Build a Butterfly - Carrara Tutorial

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Monarch of the Morning

For this month's foray into the Digital Domain, we are going to model a Monarch Butterfly in Carrara Studio 2. Our goal here is to build a fairly simple butterfly model that has enough details to pass muster, yet be small enough in file size to be practical for use in a crowd scene.

Background on the Monarch Butterfly

The Monarch butterfly is also known as the milkweed butterfly, after the plant that makes up the butterfly's diet during the larval stage. As an adult, the Monarch subsists on nectar. The milkweed diet gives the butterfly a bitter taste that is its best protection against predators. Birds associate the Monarch's color with its toxicity and learn to avoid eating them. Other species mimic the color of the Monarch to take advantage of this. Huge migrations take place every year as the Monarchs travel to their over-wintering sites in Mexico, Florida, California, and coastal Texas. Some tagged Monarchs have been known to travel 1200 miles in these migrations. The wingspan of the Monarch is about three to four inches and the Latin name is Danaus plexippus.

Strategy for Modeling a Monarch

There are three phases to this project. The first phase involves the generation of the image maps for the wings. The second phase involves the generation of the model. The third phase involves the application of the image maps and textures to the model.

For the first phase, we are going to start by generating the image and alpha maps that will be used for the wings, using Photoshop or the2D paint program of your choice. The dimensions of the wing maps will be needed for the modeling phase of the project.

For the second phase, we will begin modeling by entering Carrara's Vector modeler, drawing an outline of the body and lathing it to produce the 3D solid . We'll add a pair of spheres for the eyes. We'll also add a simple set of legs, a pair of antennae, and a proboscis using the Spline modeler. For the wings, we'll add two pairs of rectangles for the front and rear, left and right wings.

For the third phase, we will add the image maps of butterfly wings and matching alpha maps to make the non-wing parts of the rectangle transparent. We will also add a simple image map for the body of the butterfly.

Make the Image Maps

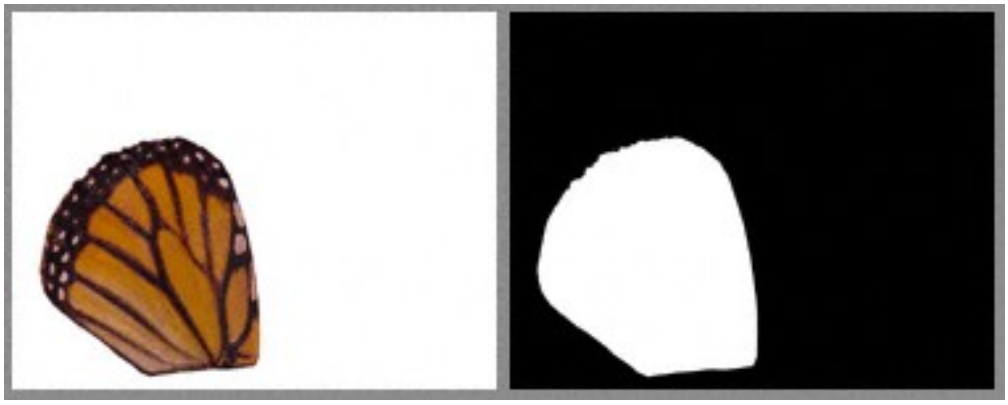
The image maps for the wings can be produced by scanning a drawing or a photograph. You can also paint your own in a 2D painting program. For this project, I photographed a mounted specimen of a Monarch butterfly that I purchased for this project through eBay. The top and bottom views of this Monarch are shown below.

Looking at the two images above, a couple of points are apparent which will have an impact on how we model the wings. First, the wings are darker on top than underneath. Second, we only have a complete view of the upper pair of wings in the top view. Similarly, we only have a complete view of the lower pair of wings in the bottom view. Third, the wings could not be laid completely flat when taking the two photographs, so the shape of a given wing is going to be slightly different between the top and bottom views.

To work around these problems, we are going to do our mapping using the images from just two of the wings. We will use the top view of one of the upper wings for the top and bottom image maps for that wing. To produce the underside of the upper wing, we will adjust the brightness and contrast to get the color right. We will do the same with the top view of the lower wing, adjusting the brightness and contrast to produce the image for the bottom side of the lower wing. This will give us image maps for the top and bottom faces of the two wings on one side of the body. Later on, the wings on the other side of the body will be produced by mirroring the mapped rectangle wing objects.

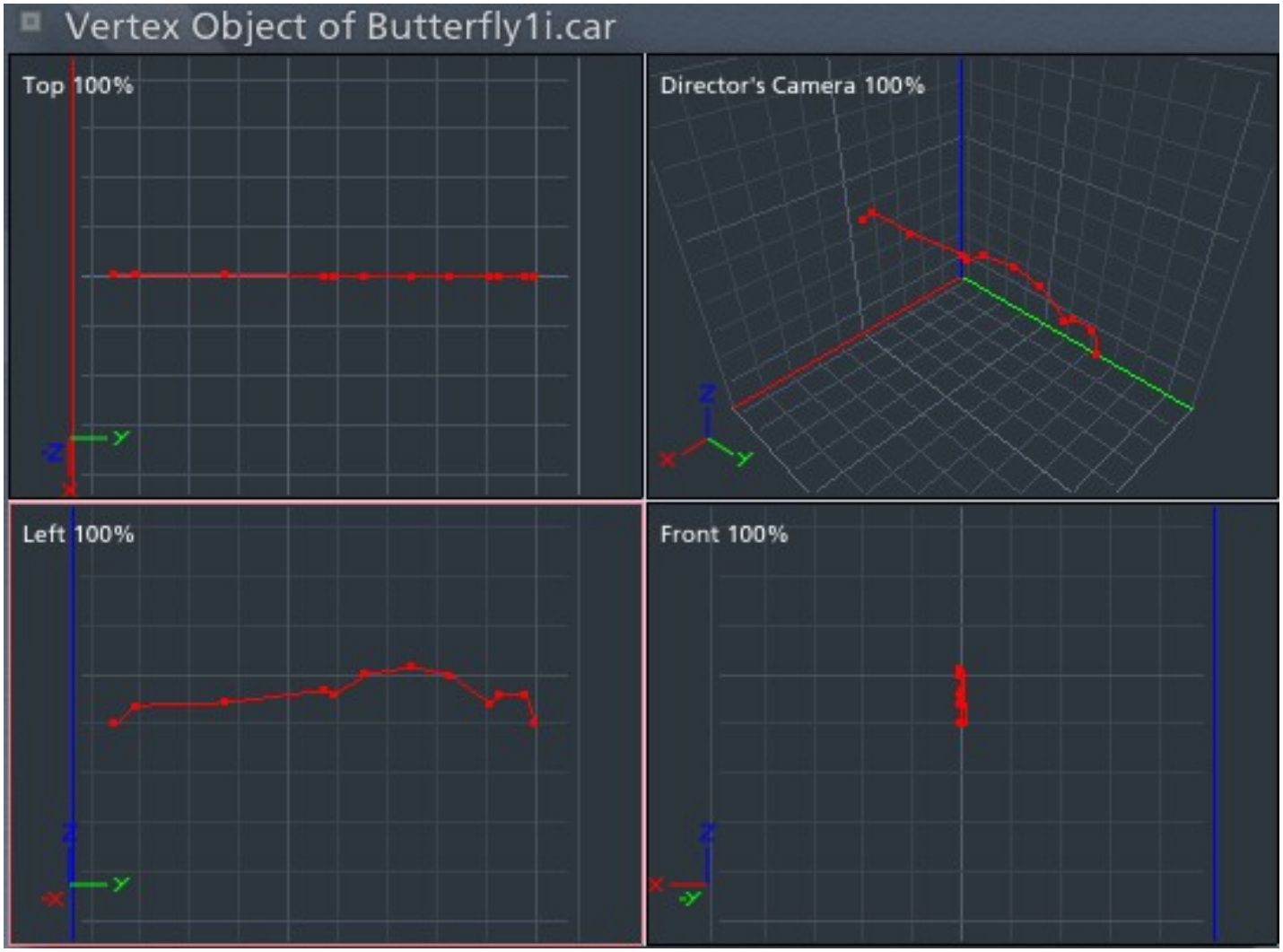
The image below shows the color and alpha maps made in Photoshop from the top view of the upper left wing. To produce the bottom view color image of this wing, adjust the brightness and contrast to get the right look for the underside and save the image under a new name. Note that the same alpha map is used for top and bottom surface of the wing.

The same process was used to produce the color and alpha maps for the top view of the lower right wing, shown below. Note that the top edge of this wing's image was cloned from the underside image since this portion of the lower wing is hidden by the upper wing. Produce the bottom view image of this wing by adjusting the brightness and contrast to get the right look for the underside.

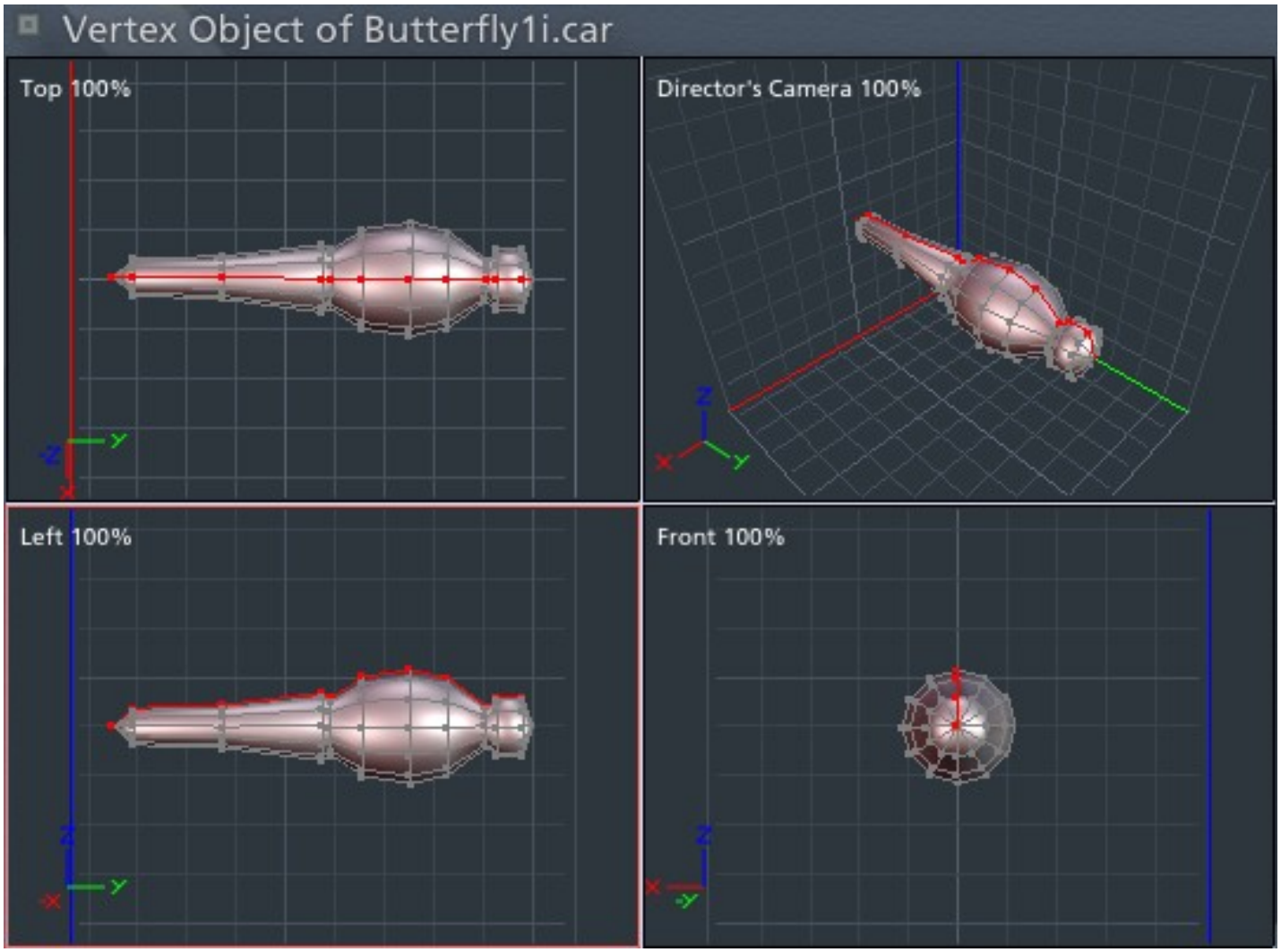


Build the Body

In the Carrara Assembly room, drag the Vertex Object icon into the 3D View to insert a Vertex object. This will put you into the Vertex modeling room. Select the Polyline tool and build the outline shown in the Left View Window below. Make sure the end points of the outline are resting on the Y axis so that X = 0.



Next we Lathe the outline to produce the 3D object. Make sure all of the points are selected and press Construct>Lathe and press Enter. Select everything and turn on Subdivision Surfaces in the Properties tray at the right side of the screen. Your view should look similar to the image below. Return to the Assembly room and use the Properties tray to change the name of this part to Body.

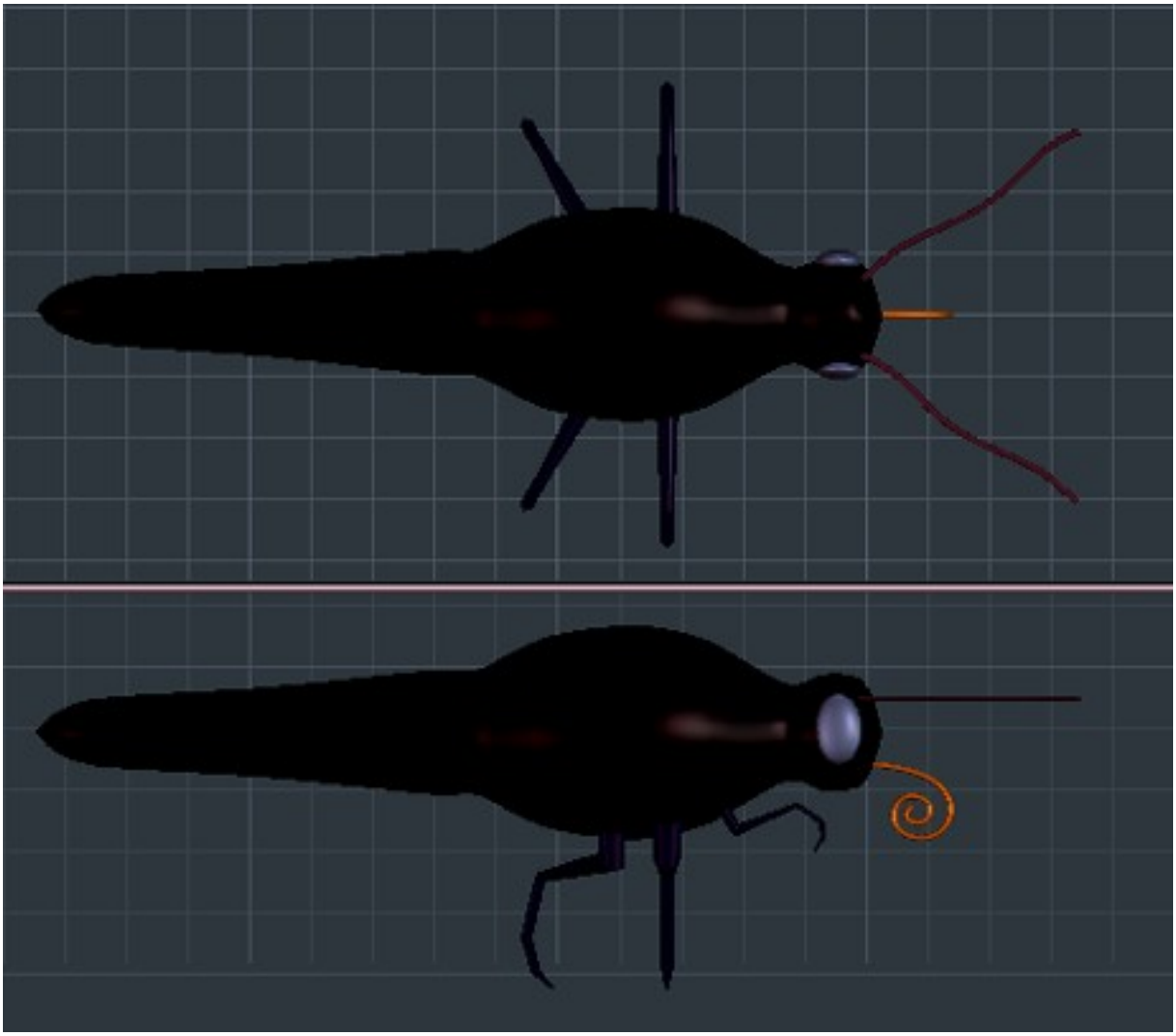


Add the Eyes

Once again, drag the Vertex Object icon into the 3D View to insert a Vertex object. In the Vertex modeling room, click Insert>Sphere and accept the default model with 60 facets. Return to the Assembly room and set the overall size to 15%. Set the X size to 50% and the Z size to 150%. Move it to the right side of the head and use the Properties tray to change the name of this part to Eye Right. Then use the Duplicate With Symmetry function in the Edit menu to mirror the eye around the plane of the X axis. Rename the new eye as EyeLeft.

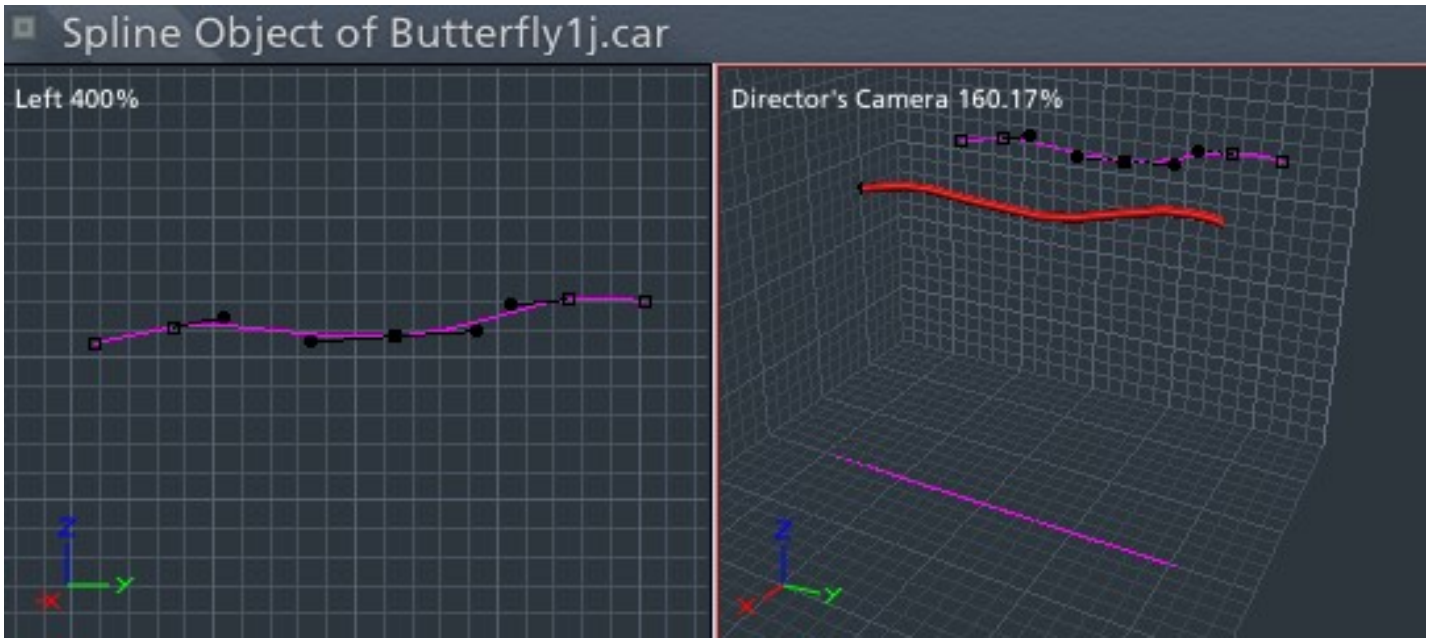
The top and side view images below show the placement of the eyes in the Assembly room. These images will also be used as reference in the following sections for the

adding of the antennae and legs.

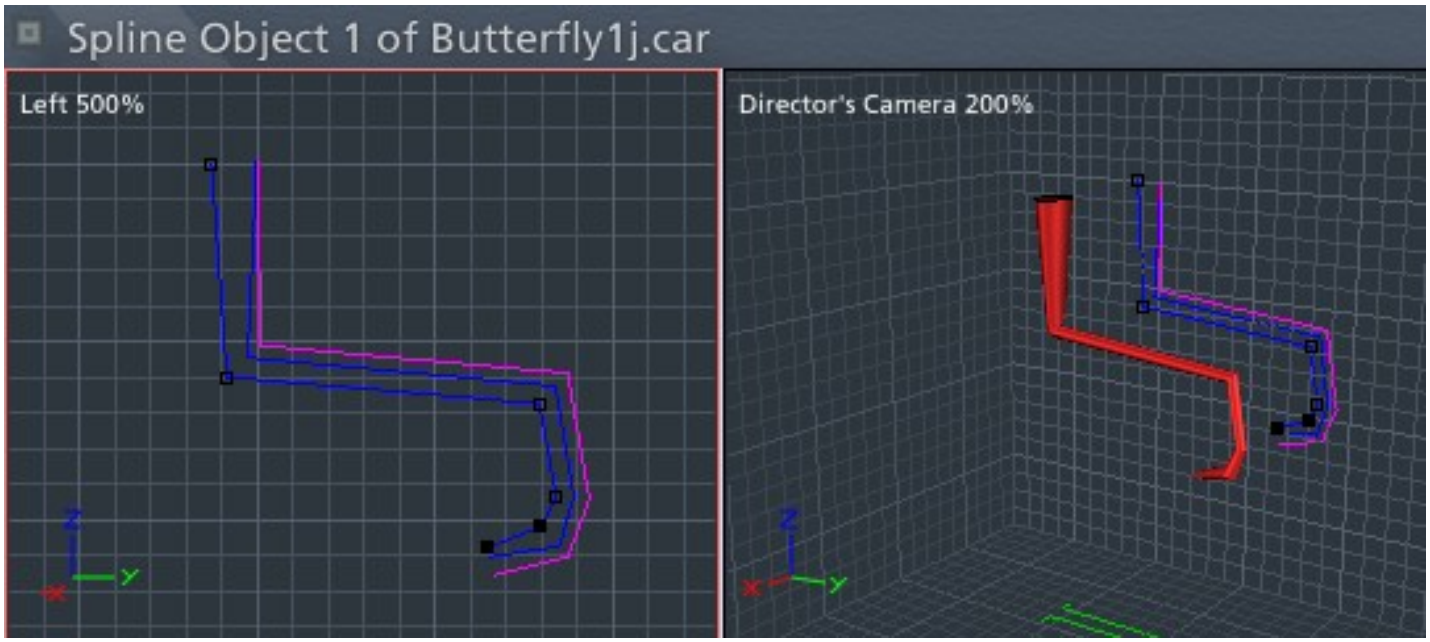


Build the Antennae and Legs

Still in the Assemble room, drag the Spline Object icon into the 3D View to insert that object and enter the Spline modeling room, then click Geometry>ExtrusionMethod>Translation. Also under Geometry, click Envelope>None. Create a line with five control points adjusted as shown below. The ConvertPoint tool was used to allow the path to curve smoothly as it passed through the three middle points. Return to the Assembly room and name this object to AntennaLeft.



Create another Spline object. In the Spline modeler's Geometry menu, choose Pipeline for the Extrusion Method. Also under Geometry, select a Symmetrical Envelope. Create a line with six control points adjusted as shown below. In the Left view, the purple line is the extrusion path and the blue lines are the extrusion envelope. Notice that the ConvertPoint tool was not used since we want the legs to be built from individual straight sections without curves. Return to the Assembly room and name this object to LegLeft1.

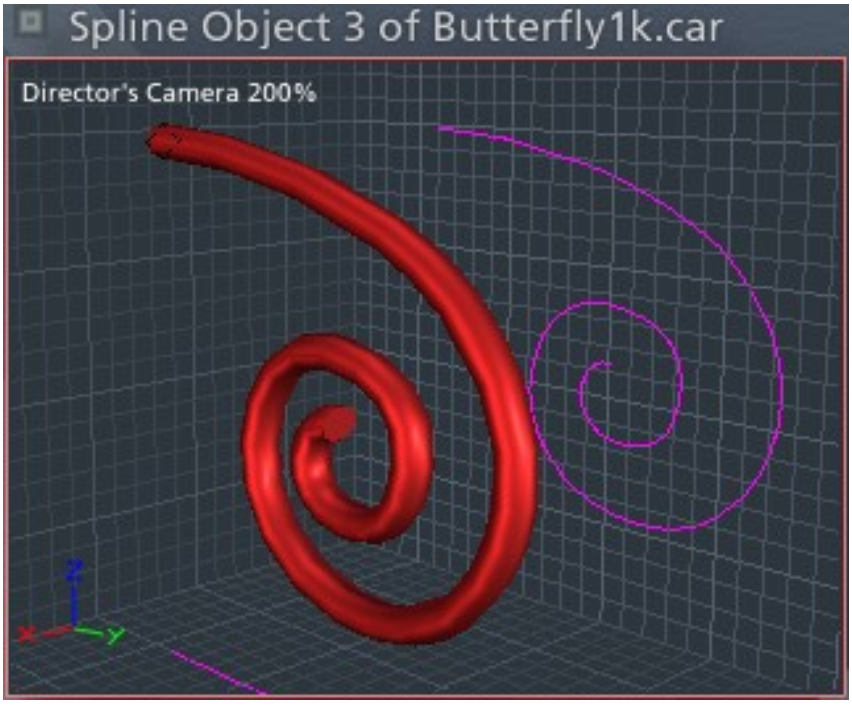


Now we are going to scale, duplicate and mirror the antennae and the legs. Back in the Assemble room, select the AntennaLeft object and scale the overall size to 80%. Set Yaw to -165, Pitch to -90, and Roll to -165. Move the antenna into the position shown in the Top view image illustrating the placement of the eyes. You may need to tweak the scale or rotations to account for differences in the models. When you are satisfied with the left antenna, click Edit>DuplicateWithSymmetry and mirror the object about the X axis. When you are done, rename this new object AntennaRight.

To produce the legs, select the object LegLeft1, and Duplicate it twice, renaming the duplicates as LegLeft2 and LegLeft3. Set the Pitch on LegLeft1 to 15, the Roll to 30, and the overall size to 25%. For LegLeft2, set Yaw to 90, Pitch and Roll to 0, and overall size to 55%. For LegLeft3, set Yaw to 120, Pitch and Roll to 0, and overall size to 55%. Arrange the legs as shown in the Top and Side view image illustrating the placement of the eyes. LeftLeg1 is in front, LeftLeg2 is in the middle, and LeftLeg3 is in the rear. Select LegLeft1 and Duplicate with Symmetry around the X axis. Rename the new object as LegRight1. Repeat this process on LegLeft2 and 3 to produce LegRight2 and 3.

Add the Proboscis

To allow our butterfly to feed, we are going to have to give it a proboscis. This is the tongue-like tube used for sipping nectar from flowers. Construct this object in the Spline modeler by extruding a circular cross section on a spiral shaped path as shown below. The path was made up of ten points, with each point's handles adjusted to produce a smooth spiral. Be sure to use the pipeline extrusion method. Back in the Assembly room, rename this object Proboscis, scale it and move it to the proper size and position.



Export the Butterfly for Mapping

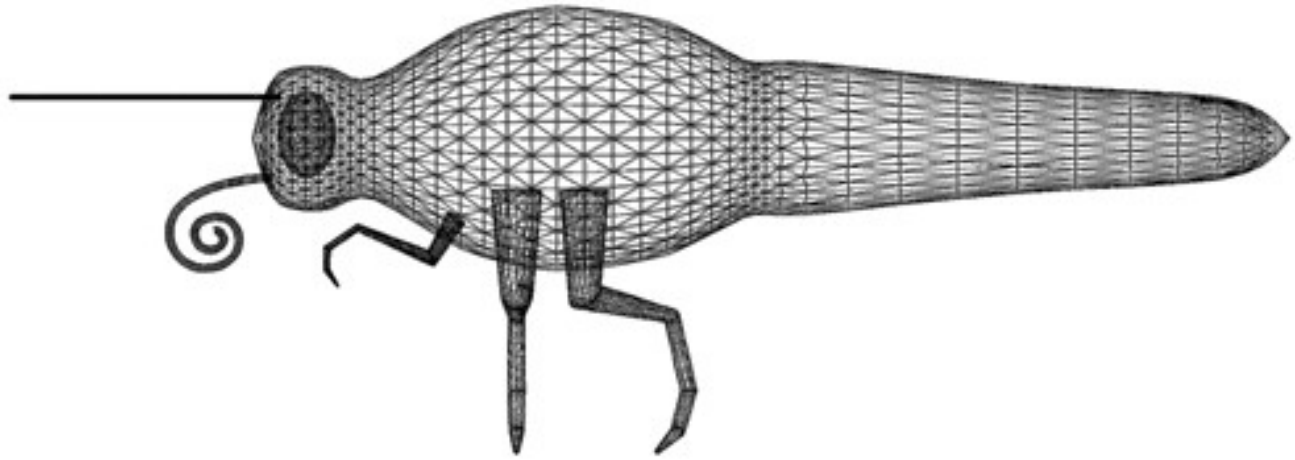
Now we are going to apply UV Mapping to the butterfly's body so we can apply a simple texture map to it. The way we export it for mapping will depend on whether we are using Subdivision Surfaces, and how we are going to use the model afterwards. If we are going to do our rendering in Carrara, then we only need to export the groups needing mapping as an OBJ file, apply UV Mapping to it, then import the mapped model back into Carrara for texturing and rendering. The same approach is used if Subdivision Surfaces were not used.

With Subdivision Surfaces, exporting a model becomes a little more involved. This is

because Subdivision Surfaces are calculated at render time in Carrara so when you export your model, you only export the basic wireframe used to control the Subdivision Surfaces. If the model is going to be used in applications that do not support Subdivision Surfaces and you don't want to lose this feature, then it will be necessary to convert the Subdivision Surfaces to an actual mesh. This is done by selecting only the model groups that are Subdivided, click on Edit, then ConvertToOtherModeler, and convert the mesh to the Primitive Modeler. Repeat, but this time convert the mesh to the Vertex Modeler. This mesh is then exported as an OBJ file for UV mapping.

Apply the UV Mapping

Import the OBJ file into UVMapper and apply UV coordinates to the model by clicking Map>Planar. On the pop-up window that opens, set alignment to the X axis and select Don't Split. You should see something similar to the image below. Note that this image has been rotated 90 degrees CCW to better fit the page. Save the mapped model as a new OBJ file and save the template image. Import the template to Photoshop, add a new layer, and paint a few black dots along the tail end chest region. Fill the layer underneath with white, flatten the image, invert the colors and save as your BodyImage map. Back in Carrara, clear the scene and load the new mapped OBJ file back in. Select the body, go into the Texture room, and apply the texture you just created using parametric mapping.



Build the Wings

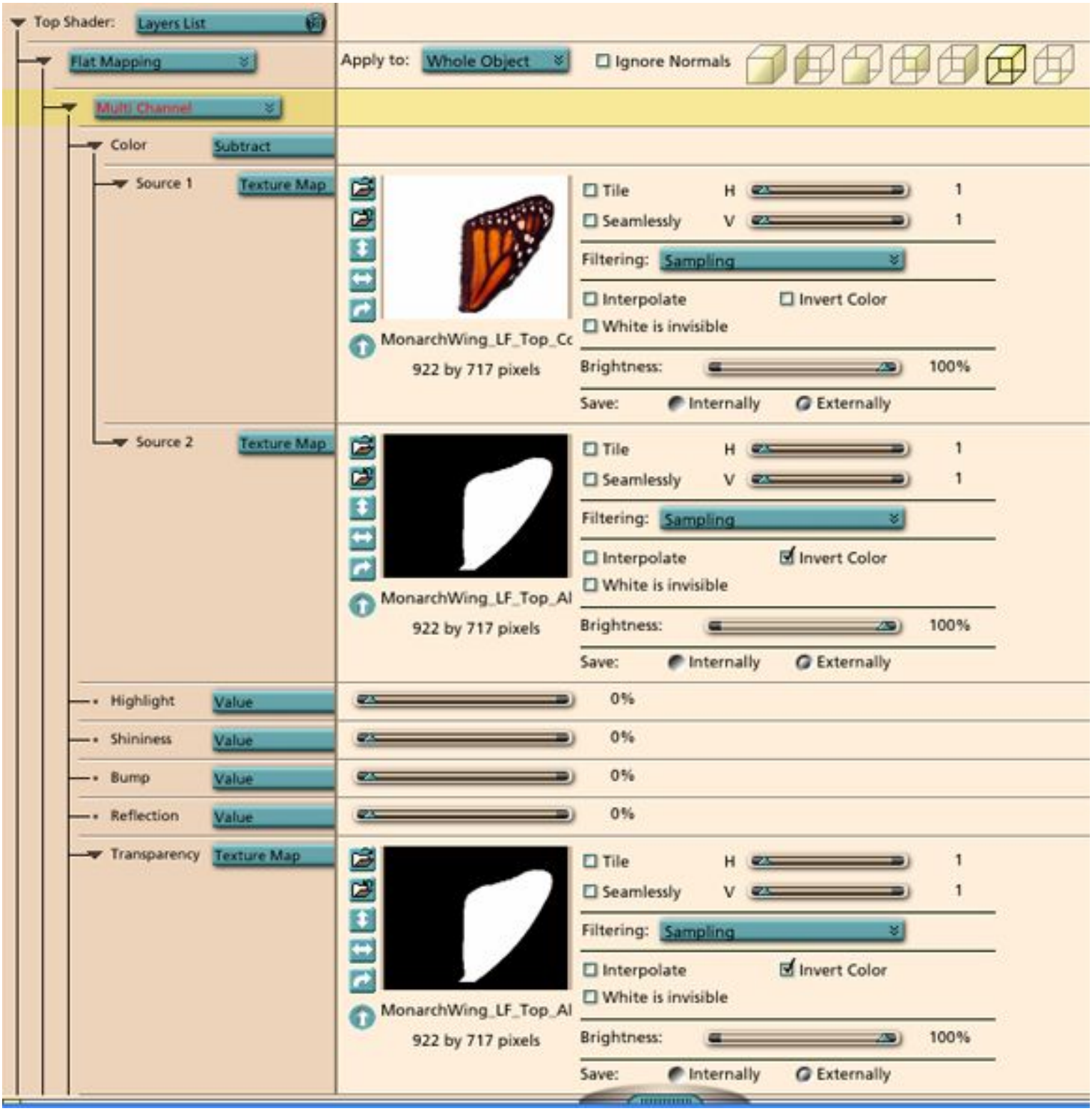
To build the wings, we start by dragging the Vertex Object icon into the 3D View to insert a Vertex object. In the Vertex modeling room, click Insert>Rectangle. For the U size ad V size, use numbers with the same ratio as the pixel dimensions for your wing image maps. For example, the images I used were 717 by 922 pixels, so I set U to 7.17 and V to 9.22. Back in the Assembly room, adjust the overall scale to get the rectangle about twice the length of the body and move it into the approximate position for the left wing. Some starting values would be 500% for the overall size. For the position, try -17 for X, 3 for Y, and 5 for the Z. The exact values will vary from model to model and you will need to do test renders of the fully textured model later on to get the wing size and position exactly right. Rename the rectangle to UpperLeftWing, then duplicate it and rename the duplicate LowerLeftWing. Lower the Z position of the LowerLeftWing by 0.1 so that it is just a little lower than the upper wing. Now group the two wing pieces together and call the group WingsLeft. Move the Hotpoint to the place where the wing attaches to the body so that the wing will flap correctly.

Apply the Wing Textures

To apply the wing textures, we are going to use two shader layers. The first shader layer will be applied to the top of the wing and the second shader layer will be applied to the bottom. A flat mapped, multi-channel set up will be used. The color channel is set to contain two sources where the alpha map (source 2) is subtracted from the top color map (source 1). The alpha map is also loaded into the transparency channel. All the other channels should be given a Value of 0%. Just saying “None” for the unused channels is not enough.

The first layer which was applied to the top of the wing is shown in the image below. It is Flat mapped onto the top of the wing. The second layer is identical except that the bottom color map is used and the shader is Flat mapped to the bottom of the wing. Though it is not shown in this image, you will also want to add a small amount of fine noise to the bump channel for the top and bottom layers.

When you are ready to make a test render to see how the wing will line up with the body, be sure to turn on the "Light Through Transparency" in the rendering options.



Mirror the Wings

Back in the Assembly room, select the group WingsLeft. Mirror the wings by selecting Duplicate with Symmetry on the X plane and name the new group WingsRight.

Make Your Monarch Strike a Pose

You can change a wing's elevation by selecting it and changing the value for Pitch in the Properties menu on the right side of the screen. For the left wing, positive values of pitch raise the wing and negative values lower it. For the right wing, this is reversed. To keep things realistic, the wing should not be raised more than 75 degrees above the horizontal, and it should not be lowered more than 30 degrees below the horizontal. If you plan on animating your Monarch, the wings flap at about 5 times per second during flight.

The Rest of the Picture

The butterfly was positioned as though coming in for a landing, with the wings elevated 60 degrees. The plant models were sprigs of Hemlock generated using XFrog and imported into Carrara. The background was a Bi-gradient applied to a simple backdrop using Carrara's scene effects. Three lights were used and Global Illumination was turned on to produce the render.

That covers it for this time around. This project covered a lot of territory and I learned a great deal from it.

Good luck with your model and Happy Rendering.

Related Links

Eovia, home of Carrara

Adobe, home of Photoshop

UVMapper

Greenworks, home of XFrog

Monarch Butterfly

[RETURN TO TUTORIALS]