Modeling the Honda HSV-010
Dark Scarab Tutorials -- Blender 2.5

Introduction


To start, I want to make it clear that this tutorial expects you to know the basic controls of modeling, such as grabbing, extruding, changing the view, and so on. Some special tools will have the keystrokes along with them, but for the most part, I won’t be telling you how to do each keystroke because that would just make the tutorial amazingly long. This tutorial is not for an absolute beginner and much of it involves you working on your own as there are many repetitive steps.

Before starting a model like this you have to find yourself some good reference images. The first place I look for any blueprints is [http://www.the-blueprints.com](http://www.the-blueprints.com). They have blueprints for any type of vehicle you could want. If you do not want to use the reference images I linked to above, I recommend going there first. When you have found your reference images, we need to find images of all sorts of angles of our vehicle. There are a couple of reasons for this. First is that there are always parts of the vehicle that you will not be able to see with only the reference images. The second reason is that you will probably want to put some materials on your car and the images will give you a good idea what to do. For the HSV-010, I found a bunch of good images here: [http://www.autoblog.com/photos/honda-hsv-010-spy-shots-at-suzuka/#2562844](http://www.autoblog.com/photos/honda-hsv-010-spy-shots-at-suzuka/#2562844). When I talk about looking at some images of the car other than the blueprints, these are the ones I am talking about.

The first thing that we want to do is set up the background images. For this tutorial I want to focus on the actual modeling of the car, so I won’t go over it explicitly. However, if you need help in setting up the images for use in Blender or have never done it before, check out [this tutorial](http://www.darkscarab.com/tutorials). I go over how to find, crop, correctly position and resize your reference images in Blender. In fact, it should work nearly seamlessly with this tutorial if you need to do that now. Also, if you decide not to do this and you run into problems with your reference images later on, it may be wise to check the tutorial out to make sure you have done everything right.
Making our First Piece

Since the very top of the car looks really nice and easy, I will start there. While in the top view, add a plane to the scene. After that, go into edit mode, delete three of the vertices, it doesn’t matter which ones. Move the remaining vertex to the center of the car so that it is right over the y-axis line. You can do this by pressing ‘N’ while your mouse is in the 3D view window and then changing the X value to 0 in the Transform section on the side panel that appears. This will leave us with one vertex and this is where we will start modeling. The image below shows what I mean.

Now we need to move our vertex into the right position. We have already gotten the vertex to the middle of the car so we only have to move it along the Y-axis to get it to the right spot. I am going to move the vertex along the Y-axis so that it is right on top of the line that marks the front most part of the roof. Once that first vertex is placed, we will extrude and follow along the front edge of the roof. With the vertex selected, extrude and place the new vertex somewhere to the right and on the front edge of the roof. Then repeat with the new vertex, and continue until you reach the corner of the roof. Here is what we are shooting for:
Now we want to cover the whole area of the roof with faces. To do this, we just select all of the vertices that are along the front edge of the roof and extrude them all at once. Place the new vertices up along the roof a bit. You should have a row of faces along the front of the roof instead of just a row of vertices. Continue extruding and placing until you have covered the roof. Don’t worry if the faces extend outside the edges of the roof yet. While you are extruding, it is best to have the vertices evenly spaced or somewhat close to it.

When you have the roof covered with faces, we need to attend to the edges. We don’t want the faces to extend beyond the edge of the roof in the same way we wouldn’t want to color outside the lines in a coloring book. The solution is to grab each individual vertex that is outside of the roof and on the edges of our mesh to go right on the edge of the roof. You will have to do this until none of the faces extend outside of the roof lines. When the edges are done and all the vertices are within the area of the roof, you can fiddle with the vertices a bit in order to even it all out.

Right now we have our roof complete in only two dimensions. What we need to do now is add that third dimension to it by using the side view and front view to get the vertices to the right height. This is where the quad view is very useful. You can turn it on by pressing Ctrl-Alt-Q in the 3D view window. You will be given a top, front, and side view plus a perspective view. The only one you will be able to move your view around in is the perspective view.

Once you have your quad view, select all of the vertices and move them to the general height of the roof so we can zoom in a bit without losing sight of the vertices. To put each of the vertices to their correct vertical height I first look at the top view and select any one of the vertices on the edge. Then I use one of the other two views to position the vertex correctly by grabbing the vertex and only moving it along the z-axis. I repeat the process for the remaining vertices. I find this system works well because it is easy to select in the top view and using the two views together is great when you cannot see very well in one of them or if one of the images is a little off. Here you can see I did all of my edges of the roof.
The last thing that we need to do to this roof is to get the area inside of the edges smoothed out. There are various ways we could do this and depending on how much time you want to spend on it or how much detail you want is going to determine what you do. I think the simplest way is to select all of the vertices in the middle and punch the Smooth Vertex button in the toolbox a bunch of times until you are happy. The problem with that is that it tries to make the vertices flat, not nicely curved. However, it can smooth out some nasty bumps quite nicely and if you are relying more on materials and textures to make it look good, this can be better as well.

Another choice would be to move the individual vertices so that they are a nice smooth curve. I tend to go one by one and use both the front view and side view to generally position them all then in the perspective view I try to get rid of the bumps and dips. Sometimes I will use Smooth Vertex a tiny bit to smooth it out. The downside is that you are moving each vertex one by one and it is relatively slow. However, the precision is much better if you take your time to get the curve right. I am sure there are other methods but all in all, no matter what you do, as long as it looks right to you, then you have done it right.
Mirroring, Normals, Smoothing, and More

Now that we have finished our first part I want to pause for a moment and talk about a few things. First is mirroring. We only have half of our roof done, however it is very quick and easy to create the other half. To mirror the roof, go into object mode, select our roof, and find the modifiers section in the right side panel (blue wrench). When you click on the Add Modifier pop out find Mirror and select it. The default settings worked well for me, but if you find that the roof is not mirroring correctly, try to change the axis setting to see if one of them makes it work right. There are other ways that you can go about mirroring, but I like this one the best because you can make changes later on without having to re-mirror it and you don’t have to worry about duplicate vertices.

You may not have run into this next problem yet, but chances are that you will run into this problem sometime while you are making your vehicle. In the image below, you can see the dark shadowy weird spots where it should be nice and smooth. This is a problem caused by some faces with their normals pointing in the wrong direction. There is a simple fix and that is to just select everything and press Ctrl-N, or you can click on the recalculate button in the toolbox panel.

Another way to fix this issue, if the above does not work, is to go into edit mode, and press N to make the properties panel on the right to appear. Somewhere in that panel there should be a section called Mesh Display. In that section, turn on Face under Normals:. This will cause the normal direction for each face to be displayed in the viewing window. When you find the faces that are pointing in the wrong direction you can go to the toolbox panel (Press T) on the left side and find Flip Direction under Normals:. You probably will not have to flip the normals manually like this though, but it’s just good to know about.
Now I want to talk about smoothing. If you look at our roof, you should see that it isn’t exactly smooth when you render it. You can see the rectangles of all of the faces we made and the sharp edges along each of them. The quick fix to this is to go to the toolbox and there is a Smooth button. Select that and it should get everything smoothed out for you (You must select the vertices if you are in Edit Mode). If that does not work out just right, you can also use the Auto Smooth setting. This setting is in the Object Data settings in the right side window. By changing the Angle setting while Auto Smooth is turned on, you can fine tune when the smooth setting will smooth out an edge. Everything with a smaller angle than the setting will be smoothed out.

The last thing that I want to point out about this tutorial is that I am going to be making the car in pieces. Right now we have the roof and that will stay as one object for the rest of the build. When we start working on the hood (which is in the next section) we will have a separate object for it and so on. My reasoning for working in this way is that it creates a smaller chance of making a mistake on a part of the car you are not working on. For instance, if we have one big piece and you are working on the back you might accidentally select a vertex for the front of the car. If you don’t notice anything you might have to undo a bunch of work or go back to the front to fix it. Not only will pieces prevent little errors like this, but it will also allow you to move parts to other layers so you can see the vertices that you are actually working on better. It isn’t a huge deal, you can still do it all as one object, but it helps prevent a few little mess ups or possibly a big one from happening down the road.

Vents and Hood

For the second piece of the car I am going to go to something a little bit more difficult, the hood. There are two reasons why this is more difficult. The first is that we cannot see some sections of the hood from the side and front view due to the curvature of the car. Another problem is just the fact that there are a few vents we have to deal with. My first instinct when I have this sort of problem is to just do the easy stuff first, which would be just getting the general shape of the hood done, then doing the vents. However, I know if I do it that way, I will have to do a bunch of fiddling around with the vertices when I want to plug in the vents. Doing the vents first allows me to avoid the fiddling and I can just build the rest of the hood off of it.
The vents are created in a somewhat similar way as the roof. We will add the plane, remove three of the vertices, and place the remaining vertex on one of the lines for the vent in top view. After that, just extrude along the edges of the vent. Unlike the roof, we won’t be doing just one edge, then extruding across (which is nice for big smooth surfaces). Instead, I like to fill the faces in along the way. For instance, in the top left corner of the right vent I could make a nice quad, so I put vertices on the corners of the little stick out and fill it in. I use Ctrl-F to fill in spots as I go when I am outlining more complex sections like this. To use it, just select the four vertices of the quad you want to make a face out of then press Ctrl-F. After I finished outlining and filling in, I extruded the areas that make up the holes of the vent downwards and forwards similar to what the actual car does.

Once thing to note about this is that I am heavily relying on images to help me get the vents look right. As you may be able to tell, some aspects of the car will be hard to see and hard to determine how to do with just the blueprints. If you are stuck because you aren’t sure how it should look, do not hesitate to find other images from all sorts of angles so you know how to continue. Sometimes you will end up just having to call it good enough even if you know it is not right.

With that in mind, let’s move on the other vents. These ones I find are somewhat easier just due to the fact that they are repeating. Like usual, I started with my one vertex and extruded and grabbed vertices until I got the shape of the first little vent cover done. I made the largest and forward most vent cover first, then just duplicated it with Ctrl-D and moved it into place. Once in place, I would go into edit mode and adjust it so it is in the right location and then move the edges a bit for the slightly different shape. Duplicating and moving is much simpler than recreating each little vent cover just because they are slightly different. After that, I continued duplicating and moving as I just explained. In the end I attached each little vent together and made one big row of vents.
Before we begin working on the rest of the hood, there is one thing we ought to do first. If you look at images of the HSV-010 you will see that the middle vents are removable pieces and more importantly, there is a nice indent all around the edges. Rather than just make that smoothed over and ignore it, we want to actually make that indent. There are multiple ways you can do this, but the way I like to do create an indent is to have the vent be a separate piece from the hood while still being the same object.

To do this, you want to select the edge all the way around the vent that will be along the indent line. Now we want to duplicate these vertices and scale it up by a small amount, I did 1.005. Now, rather than building off the edges of the vent itself, we will build off of the edges of the new ring of vertices we just created. This way, we have a gap around the vent that will appear when we render it. In the image below I extruded outwards just so you can see the gap that this creates, you won’t need to do that.
There is another thing that I want to point out before we move on. There are going to be places that you cannot see in the reference images. As great as they are for getting the correct positioning of your vertices, this is their one big downfall. Also, there are only really two ways you can go about it. The first is to just flat out guess and just play with the vertices until you are satisfied with it. This is just fine if you are not too worried about how closely you replicate the car. The other choice is to whip out as many images of the vehicle you can and then study the images so you have a really good idea of what the hidden section should look like. Then you will have a much better estimate as to where the vertices should go. In terms of replicating the vehicle as closely as possible, it is much better than guessing because you know what the hidden area should really look like.

With that in mind, let’s complete the rest of the hood. For the most part, this is going to use a combination of what we did with the roof and with the vents. I basically just extruded sections from the vents and for each section I would set it up correctly in the top view and then get the third dimension completed. For instance, the first thing I did was extrude the vertices to the left of the vent all the way to the center of the hood in the same way we did with the roof to create a grid of faces. After I did that, I would get all the newly added vertices in the correct vertical position. When that is complete I would extrude over another part of the hood and so on until the whole hood is complete. This is exactly the same thing we did with the roof, only we are doing smaller sections at a time. Below you can see what I mean by building in sections.
Before I end this section, you should note how you should position your vertices and the shape of the faces. You really want to focus on having very few to no triangles in your mesh. Some people treat triangles like the root of all evil, which in many cases is ok, but in my opinion if you are just modeling for fun then it won’t hurt to have a triangle here and there if it doesn’t affect how it looks when you render or if you will never even see it when you render. Modeling for gaming also allows for triangles.

While having only quads is great, you will also want to have your edges flow nicely. For instance, if you look in the image below and at the faces just to the bottom left corner of the middle vent you can see what I mean. Rather than just have a square grid that gets cut off (which would quickly lead to triangles) when you hit the edge, I have the faces curve around it and as you follow a row of the faces to the right you can see how it curves and wraps its way around the hood. That is the sort of thing you want to try to achieve, you want your vertices/edges/faces to curve around the surface as naturally as possible so that it is easier to get a nice smooth surface instead of one you have to mess around with for ages and ages to get just right. I find that a good way to test if your topography is good it to press Ctrl-R while in Edit Mode and just hover over things to see if the purple line stops abruptly in the middle of your mesh. If that happens, you have a problem. You goal is to make it so that if you were to use that tool, you won’t create any triangles in the process.

The Windows

Just to get things moving again, let’s go back to something that is really easy, the windows. My reasoning for having this section rather than just letting you do it on your own (as I know you can) is to show you how you can quickly get started on a new section of the car using an adjacent edge of a neighboring piece of the car. Let’s get this started.

The first thing that we are going to do is create the top edge of the windshield. Rather than adding the plane and removing vertices and so on like we have been, we are going to select the roof of the car and go into edit mode. Once there, select the row of vertices that are right up against the top edge of the windshield. With those vertices, press Ctrl-D to duplicate those vertices and move them along the y-axis by a very small amount.
to create a gap. Press P and choose Selected in the popup. This will separate the new vertices into a new object. Now we can go back into object mode and use the new object as the windshield. All you have to do now is extrude across the windshield in top view just like we did with the roof.

For the remaining pieces of the car I will pretty much use this technique to get them started. I really like it because it means I will have nice clean lines every single time while still keeping everything separate from each other. As another bonus, the positioning of the vertices on that first edge will already be in their correct position in all 3 dimensions or at least very close to it.

At this point in the tutorial I have shown you three ways to build different sections of the car. One was demonstrated with the roof where we were able to build the whole thing with a few extrusions. The second was with the vents where we built the part by tracing the edges and filling in the face. The third was with the hood, where we extruded like the roof, only we built it in sections rather than all at once. I also showed you how you can make nice clean gaps between parts of the car as well as mirroring, fixing bad normals, and making the surface of your car smooth. In another bit I mentioned the importance of quads and the topology of your car. I say all this because this is pretty much all you need to build the body of the whole car.

While I could go over doing every single part of the car, I personally think it is unnecessary due to the repetitiveness of the whole process. The doors and other big smooth areas are going to be built in the exact same way as the roof and the curvier and cornered sections will be built in sections like the hood and the details will just be built like the vents. Personally, I think I would be insulting your intelligence by repeating it over and over again. For the remainder of this tutorial I will be going over certain parts of the car that you may find troublesome. This includes the headlights, the diamond grille, the wheels, and the tires.

**Headlights**

I think the thing that trips people up the most about the headlights and taillights is the fact that most of the time you have little to no reference for what is under the cover. While the reference images that we have do have some details for the headlight, I feel it is not enough because it is so blurry. Therefore, I am relying on images to get through this. And since there are so many types of headlights out there, I can’t say there is going to be one good technique for all of them. However, I am just going to tell you what I did, so that you have some sort of idea of what you can do. Sometimes all it takes is some good old improvisation.
Let’s do the easy part first, which is the actual light and the chrome cylinder-like thing that goes around it. All I did for this part was add a circle and placed it into roughly the correct position in the front view. The rest was as simple as extruding the edges of the circle and scaling it up as I moved back on the light. I also decided not to get really detailed on this part. Rather than doing the actual light bulb and the inside of this cylinder piece, I just made the clear front cover of it and left it at that. Of course, if you want to model that part of the light, there is nothing stopping you.

After I did that part I went ahead and did the inside backing of the whole headlight area. Since I found it quite difficult to determine how some of the back of the headlight in the car was supposed to look, I pretty much guesstimated. To start, just like we did with the front window, I duplicated vertices from the hood to get the top edge of the headlight area. After that I extruded downwards and then forwards while making sure that the light cylinder was still showing as well as incorporating that rectangular inner light into that same mesh. The front edges of this part of the headlights were made by following the edges of the reference images as usual.
The last thing I did was the clear cover for the headlight. I did this part last because it probably would have just gotten in the way had I done it otherwise. Not a big deal, but it still removes a minor inconvenience. In some ways, this was more difficult than doing the back of the headlight because not only can you not see any of it in the reference images, but it is also difficult to see it in the actual photos of the car itself. So, at this point, it was just a matter of getting the edges right and curving the mesh so that everything that should be on the inside of the headlight is actually inside, after that I made sure it looked smooth and then just left it alone.

I know it is not a very detailed description of making headlights, but hopefully the images that are there will help give you a better idea of what I am doing. The best advice I can give on this part is to keep working at it. I had to restart the back of the headlight at one point because I just didn’t like it, so don’t be discouraged if you feel the need to do the same. For the most part, all we are doing is making it so it looks good enough to us when we render.

The Grille

The grille is not too difficult if you know how to use some modifiers correctly. As you can see in the image below, I have already done some of the grille. Some of the parts that I have done are not on the blueprints, nor are they technically in the real car. The blueprints don’t really match the car photos either. However, I am personally not shooting for a perfect replica, nor does this change how we are going to be making the repeated diamond grille.
Before we can use any modifier, we need to make the diamond shape first. Creating the diamond shape is the most important part of this part of grille. For the most part, the shape is just a diamond with a hole in the middle. To create this shape I just added a plane and made it fit one of the diamonds in the front view. As you can see in the image below, I do not have the pointy corners. That little feature is important for when we use the array modifier. To chop off those corners I used the knife tool. To use this tool, you have to hold down the K key while clicking and dragging with the mouse to draw a line where you want to cut. At this point (Blender 2.53) there is no straight line knife tool that I know of, so you will have to do your best with it free-handing for now.

![Image of diamond shape](image)

Ok, so why do we need the corners sliced off? I will explain with the images below. If you keep the corners, you will get something like what is in the left image, which is not what we are going after. Some holes are bigger than others when they should all be the same size. One solution is to change some settings to get it so the corners overlap rather than go point to point. However, not only will you have to search the right setting, but more importantly it will mess up the mesh and give you ugly black noise on the overlapping areas, shown in the image to the right. Therefore we just cut the corners off of them so we don't have the overlapping issue and we get the look we are going for. Be sure to try and get the cuts as straight as possible, otherwise you might find yourself with some gaps or overlap.

![Images of grille with and without corner cuts](images)
Once you have gotten the one diamond all ready to go, we need to start actually using the array modifier. With the diamond shape selected, go to the modifiers panel and add the array modifier twice. One is used for repeating in the x direction and the other is in the y direction, relative to the initial diamond shape. You can see the settings in the image to the right. The only settings I changed were the count and the X and Y value for the second array modifier. Keep in mind though, depending on how large you actually made the initial diamond shape, you may have a larger or smaller count value than I have in the image. So do not be worried if you have a different value for that setting. What you want to go after is enough diamonds to cover the whole area of the grille.

That last thing that you will need to do is click on the apply button for each of the array modifiers so that we can edit the grille as a whole. This is so we can trim edges and make holes in the grille where it is sticking into areas that the grille should not be sticking into. When you are done deleting the extra edges of the grille, you should have something similar to the image below. As you can see, I have also added the grilled parts for the left and right smaller air vents.
Wheels and Tires

Unfortunately for the wheels, we are only going to have one view for them. This means we will have to guesstimate how deep each part of the wheel is supposed to be. Again, we will have to use plenty of photos of our car to get a better idea of what we want to do. The great thing about wheels is that they are almost always radially symmetrical. Therefore what we want to do first is determine what one section of the wheel is that we need to create before duplicating that piece. Since the blueprints for our car does not have any details for the wheel, I used the side view image from the site mentioned at the beginning of this tutorial. To the right, you can see the one section of the wheel that I am going to model. When that is modeled, I will mirror it and then duplicate it.

Now that we know exactly what we are going to be modeling, we can begin. To start, I am going to add a circle and line it up to the outermost part of the wheel. When I have that lined up I am just going to extrude and scale inwards until we get to the part of the wheel the hole begins. Be sure to extrude multiple times, keeping an eye on the depth of the wheel and place vertices where you know you will need them when we add the third dimension to the wheel. I also did this for the very center part of the wheel.

As you can tell in the image below, even though the circles in the center of the wheel are centered relative to the rest of the modeled part of the wheel, they do not match up with the photo. The reason for this is that the photo is not a straight on shot, so things are skewed a bit due to the perspective. Therefore, do not worry much if the modeled part of the car is not matching up with the photo.
When I have done as much as I can where there are no holes, we can delete the parts that are just going to be duplicated (everything in the dark area in the first image in this section). Once all of the excess is removed, we just do as we did with the center vents on the hood and build as we go until we have it done from the side view. There isn’t much else to say other than the usual. Keep to quads and keep the edge flow as well as you can. You do that and things should be relatively simple when you add the third dimension. As I said before, the best you can do with the third dimension is to make your best guess and fiddle with it until you feel it looks good.

Now that we have our slice of the wheel complete, we want to mirror the slice so that we will have one full spoke. After you add the Mirror modifier, you may find that it isn’t quite mirroring correctly. All you should have to do to fix this problem is rotate the piece we have until it all lines up correctly. You may have to zoom in quite a bit (I tend to go all the way) to get this just right. When you have lined it up correctly and you have one of the six spokes complete, Apply the mirror modifier so that all of it is editable. This will allow us to spin the vertices so that we will have the full wheel.

To create the other spokes with the one we already have, we need to select the entire spoke in edit mode. Then in the tools panel on the left side of the 3D view window (press T if it isn’t there) there should be a Spin button. When you click on the Spin button you should see options appear in the bottom of the tools panel as well as copies of the spoke within the 3D view. To get the copies to go around the whole wheel correctly, we need to change some of the settings. First, I changed the Steps setting to 5. This is the number of copies we want to create. Next, we want to change the Degrees value to 300. The reason we do not want 360 degrees is because we would have overlap and since one of the spokes is 60 degrees we subtract that from 360. The last thing that we need to do is check the Dupli box. When all of the spokes are in the correct position, we select all of the wheel and press W then select Remove Doubles. At this point our wheel is complete, besides any changes you may want to make on your own.
With the wheel done, all we need to complete is the tire. The first thing that you want to do is find a tire design that you would like to create. An image search or a search on a tire store’s website should help you get something you like. If you want to use the same tires I am using, you will find it in the left image below. The first thing that I tend to do is create the raised parts of the tire by outlining them and then filling them in. You can see what I did with my tire in the right image below. It’s fairly simple, just make an outline a fill it in or use some other method you may like to use.

Once you have gotten on set of the raised areas of the tire created, we need to fill in the gaps. This sounds simple enough, but one thing to watch out for is the fact that the ends of the pattern need match up when we make our pattern loop around to create the whole tire. Doing this uses a process similar to what we have already done earlier. I just select all of the vertices on one end of our pattern and then drag them to the other end so that we know it will match up perfectly when we duplicate it.
Because the vertices on the bottom are exactly the same shape as the ones on top, we know each end of our pattern will match up perfectly when we duplicate it. Now we fill in the gaps between the raised areas, just make sure you do not move any vertices on the ends of the pattern. After the gaps are filled in, select the faces that correspond to the raised parts of the treads and extrude those faces outwards. There is no predefined distance for us to use, so just eyeball it and place the faces where you think it looks good.

Depending on how detailed you plan on getting with your tires, we can do a few more things. The only other thing I plan on doing with the treads is pulling the vertices on the outside edges closer to the tire. Other than that all that is left is extruding a curve down from the outside edges of the treads. It may be difficult to determine how far you should go when you are doing the side of the tires, but again, this is pretty much something you will have to guesstimate and place where you think it looks right.
The modeling of one of the tire patterns is now complete, so what we need to do next is add an array modifier to that pattern. The first thing that we want to do is increase the Count value a bit, it does not really matter exactly how many you have at this point. This is a good time to make sure that the pattern is repeating in the right direction as well. What we need to do next is make sure that there is no gap between each instance of our pattern. Depending on what view angle you made the treads in, you will have to change the X, Y, or Z value under the relative offset checkbox until there are no gaps between each of the instances. It is also helpful if you check the Merge and the First Last boxes so that overlapping vertices are merged together.

Next we need to make our array of treads to loop around in a circle. To do this, we will use a Curve modifier attached to the treads. The curve modifier requires a curve as a guide which the deformation will follow. Since we want a circle, we will add a circle. Be sure you use Add ➔ Curve ➔ Circle and not Add ➔ Mesh ➔ Circle. If you use a mesh rather than a curve, the modifier will not work. When you have your circle placed in the scene, take note of the name of the circle and within the Object: select box, type in or select the name of the circle in the dropdown. You should see the array of tread deform. If you find that the treads are not curving in the right direction, try changing the deformation axis to something else until you find one that works.
To make our treads go all the way around the loop, we just need to increase the *Count* in the array modifier until it goes all the way around. It may not be exact at this point, just get it as close as you can. Once you have found the closest count value, we need to go back to the circle we added earlier. With the circle selected, zoom in on the gap we need to fill in and scale the circle down or up until the ends match up as closely as you can. The *First Last* selection we made earlier with the array modifier should connect the two ends together when they are close enough to each other. After that, you should have your whole tire complete, pending any other details you may want to add the tire. One last thing that I like to do just to avoid problems later on is to apply both of the modifiers so that I can move the tires around without messing things up.
Finishing off our wheels and tires only requires putting them together as one object so that they will be easier to place in our car. Before we can put them together we have to make the two objects the correct size such that the wheel will fit right inside of the tire. This is as simple as grabbing the wheel and putting it in the correct spot, then scaling it up until it fits just right. When you have then two pieces in the correct position, press Ctrl-J to put them together.

**Putting it all together**

At this point we have completed the actual modeling part of the car, unless you decide you would like to create an interior or any other additions to the car. The only remaining step is to place the wheels and tires into the correct position. I plan on using a mirror modifier after placing the first wheel, so that we don’t have to worry about placing each one individually. If the wheel and tire are not centered on the origin, we need to do that now so that they will mirror correctly. To start, we need to be in object mode and select the wheel and tire. Then press Shift-S, choose Cursor to Center, press Shift-S again and choose Selection to Cursor.
Within *Edit Mode* we can now move the wheel and tire. We must move them in edit mode so that our mirroring will work the way we want it to. Moving in object mode would just mess up the centering we just did. Personally, I like going into side view to place it in the right spot and scaling it to the correct size and then moving it to the correct position while in the top view. After that, the wheel should be in the right position.

Now we will add a *Mirror* modifier. To get all four of the wheels we are going to select two axes rather than just one. I had to select the X and the Y axis to get them to appear correctly. Naturally, the back wheels will not end up in the correct position. There are many ways of solving this problem, but I like to just apply the mirror modifier and manually move the two back wheels to the right spot in Edit Mode using the side view. When you have placed the wheels in the correct position, we should be complete with our car.
At this point I am calling this tutorial complete. However, if you have any suggestions on how I can improve this tutorial or you want to tell me about sections that are incorrect or just want to send me a comment about the tutorial, I would love to hear it!