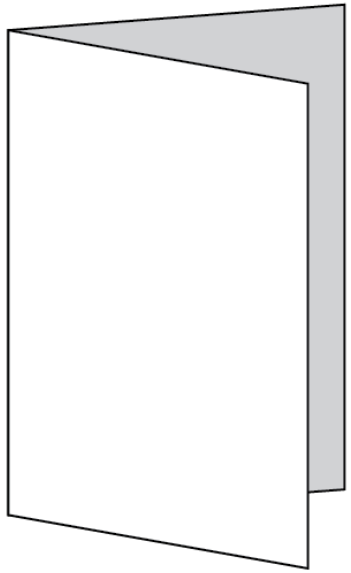


Mechanisms: Pull Slider

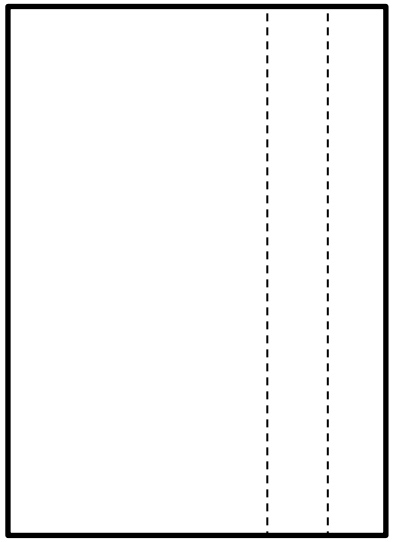
You will need 2 pieces of A4 card



1: One card is for the outer card; the other is for the slider mechanism and decoration.



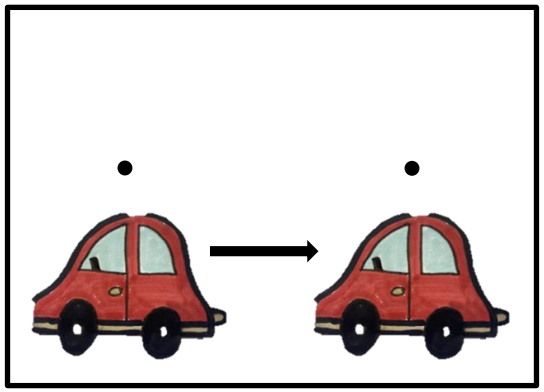
2: **Fold** one piece of card in half down the centre. Use a ruler to press along the **fold**, reinforcing it. Set aside.



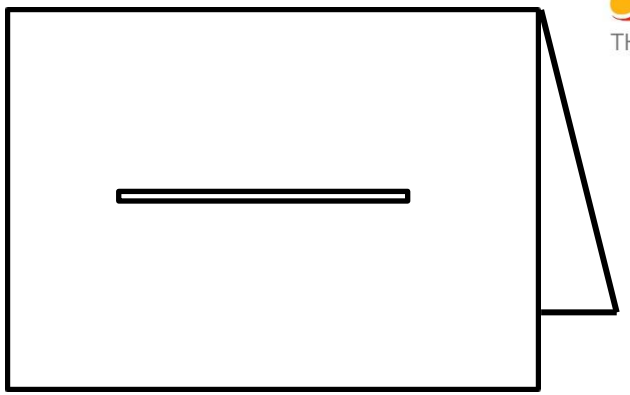
3: On the second piece of card, **cut** two strips from the long edge about 2cm wide

Mechanisms: Pull Slider

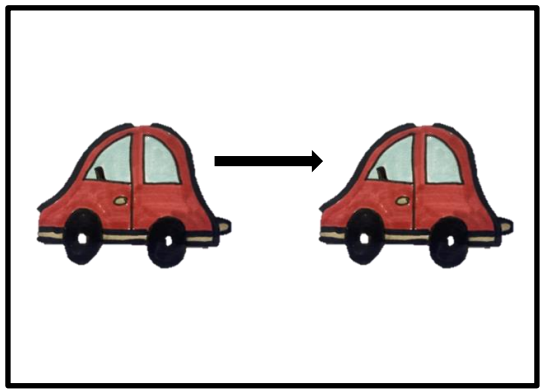
4: Create an Image that will have space to move from one side of the page to the other.



5: Mark the centre points of the image at the start and finish positions.

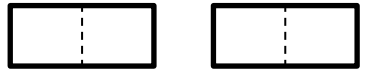


6: Mark a line / slot between these points and **cut** a slot out that is about 5mm wide.

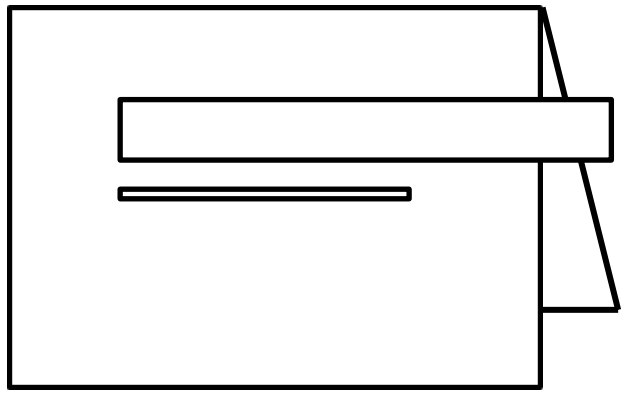


7: On one strip mark two tabs 2 cm long, that will be folded in half along the dotted line, cut the remaining strip in half

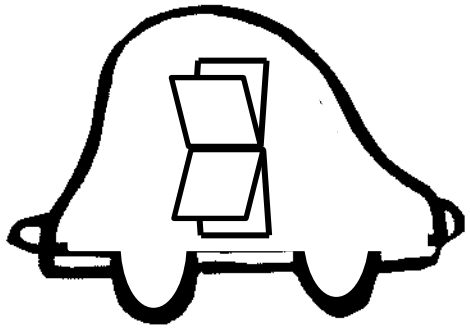
Mechanisms: Pull Slider



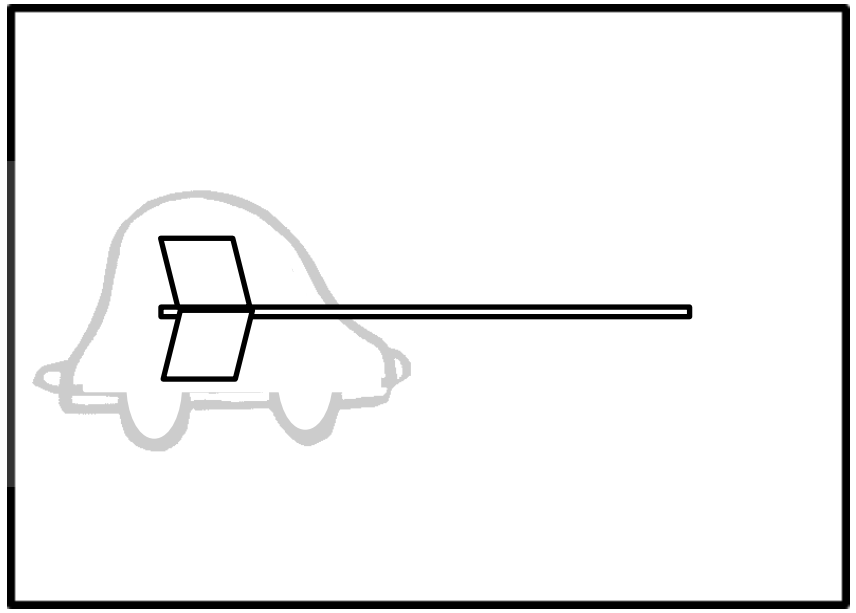
8: On the other strip, cut the strip to be the length from one end of the slot to about 1 cm longer than the card (see below)
This is your ‘Pull Tab’



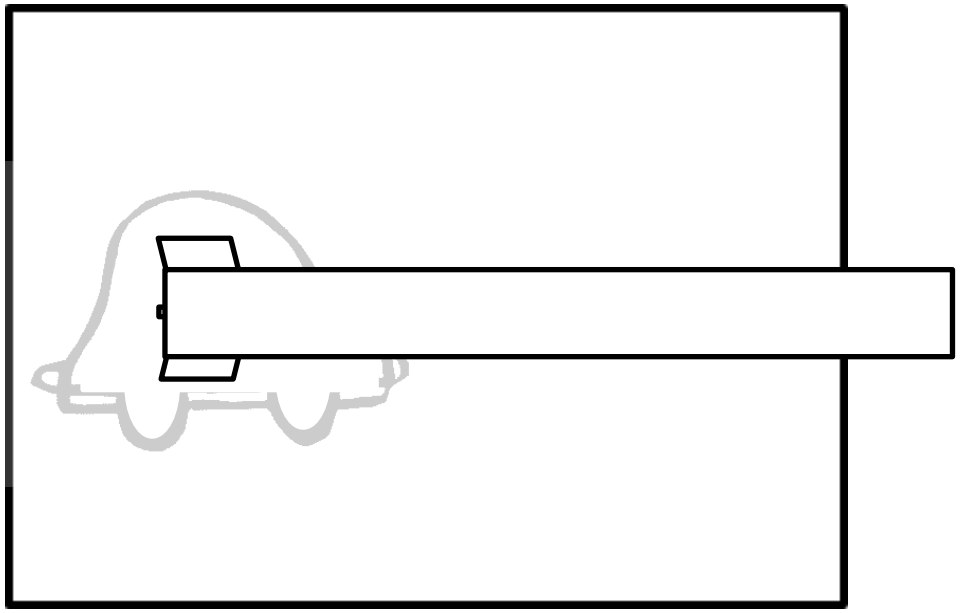
9: With the pieces from the other strip, fold the two small tabs in half.
With the folded edges together, stick to the back of your cut out image.



Mechanisms: Pull Slider

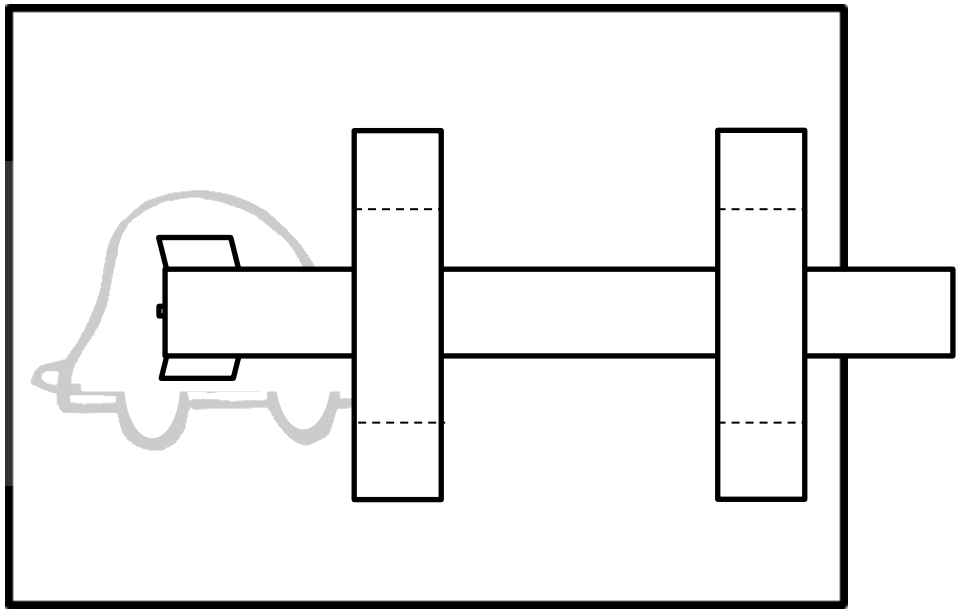


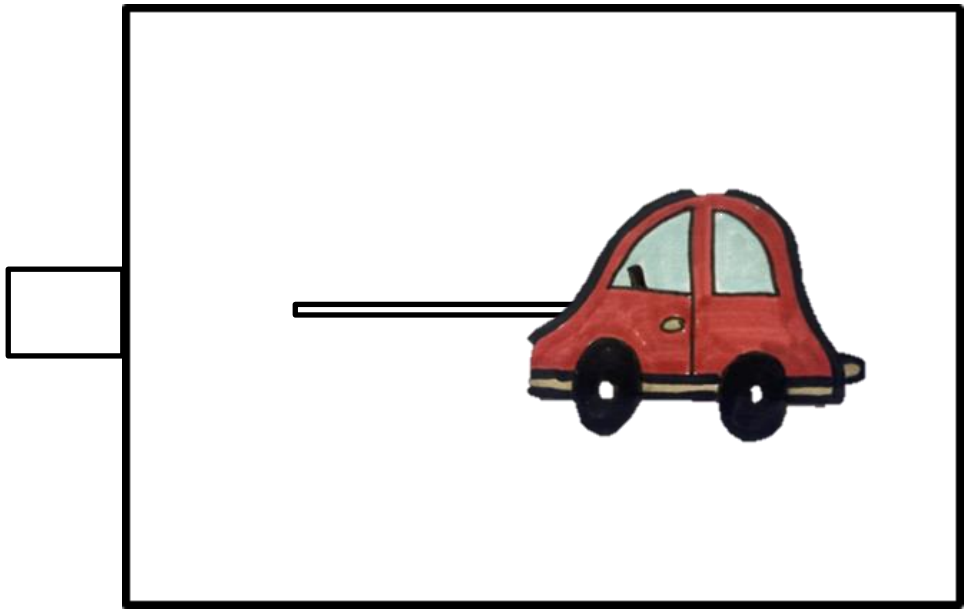
10: Slot the loose tabs through the slot on the main card, so that you image is on the correct side of the card.



11: Glue the ‘Pull Tab’ strip to the tabs

Mechanisms: Pull Slider



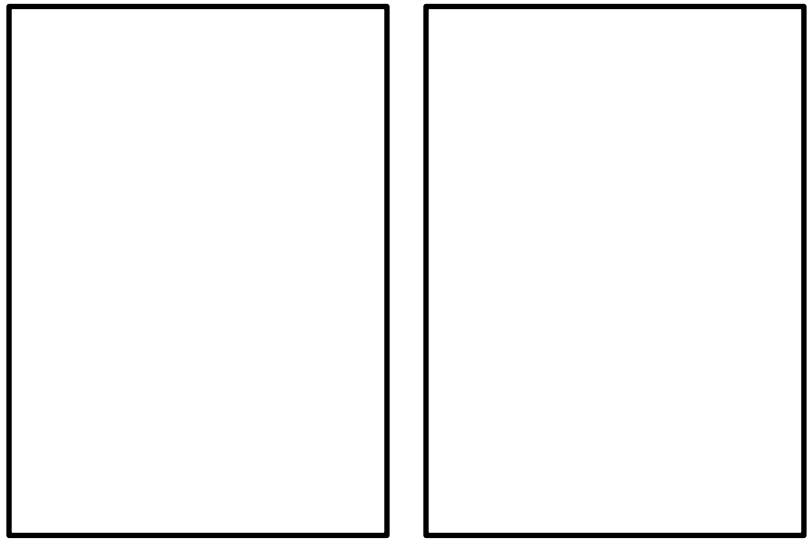


12: With the other two strips from the first strip, glue these down over the ‘pull tab’ ensuring that you don’t stick them to the ‘pull tab’ and it can still move freely.

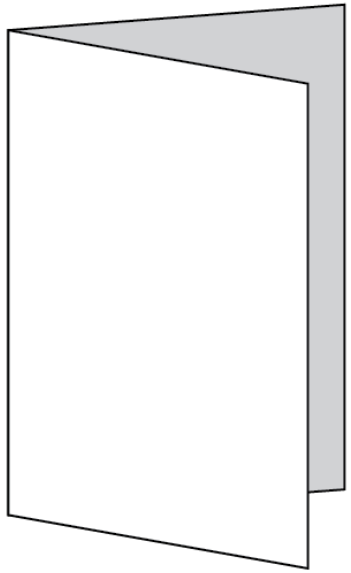
13: Turn the card over and you should be able to pull the ‘pull tab’ and your image will move across the page.

Mechanisms: Rotary

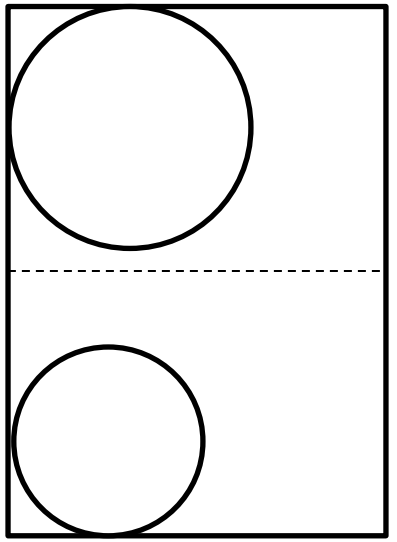
You will need 2 pieces of A4 card



1: One card is for the outer card; the other is for the rotary mechanism and decoration.

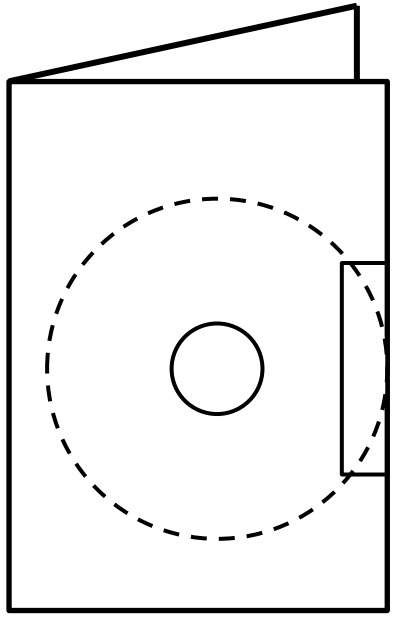


2: **Fold** one piece of card in half down the centre. Use a ruler to press along the **fold**, reinforcing it. Set aside.

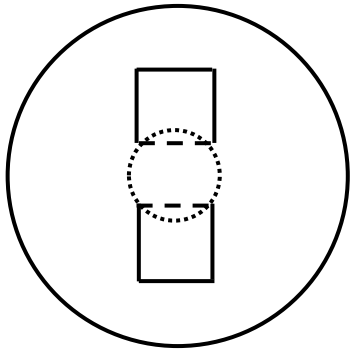


3: On the second piece of card, draw one circle that is just smaller than the size of half the card. Your image needs to fill a circle, just smaller than the first one.

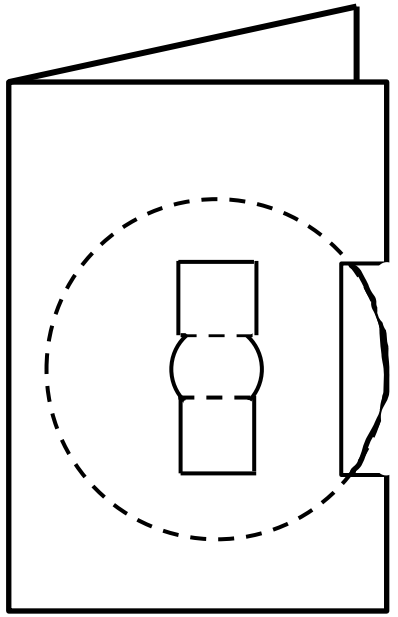
Mechanisms: Rotary



4: On the main piece of card, place the large circle to the edge of the card, mark a slot, where you can turn the circle, also mark a smaller circle at the centre of the larger one, about 1cm wide.
Cut these out.

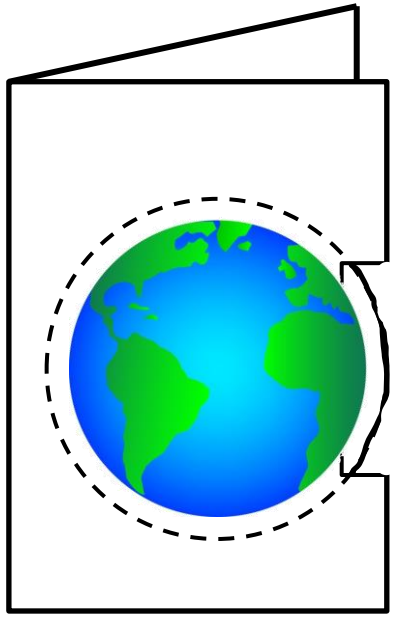


5: On the large circle, mark the smaller circle as you did on the main card, mark 2 lines across the circle and then mark from these 2 tabs.
Cut along the solid lines, fold along the dashed lines.



6: Place the large wheel inside your main piece of card, push the tabs through the small centre hole, to the front of the card.

Mechanisms: Rotary

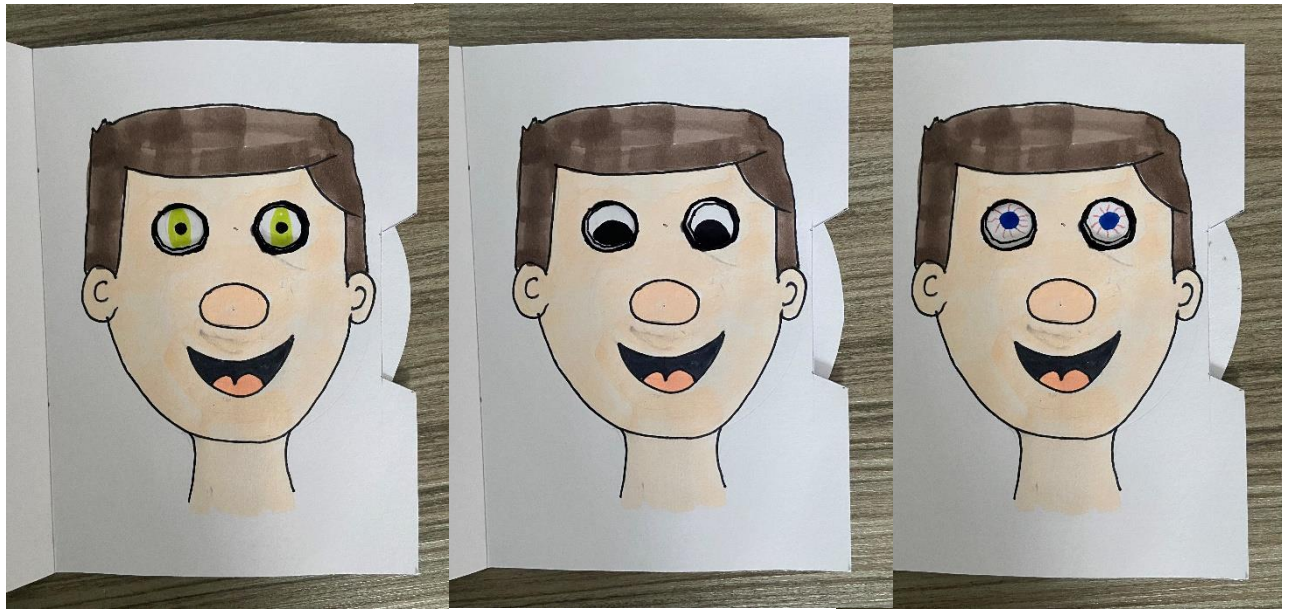


7: Glue your image / design on to the tabs, making sure that it is free to turn around.

Variation to rotary mechanisms:

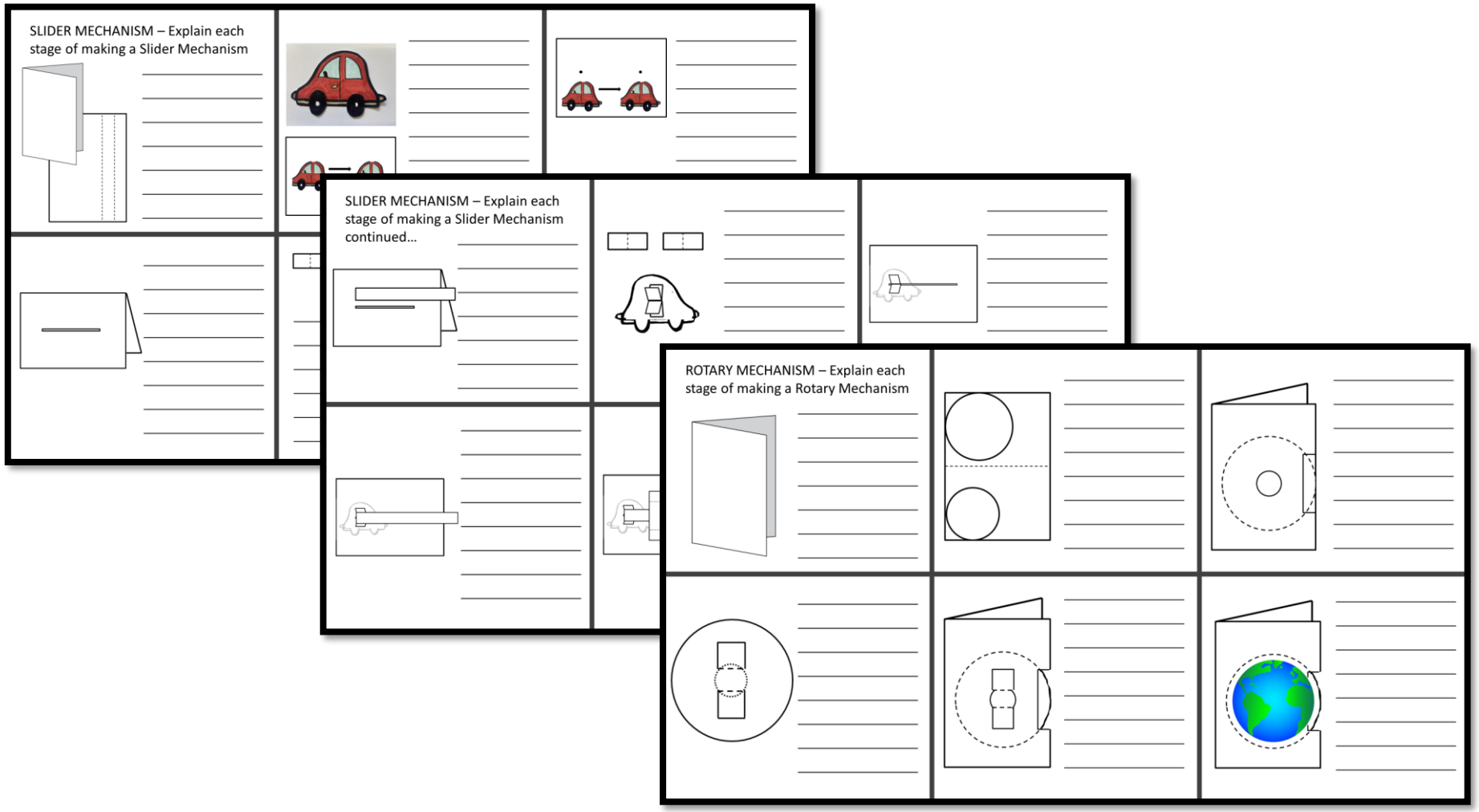
Here, the eyes change, and move around behind the cut-out eyes of the face on the front.

As well as having the moving part on the outside you can have the moving part on the inside, using windows or slots to see the moving image.



Assessment

Successfully made and explained more pop-ups and some mechanisms.



Can you explain the difference between and pop-up and a mechanism?