

## Section 1

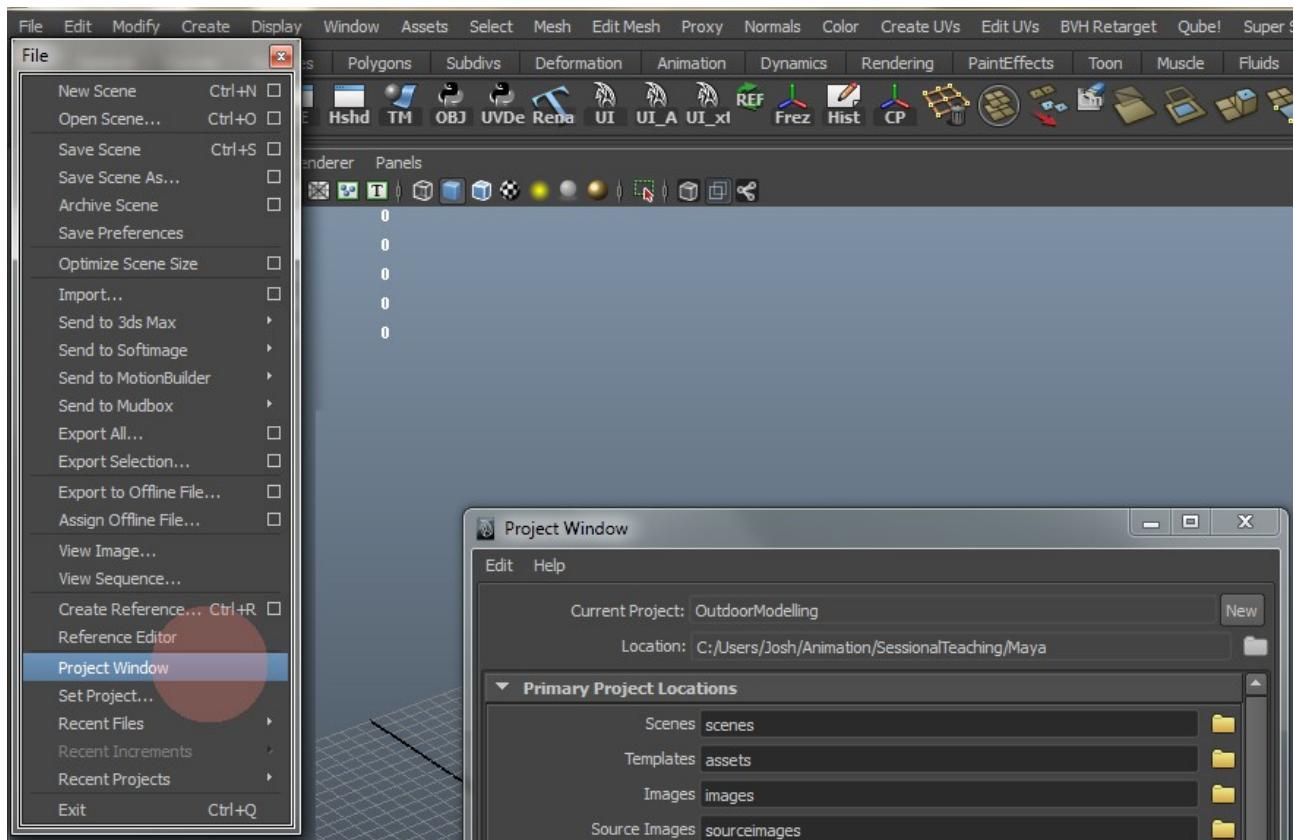
### Creating a New Project.

To keep Maya Projects separate and assets in a clean and orderly manner we need to set up a new Project. Within these projects (which creates a new file directory) files are stored that are related to it.

To make a new project go to **File > Project Window**

Choose to make a New Current Project, and type in a name for the project. Then change the directory address below to somewhere on your hard drive that you can access easily.

(*Tip:* It's a good idea to either create a new folder called 'Maya Projects' in your documents folder or to create a new folder next to your documents folder called 'Animation'.)



Click accept, and your new project is now created AND set. Choose to save the scene (**File > Save as**) and name your file “WheelieBin01”

Copy the image “Bin\_Ortho.jpg” to sourceimages folder in the new project directory.

### Setting a Project.

To set your project correctly, so that the relevant files are being read, go to File > Set Project and navigate to the 'root' folder of your project. This is folder that holds scenes, sourceimages, images etc. You could also use File > Recent Projects and select from the list.

Setting a project (or creating a new one) is a vital step before working in maya, as while working you are actually creating and reading files. Your default saves and image loads will work properly when the project is set.

### Making a Custom Image Plane.

To start modelling from an orthographic reference, we are going to create three planes with the image (reference) of the model we want to create.

First we need a plane. Go to **Create > Polygon Primitives > Plane**  
A plane should appear in the centre (0,0,0) position in the viewport.

If your plane is not shaded (grey) then press '5'. (4 reverts to wireframe)

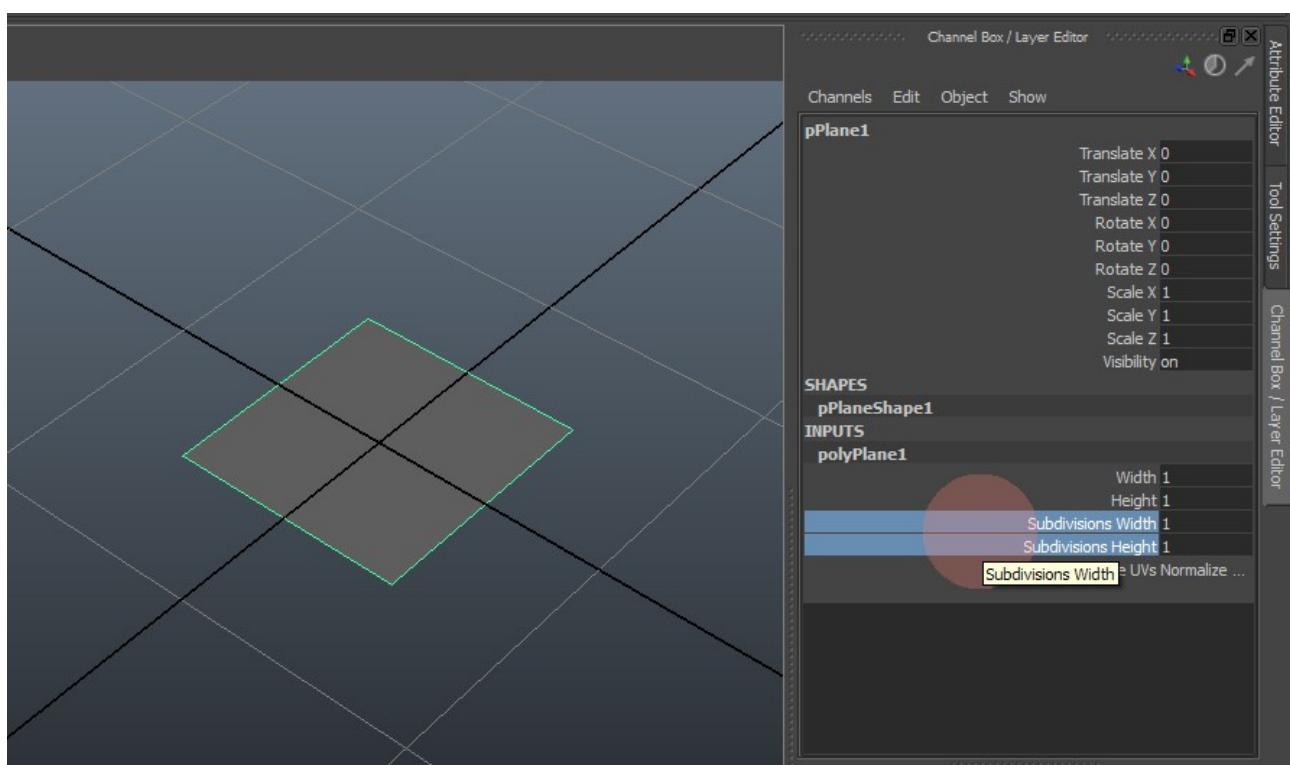
(*Help! Nothing happened!* - If your plane did not appear you may have Interactive Creation on. To turn this off go to **Create > Polygon Primitives > Interactive Creation** to turn the tick **OFF**)

Our plane has lots of polygons as default, which we don't need to use. To reduce them we're going to use the Channel Box. Click on **polyPlane1** to open up the history.

(Each primitive has history options to change them before we begin to use other tools. It is always worth checking these before starting)

Subdivision width and height alter the amount of polygon data we have when we create the plane. We want each to be '1'.

(*Tip:* You can either type '1' into each box, or you can left click and drag over the two NAMES of the history and middle-mouse-drag in the viewport to change them interactively.)

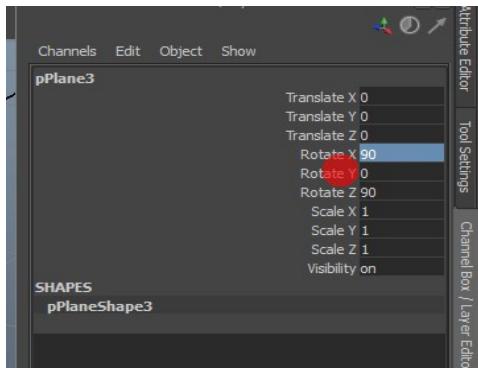


Now we need to position them. Our standard tools to transform objects are **Move (w)** **Rotate (e)** and **Scale (r)**, but before we do this we're going to duplicate the plane.

Go to **Edit > Duplicate (Ctrl+D)**. Now move it down underneath the grid.

**Mac Users – Substitute Ctrl with Cmd, so Cmd+D.**

Select the plane at the grid and open the Channel Box. Above the history is a list of the objects translations. We're going to type '**'90'** into **Rotate Z**. This flips the plane up vertically.



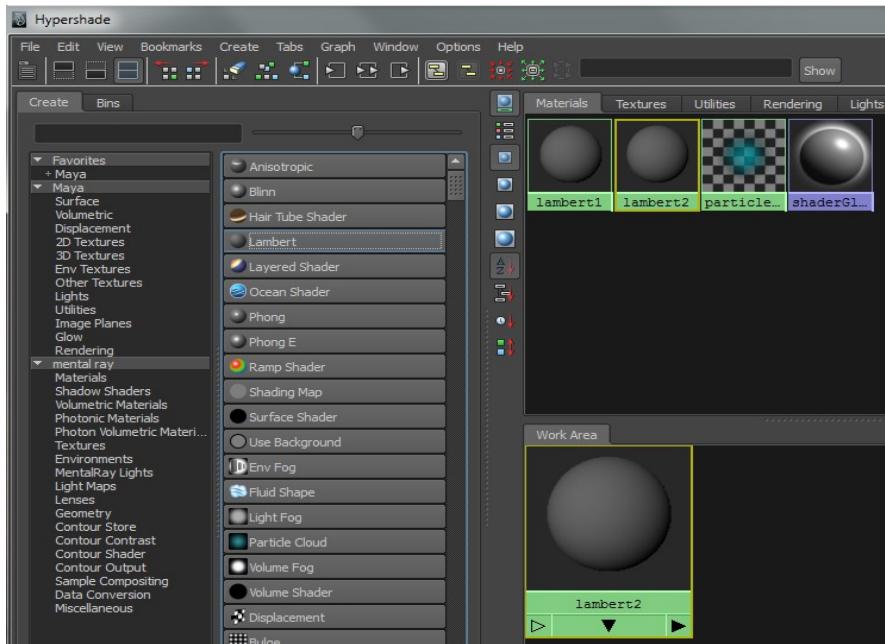
Duplicate the vertical plane. Either type '**'90'**' into **Rotate X** or, while using the rotate tool hold down '**'e'**' and click and hold on the plane. An option box will appear. Select '**Discrete Rotate**' toggle. Now, when using the rotate tool it will snap at intervals.

Select all three planes and type '**'12'** for **Scale X**, '**'1'** for **Scale Y** and '**'15'** for **Scale Z**.

Move the vertical planes out beyond the grid.

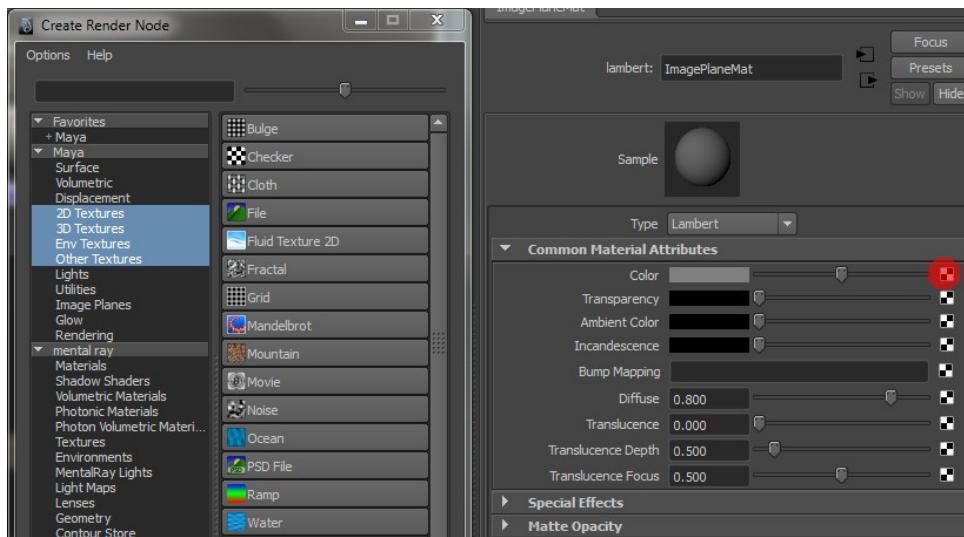
Open up the Hypershade. Go to **Window > Rendering Editors > Hypershade**.

This is the material editor. Create a new Lambert material.



The properties of the material (while it is selected) show in the Attribute Editor.

Change its name to 'ImagePlaneMat'. Then click the chequered box for 'color' and choose 'file' from the list.



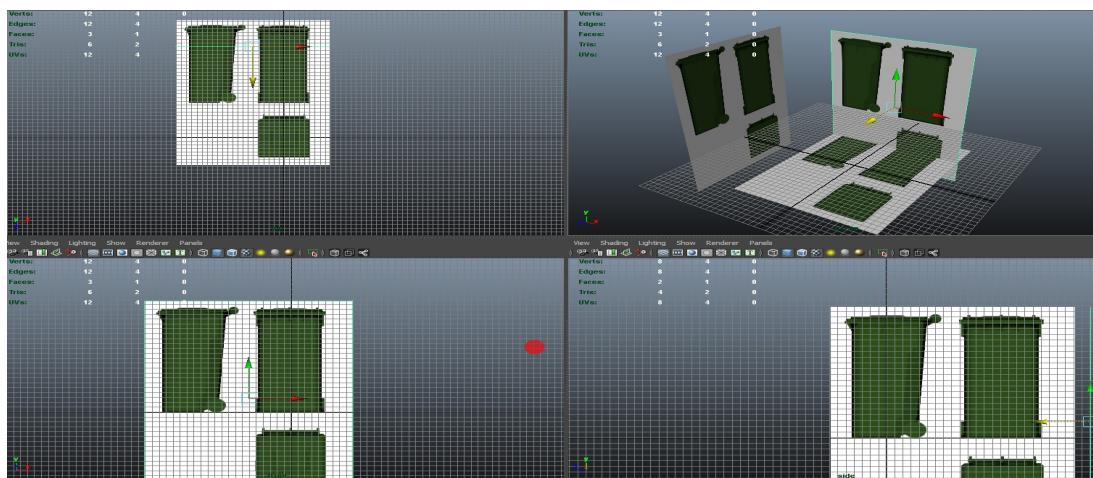
Click on the black arrow, where the chequered box was, to navigate to the image node.



Click the folder. This should open *sourceimages*, and show “*Bin\_Ortho.jpg*”. Choose that image. From the Hypershade window, middle-mouse-drag the new material onto the planes.

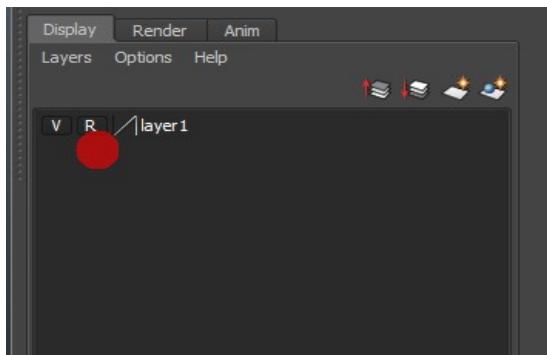
Press '6', or click the chequered ball in the viewport, to display textures in the viewport.

Using the move tool, and 'space' to use front/side/top viewports, position the planes to the centre of the grid. Pressing the **space** button in the viewport will show 4 viewports. Hovering the mouse over one and pressing space again will maximise it.



Now we want to make sure we don't accidentally select them while modelling. We are going to place them in a layer. Open the Channel Box. At the bottom is the **Layer Editor**. Select all three planes and click on the '**Create new layer and assign objects**' button (blue ball and star on paper) This automatically places the objects selected inside the layer.

Click on the box next to 'V' to change their mode to Reference (R).



### Creating a new Shelf and Shelf Buttons

We are going to make a new shelf and add buttons to them as we go along the tutorial. To do this we first need a new shelf.

Click on the **little arrow** on the far left of the shelf and choose **New Shelf**.

Call this shelf '*CustomModelling*'.

Go to **Create > Polygon Primitives** > though before clicking on 'Cube' hold **Ctrl+Shift**, then click. This adds the 'Create Cube' button to the shelf.

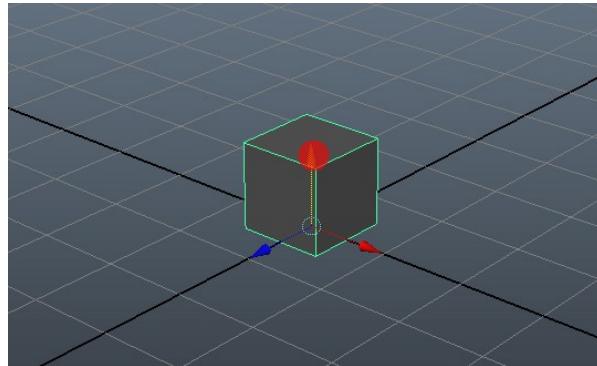
Now test out the new button. Click it once. A new polygon cube should appear in the viewport. Throughout the tutorial you will be reminded to add frequently used tools to the shelf. This speeds up the modelling process.

## Section 2

### Modelling the Bin – Body/Base

When creating a new primitive the pivot point, the location of where the transform tools are, is always centred to the model. What we want to do is move this cube on to the grid, and snap it to that position.

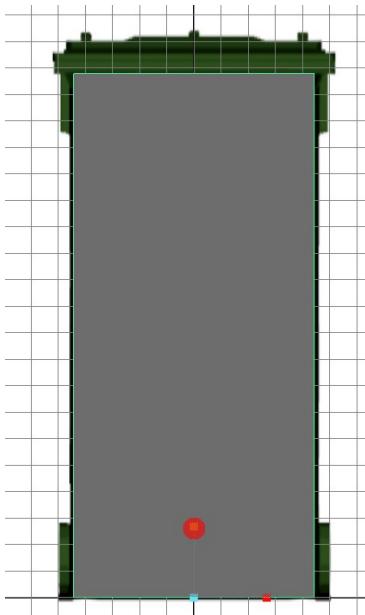
So to move the pivot we can hold 'd' and the transform changes. We can hold 'v' at the same time, and drag it only in the 'y' direction (green) to snap the pivot point to the lower vertices of the cube.



Next we will hold 'x' to move the box while snapping to the grid.

(*Help! My cube won't snap!* - Make sure you are looking at the top of the grid to snap to it, orbit the camera into a new position and try again. Also make sure you're not holding 'd', this only moves the pivot point.)

Using scale (r) and viewing from the front view, scale out the box to match the image.



(you may have to press '6' to see the textures in each viewport)

Now change to the side view and scale it to fit the top right of the image (the back of the bin).

Select modes:

So far we've been only in 'object mode', moving the object as a whole.

Buttons at the top change the select modes. These are 'Object mode', 'Vertex', 'UV', 'Edge', 'Face' etc.

I suggest using shortcuts to switch between these.

### **Object Mode – F8**

### **Vertex – F9**

### **Edge – F10**

### **Faces – F11**

### **UVs – F12**

We're going to start changing the shape of the cube using its vertices.

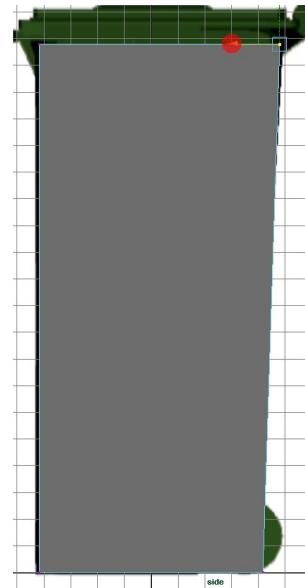
Select the cube and **press F9**.

Still in the side viewport select the top right vertices by dragging. This should select two vertices.

Move them back matching the image. Move them only using the Z axis.

Next select those directly underneath and move those to the base of the wheel, again using the Z axis.

Check the model in the perspective viewport.



We're going to use our first tool to add an Edge Loop around the base of the bin.

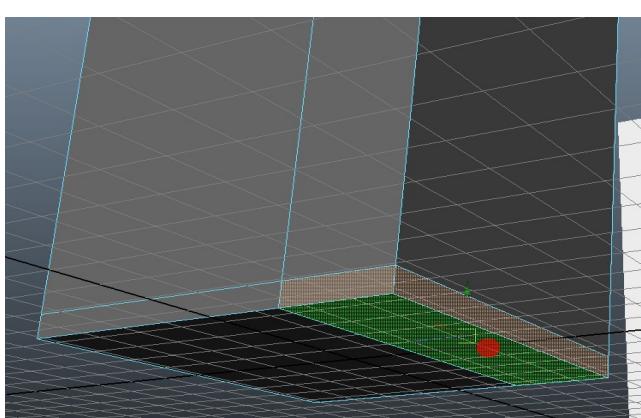
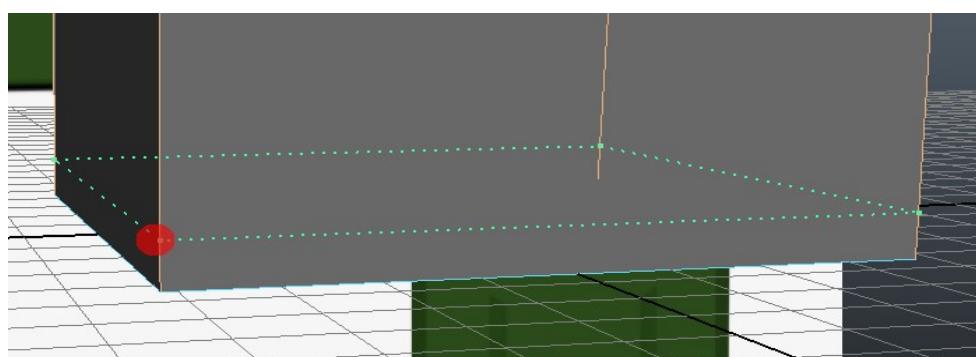
Go to **Mesh Tools > Insert Edge Loop Tool**. (*Add this to the shelf!*)

Open the Tool Settings menu and drag it to the right with the Attribute Editor and Channel Box.  
(Display > UI Elements > Tool Settings)

This should display the settings for all of the tools you use.

Make sure '**relative**' is checked **ON**.

With the tool still selected, click on the lower middle of the cube. This creates a new edge all the way around the cube.



Create another vertically that matches the 'notch' in the reference image.

Now go to face select mode (**F11**). Select the new lower faces at the back of the cube and delete them (**Backspace** or **Del**).

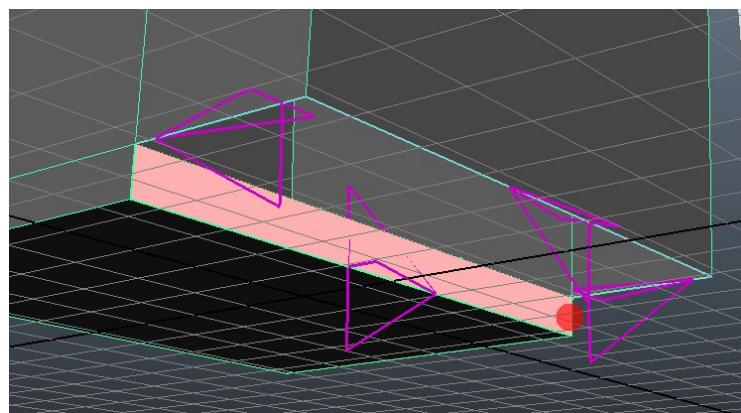
Now we're going to use the Append to Polygon tool from the same menu.

**Mesh Tools > Append to Polygon.** (*Add this to the shelf!*)

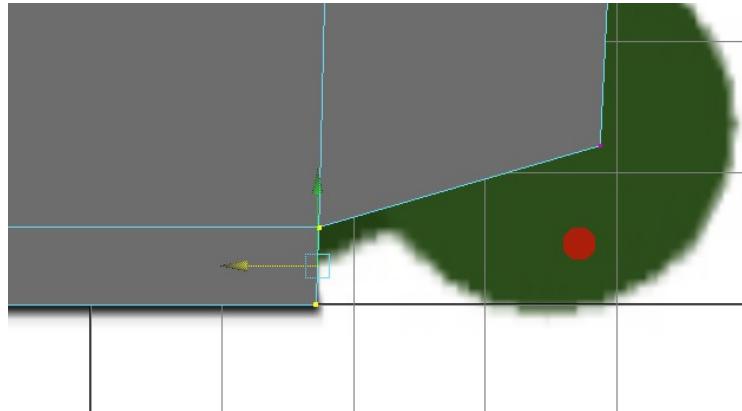
Using this tool, click once on an edge that has a thick border (these are edges with open holes).

Click next on the one opposite to create a plane from the first point to the next. Press **Enter** to finish using this tool each time.

Do this to close up the hole.

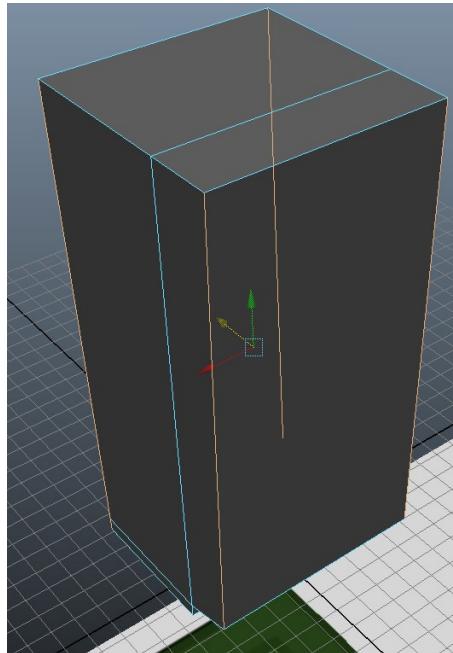


Back in the side view, line up the vertices with the image (remembering to drag not click to select the vertices).



Back in the perspective viewport, select the outer edges of the cube. To manually select multiple edges/face/vertices hold **shift and click** them. Hold **Ctrl and click** them to deselect.

(*Tip:* Double clicking edges selects loops. Try this with the front vertical edge. Both will be selected.)



### Go to **Edit Mesh > Bevel** (*Add this to the shelf!*)

Now the result may not be great, but this is why we keep the history of an object. Go to the Channel Box and click on the new **polyBevel1** to expand its options.

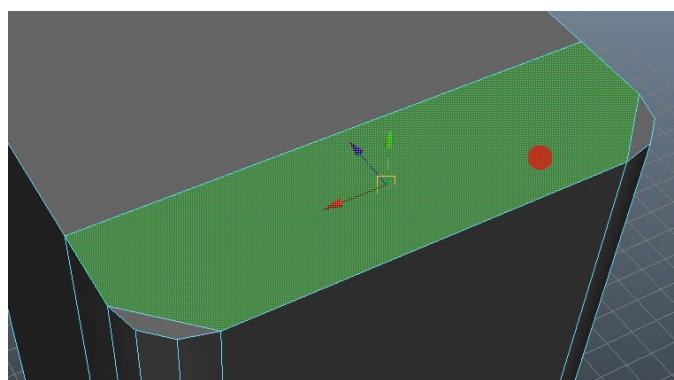
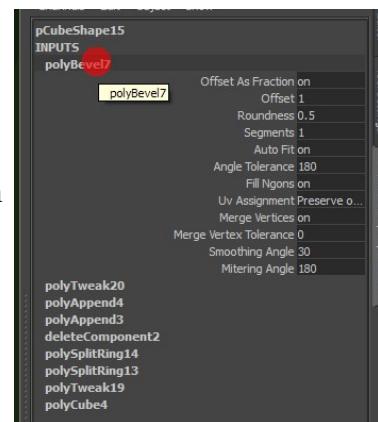
We're going to add another 2 segments to our bevel. So this value should be 3. Next select the text *Offset* and Middle-Mouse-drag in the viewport to interactively edit the bevel amount.



Save Point. Press **Ctrl + S**.

Now we've hit our first difficulty in using these tools.

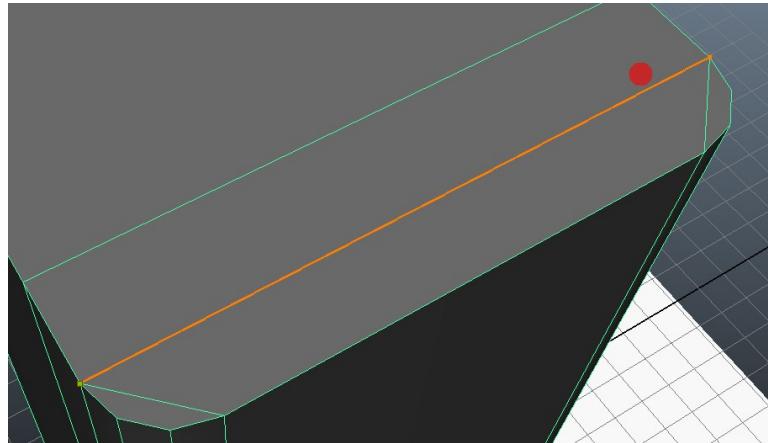
Sometimes they create polygons that aren't quads (4 edged faces) or Tris (3 edged faces). Polygons that have more are known as Ngons. These are to be completely avoided, and are best solved early before moving on to other tools.



So looking at our new ngon on the top of the cube we can see when we select it that it has 6 edges. This means if we place an edge through the middle of it on the x axis, we will have two quads.

To do this we're going to use Interactive Split tool. **Mesh Tools > Multi Cut Tool** (*Add this to the shelf!*)

Click the vertex shown in the picture then click its opposite. To end the tool press Enter. This will split the polygon in two.

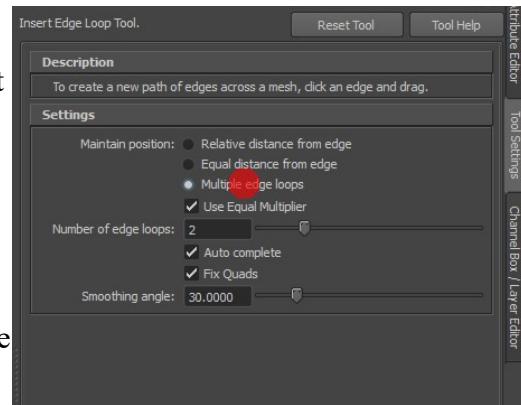


(*Tip:* This tool is a little buggy and can make maya crash. Though has improved recently, I always save before using it.)

Do the same for the other three ngons.

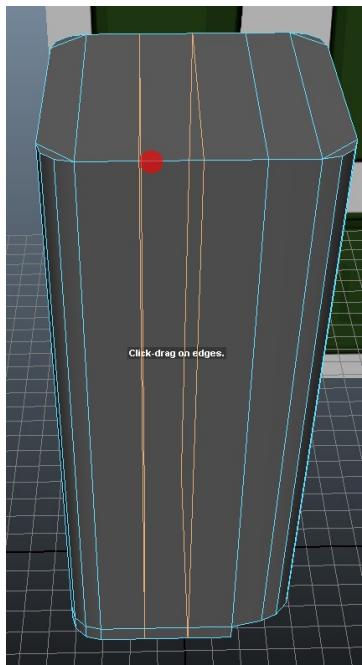
Now we're going to clean up the model a little so that we have even edge loops to use later.

Use the **Insert Edge Loop shelf button**. Change the Maintain Position from Relative to Multiple Edge Loops, and change the slider to 2.



Now click on a *horizontal* edge within the large space on the side of the bin.

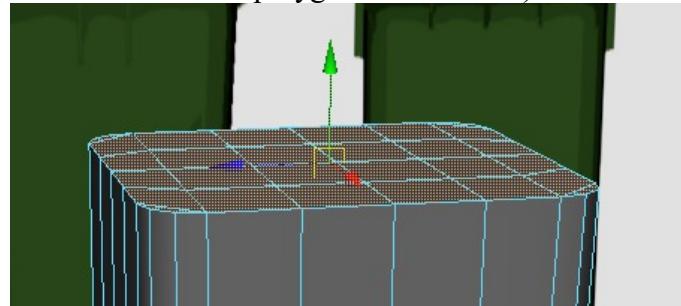
This creates two edge loops that are perfectly equal distances.



Do the same with the front of the bin, though add 3 loops.

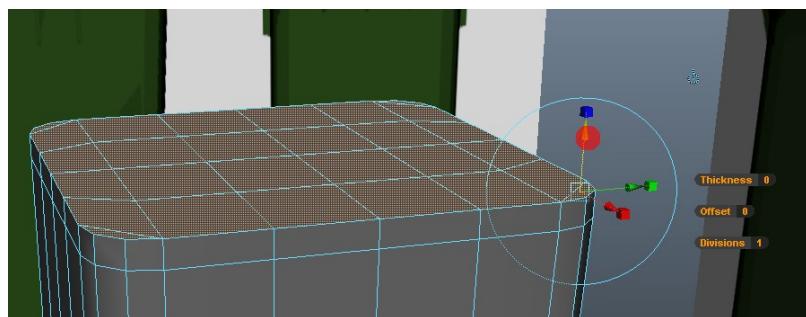
Select the top faces of the bin.

(*Tip:* You can do this by dragging over the top of the bin to select all of them, and then holding ctrl and dragging a selection box over the side polygons to deselect.)



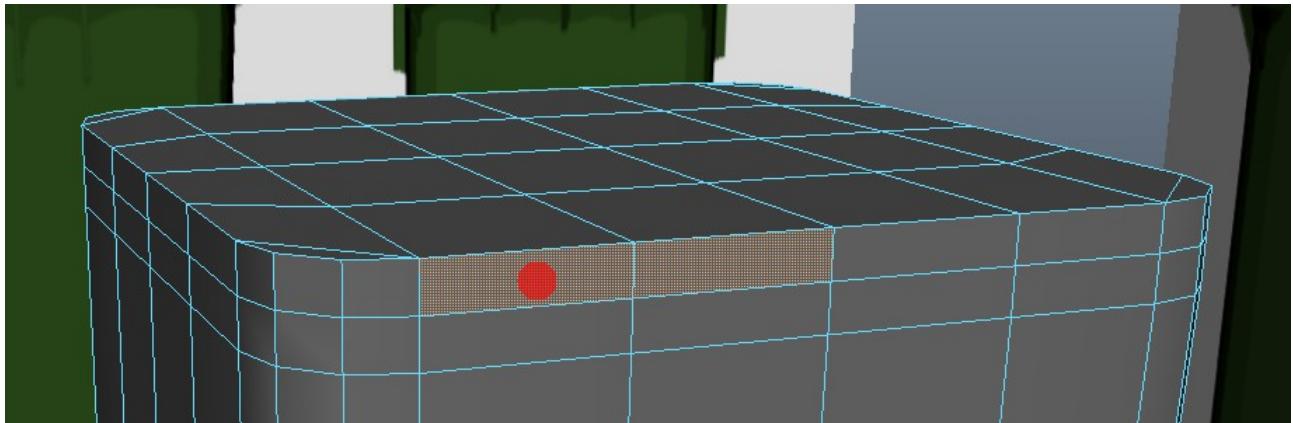
Go to **Edit Mesh > Extrude** (*Add this to the shelf!*)

Drag the new extrude tool up in the y direction. Make sure to drag on the spear pointer, and not the scale. Go to the side view to line this up with the image. (*Note:* this is the top of the bin, not the top of the lid)

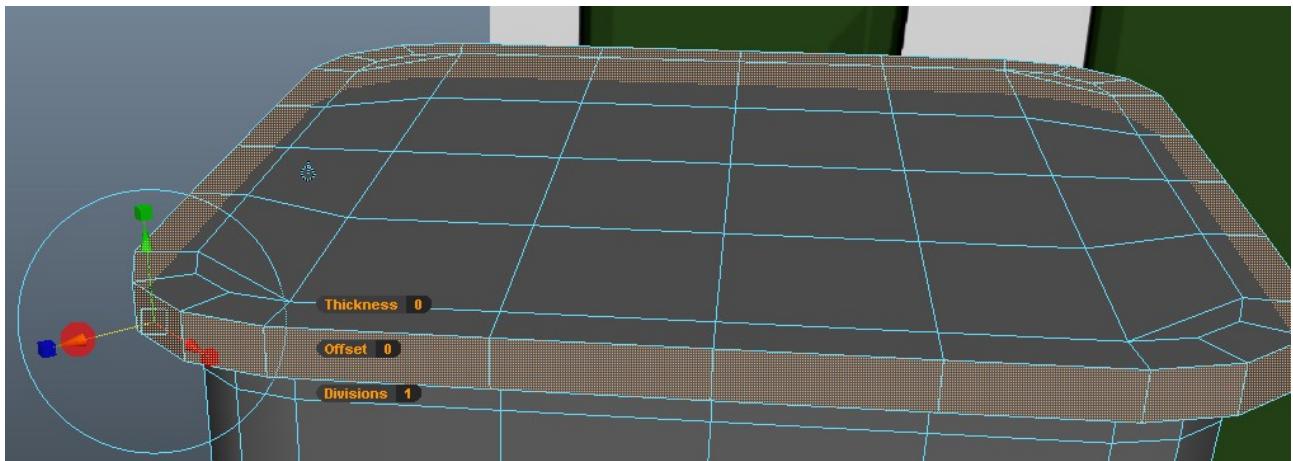


Now add an edge loop along the horizontal of the new extrusion. Do this with multiple loops and '1' in the count slider. This places the loop perfectly in the centre.

Next we're going to select the loop of faces that we've just created. Click on one, then shift and double click on its neighbouring face. This selects the whole loop.

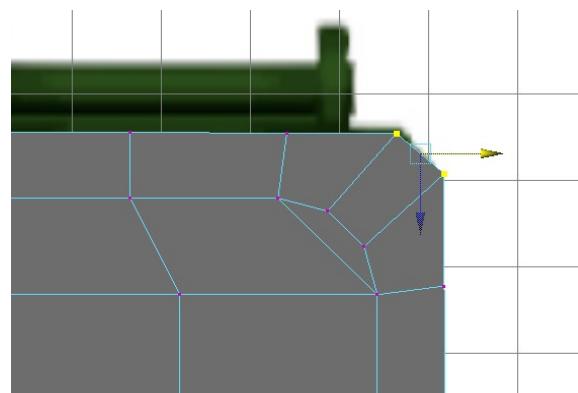


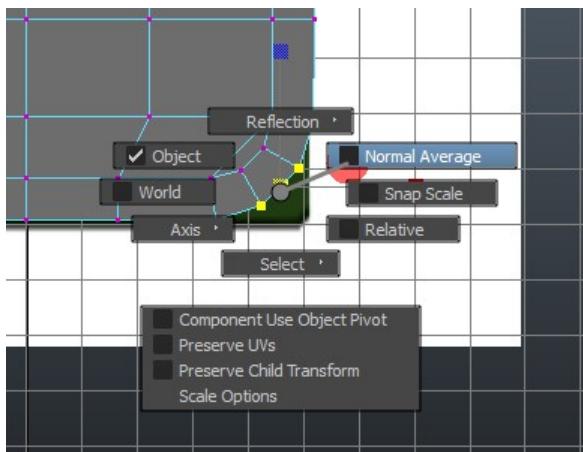
Extrude this out using the Z transform to create a lip around the bin.



The lip is as bevelled as the bin, but we want this section to be a little sharper. We're going to select the two vertices (dragging, to make sure we select those below as well) on the corner. But before we do this, we could save ourselves time by turning on reflection settings.

With the move tool selected look at the bottom of the *Tool Settings*. Check on '*reflection*'. Now when you select the two corner vertices, the two on the opposite side move with them. Move and scale the corners to match the image.





(Tip: When selecting the two vertices you can scale them closer together using a single axis. However you have to change the scale axis to 'normals average' (Newer versions of Maya refer to this as 'Component'). You can do this in the Tools Settings or by holding 'r' and left-click-hold & dragging on the model to bring up the scale menu. Remember to change it back when you're done!)

Now that we've manually moved them into position we face another small problem. In moving them, the sides are not completely straight. We need to snap the vertices to the other unmoved vertices along the top.

To do so, select the move tool and hold 'v'. Now move them on a single axis. (Don't use the multi axis in the centre as this will snap the vertex to the exact position of another. Which is not what we want...yet)

We want the lip of the bin top to completely lip over, so we'll be adding a loop on the underside using the **Insert Loop Tool**. We could just use relative as the loop type, but what if we wanted to loop on a single quarter of the space?

Add a loop using multiple on '1'. Then add another loop on multiple '1' nearer the edge of the lip. We're now going to delete the middle loop we first created.

Go to edge select mode (**F10**) and double click on the edge. This selects the whole loop.

Click **backspace/del**.

Go to vertex select mode (**F9**). Look closely at where the loop we just deleted was.

Notice the vertices left behind? That's pretty messy.

**Ctrl+z** to when we had selected the loop.

Now with the loop selected go to **Edit Mesh > Delete edge/Vertex (add this to the shelf!)**

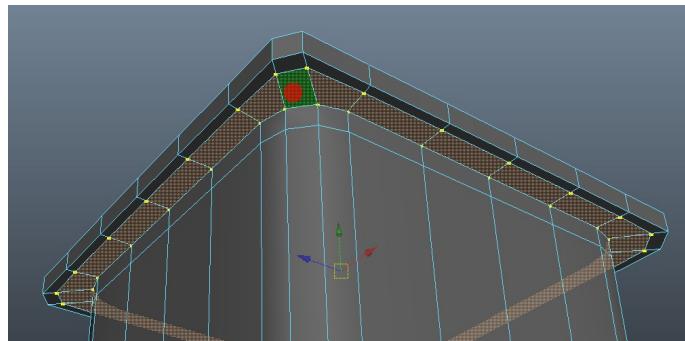
When we click this the whole loop and all of its vertices are deleted.

This should always be used when deleting edges and vertices (unless you plan on using the left over vertices for something)

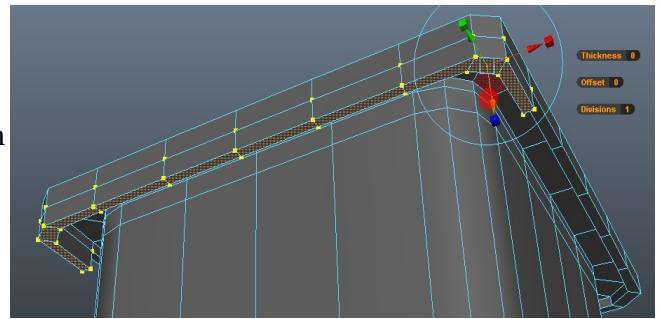


Save Point. Press **Ctrl + S**.

Now selecting the larger loop of faces from the underside of the lip, we're going to extrude those upwards, into the model. Don't extrude too much to come out of the other side!

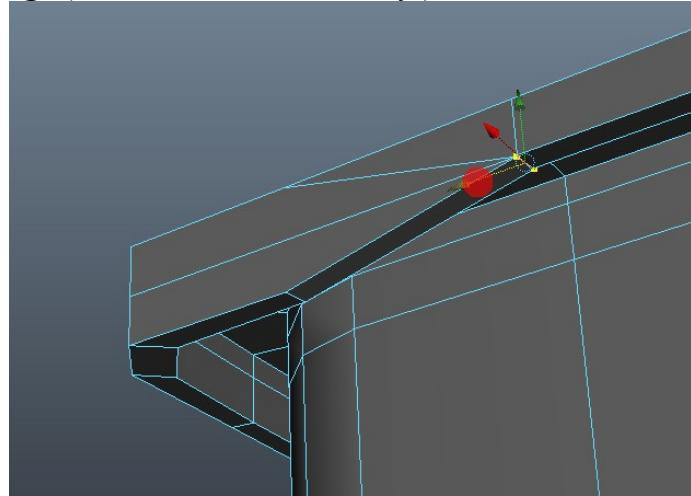


With this lip made, we want to make a second lip, but not all the way around. Select the faces at the front underside of the lip and one from each side. **Extrude** those down. Match this with the image in the side viewport.



We need to create a ramp with the two extrusions (not a block) on either side. Still with reflection on, select the two vertices on each side in the middle of the lip (4 verts in total). Snap move them on the same position as their neighbour behind them (Z axis). Now drag select the same vertices. Your poly info should read 8 vertices selected.

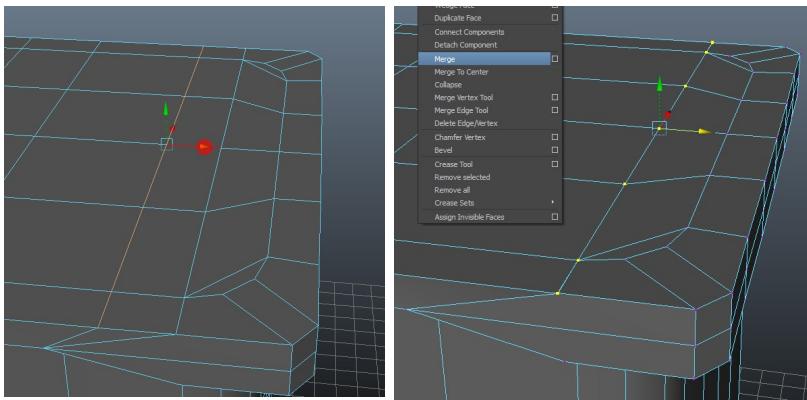
Go to **Edit Mesh > Merge** (*add this button to the shelf!*)



Clicking this with the current selection will merge the pairs of vertices together, and delete any unused edges/faces they had between them. The poly info should now read 4.

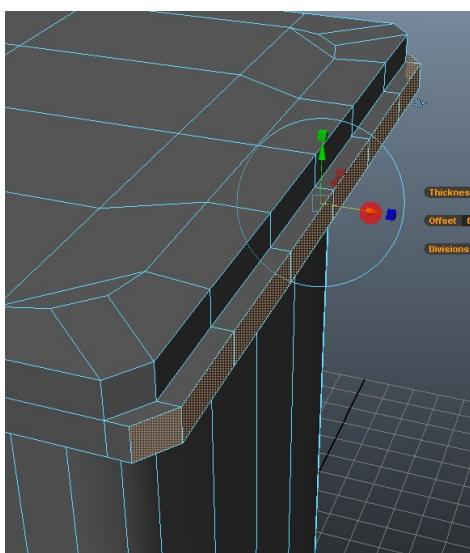
(*Help! My vertices merged into 2 and the lip is squashed!* This is because the merge scale is too high. Select the box menu, or double click the shelf button to bring up the options. Move the value down a decimal place (from 0.1 to 0.01 etc.).)

Now we have some triangles due to that operation. We're going to clean that up before moving on, using the same procedure as before. Select the loop in the image and scale it so it is straight. Select the loop behind it and snap move this (in the Z) to the one in front. All of the Vertices should line up nicely. Select them all and **Merge**.



*(Tip:* To check whether a merge has worked without calculating the maths with the poly info, you can just click select a vertex and move it. If all of the planes move with it, then it's merged. If it opens a hole you may need to open and edit the merge options or snap the vertices together.)

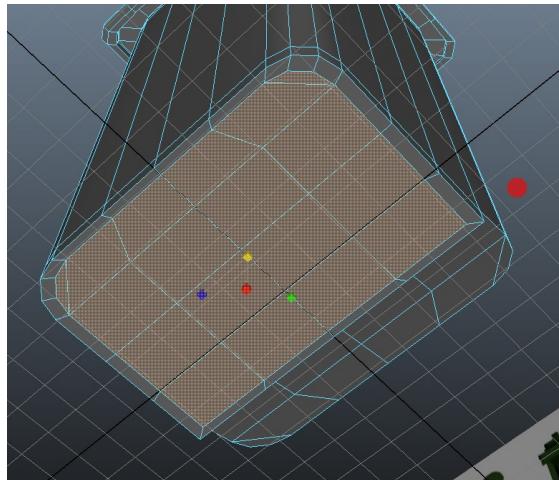
The front lip still needs a little step. Select the front lower faces and **Extrude** them out to match the image.



You want to extrude these in an absolute Z axis. As default the extrude tool opens the corner faces wide..which isn't what we want. Taking a closer look at the extrude tool you may notice a small blue '*power on*' symbol. Clicking this reorients the tool to world orientation. Now pull the extrude in the Z axis.

We're going to use the extrude tool in a slightly different way now. Select the faces on the bottom of the bin (though not those at an angle). Click **Extrude**. Click once on one of the scale boxes on the extrude tool. This reveals the scale centre, drag this centre to scale the faces smaller.

Nothing is truly 'extruding', but making a new loop in the same shape as the border of the selection. Pull the selection up slightly in the y direction.



Save Point. Press **Ctrl + S**.

## Section 3

### Modelling the Lid

The model of the lid has to fit over the bin top. For that reason we're actually going to use the same topology (placement of polygons) as our starting point.

Select the bin in object mode and **Duplicate** it.

Now we have a problem. We have two bins in the same position and don't want to move them about. To view only one object in the viewport click the green dotted square at the top of the viewport, the **isolate selected toggle**. This makes the object selected appear on its own, and hides all else.



Select the top faces of the bin. You could do this in face selection mode while holding shift, but it may take a little while. Let's paint the selection instead. Look in the tool menu on the left and select the paintbrush icon above move tool. This is the Paint Selection Tool, which can also be found in **Edit > Paint Selection Tool**.

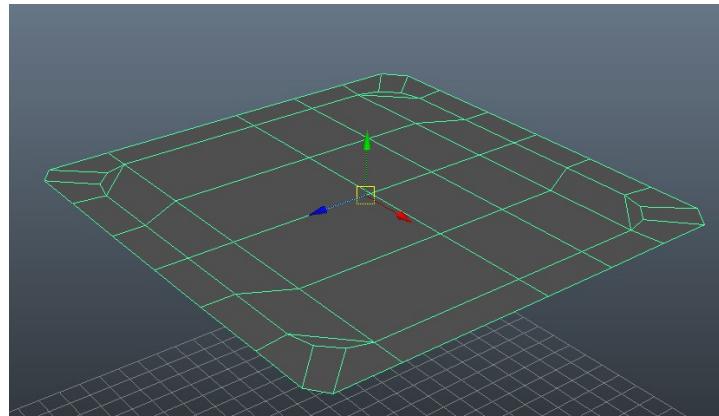
(Tip: It's worth either making this a shelf button or even a hotkey from **Window > Settings/Preferences > Hotkey Editor**)

Contra to the way maya normally selects, the paint selection tool is additive. So anything clicked over is added to the selection. You also cannot deselect everything by clicking off (you must change tool to do so).

To edit the brush size hold 'b' and drag.

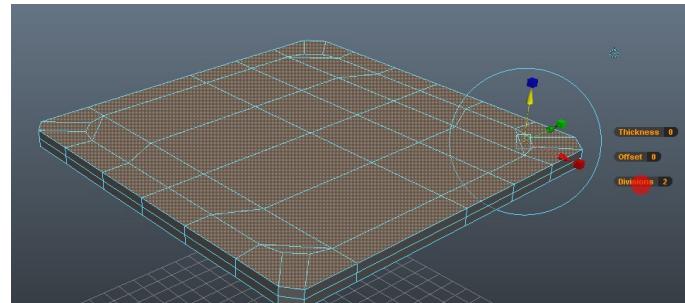
Paint select the top faces of the bin. We'll use these as the base of our lid.

Invert your selection by going to **Select > Inverse** - or **Ctrl+Shift+I**. (*Add this to the shelf or make a hotkey!*) Click **Backspace/Del** to remove the excess faces.



We want to extrude this new plane upwards to form our lid, but we don't want to use the extrude tool like we have before. Had we selected the faces and extruded them, our lid would be hollow and not a full object. If we use the extrude tool on the entire object in object mode we can make the object whole (with no 'holes').

Select the lid and **Extrude** it upwards. With the extrude tool still selected click and drag a short distance on the divisions widget in the viewport to a value of '2'.

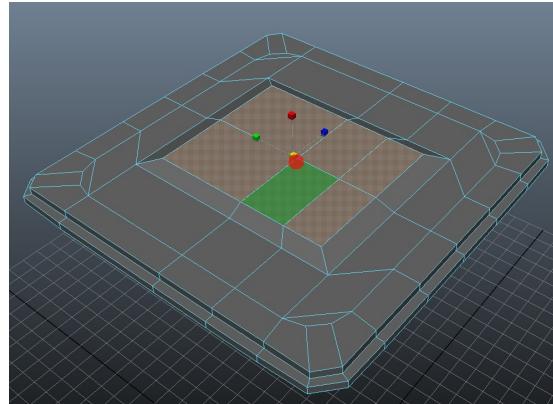


(*Help! I've lost the extrude tool!* To reselect the tool you were just using without having to 'z-back' simply click 't')

Now select the lower face loop around the lid. **Extrude** those out.

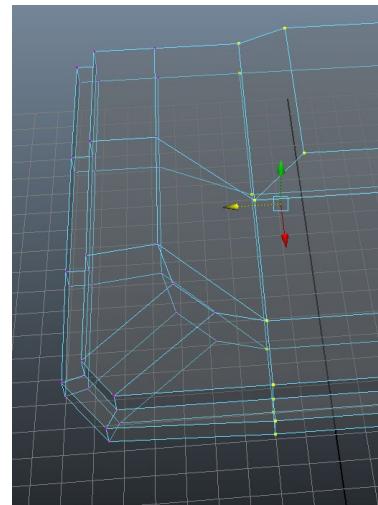
Select the central faces on the top of the lid and **Extrude** these upwards. Select the scale tool and using the central scale make the top smaller.

(*Note:* We can use the centre of the scale tool because one of the axis simply won't scale. The y axis is completely straight.)



Select half of all the faces on the -x side (the left when facing the front). **Delete** them.

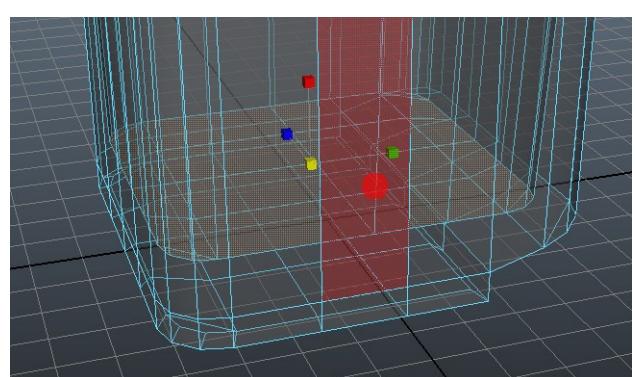
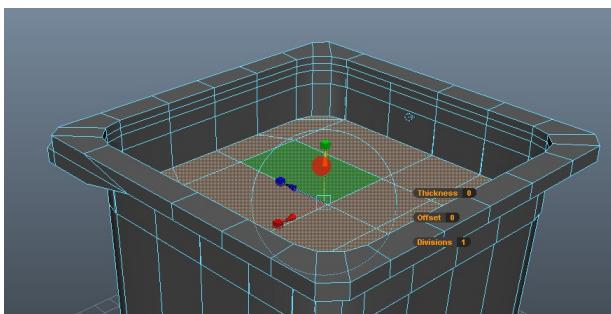
Move the loop and bevelled insert closer to the front, as shown in the image.



Toggle **isolate select** back off and select the bin. Toggle isolate select again, so that only the bin is showing.

Select the faces at the top of the bin, though not the top of the lip. **Extrude** and scale these to make the hollow of the bin.

To view through polygons in the viewport you can turn on **x-ray**, a white cube at the top of the viewport. This may be useful when pulling down the inner base of the bin.



Isolate the lid again.

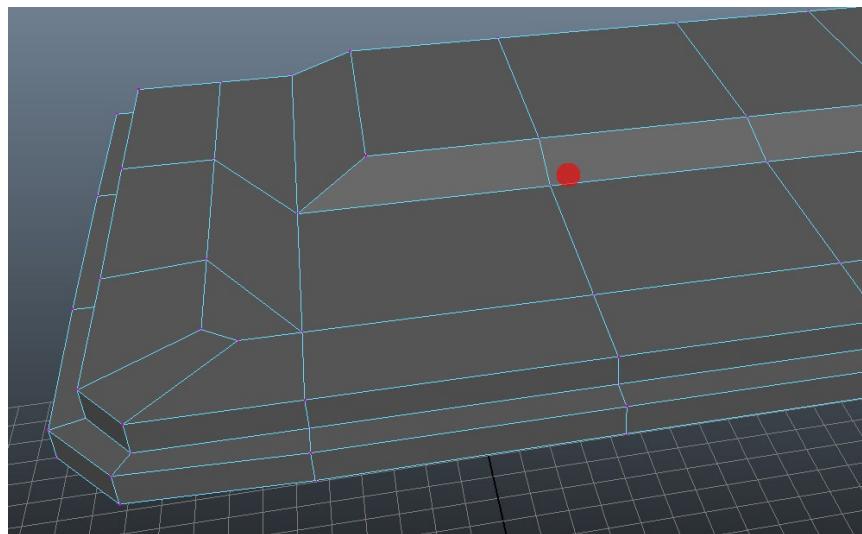
Move the vertices near the corner slightly, so nothing is overlapping or too close.

Insert a relative edge loop in the large space. You'll notice that the edge loop isn't straight, because

the loops either side are not. Ctrl+z this, or delete the loop.

Using the Top viewport use the **Multi Cut Tool**.

With the tool active, click and drag (starting away from the object) and drag over to the other side of the object. Holding shift will snap the line to vertical/Horizontal. Do this in the **Top Viewport** to get the best results. Create a perfectly straight line across the lid as shown.

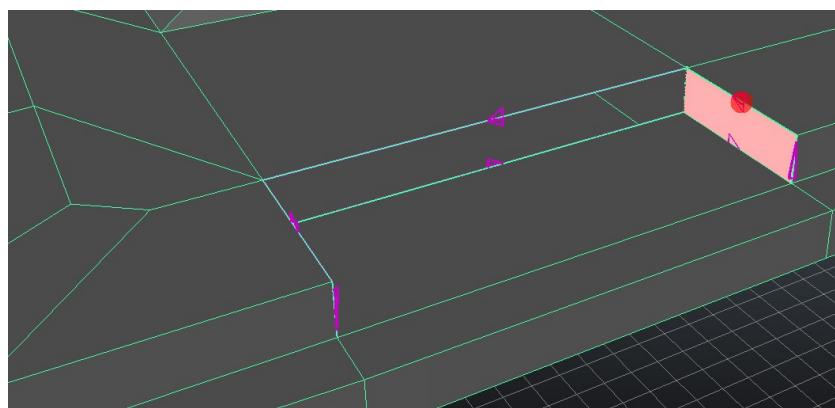


Select the two faces at the top ridge of the lid and delete them.

Extrude has yet another use. We can extrude edges as well as faces and objects.

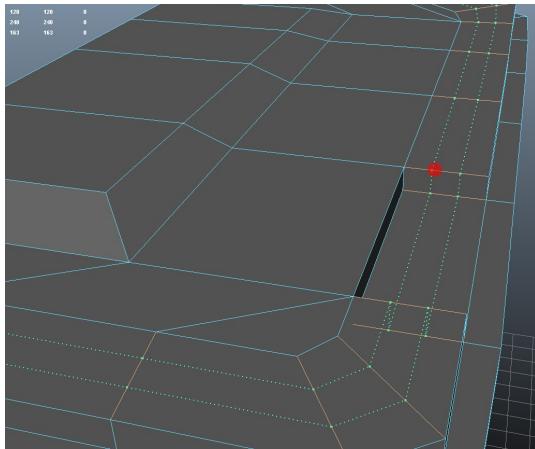
Select the lower edge of the new hole. Extrude this and snap it on the x axis to the hole edge on the other side.

Now using the **Append to Polygon** tool clean up the newly deleted holes.



(Note: When using extrude on edges, be very wary of extruding edges out from whole objects. This is a very bad idea, and may lead maya to crash. Stick to extruding from edges with holes as a repair/addition.)

Add two **Edge Loops** running along the new indent we've made.

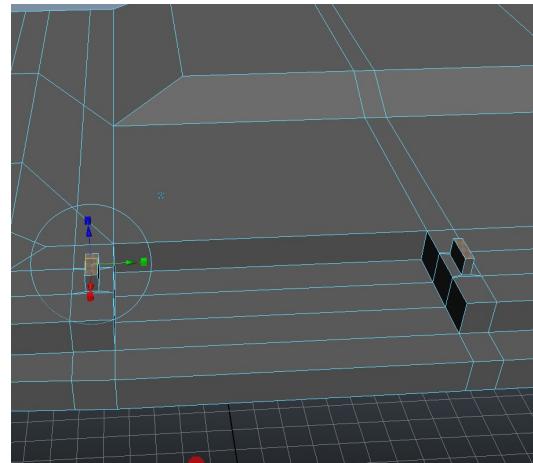


**Multi Cut** either side of the indent to form a small square quad on each side.

Save Point. Press **Ctrl + S**.

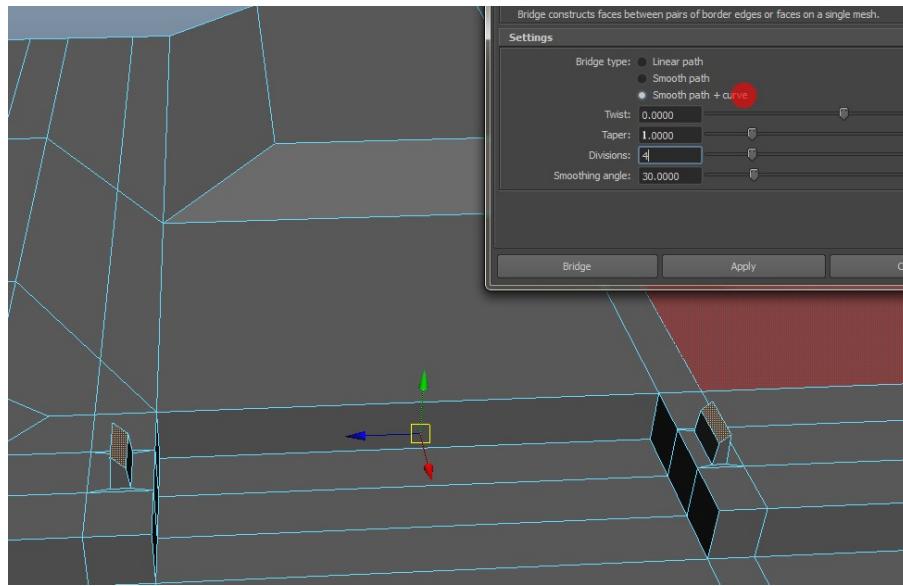
Select the two faces either side of the indent and **Extrude**-scale into a small letter box.

**Extrude** these again and lift up slightly.



Discrete rotate the face at the top of each 45degrees facing each other.

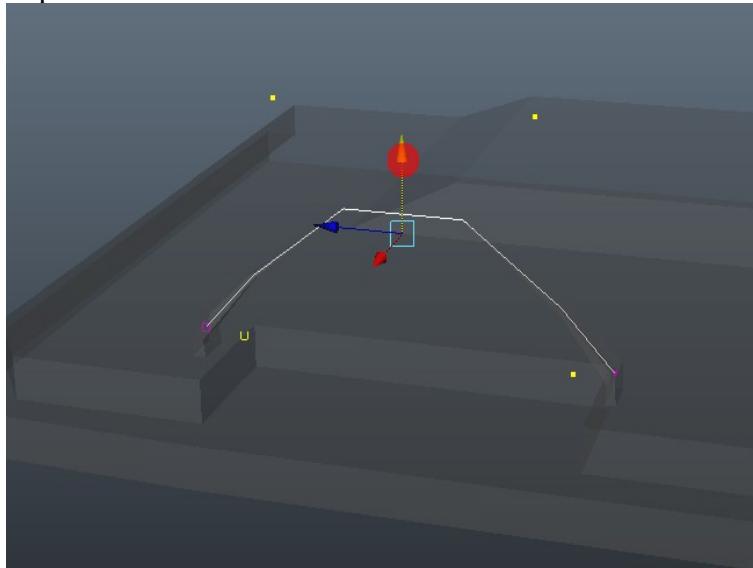
Selecting both of the faces and go to **Edit Mesh > Bridge > Option Box** (*Add this to the shelf!*)  
*Reset these options* then choose *smooth path and curve*.



*(Help! My bridge went all weird and rotated! - If this is the case, skip this section and go to the alternative option below using append to polygon. Sometimes bridge won't work properly depending on the 'vertex order'.)*

When we made the bridge we also made a curve. This is not a polygon but a nurbs curve. A quick way to select this is to drag select over the handle and deselect the lid. Then toggle isolate select until you only have the curve visible.

Hold Right-Click over and wait for the menu, then choose '*Control Vertex*' and select the vertices and move them into such a position to make a nice looking handle. Turn isolate select off to see the handle move while the points are moved.

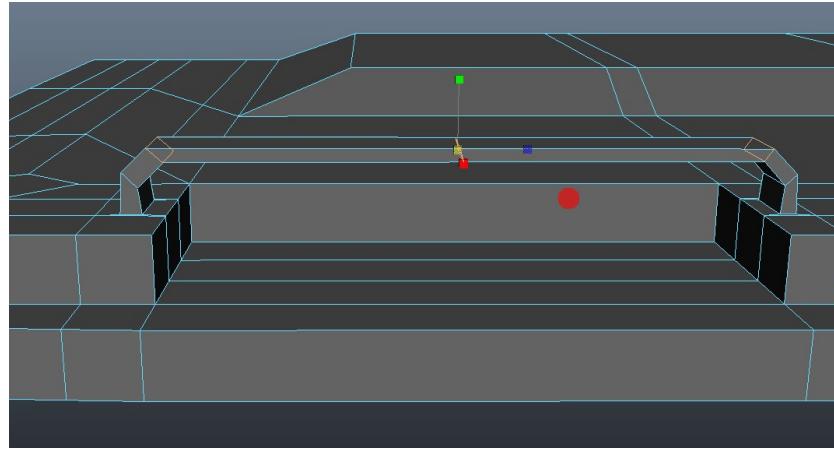


#### *Alternative:*

This is just a quick alternative in case the bridge tool doesn't work.

Delete the faces that would have been bridged. Use **append to polygon** to join the two face by face.

**Insert 3 edge loops** and manually move the vertices (in loops) to form a handle shape.



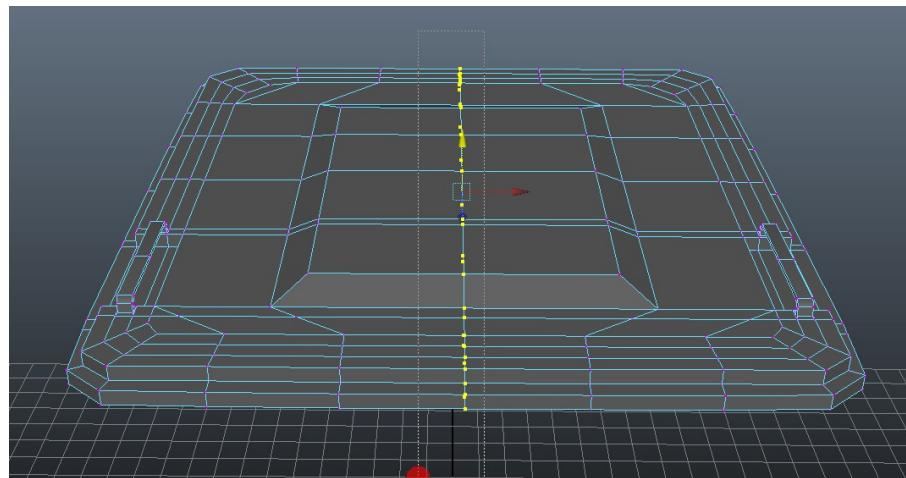
(Note: You'll find when using maya that results can be achieved in many different ways, and that the only 'best' way is the most efficient and time effective. Even if that means avoiding a buggy tool and taking longer.)

Select the lid in object mode and go to **Edit > Duplicate Special > Option Box**. (Ctrl+Shift+D) Using the options we want the lid to mirror. So we need to change the scale on X axis to -1. Because the lid's pivot point is at the grid centre, everything should line up perfectly.

These are still separate objects, so to combine them we use **Mesh > Combine (Add this and Mesh > Separate to the shelf!)**

Select all of the vertices in the centre loop of the lid. We may have combined the objects, but we need to merge the vertices. Merge the vertices using the shelf button.

(Tip: another less controllable way, though faster, is to select the new combined lid in object mode, and merge that, without selecting any vertices. Though this could merge vertices that should be kept separate.)



Save Point. Press **Ctrl + S**.

## Section 4

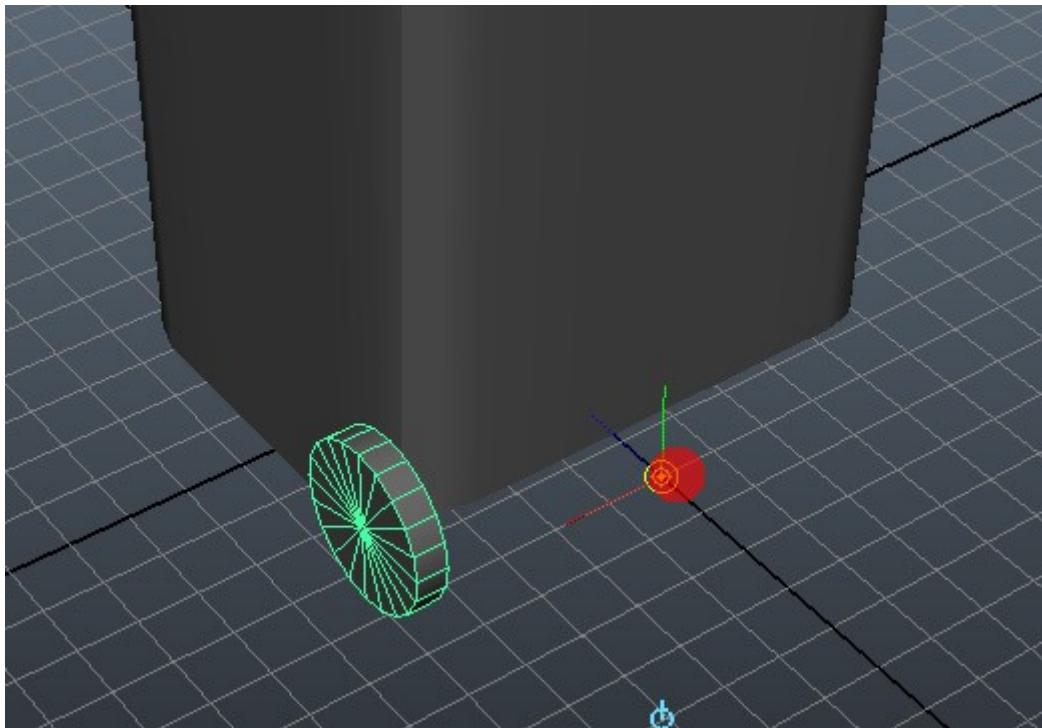
### Modelling the Wheel

Create a Cylinder.

**Create > Polygon Primitives > Cylinder (Add this to the shelf!)**

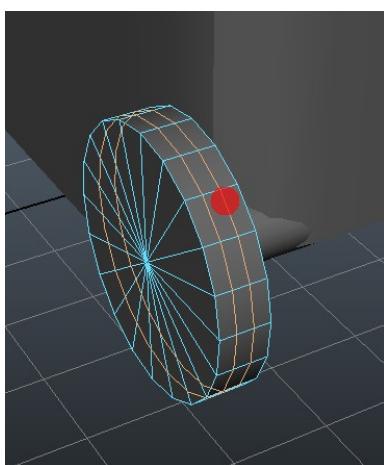
Leave the creation history alone, 20 subdivisions is a good number for what we have planned.

Place and scale the wheel using the image planes as reference. Snap the pivot point to the centre of the grid. (d+x+middle-mouse-drag)



Select the wheel and open the **Duplicate Special option box**. We're going to change a single setting. Change 'copy' to '*instance*'. Click apply.

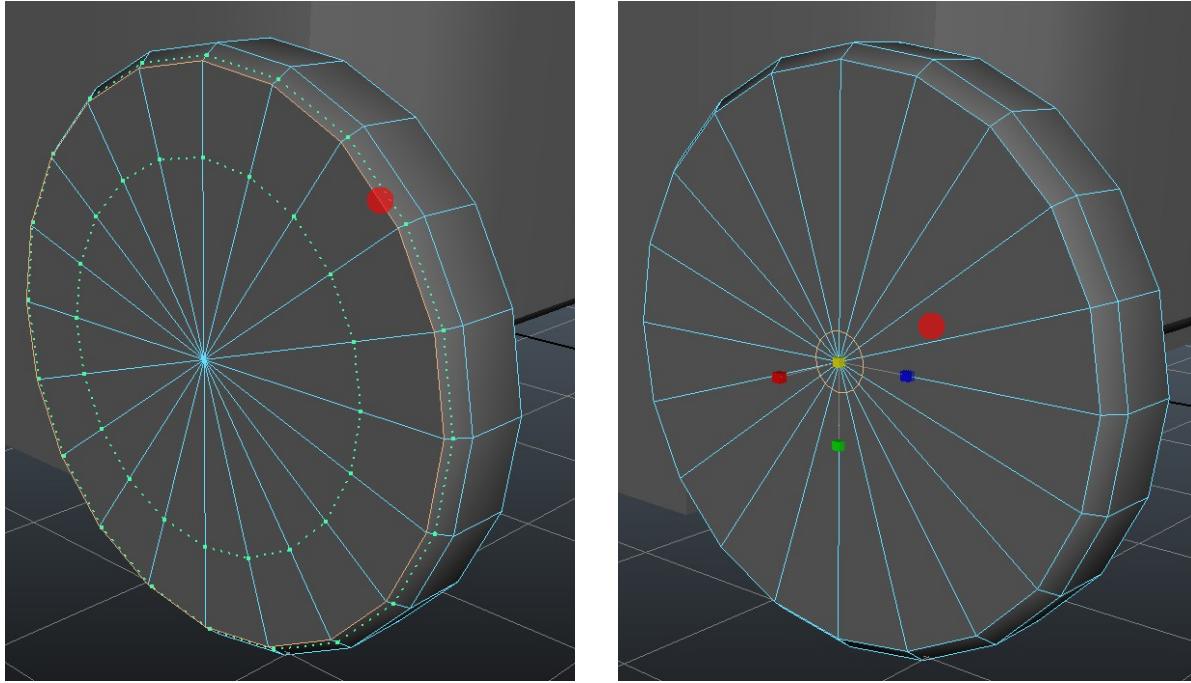
Now we're going to work on the left wheel, everything we do that affects the topology will be mirrored on the right wheel.



Add two **Edge Loops** around the circumference of the wheel.  
Scale them out slightly to form a bevel.

Got to **Mesh Tools > Offset Edge Loop Tool (add this to the shelf!)**

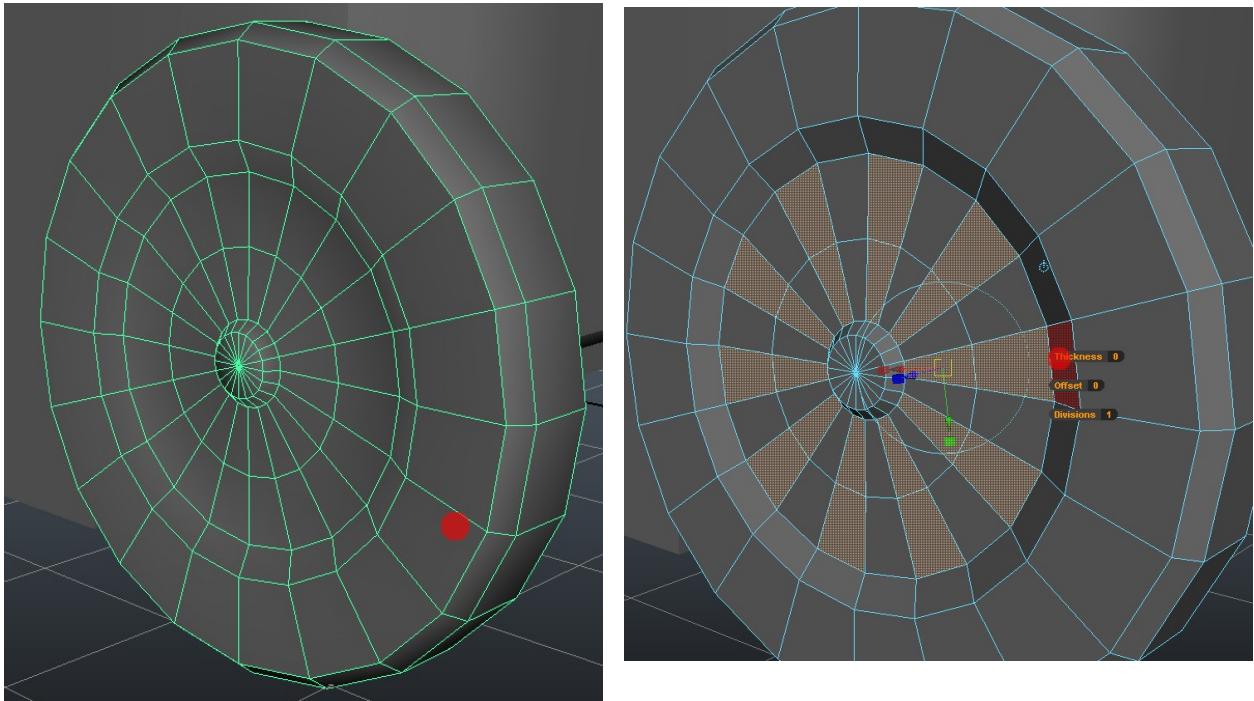
This tool adds two edge loops either side of the one that is clicked and dragged on. Click on the outer circumferential edge and drag in to match the image.

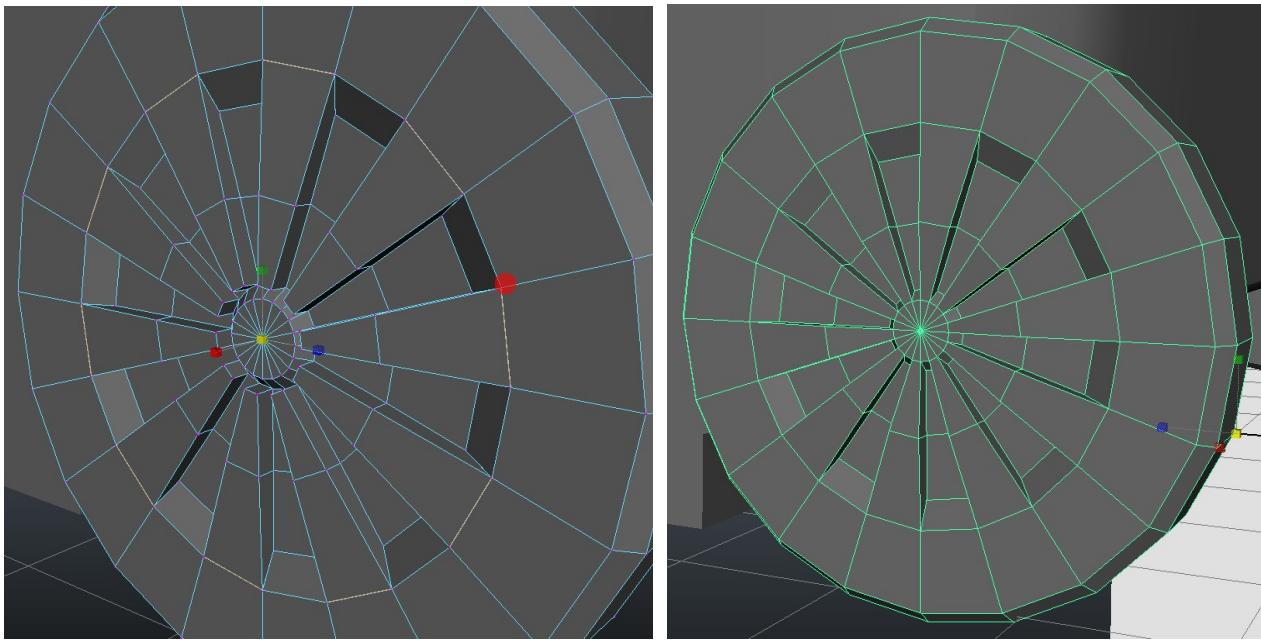


Delete the inner loop we've just created using the *correct tool*.

Scale the new outer loop in. What we've done is created a cap that we could have created when we first made the cylinder. It is usually a little tricky making the 'first' cap manually.

Use tools you feel are appropriate to follow the next few images to create the plastic 'spoke supports' on the wheel.





## Surface Normals

It's important to have a brief introduction to **surface normals**.

These are the direction your surfaces (faces) are rendered. They can have a drastic effect on how your model looks and reacts to light.

Select the wheel and go to Normals menu and rip it off by clicking the top dotted bar. Choose **Mesh Display > Set to Face**

This now hardens all of your edges by face, making the object look faceted.

Select the wheel again in object mode.

Choose **Mesh Display > Soften Edge (Add this to the shelf!)**

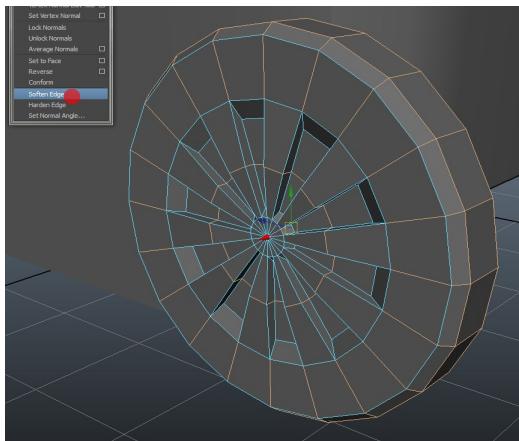
This 'smoothes' the transition of light from one edge to another. Though may produce dark spots that are reflecting light in the 'wrong' direction.

Select the wheel again in object mode.

Choose **Mesh Display > Harden Edge (Add this to the shelf!)**

Now we're going to selectively soften some of the edges.

Select all of the edges shown in the image. **Softens** those edges using the shelf button.



Feel free to delete the inner half of the wheel and mirror it to get the spokes on the inside too.

Though note this won't update via the instance. The instance will need to be deleted and a new copy made.

Make a new cylinder and place and scale it as a bar from wheel to wheel. Allow it to intersect with the bin.

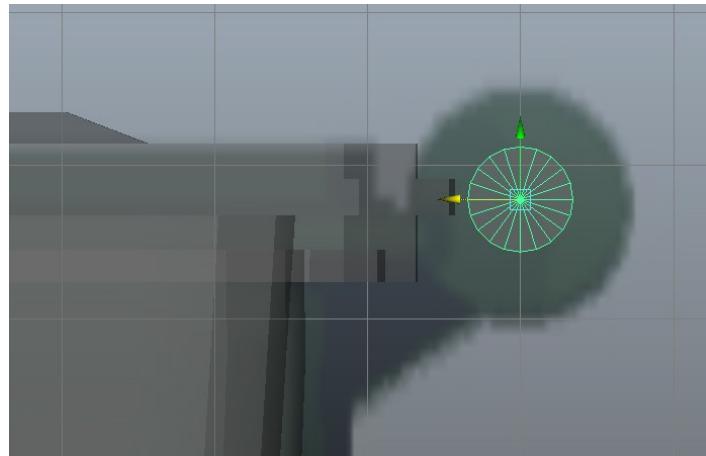


Save Point. Press **Ctrl + S**.

## Section 5

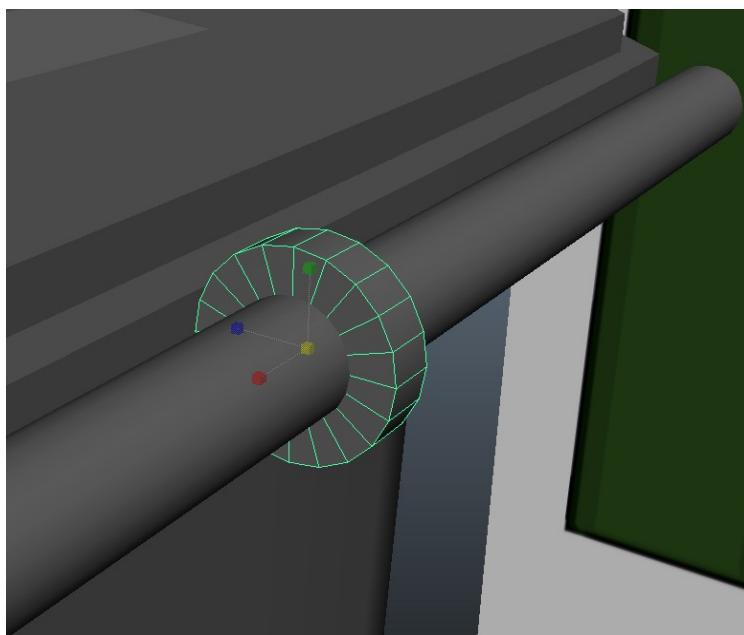
### Modelling the Bin Support

**Duplicate** the cylinder that's acting as an axel for the lower wheels and place it at the rear of the lid.

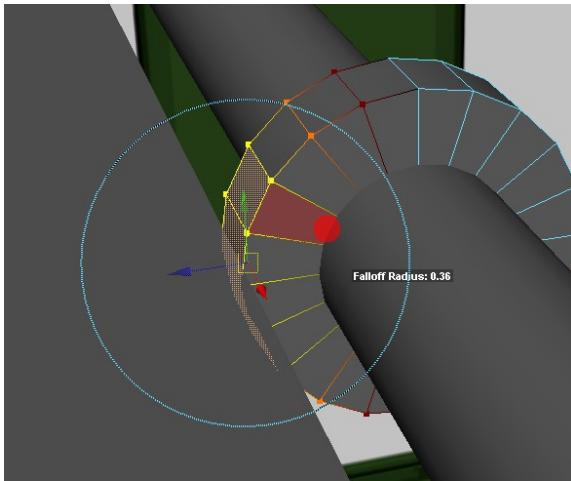


**Duplicate** this again, and scale it in on the x axis and out on both the y and z axis.

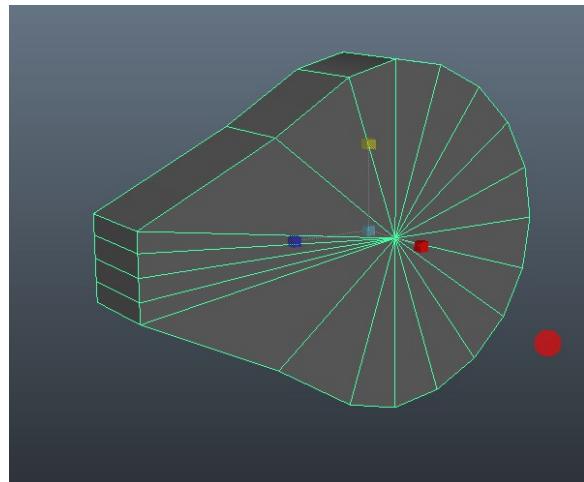
Scaling on only two axis can be done by selecting their text in the channel box, either dragging or using Ctrl+click, then middle-mouse-dragging in the viewport.



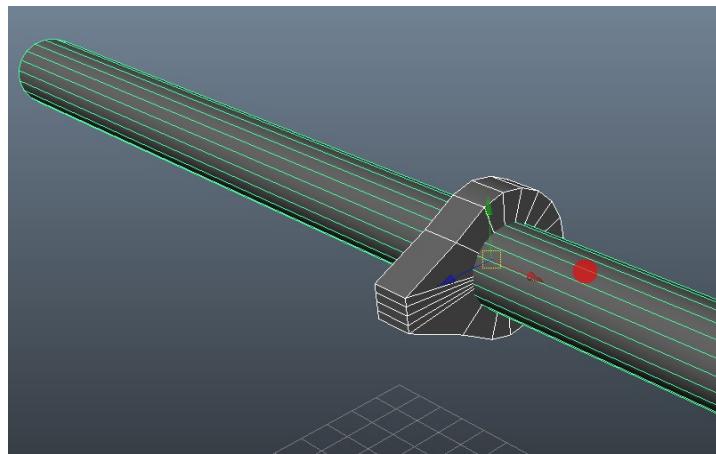
Select the front 4 faces. With the move tool active open the *Tool Settings UI* (it should still be on the right). Above reflection settings is the **soft selection**. Turn the top **checkbox on**. This can also be turned on with 'b'.



Holding b and click-dragging in the viewport resizes the soft selection size.  
Using soft selection, move and scale to get something that looks like the image below.



**Duplicate** the long bar at the top. We need another to destroy. Select one of the bars and the support piece and isolate select them. Choose the support first, then the long bar. Go to **Mesh > Booleans > Difference**. This cuts a hole in the support piece.



(Help! 1. My support piece has disappeared! Try toggling isolate select on and off. Sometimes new objects created are excluded from isolate select. 2. My support piece has disappeared! Booleans have been quite buggy and unreliable for some time, hence why we're not shelving it. If it

disappears and the operation can't be completed open the file '*'Bin\_BadBool.mb'* and start from there, or find another way of creating the hole. Maybe a few Interactive splits?)



Save Point. Press **Ctrl + S**.

I've left it a little late to talk about history deletion, but after a boolean operation is the prime time to be doing it.

Take a look in the channel box while selecting the support piece. Notice it has a *polyBoolOp1* under Inputs.

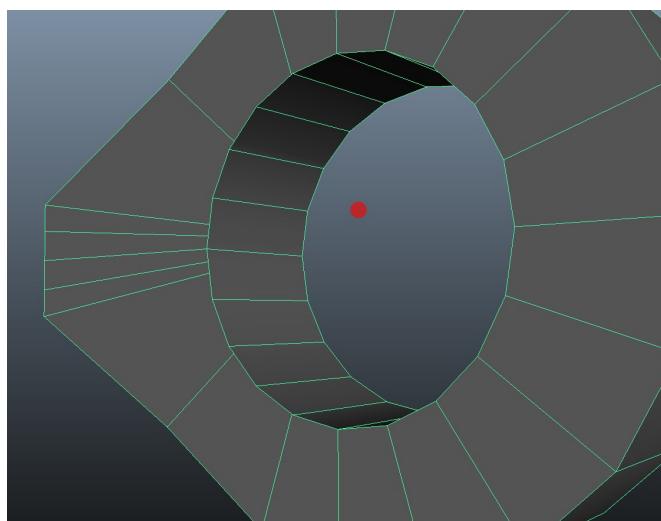
Every tool we use to edit the geometry of an object is stored in the history of that object. Changes can actually be made a few tools in the past (though this has its consequences and should be avoided). When using a demanding tool, like a boolean, it's advisable to delete the history before making any new tool additions.

You should also start to delete history after using several tools. Building up too much history can lead to an unstable object.

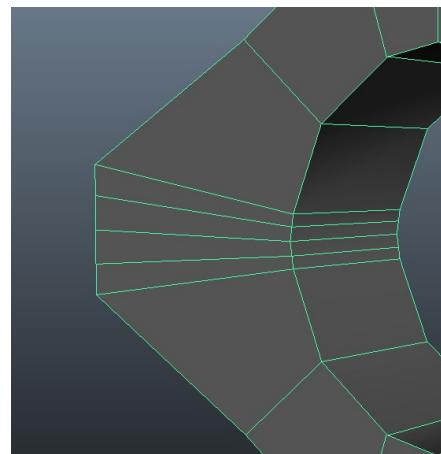
Deselect everything (just click in the viewport). Go to **Edit > Delete All by Type > History**. (*Add this to the shelf!*)

Note that *polyBoolOp1* has gone, as has the extrusions and other histories from the other objects we've made.

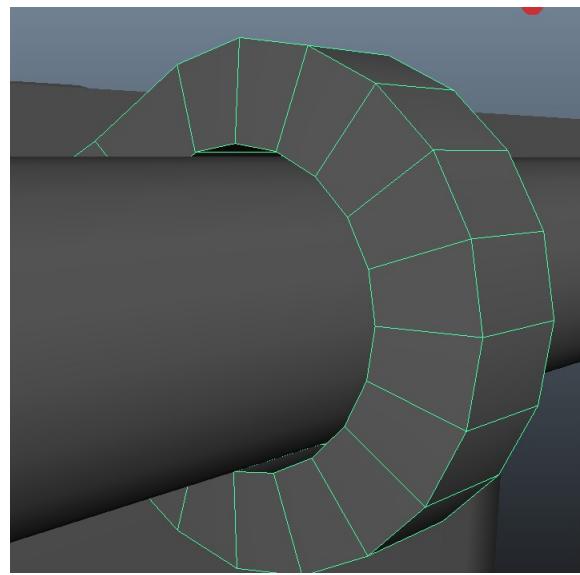
Looking back at the boolean you will notice many of the edges don't line up.



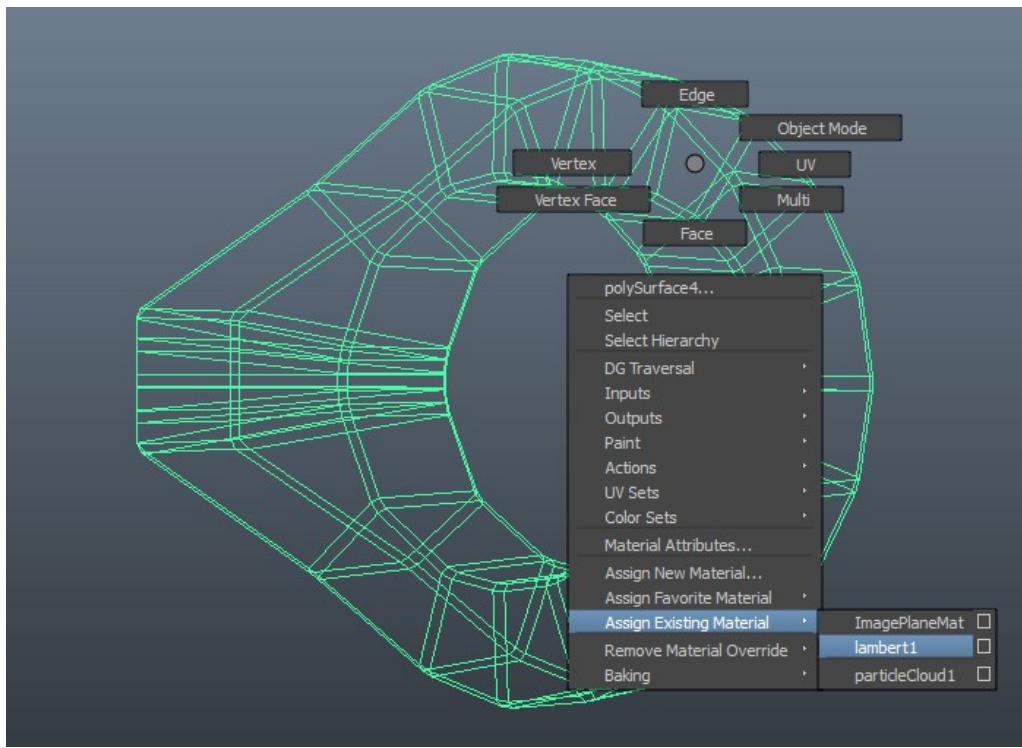
Pull them into place and merge the vertices.



Select the inner loop of faces and scale them out slightly, to create less of a tight hold on the support bar.

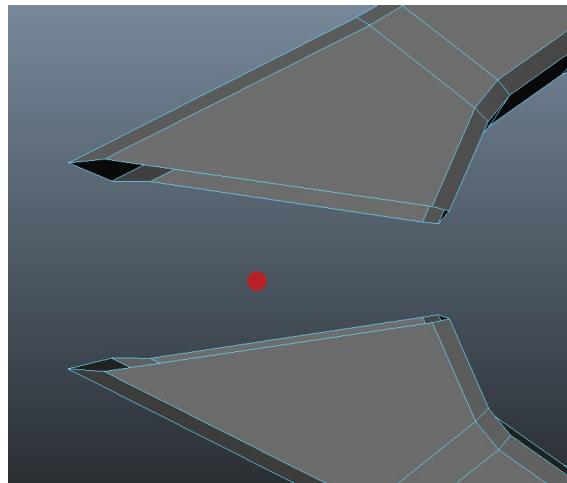
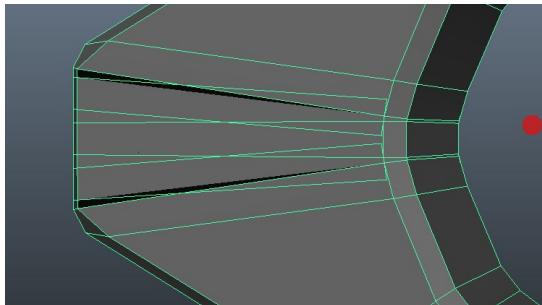


Select the support piece in object mode and click the **Bevel shelf button**. This bevels all of the edges. It also may lose its shader, so reattach it by dragging lambert1 from the hypershade on to it, or by using the right-click-hold menu.

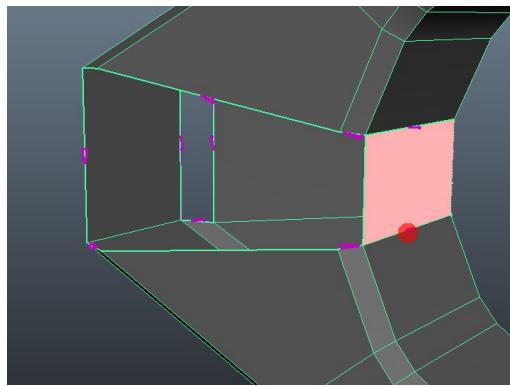


Change the offset to something suitable in the channel box. Don't worry about overlap on the pinched side.

Delete the pinched side shown in the image.



Using **append to polygon** make new planes for EVERY OTHER missing face. We're going to automatically fill the remaining ones.



Go to **Mesh > Fill Hole**. This fills all holes with single planes.

Duplicate the supports out along the bar.



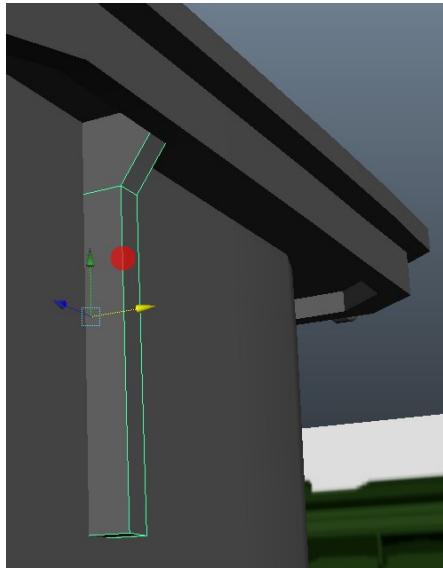
Save Point. Press **Ctrl + S**.



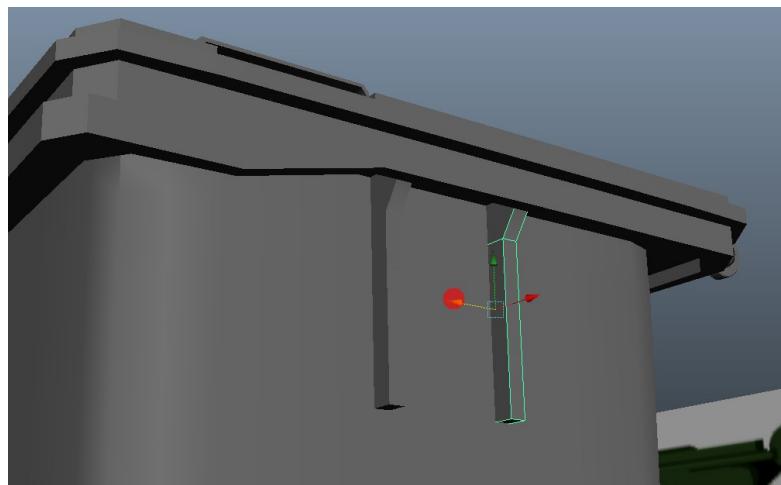
## Section 6

### Modelling Additional Supports & Finishing

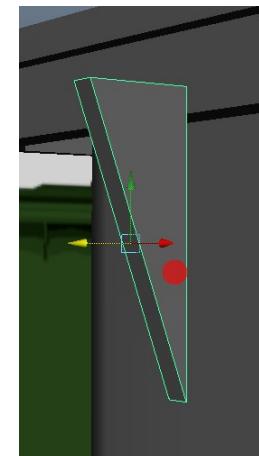
**Create a cube.** Scale into place with the under-lip-supports. Make a horizontal **edge loop** and pull out the top edge.



**Duplicate** this once, and then duplicate both to the other side.

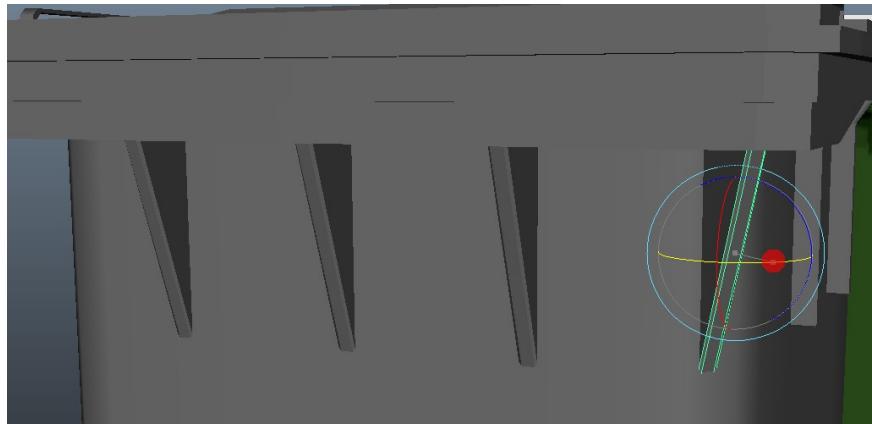


Create a cube. Snap one of the lower edges with the edge above it. Merge the vertices.

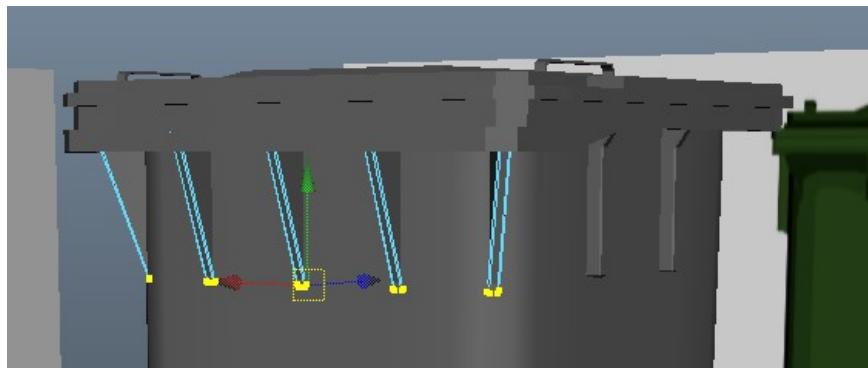


Select the two outer-facing edges and **Bevel** them.

Place the new triangle support flush against the bin. **Duplicate** and place/rotate them to match the image.



Select all of the triangle supports and select all of the lower vertices and move them up slightly so they're shorter than the cube supports.



Select all objects but the wheels. **Combine** them.

Select the two wheels and **Combine**.

With the bin selected in object mode, hold the right-mouse button down, wait for a menu to appear and, still holding down right-click, navigate to **Assign Favourite Material > Blinn**.

This makes and assigns a new material. Change the colour of this material to a green.

Select the wheels and repeat this step but colour them a dark grey.

