

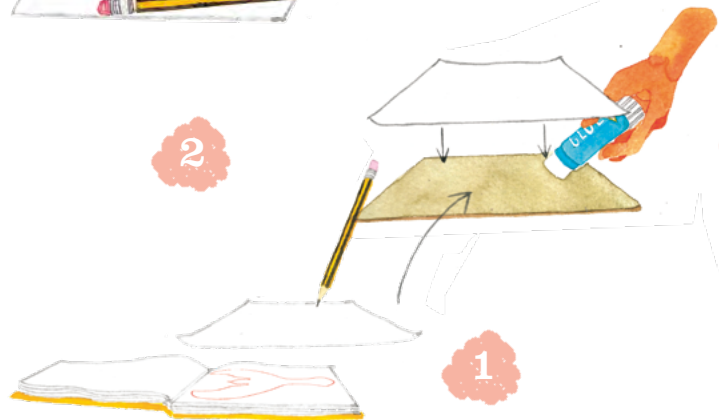
BALANCING BIRD

PARTS REQUIRED

- * 1 piece of scrap card from a cereal box or similar
- * 1 piece of tracing paper or thin sheet of plain paper
- * Pen or pencil
- * 2 small coins of the same type
- * Scissors
- * A roll of sticky tape or masking tape
- * Glue stick

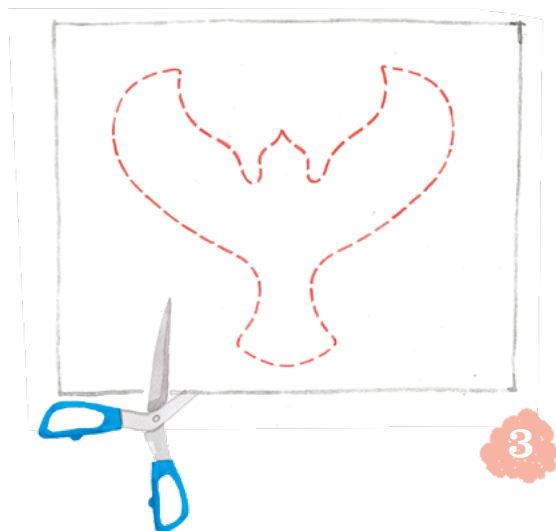


As a science teacher, I often use toys in my lessons to demonstrate scientific principles in action. One of my favourites is the 'balancing bird', which seems to defy gravity and go against all our intuition about how things should balance. I hope you'll find this toy as delightful as my students do, and that making your own helps you to learn about how it works so you can go on to design and make other balancing toys.

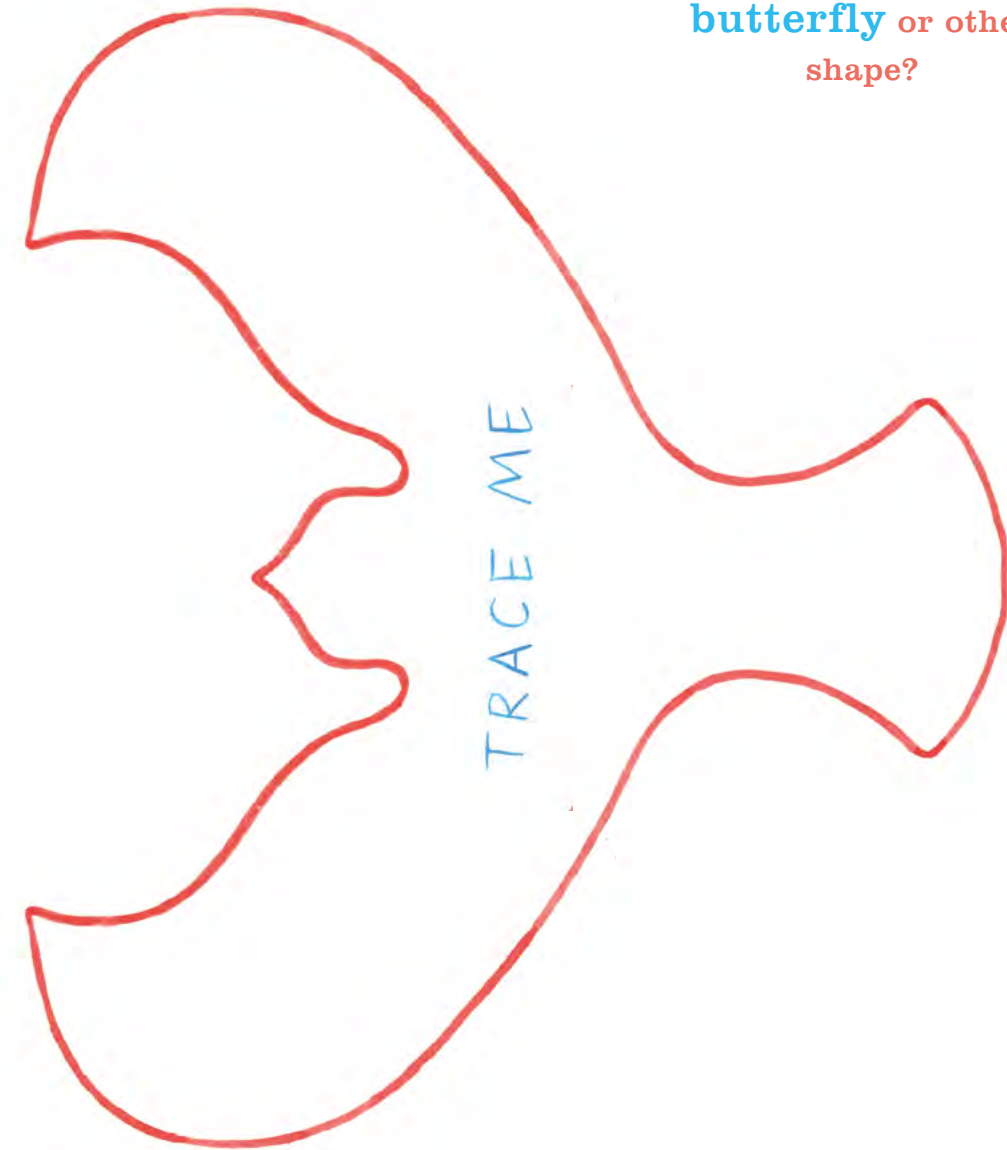


METHOD

- 1** Trace the bird outline on the next page of this book onto your piece of paper. If your paper doesn't let you see through it to trace the bird, try copying it.
- 2** Using the glue stick, stick the paper onto your piece of cardboard.
- 3** Cut the bird out of the cardboard and decorate it however you want.



Can you make your own **balancing butterfly** or other shape?



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What would happen if you **changed the position** of the coins?



What would happen if you used **lighter or heavier coins** for the wings?



Does it make a difference if you **bend the wings upwards** instead of downwards?

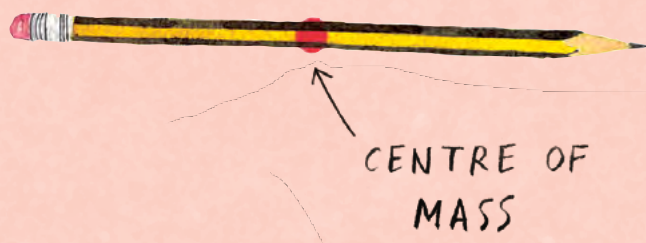


- 4 Using sticky tape, stick a coin onto the bottom of each wing, in roughly the positions shown.
- 5 Bend the bird's wings downwards.
- 6 Bend the bird's beak downwards.
- 7 Balance the bird on your finger.
- 8 Try balancing the bird on other things.



MR SHAHA says...

If you try to balance an object like a plate or a pencil, you'll find that there's only one point on the object below which you can put your finger to keep it stable. Scientists call this point the 'centre of mass' or 'centre of gravity' of the object. You can think of it as the point around which the



mass or weight of an object is evenly distributed. With something like a plate or pencil, the centre of mass is roughly in the middle of the object. For something that is heavier on one side, like a hammer, the centre of mass will be closer to the heavier end. The centre of mass doesn't have to be part of the object itself — for example, the centre of mass of a roll of sticky tape or a coat hanger is in the middle of the hole.

An object can only be balanced if its centre of mass stays in the same vertical line as the point at which it is pivoted, otherwise it will start to turn. If the centre of mass is above the pivot, this turning will make the object fall over. You can see this for yourself by trying to balance a roll of sticky tape on top of your finger — it's

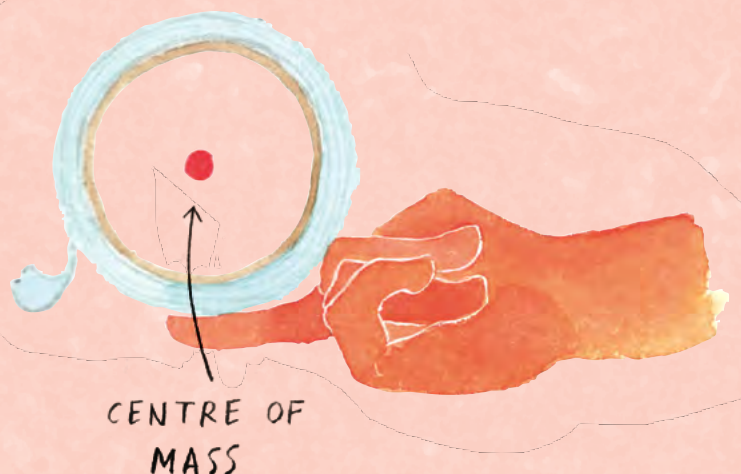
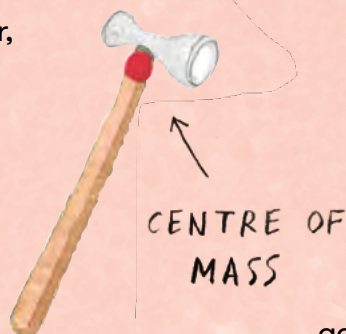
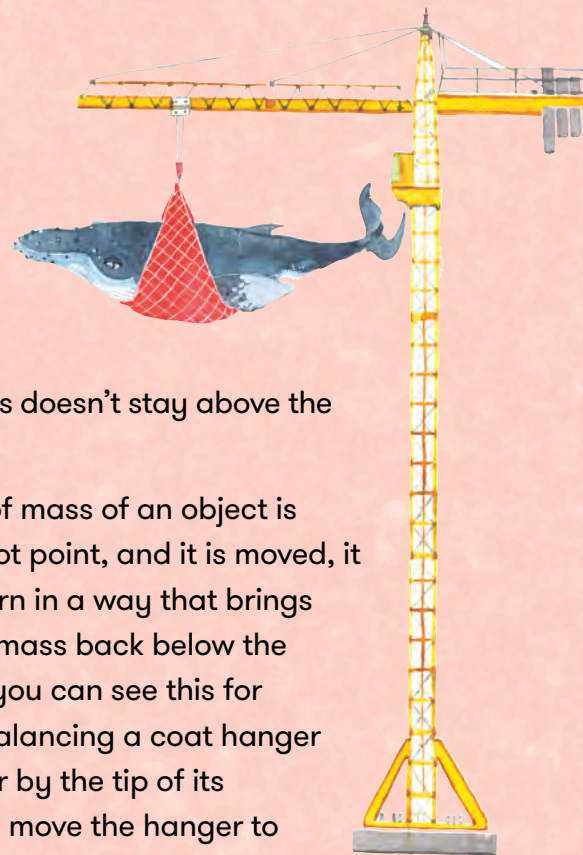


hard to do because the centre of mass doesn't stay above the pivot.

If the centre of mass of an object is below the pivot point, and it is moved, it will always turn in a way that brings the centre of mass back below the pivot. Again, you can see this for yourself by balancing a coat hanger on your finger by the tip of its hook — if you move the hanger to one side, it will swing back to its stable position. This is the secret to the stability of the balancing bird — it is made so that its centre of mass is

below the point at which it is supported (its beak), and the centre of mass always falls back to a position directly below the pivot if it is moved.

You can change the centre of mass of the bird by changing the position of the coins or by adjusting the angle at which you bend the wings. If you want the bird to balance, most of its weight needs to be below the pivot point.



BALANCING BIRD

Mr Shaha's MARVELLOUS MACHINES

Alom Shaha and Emily Robertson

“This is just one of the activities from *Mr Shaha's Marvellous Machines*, a book filled with simple instructions for building toys which fly, spin, whizz, and pop.

Mr Shaha says that we don't have to be buying new stuff all the time, instead we can make our own stuff and learn about engineering and science at the same time. Construct more of Mr Shaha's Marvellous Machines to discover the joy of making, and develop your creativity, scientific thinking, and problem solving skills.”

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