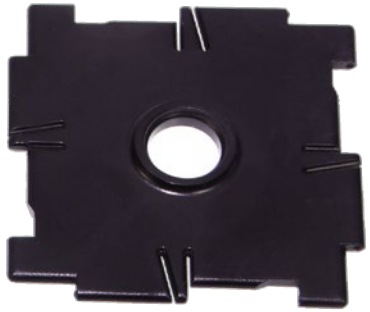
Bevel Gears 1

- Bevel gears allow motion to be turned through an angle.
- Polydron bevel gears turn through 90°. This is done by the shape of the teeth as seen in the gear on the right.
- To build a simple bevel gear arrangement, you will need two bevel gears, two squares with circular holes, a Frameworks square and two stub axles.



- The stub axles must go into the side of the square with a raised hole as seen above.
- The model on the right demonstrates how bevel gears work but it is not very useful as you have to turn the gears with your fingers.

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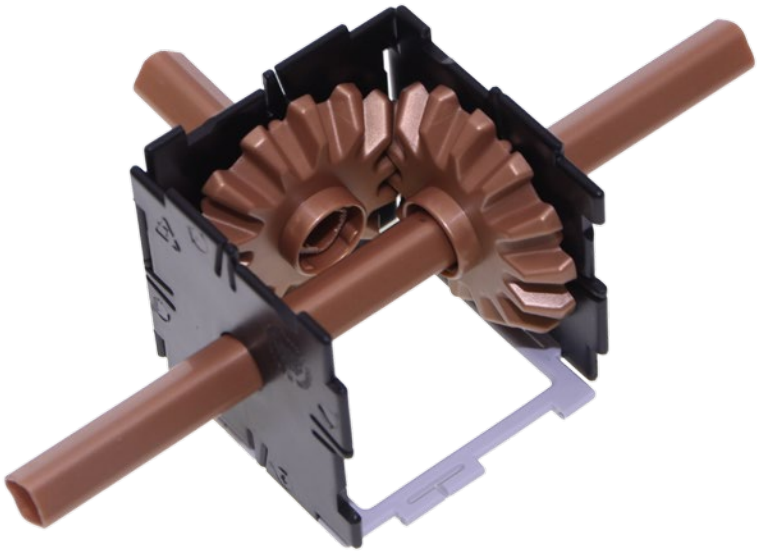
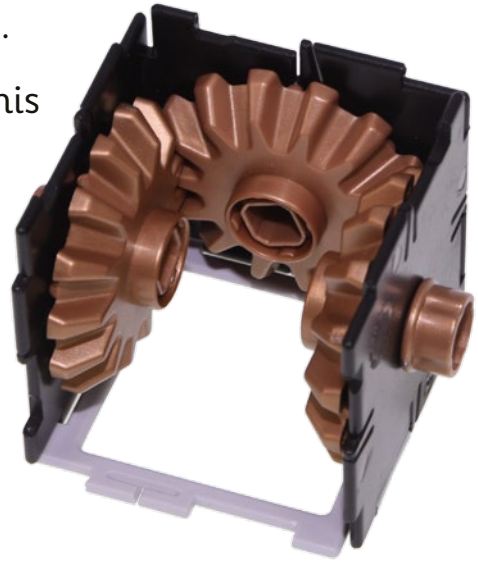
- To make bevel gears useful we need to attach struts to allow us to turn other models.
- Make the model below with two bevel gears.
- You will need three squares with circular holes a strut of length 180mm and a shorter one.



- Explore what happens when you add wheels to the long strut and a handle to the short one.

- The model below has three bevel gears.
- Here we see connectors have been used to hold the gears in place securely. You can attach struts to these connectors.
- Explore what happens when you turn the gear in the middle.
- Can you explain this behaviour?



Things to Develop

1 Explore other arrangements with three gears.

2 Explain why some of them will not turn at all.

3 There is a possible arrangement with four bevel gears. Can you find it?

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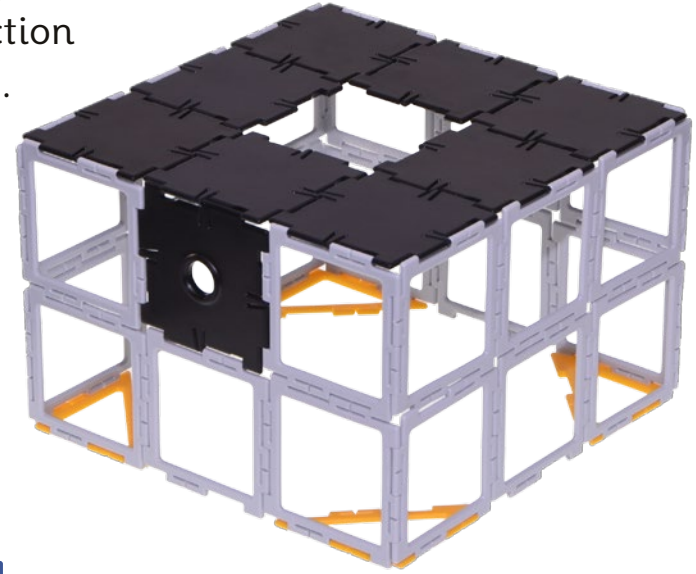
Bevel Gears 2

Principles

- In this activity you will build a platform to hold a bevel gear drive unit.
- You can then use the mechanism to rotate structures such as cranes and fairground rides.
- Build this platform from Frameworks squares and right-angled triangles, black squares and a single square with a round hole.
- It is very important that the square with a round hole has the raised edge facing outward, as shown in the photo.
- It might be a good idea to begin construction with this piece.



- The drive mechanism requires two bevel gears and two squares with round holes.
- It uses the principles learnt in Bevel Gears 1.

- The connector on the right holds a bevel gear in place but allows a strut to be fixed to it.
- The strut is 120mm and will point upwards in the final model.
- The cam shows another way to hold this strut and the bevel gear securely, but allow it to turn freely.
- Ensure that the squares with a hole have the raised edge facing inwards.

- Here is a view of the drive mechanism from the inside.

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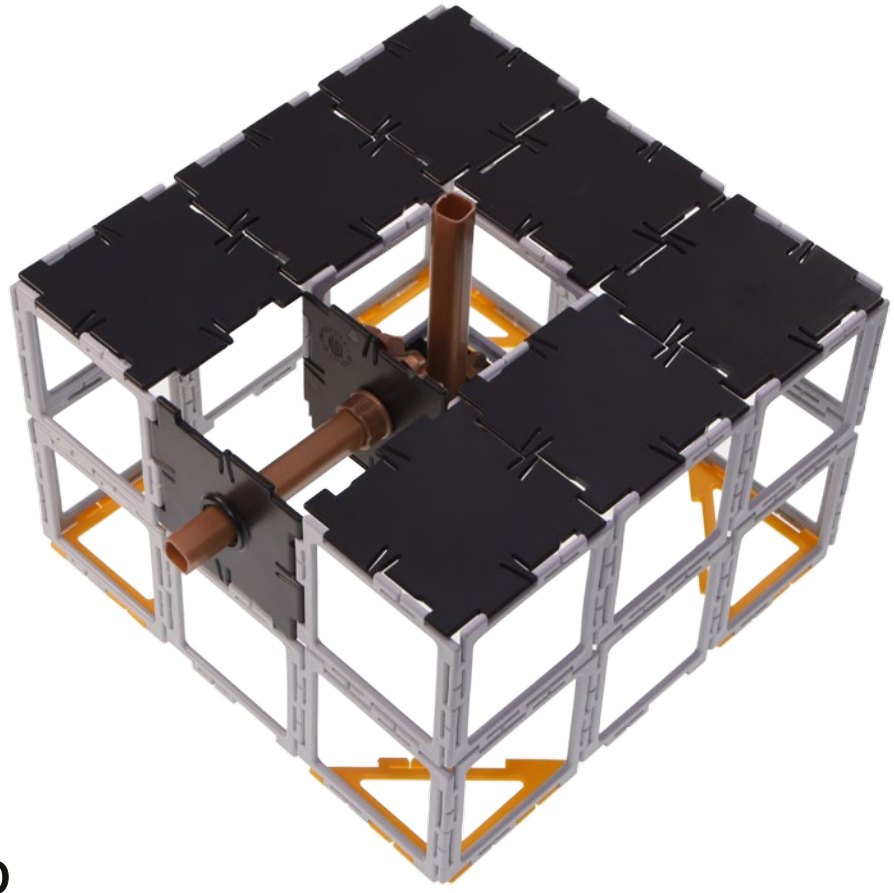
- The drive mechanism will fit inside the platform as shown in the picture.
- The existing strut in the mechanism points upwards and will be used to drive other structures.
- Another strut passes through the square with a hole and into the connector.
- A square from the top of the platform has been removed so that you can see this.
- This strut will be used to turn the mechanism. You could add a handle to it.



Things to Develop

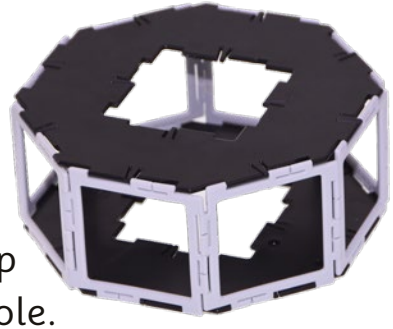
1 Build a model to sit on the platform and turn. Your model will need a square with square cut-out attached to the strut that sticks out of the top. Sitting this square in an octagon is a good way to start.

2 Identify limitations in this design. How can you improve the design to remove these limitations?

Chains and Cams

Principles

- In this activity you will work with cams and the chain. You will also explore a range of pieces, including the double square and the octagon.
- We are going to make a tower with a cube on the top that bobs up and down.



- We will begin with the base shown here and work our way upwards. Check that the octagon has the correct side up by inserting a square with a hole. The raised centre must face upwards.

- The tower section that carries the chain and cam can be built onto your base.
- The one shown here has a mixture of squares and double squares. The choice is yours.
- The squares with circular holes must have the raised surface facing outwards.

- Add the drive axles to your tower using two cams, two connectors and two 90mm struts.

- Notice that the cams have a central hole and four holes around the edge.
- The cams on the end of each axle are used to hold the axle in place when the chain is in use.
- On the other end of each axle is a connector.
- The cam in the centre of the axle is used to provide the bobbing motion. It will need to sit in the centre of the tower.
- Make sure the axle passes through a hole around the edge of the cam.

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- The next section will carry a strut that sits on the cam.
- This section is made from double squares and squares with circular holes, as shown here. Notice that the squares with circular holes have the raised centre facing upwards.

- A chain will be used to drive the cam. You create the length of chain needed by joining links together.
- Notice that the bar across a link is flattened. This allows the links to connect easily if joined at right angles.

- A cube sits on top of the tower. The square in its base has a square hole to fit tightly onto a 180mm strut.

- The final assembly of the tower needs two gears and a handle.
- We have used two medium-sized gears.

Things to Develop

- Explore different turning speeds by using other gears.
- Build something more interesting to bob up and down on the top.
- Make the tower taller with a longer strut at the top or a larger gap between the gears.

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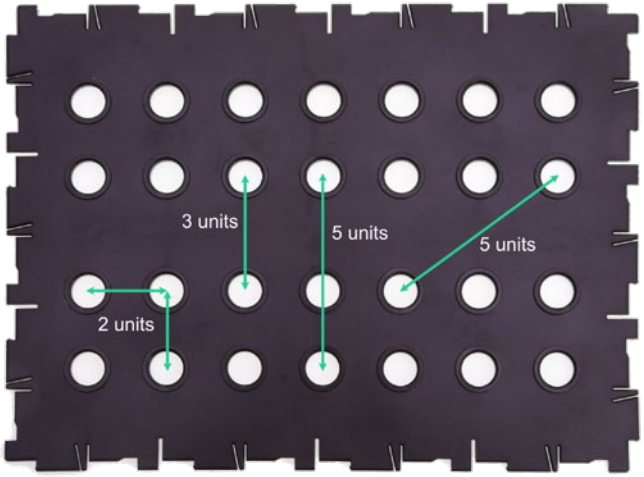
Gears

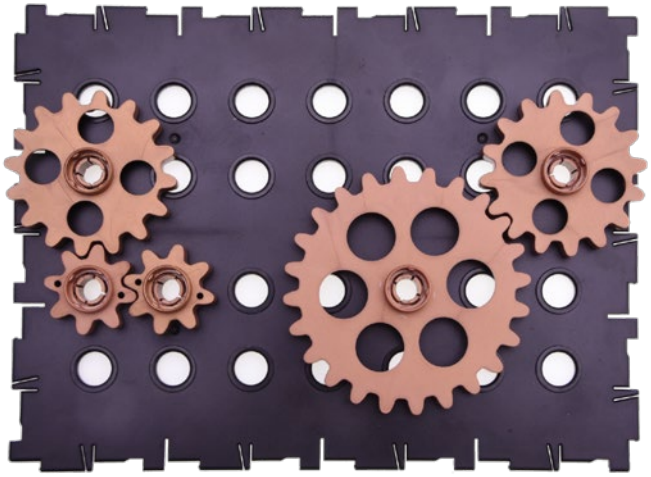
Principles

- There are three sizes of gear, in the ratios of 1:2:3.
- This means that if the smallest gear has a radius of 1 unit, then the next size has a radius of 2 units and the largest has a radius of 3 units.
- Gears can be attached to a baseboard using the stub axles.
- To discover if two gears will mesh together properly simply add the sizes of the gears together and use the guide from the hole spacing shown below.



- Make the arrangement of gears shown on the right.
- Explore how the gears turn each other.
- You could use a handle to help you keep track.

- Join the two sets of gears together with another small gear.



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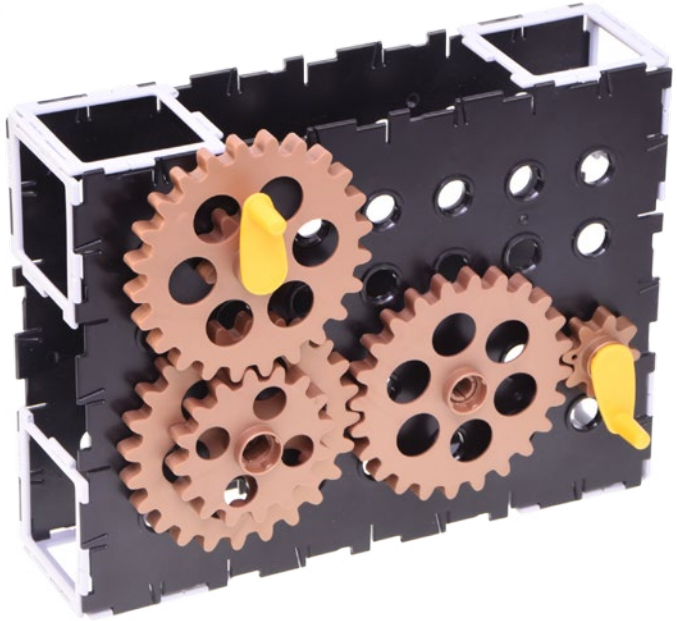
Principles

- It is easier to manage gears when you use two baseboards joined together.
- Notice that the raised edges are on the outside. This allows gears to move much more freely.

- With two baseboards you can also make arrangements that stand up on their own.
- In this example we have stacked some gears on top of each other.
- The large gear with the handle in it sits on a small gear that acts as a spacer, to make sure that gears are the right height.



- A key principle with gears is to work out the ratio of turning speeds.
- In the model bottom left, there are two handles. Can you use these two handles to work out the ratio of turning speeds?

Things to Develop

1 Explore joining more baseboards together.

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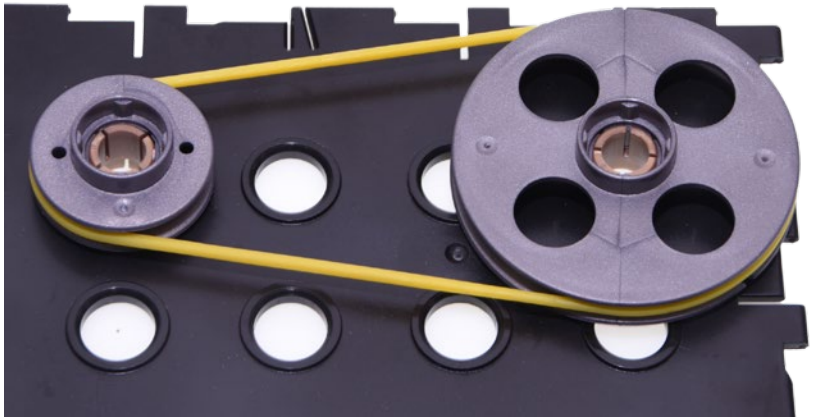
Pulleys

Principles

- Pulleys and chains are used when it is necessary to transmit motion over a distance and gears alone are either unsuitable or impossible.
- An important difference between them though is that chains will not slip, generally making them more accurate and reliable. However, they are more complex to manufacture.
- Pulleys driven by 'O' rings have the advantage over chains in that the 'O' rings may be stretched to fit a range of circumstances.
- There are two different sized pulleys in the set. The larger one is twice the size of the smaller one.

- Pulleys are joined to the baseboard or to squares with circular holes, using a stub axle or a strut.
- They can be turned by inserting a handle into the centre.

- Explore the simple arrangement shown below, with two pulleys driven by an 'O' ring.
- Move each of them to a different hole and see which 'O' ring works best.
- Put a handle in each of the pulleys so you can easily count how fast they turn.



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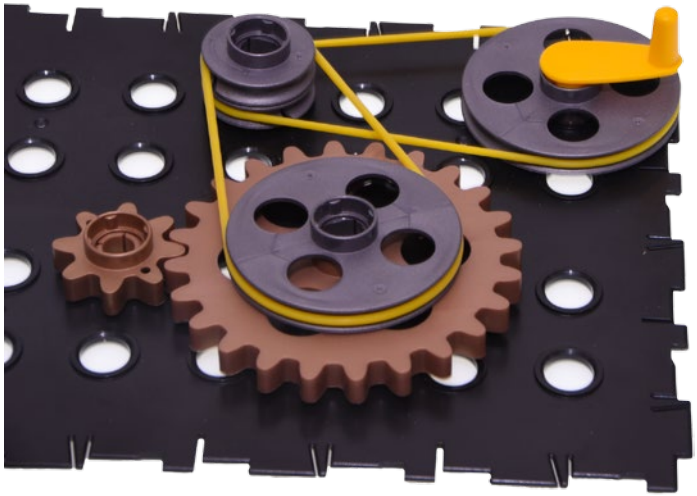
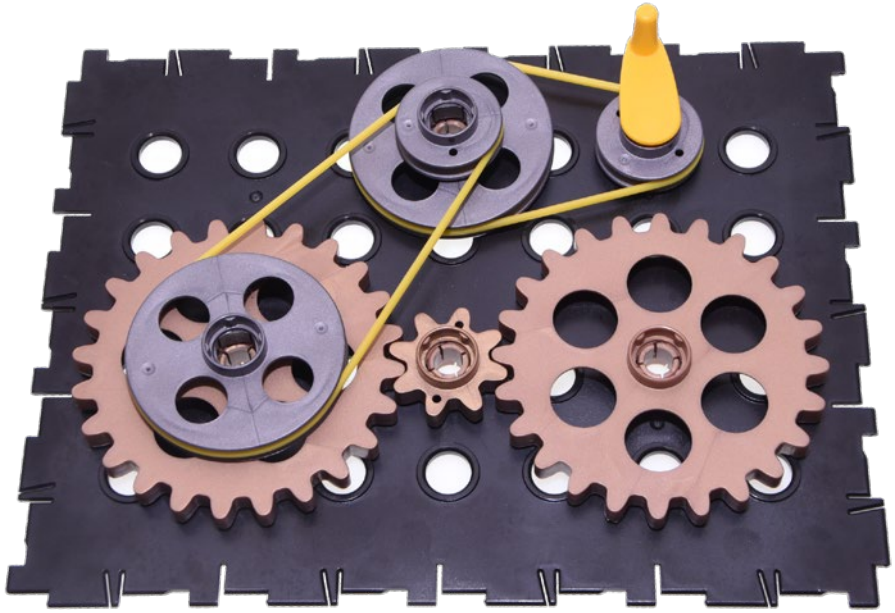
Pulleys and Gears

Principles

- Pulleys and gears work well together.
- This will often involve gears or pulleys being stacked on top of each other to achieve the correct working height.
- In the example below, move the handle to the small gear. Notice how much easier it is to turn.



- Can you calculate how many turns of the small gear are needed to turn the large single pulley once?
- In the example below, the stacked pulley causes a reduction in speed. Can you work out how much this is from the ratio of the pulley sizes. Turn the handle to check.
- When you turn the handle, notice that the two large gears rotate in the same direction and at the same speed.
- This is because the central, small gear is simply transferring motion from one to the other at the same speed, but in the opposite direction.



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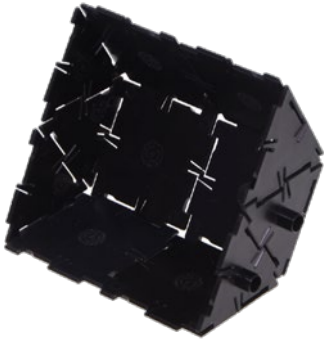
Wheels and Linkages

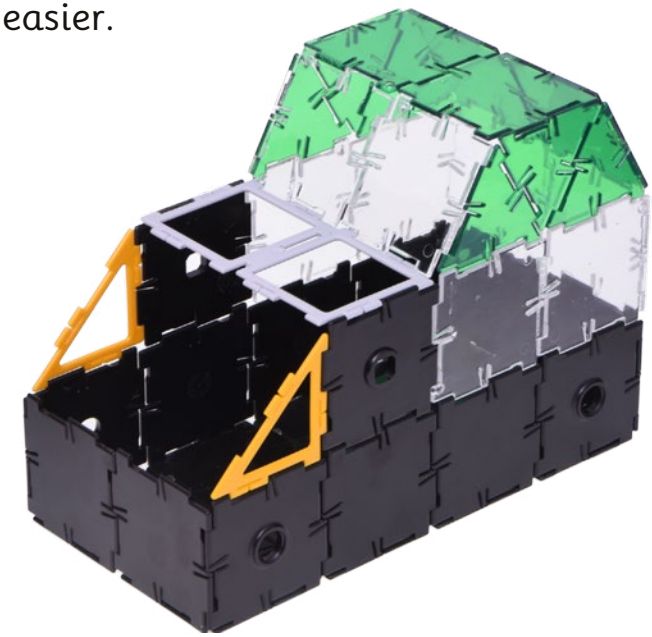
Principles

- In this activity you will explore the use of Polydron Crystal, wheels and linkages to build a bulldozer.
- The base of the bulldozer is a four by two rectangle of black squares with sides to match.
- Notice that the squares with circular holes have the raised edge on the outside.

- The bucket for the bulldozer is shown here. Notice the use of equilateral triangles with pegs. These will support the arms of the bulldozer.



- The upper body of the bulldozer has clear Polydron Crystal pieces for the sides and green pieces for the roof.
- Two black squares with square holes have been added. These will accommodate the arms of the bulldozer.
- The double square is there to allow you to get your fingers inside the model and make assembly easier.



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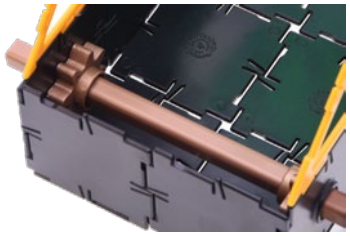
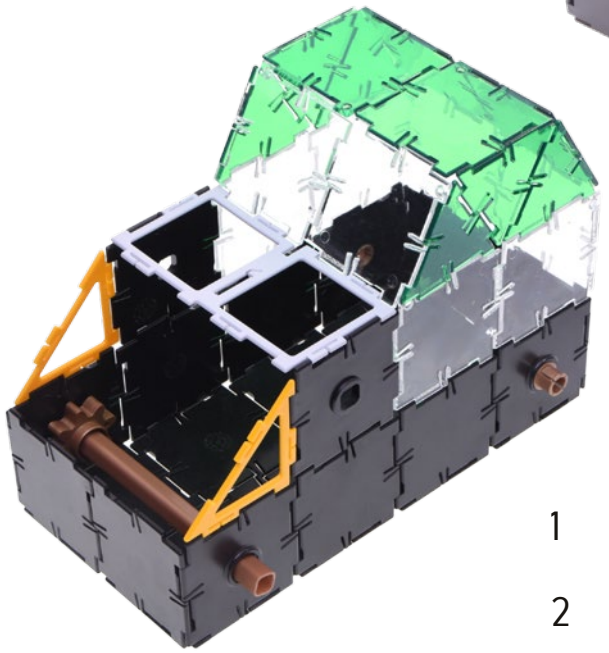
- The back wheels for the bulldozer are set on stub axles and the front wheels use a strut as a through axle.
- The through axle is needed as the arms of the bulldozer that push the bucket require space between the wheels and the body.
- The axle is held firmly in place by gears placed on the inside.





- The final bulldozer is shown here with the bucket in place.
- The main thrust on the bucket is provided by linkages.
- The linkages are held in place by connectors. The small gear is simply acting as a spacer.

Things to Develop

1 Make the bulldozer wider by using a baseboard for the base.

2 Make the back wheels stronger by using a strut for an axle.

3 Add additional wheels to the front.

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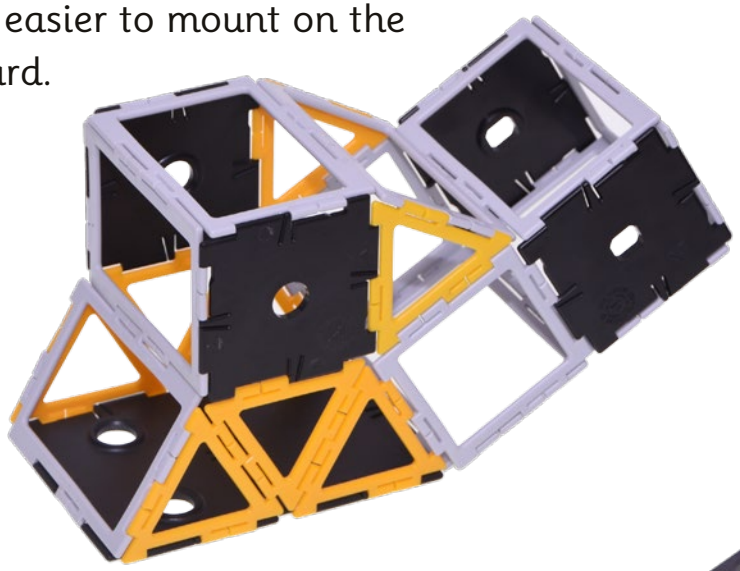
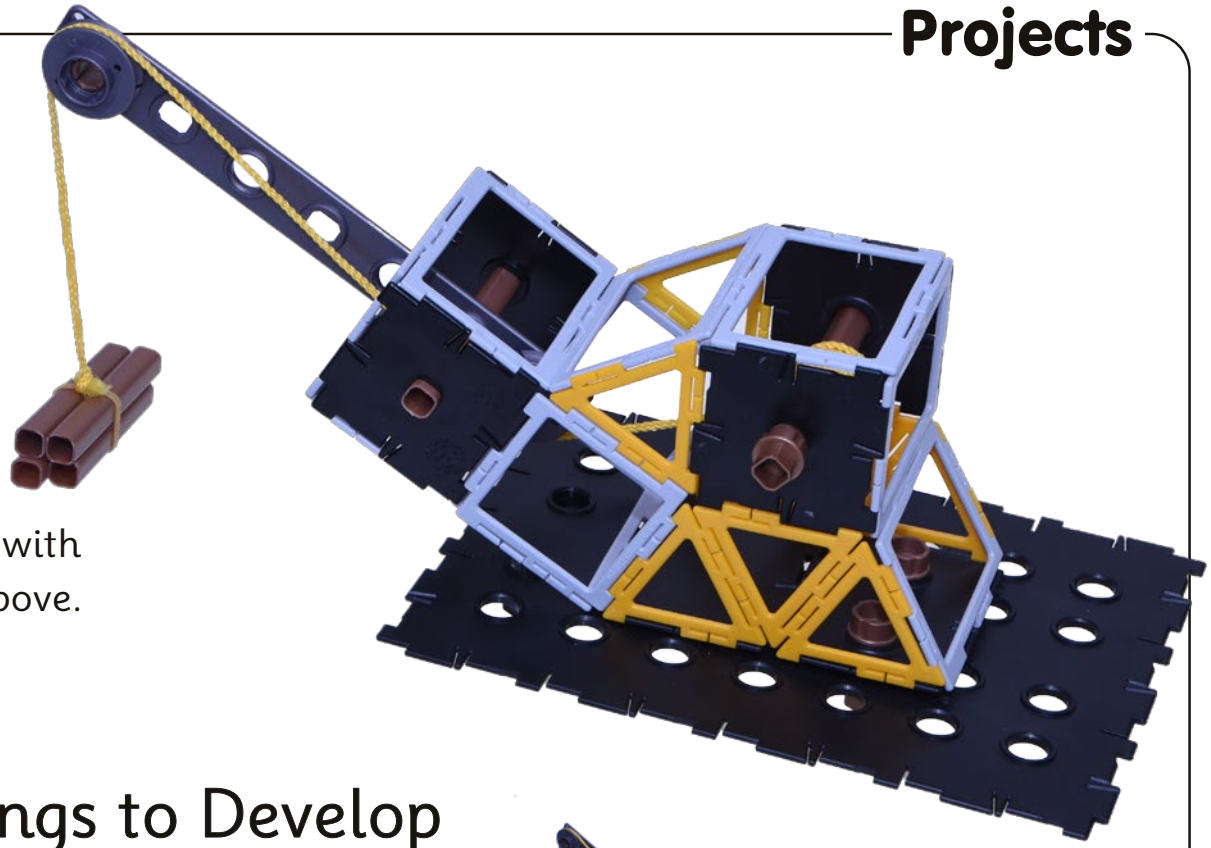
- In this project you will be building a crane on a baseboard.
- Build the frame for your crane as shown in the picture below.
- Notice that the raised holes in the squares and the rectangle face into the frame. This will make it easier to mount on the baseboard.



- The jib of the crane is made from a long linkage with two small pulleys attached with stub axles.

- To connect the jib you will need a 120mm strut.
- You will need another 120mm strut, a connector and a handle for the winding bar.
- Here is a view of the crane with the jib and winding bar in place.

- One way of fitting the crane to the baseboard uses two connectors secured through two small linkages.



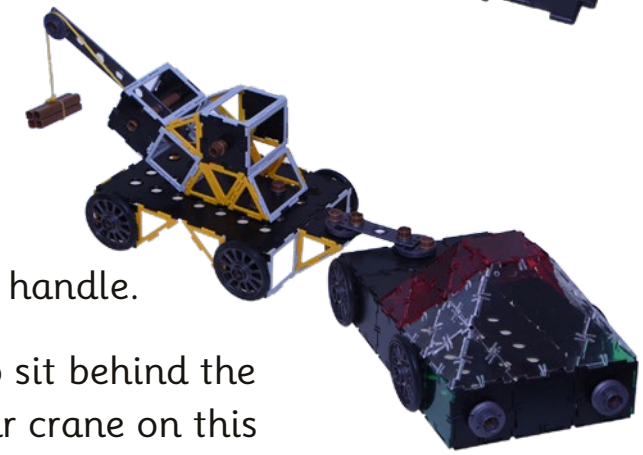
- Notice that you need the small linkages with a square hole in the middle, as shown above.

Things to Develop

1 Extend the crane by adding another linkage.

2 Explore ways to prevent the load from falling when you release the handle.

3 In 'Trucks 2' you make a trailer to sit behind the cab made in 'Trucks 1'. Install your crane on this trailer.



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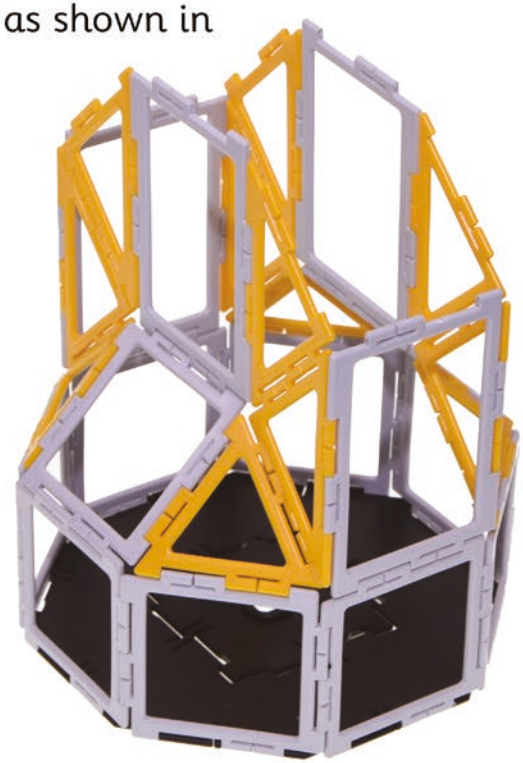
- In this project you will be building a large crane.
- Begin with a base for your crane using an octagon with square in the centre. The square must have a square hole, with the raised edge upwards. This will allow it to turn more easily when mounted on a platform or trailer.

- Build the base for your crane as shown in the two pictures below.



- Add in the jib. You will need two squares with circular holes and four with square holes, some rectangles, together with Frameworks squares and right-angled triangles.

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- To build the winding mechanism for your crane you will a number of parts as shown here.

- In addition, you will need a length of suitable cord.
- The completed crane is shown below.

- The use of cams on the winding handle allows you to add friction to the mechanism. This will keep light loads in place.
- A key aspect of this crane is that it is designed to be extended and developed.

Things to Develop

1 Enlarge the crane by increasing the height.

2 Lengthen the jib by adding sections like those on the right.

To do this, separate the jib just below the central pulley and remove the vertical Frameworks square below it.

3 Lengthen the horizontal sections made from right-angled triangles and rectangles.

4 If the crane becomes very large explore ways to stabilise it.

5 Install the crane on the platform made in Platforms 2, and use reduction gears to allow it to turn slowly.

6 Install the crane on the trailer from Trucks 2.

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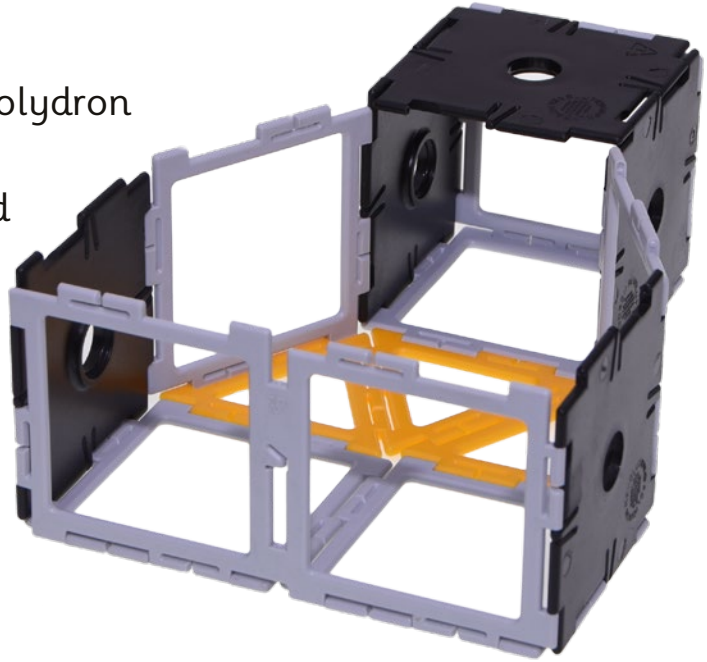
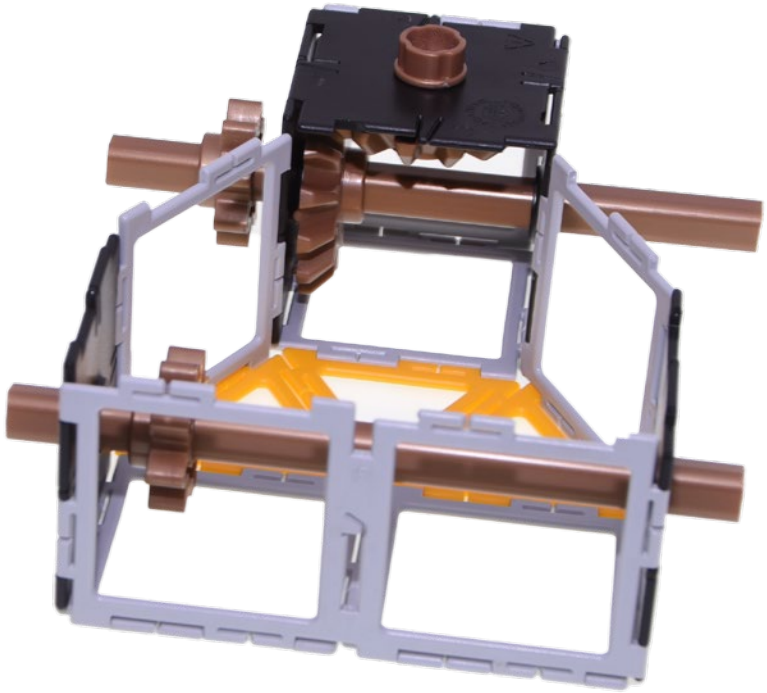
Crazy Copters 1

- In this project you will be building a crazy helicopter.

- You will need to know how to assemble the chain and how bevel gears work, as shown in the Principles activities.
- Construct the frame for your crazy copter as shown below.
- Notice that the Polydron squares all have circular holes and have the raised surface facing inwards.



- Add the bevel gears, small gears and axles. The axles are 180mm struts.
- The bevel gear at the top is held in place by a connector.



- Ensure that the two small gears line up as these will carry a chain.

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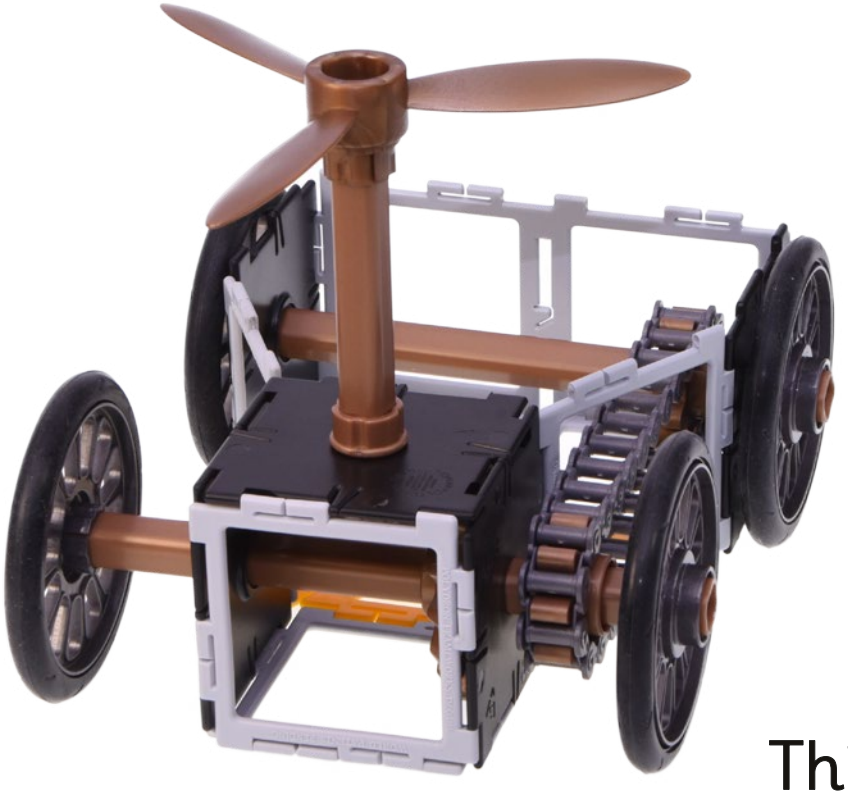
- The chain is now connected to the two small gears and passes through a square. This can be quite tricky to assemble.

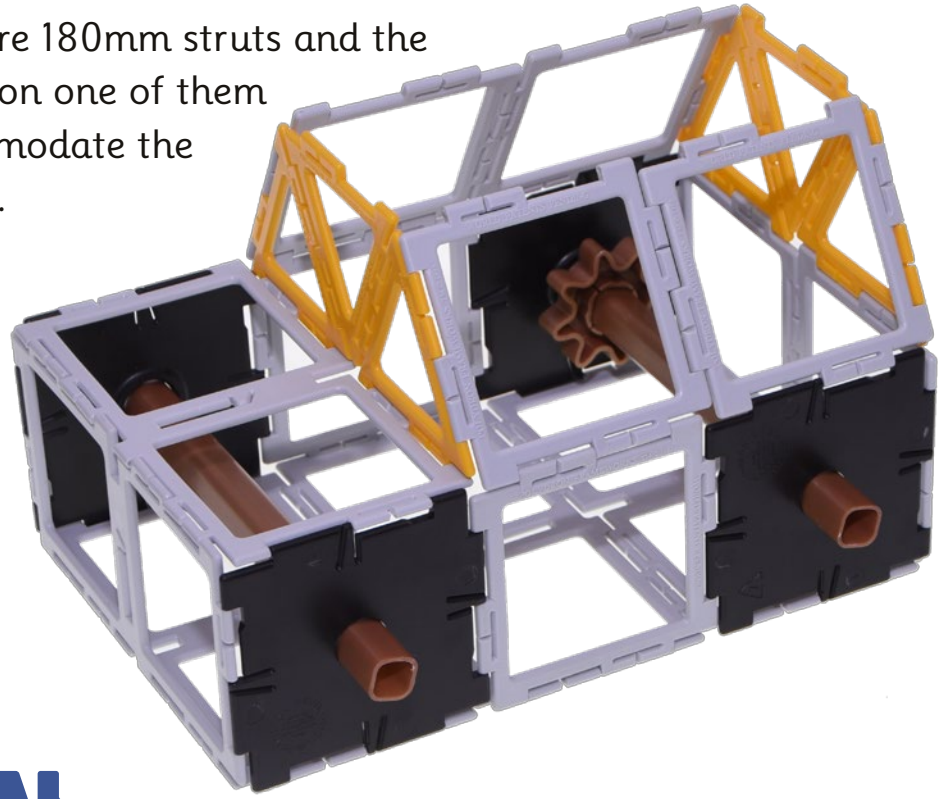


Things to Develop

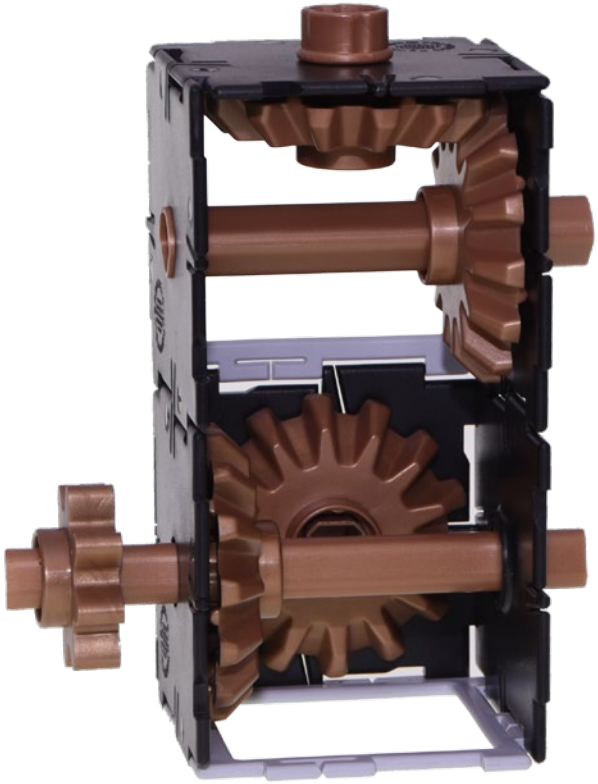
1 Extend your copter by completing and enlarging the open section of the frame.

Crazy Copters 2

- This project extends Crazy Copters 1. It allows you to explore the use of bevel gears and a chain to drive a propeller.
- You need to begin by making the frame below for the crazy copter.
- Notice that the black squares with a circular hole have the raised edge on the inside.
- The axles are 180mm struts and the small gear on one of them will accommodate the drive chain.



- The drive mechanism for the Crazy Copter is quite elaborate and needs some care with assembly.
- Notice that the raised centre of each square is on the inside.
- The view below is from the underside so that you can see all of the parts clearly.



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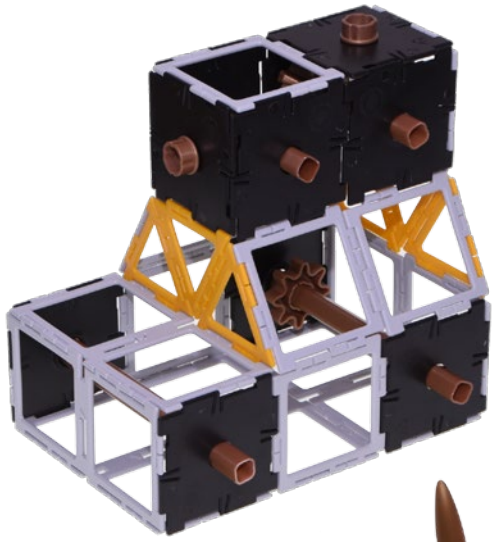
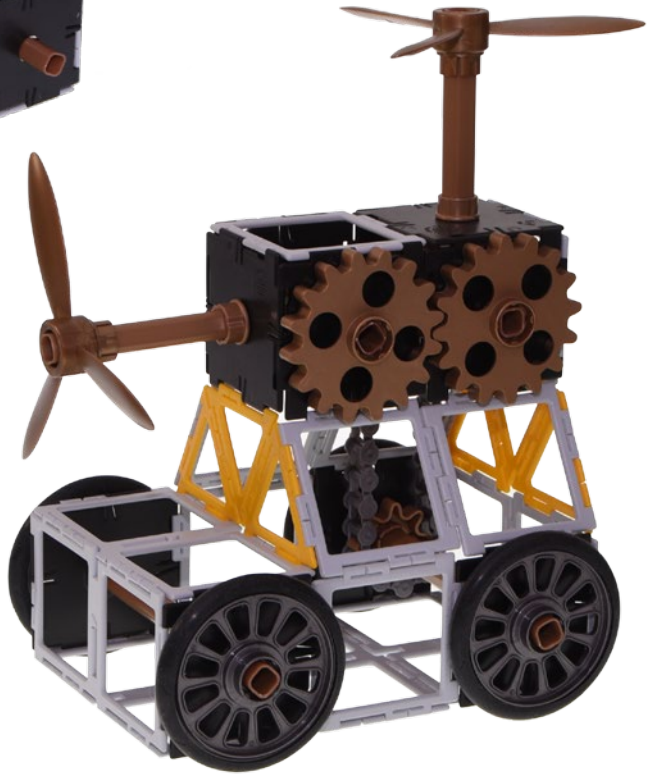
- Here you can see the drive mechanism has been added to the frame.



- Here are two different views of the final Crazy Copter, showing the chain, two drive gears and the propeller shafts.



Things to Develop

1 Replace the two drive gears shown on the left with two small gears and a chain.

2 Make the frame taller, with a longer chain.

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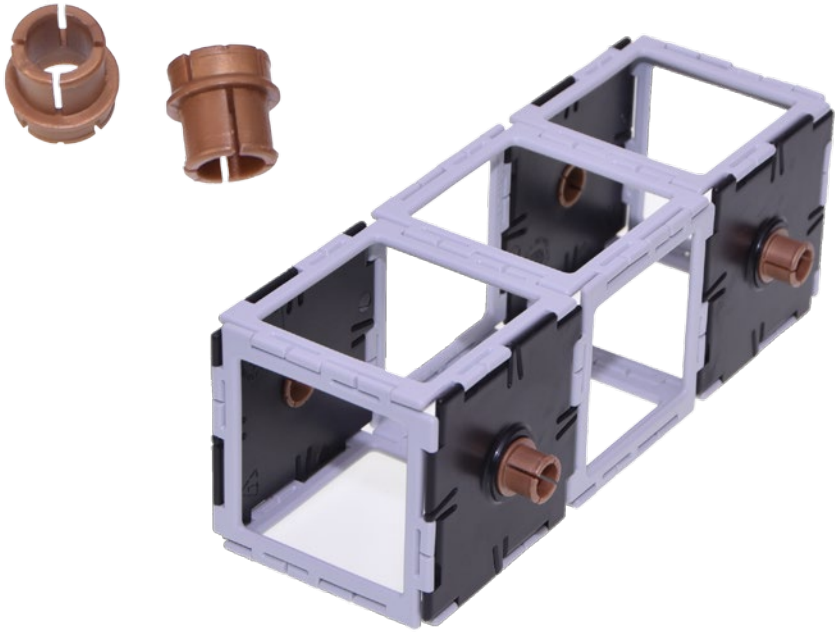
Dragsters 1

- In this project you will build and test a simple dragster.
- You will need access to a slope on which to test your dragster. You will need to raise and lower the slope and to make it safe.
- Make this frame for a simple vehicle.
- You will need squares with round holes and some stub axles.



- Once constructed test the vehicle by letting it run down your slope. Do not push it.
- Mark carefully the starting point and measure how far it travels.
- Record these results so that others can test their vehicle against yours.

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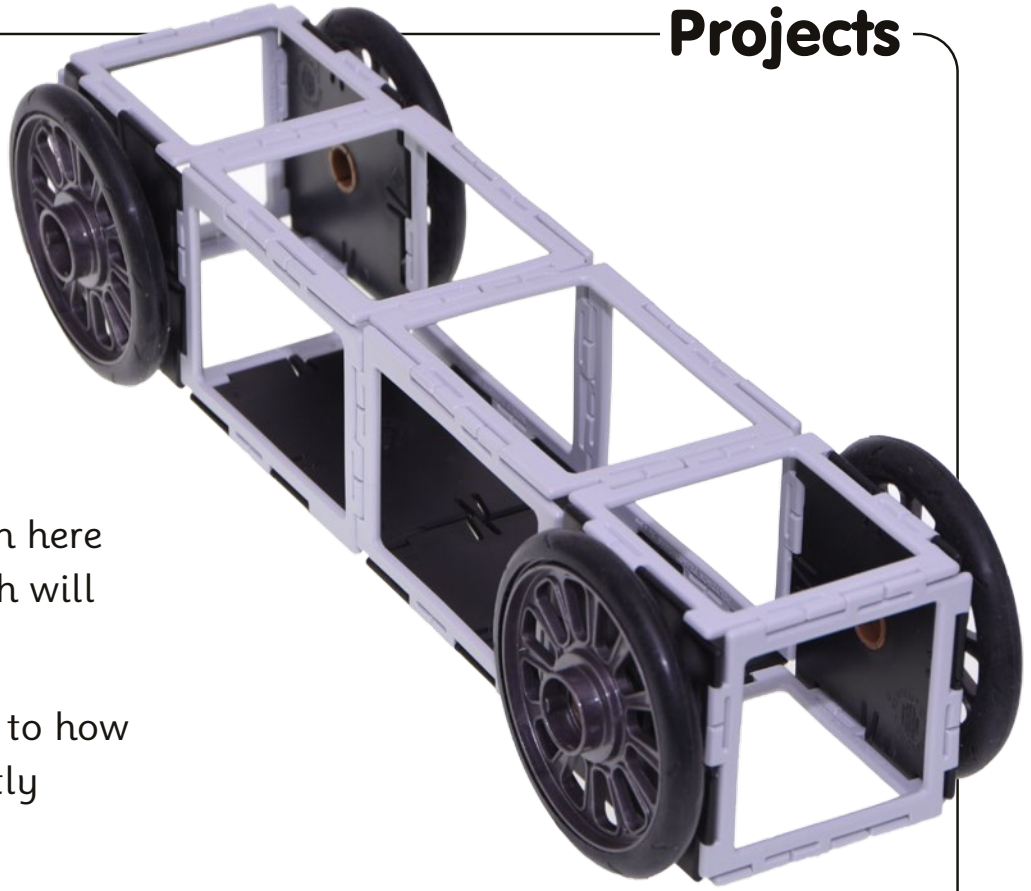
Things to Develop



- The aim is to make the dragster travel further without pushing it. Here are some suggestions.

1 Make the dragster longer. This might make it more stable and let it travel further.

2 Add mass to your dragster. The longer version shown here has suitable black squares between the wheels which will support masses.

3 Does it travel further if it is heavier? Is there a limit to how heavy you can make it before it stops rolling correctly because of friction or structural problems?

4 Add additional wheels. Make it a 'six-wheeler' or double the wheels on the existing stub axles.

5 Use the larger wheels.

6 Does it run further if you use struts for the axles?

7 What happens if you make the dragster wider?

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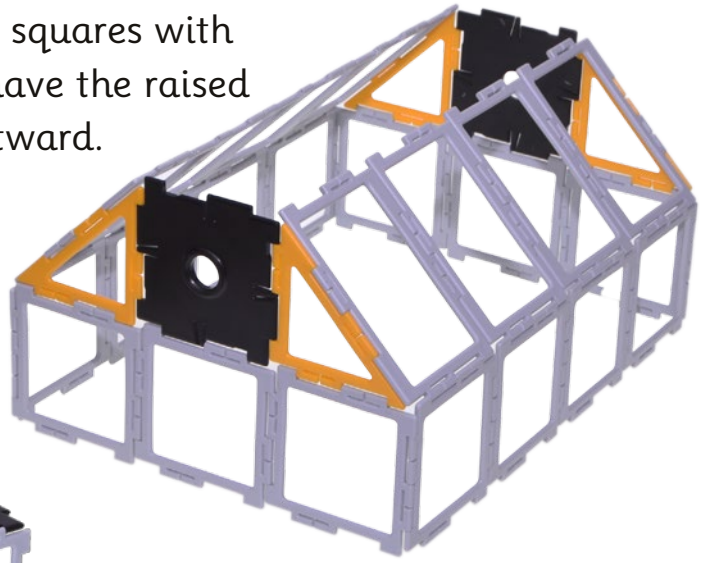
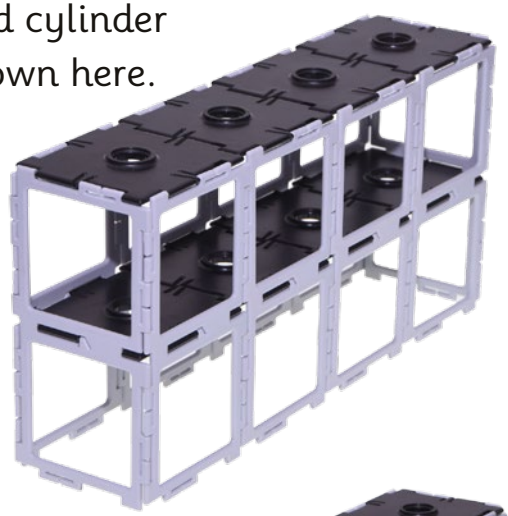
- In this project you will build a model of a four cylinder car engine.
- First begin with a frame as shown below.
- Notice that the squares with circular holes have the raised edge facing outward.

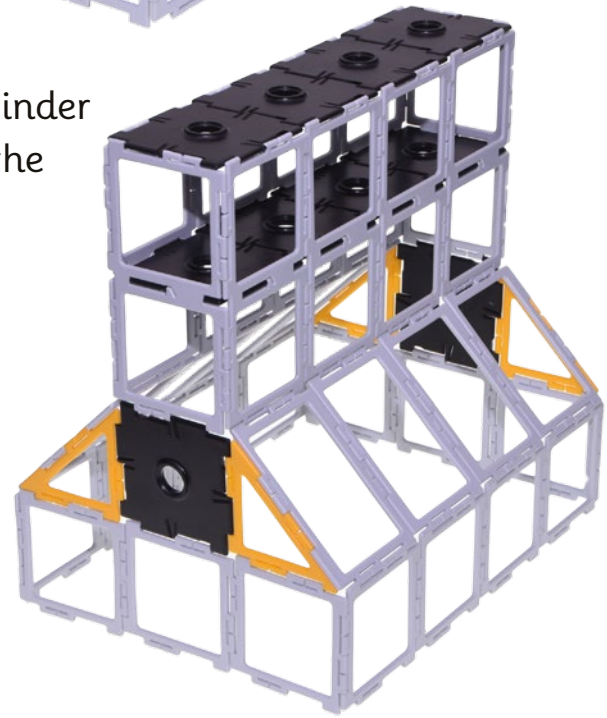


- The cylinders will move inside a frame made from squares with round holes and double squares.
- Take care to arrange the double squares **exactly** as shown in the detail on the left.

- The completed cylinder housing is shown here.



- Join the cylinder housing to the base.



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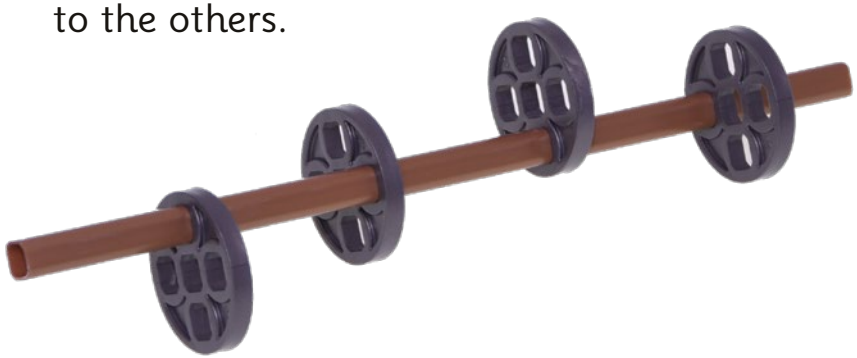
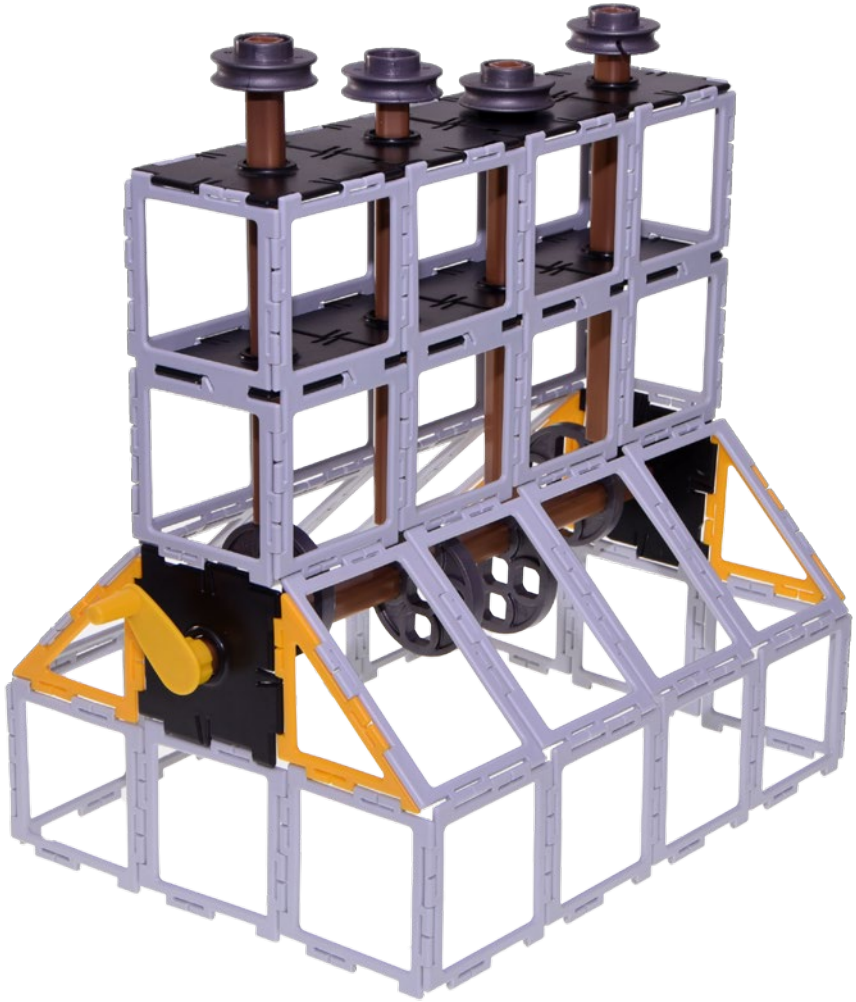
- In an internal combustion engine the pistons move up and down using cams and a cam shaft.
- The camshaft for your engine is shown below. This uses a strut of length 320mm and four cams.
- Notice that each cam is rotated a quarter turn. This will cause each piston to move differently to the others.



- The pistons are made from 180mm struts with a small pulley at the top. You will need four of these.

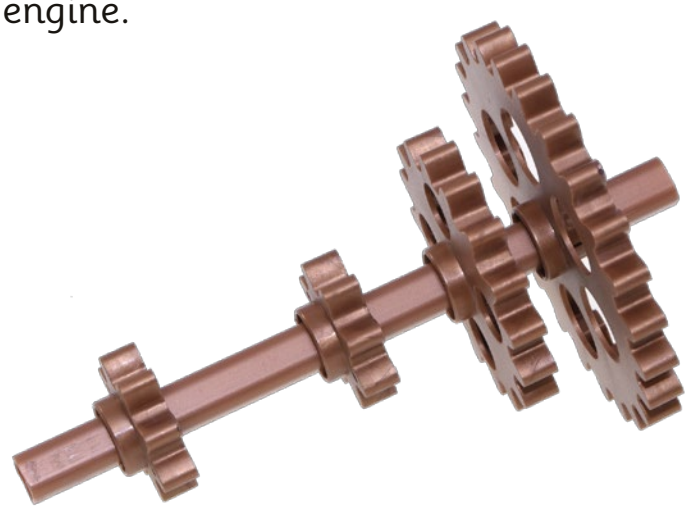
- The completed engine is shown below.
- The cam shaft is held in place by another cam fixed on the far end of the camshaft.



ORIGINAL POLYDRON

Engines 2 - A Gear Box

- In this project you will build a model of a gearbox for a car engine.
- Before you begin make sure that you are familiar with how gears work and with gear ratios. There are Principles activities that explain these things.
- Mount the gears on a strut 180mm long. Try to position them as you see them below.
- This gear shaft is the one that is driven by the engine.



- Now make a second gear shaft, as shown below. For this you need a strut 250mm long.
- Its extra length is needed as it moves back and forth through the gearbox, to change the gears.

- To construct the gearbox itself you need two baseboards and four double squares.
- On one of the baseboards insert a small gear in the hole shown. This is on the side of the board **without** the raised edges.

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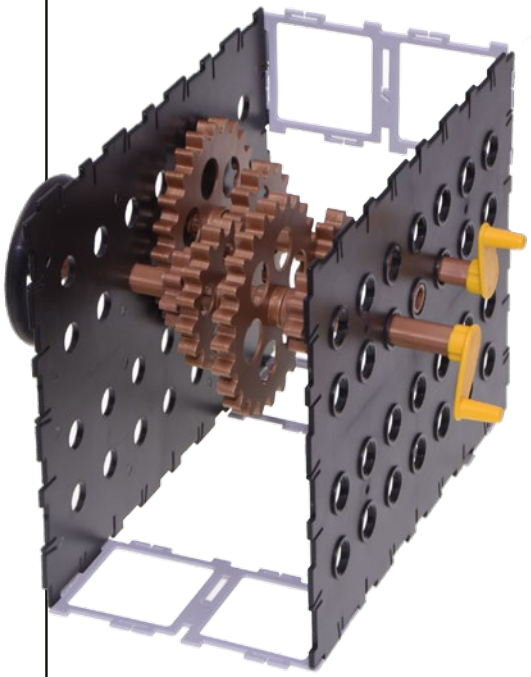
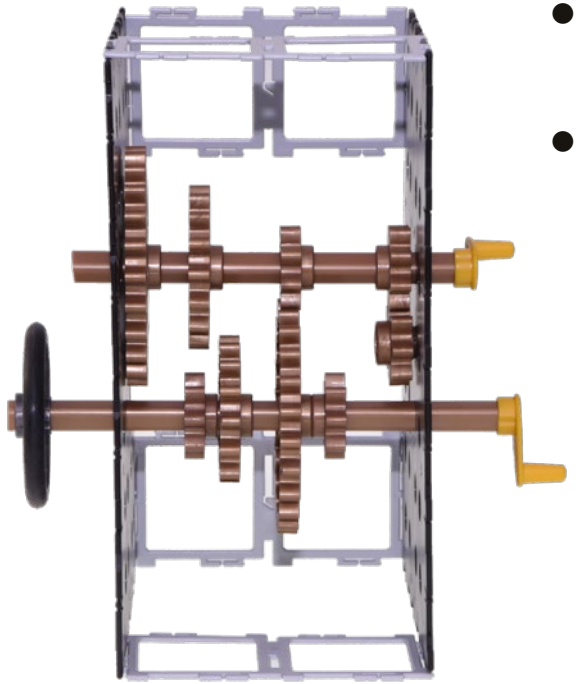
- Complete the assembly of your gearbox.
- The view below left is from a corner showing which holes are used.
- The view on the right is from above.
- To use your gearbox select a gear by pulling and pushing the left handle in and out. Turn the right handle and watch the way that the wheel moves.





- When the handle is fully out you will have selected reverse gear. The small gear attached to the baseboard acts as an idle gear to reverse direction.
- Push the handle in a little and you will have neutral.
- Push it a little further and you have first gear. You may have to wiggle the gears a little to allow them to mesh together.
- Further still selects second and then, finally, third gear.
- Notice how the speed of rotation of the wheel changes as you change gear.

Things to Develop

1 Work out the ratio between one turn of the handle and one turn of the wheel.

2 Consider Project Engines 3, in which you join the gearbox to the engine made in Engines 1.

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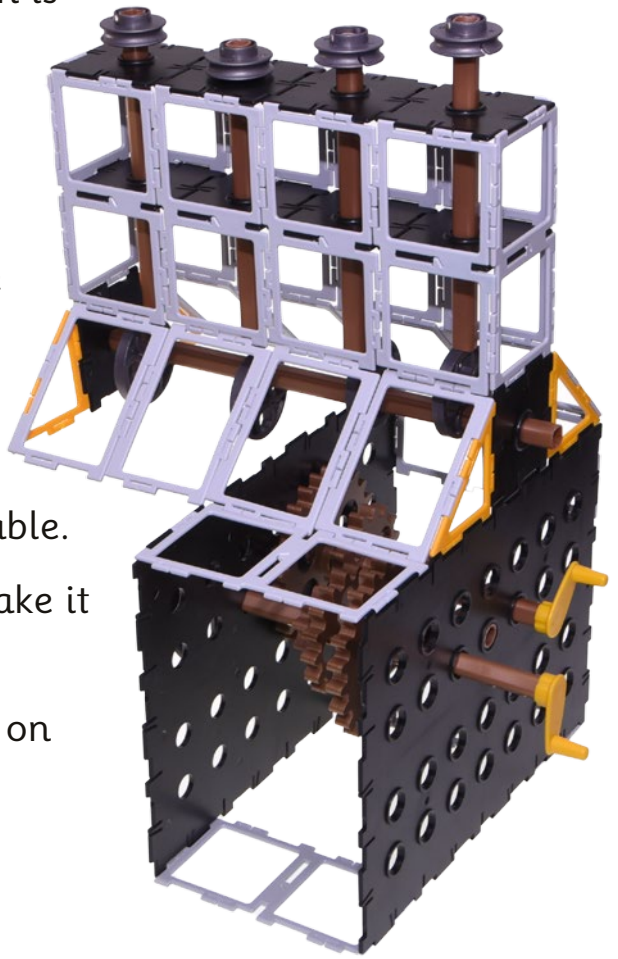
Engines 3 - Engine and Gearbox Combined

- In Engines 1 you made a four cylinder engine.
- In Engines 2 you made a gearbox.
- In this project you will join the engine and gearbox together.
- Take the engine and remove the ring of squares that forms the base.

- The engine is then mounted, as shown, onto the gearbox made in Engines 2.
- Ensure that the strut used to change gears is 250mm as this will become important later when the chain is attached.
- Notice the use of double squares to strengthen the structure.



- This assembly is unstable.
- Try to find ways to make it stable.
- One method is shown on the back of this card.

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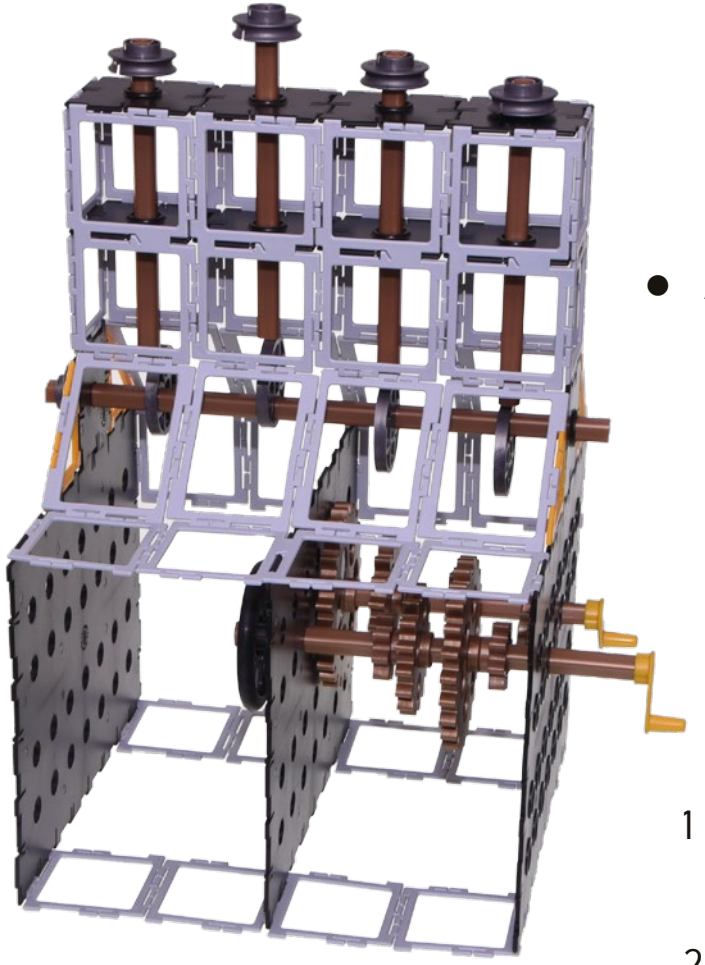
- Here the engine and gearbox have been improved with the addition of a third baseboard.



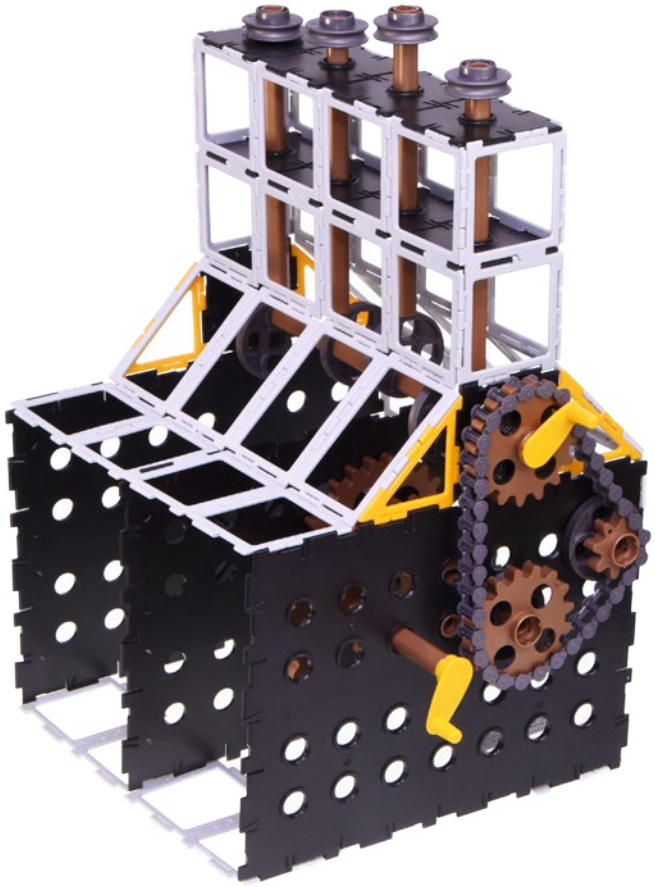
- Adding the third baseboard involves moving the double squares so that they straddle the one in the centre.

Things to Develop

1 Explore different gears for the chain drive.

2 Add more pieces to make your model stronger.

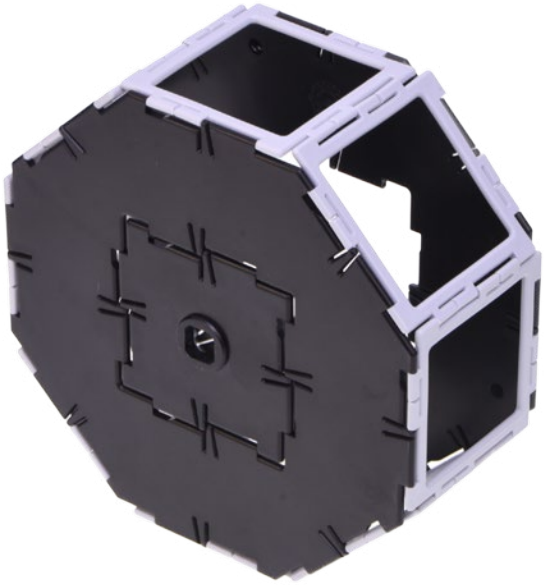
- The final assembly is shown below from the front, with a drive chain and gears linking the engine to the gearbox.
- Notice the use of cams to hold the struts in place so that the chain moves freely.



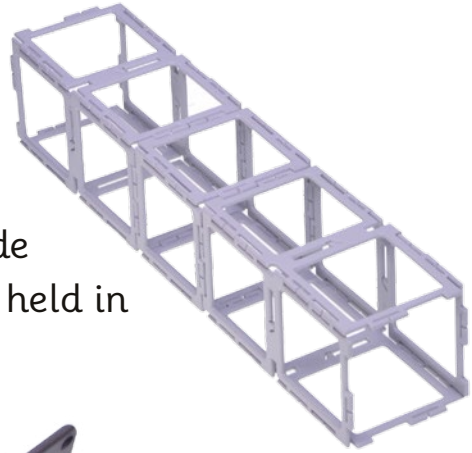
ORIGINAL POLYDRON

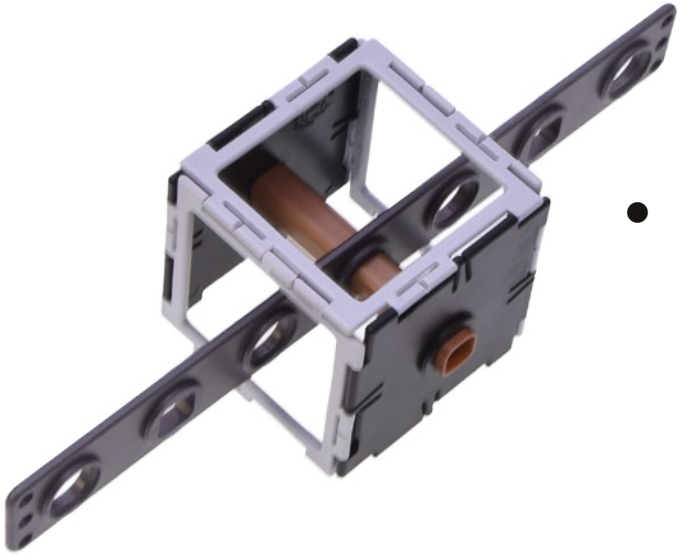
Fairground Spinner

- In this project you will be building a simple fairground ride that spins.
- The intention is to provide you with lots of opportunities to develop it.
- The image below shows the base from below.
- Notice that the square with a square hole has the raised edge outwards. This makes it less stable when mounted on a platform but lower friction makes it easier to spin.



- The fairground ride has a tower that is joined to the base.
- Make the vertical section of your tower from a mixture of squares and double squares, like this one.
- We have made our tower section five squares high.
- The top section of the ride has a horizontal linkage held in place by a cube.





- Notice that the black squares have a square hole to secure the strut in place.

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- The fairground ride has a large linkage hanging down each side secured with a connector.
- You also need two small linkages with circular holes in the centre.

- The assembled ride is shown on the right.
- To make use of your fairground ride you will need to mount it on a platform that rotates.
- The platform made in Bevel Gears 2 will do fine. Platform 1 is better, but more demanding to make.

Things to Develop

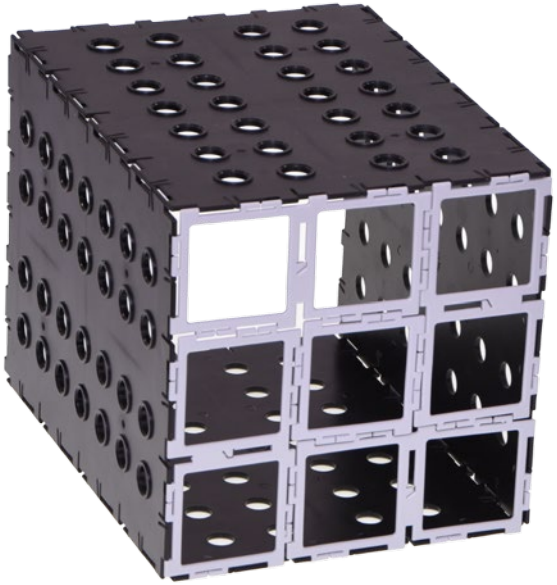
1 Add another rotating section to the top at right angles to the existing one. This will give you four arms that rotate together.

2 Design and create chairs for your ride that can be attached to the end of the large linkage. You could attach them with paper clips.

3 Design a different arrangement for the hanging arms of the ride.

Platforms 1

- In this project you create a base for other platforms in order to make them much taller.
- The platform made in Bevel Gears 2 can be placed on top. Or, for a more demanding project, build Platform 2, from the Advanced Projects.
- To make the other platforms much taller you need four baseboards.
- The image below shows them on their side so that you can see the way they are fitted together, with the raised holes on the outside.
- The bottom of the tower uses four double squares and one single square. You may use nine squares if you wish.



- To use the chain to drive a rotating model we shall need two, 250mm struts passing through the base, as shown.
- There is a cam at the end of each strut to hold it in place. Make sure that the struts can turn freely.
- Gears may be placed on each strut as needed.

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- The use of gears allows us to alter the speed of turning.
- If turning a crane then the speed needs to be reduced.
- The image below shows how the chain is used to drive the platform made in Gears 2.
- This arrangement gives a 3:1 reduction in turning speed.

- If you are turning a fairground ride then no speed reduction is needed, so all three gears could be the same size.
- More significant reductions in speed can be achieved with stacked gears, as shown on the right. Remove the cam before placing the stacked gears.
- Can you see how this produces a 9:1 reduction in the speed of turning?

Things to Develop

1 Explore different arrangements of gears and the chain.

2 Build to Platform 2 and place it on top of Platform 1.

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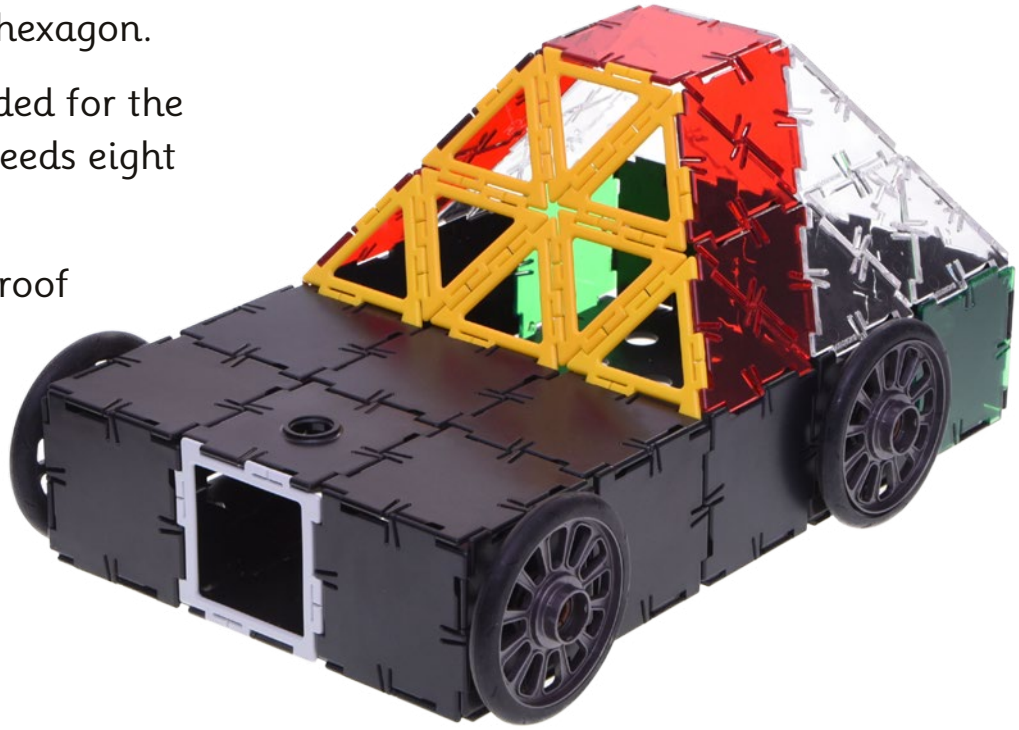
Trucks 1 - The Cab

- You are going to build the cab or tractor unit of a truck.
- The bottom of the cab is made from a baseboard, extended with three squares, as shown on the right.

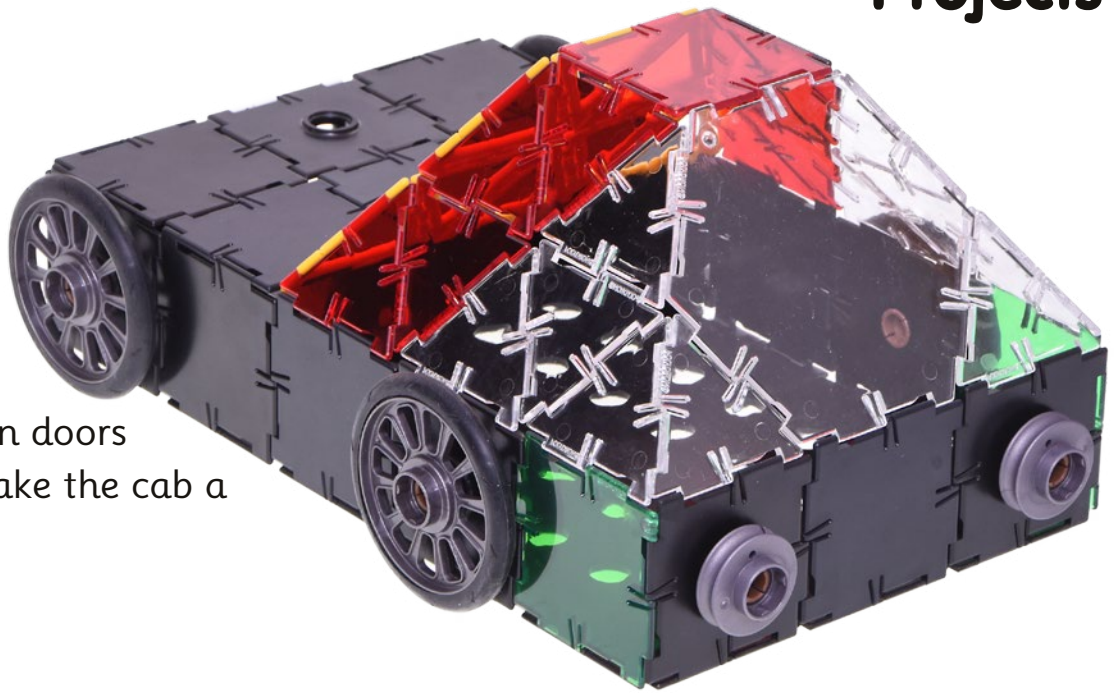
- The raised holes you see here must face downwards.
- The wheels are connected using squares with round holes, and a stub axle.

- You need clear, Crystal Polydron for the windows. This cab needs ten equilateral triangles and one hexagon.
- Two green Crystal Polydron squares are needed for the doors. The remainder of the sides and roof needs eight red equilateral triangles and one red square.
- The use of Frameworks triangles behind the roof allows you to gain access with your fingers to clip the final joints during construction.
- At the rear of the cab you can see a square with a circular hole. This will be used to couple the cab to a trailer.



ORIGINAL POLYDRON

- Two small pulleys are used for the headlights. These are connected with stub axles.



Things to Develop

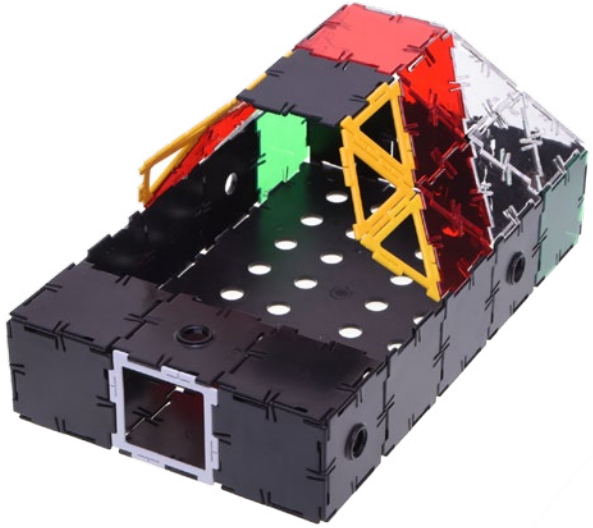
1 Move the front wheels to where the green doors are and insert a third set of wheels to make the cab a 'six-wheeler'.

2 Make the cab even longer or taller.

3 Use 250mm struts for axles to make it stronger.

4 Build a new structure on the back of the cab.

The picture on the right shows a construction under way with the back opened up.



5 If the cab is to be used with a trailer you will need to be careful not to build over the coupling.

Trucks 2 - Build a Trailer

- In this project you will be building a trailer to fit on the back of the cab shown on the right.
- The trailer is built upon a baseboard. Make sure the raised holes are on the top.
- You will need four squares with circular holes and stub axles for the wheels.

- To join the trailer to the cab you will need the linkage shown in the two views below. This linkage uses four connectors and two cams.

- This linkage connects to the trailer through a square with a square hole.
- Notice that two of the connectors are not pushed all the way in. This allows the linkage to operate more efficiently.

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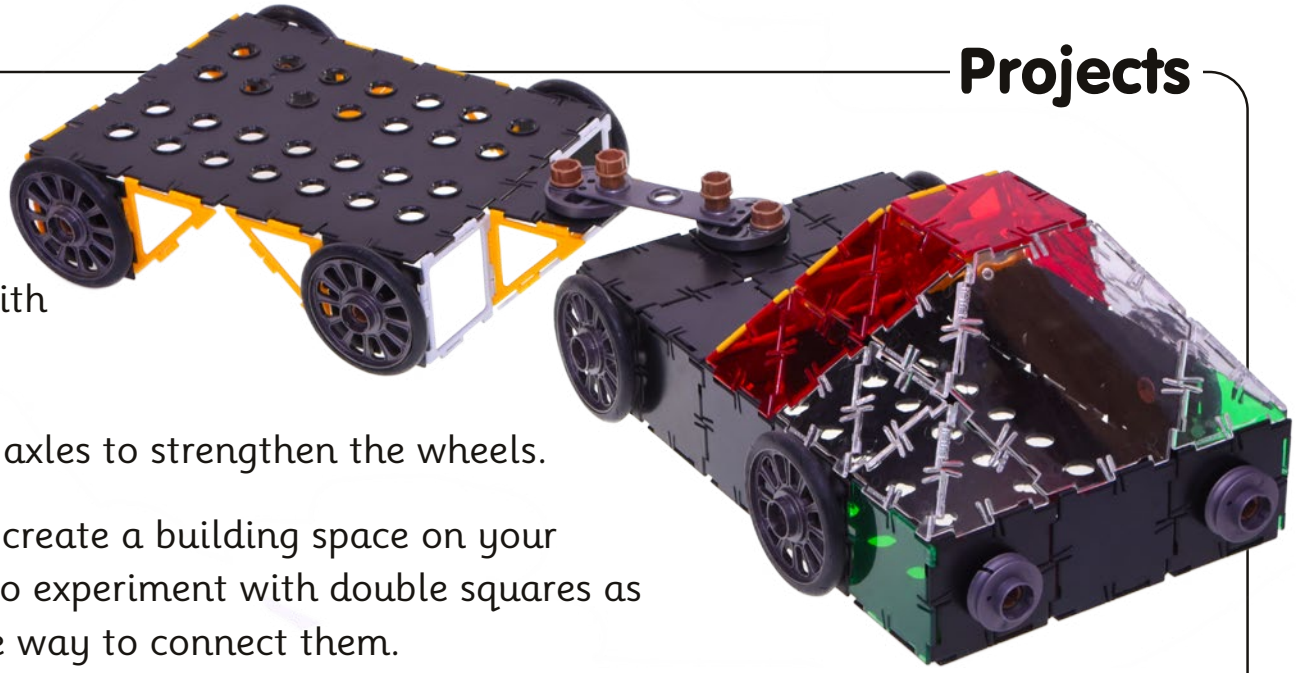
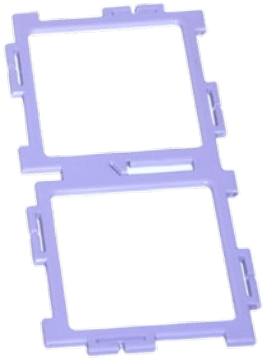
Things to Develop



1 Consider strengthening the trailer with additional pieces around the edge.



2 Use 250mm struts for axles to strengthen the wheels.

3 Use double squares to create a building space on your trailer. You will need to experiment with double squares as there is more than one way to connect them.

4 Modify the trailer with another baseboard. The image below shows the construction under way. Some double squares have been added to this one so that you can see how they work.

5 Try building both trailers and decide which one is the stronger or most useful.

6 Design a better linkage between cab and trailer.

7 Use the trailer as a platform for other projects. For example, Cranes 1 is built upon a baseboard and would look very good on the back of a trailer.

ORIGINAL POLYDRON

Weighing Machines 1

- In this project you will build a machine to measure mass – a weighing machine.
- Your machine will be based upon the principles of rubber bands to support the mass and levers to change the sensitivity or the range of things to be weighed.
- Begin by creating this base for your machine.
- Notice that the squares with a square hole have the raised edge facing outwards.

- The square cutouts in the octagons will accommodate two of these support towers.
- The three black squares shown have circular holes and the raised edge facing outwards.

- Between the two towers will sit this rotational joint.
- Notice that this joint has four squares with square holes, and two Frameworks squares.

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- There are several parts needed. The struts are of length 120mm, 250mm, and 320mm.

- The linkage has a square hole in the middle.
- The bucket can be any small container.
- Here is one made from two Polydron squares and eight right-angled triangles.

- Below you can see how the struts are fitted into the rotational joint.

- Here are two views of the finished weighing machine.
- Notice below how the elastic bands are looped through the linkage and then over the connectors at the bottom.

Things to Develop

1 Find ways to measure the mass of various objects. One method is to record the height of the bucket with a ruler.

You will first need to calibrate your weighing machine with known masses.

2 Weighing Machines 2 explores ways to improve the use and accuracy of this machine.

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Weighing Machines 2

Advanced Projects

- In this project you will explore ways to calibrate and use the weighing machine made in Weighing Machines 1.
- First, we shall decide if the overall range for your machine is what we need.
- Place a 100g mass in the bucket and see how far it goes down. If it just touches the table or gets close to it, the range of masses we could measure will be 0g to 100g.
- To increase the range move the cam closer to the joint. To decrease the range or make it more sensitive, move it closer to the end.
- A simple way to calibrate the weighing machine is to stick a long thin strip of paper to a metre stick.
- Using known masses of 10g, 20g, etc mark the height of the bucket on the strip.
- Measure an unknown mass and record the result. Check how accurate this is by weighing the mass on another machine.
- The next method of measuring involves a circular scale and gears to amplify movement.
- In the image on the right, you will notice that one side of the horizontal support strut passes right through a square with a circular hole, to the outside of the machine.

- Place a large gear on this strut.
- Replace the square below this gear with another square with a circular hole.
- Insert two small gears and a stub axle.
- Squash the end of a short paper drinking straw and insert between the two small gears, as shown.
- This will be the pointer for your scale.

ORIGINAL POLYDRON

- Trim an A4 sheet of paper along its long edge so that it is approximately 150mm wide.
- Draw a semi circular arc on the paper and fix it in position, as shown below.

- As before, calibrate your machine by placing known masses in the bucket and marking the paper accordingly.
- Weigh a variety of objects and check how accurate your weighing machine is.
- Decide if you can add marks regularly around the edge of the arc.

- Another way to improve your weighing machine is to use an LED pen.
- The one on the right is low power and charges from a USB port.
- It can be used to amplify the movement by shining a dot on the wall some distance away.

- Here it can be seen fixed to the top with two short rubber bands.
- This machine will be very sensitive but will be more demanding to calibrate and use.

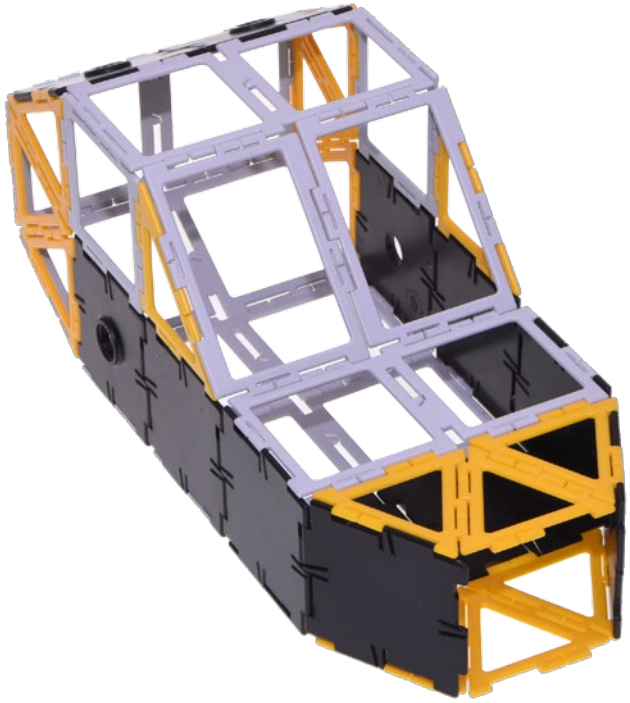
Things to Develop

1 Explore ways to increase the sensitivity and the accuracy of your weighing machine.

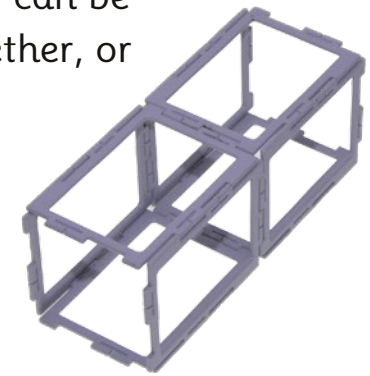
ORIGINAL POLYDRON

- In this project you will be building and testing a large dragster that stores its propulsion in a stretched elastic band.
- Apart from the STEM Polydron set you will need some paper clips and an assortment of elastic bands.
- The frame of the dragster is in three parts. The front section is shown below. Notice that the squares have two sorts of hole. The circular ones are for the wheels and the square ones are to hold a strut.

- The rear section is shown below.



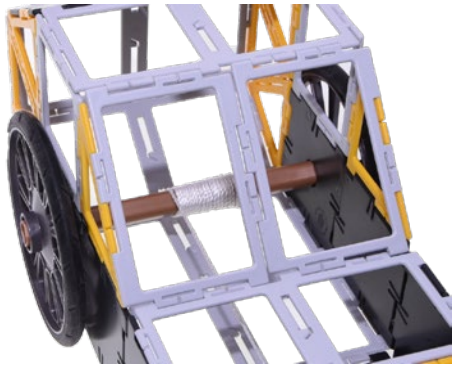
- The central section of the dragster can be varied. You can leave it out altogether, or make it longer.
- Here we have used rectangles to make a frame.



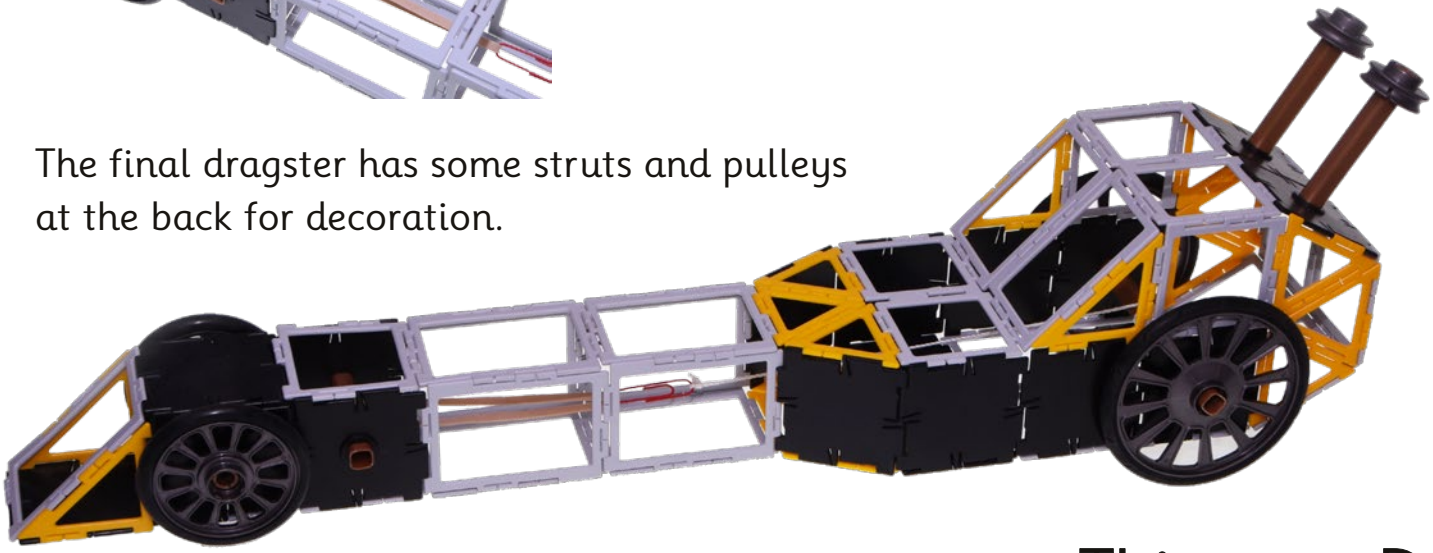
ORIGINAL POLYDRON

- The elastic band passes over the strut at the front.

- You need a 180mm strut for the back axle.
- Tie the string to this axle but allow it to turn freely once the propulsion is used up.



- The final dragster has some struts and pulleys at the back for decoration.



- To use the dragster, pull it backwards until the elastic band is taught and then let it go.
- You will need to pay attention to the way the cord is fixed to the axle.

Things to Develop

1. Make your dragster longer.
2. Try increasing the strength of the elastic bands.
3. Make the back wheels into doubles.

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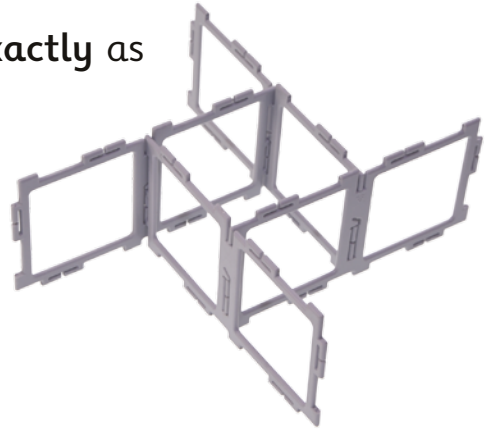
Platforms 2

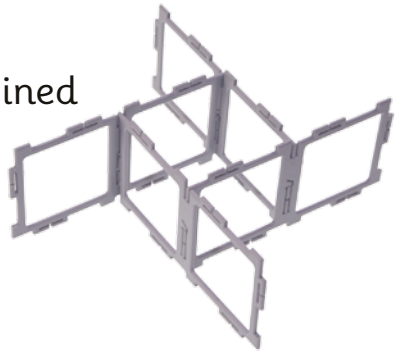
Advanced Projects

- In this project you will build a platform and a drive mechanism to support rotating structures, such as cranes and fairground rides.
- This is a very demanding construction. You need to be familiar with bevel gears and with double squares, before you begin.
- Begin by making this housing for the bevel gears.

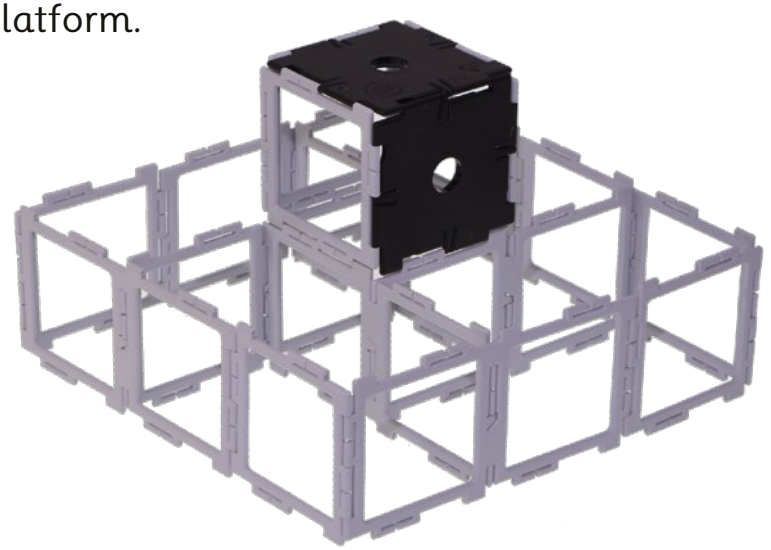
- The housing is supported by four double squares.
- They must be joined **exactly** as they are in the photo.



- Join the housing to the support.
- Now make make four strips using a double square and a single square.
- Your strips must be joined **exactly** like these.

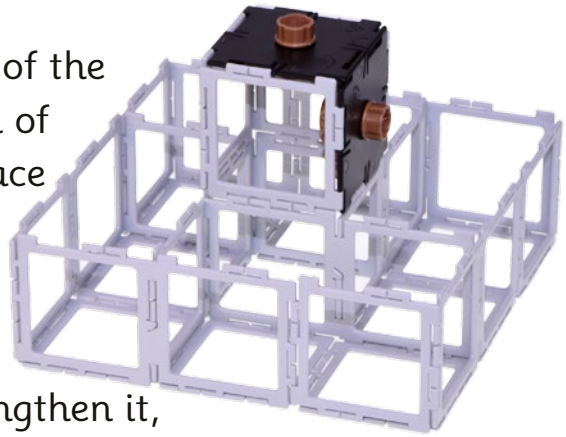


- Join your four strips around the edge of this support to complete the first half of your platform.



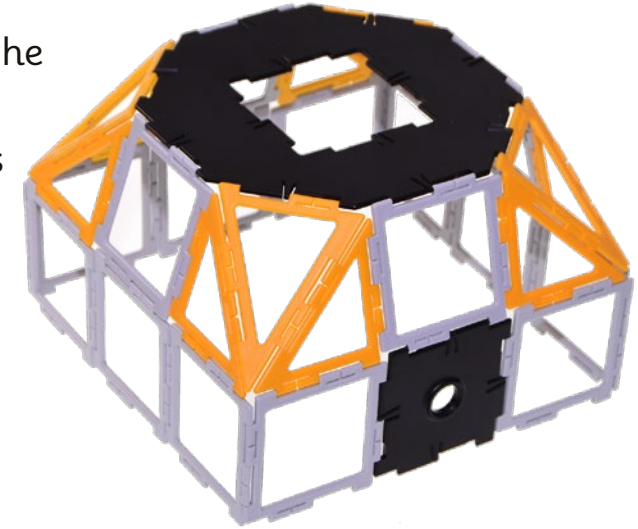
ORIGINAL POLYDRON

- Here you can see the base of the platform with the addition of the bevel gears, held in place by connectors.

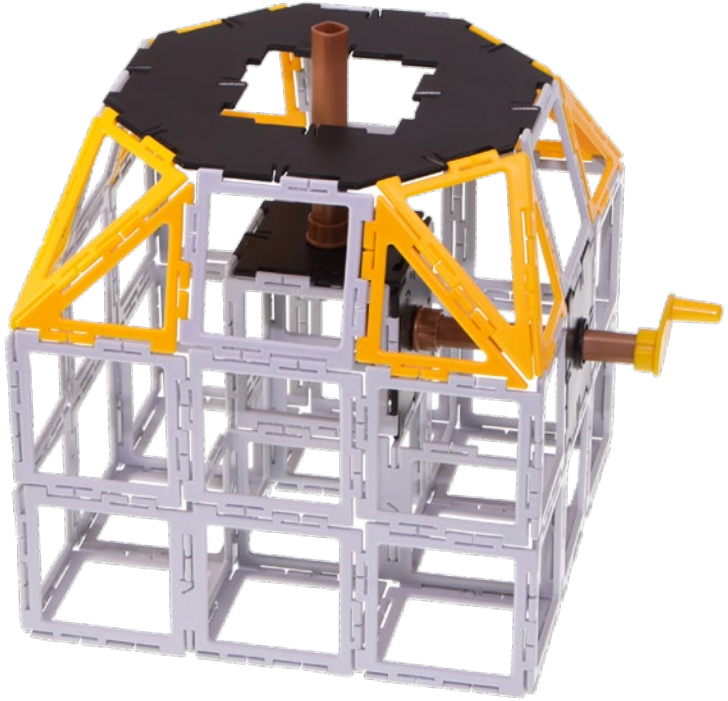


- We have also added more double squares to the bottom of the base to strengthen it, but you can leave these out if you like.

- The top section of the platform is more straightforward.
- Make sure that the square with a circular hole has the raised edge facing outward.



- The finished platform is very stable and can now be used to turn your own models.



Things to Develop

1 Build a model to sit on the platform and turn. The Fairground Spinner is one example.

The base of your model needs an octagon and a square with a square cut-out in the centre.

ORIGINAL POLYDRON