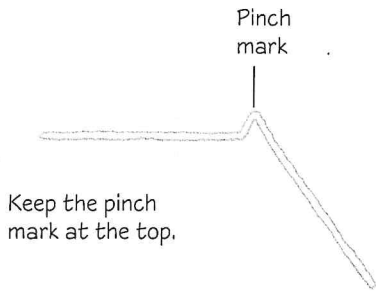# Bendy balancers

YOU WILL NEED: pipe cleaners, a long piece of thread, two chairs, beads that you can thread onto pipe cleaners

Pinch mark

Keep the pinch mark at the top.

Bend the pipe cleaner like this to make the shape to the right.

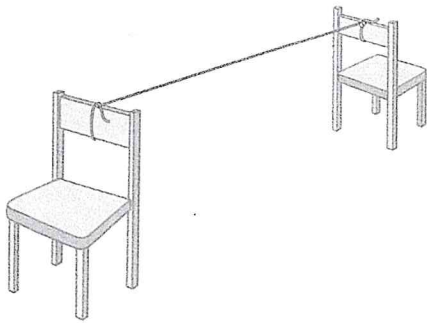Keep each part of the pipe cleaner straight.

1. Bend a pipe cleaner in half, and pinch the middle. Bend one side out, a finger width from the pinch mark. Then, bend the other side up, too.
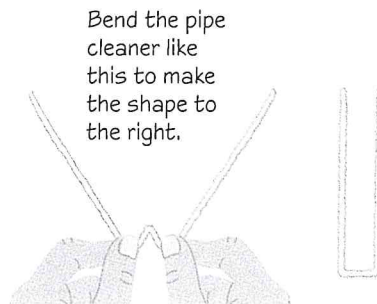
2. Holding the two bends that you've just made, carefully flatten the pinch mark to make a squared-off 'U' shape, like this.
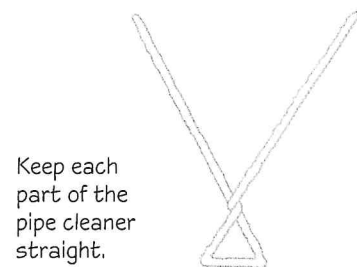
3. Bend both sides of the pipe cleaner into the middle, until they cross over. Then twist them over each other, to keep them in place.

Rest the middle of the flat section on the thread.

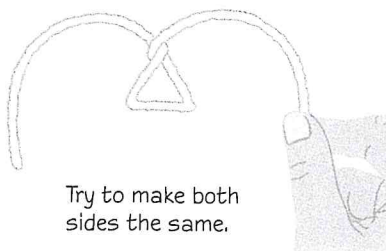You can find out more about how things balance on pages 38-39 and page 68.

4. Cut a long piece of thread. Tie each end of the thread to the back of a chair. Move the chairs apart until the thread is tightly stretched out.
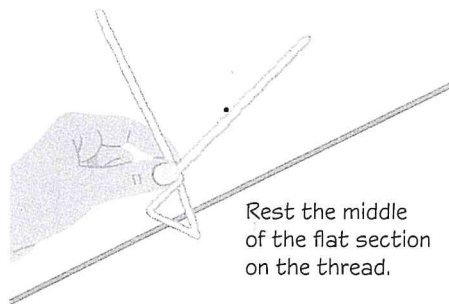
5. Keeping the flat middle section at the bottom, try to balance the pipe cleaner on the thread. Can you get the pipe cleaner to balance?
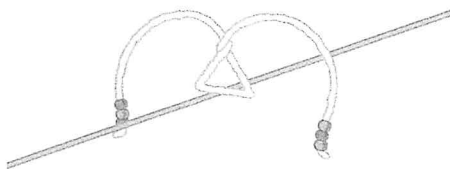
Try to make both sides the same.

Some of these pipe cleaners look like they might fall off, but they're still balancing on the thread!

6. Hold one side of the pipe cleaner between your thumb and first finger. Firmly pull down it, to make a curve. Then, curve the other side.

7. Thread three beads onto each side and bend the ends, to keep the beads in place. Now try to balance the pipe cleaner on the thread again.
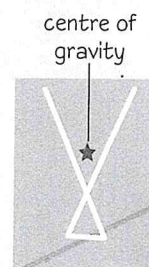
If you want to make one side of the pipe cleaner longer than the other, add different numbers of beads to balance it.
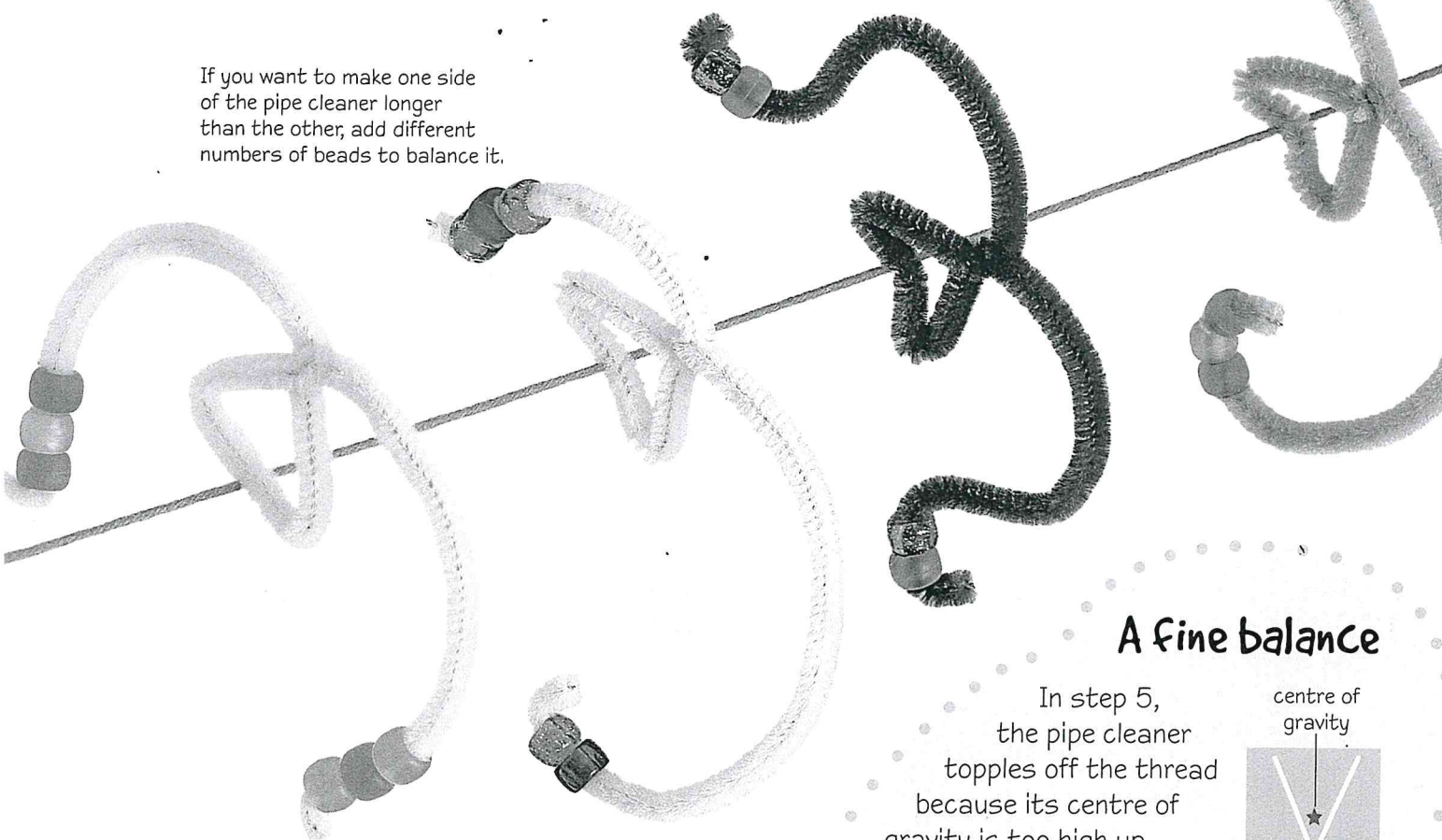
A fine balance

In step 5, the pipe cleaner topples off the thread because its centre of gravity is too high up for it to balance.

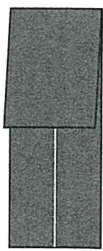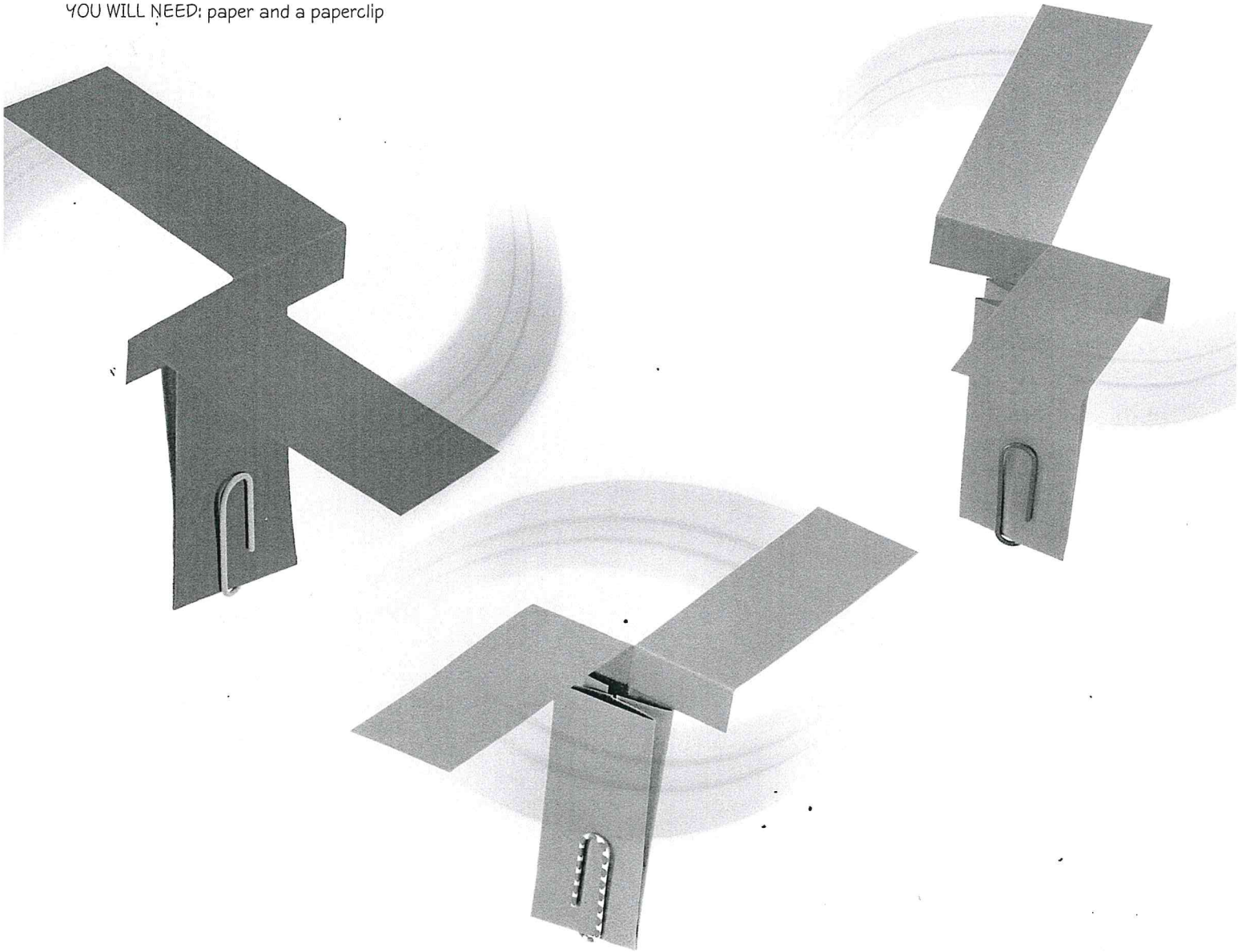centre of gravity

centre of gravity

By bending its sides down and adding beads, you lower its centre of gravity, and it sits happily on the thread. This is how to balance an uneven shape, too — just bend it and add beads until it balances.
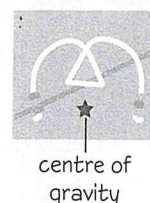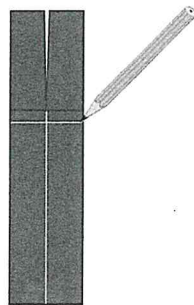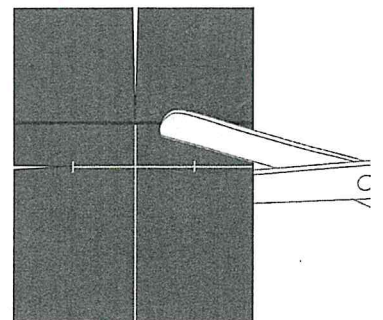
Spinning paper helicopter

YOU WILL NEED: paper and a paperclip

1. Cut a strip of paper that is 5 x 20cm (2 x 8in) in size. Draw a line down the middle with a pencil. Then, fold down the top third of the paper.

2. Unfold the paper. To make helicopter 'blades', cut down the line, as far as the fold. Draw a line across the paper, a little way below the fold.

3. Make marks on the line you have drawn, halfway between each edge and the middle. Then, cut in from each edge, up to the mark.
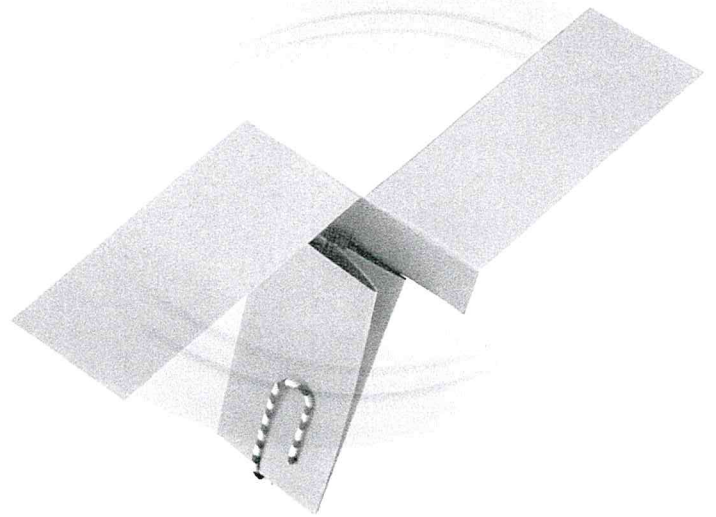
In a spin

The helicopter falls to the ground because of gravity. Instead of dropping straight down like most things do, it spins gently to the ground. As the helicopter falls, each blade hits the air, forcing the air out to one side. This makes the helicopter spin and slows down its fall.
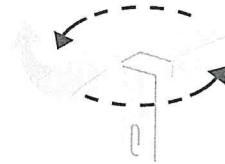
4. Fold one edge into the middle of the paper, until it meets the pencil line. Press the fold down well, then fold over the other edge, too.
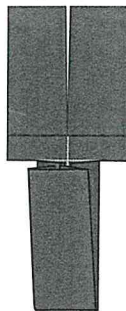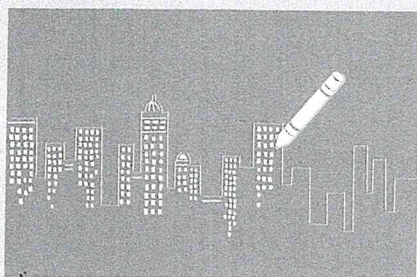
5. Fold up the bottom edge of the paper until it reaches the pencil line below the blades. Crease the fold well, so that the paper lies flat.
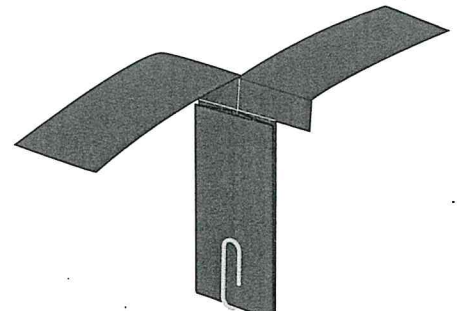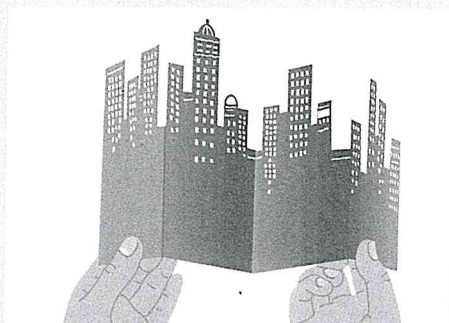
6. Push a paperclip onto the bottom of the helicopter. Fold one blade to the back and one to the front. Then, throw the helicopter high into the air.

City skyline

YOU WILL NEED: thin dark cardboard and chalk

1. Draw a city skyline across the middle of a piece of thin dark cardboard. Add dots of white chalk for windows. Then, cut along the skyline.

2. Try standing the skyline up. It won't stand up on its own, so fold it in half. Fold the ends in to meet the fold, like this. Now try standing it up again.
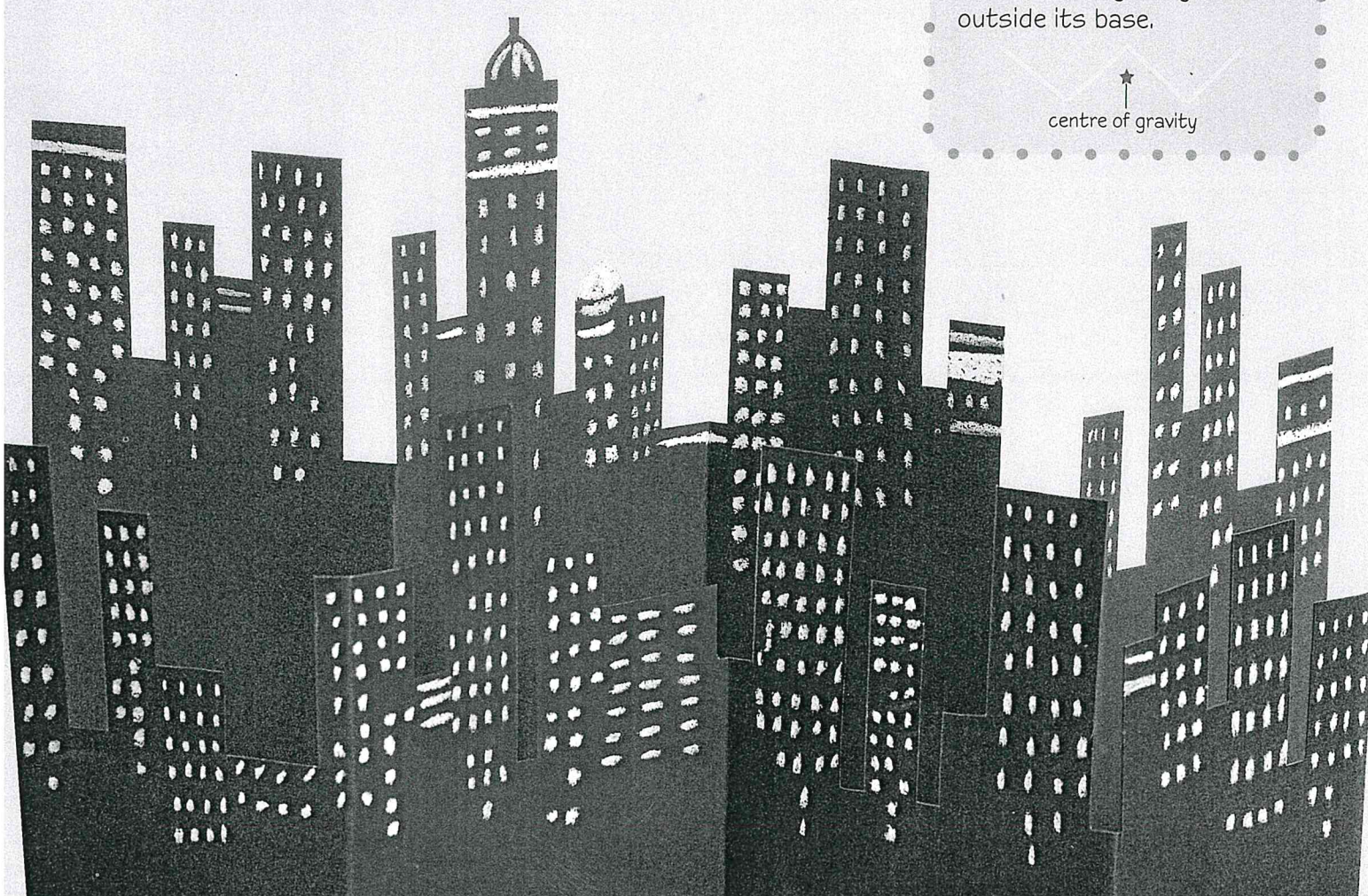
Balancing act

At first, the skyline can't support itself, because its centre of gravity is unable to stay over its base. If the paper leans at all, this point moves away from the base and the skyline falls over.

centre of gravity

Folding the skyline makes it much more stable. It now has to lean over a lot before its centre of gravity moves outside its base.
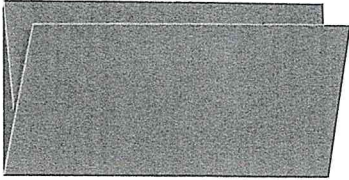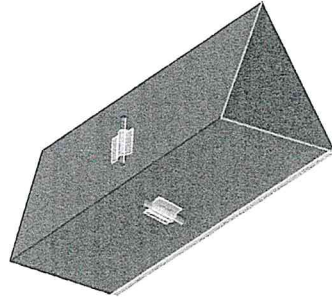
centre of gravity

fantastic flingers

YOU WILL NEED: thick paper, two drinking straws, corrugated cardboard, thread or string, poster tack, a clean lid from a plastic bottle
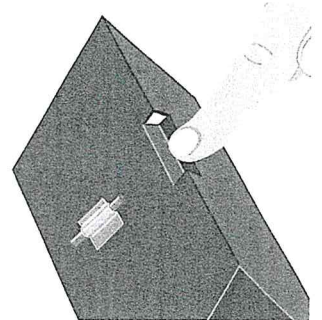
Crease the folds well.

1. Cut a 30cm (12in) tall rectangle from thick paper. Fold one short edge about a third of the way down, then fold up the bottom edge.
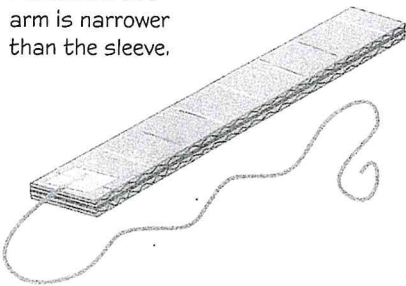
2. Fold the paper into a triangular base and secure it with tape. Then, tape pieces of a straw onto the front and bottom of the base.

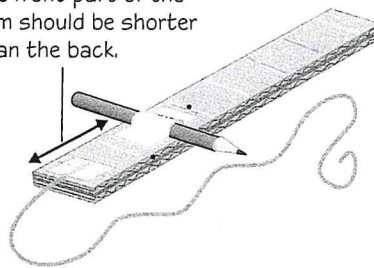The straw holding the 'arm' in place will slide through here.

3. Make two small cuts in the top edge, about three finger widths apart. Then, push down the edge between the cuts, like this, to make a 'sleeve'.
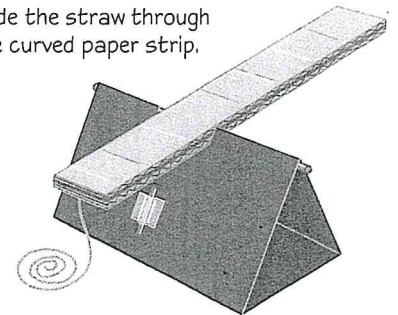
Make sure the arm is narrower than the sleeve.

4. Cut two 30cm (12in) strips from corrugated cardboard and glue them together for an 'arm'. Tape a long thread onto the front end of the arm.

The front part of the arm should be shorter than the back.

5. Cut a small strip of paper. Lay a pencil across the arm, then lay the paper strip on top and glue the ends onto the arm. Slide the pencil out.

Slide the straw through the curved paper strip.

6. Turn the arm over and lay the curved paper strip in the sleeve. Slide a straw through from one side of the base to the other, like this.

Put one blob on each corner of the base.
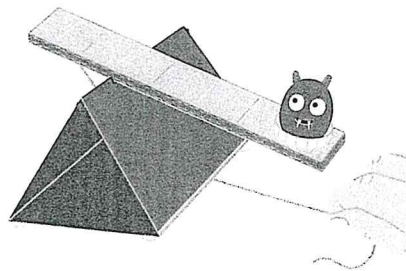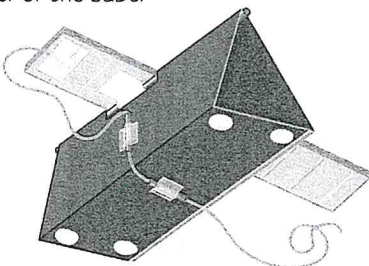
7. Push the thread through the straw on the front, then through the straw on the bottom. Press big blobs of poster tack on for feet.

8. Glue a clean lid onto the long end of the arm. Press the flinger onto a surface and put a toy in the lid. Tug the string to send the toy flying!

Ready to launch

The arm of the flinger works like a lever. By tugging on the thread, you suddenly force one end of the arm to swing down. As it goes down, the other end is forced up into the air. This action launches the toy sitting on the end of the arm. The energy you used to tug the thread is transferred into the arm and used to fling the toy.

These flingers were wrapped in paper in step 4 before the thread was taped on.
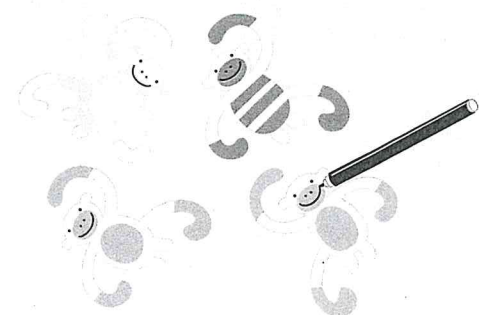
Dangly monkeys

YOU WILL NEED: thick paper, felt-tip pens, pipe cleaners, thread
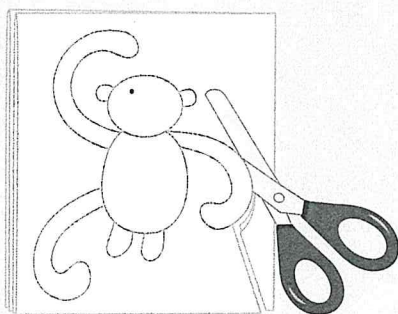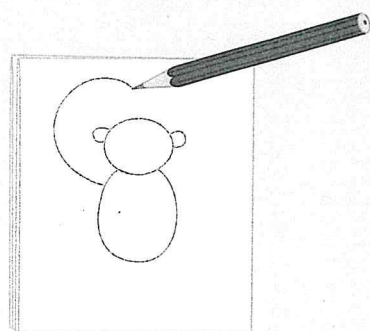
1. Fold a piece of thick paper in half, then in half again. Draw a monkey's head, ears and body on the paper. Add an arm curving up over the head.
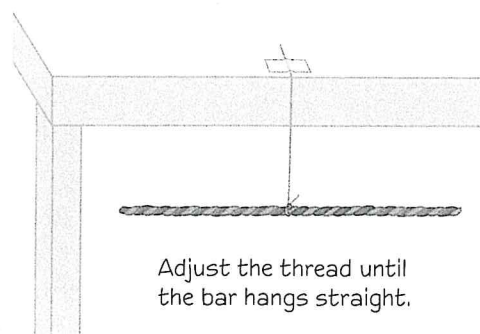
2. Draw the other arm curving down, then add legs and a long tail. Cut out the monkey through all the layers of paper. This will make four monkeys.

3. Turn one or two monkeys over, then decorate them all using felt-tip pens. Then, add the monkeys' faces using a thin black pen.
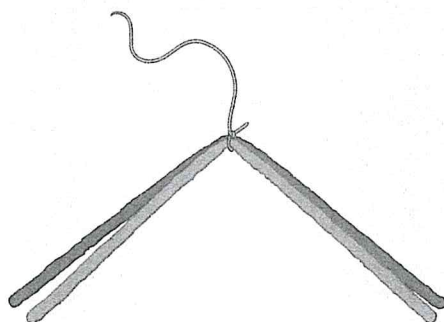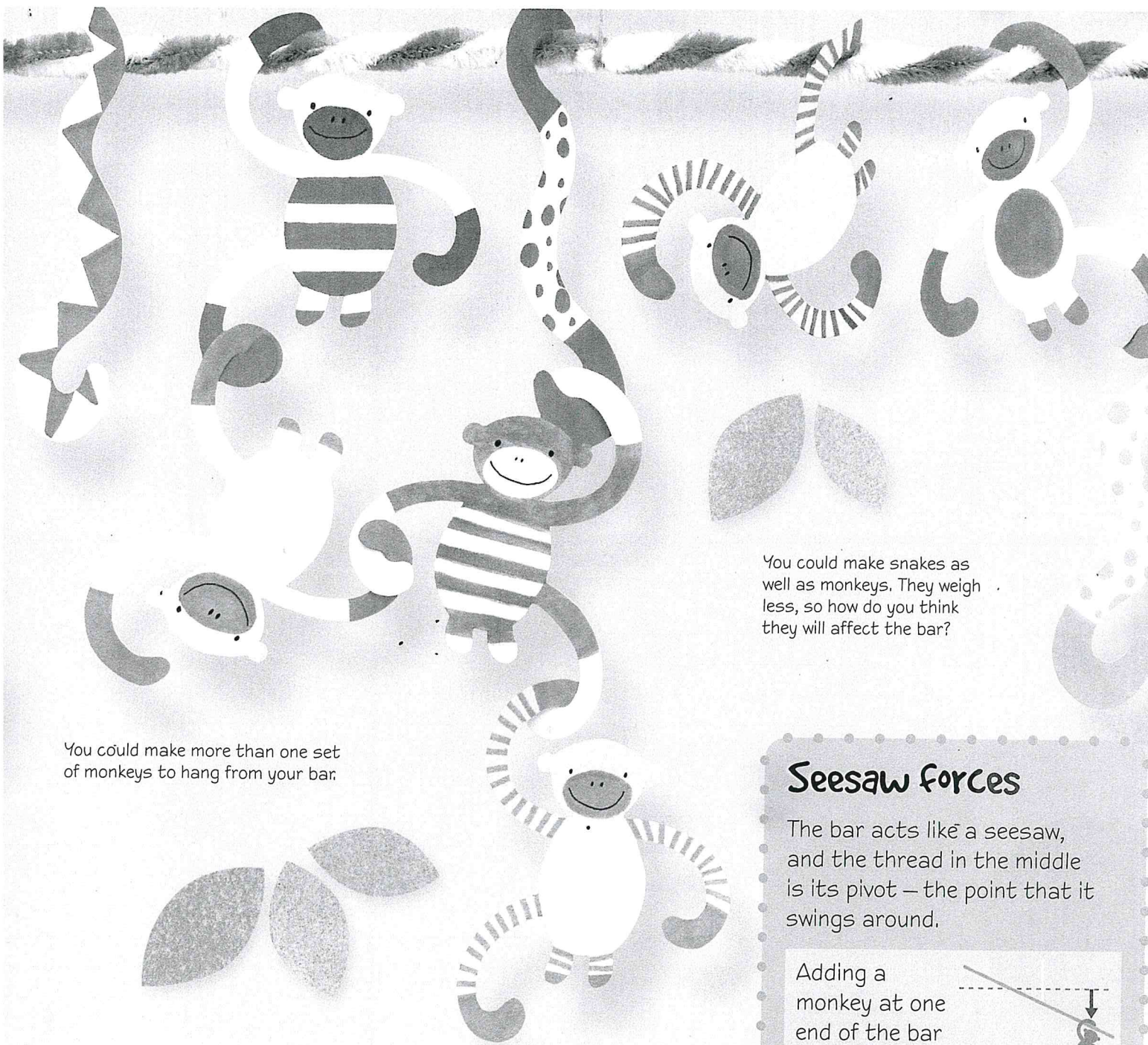
4. Bend two pipe cleaners in half and pinch the middle. Then, unbend the pipe cleaners a little and tie a piece of thread around the middle.

5. Straighten the pipe cleaners, then twist them together to make a bar. Tape the thread onto a table or other surface, like this.

Adjust the thread until the bar hangs straight.

You could make snakes as well as monkeys. They weigh less, so how do you think they will affect the bar?

You could make more than one set of monkeys to hang from your bar.

Seesaw forces

The bar acts like a seesaw, and the thread in the middle is its pivot — the point that it swings around.

Adding a monkey at one end of the bar makes it tilt a lot...

...but the bar only tilts a little with the monkey halfway.

This happens because things far away from the pivot have a bigger force on the bar than things closer to the pivot.

Hanging a monkey from the tail of another also makes the force bigger. This makes the bar swing down more than if there was only one monkey.
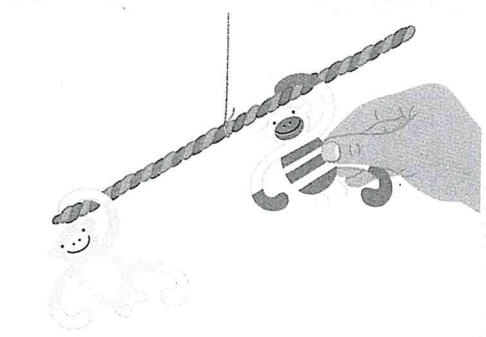
6. Hang a monkey at one end of the pipe cleaners. Then, hang another monkey on the other side, halfway along. Does the bar hang straight?
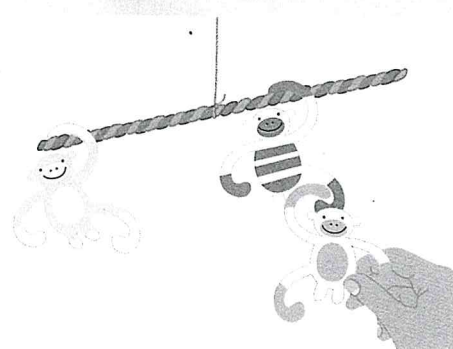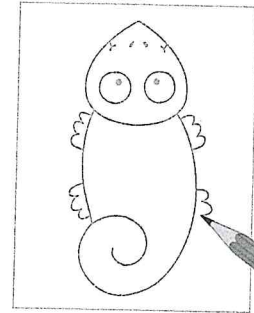
7. Hang another monkey from the tail of the second one. Then, experiment with hanging all the monkeys at different points along the bar.

29

climbing lizard

YOU WILL NEED: thin cardboard, felt-tip pens, thick thread or string, a straw, a small coin, beads
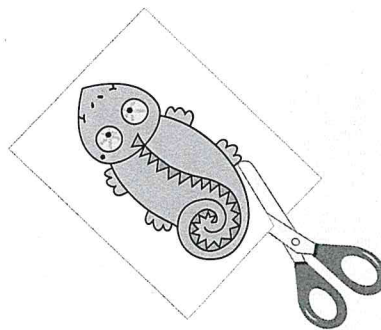
The lizard should be about as long as your hand.
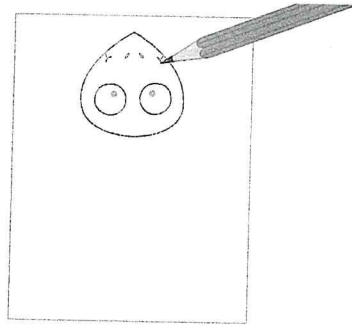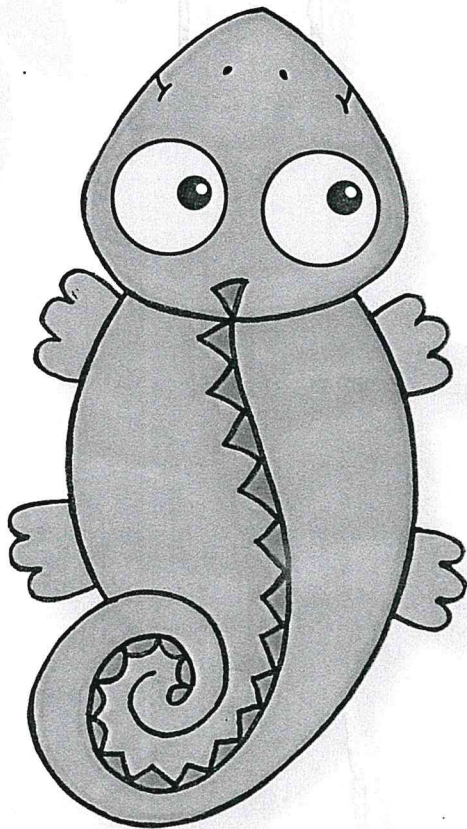
1. Draw a lizard's head near the top of a piece of thin cardboard. Then, add big round eyes, dots for nostrils and a mouth.

2. Draw two curved lines for the sides of the lizard's body. Add a spiral for the tail at the bottom of one of the lines. Then, add four feet.

3. Draw a spiky spine down the lizard's back, then fill in the lizard with felt-tip pens. Then, carefully cut around it with scissors.
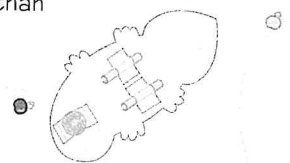
4. Cut a piece of thread or string, about 1m (3ft) long. Then, cut two pieces from a straw, making each piece about 3cm (1in) long.

The weight of the coin will help the lizard to work better when you use it.
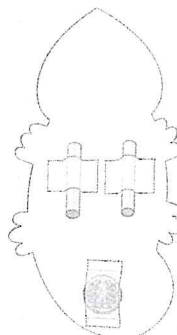
5. Turn the lizard over and tape the pieces of straw about halfway down. Then, tape a small coin near the bottom, like this.

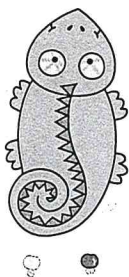The beads need to be wider than the straws.

6. Push the thread up through one straw, then down through the other one, to make a loop at the top. Thread beads onto the ends and knot them.

As you pull the threads, pull them out to the side.
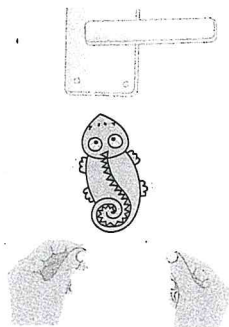
7. Loop the middle of the thread over a door handle. To make the lizard climb, pull one end of the thread, then pull the other, again and again.

8. When the lizard has climbed up to the door handle, let go of both ends of the thread. The lizard will slide back down to the bottom again.

Up and down

When you pull the threads, they press against the inside of the straws. This creates a force called friction that stops the two things from sliding past each other. When you let go of the threads, they stop pressing against the straws, so there is less friction and the lizard slides down. If you turn your lizard over, you can see this happening.
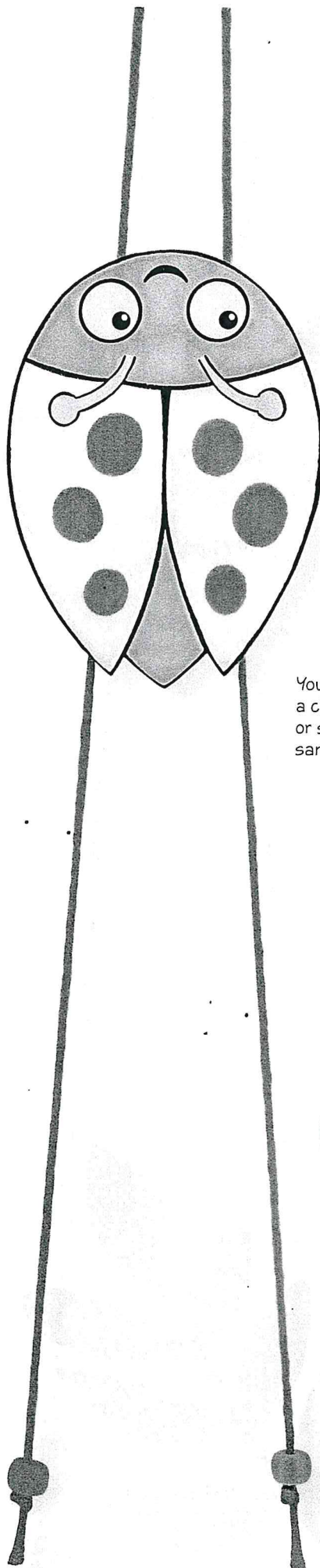
You could make a climbing bug or spider in the same way.