

When dragons ruled the skies

Mastering 3D Graphics ~ issue #3

3D Studio MAX ~ Jerry Potts

For hundreds of millions of years giant winged dragons ruled the skies. Vicious and efficient four winged hunters who could change direction instantly or could hover in place at will. They saw the coming of the dinosaurs and could have easily avoided the snapping jaws of an annoyed T-rex. How many millions of creatures fled in panic as the shadow of a 24-inch wingspan darkened the skies overhead? Often the last thing these unfortunate creatures would ever see.



These dragons still live, although not as large as their ancestors, but every bit as capable in the air. Great hunters of the air that have been clocked at over 30 miles per hour and without them, we would be consumed by hoards of mosquitoes; a dragonfly's favorite food.

Setup

The first thing I do before I start any picture is perhaps the hardest, research. Before you can make anything you must know that thing inside and out. If you can draw, do so. Drawing forces you to study an object. If not find pictures of the object or go out into the field and take pictures. While making your scene keep the drawings or pictures in view so you can constantly refer to them. For the dragonfly I took my sketchpad to the local pond and went home with drawings and a little more respect for this little bug. I found some great pictures on the Internet and the local library is also a great research. Don't skip this part of any project, it may be the most important. If you do not have plenty of reference material at hand

while creating your model or while making maps, you will unconsciously generalize or simplify and the finished product will suffer. I have taken pictures of subjects in the field and I have also made sketches but it is always the sketches that I will turn to first for reference material. I think it may be because a photograph is easy to make and is over in a second, but a sketch forces me to look at each detail of an object. I have to think of the object as a collection of different shapes and how these shapes are connected. When I looked at the dragonfly, I saw a head for instance that was made up of many details. However, when the time came to put it on paper I was forced to distill the detail down to three main shapes or parts, that detail could be added to later. This is the same process one uses in any 3d modeling software. Also the surface of the large eyes of the dragonfly had a great amount of



Figure 2

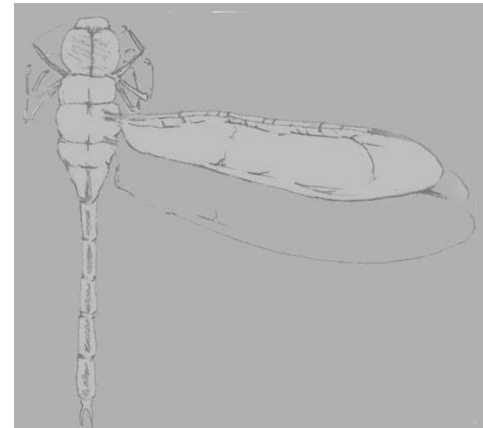


Figure 3

depth, something I did not see in any of the dozens of photos in books or on the net.

I took my sketch and scanned it into my computer. If you don't have a scanner all ready, I would highly suggest you get one. Not only can you scan sketches and any photo or texture from books, but you can put nearly anything on a flat bed scanner; the prices have come way down anyway.

In Left view port I loaded the background image (figure 2) in Top view (figure 3) and turned on Aspect Ratio and Match Bitmap. This will lock the map to the models when you move and zoom in the viewport.

Now is a good time to save the file. I got into the habit of saving often by learning the hard way, after losing hours of work to a lot of computer crashes (figure 4).

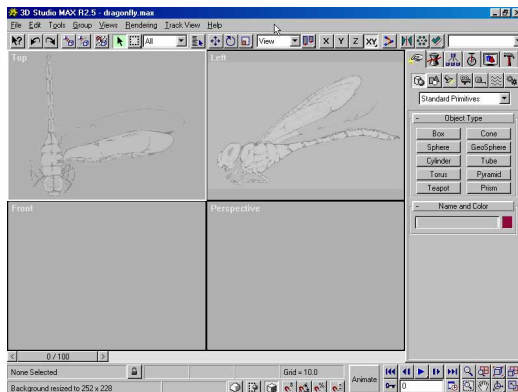


Figure 4

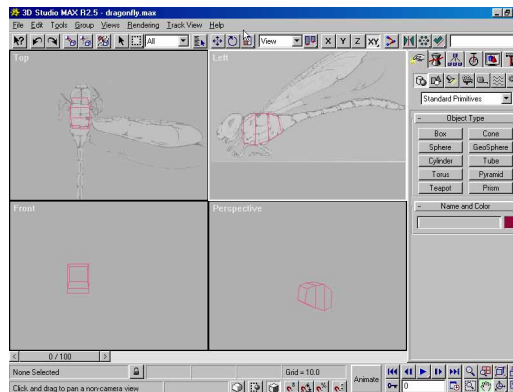


Figure 5

Modeling

The Body

Create a Box with 3 Width segments roughly the size of the drawing of the main body. Rename the box and convert to Editable Mesh. Renaming objects is a good habit to get into; it may be an extra step but having everything in a scene called Box or Line can be very confusing.

With the box collapsed, you can now move the vertices so that they line up with the outline of the main body (figure 5).

Mesh Smooth with 1 Iteration; this will give us more vertices to move. Collapse to an Editable Mesh, then in Sub-Object vertex mode again, align the vertices to the drawing of the insects body. Take special care to align the 3rd

and 5th vertical rows of vertices in both the top and left views with the vertical segments of the body's drawing (figure 6).

Now we will Mesh Smooth our body one-third at a time to give the body a more segmented look. First, in Sub-Object face

mode select the first one-third of the body using the third row of vertices as the dividing line and apply mesh smooth. Collapse and repeat the process with the middle and last third of the body. Mesh Smooth the entire body and smooth the result, apply planer UVW mapping coordinates and collapse (figure 7).

The Tail

Create another box as long and narrow as the drawing of the tail with 9 segments running the length of the tail and rename it. Collapse and move the vertices to align with the outline of the tail. A quick and easy way of doing this is to select an entire vertical row of vertices and scale larger or smaller as required (figure 8).

Select the faces in the first segment of the tail immediately behind the body and apply a mesh smooth modifier, strength 0.3 smooth result with 2 Iterations. Collapse, then select the remaining faces of the tail and mesh smooth

them. The tail still looked a little rough for close ups so I added a Mesh Smooth modifier to the entire tail.

To make the spikes at the end of the tail create a cone in front view with a radius 1 of 3 units, radius 2 of 1 unit, height of 28 units with 5 height segments and 8 sides.

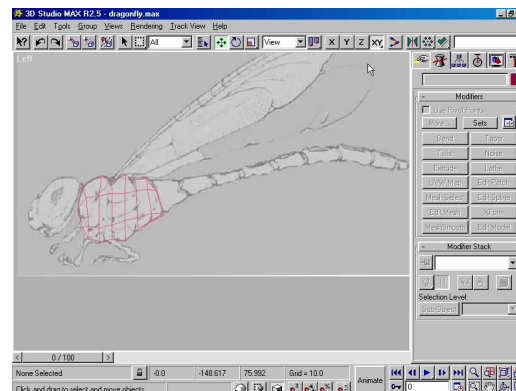


Figure 6

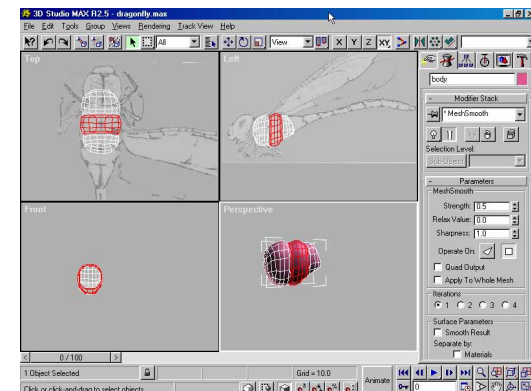


Figure 7

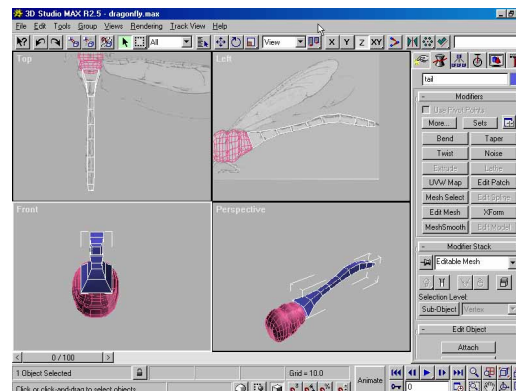


Figure 8

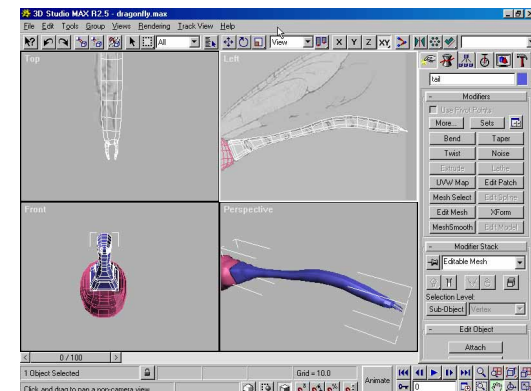


Figure 9

Apply a Bend modifier with an angle of 25 in the Z-axis. Collapse to an Editable mesh and Mirror in the X-axis with Copy on. Move the cones to the end of the tail and scale to fit. Attach to the tail and apply a planer UVW mapping coordinates then collapse (figure 9).

The Head

The head is a little more complicated than the body and tail. It is made up of three main parts the base, the eyes and the mouth. Let's make the base of the head first. Again, start with a box primitive with 2 width segments and rename it. Collapse and in Sub Object vertex mode move the vertices to align with the head structure, ignoring the shape of the eyes (figure 10). Apply a Mesh Smooth modifier with 1 Iteration, collapse and again in Sub Object vertex mode adjust the vertices to fit the head drawing. I found that I only needed to adjust the vertices on the backside of the head by moving them outward in the top view port. Apply mesh smooth again, give it a spherical UVW mapping coordinates and collapse.

The Eyes

For the eyes I created an Icosa geosphere with the radius of 28 units, 8 segments and renamed it outereye. Apply a FFD 4x4x4

Box modifier in the top view. Select all the control points of the FFD box except for the outside (or left) row and move them left or towards the outside, to narrow the eye slightly. Then in Left view choose the bottom corner row of control points and pull them up towards the center of the eye until it fits the shape of the eye in the Z-axis. In order to make the eye have a lot of depth, we will need to create an inner eye with a coloration map applied and an outer transparent layer. I will show how to map it in the mapping section later. While holding down the shift key, scale down the eye; this will clone a smaller copy of the eye. Scale the clone copy of the eye just a little smaller than the original – you may need to left click the scale button to access the scaling unit measurements. For the clone I scaled it 98 for all three axes or about 2% overall. Rename the clone to innereye. Select both inner and outer eyes and mirror in the Z-axis with copy on, to create a duplicate set of eyes (figure 11).

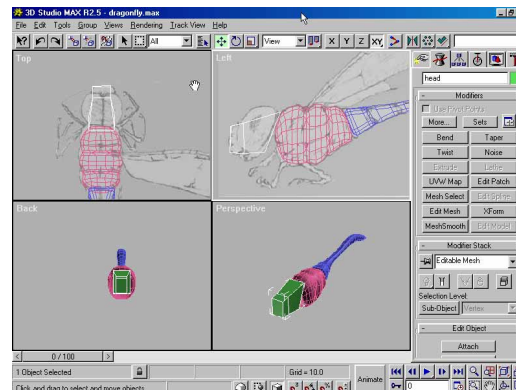


Figure 10

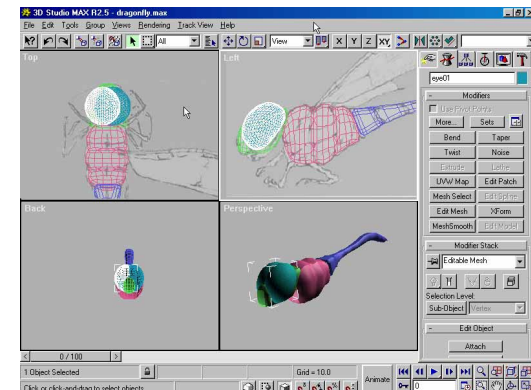


Figure 11

The Jaw

The jaw is made up of two claw-like shapes. To make one I created a line outlining the general shape and renamed it jaw (figure 12). I extruded the shape 5 units, applied a Mesh Smooth modifier with 1 Iteration and applied a planer UVW mapping coordinates. Mirror copy in the X-axis and move the new jaw to align with the original. Rotate and place in position (figure 13).

Before we move on, I want to create a little detail for the head; namely some antennae. Although dragonflies have very little antennae (if any) it just don't seem right to make a bug without antennae. I created a three-sided cone 1x1x20 with 5 height segments so that I could bend it a little. I then shift-copied it and moved them both to the point where the two eyes meet at the top of the nose.

The Legs

A dragonfly has six legs and each leg is made up of four segments. The first two legs can be used for catching and grasping its prey during flight. Fortunately, we need make only one leg. The others can be modified copies of the first. For a guide I loaded a

drawing I made of the bottom three segments of the leg (figure 14) into the background of the left view port. Not shown in the drawing is the small section of the leg that joins the leg to the body. This can be made easily with a box twice as high as it is long and wide, with a taper modifier applied to the bottom. Apply a box UVW map-

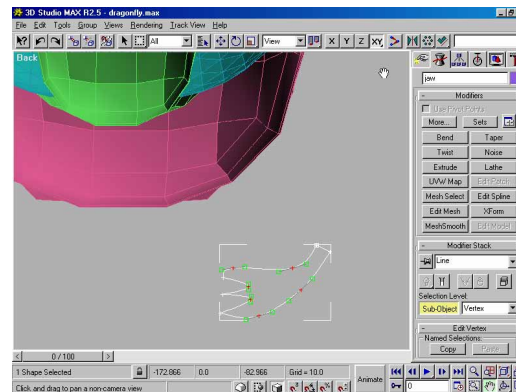


Figure 12

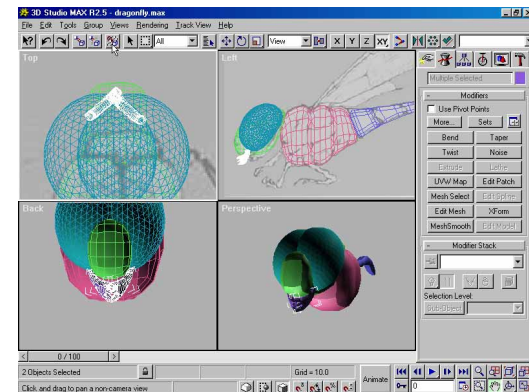


Figure 13



Figure 14

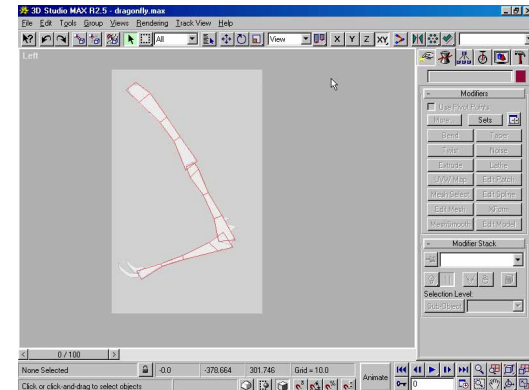


Figure 15

ping coordinates and a Mesh Smooth modifier. For the lower sections create a long narrow box with 4 segments. Collapse and align the vertices to match the drawing of the upper leg. While holding down the shift key select the leg and drag down to create a copy. Repeat until you have three leg segments. Adjust the vertices to match the drawing as you did with the first segment (figure 15).

To make the spikes on the middle section and end section, I selected the face that the spikes are to extend from and divided it into two faces by cutting horizontally from the center of each vertical edge of the face. Then in face mode, I extrude each face 3 times, uniform scaling each time to produce a pair of curved cones (figure 16).

Rename each segment upper, mid, lower leg respectively. Shift-copy move the four shapes twice until you have

three copies of the leg. Apply both a Mesh Smooth and cylindrical UVW mapping coordinates then collapse each segment in the first leg and mirror copy in the X-axis. Adjust the second leg primitive by elongating one or more segments before applying the mesh smooth modifier. Then mirror copy as you did for the first leg. Repeat the process for the last leg and adjust all the legs to the body (figure 17).

If you plan to animate the dragonfly you may want to move the pivot points to the joints of all the leg segments.

The Wings

The wing is made in the same way as the jaw by outlining the shape of the wing, this time using the drawing as a guide then extruding the shape to give it dimension. All

four of the wings are not the same, the back wings are slightly wider than the front. They also have an intricate web lattice support structure. This will be one case where the texture map is made before the model. Fortunately, I was able to find a photo of both wings which I used as the basis of all maps.

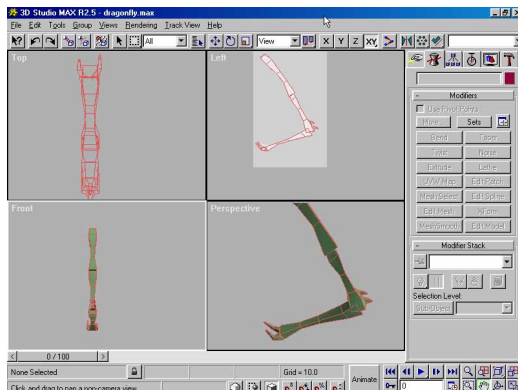


Figure 16

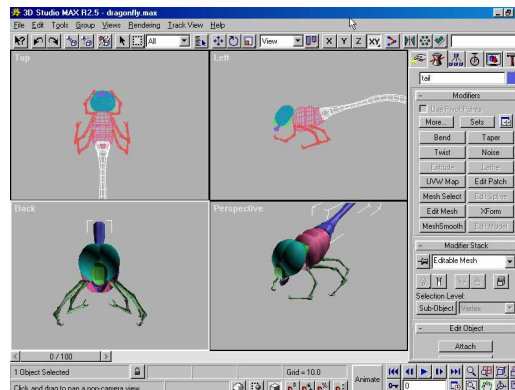


Figure 17

I loaded (figure 18) as the background to the top view port and created a line outlining the picture. Extrude the shape to give it a third dimension and apply a Mesh smooth modifier. Rename it to backwing and collapse.

Load (figure 19) as a background in the top view and repeat the process, this time renaming to forewing. I moved the pivot to the base of the wing to make movement of the wing more natural. We will use both maps in the diffuse channel later. Because some mapping adjustments will be necessary I applied the entire mapping to the wings before I Mirror-copied the wings.

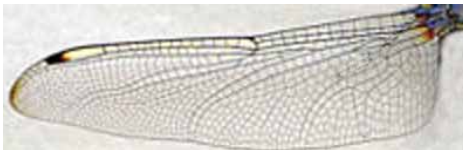


Figure 18

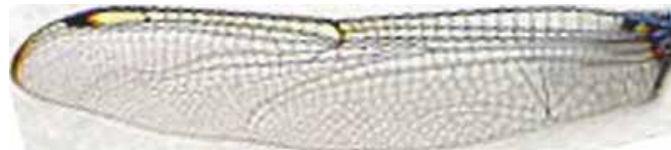


Figure 19

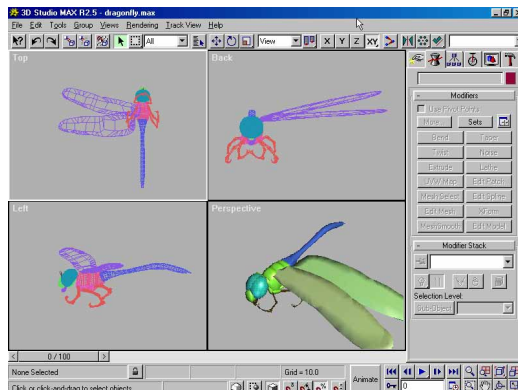


Figure 20

We are now done with the modeling, I will show you how to map our dragonfly next (figure 20).

Mapping

Mapping is very important, maybe more so than modeling. I know you've probably heard this many times before (if you were like me when I first started working in 3d) I was just proud of myself for being able of producing a 3d model. I wanted to get it out as soon as possible to show people. So, I would slap some basic map or material on it and out it went. Months later, after I had improved my renders, I

would look back on these old endeavors and they always lacked a good set of maps, which made them look fake. Now that I'm months older and infinitely wiser I'll pass this on; always make your own maps and take your time making them.

Mapping The Eyes

As I mentioned earlier, the eye of the dragonfly has a lot of depth. Layering several maps is a good way of giving a model an appearance of depth, however, for the amount of depth that I need here I found that I needed an inner opaque eye and an outer transparent eye.

The basic color of the eye was a light green on top, a dark green on bottom with a spotty mixture of the two in the center. In my paint program I created a layer of light green on top of a layer of dark green and using the eraser tool, removed the light green at the bottom to produce the basic pattern. I then used a variety of filters such as a filter that would rough up the border between the two colors – splatter – and a little noise and blur to further blend the two together. And finally, a little tan and dark brown to offset the colors (figure 21). I wanted the eye to have a metallic look so I changed the material to a Metal shading type. In the diffuse channel I loaded our map figure20.tif and turned both the shininess and the shin strength to 64. I renamed the material innereye and applied it to both of the inner eyes. I applied a spherical UVW mapping coordinates to each of the eyes. You may need to turn on Show map in viewport for the map and

adjust the mapping gizmo to get the light part of the map to the top of the eye. You can see the inner eyes better by hiding the outer eye in the display floater.

The outer eyes must be transparent and shiny, so the material I applied to them had opacity value of only 30, a shininess of 49 and a shin strength of 81. Although not much color will show, some will, so I set the diffuse color to a grey-blue R 63 G106 B120 H138 S121 V120. Also the outer eye must have the multi-faceted look of an insect's eye. To get this I applied a bump map set at 100 (figure 22). This map is easily made by drawing equally spaced diagonal lines onto a transparent layer in your paint program. Then copy this layer on top of the original and rotate it 90 degrees. I then applied a spherical UVW coordinate to each eye and rotated the gizmo to align the bump map.

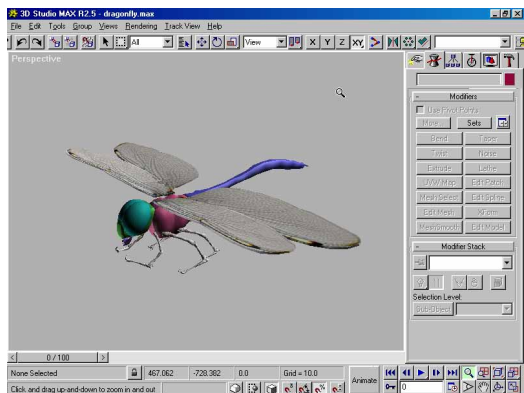


Figure 21

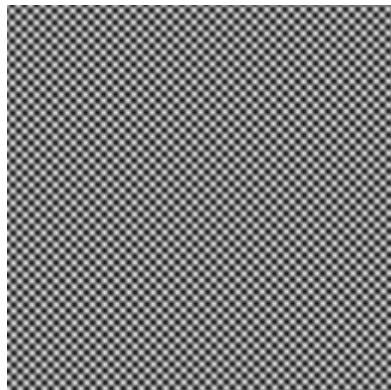


Figure 22

Mapping The Body and Head

The body has a more complicated map applied to it. Dark brown lines over a light green background must line up with the valleys of the segments that we carefully modeled. There are many plug-ins that will allow you to paint directly on the model and they work very well from what I understand. However, I do not have these nice plug-ins, so we will have

to make do with what we have. One of the simplest ways is to zoom in on the side of the body in the left or right viewports and render it. Then load the rendered image into a paint program and paint directly over it. You can then apply a planer-mapping coordinate to the side of the body and apply the new map to it. I painted the map in much the same way as I did for the eye map using several layers and filters. When done, I saved it as (figure 23). I also need a bump map so I converted the body map to grayscale mode and adjusted the contrast and brightness (figure 24). The body should be shiny and a little transparent in certain areas so I turned the shininess to 58 and the shin strength to 71. I loaded figure23.tif into both the bump and opacity channels with 120% in bump and an 8% opacity. I applied this same material to the base of the head and the pair of jaws with some adjustments to their mapping gizmos, particularly the nose portion of the head. I rotated and tiled until the segment line ran horizontally across the nose.



Figure 23

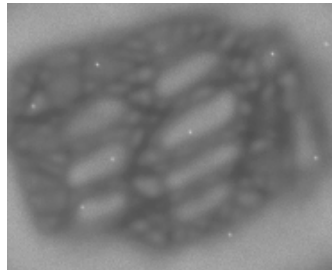


Figure 24

Mapping the Tail

The tail was done the same way as the body by rendering the side and painting a map (figure 25). The map was painted in much the same way as the body by starting with a blue base color. I then added a gradient layer of green on the right side. I then painted lines on yet another layer for the tail segments. Each layer can then be lightened or made semi-transparent to blend with the layers beneath. I added a noise filter to all but the layer with the dark line segments. Flatten the image and save. Tails of dragonflies often have a metallic sheen so I used a Metal shader here too, with shininess at 74 and shin strength at 49. When making the bump map I again converted the diffuse map to grayscale but I didn't want the black spots on top of the tail to be dents so I removed them from the bump map (figure 26).



Figure 25

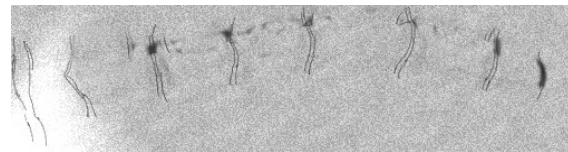


Figure 26

Mapping the Wings

The wings have a web like structure of struts with hundreds of small round and square segments between them. I could have taken the time to draw each one but I found a nice set of photos. so why not use them?

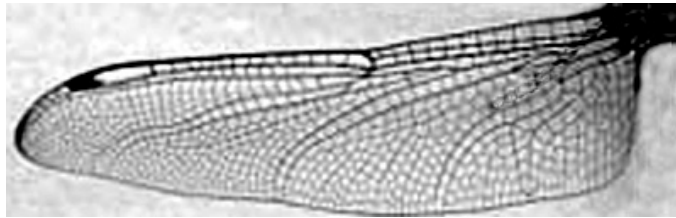


Figure 27

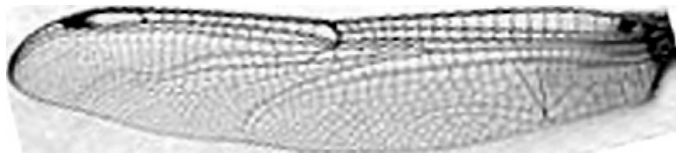


Figure 28

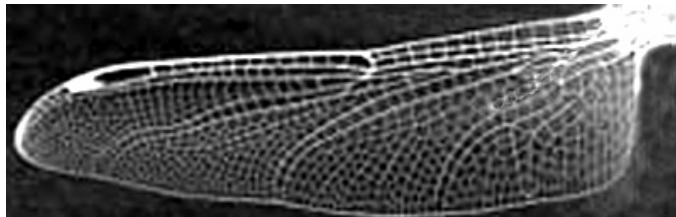


Figure 29

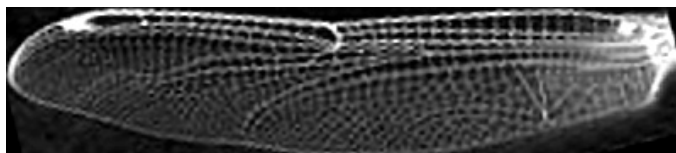


Figure 30

I also needed an opacity map since the areas between the black lines are transparent. So I converted the two diffuse maps for the back and front wings (figure 1 and figure 1) to greyscale mode and adjusted the brightness and contrast a little to bring out the shape (figure 27 – 28) and saved it as a new file. I then inverted it, turning what was black to white to be used for the opacity map, since that which is black will be transparent (figure 29-30). I made two materials that were identical, renamed forwing and backwing and loaded figure17.tif as the diffuse, figure26.tif in the bump channel at 96% and figure28.tif in the opacity channel at 100% for the back wing. With Shininess set at 22 and Shin strength set at 57 for both materials.

The forward wing should have figure18.tif in diffuse, figure27.tif in bump and figure29.tif in opacity. Apply a planer mapping coordinates to both wings. You may need to adjust the mapping gizmo to align the diffuse map. Once both wings are looking right you can then mirror-copy them to the other side of the body.

Mapping the Legs

For the legs, I painted a map that was basically dark brown on each side and light tan in the center (figure 31). This was easily done using a light tan for a base and a dark brown gradient layer on top – using gradient from the sides to the center, fading to transparency. I flattened the image and then adjusted or replaced some of the color by first selecting

a band of color on each side then changing its hue, saturation and brightness. I then added a new layer and painted some light areas to break it up. I gave this layer an embossed effect, which made the light areas look like bumps. I flattened the image again and applied a noise filter. I saved the map then changed it to grayscale mode, adjusted the brightness and contrast again and saved as a bump map (figure 32).

Again, the legs should be shiny (as is the body) since they too have a hard outer shell.



Figure 31

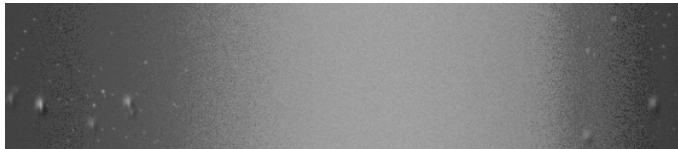


Figure 32

Finishing Up

So there we have a finished dragonfly all set for merging into a detailed pond scene or a scene showing this voracious hunter catching bugs while in flight. For this final render I took a stock landscape photo and applied a di-

agonal motion blur filter to it and used it as the backdrop. I then added a bright light, pale yellow in color to simulate the sun and two pale gray-blue lights to the side and below for ambient lighting (figure 33). Make sure to turn on cast-shadows for all lights. I hope you have enjoyed making this scene as much as I did.

Biography

I have been working with 3d Studio Max and Photoshop for sometime now. I am a freelance artist with formal art training at Illinois State University. Currently I'm making background renders for an educational game called Haunted Math for Developing Mind Software. More of my work can be seen at my web site:

<http://www.geocities.com/SoHo/Studios/1038>
jpotts@fgi.net

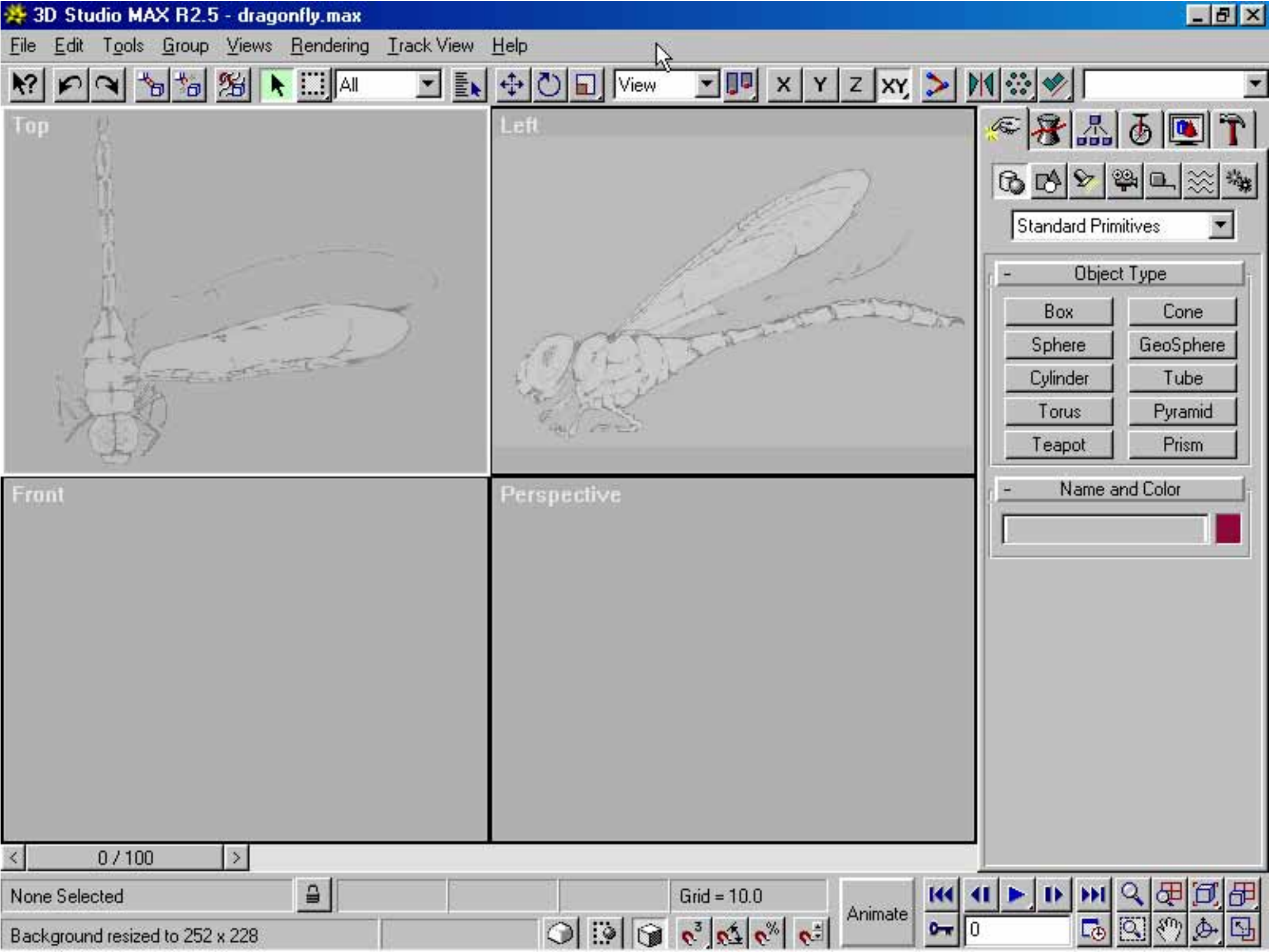


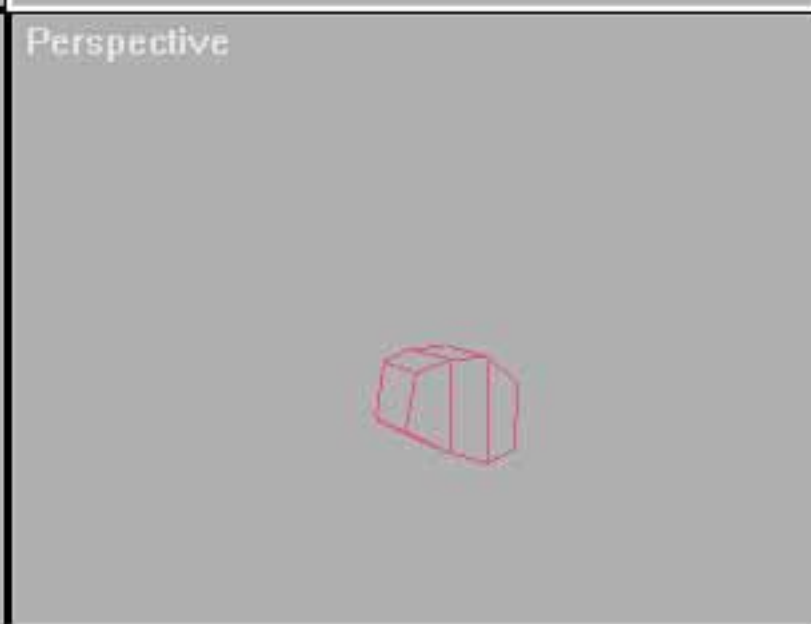
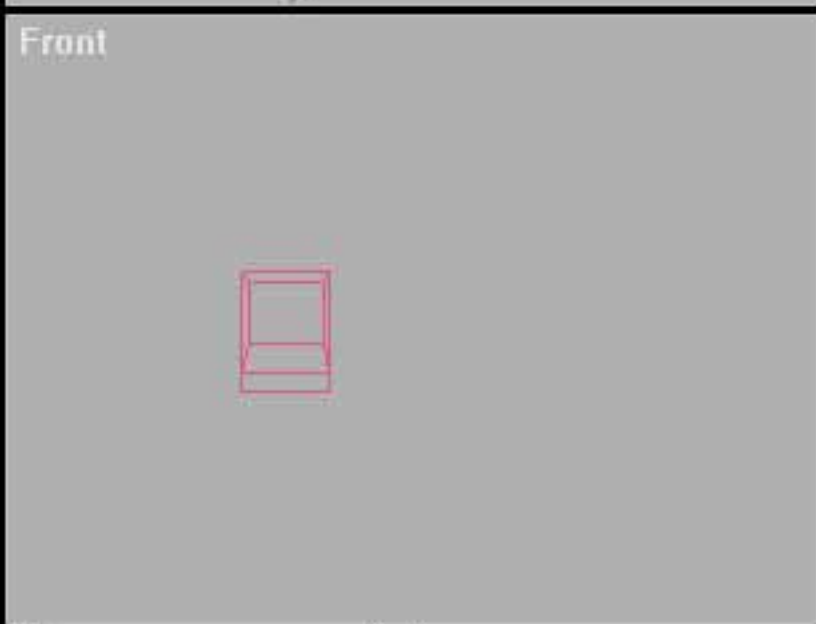
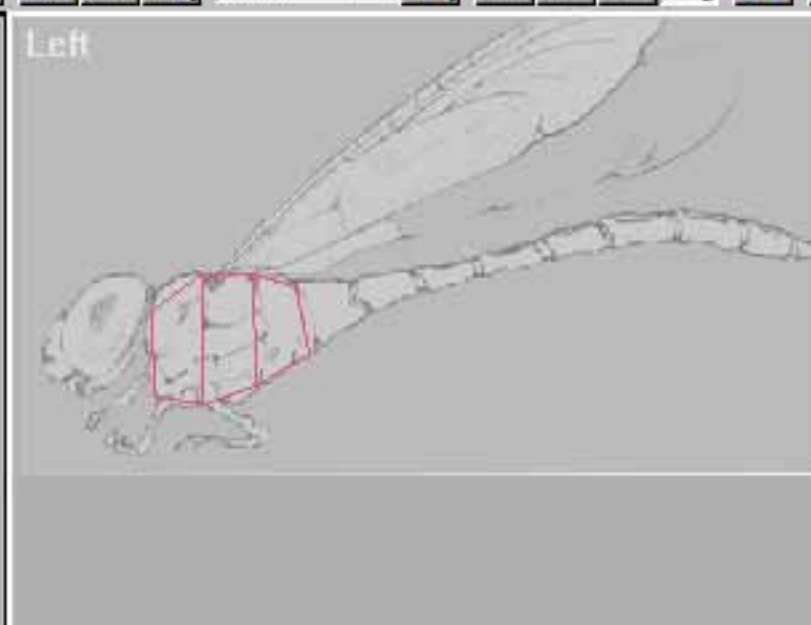
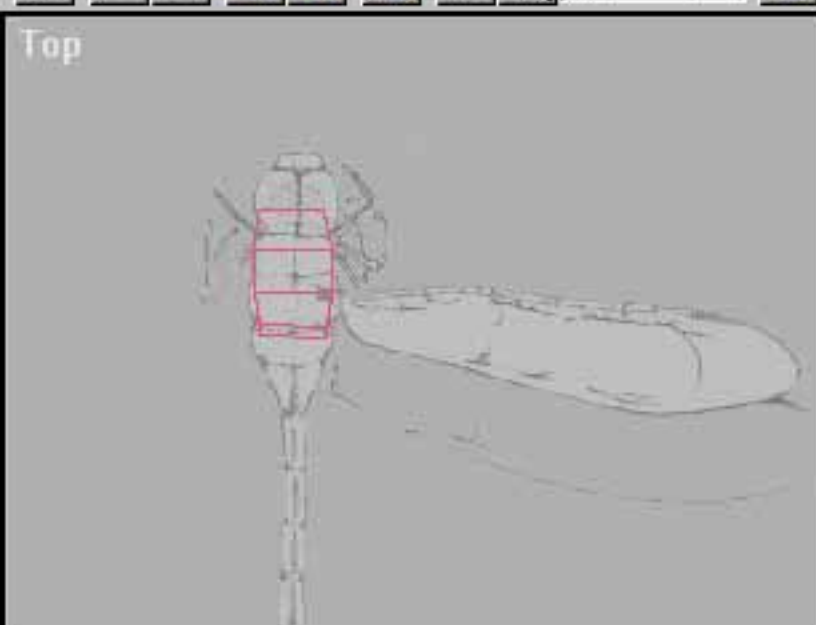
Figure 33











Standard Primitives

Object Type

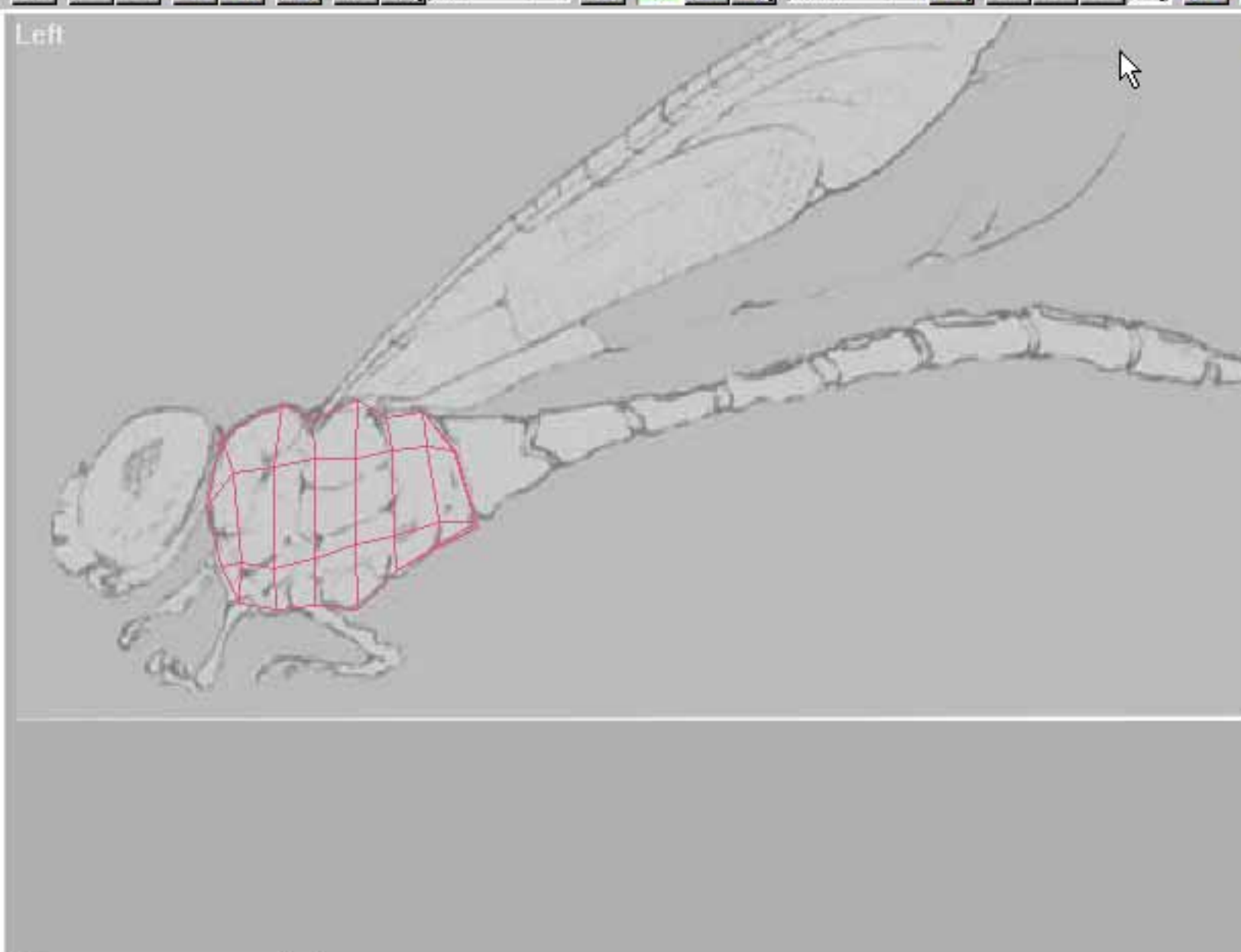
Box	Cone
Sphere	GeoSphere
Cylinder	Tube
Torus	Pyramid
Teapot	Prism

Name and Color

[Name Field] [Color Picker]



Left



Modifiers

☐ Use Pivot Points

More...

Sets

Bend

Taper

Twist

Noise

Extrude

Lathe

UVW Map

Edit Patch

Mesh Select

Edit Spline

Edit Mesh

XForm

MeshSmooth

Edit Model

Modifier Stack

Selection Level:

Sub-Object

< 0 / 100 >

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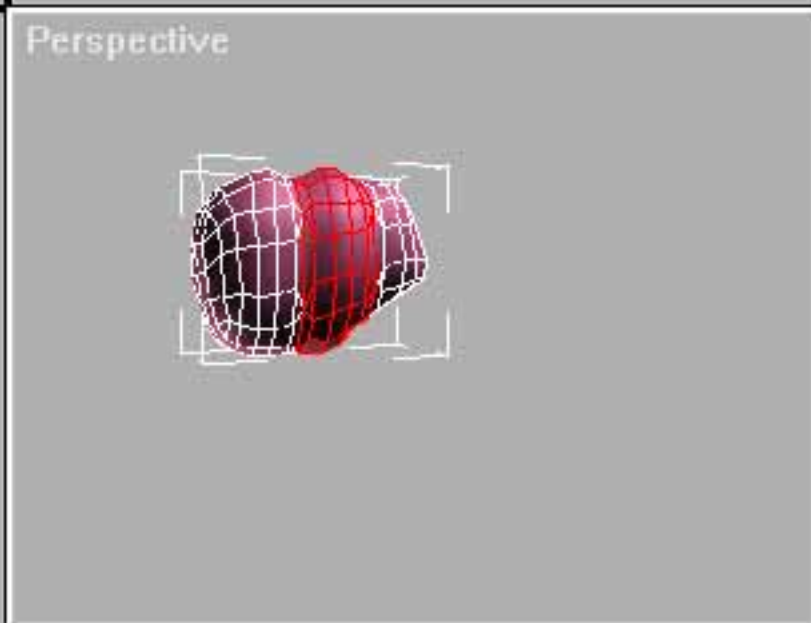
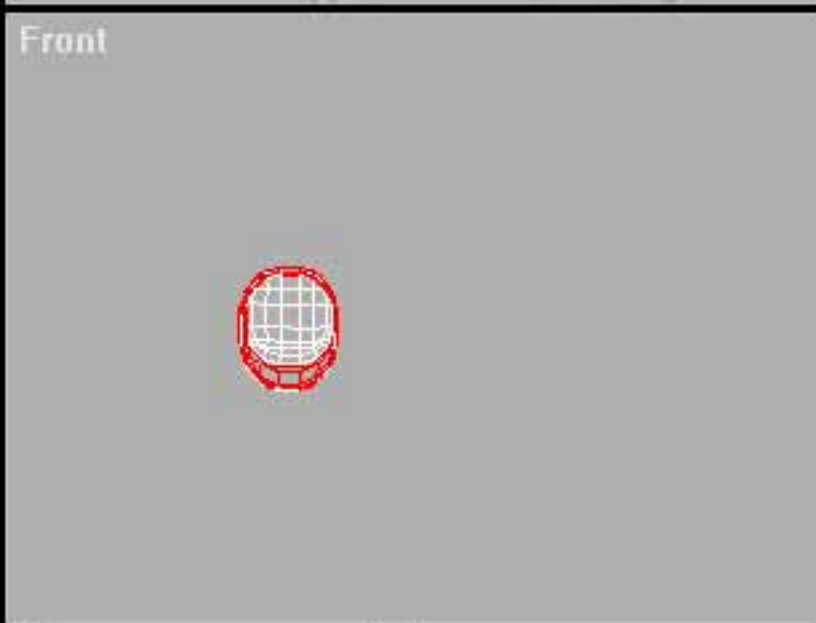
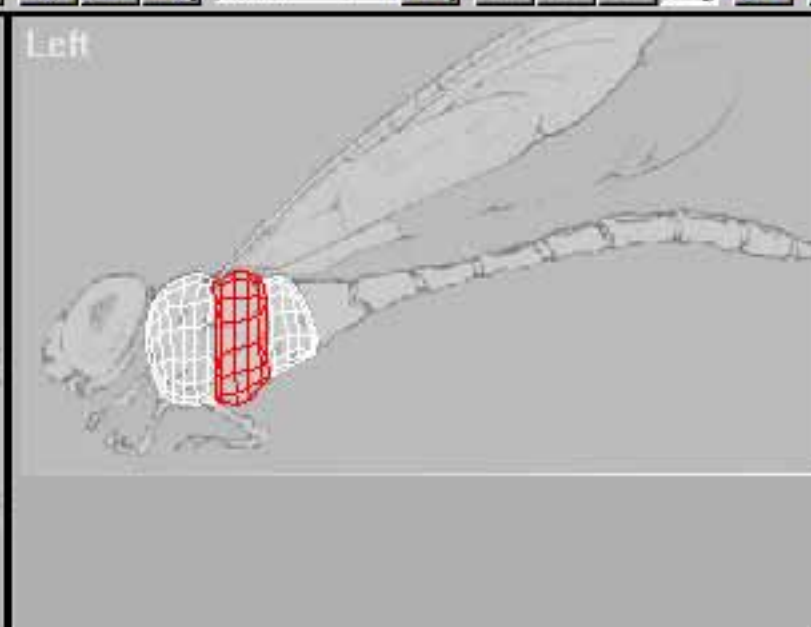
75.992

Grid = 10.0

Animate

Click and drag to select and move objects

0



body

Modifier Stack

* MeshSmooth

Selection Level: Sub-Object

Parameters

MeshSmooth

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Relax Value: 0.0

Sharpness: 1.0

Operate On: ☐ ☐

☐ Quad Output

☐ Apply To Whole Mesh

Iterations

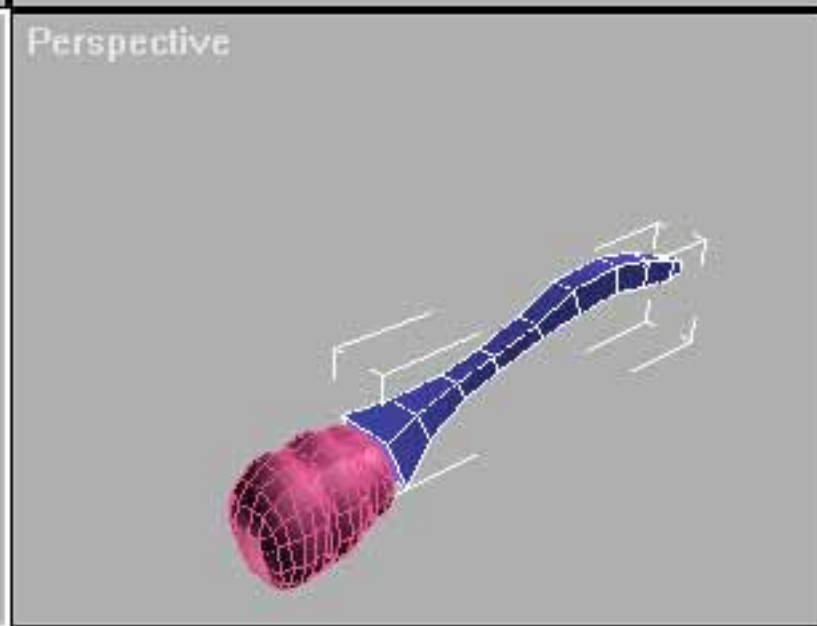
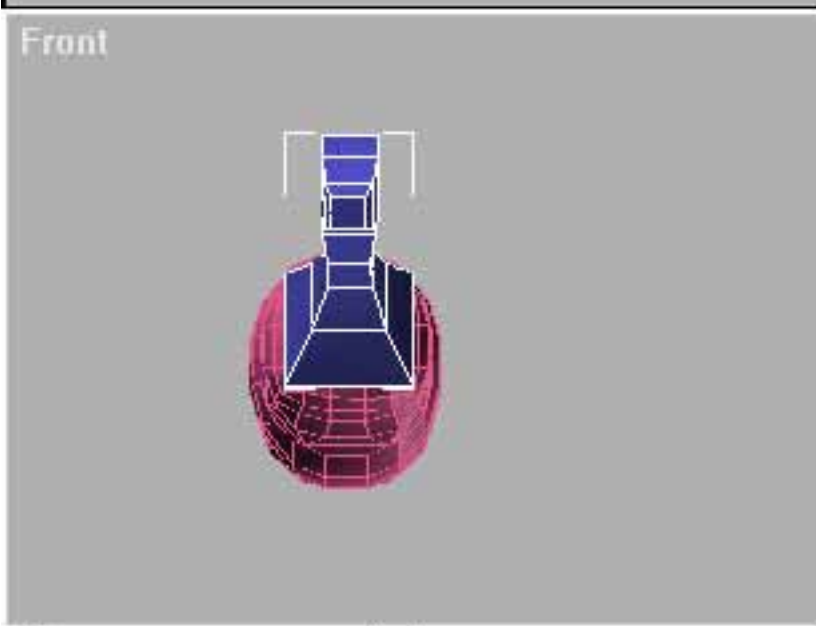
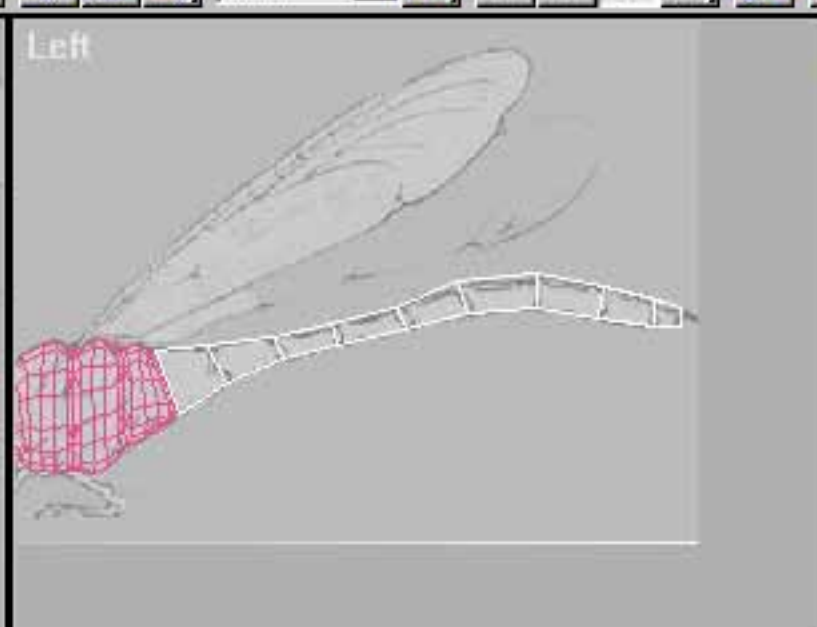
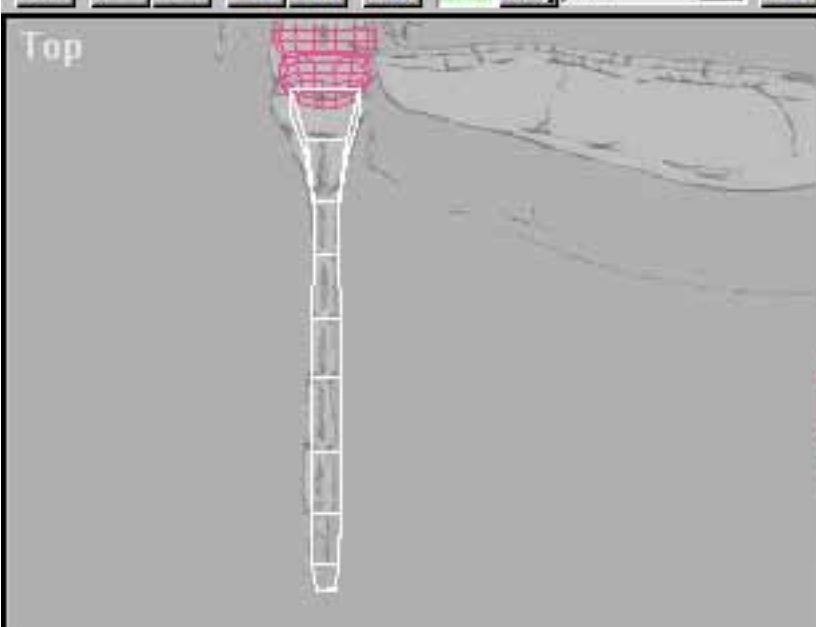
☒ 1 ☐ 2 ☐ 3 ☐ 4

Surface Parameters

☐ Smooth Result

Separate by:

☐ Materials



tail

Modifiers

☐ Use Pivot Points

More... Sets

Bend Taper

Twist Noise

Extrude Lathe

UVW Map Edit Patch

Mesh Select Edit Spline

Edit Mesh XForm

MeshSmooth Edit Model

Modifier Stack

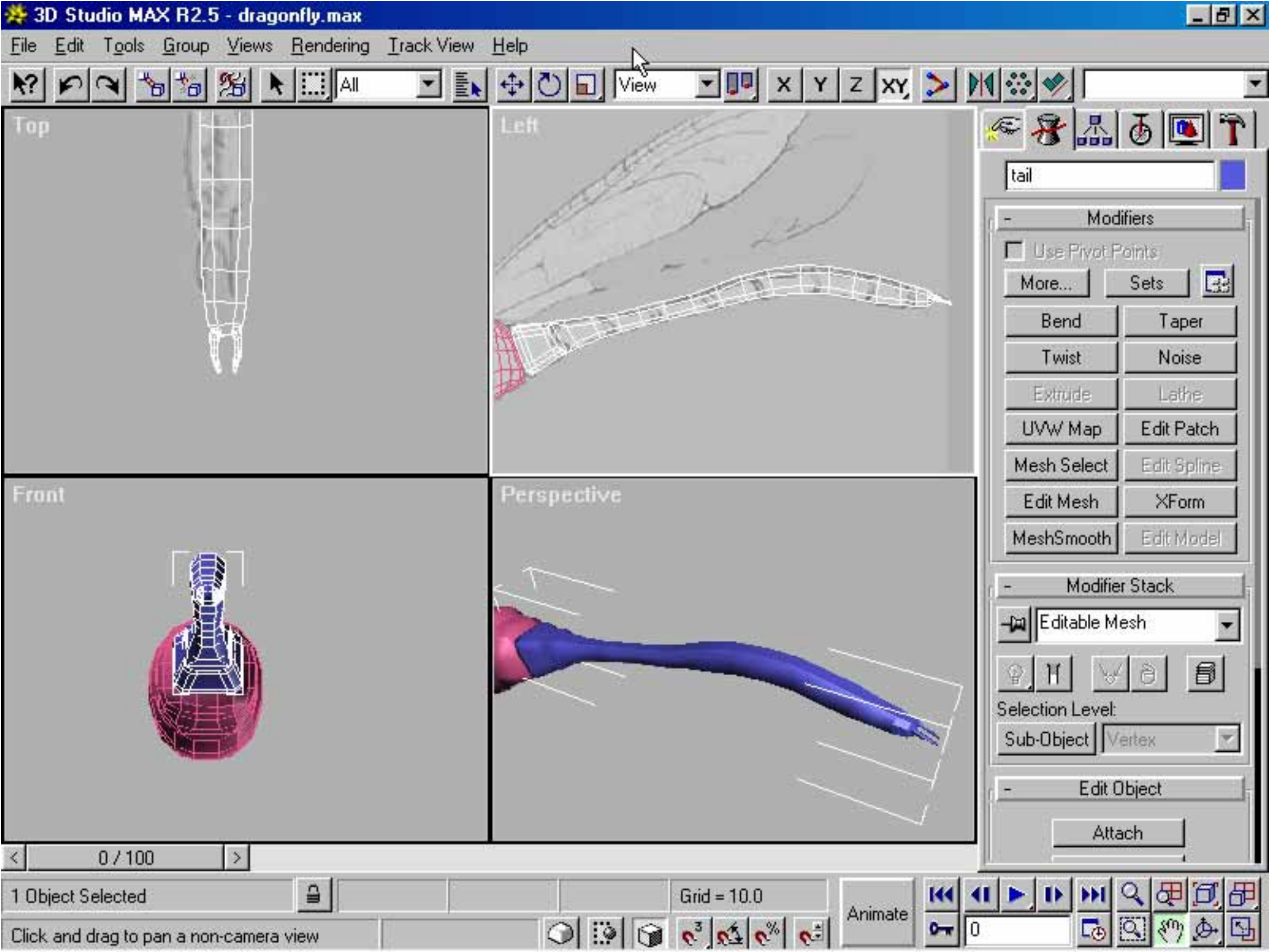
Editable Mesh

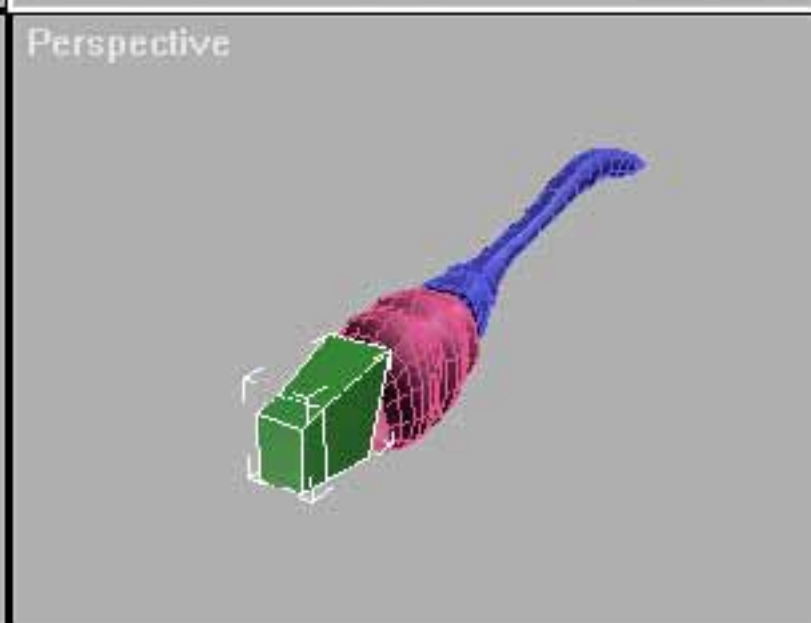
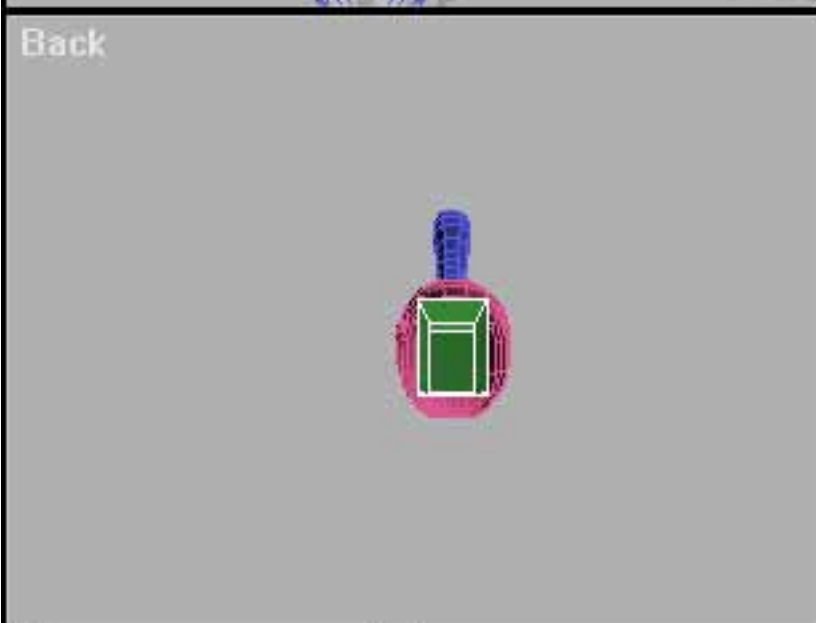
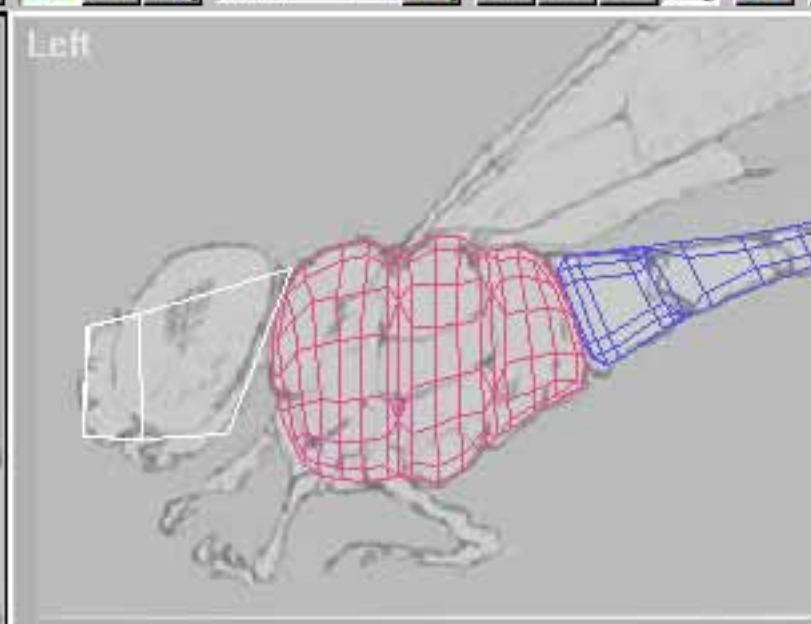
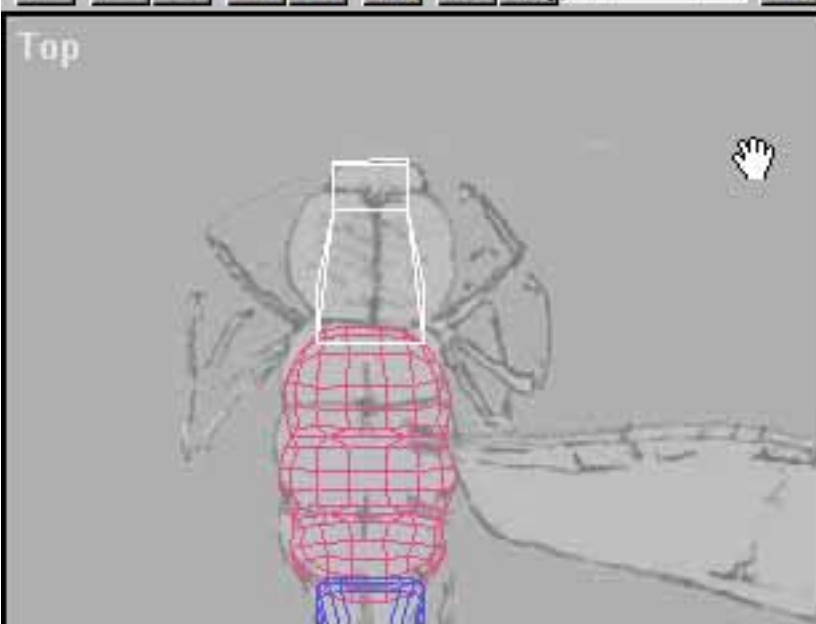
Selection Level:

Sub-Object Vertex

Edit Object

Attach





head

Modifiers

☐ Use Pivot Points

More... Sets

Bend Taper

Twist Noise

Extrude Lathe

UVW Map Edit Patch

Mesh Select Edit Spline

Edit Mesh XForm

MeshSmooth Edit Model

Modifier Stack

Editable Mesh

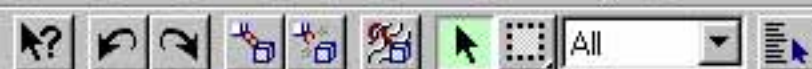
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Sub-Object Vertex

Edit Object

Attach

< 0 / 100 >

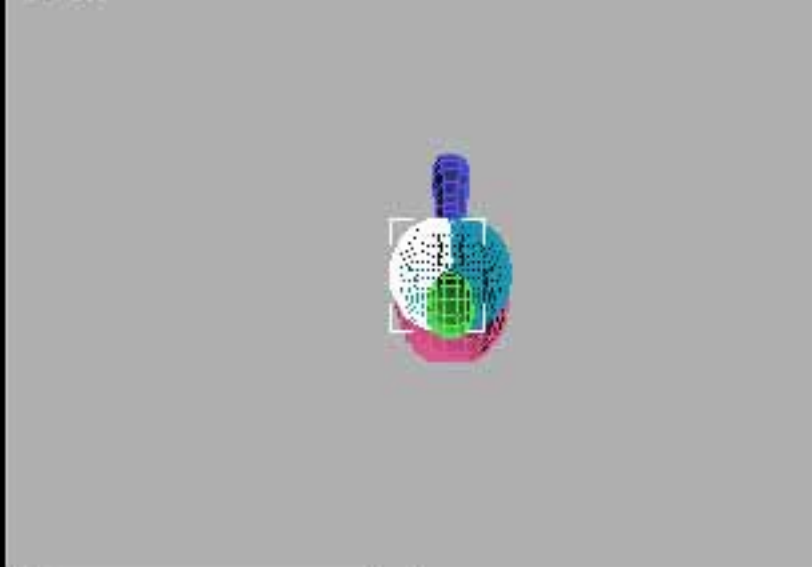


Top

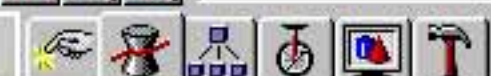
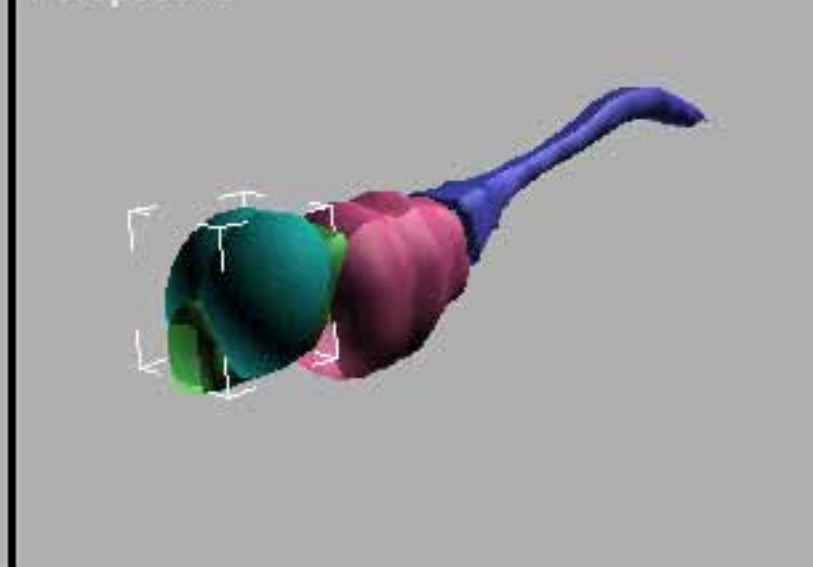


Left

Back



Perspective



eye01

Modifiers

☐ Use Pivot Points

More... Sets

Bend Taper

Twist Noise

Extrude Lathe

UVW Map Edit Patch

Mesh Select Edit Spline

Edit Mesh XForm

MeshSmooth Edit Model

Modifier Stack

Editable Mesh

Selection Level:

Sub-Object Vertex

Edit Object

Attach

0 / 100

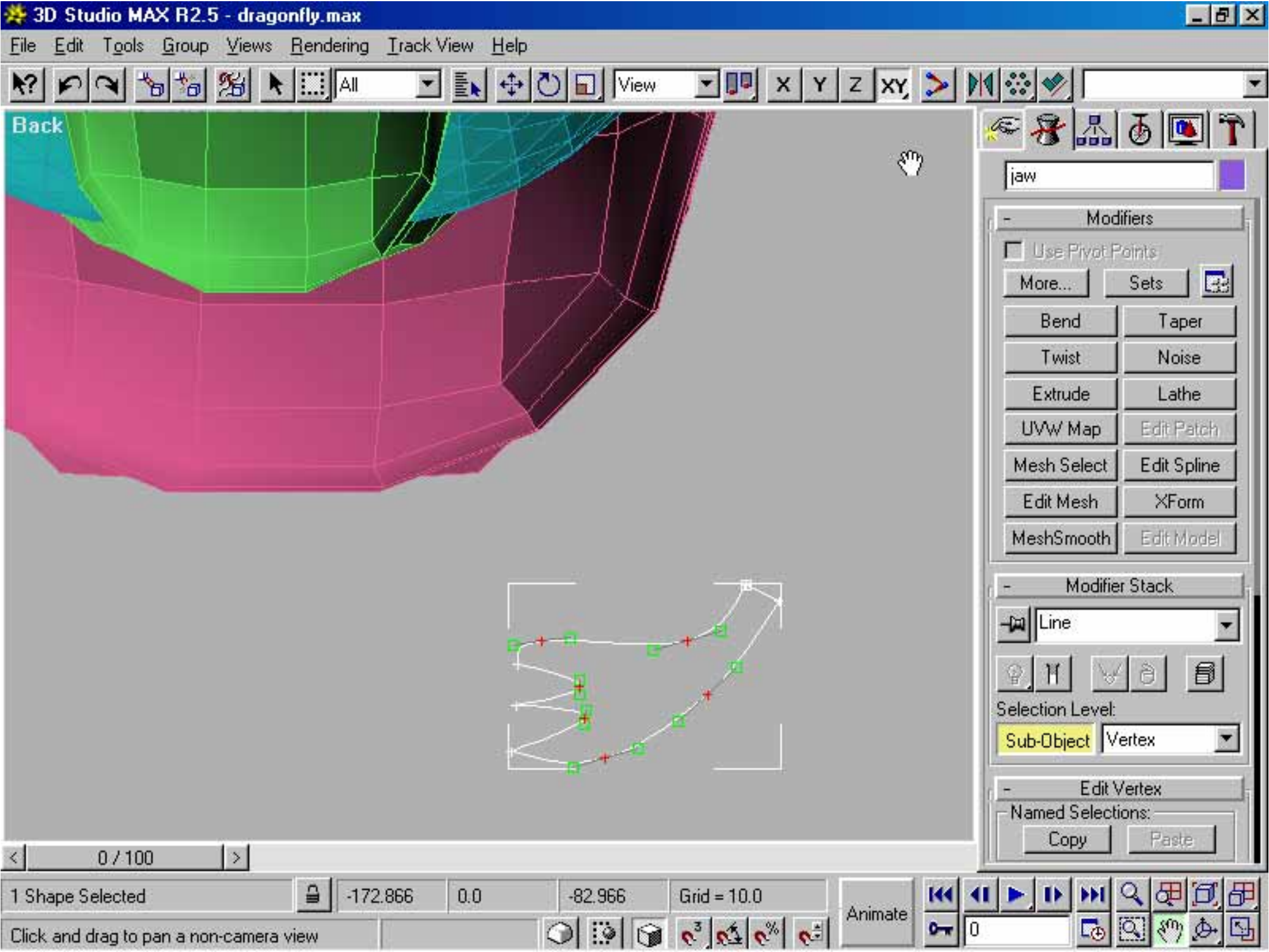
1 Object Selected

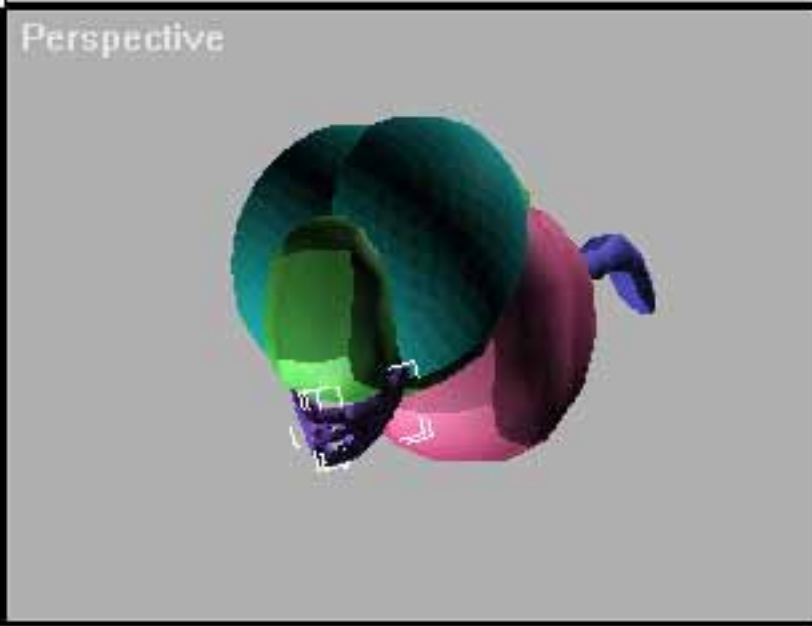
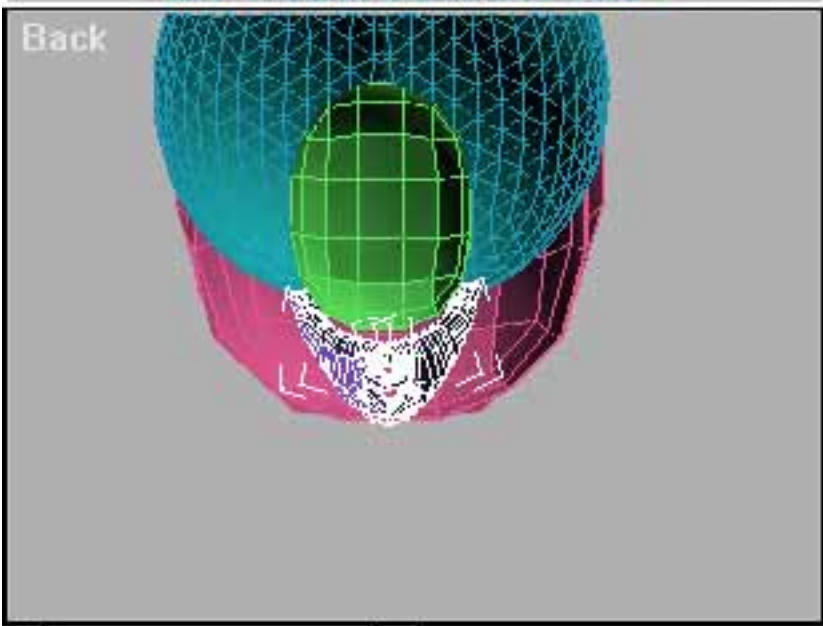
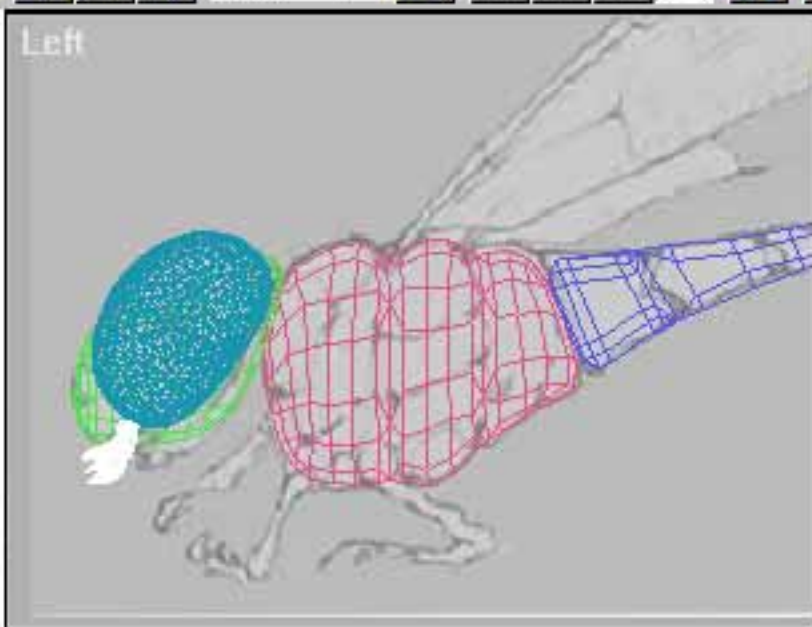
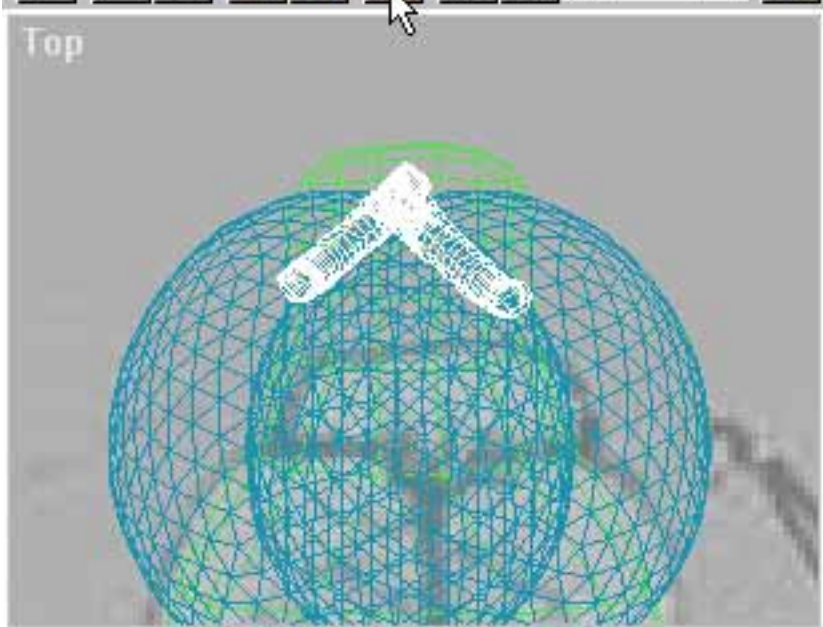
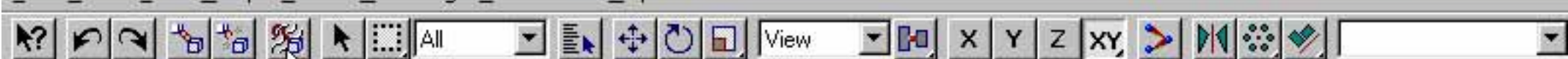
Click or click-and-drag to select objects

Grid = 10.0

Animate







Multiple Selected

Modifiers

☐ Use Pivot Points

More... Sets

Bend Taper

Twist Noise

Extrude Lathe

UVW Map Edit Patch

Mesh Select Edit Spline

Edit Mesh XForm

MeshSmooth Edit Model

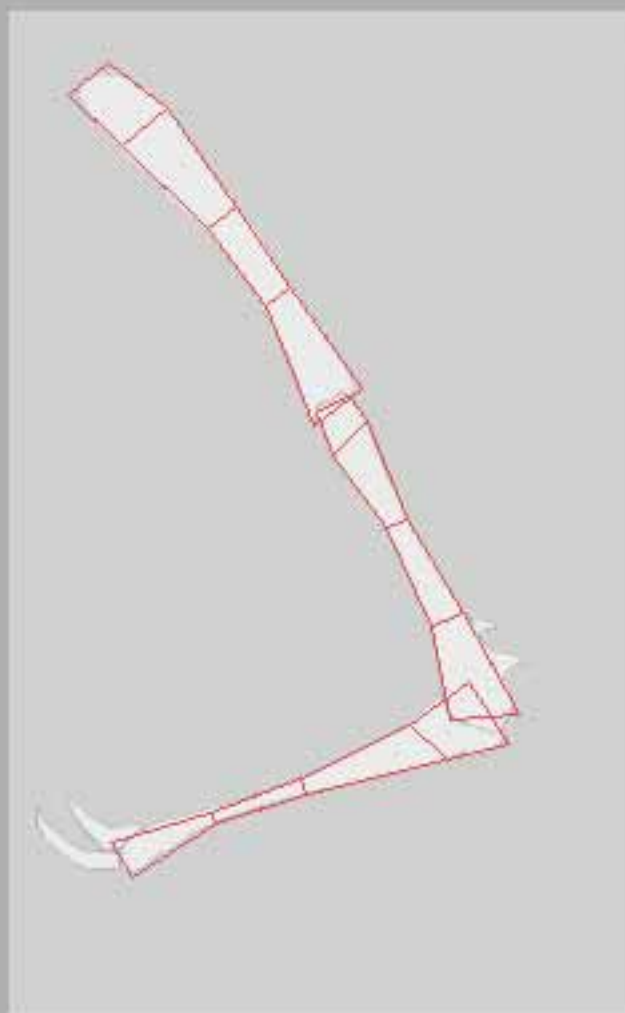
Modifier Stack

Selection Level: Sub-Object





Left



Right-hand panel containing the Modifiers and Modifier Stack sections.

Modifiers

- ☐ Use Pivot Points
- More... Sets
- Bend Taper
- Twist Noise
- Extrude Lathe
- UVW Map Edit Patch
- Mesh Select Edit Spline
- Edit Mesh XForm
- MeshSmooth Edit Model

Modifier Stack

Selection Level:
Sub-Object

< 0 / 100 >

