

insectoid characters **3D Studio MAX** ~ Sergio Muciño

Hello everyone. Welcome to this tutorial on modeling and texturing bugs. I've chosen to show you how to model a rather unusual insect. It's a character I designed for a private project I'm working on (my demo reel, actually). I won't go into details of this project right now, but we'll analyze this little bug's life, community and environment to get to know him better and help us make the best modeling and texturing choices.



For this tutorial, I'll use 3D Studio MAX 2.5, although you should be able to translate the procedures to your preferred modeling program. I'll use NURBS modeling throughout for a couple of reasons. First, NURBS surfaces are built from profile or boundary curves, and this will be helpful in the modeling process of my insect, due to the specific nature of its structure. And second, because I've noticed a general "hunger" for NURBS tutorials within the MAX community. I hope that by following along this tutorial, most of your NURBS related inquiries will find a satisfactory solution, and maybe learn some new tricks along the way! Of course, you might know a better way to get the job done. If you do, please let me know! And, if your 3d app does not support NURBS modeling, maybe with a little extra work your spline-based modeler will get the job done. Ok people, let's get started!

NURBS 101.

Let's talk a little bit about NURBS modeling. NURBS stands for Non-uniform Rational B-spline. If you don't know what that is, don't worry. You don't need to know NURBS math to be able to use them quite effectively. I won't go into a full-blown NURBS talk right here, but if you want to get your feet wet with some NURBS theory,

please refer to your MAX reference and users guide. You'll find some interesting info right there. I also strongly suggest following the tutorials that ship with MAX, and analyzing the sample scenes included in the MAX CD. Ok, let's get back to business.

There are two main ways of creating NURBS geometry. The first one, is start with a NURBS primitive (basic geometric shape) and then modifying it to get the shape you want. This can be accomplished by manipulating directly the lattice that surrounds the geometry, or by adding some other primitives or curves to the original shape. A lattice is an imaginary cage that surrounds your object. This "cage" is visible in the standard MAX viewports, and you can access the vertices that make up this cage. When you move one of these points, the underlying geometry adapts

itself to the new boundaries set by the lattice. This procedure resembles working with "virtual clay". You can sculpt your geometry any way you want. Here's a sample of how your scene might look working with this approach, [figure 1](#).

The second approach to working with NURBS models, is to begin with some curves and start creating surfaces out of these curves.

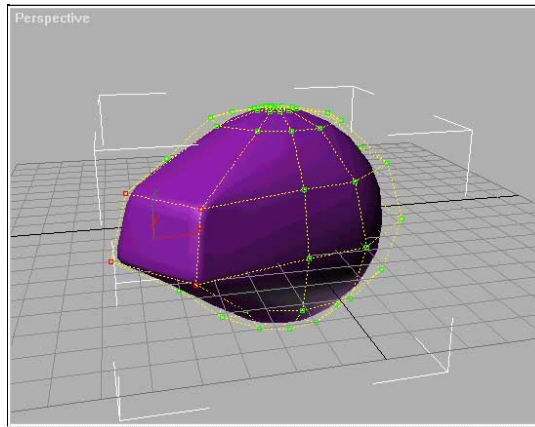


Figure: 1.

Personally, I like this approach a lot more, because of the degree of control it provides over the final geometry. MAX uses what's called "relational modeling". This means that, when you create a surface out of a set of curves, this surface is "dependent" on those curves. If you modify one of the curves, the dependent surface will instantly adapt to the new structure set by the curves. Here's a sample image of a surface and the curves that are used to create it [figure 2](#).

For this tutorial, we'll use both approaches, relying more on the second one. We'll begin by drawing some curves, and start creating surfaces from them. You'll be creating excellent models in no time!

The Background.

Before starting to model anything on that computer of yours (I know your fingers are itching already, but please read on) there's a bit of homework to be done. First, we have to decide where our little bug lives, what he eats, how's life in his environment, and do some sketches to have a more solid idea of what we're trying to accomplish.

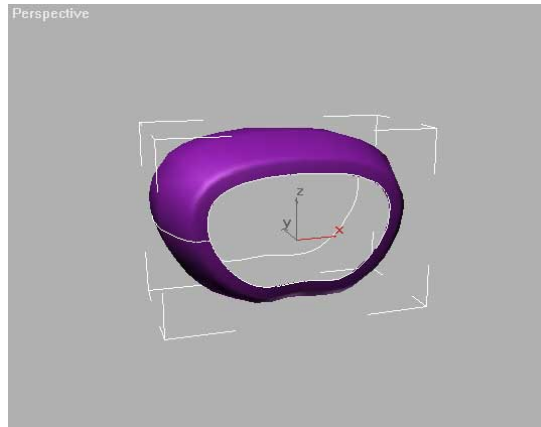


Figure: 2.

The bug I've chosen to model is not a real-world bug (at least not that I know of). However, I've based my designs on its real life counterparts. Let's take a look at it's environment.

The whole project revolves around the life of another character. The story develops in the interior of what could be called a "house". I put it this way because it's far more complex than that. This house is a place of decay and aggression. Life here is not easy. There are several inhabitants within this house, and although they live peacefully most of the time, food is scarce and life is not often long. There are predators lurking in every corner, and very few things are friendly here. It's a lot like... a real bug's life.

This house is mainly made of stone and concrete, and is all worn down. The climate is rather cold, and there are very few things a bug can eat. Some wood is present in parts of the house, but trying to get to those parts represents an almost certain death for any bug-sized creature. Therefore, cunning and intelligence, as well as a strong sense of teamwork is crucial for

our little friends to survive. Friends you say? Yes. There's more than one. Let's take a look at this little fella's community.

Our little bugs are creatures that resemble wasps a lot, but differ in some aspects from their friendly little cousins. First, our bugs are not friendly. In fact, they're rather dangerous. One bug does not pose much of a threat, but how about a hundred of them? If you happen to live in a place populated by insects, such as rainy or hot weather, you'll know what I'm talking about. Our bugs have constructed a colony in one of the darker rooms of the house. This is because it's also one of the least visited by the other inhabitants of the house, so our bugs live rather undisturbed. The second reason is that it is also one of the most isolated rooms of the house, so weather is not as harsh as in other parts of the house that have already begun to crumble down. This colony was constructed in the very inside of one of the stone walls! These friends can carve stone out with their mouths (little by little, of course)!

The colony is not very big, only about a hundred of them. They live a very organized life that resembles that of ants and they don't reproduce very often, or in large quantities. To overcome this situation, wise Mother Nature has given these little creatures some quite amazing abilities. Let's take a look at their main features.

These little bugs are born natural warriors. If a species living in this house knows what survival is all about, it's them. This is mainly because they're the smallest species living here. The rest are all mammal-sized beings, sometimes bigger. So, these little guys have to fight quite often, sometimes after food, sometimes for their own life. However, anyone fighting these creatures cannot hope to remain unscathed. This is a fierce species and has very effective weapons to defend itself. Their carapace is unusually strong. They can sustain some strong blows and survive. When facing another kind of bug, they have great advantages. They have a really strong mouth, which they use to finish-off their opponents, to break big chunks of material into smaller pieces, to carry things and some other activities.

Next, their legs have some sharp appendages they use to attack with when flying around. If you get scratched with these appendages, you'll have a little wound that'll itch for days. If you get scratched by one hundred of this little appendages... well, you get the idea. And finally, they have a small sting in their rear, just like wasps do. This is a poisonous weapon and should be avoided at all times, since it can cause anything from physical discomfort to death, depending on the magnitude of the attack and the number of attackers. They feed mostly on other insects (when they are found) some plants and some dead meat when they find it still usable (no one likes rotting flesh for

breakfast, although in our house this is often found lying around in some of the corridors).

They also have a quite effective communication system. This is crucial to their survival. Since the colony is not very big, it cannot afford heavy losses, so they've developed some special abilities and systems to ensure that most of the colony members survive until a couple of generations have spawned. For example, they have the extremely good and healthy habit of storing food. However, when they need to look for extra sources of food, they send out a "scout". Once the food has been located, the scout can signal the colony by expelling a certain special odor, which most other species can't detect, but strong enough to fill the entire house within a minute. When the rest of the insects detect this odor, they immediately travel to where it is coming from and start taking the food back to their home as fast as they can. Thus, no visual communication is needed. A similar procedure takes place when one of them is attacked. However, the help the attacked insect gets is not always to help him return home. Most of the times, when faced by a bigger or particularly menacing aggressor, only a small number of insects attend the call, mainly to drive the attacker away from the colony, not to help themselves survive. The insects that help in this way often leave to never be seen again. Fortunately, in this house very few other inhabitants are interested in these little beings, so they have to face these kind of situ-

ations rarely, but it's a fatal experience when it happens.

This is some good background information to get started. It should help us make some geometrical detail and texturing decisions. You'll see how all this information starts to fall into place during the modeling process, to later help us complete the model with some nice textures.

From mind to matter.

It's time to exercise the wrist by doing some sketches of our insect. You can do some research by going out and borrowing a book on insects or by going to your garden and looking for some. I preferred the first approach, because the bugs at my location are not very fond of people and like to remain hidden. Also, because there are no vicious, bloodthirsty bugs like the one I'm creating, it can get a little complicated. Another approach is to search for some good WebPages. I found some with quite good insect pictures, which I borrowed to design my friend. Go and get surfin'! These pictures will serve as source material to get some ideas flying around.

After some inner debate over the pictures I found, I decided to model my character after a common black garden beetle, but with more aggressive features, combined with a wasp. I also used some material from a scorpion from the Sonora desert in Mexico (quite deadly, believe

me). Just get things on paper to approach them with a clearer picture in mind.

Having gone through the previous step, I was ready to sketch my little insect, using my previous sketches as a basis for my design. Here's what I ended up with, after going through several different design ideas. You might find that you have to do several iterations of this process before getting what you're really looking for. Don't despair if this sounds like a lot of homework. It's much better to spend a month drawing and sketching ideas, that to sit down and model the first thing you come up with only to find out later that you don't really like it, or that it doesn't fit into your story.

That's why the biography is so important. For better examples of this step, please refer to the great articles written by Bill Fleming in the first two issues of the Serious 3D Magazine. Also, sketching and drawing in advance may help you visualize more easily how to model your character, so you spend more time building surfaces and less trying stuff that may not be suitable for your project, or worse, that doesn't work at all. Ok, I've included at the end of the article my finished sketches, which I used as modeling templates loaded into viewports. You can use them to complete this tutorial, or as guides to make your own.

Some people like to draw top and side views of the objects they model, so they can load them into their 3d modeling program and use them as reference for the object construction. I use this method when I have a more or less accurate drawing of my model. If you're really good with the pencil, you might want to do this. However, it's not ultimately necessary. But if you don't do this, your model might need additional scaling and tweaking after it is finished to compensate for any proportion inconsistencies. In this case, I first sketched my bug on standard white paper, but did the final drawing on graph paper. This way, I was able to draw the front (or side) and top views with the same proportion. This is crucial, otherwise what you model in one view will appear out of size in other view. This is the basic procedure to make a special drawing used for templates:

1. Use a piece of paper with some sort of grid you can use as reference. I used graph paper.
2. Start drawing (the side view is perhaps the easiest to start with) trying to maintain some proportion between the different model parts. If you can't draw like this... practice!!! This is a very helpful skill to possess. If you REALLY can't draw, or just don't want to, find a friend that can (such as an artist or an architect) and give him your sketches and explain to him what you want. Buy him a pizza or something and thank him for helping

you. This will help you develop a skill called “politeness”, a skill highly appreciated in most production studios.

3. Once you’re done, draw some vertical lines that separate each part of the model. In this case, you’ll notice my drawing has lines at the beginning and the end of the head, the torso and the abdomen. Make these lines long enough so that you can use them below this drawing to draw the top view and use them to draw your model with the exact same size.
4. Draw a horizontal line in the exact middle of your model (or as close as you can get) that runs from head to tail.
5. Below your first, draw another horizontal line of the same length as the upper one. This will be the exact middle of the top view, so make sure you’re leaving enough space for the drawing to fit without disturbing the side view, or you might be forced to alter the drawing proportions in order to fit.
6. Using the horizontal line as the geometric center, and the vertical ones as defining areas for the various parts of the model, begin drawing the top view paying attention to proportion and detail. Don’t worry if your drawing is not symmetrical. I haven’t met anyone that can draw a perfectly symmetrical model (besides the Terminator and C3PO that is) and your drawing will be only used for reference.
7. Take the first drawing. Find the horizontal middle line, and see which part of the paper (top of the line or bottom of the line) the drawing takes up more space. Count the number of markers on the paper (in this case, the printed squares) in that direction, leaving an extra marker for space. Draw a mark there. Next, count the exact same number of markers in the opposite direction from the middle line. Mark the paper right there. Draw a square that encompasses the whole model using those marks. The size of the square should be from mark to mark vertically and from the beginning to the end of the model horizontally, with an extra marker at the left and right ends (for space).
8. Repeat the previous step for the top view drawing. The width of the square encompassing this drawing should be exactly the same as the above square. This is important, or your drawings will have different sizes once loaded to the viewports. And they must be symmetrical along the horizontal lines, or the center of your templates may be offset from the center of the universe.
9. Scan the area inside the squares of both drawings. Save in your project/insect directory (or wherever) and load up that 3d program of yours!

That's all I did. My final drawings are at the end of the article. They're not pretty, but they sure are useful. So you now have a clear idea of what you have, your drawings, quite some time to spend and a lot of drive. Let's get started.

Modeling.

Before you begin please...

We will divide the modeling process into separate tasks. Each task will concentrate in different parts of the model. Once each separate part is finished, they'll be joined. We will separate our model into the following parts.

The head.

The head encompasses the skull, the eyes, the mouth, the protective plaque, and the antennae.

The neck.

Well, insects don't have necks. We'll just call this the part that joins the torso and the head. It's a rigid piece, part of the natural armor of the insect.

The torso.

The torso of the insect is made of several separate pieces, designed to give the insect a limited range of flexibility. They all join together to form a semi-spherical piece.

The abdomen.

We'll separate the abdomen into two parts. The upper part (or the "back" of the insect) which is a hard shell protecting the insect, and the lower part (the "stomach" part) which is the softer part, but not unprotected. Both parts will be joined afterwards.

The sting.

This part is at the very end of the insect. It will be joined to the tail when finished.

The protrusions.

The torso and the upper abdomen are covered with some protrusions resembling the thorns on some plants. These will be points pulled from the surfaces they conform. This will be pretty straightforward.

Preplanning

This is something you should always do before sitting in front your computer. Getting into the habit of doing so will save you a lot of headaches and wasted time. You should sit down with the sketches you've drawn of your model and analyze them to come up with the best possible modeling process for each part of the final model. You should take into account the structure of the part and how it will be animated. Some animation scenarios require special modeling procedures, depending on the re-

quirements of the scene. Facial modeling is one such case. In the case of this project, I've decided to model each part in the following way.

Head.

The head will be modeled out of a set of curves, with a separate structure for the mouth blended in. The eyes will be spheres, with some editing performed into the eye sockets. We don't want the eyes to look like spheres just moved over another sphere. Believability lies in detail. The protective plaque on the forehead will be a lofted and capped curve on the surface.

Neck.

The neck will be modeled from a profile spline and lathed by using a birail sweep. This will give us more control over the final appearance of the object rather than just lathing it, since it's not a very regular shape.

Torso.

The torso will be made by lathing a profile curve and duplicating the final object until we have the total number of sections for the torso. Each section (or piece) will be rotated, scaled and moved into place to conform to the final appearance of the final object. Each section will be a separate object, since this will allow us to have a nice IK setup for animation, and will let us animate the character without the need of a deformation plugin.

Abdomen.

We'll model the upper part by creating curves that define the boundaries of the surface and others that define the overall shape of the object. These will be UV lofted. The lower part will be a birailed curve. Both pieces will be blended to finish the object.

Sting.

This will be constructed out of the abdomen object. We'll just extrude the open end of the object into something we can edit further.

Protrusions.

Just some pulled points on the carapace surface, with weights adjusted properly.

The legs.

Although they're not present in the sketches, we'll construct the legs out of primitive cylinders with some modifiers applied to them, and we'll blend them with the body.

So, there you are. There's your roadmap to the finished model. All you need to do is stick to it. Of course there's always room for experimentation. But you should always start with a general idea of how your modeling process will evolve, either on paper or in your head. One final comment before getting to it.

Modeling Conventions.

I'll try to be as specific as I can to explain each step in the modeling process. The pictures should make the understanding of this tutorial easier. If, however, there's a place where something is not specified thoroughly, use common sense, such as switching to the modify panel before being able to modify a curve just created. It is assumed that you know already how to use MAX, a general knowledge of the interface and that you can find your way through most of the tools and use them effectively. If you have just begun using MAX or are unfamiliar with it, I suggest spending some more time with the program and going through the various tutorials you'll find in the online help. I strongly suggest doing the NURBS tutorials that ship with MAX and reading the NURBS chapters of the MAX reference manual, vol. 2. This will give you a better understanding of how MAX's NURBS work. When creating NURBS objects, you can use the NURBS Creation Toolbox, or the buttons found in the modify panel when at top object level. Personally, I like to use the creation toolbox because it will allow me to create sub-objects regardless of which level of the object I'm on. To use the modify panel dependent sub-objects buttons, you must return to the top object level first. And remember that to edit a newly created object, you should first switch to the modify panel. I mention this because you can change levels within an object by right-clicking on it, but this only works while the modify panel is active. Also, if at any

time a surface you create looks like it is "inside out", go into surface sub-object level, select the offending surface and check the Flip Normals checkbox. Sometimes surfaces are created with reversed normals due to the direction of the curves making it up, but this should immediately correct the problem. If you construct a surface and it looks all warped, or nothing like what you should've gotten, undo immediately and double check the curves that make up the surfaces. Some surfaces, such as the 2-Rail Sweep surface, have special requirements to be created effectively. This is why snaps will be often used. When in doubt, consult your online reference for further information on surfaces and NURBS modeling.

A final note for users of other programs following this tutorial. If your modeling application supports NURBS modeling, you should be able to follow along nicely. Those using Alias, Maya or Softimage should be able to translate these instructions into their own modeling packages. LightWave users will find MetaNURBS modeling a close approach. Just take the shape of the curves and primitives we're using and start from there. If your program supports spline-based modeling, you might need a couple of extra steps to complete the tutorial, but you should be able to do it. Another solution might be, or if your program doesn't support spline modeling, to download the Rhino trial version from the McNeil & Associates website (<http://www.rhino3d.com>). Go through the tu-

torials to get familiar with the tools. Rhino is a NURBS based modeler, and although it doesn't support animation and lacks strong surfacing tools, it's a powerful modeler that can easily complete the tutorial. It also supports several export formats, so you should be able to export the final model into a format your 3d application can read, although it's most likely that the model will be converted to a polygonal model, losing all NURBS information along the way. The constraints noted are always in view axis, unless otherwise specified. Let's begin!

THE MODELING PROCESS.

A few words regarding the modeling process. Due to the specific needs of my project, I need two versions of this character. A hi-res model (the one we'll be constructing) for close shots, and a low-res polygonal model to be used as instanced geometry by particle systems. You don't want over 100 versions of your hi-res model flying around in your scene, unless you want to drive your computer mad. With that in mind, let's crunch some surfaces.

First, load the background images into your viewports. Make sure that match bitmap is selected for both images, and check lock zoom/pan. I've created a sphere to use as reference so I can align my images to match the geometry. The sphere should align with both viewports. If you put it on the head, it should appear to take up the same space within the sketches in both viewports. If it doesn't,

you should check both sketches are the same size and that their centers are aligned. If not, you should remake them and scan them again.

THE NECK.

In the left viewport, create a NURBS CV curve (it's under the create panel/splines/NURBS dropdown list/CV) using your front and top viewports for reference. I used 3d snap turned on, so I could get an exactly symmetrical shape. It's important to begin with symmetrical shapes, so your model will have a uniform finished look. Anyway, you'll be able to modify it afterwards. Don't worry about the exact shape, just get the approximate size. I created the shape in the top viewport using the front viewport for reference. Turn 3D snap off. Move the curve to where the neck of the bug begins in the top viewport. Zoom in on that part of the drawing in both viewports (top and front). Remember, zooming in with a background image displayed consumes more RAM, so be careful if you're computer doesn't have much RAM. If the image takes too much RAM to display, MAX will ask you if you want it displayed anyway. This is a helpful feature.

Then, go into Curve CV sub-object level, and start moving your CV's around, trying to match the approximate boundaries of the top viewport sketch. Take care of keeping the curve symmetrical. To achieve this, non-uniform scale opposite points in the left viewport instead of moving them.

If you move them, move any point that lies in line with the one moved. You'll notice the shape is not exactly what the drawing portrays. Don't worry. Remember the sketches are not perfectly accurate. Just make your curves match the sides of the insect. Name the curve FrontNeck CVcurve. Here's what you should get, see [figure 3](#).

Next, shift-move the curve in the top viewport with your move axis restricted to X, and place it at the back of the "neck" piece we're modeling. Select copy as the cloning method. Go into curve CV sub-object level, and adjust as necessary to get the shape of the back of the piece. Name it BackNeck CVcurve. Notice where the bottom CV's lie on the drawing.

Now, turn on 3D snaps, and in the NURBS snaps dialogue box, select Curve Edge. (You can access the NURBS snaps dialogue box by right-clicking in the 3D Snaps button, and selecting NURBS from the dropdown list on top of the dialogue box). This will help us create our next curves accurately.

In the front viewport, draw a CV curve that starts at the left curve and goes to the right curve following the bottom profile of the neck piece. Make sure the first and last points actually touch the curves by checking on the snaps cursor. It should turn light blue if it is touching the curve. When you're done, turn off 3D snaps, go into Curve CV sub-object level and adjust the CV's in the front viewport. Name the curve NeckProfile CVcurve. This is what you'll get, see [figure 4](#).

Now, to build the surface we'll need to attach our curves together and collapse them into an editable NURBS surface. On the modify panel, click on one curve, and select attach multiple. Select all the other curves on the list. Then, click on the edit stack button, and select Convert to NURBS Surface. Ok, now we can build a surface out

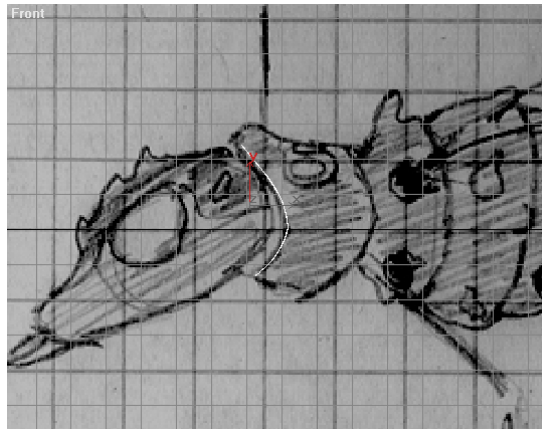


Figure: 3.

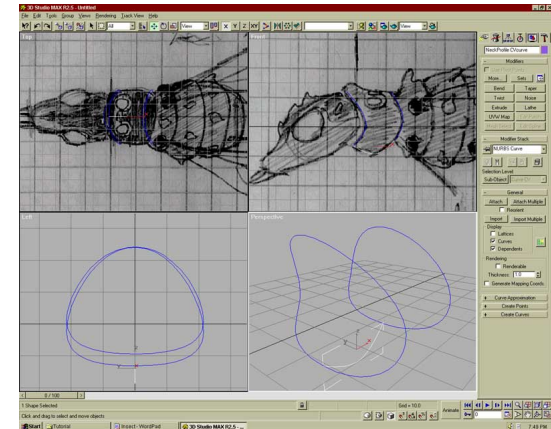


Figure: 4.

of our curves. Return to the top level, and select 2-Rail Sweep Surface from the Dependent Surfaces menu in the modify panel, or from the NURBS Creation Toolbox. When prompted to pick the first rail, in the perspective viewport (rotate it if you can't see all three curves clearly) pick the curve formerly named BackNeck CVcurve, pick the curve formerly named FrontNeck CVcurve for the second rail, and pick the curve formerly named NeckProfile CVcurve when prompted to choose a cross-section curve. Right click twice to end. You should see a nice surface that revolves around the "profile" curves, but doesn't quite conform to the shape we need. We'll fix that now.

Now go into the surface sub-object level, select the surface and click on the make loft button. You'll see a new set of curves appear on the surface, along with a small dialogue box showing the loft surface creation options. Make sure from V Iso Lines is selected and accept the 8 V curves value (or any value the program gives you. This value might depend on how many CV's you used to build your curves). Click OK.

All right. Now, we'll make our surface fit into the sketched neck. In the modify panel, got to the sec-

tion labeled U loft surface. You'll see a window with a list of the CV curves that make up the surface. Click on one. You'll see the curve turn blue in the viewports. Each time you click on one of the curves in the list, the curve will be highlighted in the viewports. Now, select one of the curves at the top of the surface (select from the list until you hit the correct one). The curve will be highlighted in the viewports. Click on the Edit Curves button below the U curves window. The curve's CV's will become visible. Move the points to adjust the curve, and the surface will adjust itself to reflect your modifications. That's the beauty of relational modeling!. You can control-click on any number of curves to select them and edit their CV's simultaneously (you should do this with some curves to retain the symmetrical properties of the object). Continue to select the remaining curves (except the one at the very bottom of the surface) and adjust the CV's accordingly. At the end, your surface should closely resemble the one in the sketch, see [figure 5](#).

To create the little bulge on top of the neck, go into curve CV subobject mode, and in the front viewport, select the CVs closest to where the bulge decays.

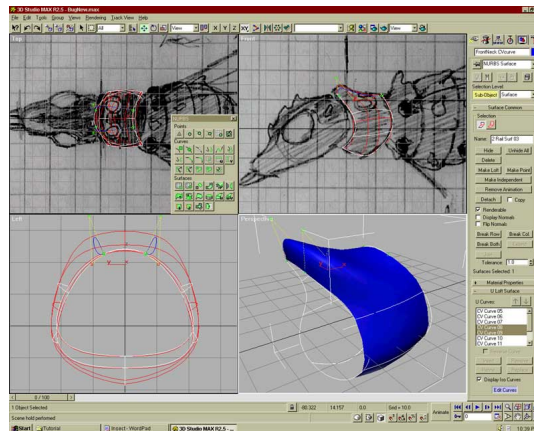


Figure: 5.

On the weight spinner, type 0.95 and click enter. You'll see the surface adjust a little bit. Move the CV's around until you get the bulge to show up a bit more. We're almost done!

In the front viewport, deactivate the background image (right-click the viewport label, and uncheck Show Background) because we'll really zoom in on this part of the model and the background image would take up too much RAM. Now, click on the create V Iso Curve button. Move the cursor over the surface. You'll see a blue line that runs in the world Y direction over the surface at the mouse position. Move the mouse, and the curve moves, following it. Place the mouse pointer near the right edge (in the front viewport) of the surface and click to create the curve. Right-click to end. Go to curve sub-object mode and select the curve. In the modify panel, find the position spinner, and type 0. The curve will move over to the right edge of the surface. This spinner controls the position of the curve along the surface, where 0 is one edge and 1 is the other, with decimal positions in between. Name the curve Vcurve1.

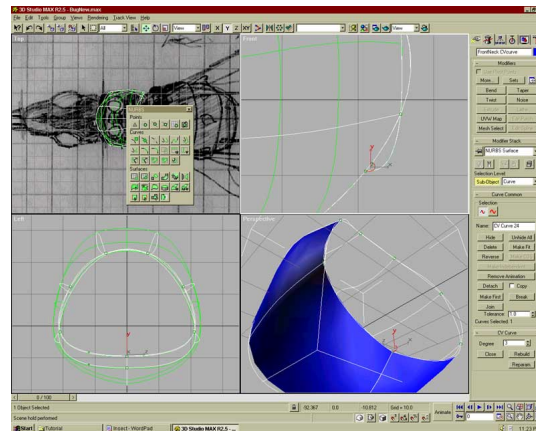


Figure: 6.

In the NURBS Creation Toolbox, or the Create Curves rollout on the modify panel, click on the Create CV Curve button. In the modify panel, uncheck capture mouse. This will allow us to create a curve in different viewports simultaneously. Turn on 3D snaps. You should still have the curve edge snap turned on. Create a CV curve starting in the left viewport, snapping to the very end of the NeckProfile CV curve (remember it?) and then continue creating the curve in the front viewport, until you have a small hook that meets the Vcurve1 at its starting point, see figure 6.

Make sure that the Plugin Keyboard Shortcut Toggle is enabled. Now, click on the Create 1 Rail Sweep Surface button (from now on, we assume this can be on the NURBS Creation Toolbox, or in the modify panel rollouts).

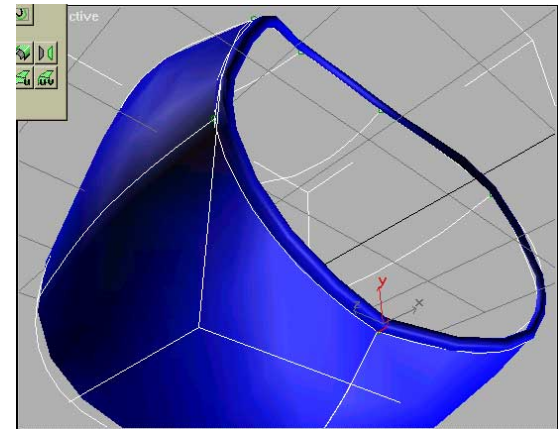


Figure: 7.

At the pick rail curve prompt, hit the H key on your keyboard. A list of curves will appear. Select the Vcurve 1 curve, and click the select button. At the select first cross section curve prompt, click on the little hook. The surface will appear in your viewports, but it will look messed up. Don't panic. Right click once to end the surface creation process, and in the modify panel, click on the Flip Normals checkbox. The surface will appear correctly in your viewports, see [figure 7](#).

Now, repeat the same process on the other edge of the surface. This time, because of the direction of the curves we're using to create the surface, make sure to uncheck the sweep parallel checkbox and check the flip normals checkbox in the modify panel at the surface level, when you've finished creating the surface. The goal is to give the neck some sort of volume. Don't worry, you'll actually never look inside the bug, so we only need to simulate the piece has some volume, not actually create it. And now we've finished with the neck!

Return to the top level, and name the whole object Neck, hide it and reactivate the background image for the front viewport.

THE TORSO

The main body will be a lot faster to construct. This time, we'll use a different technique. First, in the top viewport, create a CV curve with hook-like ends that resembles the boundaries of the biggest section of the body. It has to be a little bit bigger. Take a look at [figure 8](#).

Now, apply a Lathe modifier on the curve. Set the direction to X. Click on the sub-object button, select axis, move the axis in your top viewport with the axis movement restricted to Y. Manually adjust the axis until your lathe takes the actual dimensions of the background image. Click subobject again to return to whole object mode, and in the front viewport move the object to its correct position in relation to the background image. Set the output of the lathe operation to NURBS. Uncheck cap start and cap end. Name it Section01.

With the object still selected, shift-move it to the right in the top viewport towards the next section of the body. Select copy as the cloning method. Then, in the modifier stack, go back to the NURBS curve stage. Then, go to curve cv subobject level and move the cv's to get the shape of the next body section. Once you've

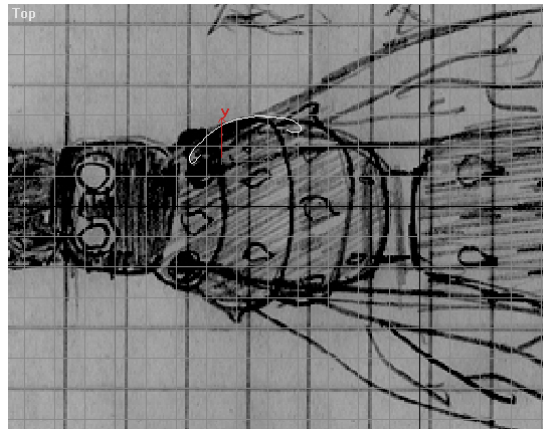


Figure: 8.

finished, return to the top level and to the lathe stage of the modifier stack. In the front viewport, rotate the object a bit in the Z view axis and relocate it to the position and orientation shown in the sketch.

Reselect Section01 and shift-move it in the top viewport with axis restriction on X to the last of the body sections (right). Then, repeat all the steps you performed on the previous section, which are adjusting the curve's CV's, rotating and positioning the object according to the background image. Why use Section01 and not Section02? You're right... since Section02 has been rotated, it's CV curve is no longer aligned with any viewport, which would make it a lot harder to edit without the help of a grid helper object. So, just let's save us some unnecessary sweat and use the non-rotated Section01. Here's your new section object (Section03) see [figure 9](#).

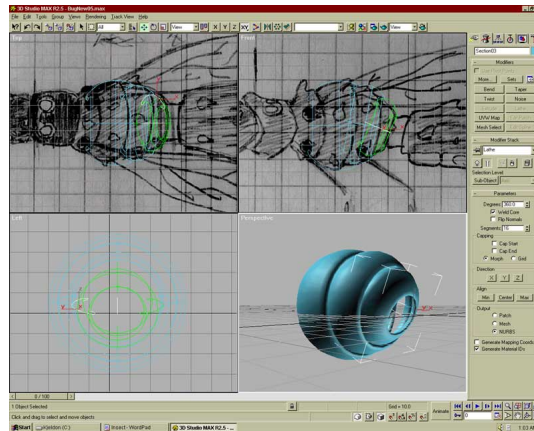


Figure: 9.

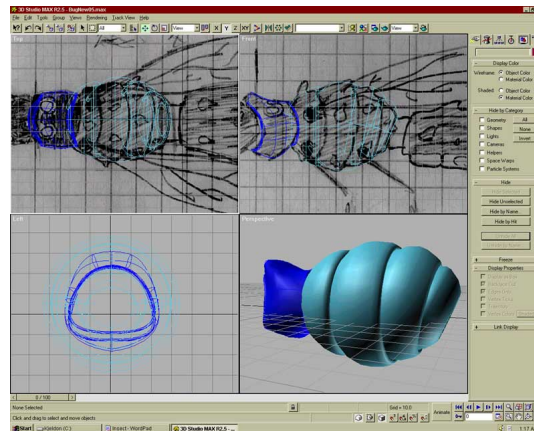


Figure: 10.

For the last section of the body (which happens to be the first one) just shift-move Section01 to the left and repeat the same process, but without rotating the final element this time. But now, you may have to edit the CVs of the original spline of Section01 to make it's "pointy" part fit into Section04. Just make the tip of Section01 fit into Section04 by moving its spline's CV's into Section04. Then, unhide the neck piece and adjust the Section04 spline to fit into it. Don't worry if the fit is not perfect. We'll fix it afterwards. You should have something a lot like [figure 10](#) so far.

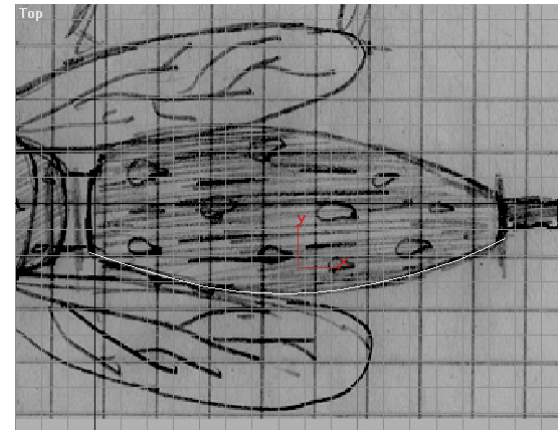


Figure: 11.

THE ABDOMEN

Ok. It's time to start on the abdomen object. First, select everything you've done and hide it. Zoom in the front and top viewports on the tail of the insect. We'll create a series of curves that describe the top (carapace) of the tail of the insect. In the top viewport, create a CV curve that follows the shape of the tailpiece, something like [figure 11](#).

Select the move tool and constrain your move axis to Y. Click on the modify panel and go to curve CV sub-object level. In the front viewport, select the CV's and move them to fit to where the upper carapace meets the lower abdomen. Go to curve sub-object level and name this curve Lside. [Figure 12](#) shows what you should get.

Switch to the top viewport. Click on the create mirror curve in the nurbs creation toolbox. At the pick a curve prompt, select the curve, set the mirror axis to Y and type 20 in the offset spinner. Go to curve sub-object level and name this curve Rside_mirror. This is what you'll see.

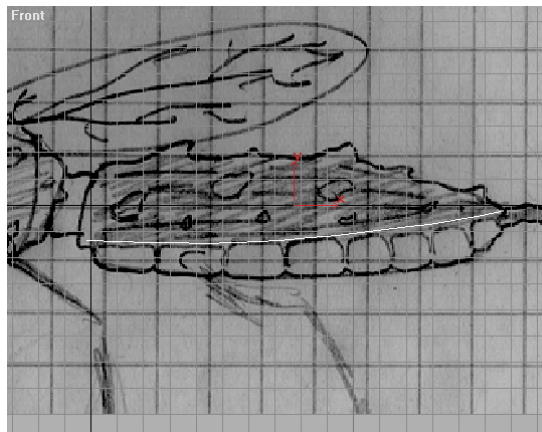


Figure: 12.

In the front viewport, create a CV curve that follows the profile of the insect's abdomen. Click on the align tool, and select the previous curve at the pick align target object. At the Align Selection dialogue box, check the Z position checkbox, and make sure center-center are the align options selected. You'll see the curve move. Click on OK. We've done this because since the sketch is not perfectly aligned to the center of our universe (I must apologize for that), we need to align this curve to the center of where our tail will be, and that's in the exact middle of the other curves. We will later realign the tail with the rest of the model. If needed, go to curve CV sub-object mode, and adjust the shape of the curve. Name this curve (in curve sub-object mode) Top. [Figure 13](#) shows what you should have.

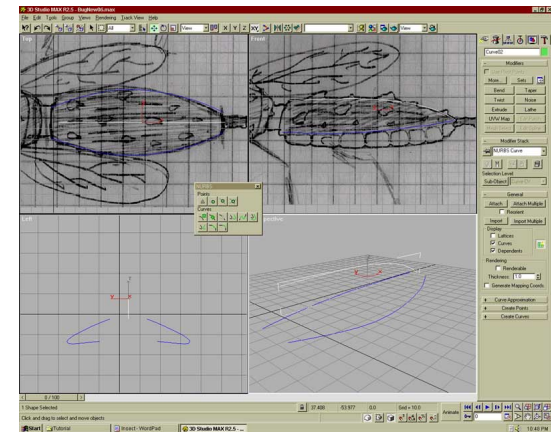


Figure: 13.

Right-click on the snap toggle button and the snaps dialogue box will appear. Under the NURBS section, check Curve End, uncheck Curve Edge, and uncheck grid points in the standard section. Close the dialogue box and activate 3D snap. In the NURBS Creation Toolbox, click on the Create Point Curve button. Why use point curves instead of CV curves? Because, we need the curve to pass exactly through the CV's of the other curves. If we used CV curves, the curve CV's would pass through the other curve's CV's, not the curve itself. Point curves pass exactly through the points that make up the curve, so it's the right choice for the next step. First, click in the lower curve's leftmost end (check you're really snapping to it). Then, somewhere in between the lower curve and the middle one, then on the middle one's leftmost end, then somewhere in between the middle curve and the top one, and then in the top curve's leftmost end. Right click to end.

Switch to the front viewport and go into point level sub-object mode, and move the points to follow the exact shape of the abdomen profile. **Figure 14** shows what you have right now.

Lastly, on the NURBS Creation Toolbox, click on the Create Point

Curve, click on the rightmost end of the bottom curve to the rightmost end of the top curve. In your perspective viewport, zoom in to the rightmost end of the middle curve. Go into curve CV sub-object level, and select the last CV of the curve (the rightmost one). Move it until it touches the last created curve (the straight one). It should correctly snap to the midpoint of the curve. Here's how it looks.

Return to the top level, and click on the Attach button. Select the side curves. Right click to end. Now all curves are joined in one single object. Click on the edit stack button, and convert the object to a NURBS surface. Switch to your perspective viewport and select zoom extents. Rotate the view until you can see all curves clearly, with the shortest curve (the straight one we created last) closer to you.

Now, in the NURBS creation toolbox, click on the create UV loft surface. MAX will prompt you to select U curves. Select them in this order. First, the left side curve, then the top one, then the right side curve. Right click to end U curve selection. You'll be prompted to select V curves. Select the farthest profile curve, then the nearest (the straight one). Right click twice to end the surface creation.

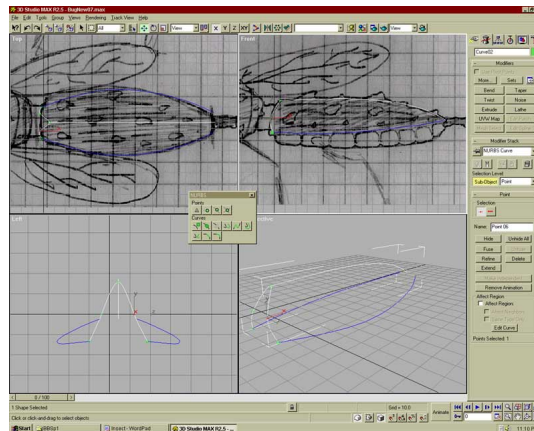


Figure: 14.

And voila! Here's your carapace! Name the whole object Abdomen, see [figure 15](#).

To make the abdomen of the insect, return to the top level, activate your left viewport, select the move tool and right-click on it. Type 0 for the Y Absolute World spinner. This will return our model to the center of the universe on the Y axis. We'll be drawing a curve at the center of the universe, but our model isn't there right now, so we need to move it to have our curve at the very center of the model.

Now, create the following CV curve in the front viewport. Notice it follows the "wavy" pattern of the abdomen. This is what you should see now, see [figure 16](#).

I've marked a place where I placed "double" CVs. To create them, just double click on the same place. This will create one CV on

top of the other, thus making for a sharper peak in the curve. As you noticed, I didn't follow the outline of the drawing exactly. I just created my curve above it but following the shape.

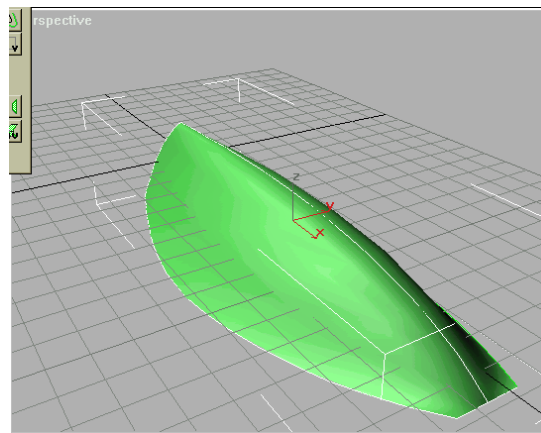


Figure: 15.

Now, in the left viewport, create the following CV curve. We'll use it to complete our surface creation process on the abdomen. Make sure you snap the ends of the curve to the ends of the rail curves used previously (Lside01 and Rside_mirror01) by turning on Curve End on the NURBS section of the 3D Snaps dialogue box, and turning on snaps. Move the rest

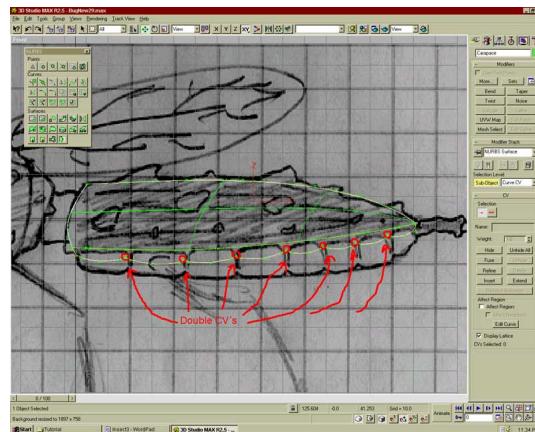


Figure: 16.

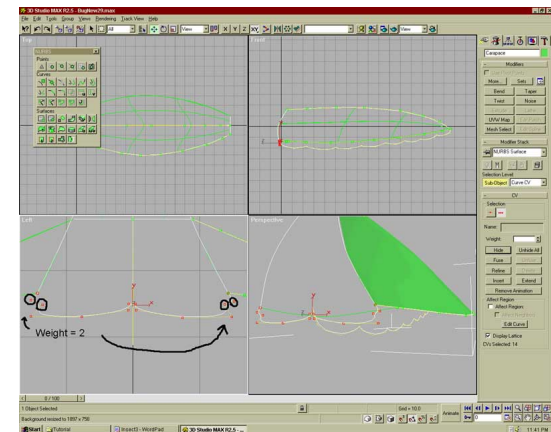


Figure: 17.

of the CVs in the front viewports back in line with the snapped ones, since they might be a bit offset. You should end up with something like [figure 17](#).

The marked CV's have a different weight from the others. Set these CV's weight to 2 in the Weight spinner. Name the curve FrontAB. Now, switch to the front viewport, select the move tool and restrict your movement to the X-axis. Lock your selection (space bar) and shift-move the curve to the back of the abdomen. Position it at the end of the model. Now, move it in the Y axis until it comes close to the ends of both side curves. Go to Curve CV sub-object level and move the CVs to conform the same shape as the original curve, but smaller so it fits between both side curves. Use non-uniform scale on all CVs one axis at a time (first X-axis, then Y-axis, both in the left viewport so your curve remains symmetrical). Make sure the ends of the curve snap to the ends of the side curves by using 3D Snaps, and move the rest of the CVs back in line in the top viewport by zooming in on the curve (turn of the background image before doing so by right-clicking in the viewport label and deselect Show Background). Name it BackAB.

Now, move the end CVs of the middle curve to touch the profile curves you created. Use a Curve Edge 3D snap. Ok. Ready to create the surface? Rotate your perspective viewport so that the front of the object is facing you and you can see all curves clearly. Click on the Create UV Loft Surface button. When prompted to select the U curves select the following in this order: Rside_mirror01, the middle wavy curve and Lside01. Right-click to end U curve selection. For V curve selection, click on FrontAB (the one facing you) and then on BackAB. A nice curved surface is created, see [figure 18](#).

Now, we just need to join both surfaces into one continuous surface. Select either surface at the surface sub-object level, and click the Join button on the Surface Common rollout in the modify panel. In your left viewport, place your mouse over the right side of the abdomen (lower) surface. The surface will turn yellow, with the right edge highlighted in blue. This means that this surface will be joined using this edge. Click once. Now, place your mouse over the carapace (upper) surface, at the right side. The surface will become yellow, with the right edge highlighted in blue. Click again. Both

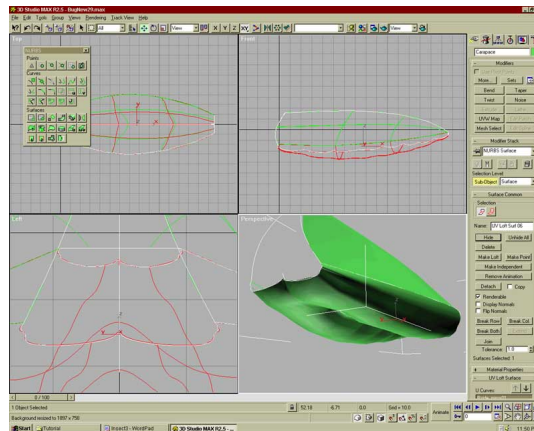


Figure: 18.

surfaces will be joined at this edge, making one surface. Now, what about the other (left) edge? It can't be joined, because the surfaces are already one. But, it's easy to close this edge. In the CV Surface rollout, click on the Close Rows button. The surface will be automatically searched and any gaps along its rows closed. Now you have a nice, closed continuous surface, see [figure 19](#).

To finish our surface, click on the Reparam button on the CV Surface rollout. Choose Chord-Length as the reparametrization method. The surface will be reparametrized. Go to Surface CV sub-object level. Now, here comes the tricky part. If you zoom in closely into the surface in the top viewport, you'll notice that near the middle of the model, some CVs on one side of the surface cross to the opposite side of the surface. This is easily noticeable if you examine the lattice (the yellow lines connecting the CVs). Start moving one by one those CVs and returning them to their original side of the surface. This will be very valuable afterwards. And we're done!

THE HEAD.

Ok, let's do the insect's

head. We'll do some curves that define the boundaries to the head, and build the surface from there. Hide what you've done so far. We do this to be able to see more clearly what we're modeling, and to speed up screen redraw. Re-activate Show Background in both front and top viewports. Zoom in/pan to the head of the insect on the drawing. Now, in the front viewport, create two curves separately, one for the top of the head and one for the bottom. More or less like [figure 20](#).

Now, in the top viewport, do the same for the left side of the head, which is at the top of the viewport, and then create a mirror curve to create the other side of the head. Set the mirror axis to Y and the Offset to -13. This is what you should see – [figure 21](#).

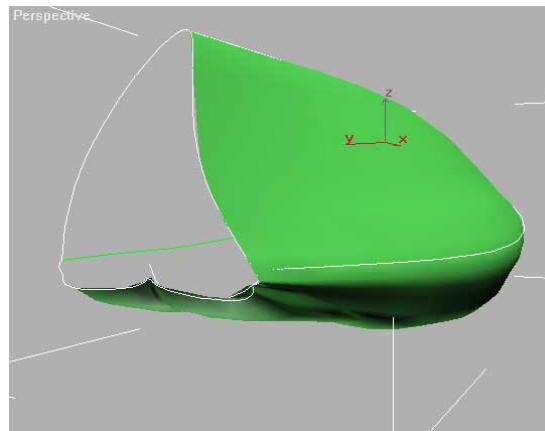


Figure: 19.

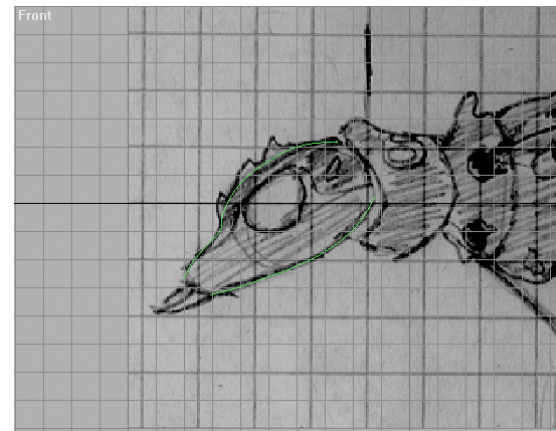


Figure: 20.

You'll notice that our curves are not at the right angle. Check the front viewport. They're straight, but because the head is at an angle, we need to rotate them. In the front viewport, rotate them 35 degrees in the Z axis (use angle snaps) and reposition the curves so that they go through the head at the exact middle of it.

You'll see that now our curves don't fit very well. We need to move some CVs, but if we move them in the top viewport, they'll become non-planar with respect to the rest of the curve. So, to make things easier, we'll use the almighty grid helper object. Create a grid in the top viewport. Then, select the align tool with the grid still selected, and click on one of the side curves in the front viewport. The Align to dialogue box will appear. Check the align orientation in the X axis, and align position in the X and Y axis. The grid will move over to the curve location, at the right angle. Right-click on the grid object, and select Activate Grid. The grid will become active as our new plane. Switch to the left viewport, right click on the viewport label, and select views/grid/top. We're ready to modify our curve. In that

viewport, zoom in on the side curves, go to Curve CV sub-object level, and start moving the CVs using the original top viewport as reference for your movements. You only need to modify one curve because the other is a mirror of it and will adjust itself accordingly. You'll notice that I'm not taking into account the space occupied by the eye. We're drawing the head profile. The eyes will come later. There's one point where you'll need a sharper curve, and it's where the eye meets the "mouth". Select that point and increase the weight in the weight spinner to about 4.2. Then, move the remaining CVs again to get a better curve. Do the same in the front viewport to the top CV curve (the first you created) at the same point. Once you're done, return to the top level. This is what you should have now, see [figure 22](#).

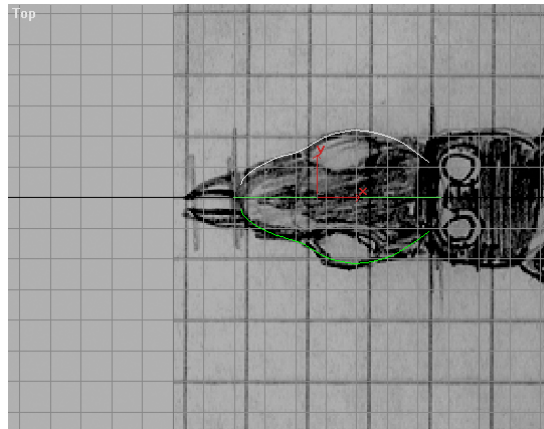


Figure: 21.

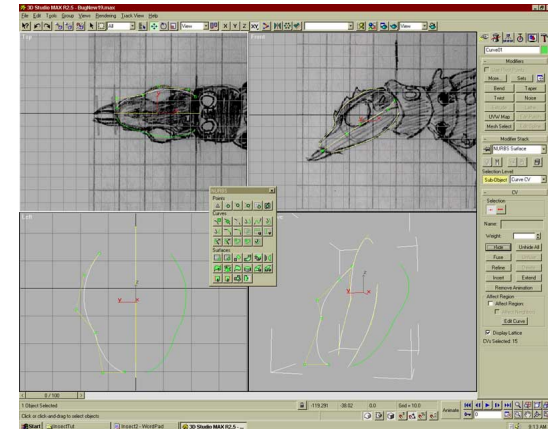


Figure: 22.

We're done using the grid, so you can delete it. Select one of the curves and click on the Attach Multiple button in the modify panel. Select the remaining curves from the list. Click on the Edit Stack button and convert the curves to a NURBS surface.

We'll create a pair of curves that will help us define the head surface. Turn on 3D snaps and activate Curve End from the NURBS snaps dialogue box. Uncheck Curve Edge. Now, rotate your perspective view so you can see all curves clearly. Click on the Create Point Curve button, and click on the curve ends next to where the "mouth" of the insect should be in this order: top curve, left curve, bottom curve and top curve again. At the "Close curve" prompt, select Yes. Why a point curve instead of a CV curve? Because point curves go through each point in the curve, whereas CV curves do not, and in this case we needed a curve that passed through those points since we need them to touch the rest of the curves, just as in the previous case where Point Curves were used. When you're done, do the same for the back of the head. Create a Point Curve that touches the other ends

of the curves, in the same order (top, left, bottom, right and top) as the first one.

Now, uncheck Curve End and check Curve Edge from the NURBS Snaps dialogue box. Now, create seven more point curves in the same order as the previous ones, always snapping to the existing "rail" curves. Make them symmetrical using the top and front viewports as reference during curve creation. Once you're done, you should see this, see [figure 23](#).

Now, simply create a Uloft surface out of these curves (the point curves only!). Select them from the back of the head to the front of the head. Here's your finished surface, see [figure 24](#).

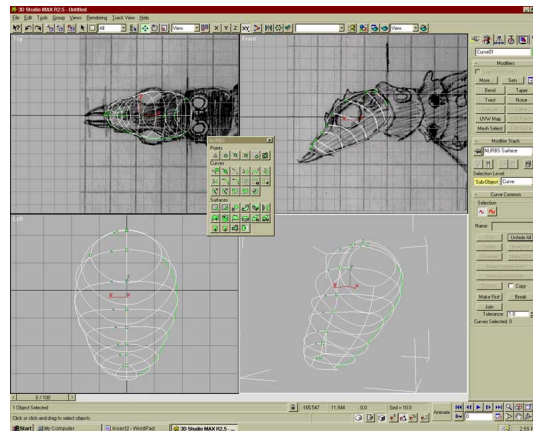


Figure: 23.

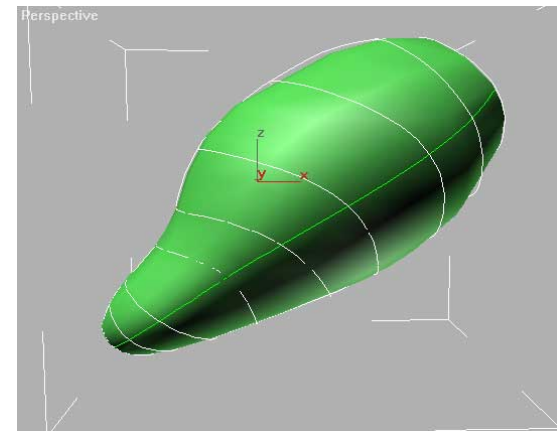


Figure: 24.

Now, create a sphere in the front viewport where the eye is. In the top viewport, move it over the right eye of the insect. Now, scale and rotate the sphere to make it fit the shape of the eye. When you're done, convert it to a NURBS surface. Apply a FFD box modifier to it. Set the number of points to 2x4x2. Start moving the points to fine-tune the overall shape of the eye. Here's the finished eye, see [figure 25](#).

In the top viewport, mirror the sphere using the mirror tool. Set the mirror axis to Y, the offset spinner to 34.2 approximately and the clone selection method to instance. Now you've got both eyes ready. Select the head and click on the Attach Multiple button. Select both spheres from the list. Both spheres will be attached to the head. If one of the eyes looks wrong, go into surface sub-object mode and check (or uncheck) the Flip Normals checkbox. That should correct it. Anyway, go into surface sub-object mode and select each surface naming them Right Eye, Left Eye and Head Uloft respectively. Now, we don't want those eyes to look like

spheres just positioned over the head. Let's create a small protective membrane that keeps the eyes in place on the head.

We'll build the left eye membrane first. Rotate your perspective view so you've got a nice front view of the eye. Click on the Create V Iso Curve button. Place your mouse over the eye surface. You'll see a blue line appear over the eye. Move the cursor towards the lower end of the surface. When you're close to the end of the surface, click once. This will create a curve at this position that accurately follows the eye surface. Now, move the cursor closer to the center of the eye. Click once again to create another surface. Right-click to end curve creation. You've got two curves over the eye surface, see [figure 26](#).

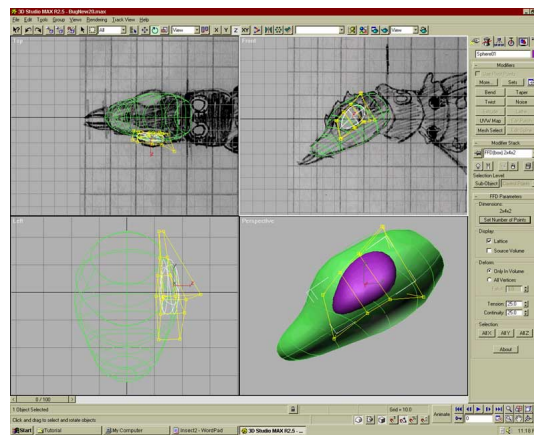


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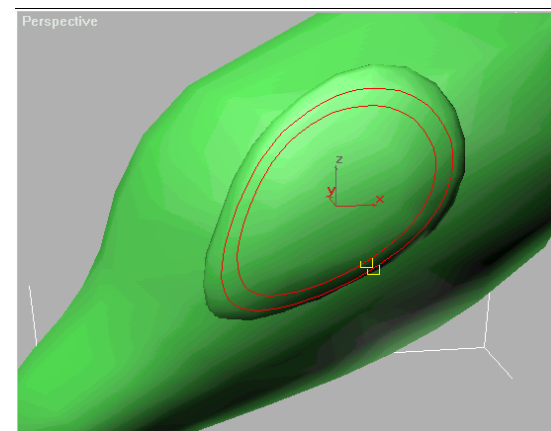


Figure: 26.

Now, in the front viewport, draw a curve starting at the top of the eye in a counter-clockwise direction that encircles the eye, roughly following the same shape. End the curve right at the point where it began, and answer yes at the Close Curve prompt.

In the left viewport, select the curve (you'll notice it's inside the head) and drag it to your right (restrict the movement axis to X) so that it lies outside the head.

Switch to your front viewport and click on the Create Vector Projected Curve. At the select a curve prompt, select the curve you just dragged. At the select a surface prompt, select the head surface. A curve will be created over the head, although you might not see it. Right click to end.

At the curve sub-object level, hit the H key (make sure keyboard shortcut toggle is enabled beforehand) and select the Normal Projected Curve you just created (it will be the only one on the list). You'll notice the shape changed, it no longer corresponds to the shape of the original curve. That's because of the way the head surface curves in front of the curve. But we'll fix that in a minute.

In the modify panel, hit the Make COS button. The curve will be converted to a Curve On Surface curve. This basically means that the curve lies exactly over the surface of the head, no matter how you modify it. Leave the default CV value and hit Ok at the convert curve dialogue box. Hit the edit button at the bottom of the modify panel, in the CV Curve On Surface rollout. A modeless dialogue box will appear with the curve in it. You'll notice that when you move a CV on the curve, the actual curve moves in the viewports. Start adjusting your CVs until you have a curve that resembles the original curve you used to project the Normal Projected Curve. (You should zoom in on the curve to see your CVs more clearly). When you're done, close the dialogue box by hitting the Done button, see [figure 27](#).

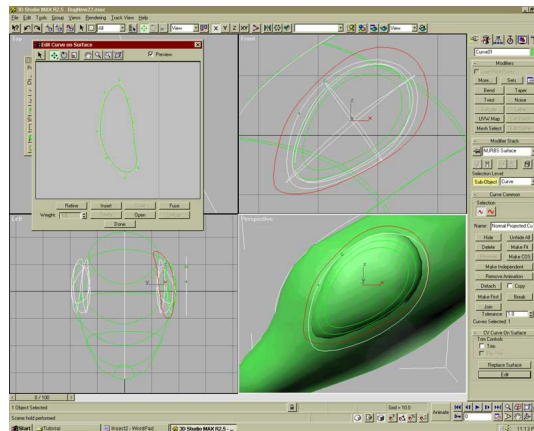


Figure: 27.

Select the V Iso curve that lies to the edge of the eye surface and click on the Make Independent button. In the left viewport, select the move tool, restrict your movement axis to X and drag the curve to your right side, leaving it “floating in space”. Not much, just a bit so it doesn't lie on the surface of the eye. Now, create a ULoft surface from the Normal Projected

curve, to the outer V Iso curve, to the inner V Iso curve. Right click to end, see [figure 28](#).

Ok, so now our bug looks like he's wearing WW2 pilot's goggles. This doesn't look like a membrane at all. But, thanks to the power of relational modeling, we're able to fix that in the blink of an eye. Go to surface sub-object level, and select the membrane surface. In the U Loft Surface rollout, click on the refine button. Move your cursor over the membrane in the front or perspective viewports (if you can see the surface there) and click in between the outer and middle curves. A new curve will be created.

Select the outer curve of the membrane surface and click on the Edit button in the CV Curve On Surface rollout in the modify panel. Select all the CVs and scale them so that the curve becomes bigger. Move the CVs up a bit so the curve gets closer to the mouth, smoothing up the blend at the head and creating a small bulge behind the eye. Then, select the curve you created by refining, scale it down and move it

outwards from the head (-Y axis) a bit in the top viewport. Don't let the membrane surface cross the eye surface though. Tweak both curves as necessary to have a nice blending surface between the eye and the head, see [figure 29](#).

Now, repeat the same steps to create the membrane of the right eye.

To create the mouth of our friend, create in the front viewport a NURBS CV curve that looks like the profile of a long cup-like object. Now, apply a lathe modifier to the curve. Use the X direction. Set the output to NURBS. Click in the sub-object button and go into axis level. Select the move tool and move the axis in the -Y direction until you create a capsule-looking surface. Rotate and

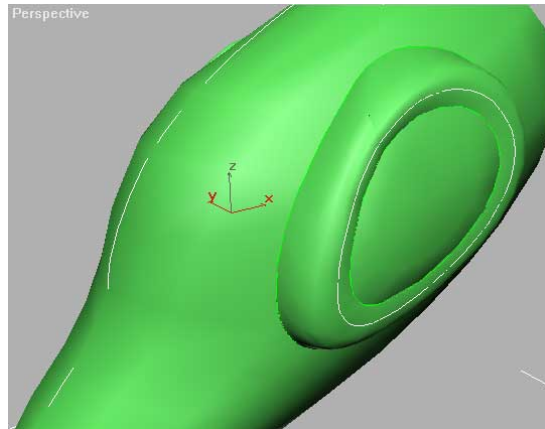


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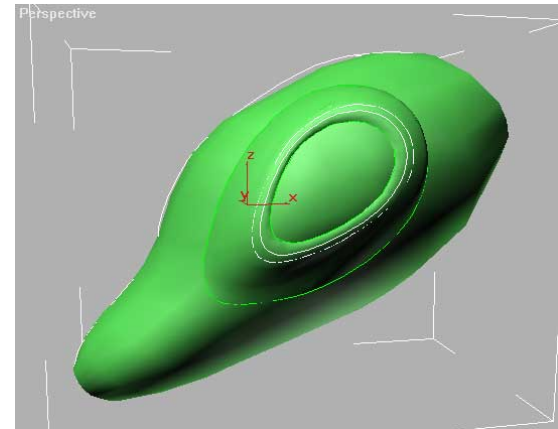


Figure: 29.

move it so it's positioned inside the head looking towards the mouth, see [figure 30](#).

Select the head and in the modify panel (make sure you're at the top level of the object) click on the Import button. Select the capsule. It will now become part of the object. Click on the Import button once more to end. Now, just create a Blend surface that goes from the "mouth" edge of the head surface to the open edge of the capsule surface, joining them. And the mouth is finished, see [figure 31](#).

JOINING EVERYTHING TOGETHER

Now we'll join all body parts together. We'll accomplish this by blending the edges of each part, or by creating some curves first and blending those. First, unhide all objects. Select the abdomen and

hide everything else. Click on the create U Iso Curve button. On the abdomen surface, click anywhere close to the left edge (the one facing the torso). We'll position the curve accurately later, just get close. Now, go into Curve Sub-object level and select this curve. Set its position by increasing the Position spinner value until the curve is at the edge of the surface. Once you're done, name this curve Blend Curve, see [figure 32](#).

Now, unhide Section 3. Click on the Edit Stack button and collapse the object to an editable NURBS surface. (Have you been saving often?!) Click on the Create V Iso Curve button and create a curve

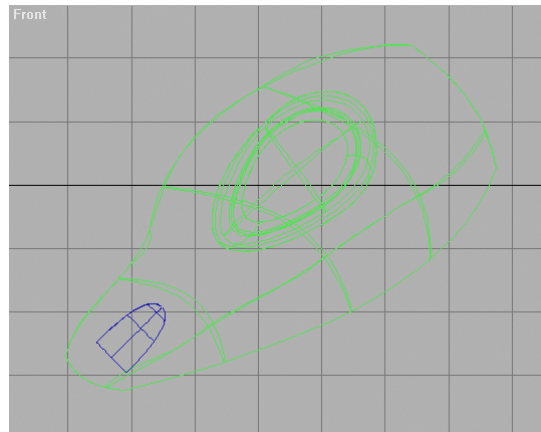


Figure 30.

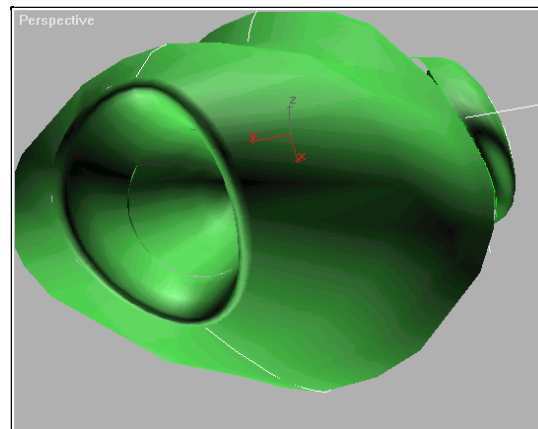


Figure 31.

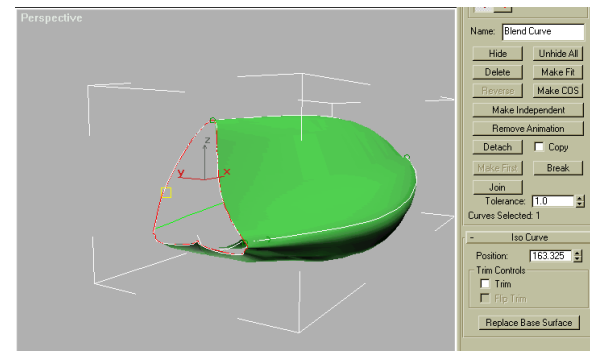


Figure 32.

just where the object starts to go into itself, on the side facing the abdomen. Here's the curve you should create, see [figure 33](#).

Name this curve Blend 2 Curve. Now, attach both objects together by selecting either and clicking on the attach button at the top level, then select the other.

Now, just create a ULoft between this curve and the left edge of the abdomen. The ULoft surface will be all warped up. To fix this, go to curve sub-object level, select the Blend Curve and click on the Make Independent button. Then click the Reverse button. Now comes the “tweaking” part. Click on Make First and click on the left side of the curve in the left viewport. The ULoft surface will look much better. If it still looks somewhat twisted, try clicking in a different part of the curve (not too far away though!). Does it look better? Does it look worse? This will give you a hint on where to click. Continue to do this until the surface looks fine. Here's mine, see [figure 34](#).

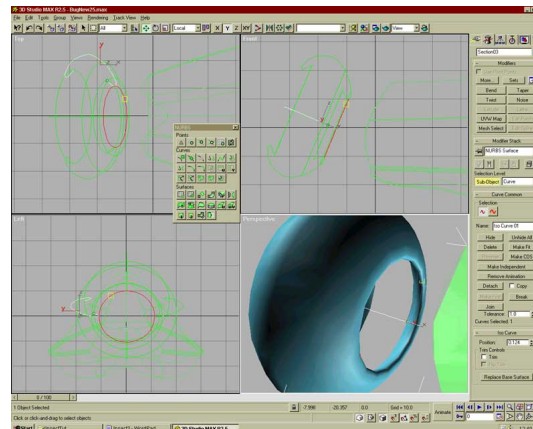


Figure: 33.

We're almost done. Let's take off a bit of the “linear” look on this ULoft and make it smoother. You might still wonder why we didn't use a blend surface - if it's much smoother. Sometimes, the most obvious choices are not the best. One nice ability ULoft surfaces have is that they can be refined, making for a better surface for tweaking. So, let's tweak.

Go to surface sub-object level and select the ULoft surface. Under the U Loft Surface rollout in the modify panel, click on the Refine button. In the front viewport, place your mouse near the rightmost end of the surface. A blue curve will appear. Click once. You've created a new curve that can influence the surface, and we'll need it just for that.

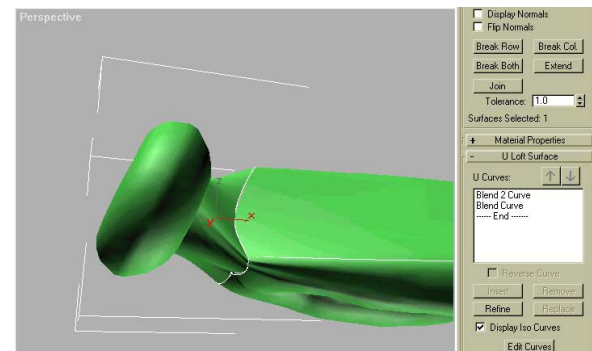


Figure: 34.

Now, click on the Edit Curves with the new curve still selected. The curve's CVs will become visible. Move the top CVs a bit upwards in the front viewport so that the curve has almost the same height as the abdomen surface. Now, that's a much nicer surface! To end this part of the creature, join the rightmost edge of this surface to the leftmost edge of the abdomen surface. (You know how to join two surfaces already. If you don't, stop cheating and read this article from the beginning!)

There's a visible stitching problem at the joined edges area. Let's remove that. Select the new surface and click on the Rebuild button at the bottom of the CV Surface rollout. Set Reparametrization to Centripetal and accept the default values in the Number in U and Number in V spinners. Click OK. Your surface now has a smoother stitch. Go to Surface CV sub-object level, click on the Column of CVs button in the Selection area and find the column creating this deformation on the surface. Once you have selected it, return to Single CV selection mode and deselect the top and bottom CVs in your left

viewport. Leave only the side ones. These are the ones we need to fix, see [figure 35](#).

Now, in your left viewport, non-uniform scale them in the X axis. They should move outwards from the center of the surface. As some of the upper and lower points reach their desired positions, deselect them and continue with the remaining CVs. You may notice that you need to move some adjoining columns of CVs. You can also adjust the weight on these points, so that they influence the surface less. Continue to adjust the surface until you're satisfied with the way it looks. Don't worry if it isn't completely smoothed out. We don't want that anyway. The subtle imperfections that show up are what will make our model more believable. Where have you ever seen an ultra-slick-super-smooth insect flying around anyway?

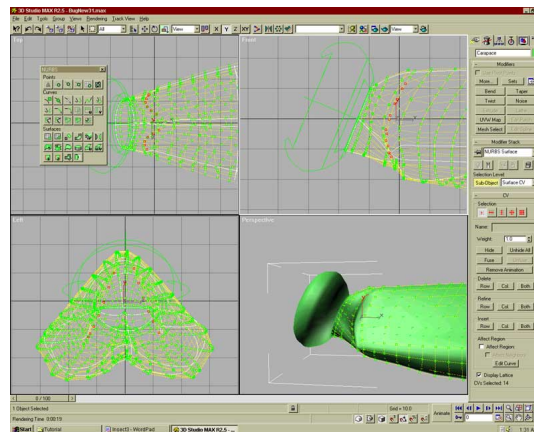


Figure: 35.

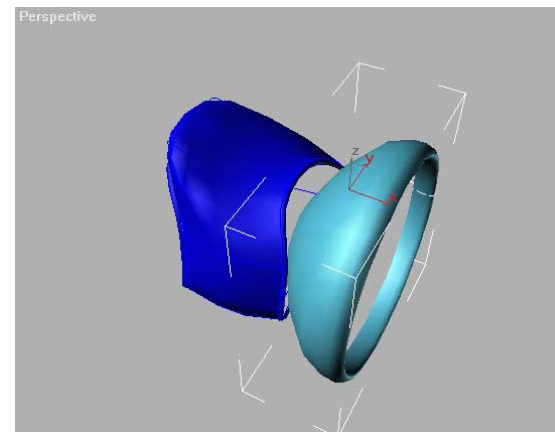


Figure: 36.

Well... there's the corner of "Toys R' Us" for one thing!

To join the first section of the torso to the neck piece, first select the torso section (Section04). Go back to the NURBS curve stage of the stack, go to Curve CV sub-object level and in the top viewport start moving and rotating the leftmost CVs so that when you return to the lathe stage, there's some space between both pieces, see [figure 36](#).

Hide the parts of the insect you won't be using, Collapse Section04 into an editable NURBS surface. Create a V Iso Curve on the section object near the neck object, see [figure 37](#).

Now, create a V Iso Curve on the inside of the rail surface at the side that faces the Section object, like the one you created on the last torso section to blend it with the abdomen.

Return to the top level and attach both objects. Select both V Iso Curves, then select-invert to select the remaining curves and hide them. Now, do you see the

yellow squares on both curves? We need to align them. See where the square is in the neck curve. Select the Section curve and in the left viewport, rotate it in Z until its square matches the other curve's. Done? Now, just create a blend surface from the neck curve to the section curve. (You'll be better off selecting the curves by hitting the H key after clicking on the Create Blend Surface Button. Just make sure Plug-in Keyboard Shortcut Toggle is activated. This way you won't blend the wrong edges). Nice surface, isn't it? Just go into the surface sub-object level, select the blend surface and set the Tension 2 spinner to 1.5. We're done, see [figure 38](#).

If the blend surface appears to be twisted, select the curve created in Section04 and in the left viewport rotate it in the Z axis until the blend appears just right.

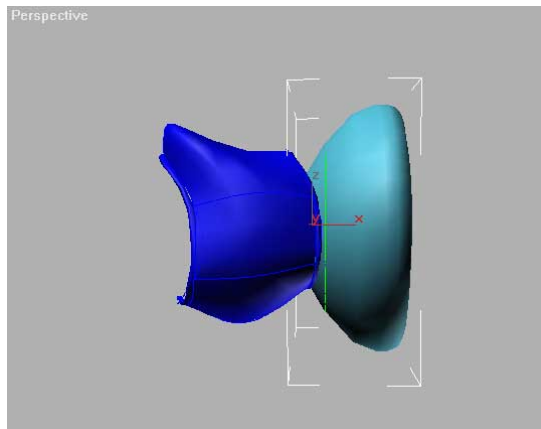


Figure: 37.

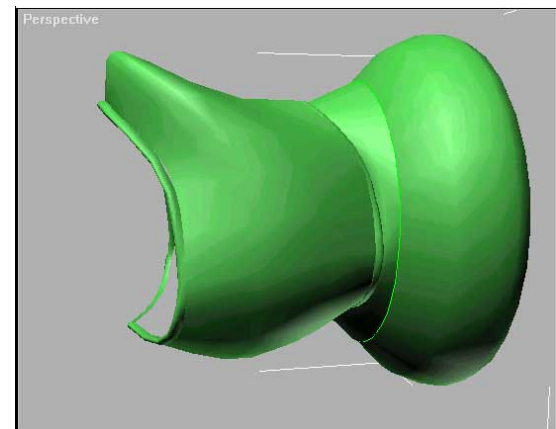


Figure: 38.

To blend the head and the neck, we'll use the same procedure. Join both objects, create a V Iso Curve at the rightmost edge of the head, another V Iso Curve inside the neck piece, and blend. Tweak blend and that's it. Just follow what you did with the last blend. If you notice the blend showing through the neck surface, select the curve it depends on and scale it down so that it lies inside the surface instead of over it. Don't forget to join the head surface to the blend surface when you finish tweaking the blend surface! See [figure 39](#).

(If you run into any trouble during the joining of surfaces, just double-check that the first vertex of the curves that make up one surface are aligned with the first vertex of the curves making up the second surface, and that all curves run in the same direction. If you're using no curves, you can get some by clicking on the Make Loft button in the Surface Common rollout. Work from there and use common sense. (By this time, you should have a real good understanding of NURBS modeling.)

To finish things up, select the three surfaces making up the neck piece (the first "rail", the neck surface

and the back "rail") make them independent and click Close Cols in the CV Surface rollout for each surface.

THE DETAILS.

All right folks, we could say that we're through with the heavy work. We just need to do the last parts we're missing... that's the antennae, the sting, the legs, the wings, the "fangs" and the protrusions. So, let's get to it.

The wings.

The wings will be modeled from a UV loft surface, blended into our friend's torso. However, in order to get those to blend with the body, we'll need to make some holes into its carapace. Here we go. First, select the head-neck-torso part of the model (it should be one part already, since you joined it previously) and hide the rest. Now, freeze it. We'll use it as a reference, but we don't want to modify it by accident. In the top viewport, draw the silhouette of a wing. Make it using a new curve from the Create/Splines/NURBS/CV Curve panel. We'll use a brand new object and we'll attach it later. This will allow us to modify it a bit more easily. Get the rough, over-

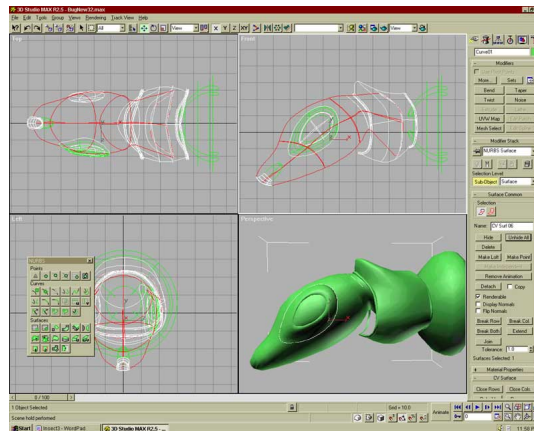


Figure: 39.

all shape and go into Curve CV sub-object level to fine-tune it, more or less like [figure 40](#).

In the front viewport, create a grid helper object and in the top viewport, rotate and position it where the curve's ends lie. Select the curve, go into Curve CV sub-object level and position its end CVs at the grid's location. Activate the grid and switch your left view into a grid/Display Planes view. Now, select both endpoints, select invert the rest of the points and hide them. This will allow us a better view.

Turn on 3D Snaps and turn on Curve End and off Curve Edge from the NURBS section of the Grid and Snap Settings dialogue box. In the grid view, create a semi-circular Point Curve. Make sure you're snapping to the CV curve's ends and close it, see [figure 41](#).

Go to Curve sub-object mode, select the profile curve, click on the Break button in the modify panel, move to the middle of the curve (approximately) which is at the farthest end and click once. This will divide our curve at that

point into two different curves. Now, create a 2-Rail Sweep surface, using as rail 1 the left silhouette curve, as rail 2 the right silhouette curve and our circle as the cross-section. Right click. You may need to flip the normals of the surface in order to view it properly. Now, go to Surface sub-object level, select the wing surface you just created and click on the Make Loft button. Make sure that From V Iso Lines is checked and accept the default number of curves. Click Ok.

Hide the surface. In the modify panel, select the second curve in the U Curves list in the U Loft Surface rollout. Click on the Edit Curves button. Select all CVs and scale them down in the Y axis (use axis constraints). Then, select the next curve and repeat, always scaling to the previous surface's same scale. Repeat until the last curve.

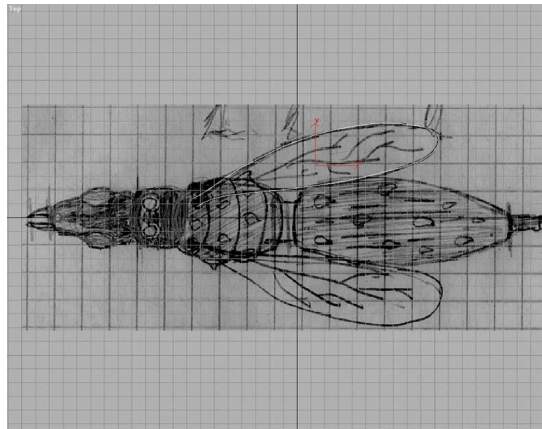


Figure: 40.

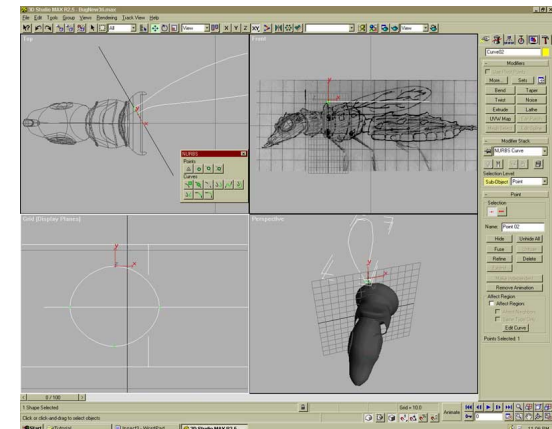


Figure: 41.

You should have a flatter wing now, not a balloon, see [figure 42](#).

Now we'll make the hole where our wing will fit in. The wing can't be attached to the carapace of the insect. We need to carve a hole in the carapace and put the wing in it. Deactivate the grid object and hide it. In the top viewport, create a CV curve over the carapace. Make it a closed, semi-circular shape, but a bit irregular. In the front viewport, move it up and over the body of the insect.

Unfreeze the insect (what's visible) and attach the curve you just created to it. Now, in the top viewport, create a Normal Projected Curve. Use this semicircle as the curve and the carapace as the surface. A small, deformed version of our curve will be projected onto it. Go to Curve CV sub-object level, select our semicircle and start moving its CVs until the shape of the projected curve is bigger, see [figure 43](#).

Switch to Curve sub-object level, select the projected curve and in the Normal Projected Curve rollout (in the Trim Controls section) check Trim and Flip Trim.

You'll see a hole appear on top of the carapace. Ok, now we'll do something a bit tricky. Go to Curve sub-object mode and select the trimming curve. In the Curve Common rollout, select Copy and click the Detach button. Name the copy Trim below. Return to top object level. Select the newly created Trim below object. You'll notice you didn't only copy the curve, but the whole carapace object. Go to Curve sub-object level, select the new curve and uncheck Flip Trim. Click on Make Independent, go to Surface sub-object level, select all and delete. We now only have the curve. Scale it and move it so its below the hole of the original insect – but a bit smaller – in the inside of the body.

Return to top object level. Reselect the insect and attach the new curve to it. Now, just create a blend surface that

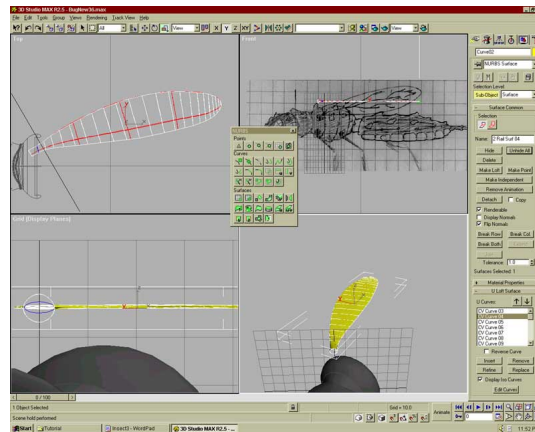


Figure: 42.

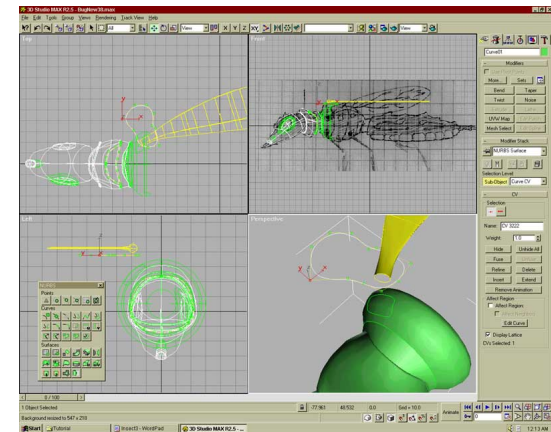


Figure: 43.

goes from the trimming curve to the new curve you just created. Check Flip Tangent 1 to give it a little bulge. And there's a hole ready to receive a wing.

Return to top object level and select the wing object. In the front viewport, rotate it upwards a little in the Z axis and move it closer to the hole in the carapace. Reselect the insect and attach the wing object to it. Now, just create a blend between the first curve making up the wing surface and the curve at the base of the blend in the carapace hole. Set Tension 1 to 1, Tension 2 to 0.5, check Flip End 1 and Flip Tangent 2. That gives us a nice blend. And we're done with one wing! See [figure 44](#).

Now, do the same to create the wing on the other side. Start by mirroring the projection curve (the one you used to create the projected curve) and create another trim from there. Then mirror the wing surface and blend. Make any adjustments necessary.

The forehead protective plate and the antennae

This will use fairly simple pieces to build. First, we'll

create a nice vector projected curve onto the head, extrude it and make the antennae alongside. Here we go.

First, take a look at the sketches again. You'll notice there's some sort of protection on the insect's head. We'll need to model that before anything else on the head, because the antennae position will depend on the area this surface takes. So, here's what you need to do.

In the top viewport, zoom in on the head. Create a CV curve over the head that follows the outline of the plate. Create only one half of it. Use the create panel, not the dependent curves buttons. This will allow us to work more comfortably. We'll attach the curve later, see [figure 45](#).

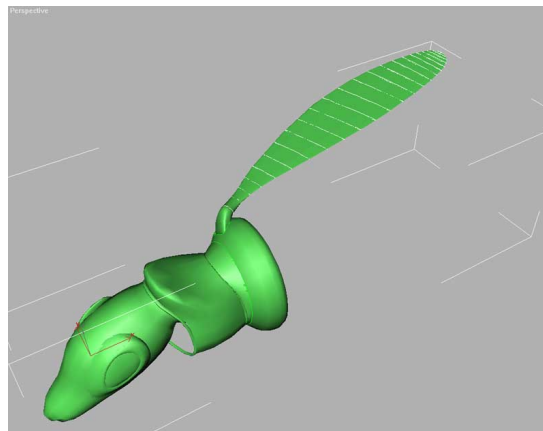


Figure: 44.

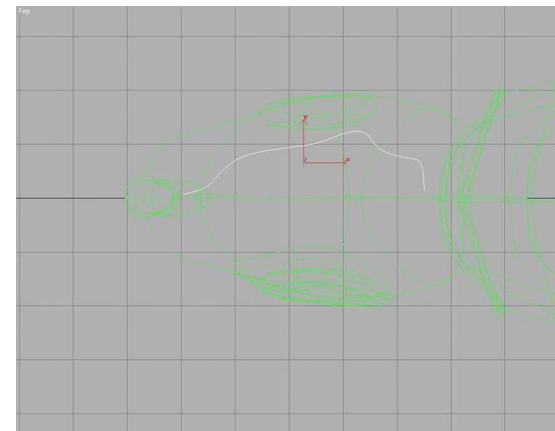


Figure: 45.

Ok, now click on the Create Transform Curve button and select the vector projected curve. In Curve sub-object level, select the Transform Curve you created (it's easier by hitting the H key) and move it upwards, scale it down a bit, position it above the head (not too far away) and at the center of the original curve, see [figure 47](#).

Name it Capping curve. Select one curve and click the Rebuild button. Set the number of CVs to 20. Leave Reparametrization at Chord-Length. Repeat with the other curve.

Now, go into Curve CV sub-object mode, select the original curve's CVs by going into All CVs selection mode and clicking on any CV. All will become selected. Hide them. Now, in the front viewport, select and move/rotate sets of points so that your curve doesn't go into the head surface, but follows nicely the overall shape of the original curve.

Now, just create a Blend surface that goes from the Vector Projected curve to the Transform curve. Go back to Curve sub-object level, select both curves and

hide them. Then create a Cap surface. Select the Capping curve to create the cap surface, see [figure 48](#).

The spikes in the top of the head are pulled points. Select the cap surface and click on the Make Point button in the modify panel. The surface will be converted to a point surface. Go to Surface Point sub-object level and start pulling some points in the front viewport. Increase the weights so the spikes appear more pointed. When you're satisfied with the appearance of the surface, return to the top object level. You should vary the size and distribution of these spikes on the surface. And that's it.

To create the antennae, in the top viewport create a Cylinder on the forehead (above the left eye) where they are supposed to be. Enter the following values in their re-

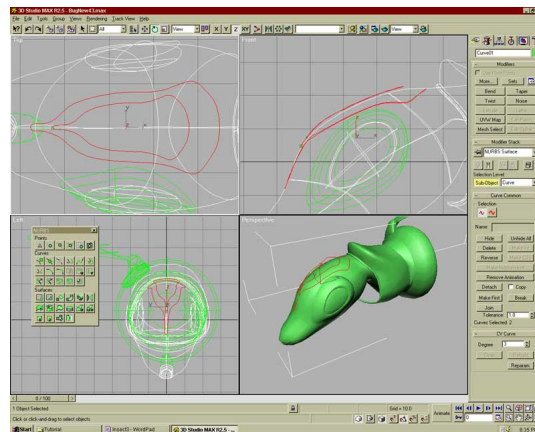


Figure: 47.

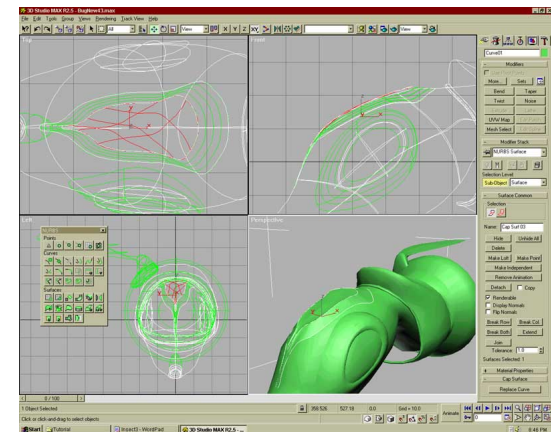


Figure: 48.

spective spinners: Radius=0.5, Height=13, Sides=24, Smooth=True (which means checked, in MaxScript language - thought you'd like to know). Leave the rest alone. Done? Ok. now click on the Edit Stack button and convert the cylinder to a NURBS surface. Go into Surface CV level, select the top row of CVs in your front viewport and scale them to a "pointy" end. You don't need to make it a perfect "pointy" surface, just scale them down enough. Now, select the bottom row of CVs and scale them up a bit. Ok, in your top viewport, select the center CV in the bottom of the cylinder. In the Affect Region section of the CV rollout, check Affect Region and click on the Edit Curve button. Set the Falloff to 0.75 and close the dialogue box. Lock your selection by pressing the space bar. Select the move tool and set your movement axis to Y. In the front viewport, bring the CV up to where the second row of CVs is. Move the whole cylinder (by returning to top object level) on top of the head. This is how it should look, see [figure 49](#).

Return to top object level and add a Noise modifier to our cylinder using the following values: Scale=2.0, Fractal=True (or checked, as you like) Roughness=0.25, X Strength=0.5 and Y

Strength=0.5. Leave the rest at their default settings. Our cylinder will be a little deformed. Change its name to AntennaeSeg01.

In the front viewport, move the cylinder closer to the head, just behind the plate surface. Check its position in the left viewport also. Now, in the front viewport, rotate it 20 degrees in the Z-axis (using the world coordinate system). Rotate it again in the left viewport, this time -20 degrees.

Creating the rest of the antennae is fairly simple. First, switch to the local coordinate system. Then, just click on the Array tool and enter the following values: Move in Z=11.5, Rotate in Y=-15, Type of Object=Copy, Array Dimensions 1D=10. The Total in Array value should show 10 automatically. Click OK. The antenna is completed.

Now, just select each segment (all but the first one we did) and change the seed value in the noise modifier. The actual value does not matter, since it's used to calculate the way the noise effect is generated. We just do this to make each segment look somewhat different from the others (believability lies in detail, remember?). And you're done.

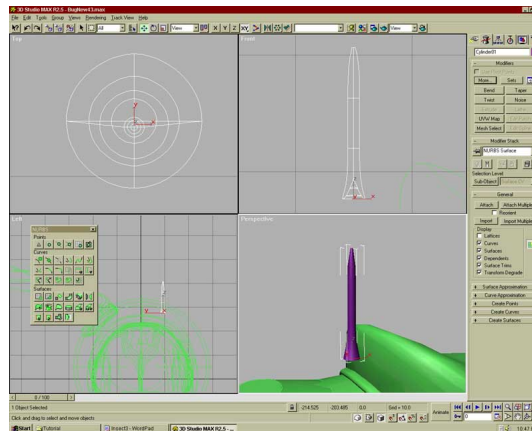


Figure: 49.

To create the opposite side antenna, select all segments and mirror them in the left viewport. Set the Mirror Axis to X and the offset spinner to somewhere near -36. Use the viewport to select the exact location. Click ok. Now, you've got your antennae, see [figure 50](#).

To join the antenna to the head, we'll use the ol' projection-blending method we've used so many times successfully... so here goes. Select the very first segment you created. Click on the Modifier Stack button and in the Stack window, click on Collapse All. Answer yes to the warning. The effect of the Noise modifier has become part of the object now. Click on the Create V Iso Curve button. Click somewhere near the bottom of the cylinder. Go into Curve sub-object level and select the curve. Type 0 in the Position spinner in the Iso Curve rollout. Return to top-object level, select the insect's head and attach the cylinder to it.

Click on the Create Normal Projected Curve button. In the top viewport, click on the V Iso curve you just created and then on the head surface. A curve will be created over the surface of the

head. Go to Curve sub-object level, and select this normal projected curve. Click on the Make COS button in the Curve Common rollout. Now, go to the CV Curve On Surface rollout at the bottom. Click on the Edit button. A dialogue box will appear with a really small curve on it. Zoom in on the curve. Then, select all CVs and scale them up. Watch your viewports for feedback. Make the curve slightly bigger than the base of the cylinder.

Now, just create a blend surface between both curves, going from the cylinder curve to the head surface curve. Flip the blend surface's normals if necessary and set the Tension1 spinner to 5. This will give the blend surface a nice bulge. And you're done. Repeat the same for the antennae on the other side, see [figure 51](#).

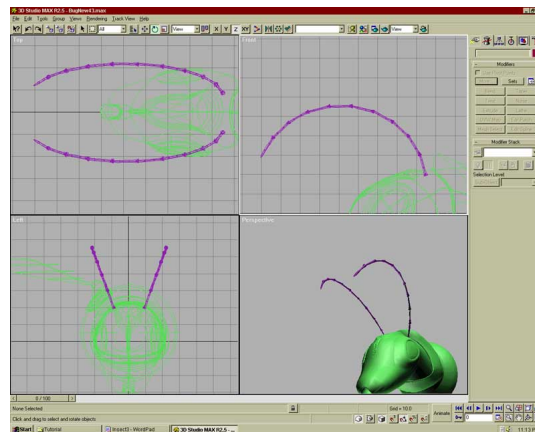


Figure: 50.

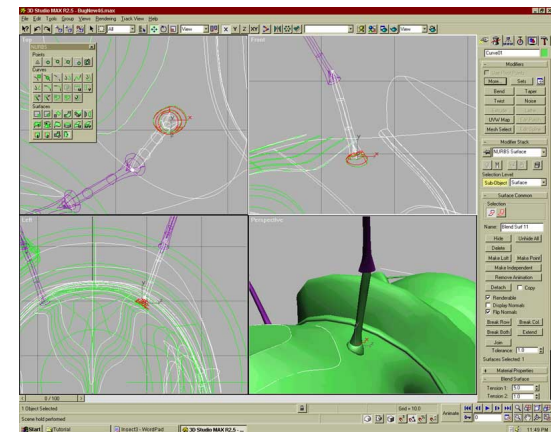


Figure: 51.

The Fangs

This will be composed of very simple objects. We start by creating in the left viewport a cylinder with the following values: Radius=1, Height=10. Move the cylinder to where the mouth is and name it LFang.

Apply a Taper modifier to the cylinder. Set the Tape Amount to -0.99, the Taper Curve to 2, the Taper Primary Axis to Z and the Taper Axis Effect to XY. Now you have a curious bullet-like object.

In the left viewport, non-uniform scale the cylinder on the X axis (world coordinate system) to 65%. This makes it a bit thinner. Apply a Bend modifier to our cylinder. Set the Bend Angle to 30. Make sure the Bend Axis is set to Z. We're doing fine. Now, just rotate the fang to the same angle the head is tilted to (about 45 degrees) and place it inside the mouth of the insect. You might want to non-uniform scale it in its local Z-axis to make it go deeper into the mouth. To create the opposite fang, just mirror this one in the top viewport. Set the mirror axis to Y, the offset spinner near to -4.3 and the Clone Selection type to instance.

This may seem like a very simple piece of geometry. I decided to go this way because of the way they're going to be animated. This way, as simple as it may seem (and somewhat crude since I'm not even doing a blend between the fangs and the mouth) will make animation easier, because the fangs will be rotated slightly during the course of each shot. And since I'm not doing and close-ups on the mouth of the insect, additional modeling would only make for a heavier model that would take more system resources for no reason. If you wish, you can work more on the inside of the mouth. You could even do a detailed animation of the camera being eaten and swallowed by the vicious horror! But for most of us, this is finished. Here's the final picture, see [figure 52](#).

The Sting

The sting will be a straightforward surface also. Start by unhiding all. Still got that grid helper object over there? You can delete it now. Select the tail object and hide everything else. Now, zoom to extents in all viewports and in the perspective viewport rotate the object so you can clearly see its rear.

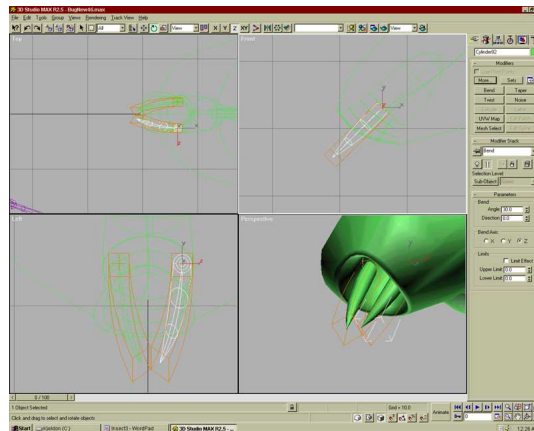


Figure: 52.

Click on the Create V Iso Curve button and click on the tail surface near the end where the sting will be. Go into Curve sub-object level, select the curve and drag the Position spinner as far as it can go so the curve will move to the very end of the surface, see [figure 53](#).

Rename this curve to Sting Base CVcurve. Now, in the front viewport, re-activate the show background option. We need to see how far this appendage has to go.

Click on the Create Extrude Surface button and select the Sting Base curve in the front viewport. At the modify panel, set the Amount to 40, the Direction to X and check Flip Normals. Right-click to end. Go into Surface sub-object level, select the extrude surface and click on the Make Loft button. Set the make loft options to From V Iso Lines and 8 V Curves. Click OK.

Go to the U Loft Surface rollout and click on the Edit Curves button. It'll turn blue to remind you that you're in Edit Curves mode. Now, select one by one all the curves but the first one and the last two, select-

ing all CVs on each curve and moving them towards the body. Just leave the last two curves in place.

Now, go back to the second curve, and move its CVs so that the shape grows a little bit bigger and resembles a circle. Do this progressively until you're done with the last curve you moved.

Take the curve before the last one and make it more circular (as much as you can). When you're done, scale it down so that it can fit into the curve before it; not by much though. And move it back in the front viewport so that you put it inside the whole surface, inside the last curve, see [figure 54](#).

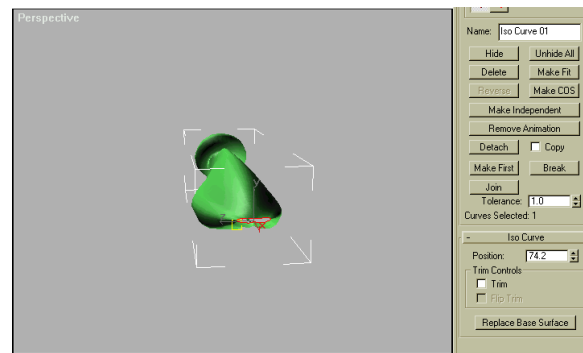


Figure: 53.

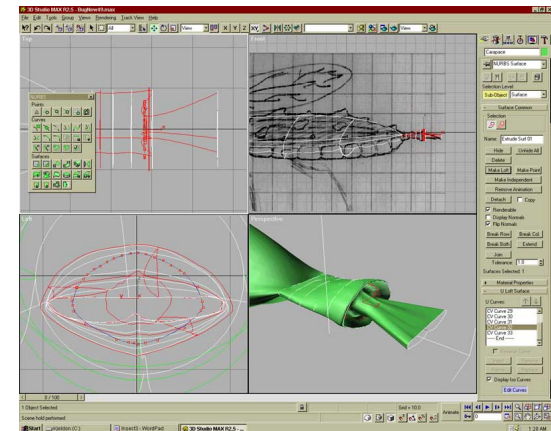


Figure: 54.

Do the same with the last curve, but without moving it and reducing it to a point, or as close as you can get. Watch the surface carefully. If you see it warp over itself, go back to the curve before this one and make it a bit bigger, taking care that it still fits inside the sting object.

Now, select the second and fourth, and scale them up a bit. Select the third and fifth and scale them down a little bit. This will make for a more oddly-shaped appendage. Now there's a poisonous little sting to avoid, see [figure 55](#).

The horny protrusions

All right. Time to do the horny protrusions on top of our friend's carapace.

As we stated at the beginning of the modeling process, these horny spikes that our insect uses to defend himself from nasty predators will be modeled out of the carapace geometry itself, instead of using new geometry. We will pull some points on the surface of our friend and adjust the weighting and region affected by the point accordingly. I will describe the whole process for a couple of points, then

you'll be able to complete the rest of the surface as you judge appropriate. I will not show you the exact points used (there are more than a thousand CVs on my surface!) but I'll help you decide which points to use for modeling (or should I say deforming) these parts of the insect's anatomy.

First, go into Surface CV sub-object level, with the carapace still visible and selected. You'll notice an enormous quantity of CVs on our surface. If you see no CVs on the carapace's surface, go into Surface sub-object level and verify the Make Independent button is disabled. If it is not, you must have missed some step somewhere. But don't worry, just click on it. Our surface will stop depending on the curves that constructed it, and will have CVs of its own. This way, we'll have a surface we can edit directly.

The downside is that we lose control of the surface through the manipulation of the curves that define it. That way it becomes a bit more difficult to change its overall shape for example, but not impossible. So let's get started.

If you see few (you should have over 100... just select them all and in the modify panel you'll see how many you've got) CVs on your sur-

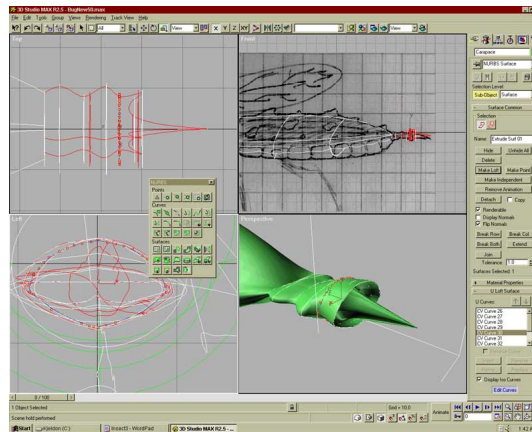


Figure: 55.

face, you can create more by going into Surface sub-object level and clicking on the Rebuild button. A dialogue box will appear prompting you to enter the number of V control points and U control points you want. Also, two choices on reparametrization are offered. Choose the values you need to have a model ready for further editing.

We'll start with the row of protrusions that lie in the middle of the model. It'll be easier to model these in the front viewport. Select a CV near the start of the carapace. Not one too close to the start of the surface, but a little bit towards the center. Pull it up and to the right; since we're dealing with a great number of tiny CVs, it's a good idea to lock your selection every time you select a new CV. Another technique to use once you're more experienced with this type of modeling is to select beforehand all points you'll be moving, select inverse for the rest of the points and hide them. We'll use the first technique for this part of the tutorial.

The protrusion looks a little bit pointy and edgy. Set the weight spinner to 0.75. Now, that's better. Let's continue and make a somewhat bigger "horn".

Select another point along the same center row further towards the center of the surface. This time, check the Affect Region checkbox and click on the Edit Curve button and set the Falloff to 10. Click OK. Now, move the button in a similar fashion as the previous one, but less so. You'll see that a region of CVs nearby moves with it. This makes the protrusion more rounded and fuller than the previous. But for this center row of points, we want them to look thin. So, undo your move, uncheck Affect Region and move it again, adjusting the weight of the point afterwards. Here's my model after moving some points on it. Notice that I hid the rest of the points I'm not using; this makes our life easier, see [figure 56](#).

To add more detail to this part of the model, select the entire row of points, deselect the ones you've already moved, deselect the first and last two CVs of the row. Deselect some in-between points so that you end up with some of the middle points in the row. Move them up a bit less than the points you moved previously. But this time, increase the weight spinner slightly instead of decreasing it.

The insect now has a nice serrated top. Now, unhide all the points. Se-

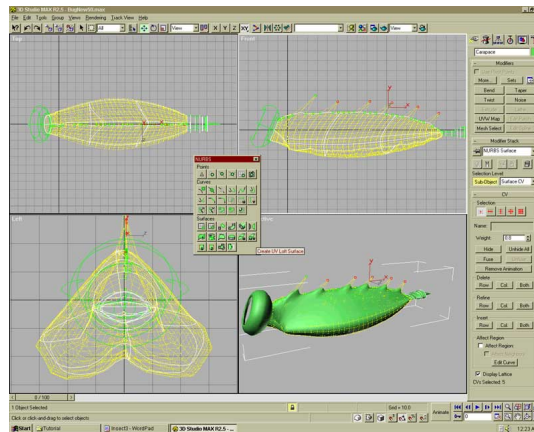


Figure: 56.

lect the row of points you've moved and the points at the bottom of the surface and hide them; we won't be using them anymore).

Now, in the top viewport, select some points on the surface of the object. These will make the main protrusions on the insect. This time we'll use the Affect Region curve to make some rounder, fuller horns. Once you've got them selected, lock your selection and in the top viewport move them up and backwards. Then, using the Transform Coordinate Center, non-uniform scale them in the X-axis in the left viewport so that they "spread" apart. Adjust the weighting on these points see [figure 57](#).

Now, deselect these points and select some more points on the surface. Apply a small-scale movement without affect region checked, scale them apart and weight them a bit more so you get some "secondary" support thorns on the carapace.

For the spikes on the head, repeat the same procedure on the cap surface. Remember, you may have to make it independent first in order to have CVs to work with.

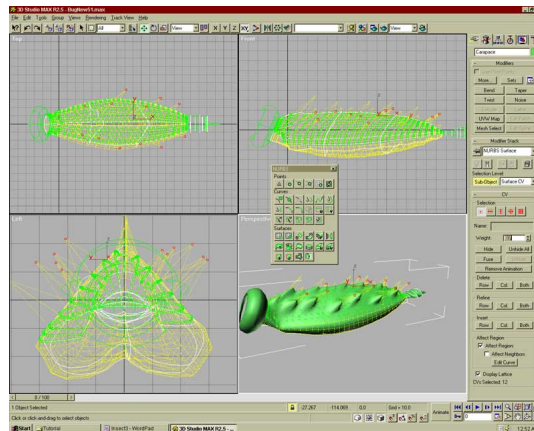


Figure: 57.

The legs

From the display tab, click on the Unhide By Name button and select all but the Antennae objects. We'll need those to make the legs. In the front viewport, reactivate Show Background. Do you see where the front leg meets the body? We'll need to do some modeling there in order to prepare it to receive the leg. We will need something more than a cylinder stuck into the body.

In your front viewport, create a CV curve that lies more or less where the leg meets the body. Use a new object, not a dependent curve. Move it downward in the top viewport so that it lies outside the body, not inside. You're right... we're going to use some projected curves here; brace yourself, see [figure 58](#).

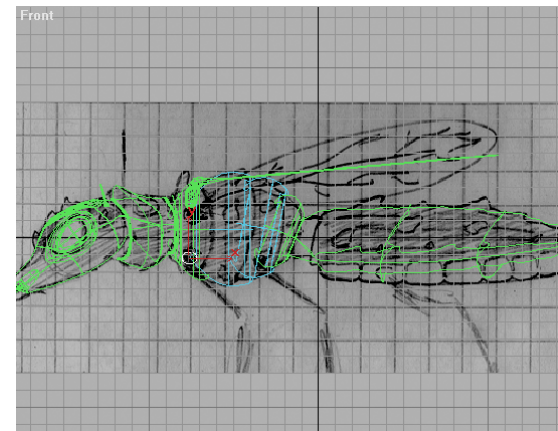


Figure: 58.

Select the head object (which now encompasses more than the head) and attach the curve to it. You may wonder why I create separate objects only to later attach them. Because it's much easier and faster to move them around and edit them if they're separate objects than if they are sub-objects of a bigger object. You might want to observe this tip, especially if you have a slow machine. Deactivate the Show Background option in the front viewport. Zoom in onto the curve. Click on the Create Normal Projected Curve button and in the front viewport, select the curve first, then the Section surface (the round one). You'll see a much smaller curve appear over the surface. We'll make this new curve independent so we can edit it directly, but still lying over the surface of the object, without having to deal with the Projection curve we used.

Go into Curve sub-object level, select the projected curve and click on the Make COS button. Accept the default CV values for the COS curve. Now, (on the CV Curve ON Surface rollout) click on the Edit button and move your curve's CVs until it approaches the original curve shape and position.

To create the other side curve, just move the Projection curve upwards

in the top viewport to the other side of the body, convert your front viewport into a back viewport and project another curve there. Adjust the projected curve and that's it.

Now, to make the legs themselves. First, in the left viewport, create some curves that represent how the leg segments will be modeled and placed. Don't worry much about precision, we won't use these curves as a starting point for modeling, just for reference. Something like this, see [figure 59](#).

Ok, I will rotate the curve back to its original position. Now, in the front viewport, create a cylinder with the following values: Radius, 2.5, Height, 54.5, Sides, 12. Place it near the body where the curve representing the leg is, but not touching the body. Now, convert it to a NURBS surface.

Apply a FFD(Cyl) modifier. Set the dimensions to 4x6x10. Select all control points, but the first and last columns. Scale them down so the cylinder gets a little thinner in the middle. Now, apply a FFD 4*4*4 modifier and move the control points in the left viewport so that the cylinder follows the shape of the curve.

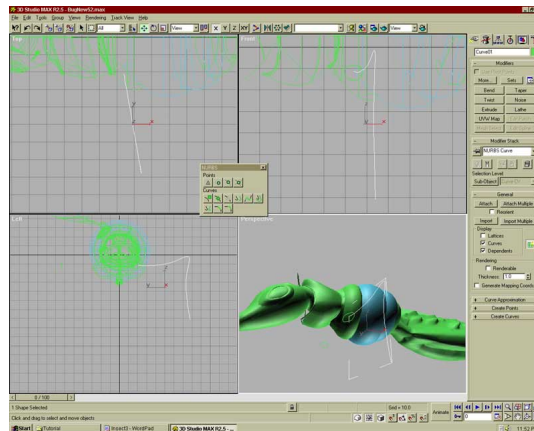


Figure: 59.

Now, apply another FFD 4*4*4 modifier. This time, go into the Lattice sub-object level and re-scale the modifier, move it and rotate it so that it lies and influences the tip of the cylinder only. Make sure Only In Volume is selected from the Deform section of the FFD parameters. Now, go into Control Points sub-object level and deform the tip of the cylinder into a spoon-like surface, see [figure 60](#).

Collapse the entire modifier stack into a single editable NURBS surface. We've lost our modifier parameters, but we had already finished, so it doesn't matter. Remember, you must like how your surface is right now. Collapsing the stack removes all modifiers and any animation parameters they may have carried.

Now, go into surface sub-object level and join all three surfaces together into one. Three? Which three? Hit the H key... you'll notice our cylinder is made up of three surfaces, the cylinder itself and two capping surfaces. Click on the Join button. You'll be prompted to select the first surface edge. I suggest using the H key to select the corresponding

edges. You'll see a list of the different surfaces. The ones with the plus sign have more than one edge choice to offer. If you click on one edge once without clicking on the select button, your choice will be highlighted in the viewports. Just use the edges that are circular closed shapes. Remember that both edges must be nearby or touching. You'll end up with a nice and smooth surface.

Go into Surface sub-object level. You'll notice that at the spoon-like end, all the lines meet at a center point. Select this center CV. Lock your selection. In the Affect Region section of the CV rollout, check Affect Region and click Edit Curve. Enter a value of 8 into the Falloff spinner. Close the dialogue box. In the left viewport, drag the point upwards and into the left, to make the spoon end concave, see [figure 61](#).

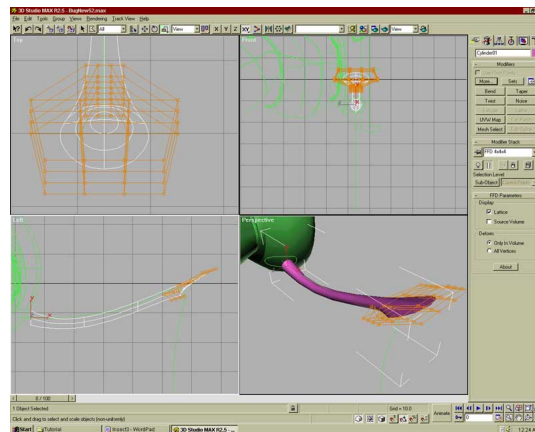


Figure: 60.

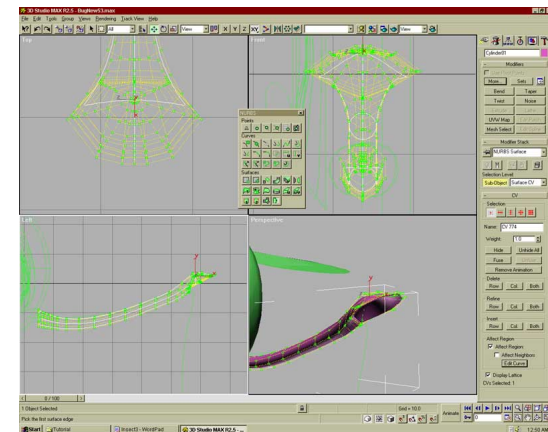


Figure: 61.

Now we'll create the other end of the leg. Go into Curve sub-object level and click on the Create V Iso Curve button. Select the leg segment near the end that will join the leg to the body. Select the new V Iso curve and enter 3 into the Position spinner. The curve will be placed near the end, but not at the edge of it.

Now, we'll blend both curves together. If you perform the blend operation now, you'll notice the blend surface is all warped. This is because the first vertex on the curves is not aligned. If you try to modify the first vertex of one of the curves, you won't be able to. How do you change the first vertex of a dependent curve? Here's how...

Select the V Iso curve on the leg and make it independent. You still can't change the first vertex on the curve. It lies at the top of the curve (viewed from the front viewport) and we need it to be at the bottom of the curve. Ok, hit the Break button and break the curve at the bottom. We now have two curves. Click the Join button and select one of the two halves **AT THE TOP** of the curve. Select the other half **AT THE TOP** also. The curves will be joined at the top, leaving the first vertex at the bottom. Voila!

Now we're ready to blend both curves correctly. Go ahead. Perform a blend operation (a fancy way of saying "create that bloody blend surface!") between the V Iso Curve and the Projected curve (in that order). Check Flip Normals and Flip Tangent 2. There you are; nice connection, isn't it (figure 62)?

To create the next segment of the leg, create a sphere in the top viewport with a 3.5 radius value and convert it into a NURBS surface. Position it at the spoon-shaped joint. Then create a cylinder directly below it with a radius of 2 and a height of 64. Convert this one also to a NURBS surface. With the cylinder selected, go into Surface sub-object level and select the top cap of the cylinder. Delete it. Go back to top object level, select the sphere and create a V Iso Curve on it. Set the curve position to -0.5.

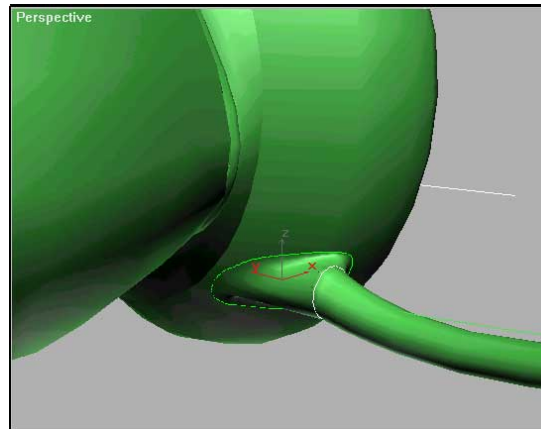


Figure: 62.

Select the cylinder and apply a FFD 4*4*4 modifier. Adjust the two rows of control points in the middle of the lattice so that the cylinder adapts to the shape of the curve you created for reference. Then collapse the modifier stack.

Attach the sphere to the cylinder. Now, create a blend surface between the upper edge of the cylinder

der and the V Iso curve on the sphere. On the blend surface, flip both tangents and set tension 1 (assuming you selected the cylinder edge first) to 0.5. Make the blend surface independent and join its lower edge to the cylinder's top edge, see [figure 63](#).

Afterwards, join the cylinder's lower edge to the outer edge on the lower cap surface. Go into Surface CV sub-object level and adjust the surface so it looks like [figure 64](#).

Do it by selecting the center point at the very bottom of the surface with Affect Region checked and a falloff of 2.0 from the Edit Affect Region Curve dialogue box, and moving it up a bit to where the third row of points lie. Then, select the third lower row of points and scale them up. Do the same with the second lower row of points so that's bigger than the third. Leave the bottom

one as it is. To finish this part of the model, just add a noise modifier with the following settings: Scale=65, Fractal=True (You know what I mean...) Strength in X and Z=5. Collapse the stack now. Now, in the front viewport, create the following spline, see [figure 65](#).

Apply a lathe modifier to it, set the Direction to Y, the Align to Minimum and the output to NURBS. If you want, go back to the NURBS curve stage in the modifier stack, go to Curve CV sub-object level and move some CVs to get the precise shape you want.

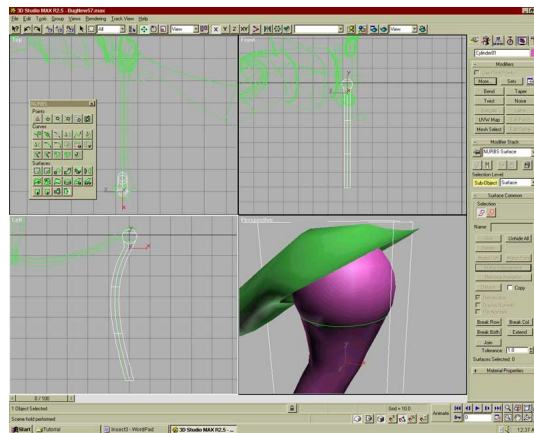


Figure: 63.

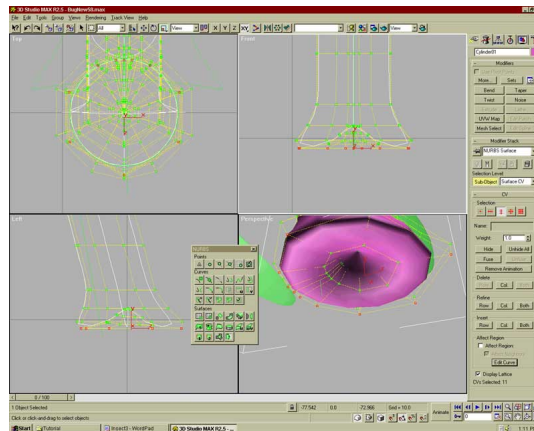


Figure: 64.

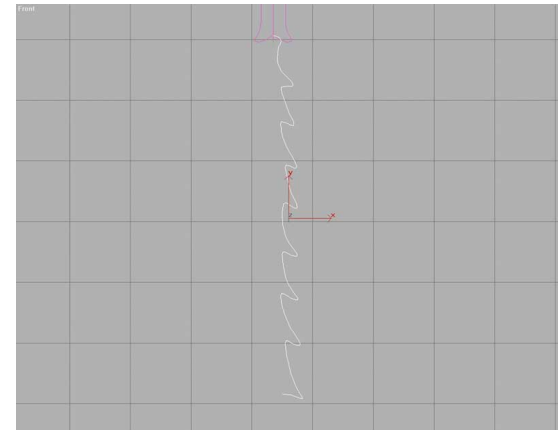


Figure: 65.

Now, collapse the stack, go to Surface sub-object level, select the surface and make it independent. Go back to top object level and apply a bend modifier to the object. Go to Center sub-object level and move the gizmo's center to the top of the object. Set the Angle to 90, the Bend Axis to Y, check Limit Effect and set the Lower Limit to -40. Collapse the stack again. To add a little chaos to our geometry, add a noise modifier. Set the Strength on X and Y to 10, check Fractal and set the Roughness to 0.2. Set the scale to 65 and collapse the stack when done, see [figure 66](#).

Ok, we're ready to make the remaining legs. This will be easy. All you need to do is select the head piece, because we'll need the first segment of the leg that's attached to it. Go to Surface sub-object level, select the leg surface and click on the detach button, with the copy checkbox checked. Name the new object Legsec01. We now have a copy of this surface. Return to top object level and click on the Select by Name button. From the list, select Legsec01 and in the front viewport, move it towards the rear of the body using a movement constrain on the X axis. You now have a copy of the first leg section on the back of your model.

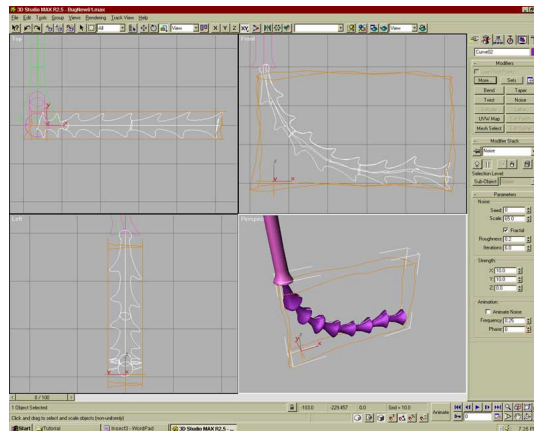


Figure: 66.

In the front viewport, zoom extents and reactivate the Show Background option. Position Legsec01 where the drawing shows the position of the second leg. Now, in the left viewport, scale the leg uniformly by 10% (the indicators below the viewports should read 110%). Reposition the leg accordingly. It should be facing the Section02 object, but NOT touching it. Leave some space between the leg and the body. We'll need it to create a blend surface that joins both parts.

In the front viewport, shift-move the second leg back towards where the left leg will be. Select copy as the cloning method. Scale this one up by another 10% (to a 110% total). Rotate it in the left viewport 15 degrees in the Z-axis. The leg should look more raised than the others. Reposition the new leg accordingly using the front, top and perspective viewports, and the above guidelines. Again, the leg should not touch the body.

Select the curve you used as reference to construct the legs and delete it. You won't need it anymore.

In the front viewport, select both the second and third pieces of the leg and shift-move them twice, first to the second leg's location, then

to the third leg's location. Select copy as the cloning method and scale the objects up by 10% in every case. That way, you should have scaled the first duplicate by 10% from the original and the second copy 20% from the original (10% from the first copy). Now our friend has three of his six legs completed, see [figure 67](#).

Creating the other three legs will be easy. Just select all the segments you've done so far and click on the mirror tool. Make sure you're using the Transform Coordinate Center. Set the Mirror Axis to Y, the Clone Selection to Copy and you may need to add some offset to have the copies created in their correct locations. Use your eyes. I used 26. But now, we have six legs... but wait! There's one segment missing; the first leg segment that belongs to the front leg. That's easy. Just select the head (where that piece of the model is attached) and go to Surface sub-object level. Select the leg surface and detach it with the copy checkbox checked. Name the copy MirrorMe. Return to top object level, select the MirrorMe object and use the mirror tool on it. Set the Mirror Axis to Y and the Clone Selection to No Clone. The piece will be mirrored to its correct location. And there you go... six legs already!

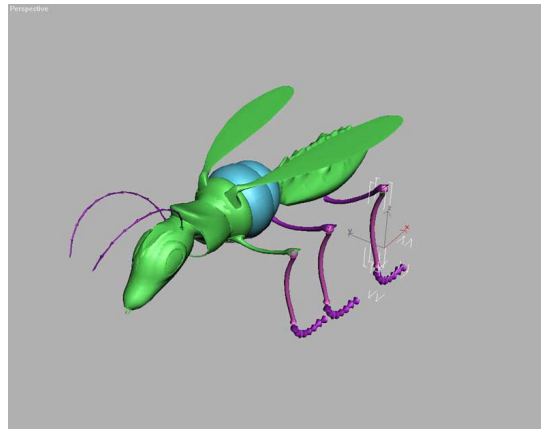


Figure: 67.

All that remains is to create the blend surfaces that will join the first segment of each leg with its corresponding body part. To do this, we'll proceed just as we did with the first leg segment we attached. We will create a V Iso Curve at the end facing the body of each leg segment. Project each curve onto the surface of the object using the Create Normal Projected Curve command, convert these curves into Curves On Surface using the Make COS button. We'll adjust the curves accordingly and create the blend surfaces from each V Iso Curve to its corresponding COS Curve.

Go ahead and create a V Iso Curve on each leg segment by following these steps: Select the leg segment you'll work with. Click on the Create V Iso Curve button. Place the mouse pointer over the surface and the curve will appear in blue. Click once to create it. Set the position spinner to 2.6. Right-click to end. Select the body part to where the leg will be attached. Attach its corresponding leg segment to it. You'll notice that sometimes, when attaching an object to another, the attached object's normals become flipped. You'll need to go to Surface sub-object level, select the surface and check the Flip Normals checkbox.

This is especially true on mirrored objects. Let's continue. Click on the Create Vector Projected Curve button (this one behaves better in some situations than the Normal Projected Curve). In the viewport that faces away from the curve (front viewport for the left legs, back viewport for the right) select the curve, then the corresponding surface. Remember, if the curve is created at the opposite side of the object, adjust the seed spinners to higher or lower values. This should correct the problem. Right-click to end. Select the projected curve and click on the Make COS button. In the Convert Curve On Surface, set the Number of CVs to some value low enough to provide ease of editing, but high enough to preserve the overall shape of the curve. I used from 10 to 16 CVs, depending on the overall surface curvature. Use your eyes to decide. Return to top object level. Proceed with the next curve. Once all curves have been created, go back to Curve sub-object level and select one of the Curves On Surface (the ones you originally projected). Click on the Edit Curve button in the modify panel and adjust the curve's shape to be a little bit bigger than the original V Iso curve. Continue with the next COS curve, see [figure 68](#). And that's it!

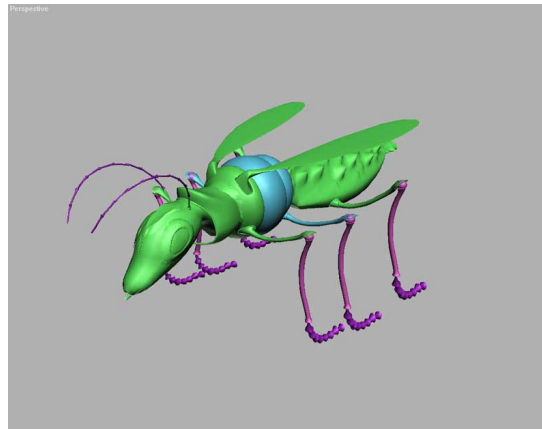


Figure: 68.

Texturing

As most already know, texturing is one of the most important and often overlooked stages of 3D animation. You will often find some models that are very accurate, but somehow, something is “wrong” or missing from them. Textures can make or brake the believability of a 3d model. If you wish to have a better understanding of texture creation, please read any of the excellent articles Bill Fleming has written on this subject. If you haven't, these are a “must-read” for anyone involved in photo-realistic rendering. This is especially important if you're going to match your 3D animation with live-action video. But let's get started with the texturing process. Although I won't cover texture creation and placement for the whole model (I'd need some more space, but I doubt they'd devote the entire issue to this) you'll get the hang of it and should be able to complete it by yourself.

Adding skin to the muscles

All right, time for the nice stuff; texturing our model. I'll show you how to texture one body part and you should be able to apply the same

procedure to the whole model. We'll use the most complex part... the carapace.

Select the carapace and hide everything else. Go into Surface sub-object level. Hit the H key. A list of all surfaces that make up the object will appear. We've got seven surfaces. The two blend surfaces that join the legs to the body, the two legs, the carapace itself, the sting and one section of the torso. We'll work on the carapace surface (the biggest of them all) so select all the others and hide them.

Open the material editor, and create a multi-subobject material composed of seven materials. Name it Carapace. Go to the first sub-object material and name it belly. Now it's time to take a look at the maps we'll use, see figures 69-72.

In the belly material, click on the button at the diffuse channel. Select Bitmap as the map type. At the Bitmap Parameters rollout, click on the bitmap button and assign the color map (CarapDiff). Click on the Show Map In Viewport button and in the perspective viewport, right-click on the viewport label and

activate Texture Correction. You'll see that the map doesn't match very well. We'll fix that.

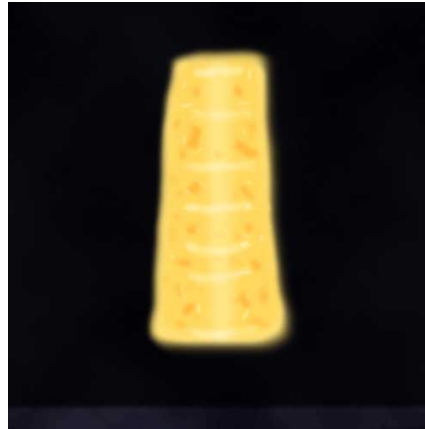


Figure 69: Texture for the Diffuse channel.



Figure 70: Texture for the Shininess channel.

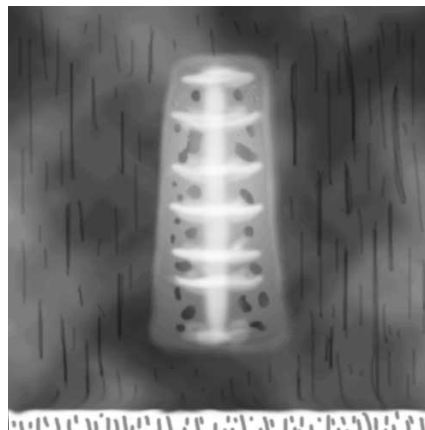


Figure 71: Texture for the Shininess Strength channel.

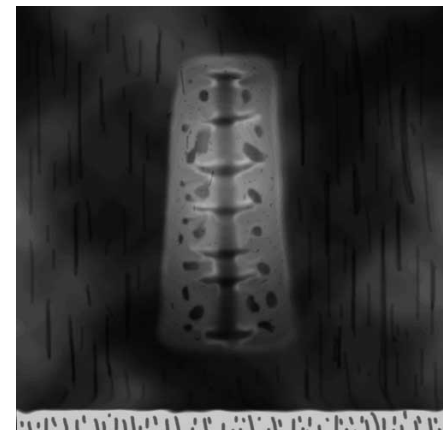


Figure 72: Texture for the bump channel.

There are two ways of doing this. The difficult one is using the texture controls and the Edit Texture Surface button to get the surface to fit the area of the surface we need. However, with an object as complex as this one, we'd end up with a texture full of pulls and tears. The second one and the easiest, is to work with a polygon model. What, you say; after all this work? Remember one thing... we were going to do this anyway. We need this model to be a particle emitted object... it would be insane to have a particle of 100,000 polys and have about 35 particles, wouldn't it? So, just select your object (the carapace in this case) and assign a Mesh Select modifier to it. This will convert it to a mesh object. Then, go into vertex sub-object level, select all vertices and click on the weld selected button. All seams on the mesh will disappear. Now, apply an Optimize modifier to reduce the number of faces further. Set the Face Threshold to 6. Now, we've got an object with a very good resolution (close to the original) with less than 1/10th of the faces the original had (if you tried to render the original carapace, the rendering dialogue should've read about 90,000 faces... how's that for a CPU-ache?). Collapse the stack to an Editable Mesh object.



Figure: 73.

Now, go into Face sub-object level and select to work at the element selection level. Click on the carapace and assign it a Material ID of 1. Continue clicking on the different elements and assigning progressive Material IDs to each one of them. Then, create a Multi/Sub-object material and assign it to the object. Now, apply a Mesh Select modifier to our object. Click on Select By Material ID, and choose 1. The carapace element will be selected (if you assigned the Material ID 1 to it previously). Assign a UVW Map modifier to the selection. Now, the surface has mapping coordinates assigned to it. I'm using a cylindrical gizmo because I painted my maps to be used that way. You may use whatever mapping method suits you best. Some people prefer planar mapping. I just painted my maps after using a cylindrical gizmo and unwrapping the texture coordinates onto a bitmap, so I'll use the same mapping gizmo I used to paint my maps, or the maps won't fit. Continue to select elements and assign mapping coordinates. Then, create a Multi/Sub-object material with the appropriate number of Sub-materials for this object and assign it to the whole object. If you did this right, you should have your mesh properly mapped and rendered. Do the same for

the rest of the objects in the model. And that's pretty much it, see [figures 73](#) and [74](#).

Wrapping it up.

Well, that about does it. Now you have a nice little bug on your computer! Try and design your own insect. You can make a crawling insect, a flying one, a real one, a fantastic one, or whatever. Sketch it until you like it and take a good look at it. Write his biography. Analyze it and try to describe its surfaces. Should you use NURBS to model it? Maybe patches? Or will plain ol' polygons do the job? Will you use boolean operations? Lathed splines? Use the box method? Maybe you can come up with several ways to model one given part of your character, in which case, take into account how you'll animate it. And once you can imagine how you'll be modeling it, do it! Nothing is more rewarding than knowing that you're able to translate all those

things inside your head into renderable objects. I hope you've found this tutorial helpful and that it has given you a better insight into MAX, it's tools and the general NURBS modeling process. Hope to see you soon and don't hesitate to drop an email if you run into any trouble. See ya soon! Until then, render everybody speechless!

Material.

I hadn't included these, but here they are... the background images used as modeling templates in the viewports.

Biography

Sergio Muciño is a freelance artist based in Mexico. He's been working in the broadcast industry for more than three years. Previously, he was a cartoonist and profesional musician with over eleven years of experience. He currently works for a post-production facility handling storyboarding, animation, compositing and non-



Figure: 74.

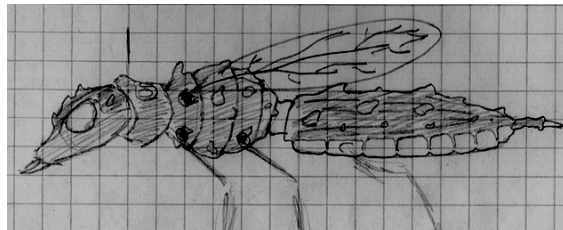


Figure 75: Front viewport.

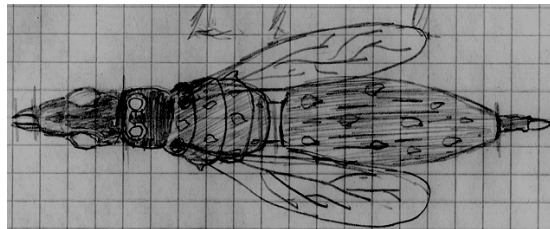
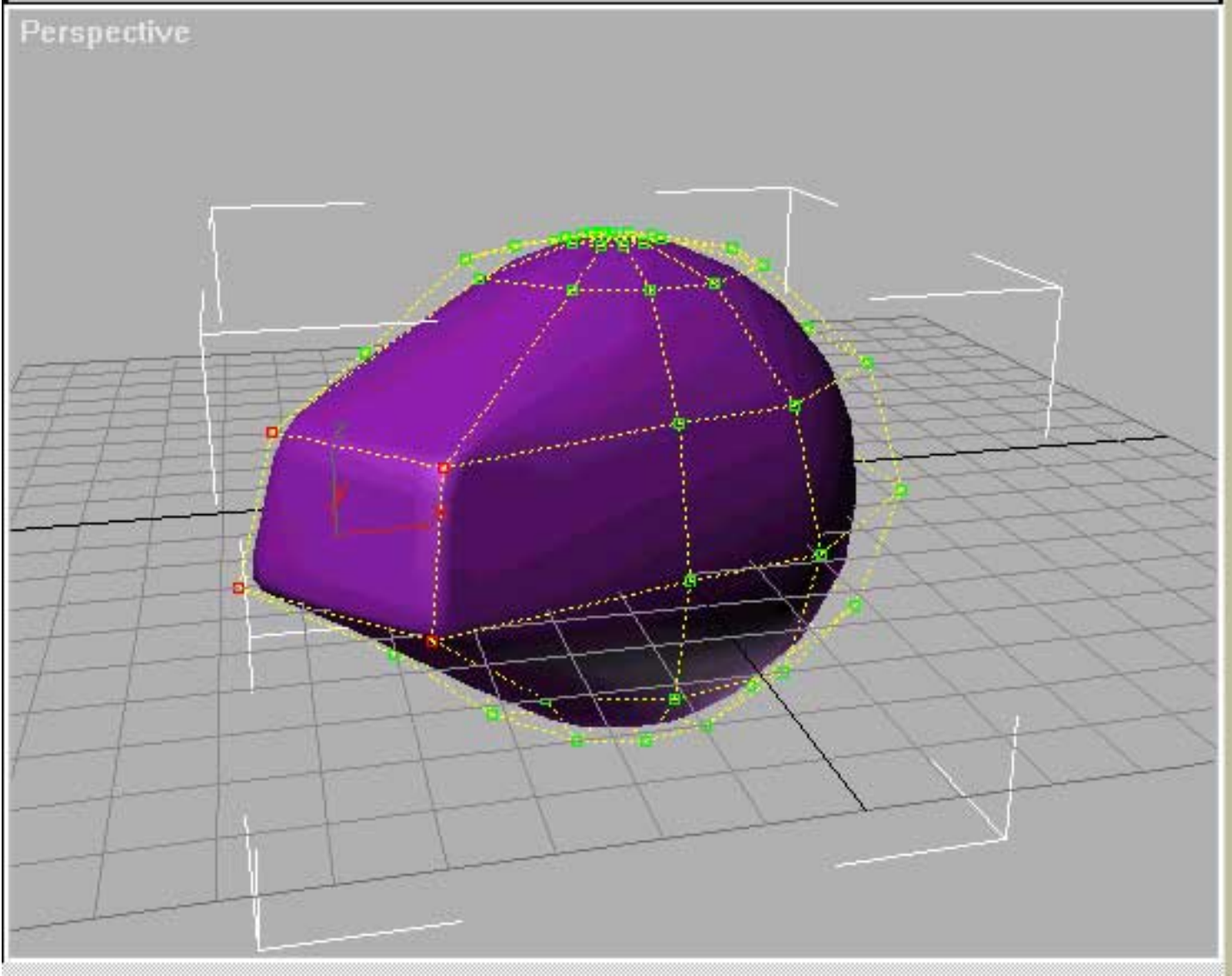
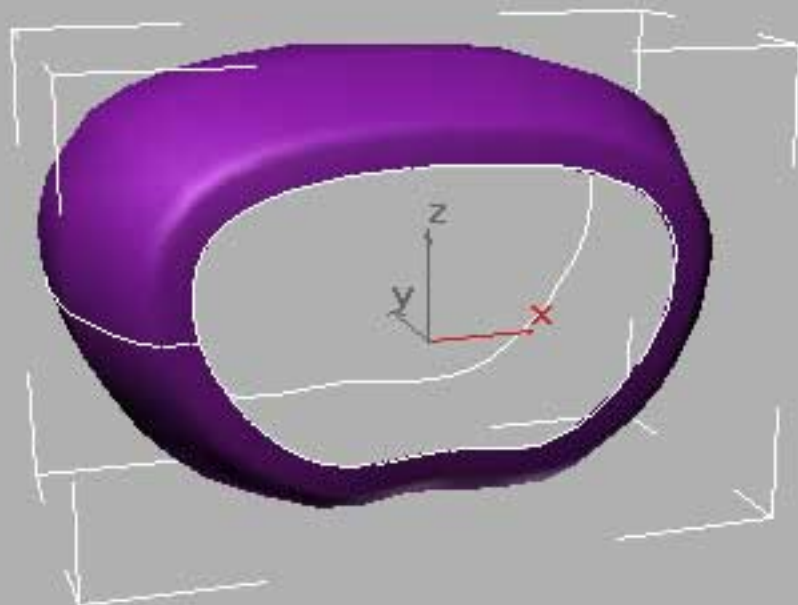


Figure 76: Top viewport.

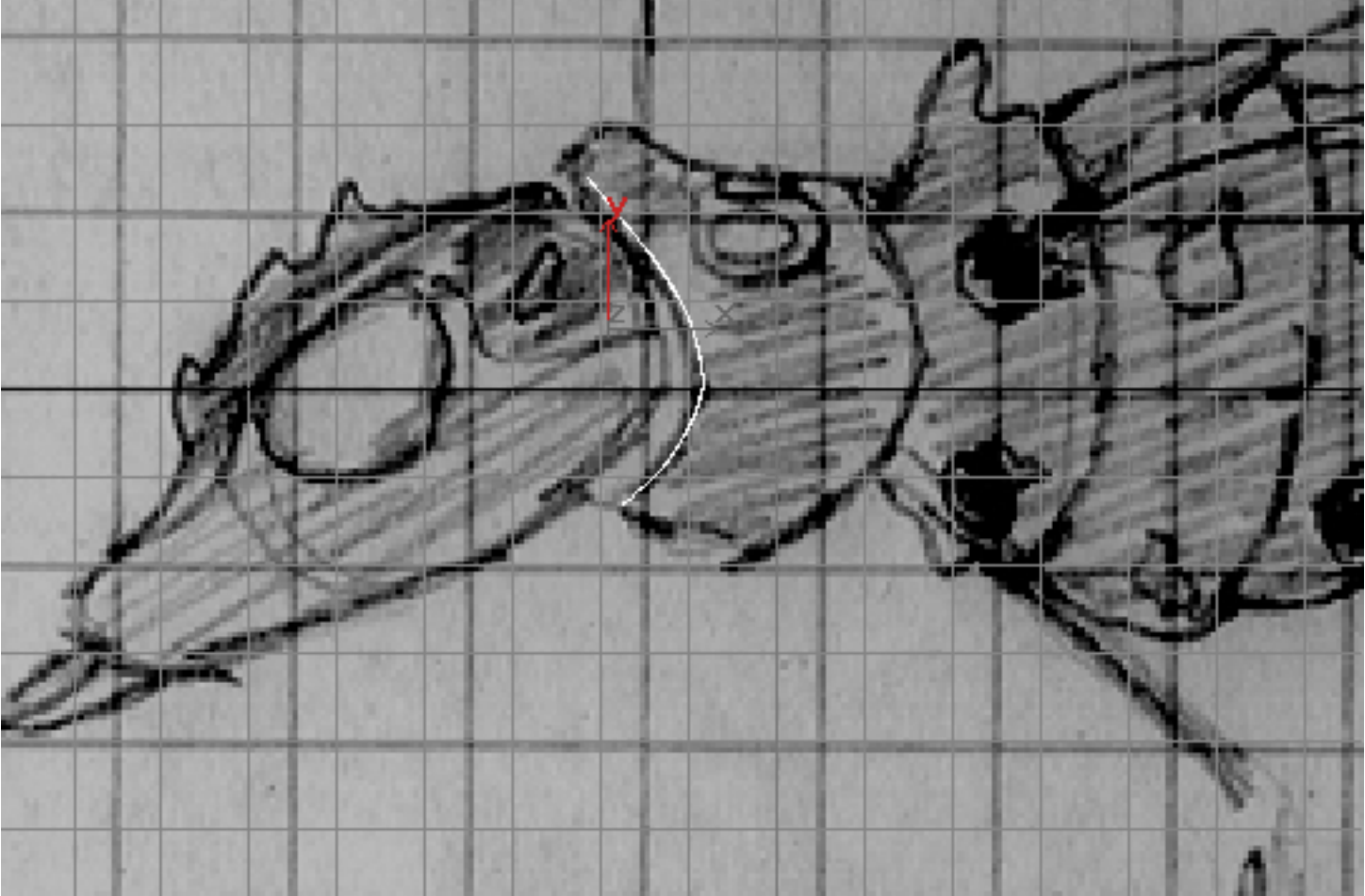
linear editing projects. Afterhours, he commands his own freelance enterprise from his own home. As a freelance artist, he has worked on very different projects, from architectural visualization to industrial design and television commercials. He can be reached at kjeldon@hotmail.com.

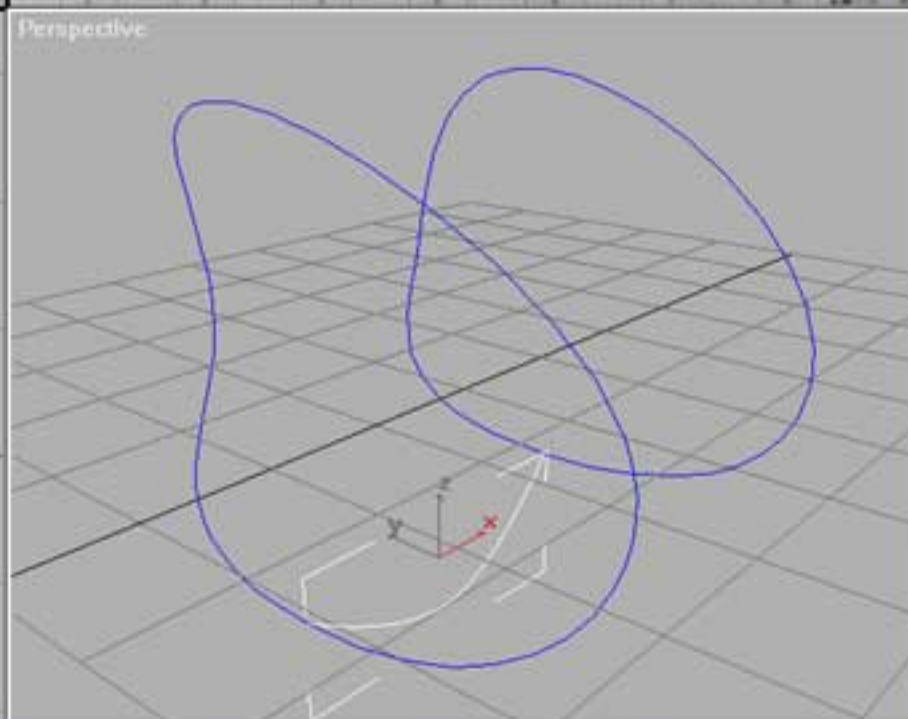
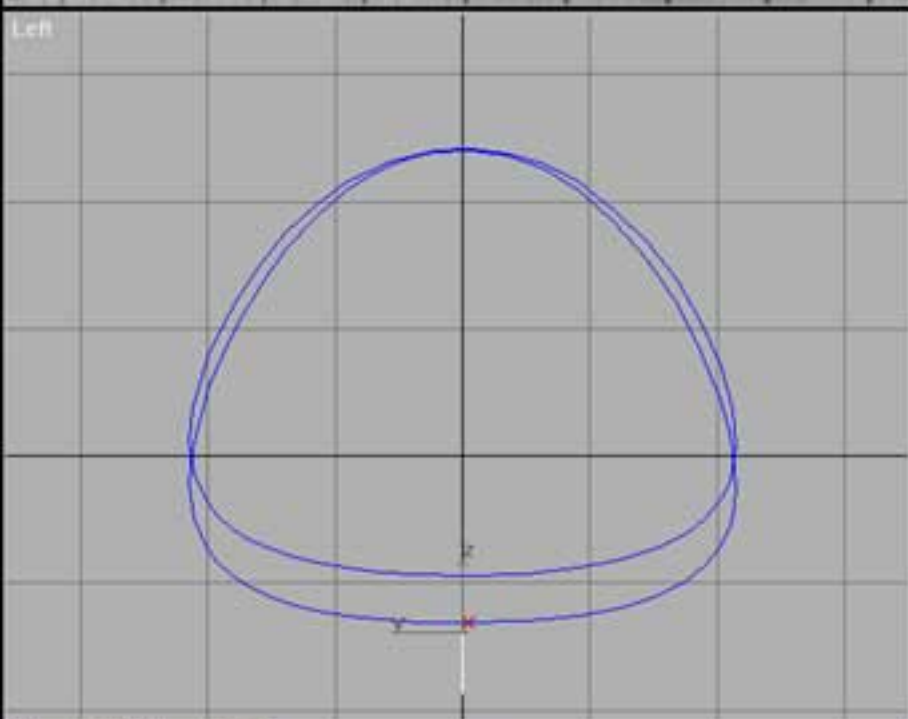
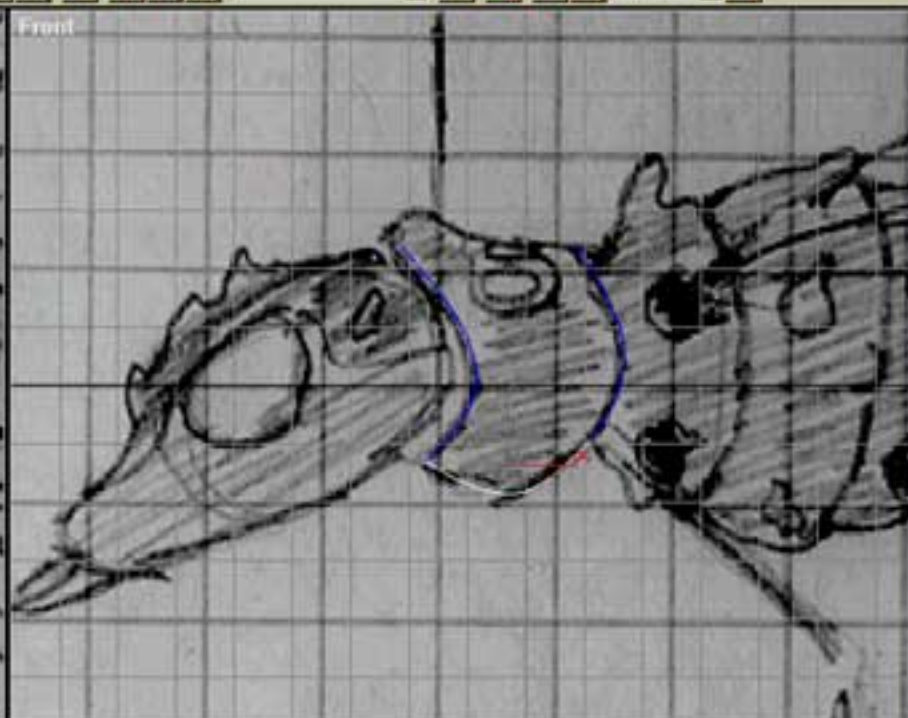
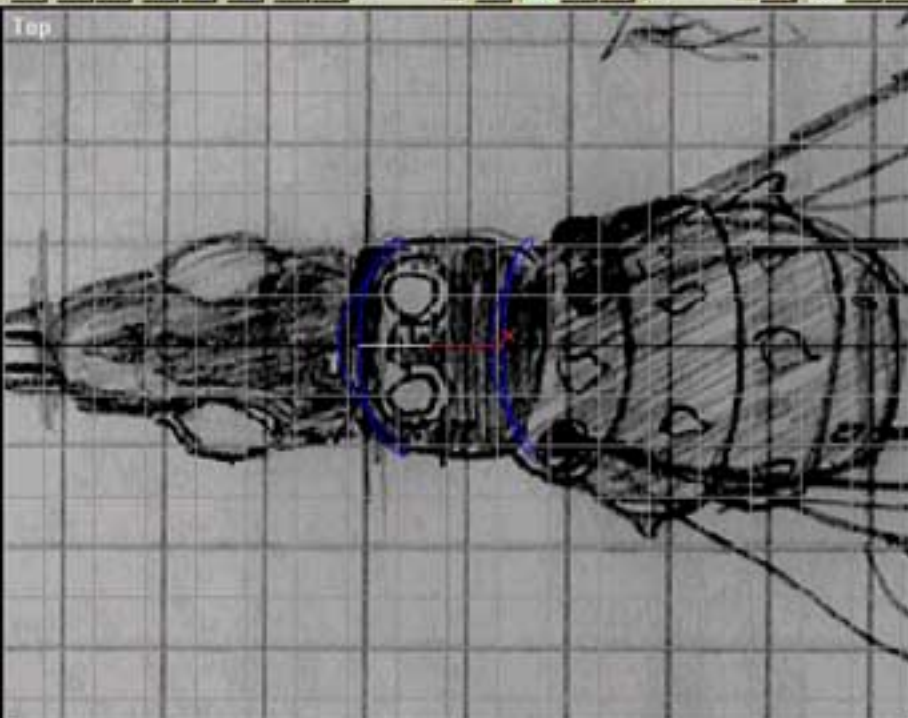
Perspective





Front





NeckProfile CVcurve

Modifiers

☐ Use Pivot Points

More... Sets

Bend Taper

Twist Noise

Extrude Lathe

UVW Map Edit Patch

Mesh Select Edit Spline

Modifier Stack

NURBS Curve

Selection Level

Sub-Object Curve CV

General

Attach Attach Multiple

☐ Recorient

Import Import Multiple

Display

☐ Lattices

☒ Curves

☒ Dependents

Rendering

☐ Renderable

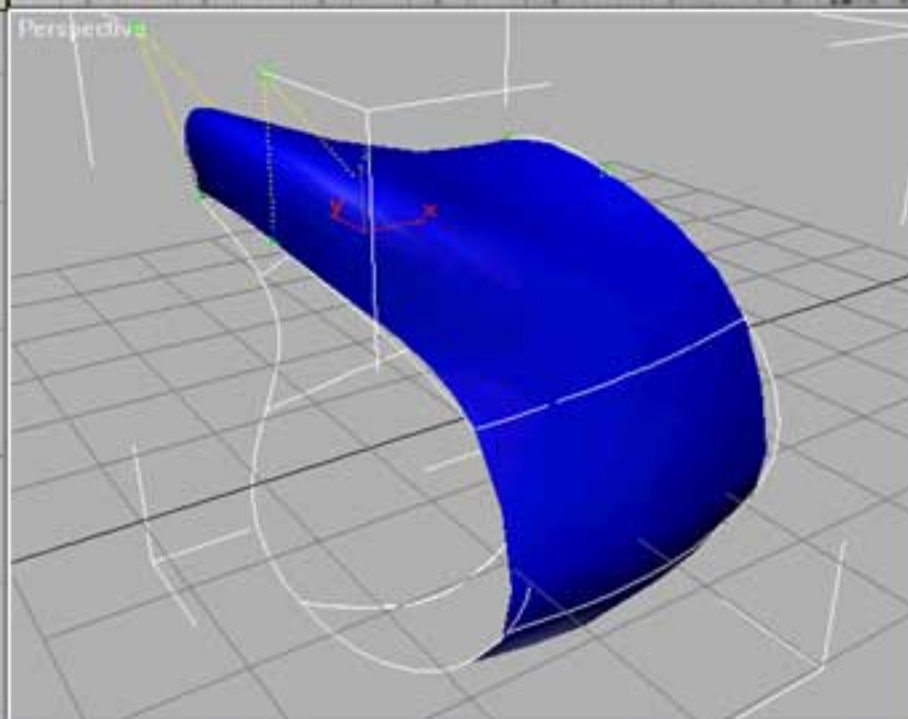
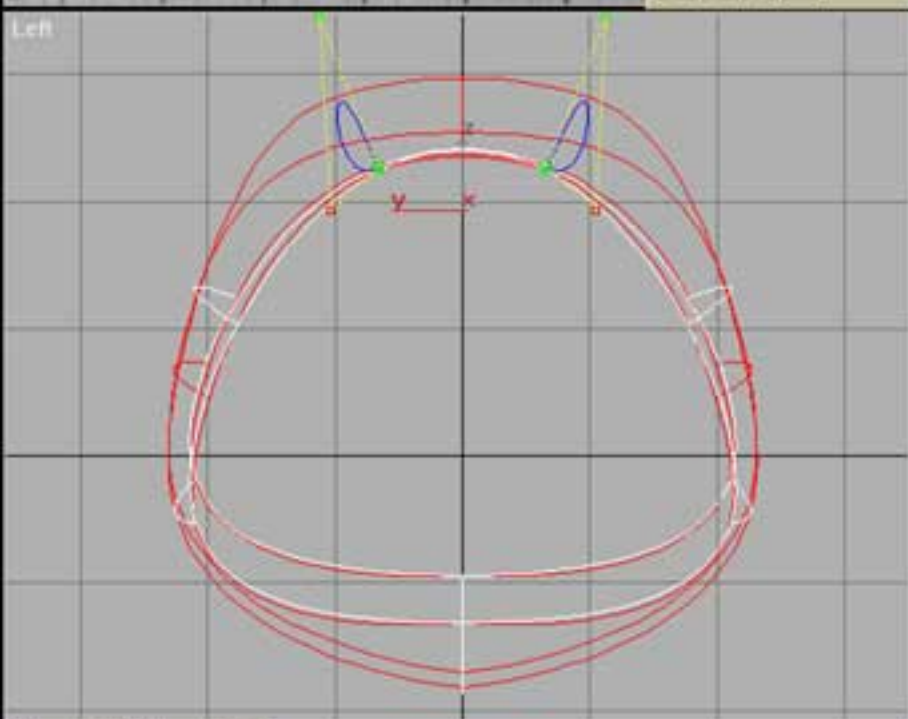
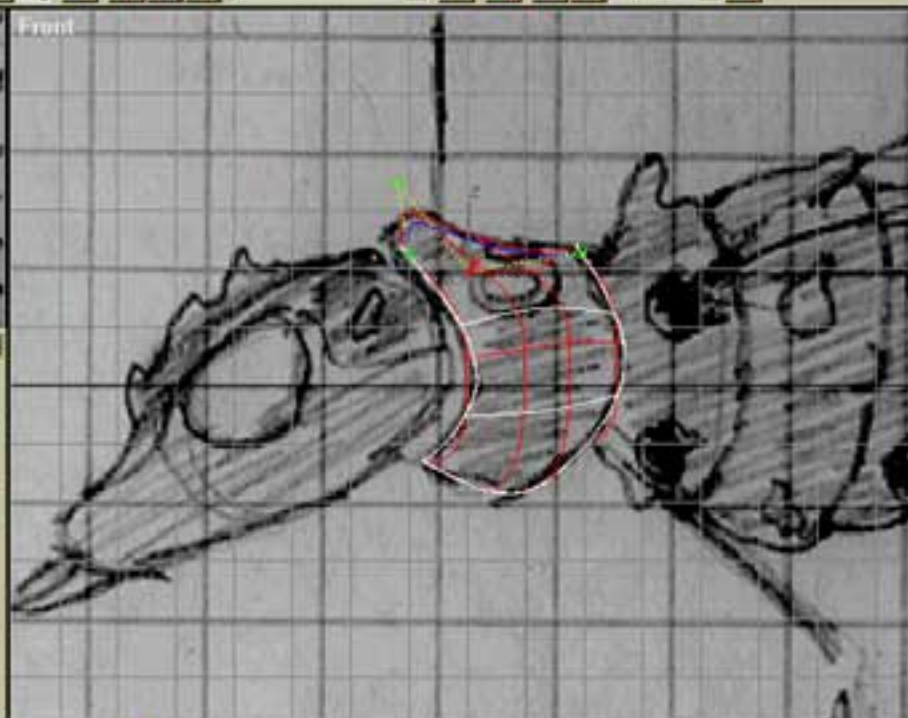
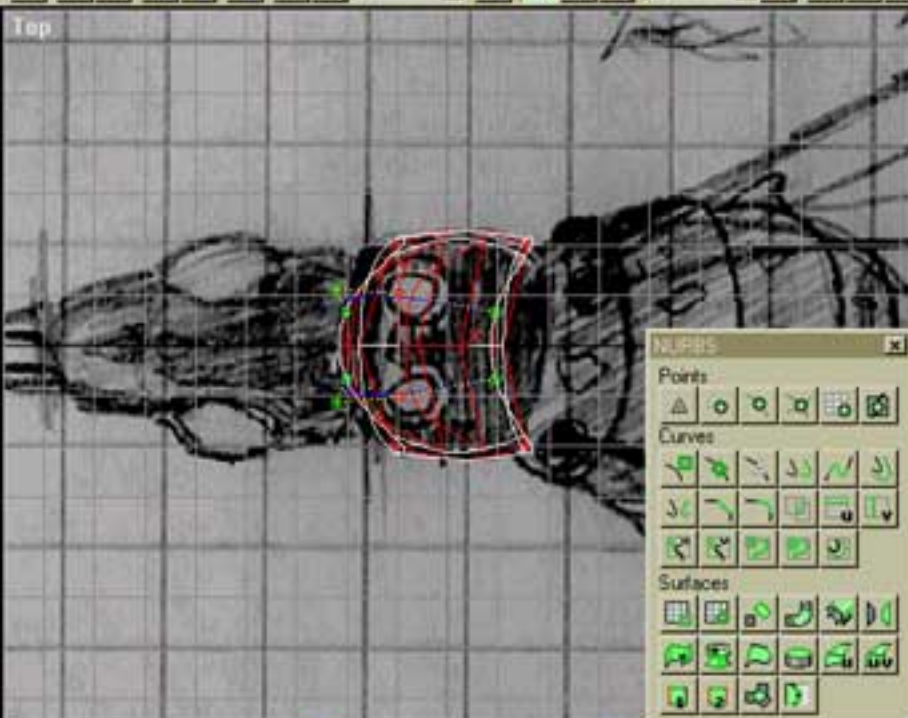
Thickness: 1.0

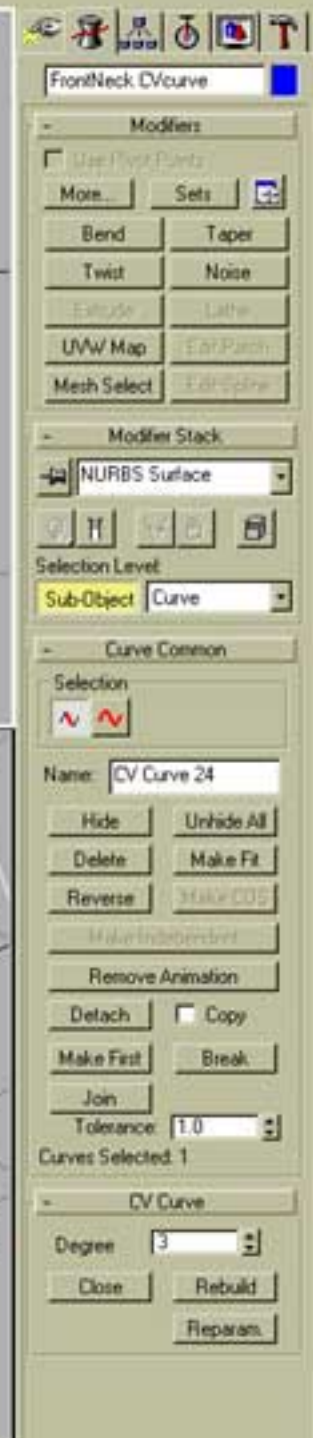
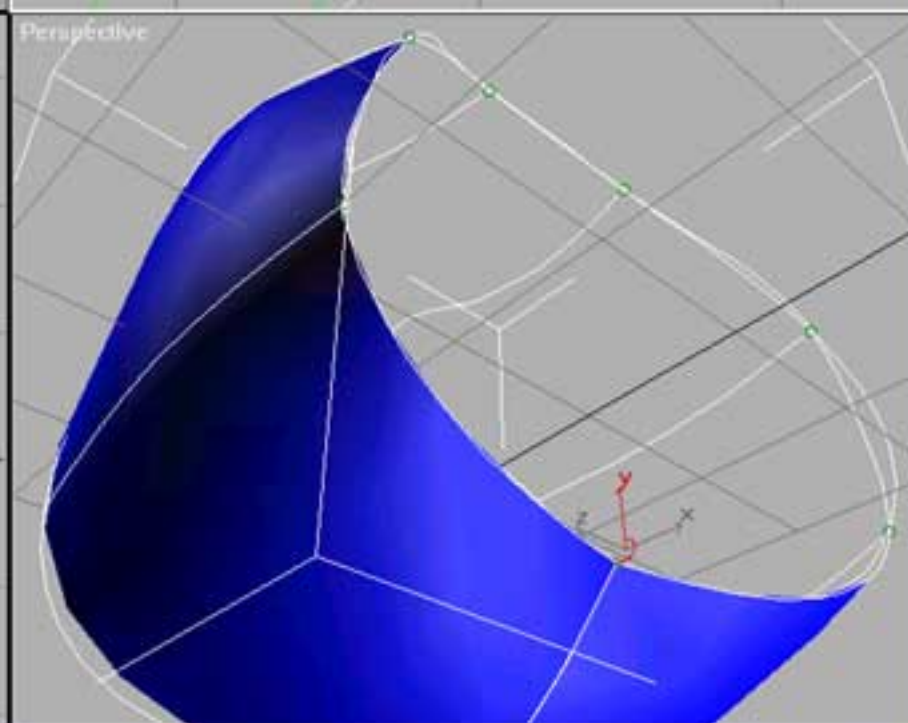
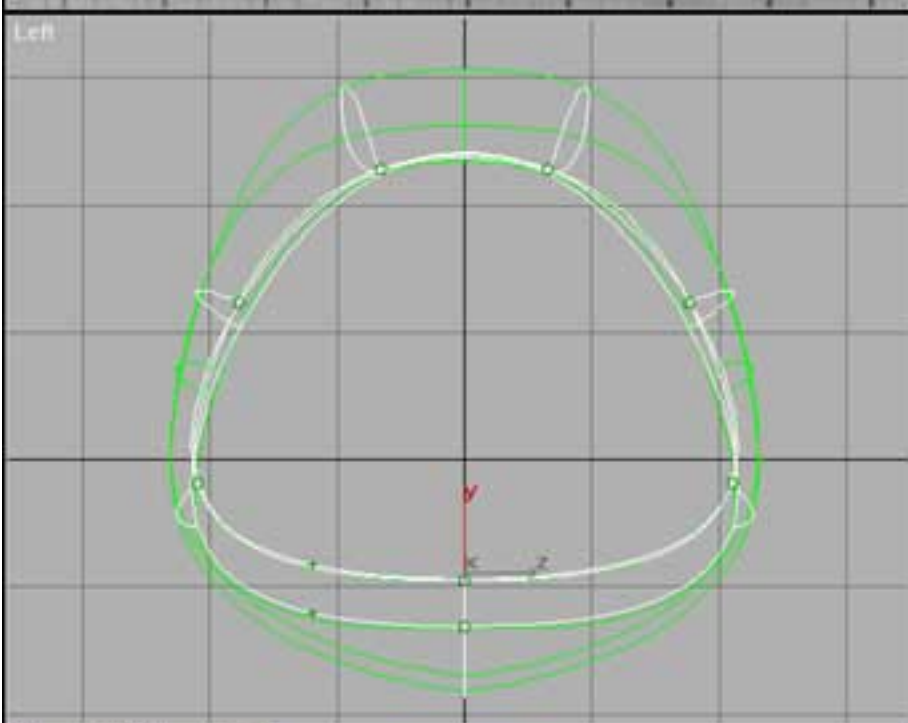
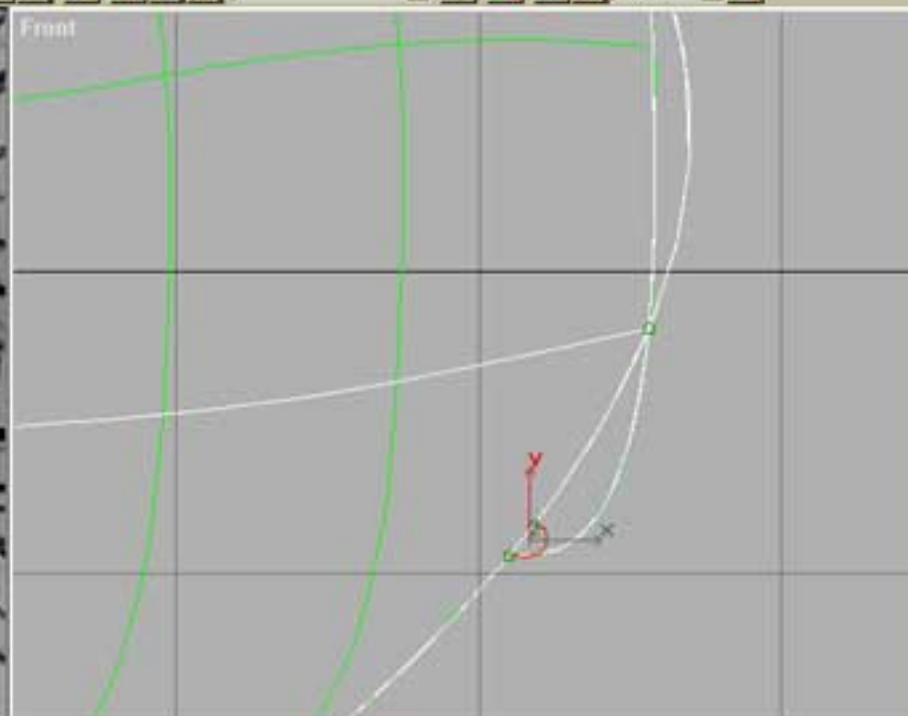
☐ Generate Mapping Coords

Curve Approximation

Create Points

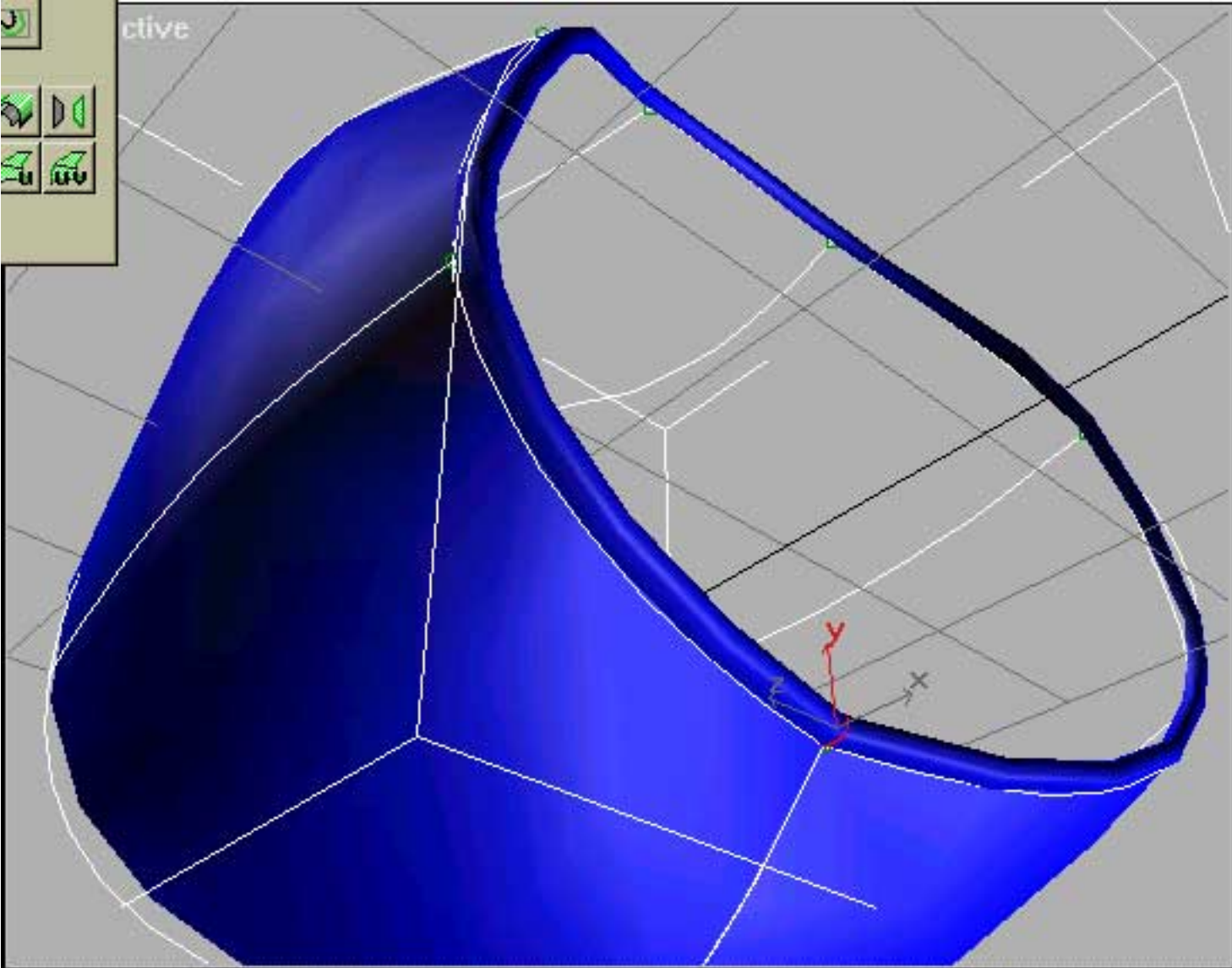
Create Curves

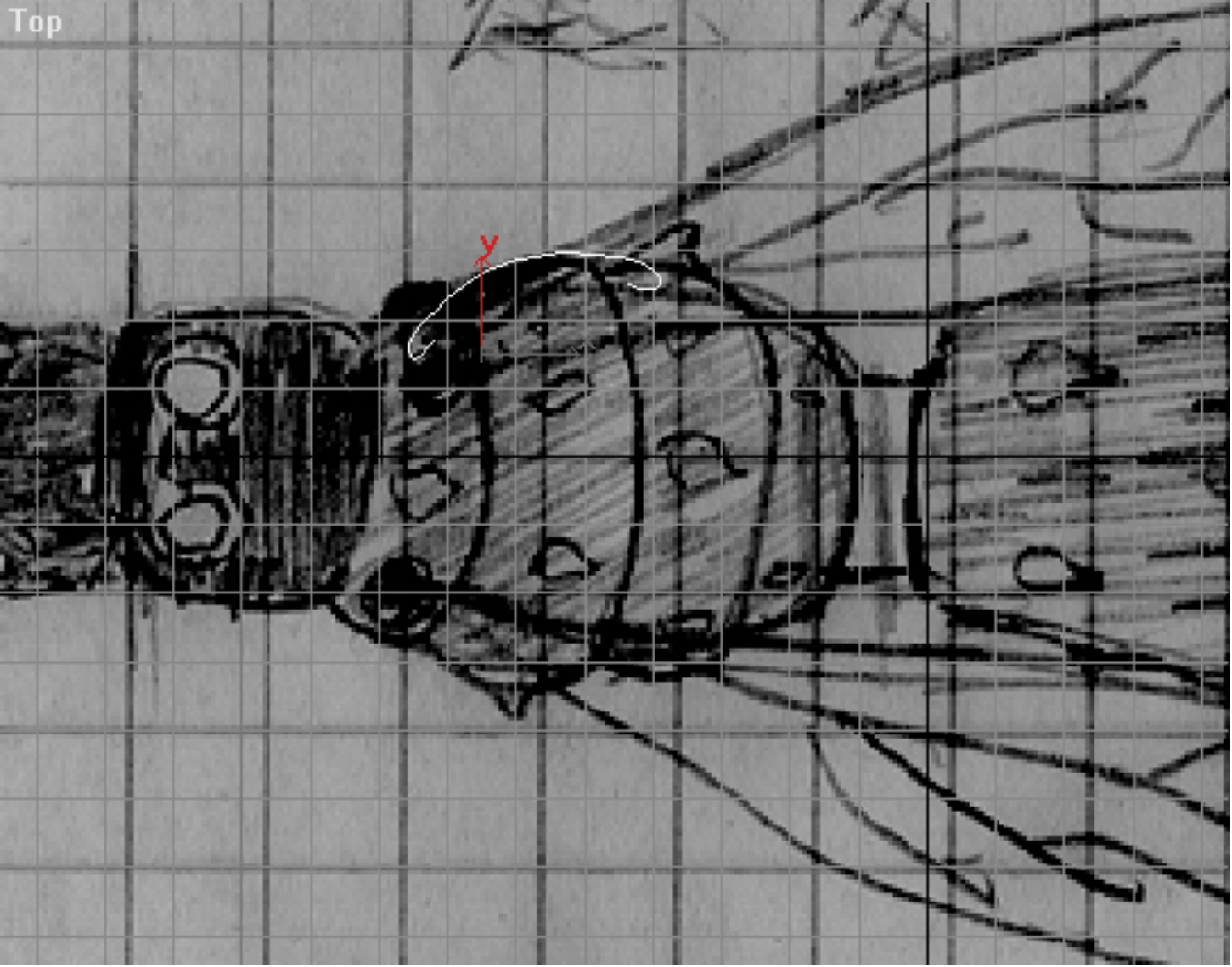


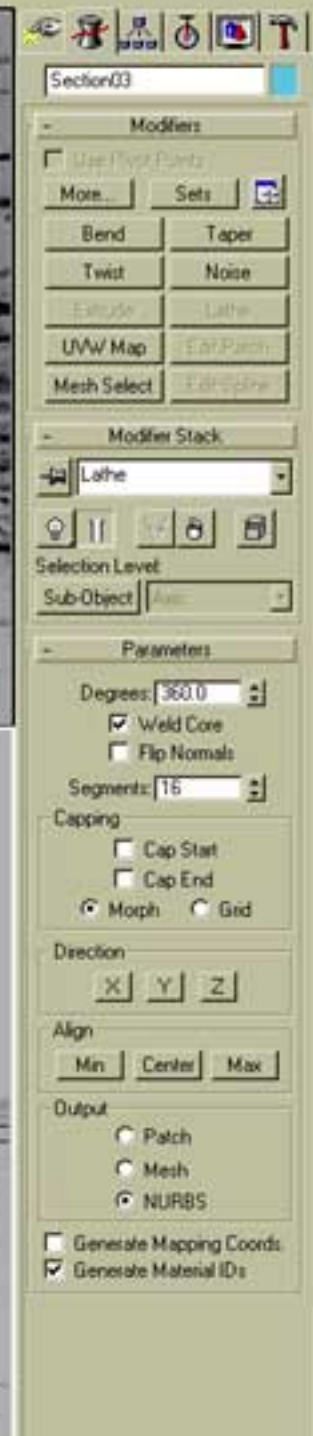
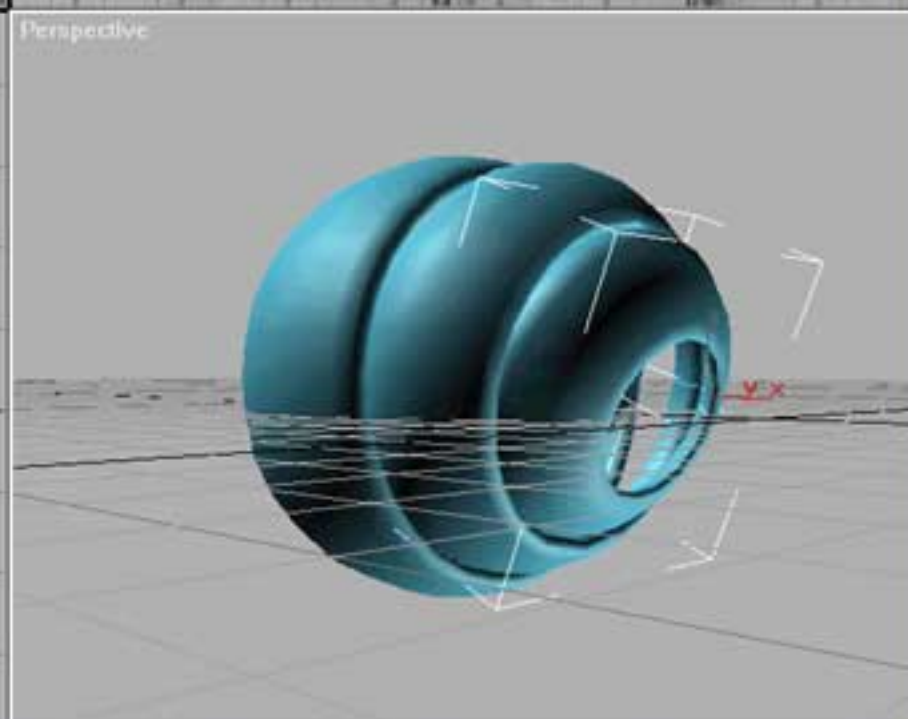
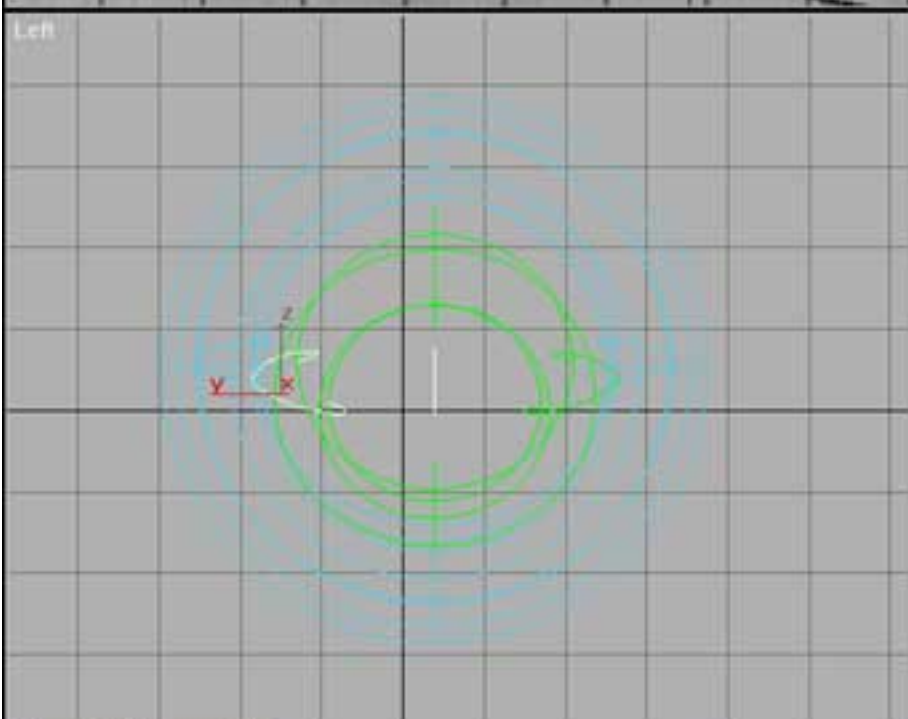
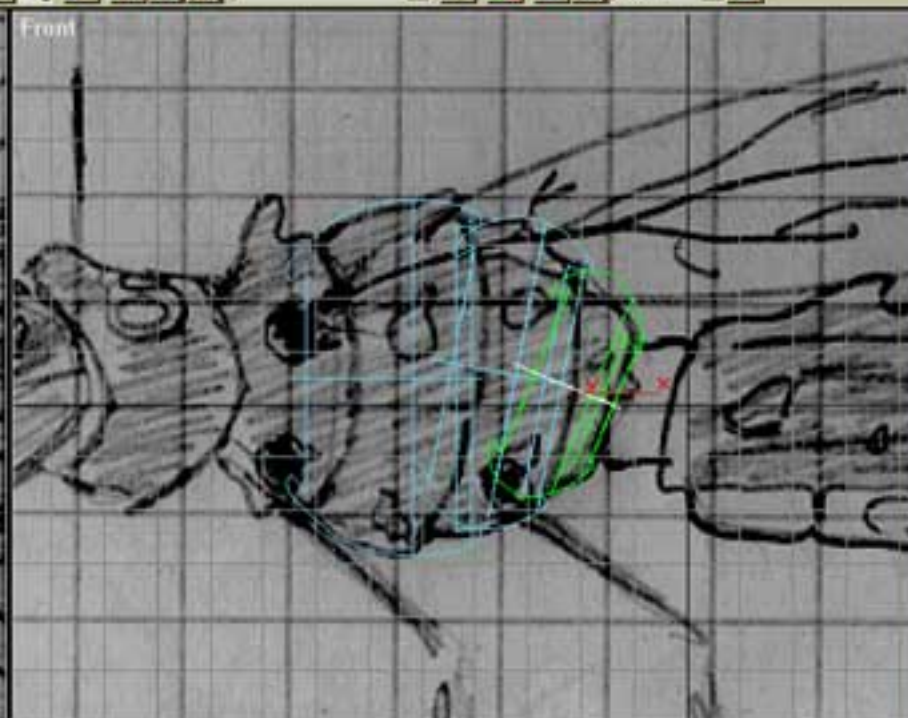
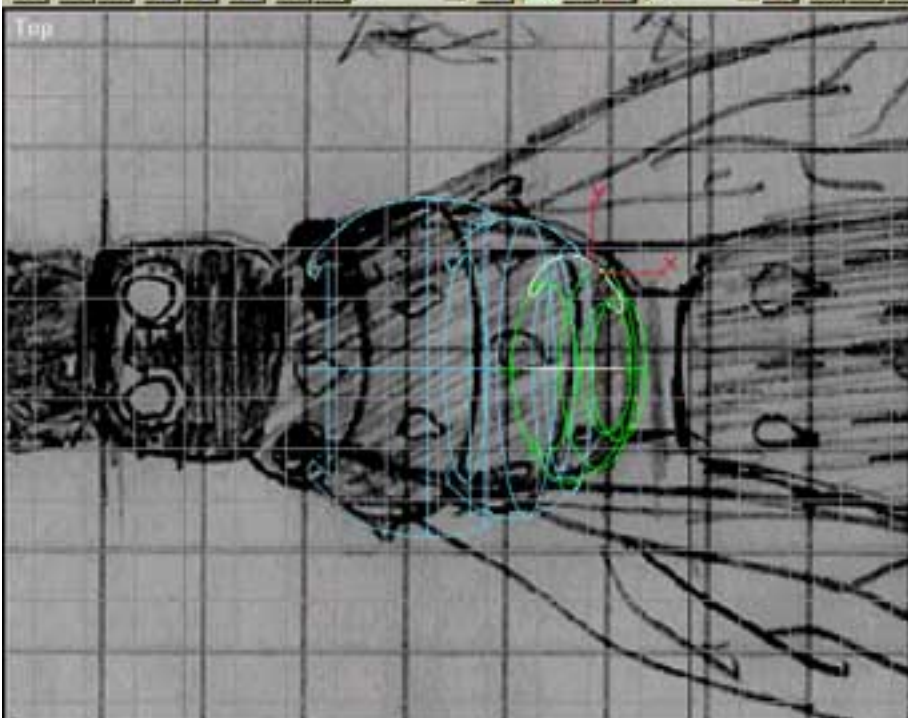


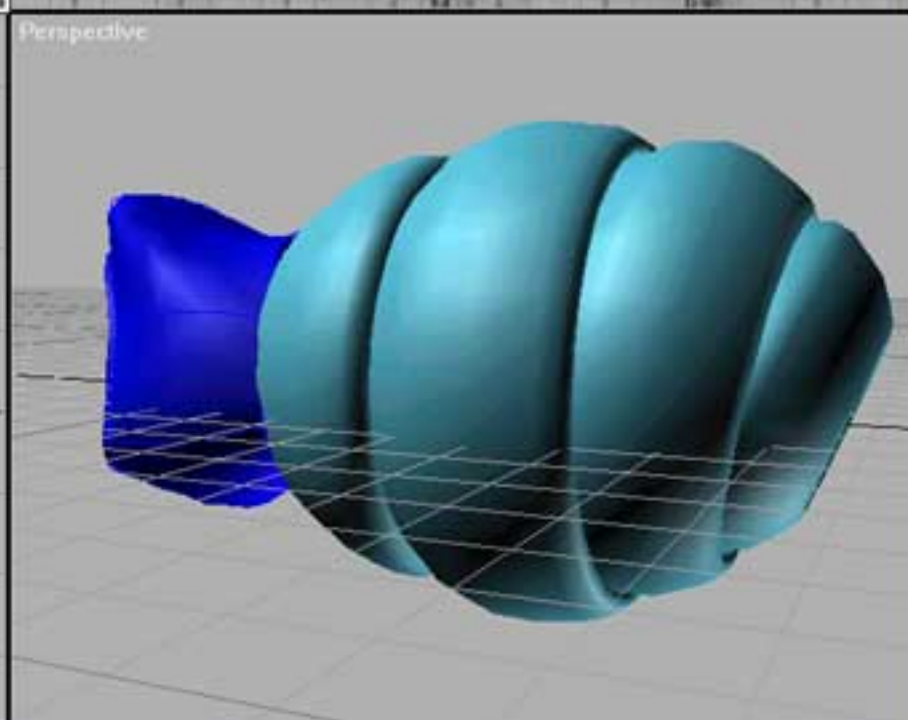
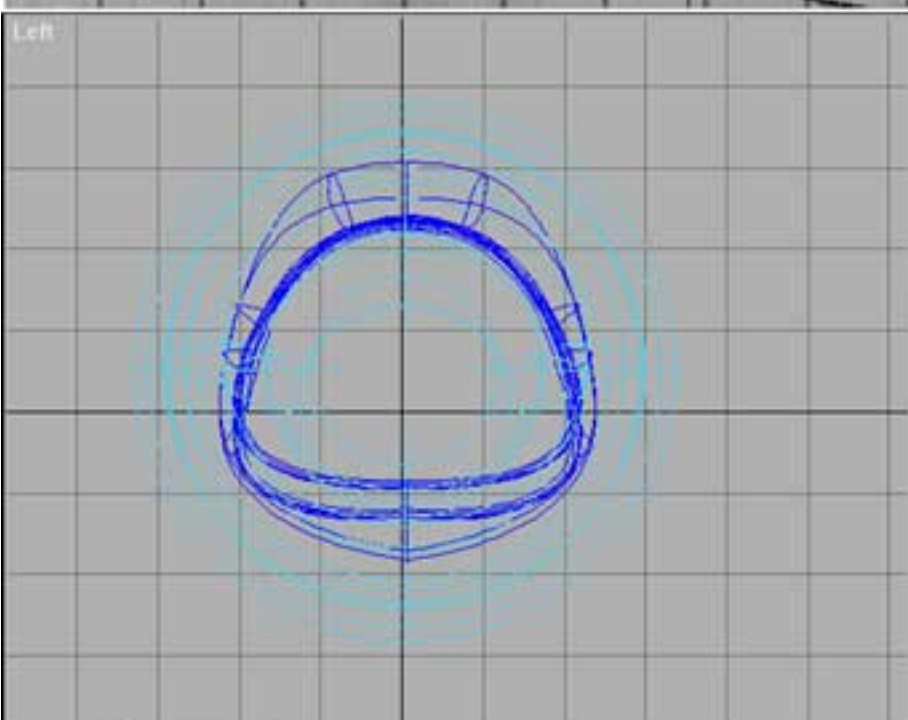
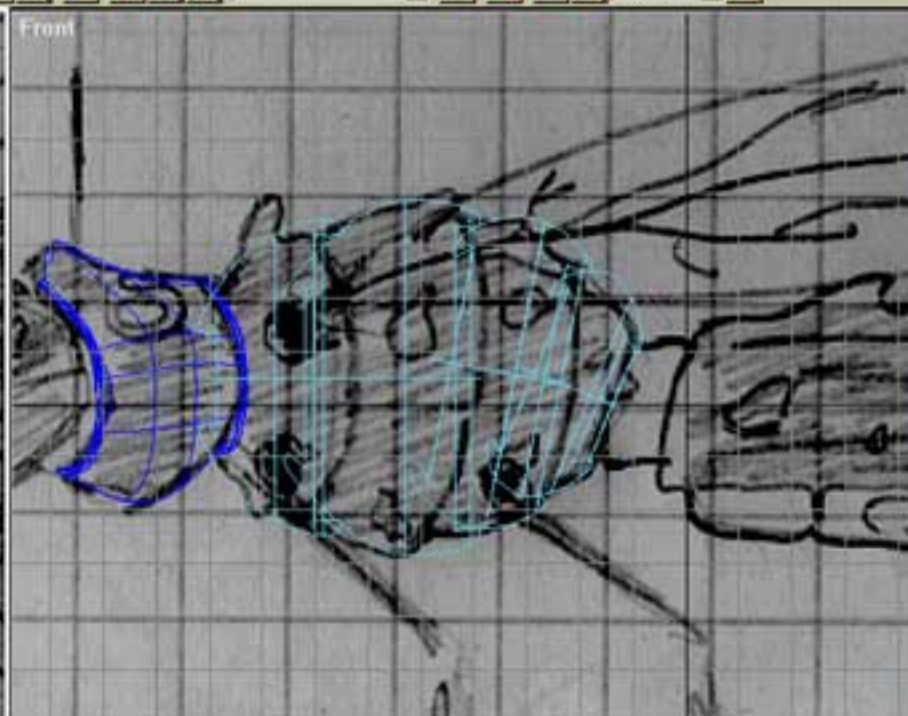
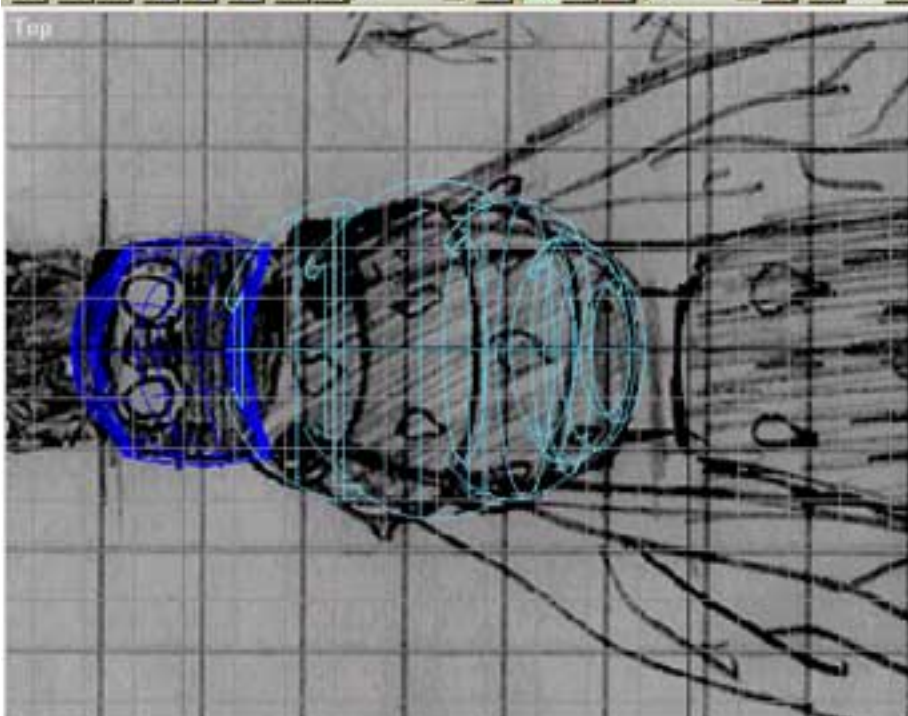


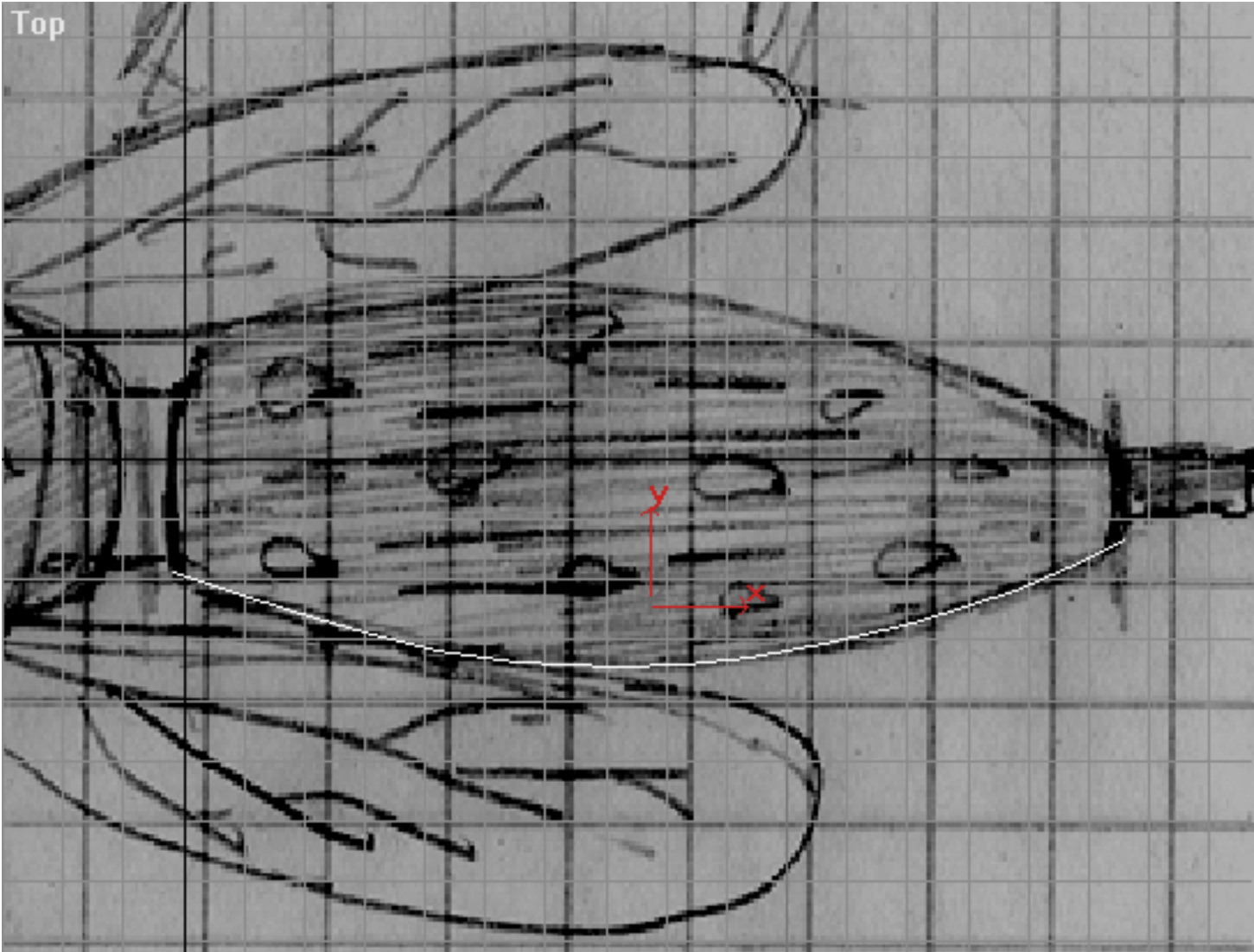
ctive



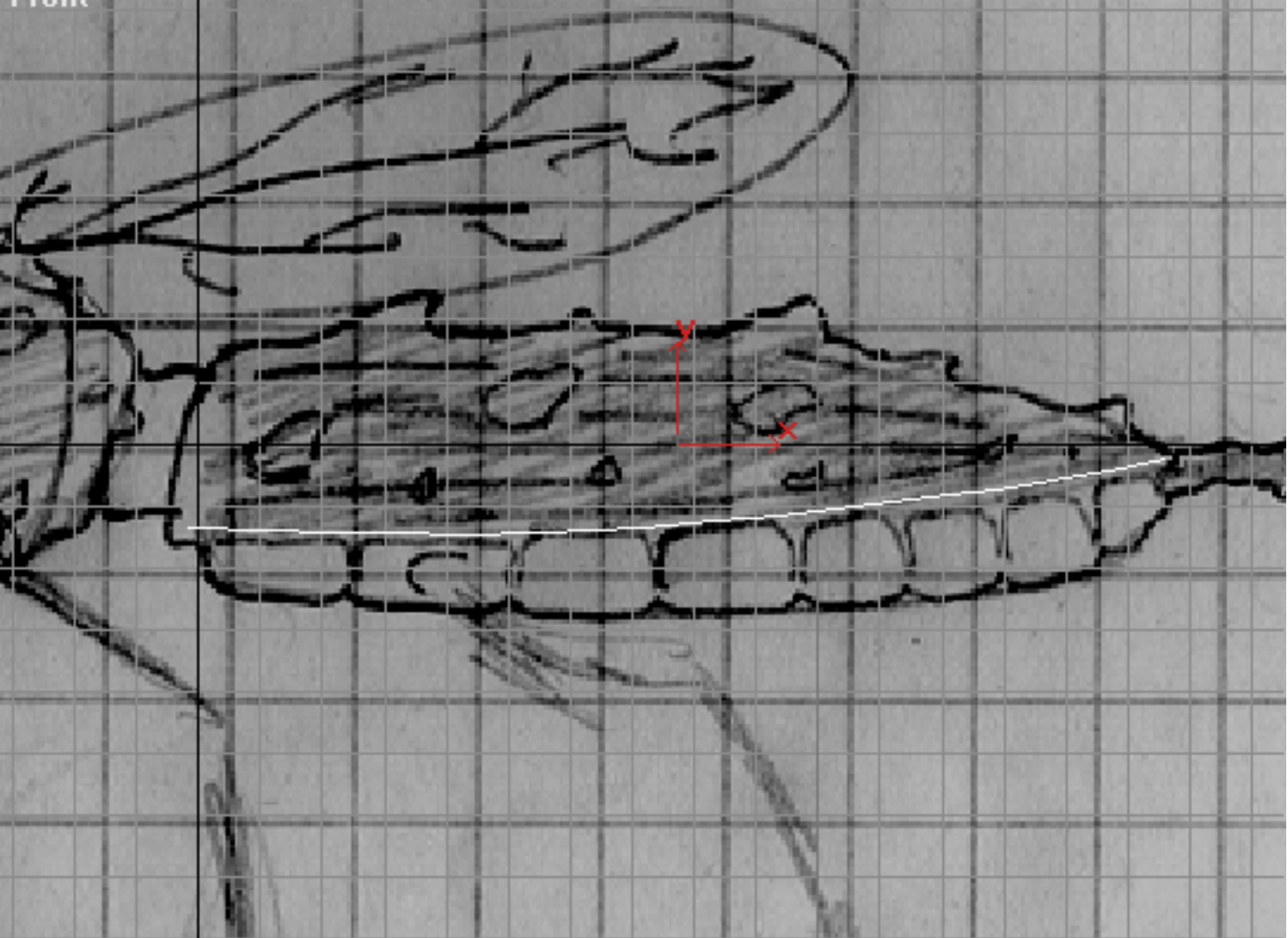


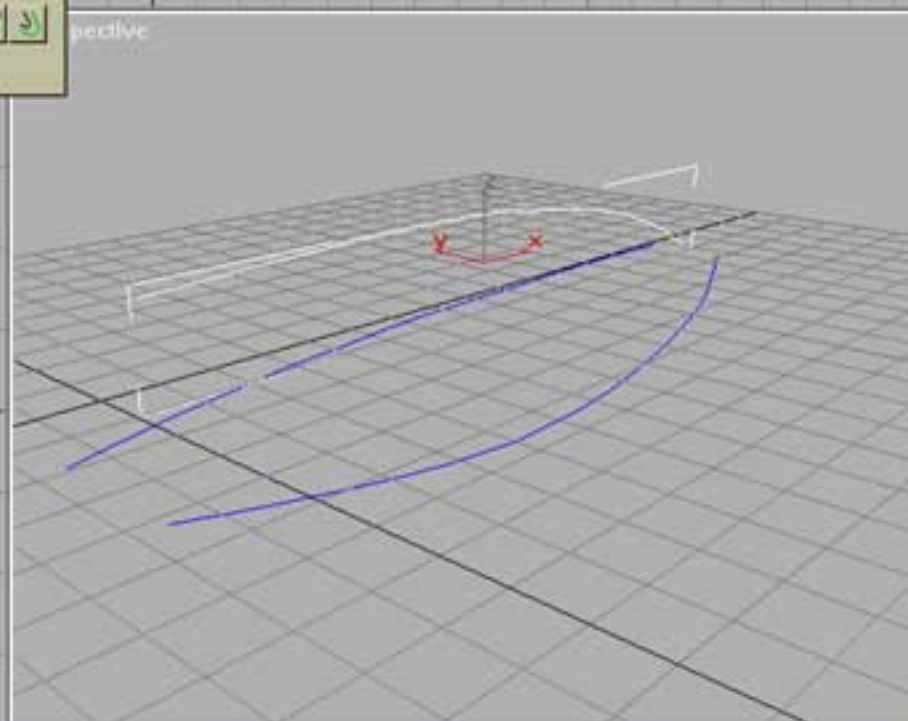
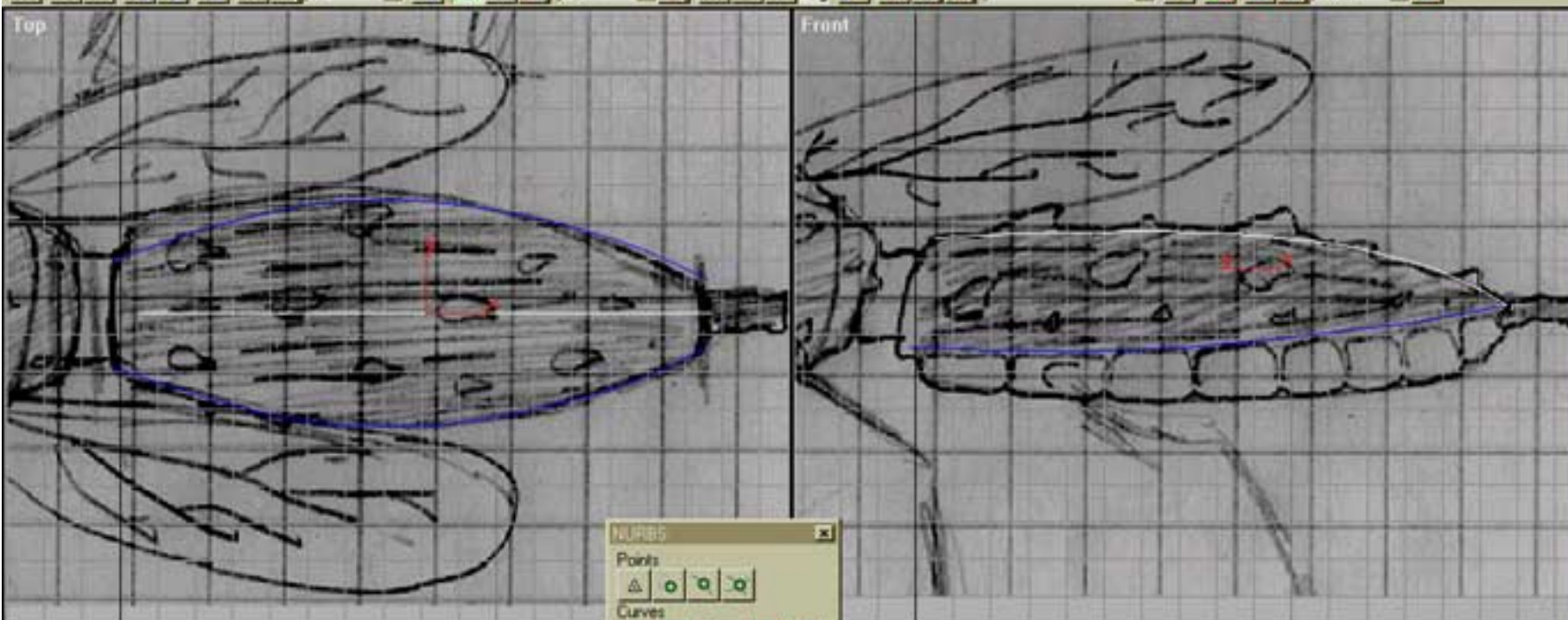


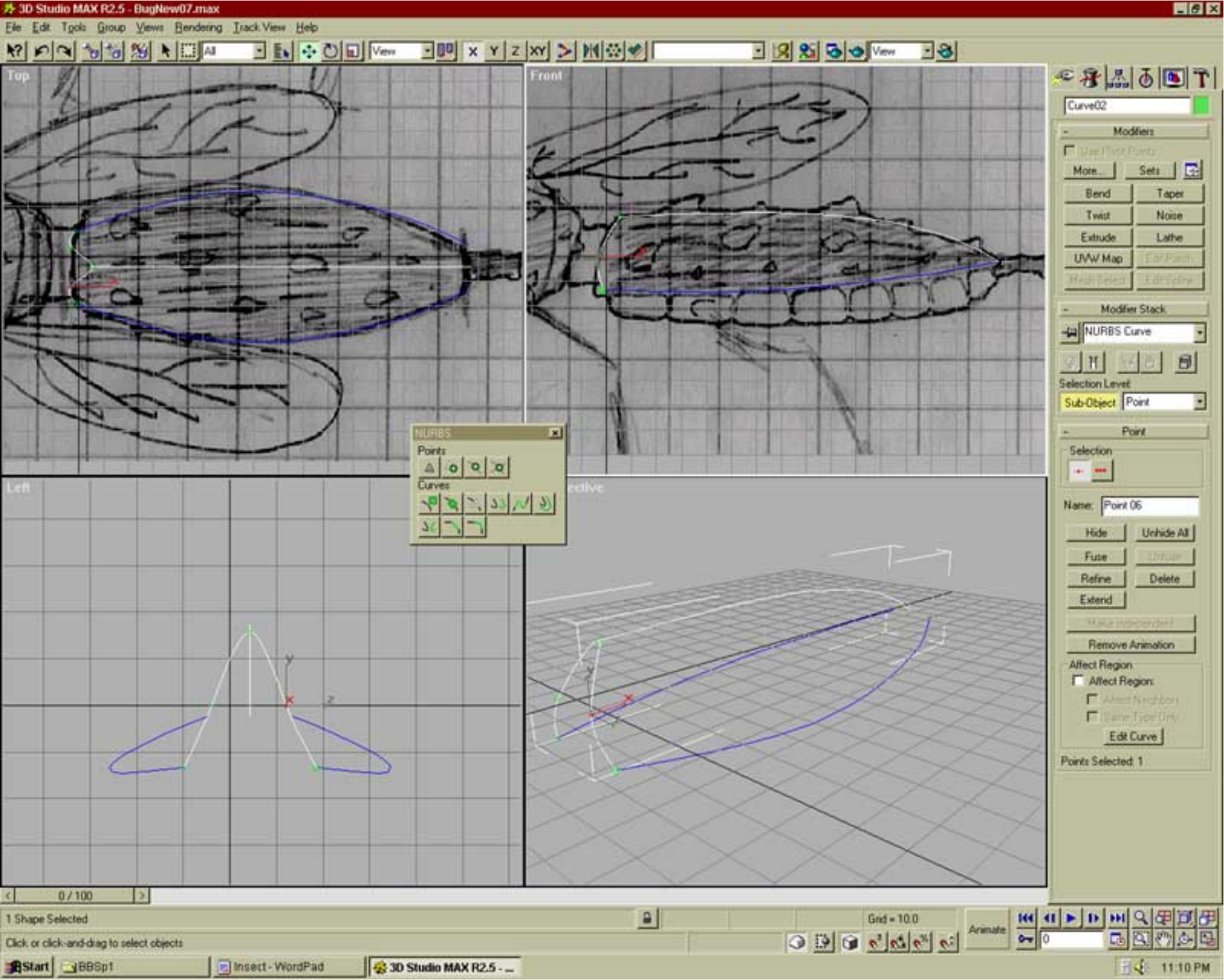




Front

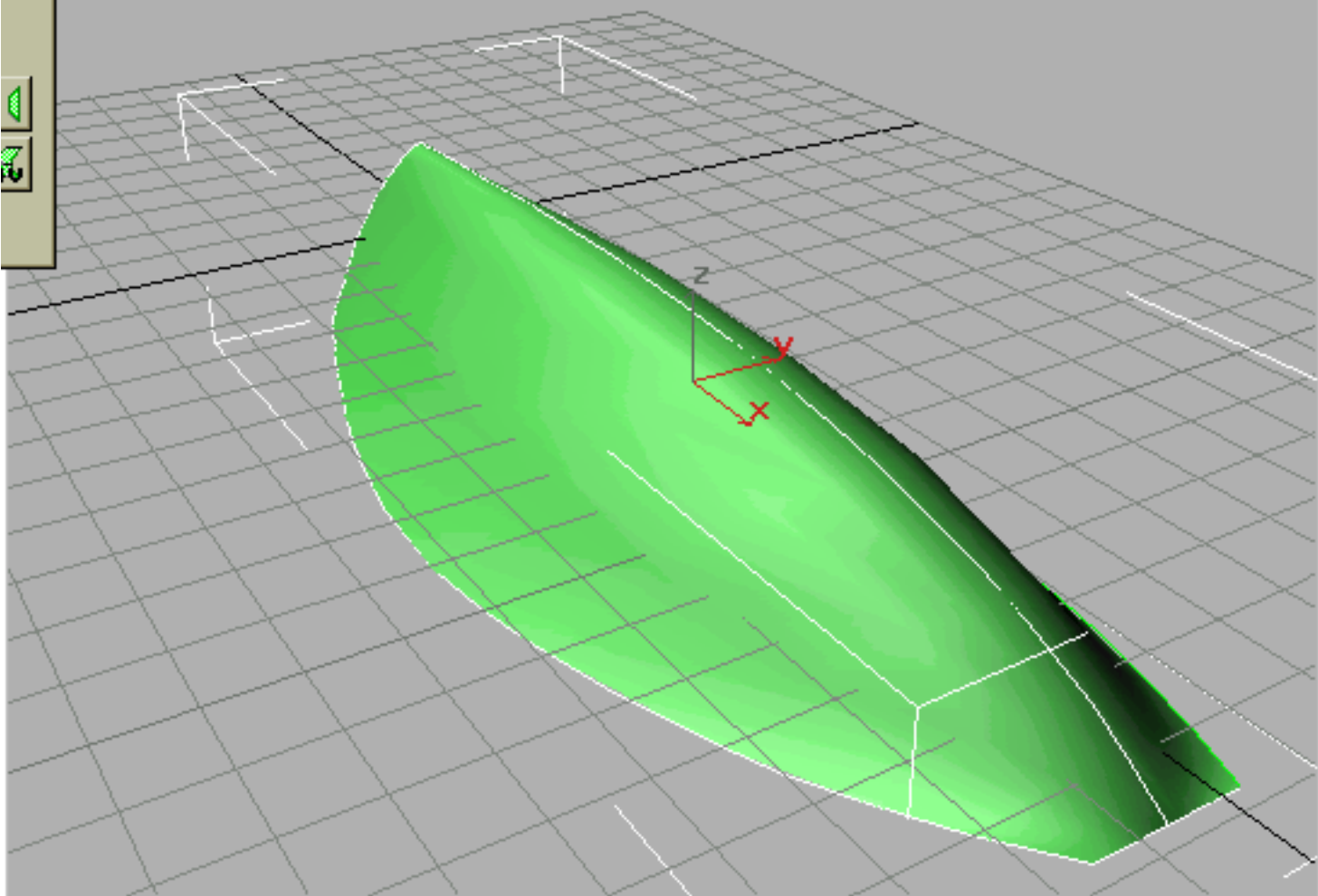




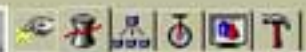




rspective



Front



Carapace

Modifiers

☐ Use First Points

More... Sets

Bend Taper

Twist Noise

Extrude Lathe

UVW Map Edit Patch

Mesh Select Edit Spline

Modifier Stack

NURBS Surface

Selection Level

Sub-Object Curve CV

CV

Selection

Name:

Weight: 1.0

Hide Unhide All

Fuse Unfuse

Refine Dyna

Insert Extend

Remove Animation

Affect Region

☐ Affect Region☐ Affect Neighbors

Edit Curve

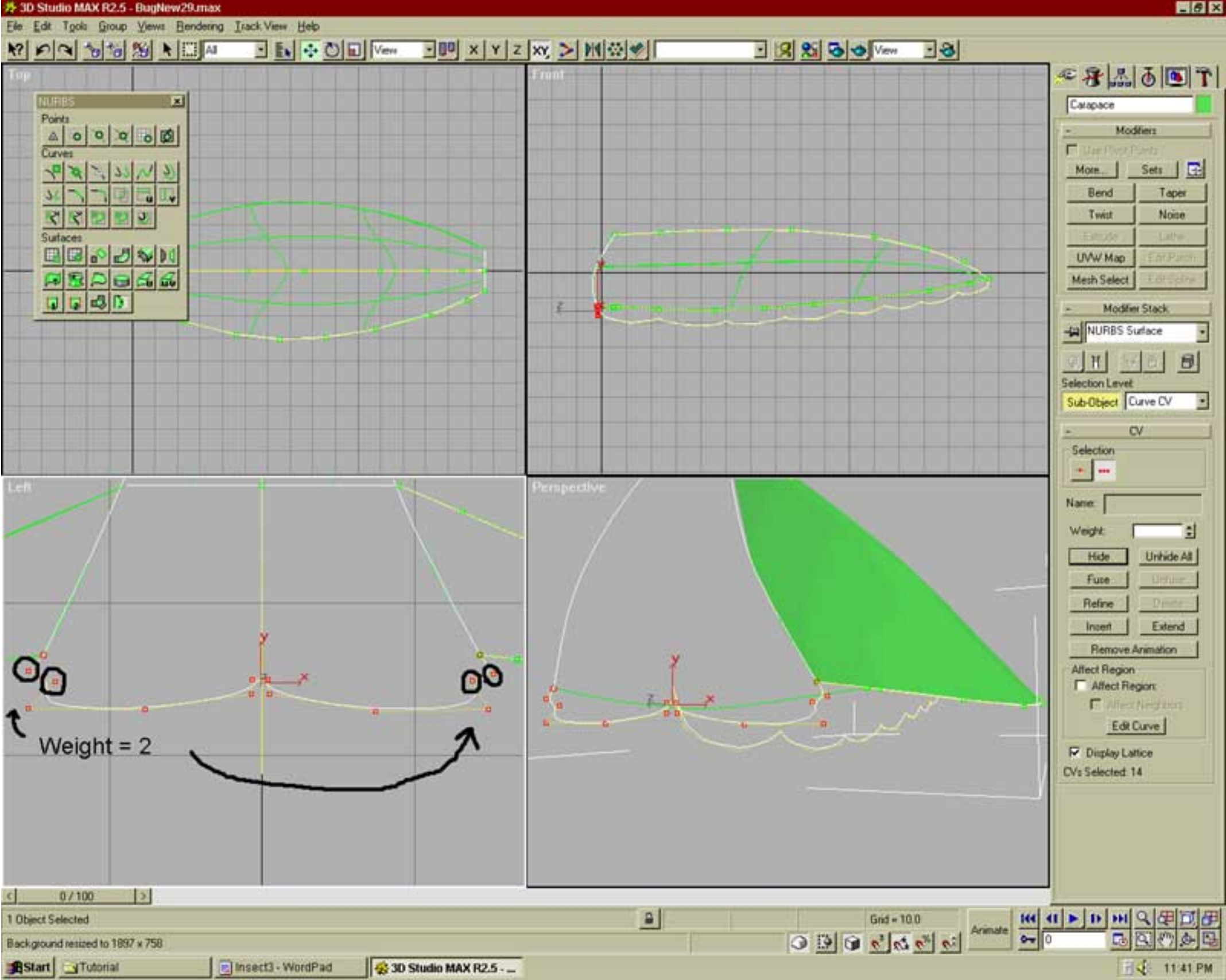
☒ Display Lattice

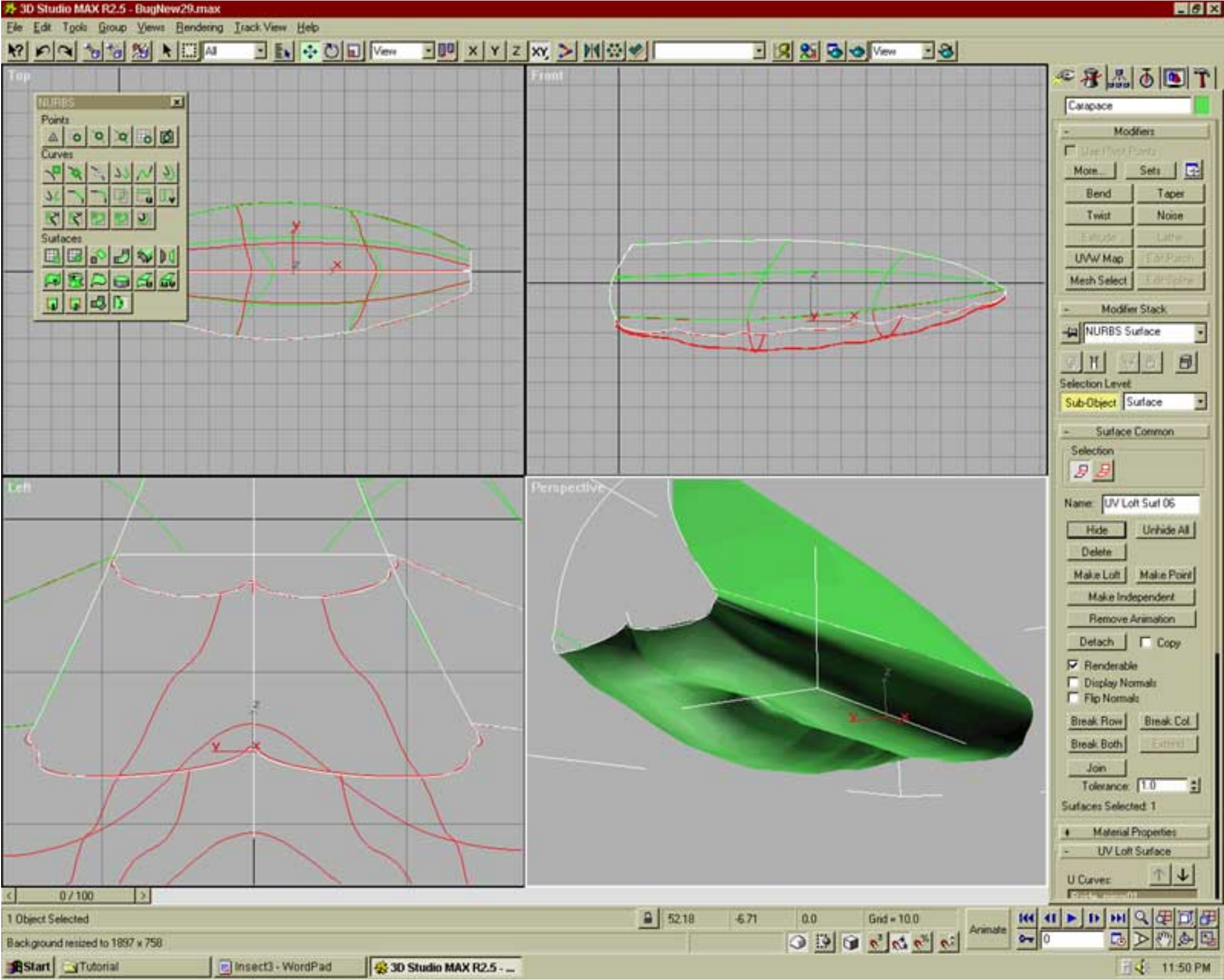
CVs Selected: 0

0 / 100

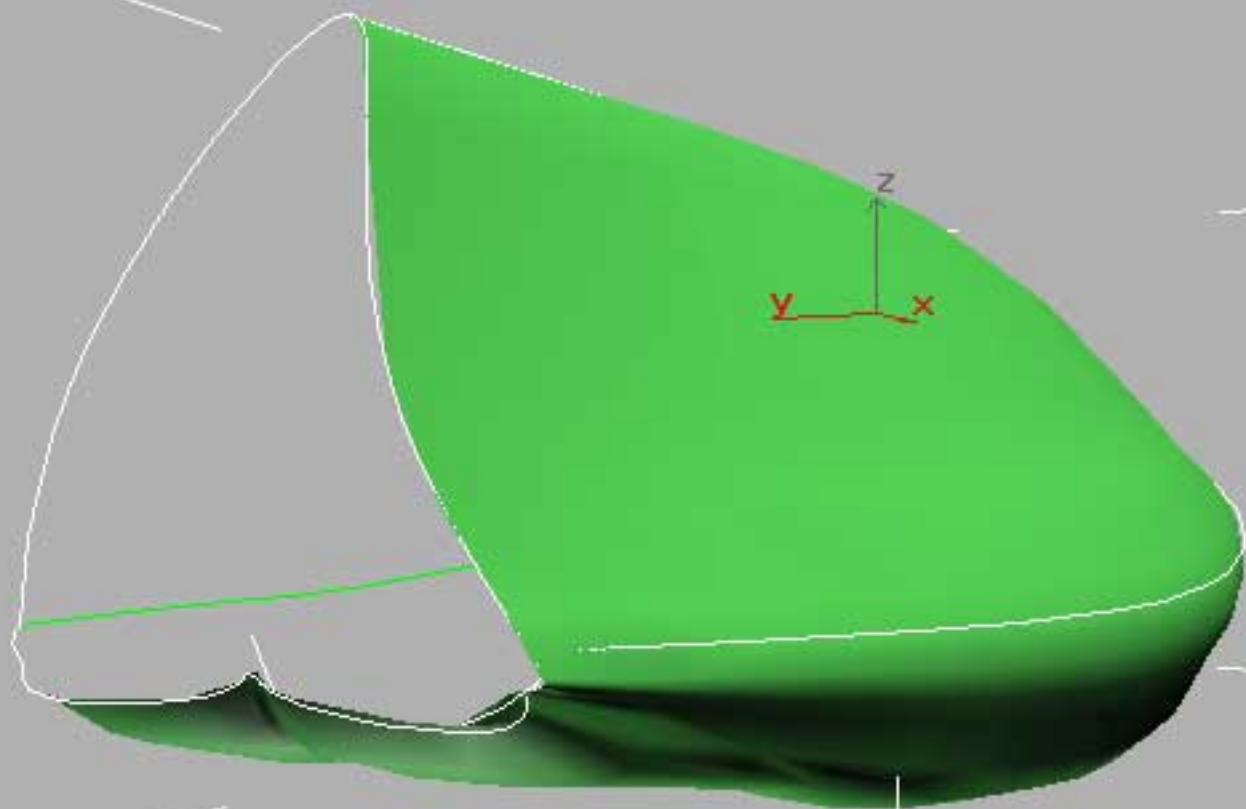
1 Object Selected

Background resized to 1887 x 758

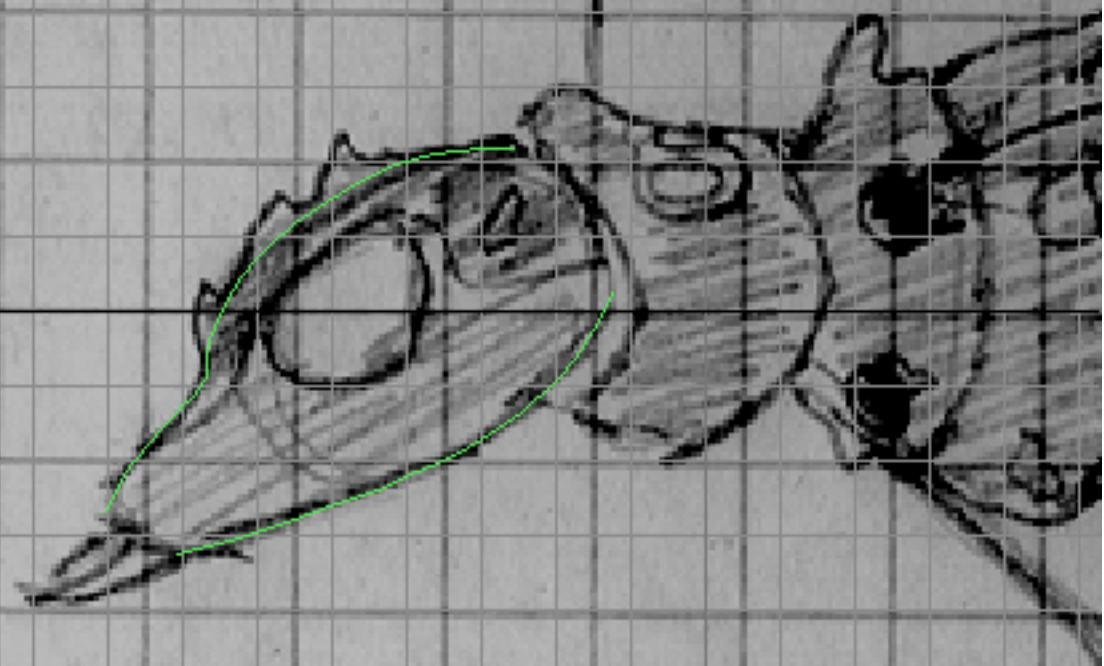


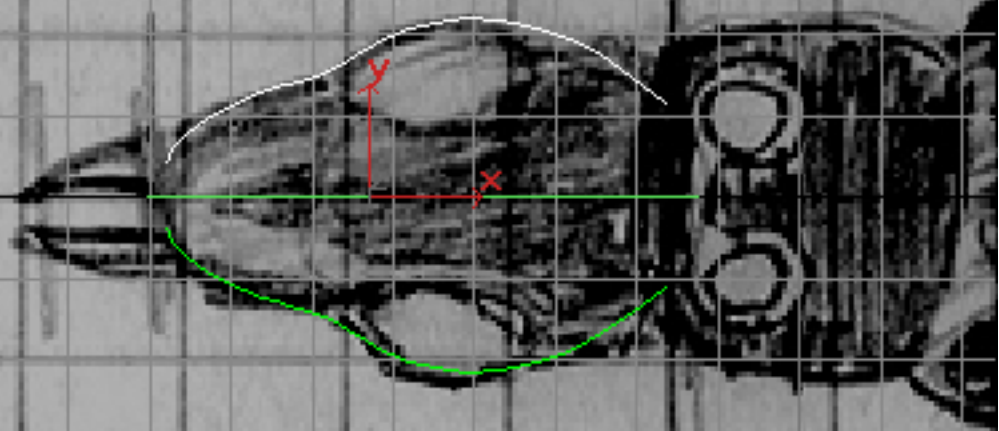


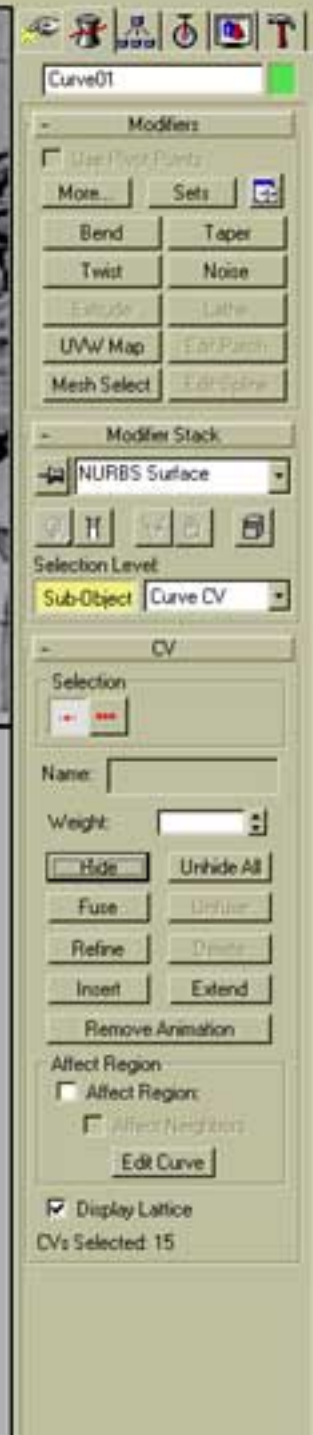
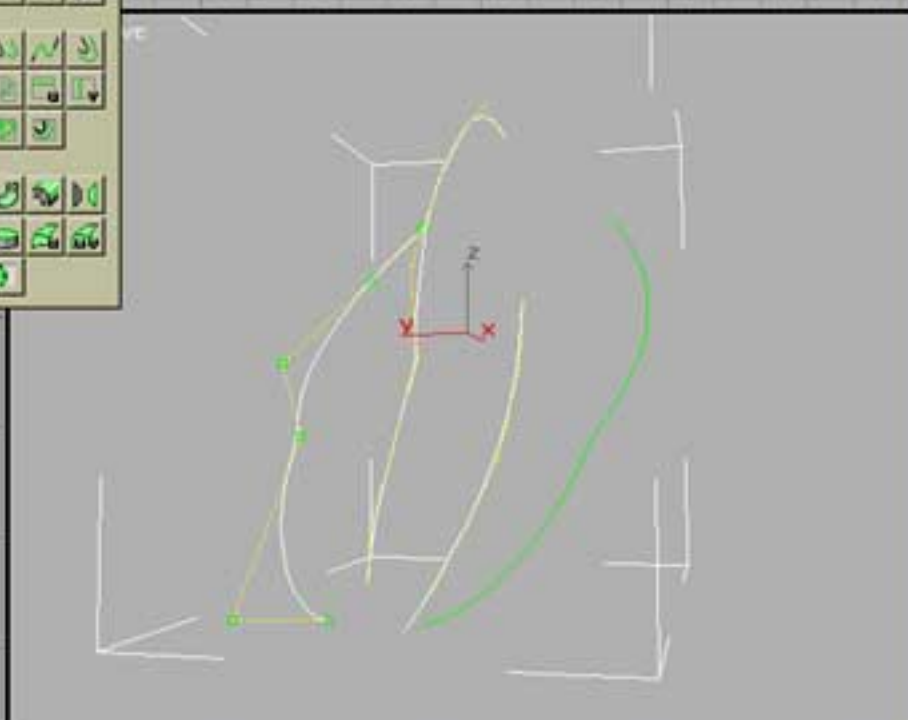
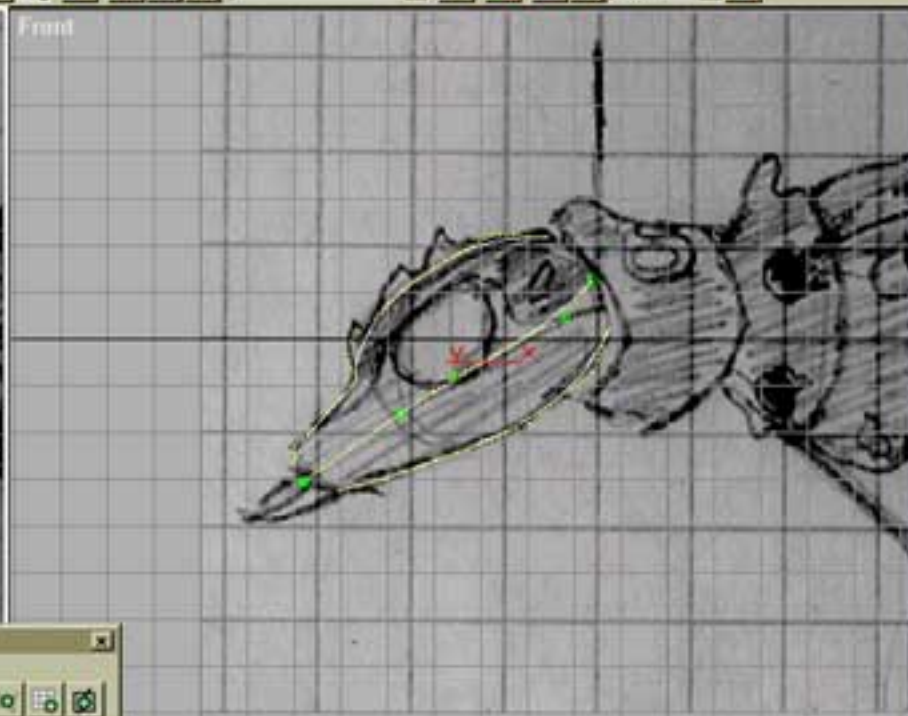
Perspective

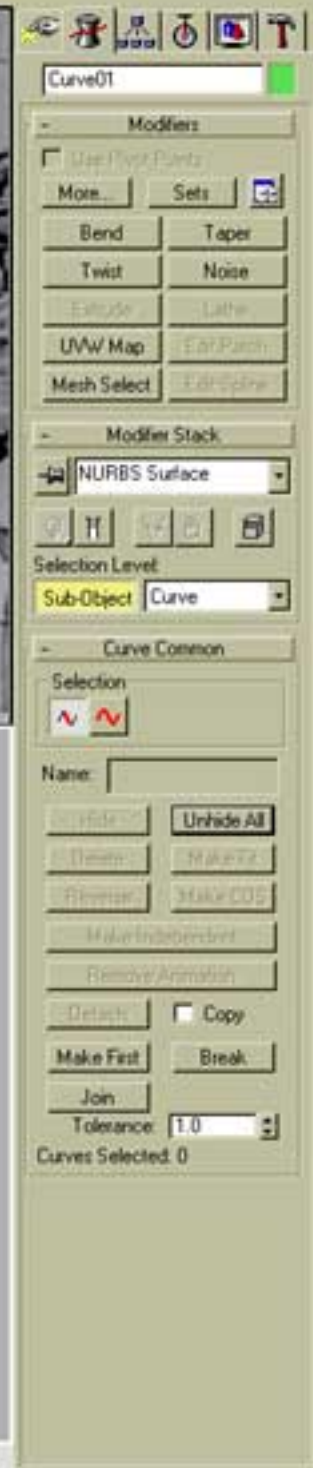
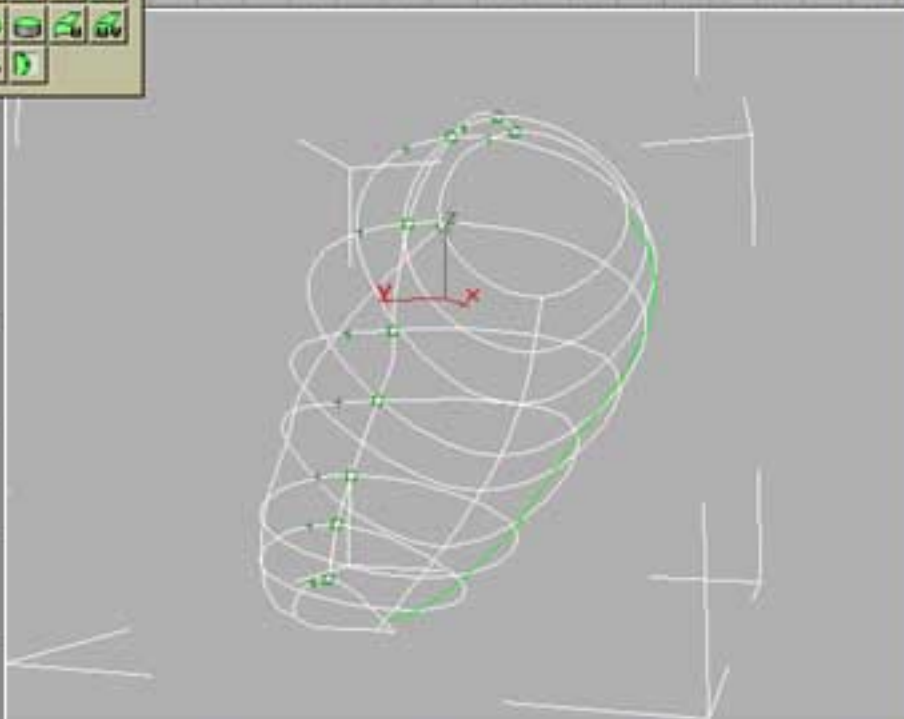
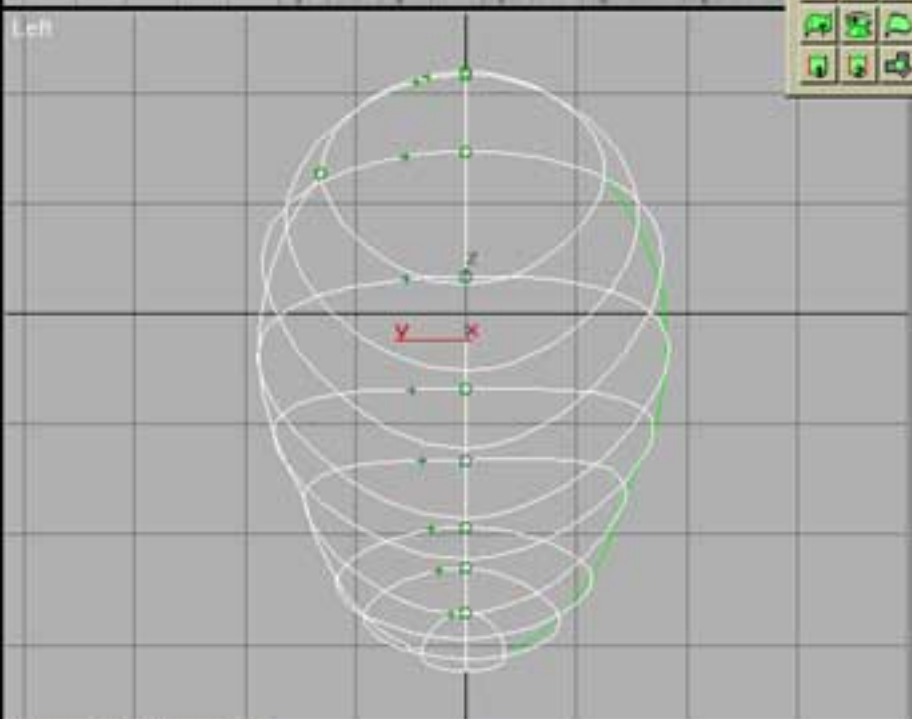
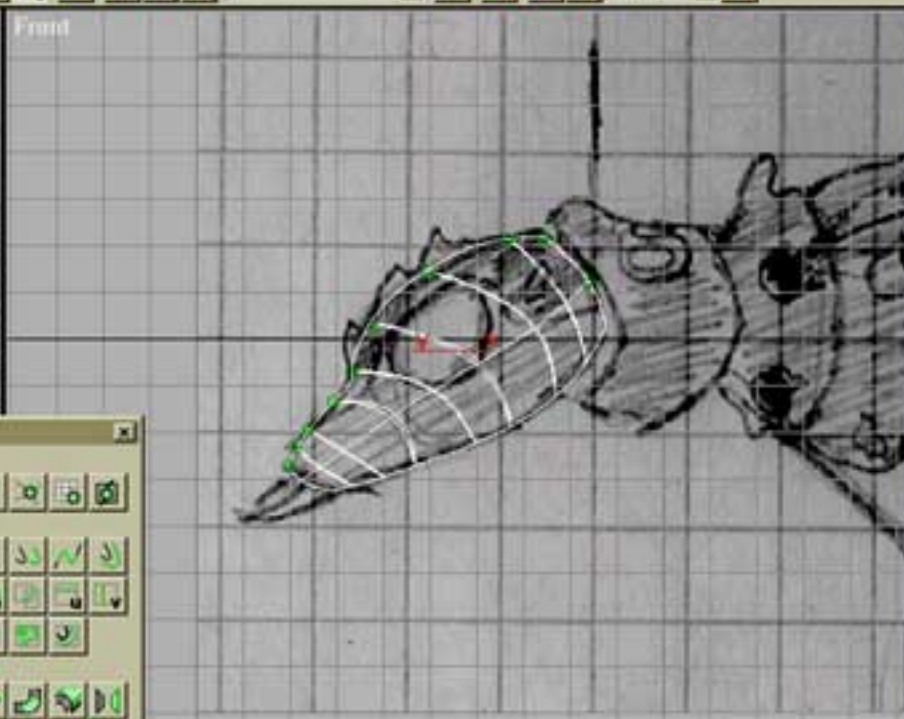


Front

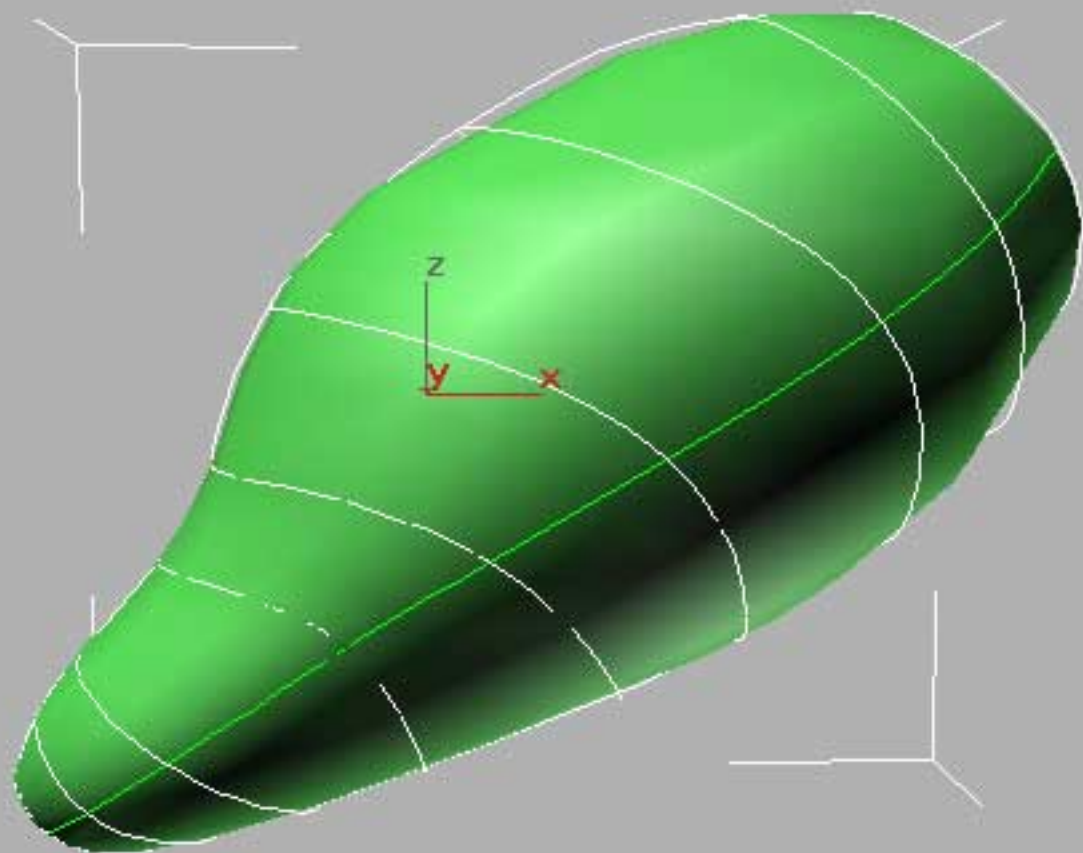


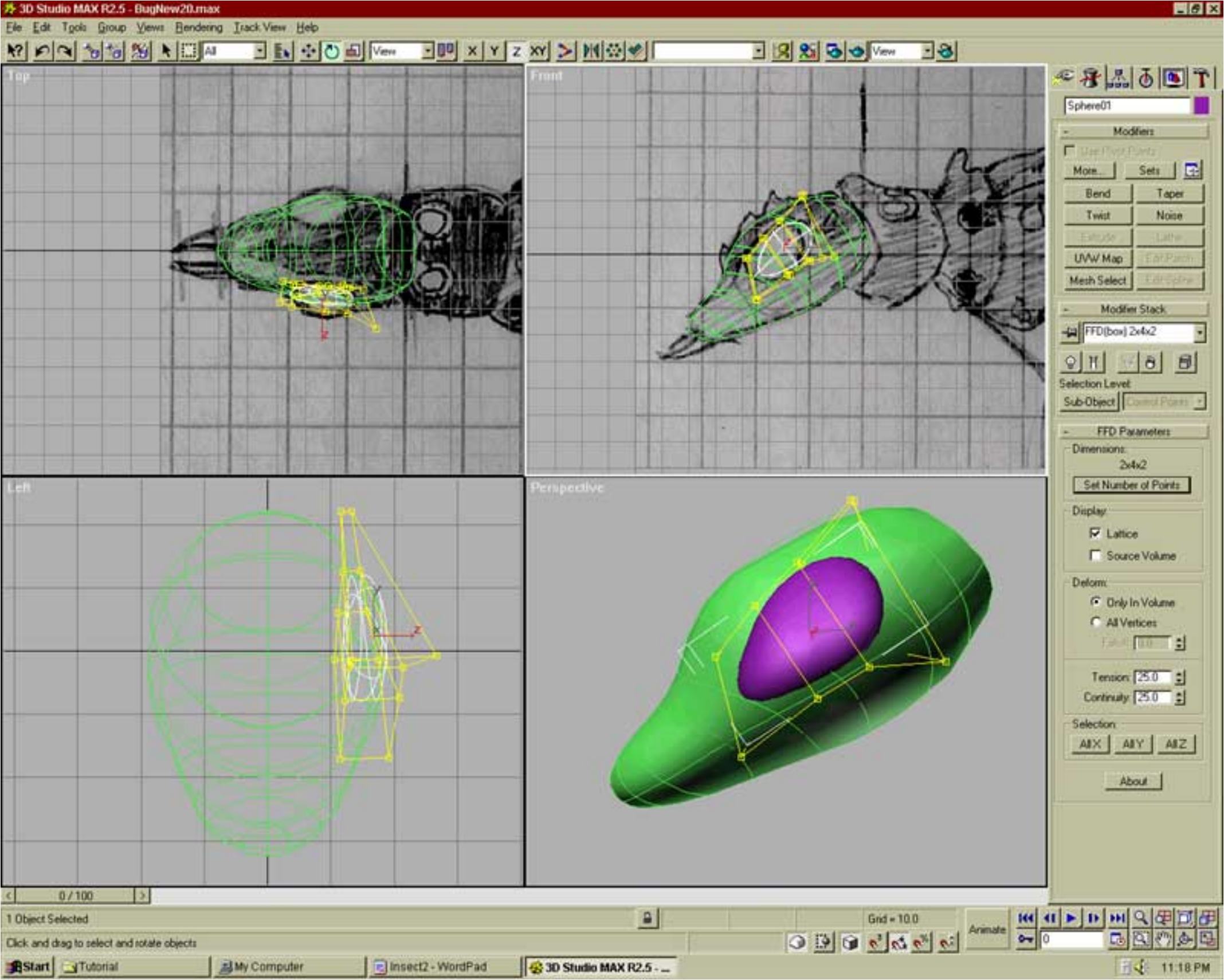




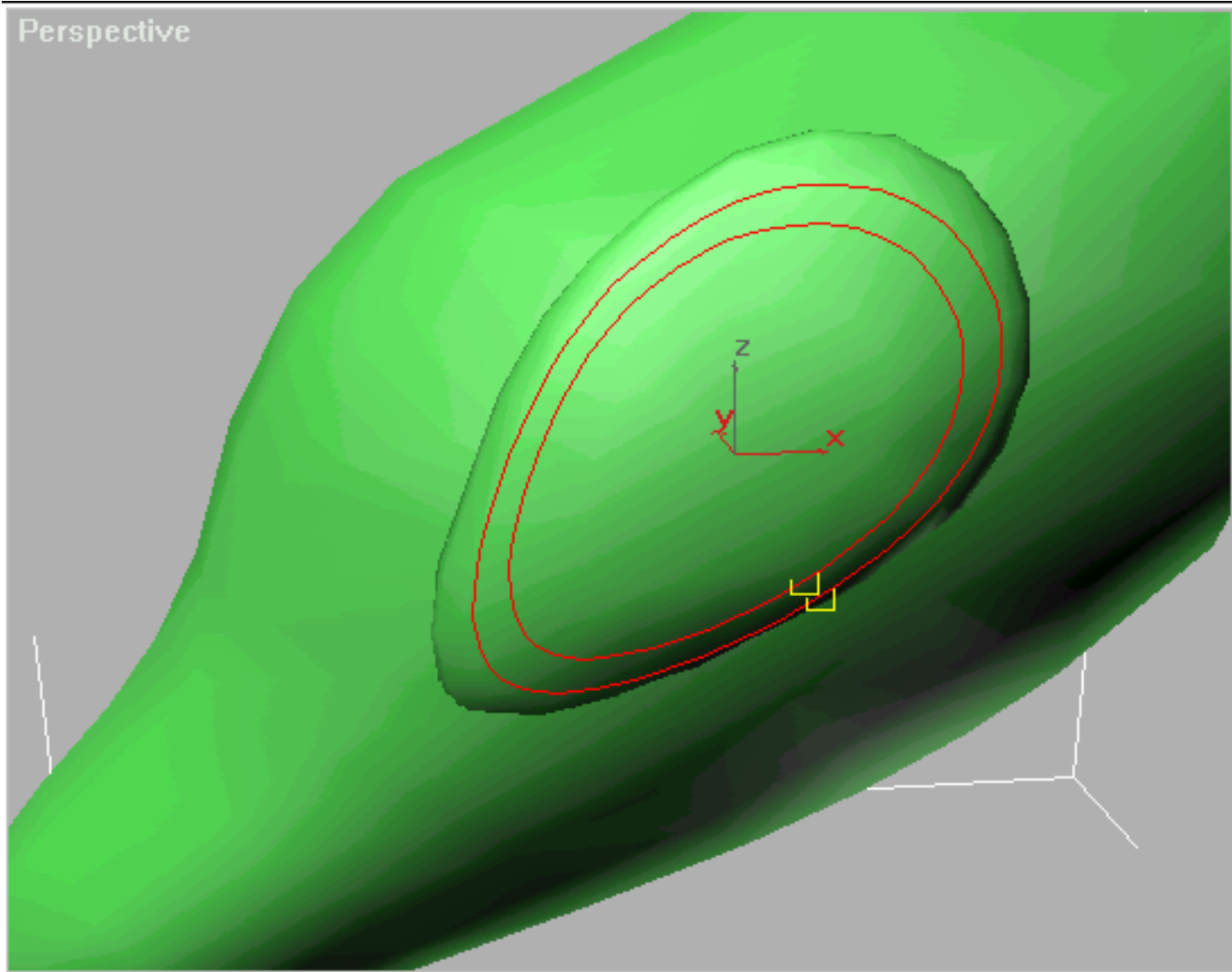


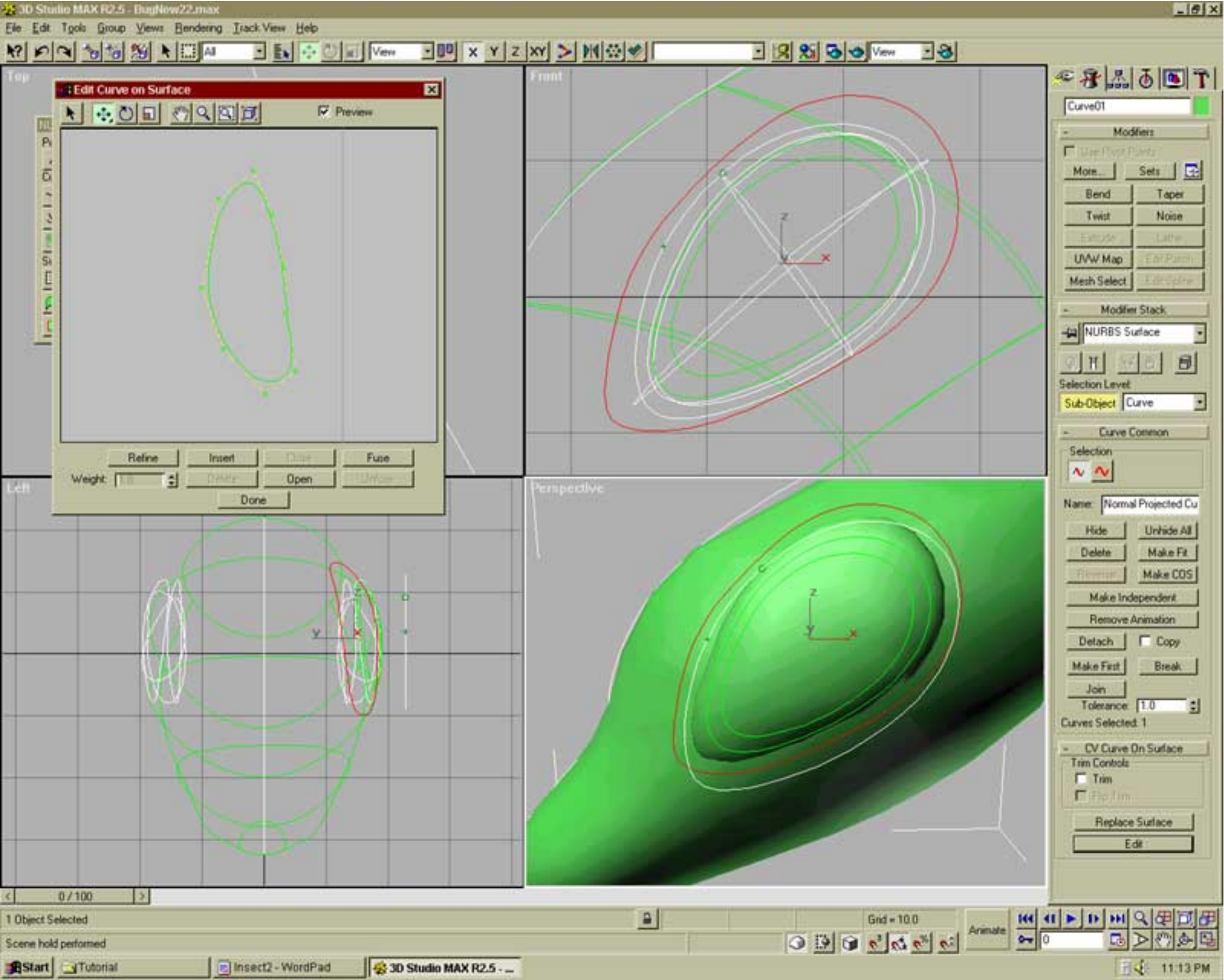
Perspective



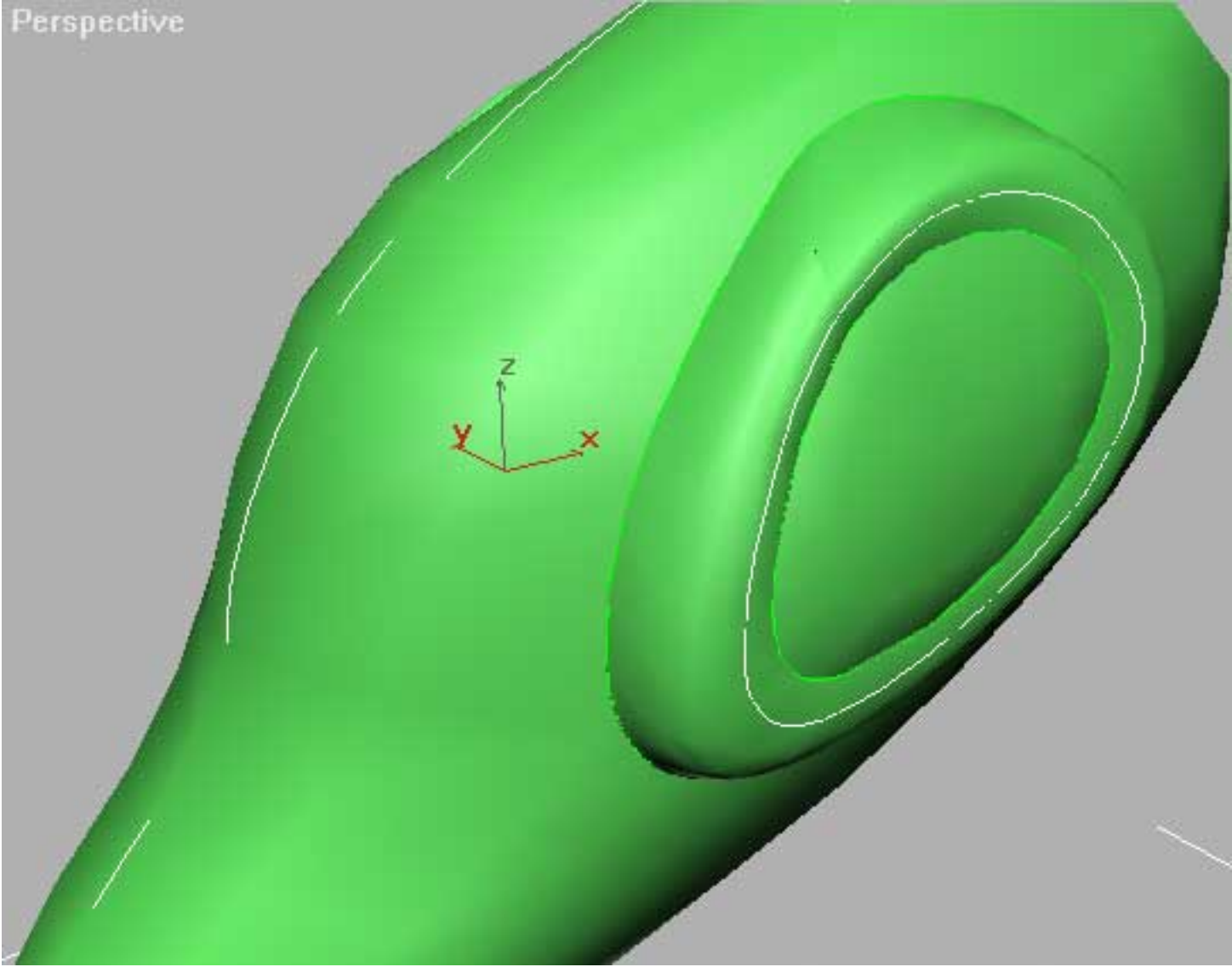


Perspective

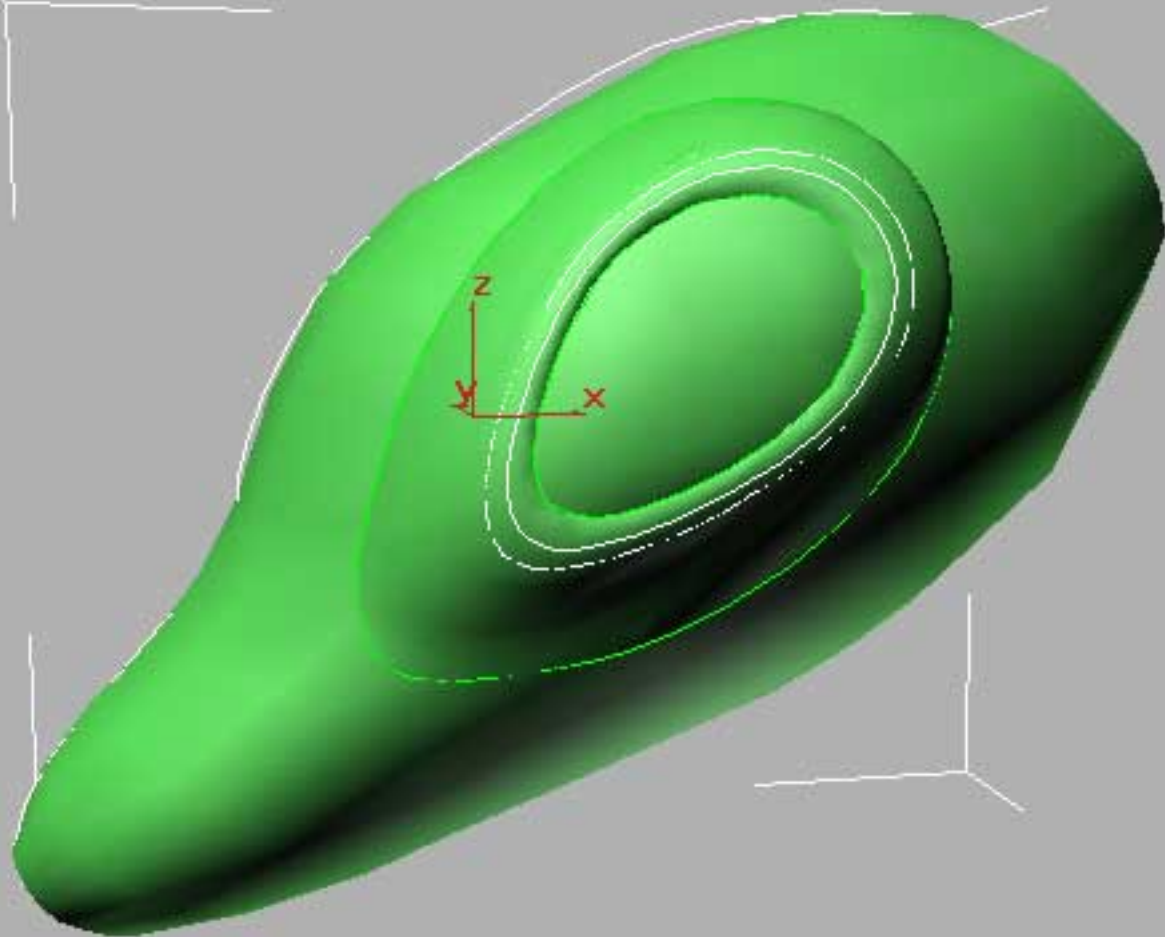




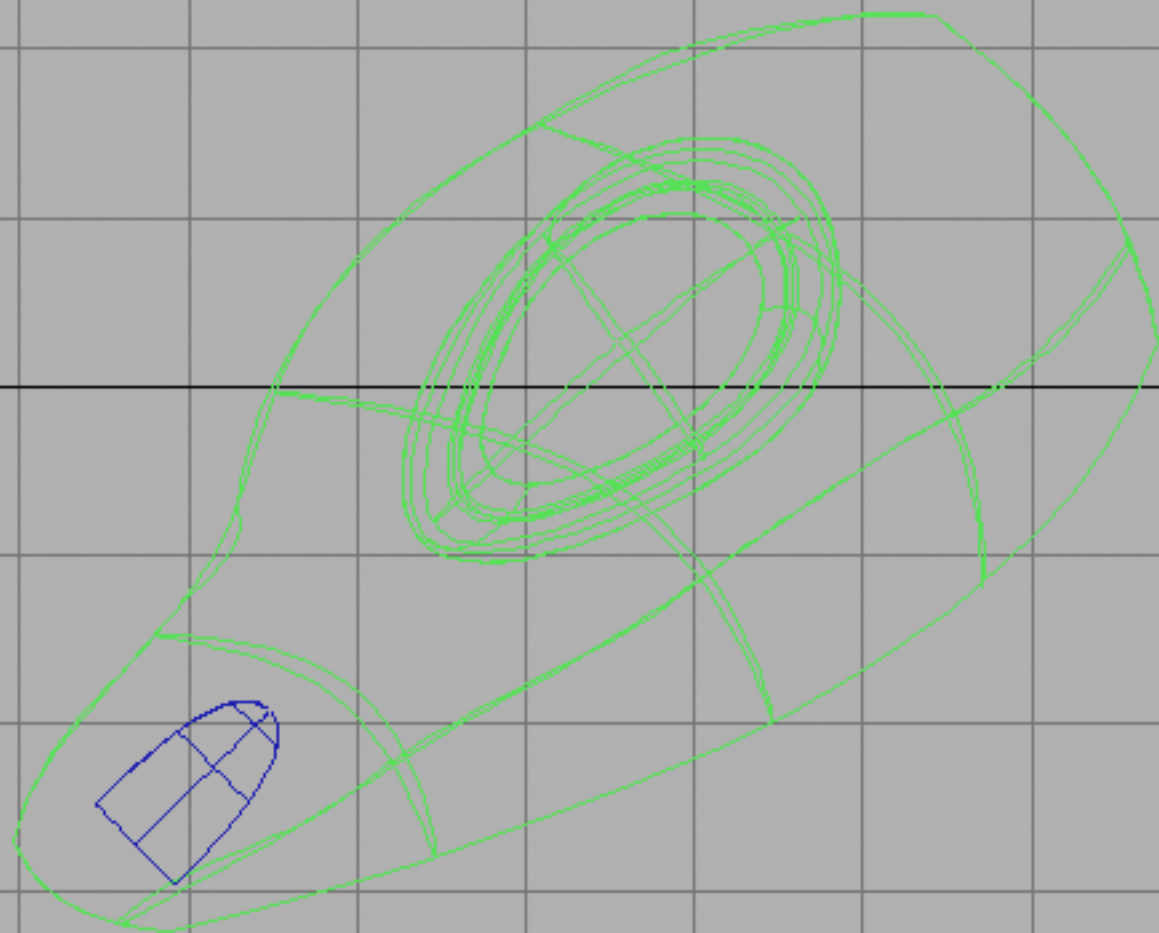
Perspective



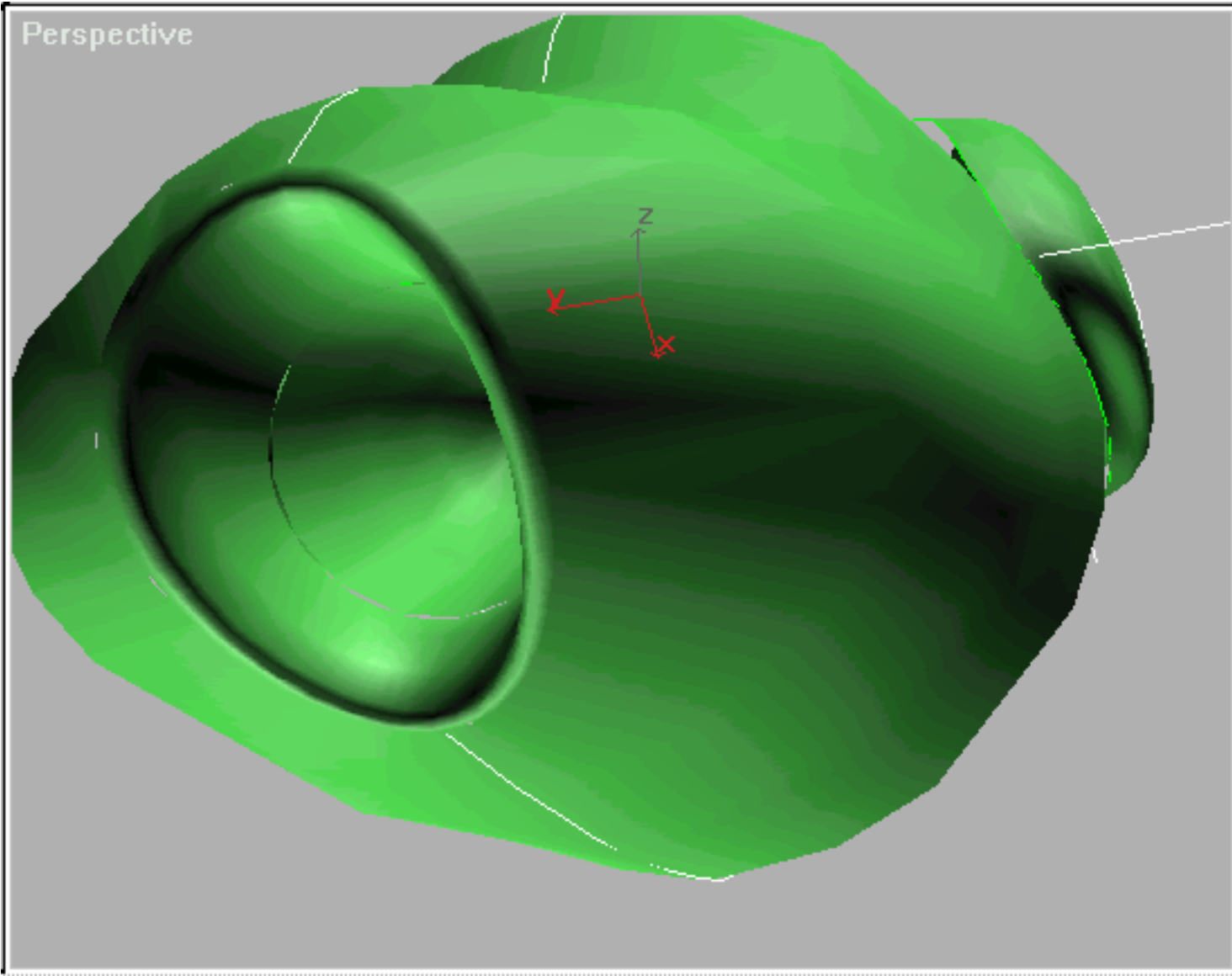
Perspective



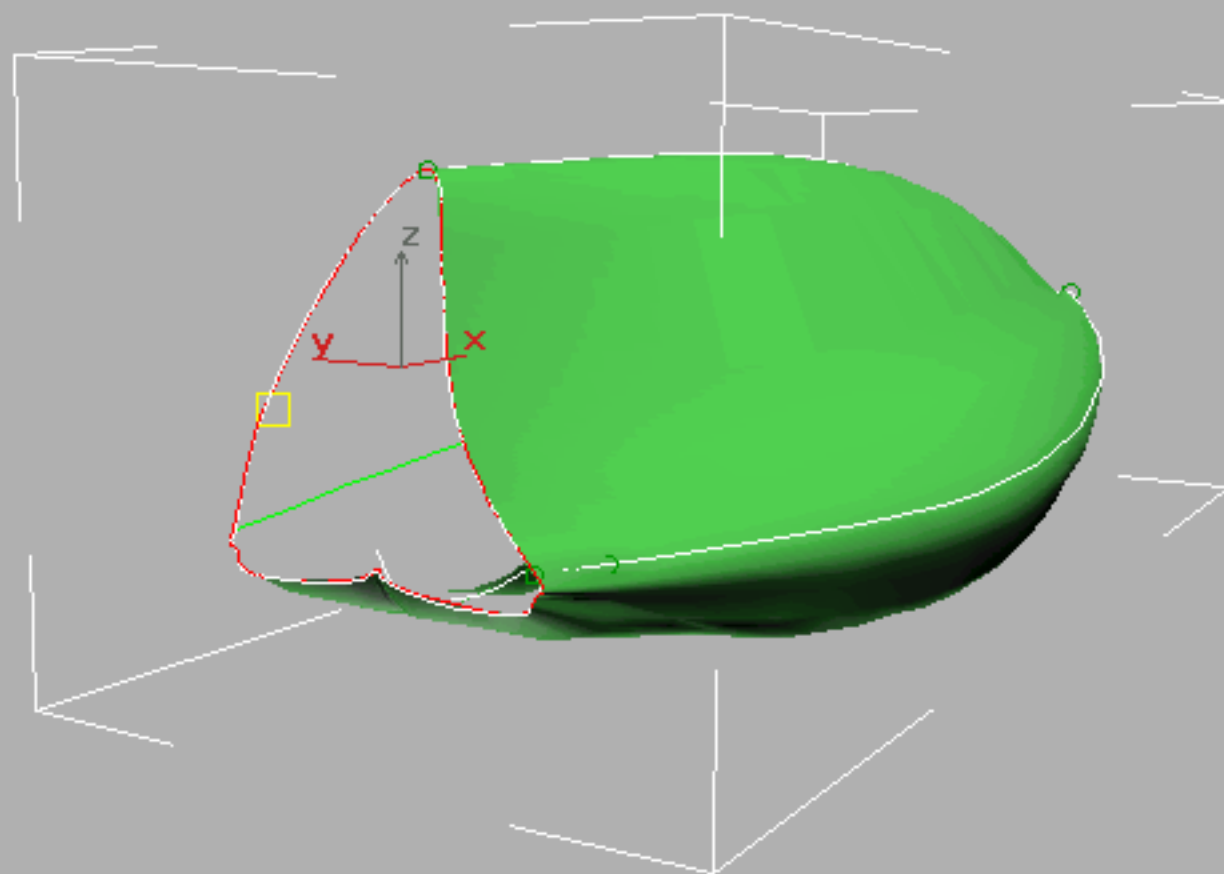
Front



Perspective



Perspective



Name: Blend Curve

Hide

Unhide All

Delete

Make Fit

Reverse

Make COS

Make Independent

Remove Animation

Detach

☐ Copy

Make First

Break

Join

Tolerance: 1.0

Curves Selected: 1

- Iso Curve

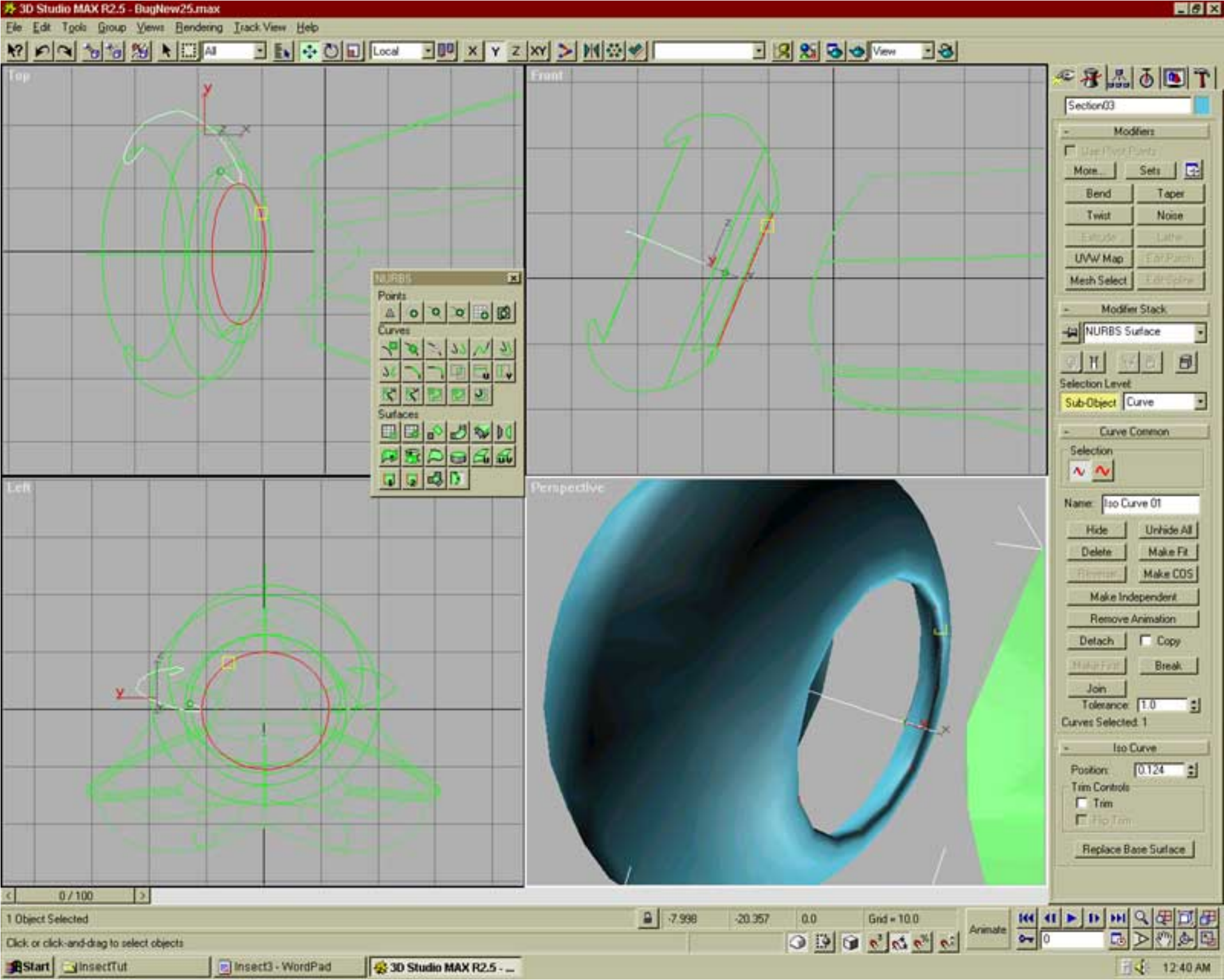
Position: 163.325

Trim Controls

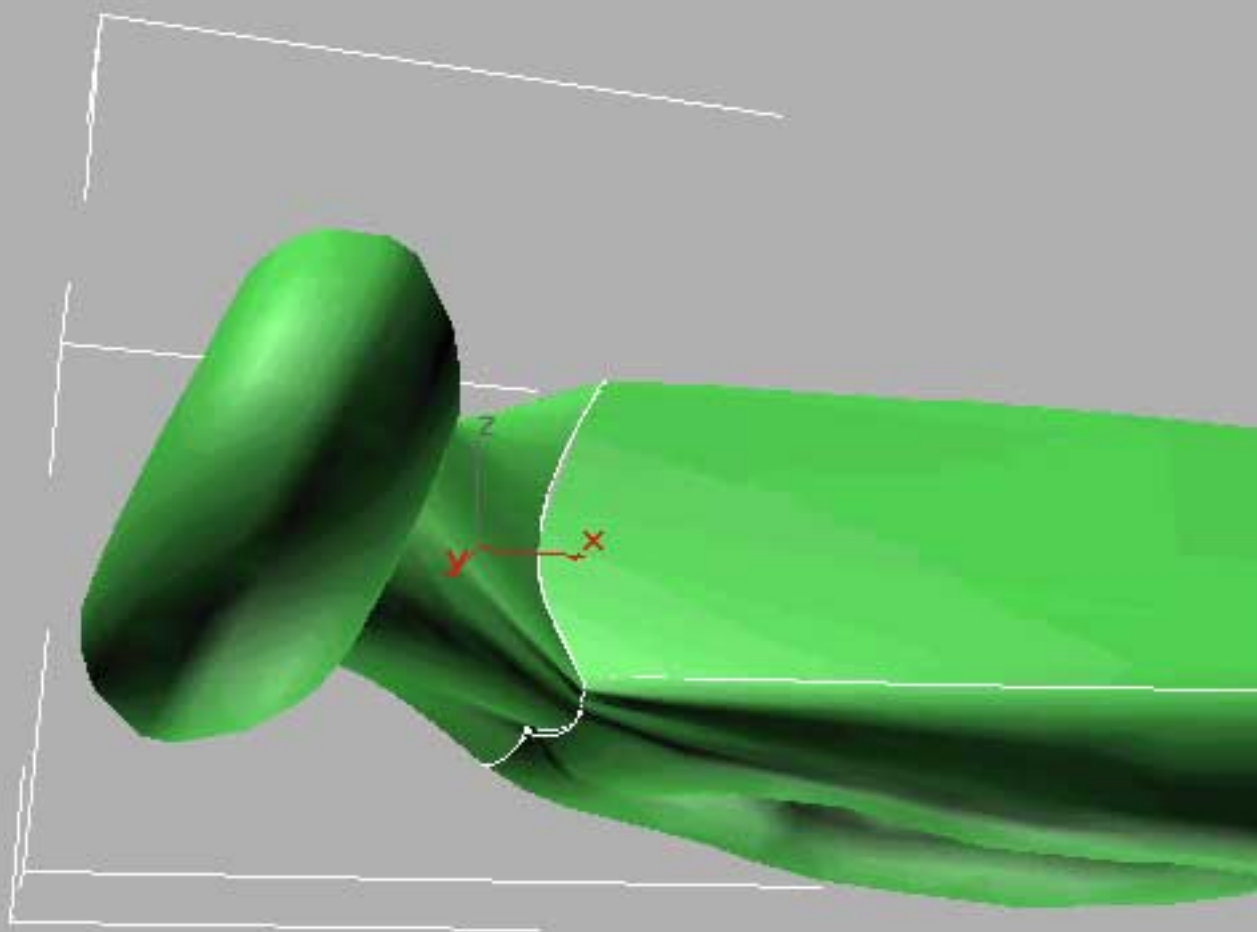
☐ Trim

☐ Flip Trim

Replace Base Surface



Perspective



☐ Display Normals

☐ Flip Normals

Break Row

Break Col.

Break Both

Extend

Join

Tolerance: 1.0

Surfaces Selected: 1

+ Material Properties

- U Loft Surface

U Curves:



Blend 2 Curve

Blend Curve

----- End -----

☐ Reverse Curve

Insert

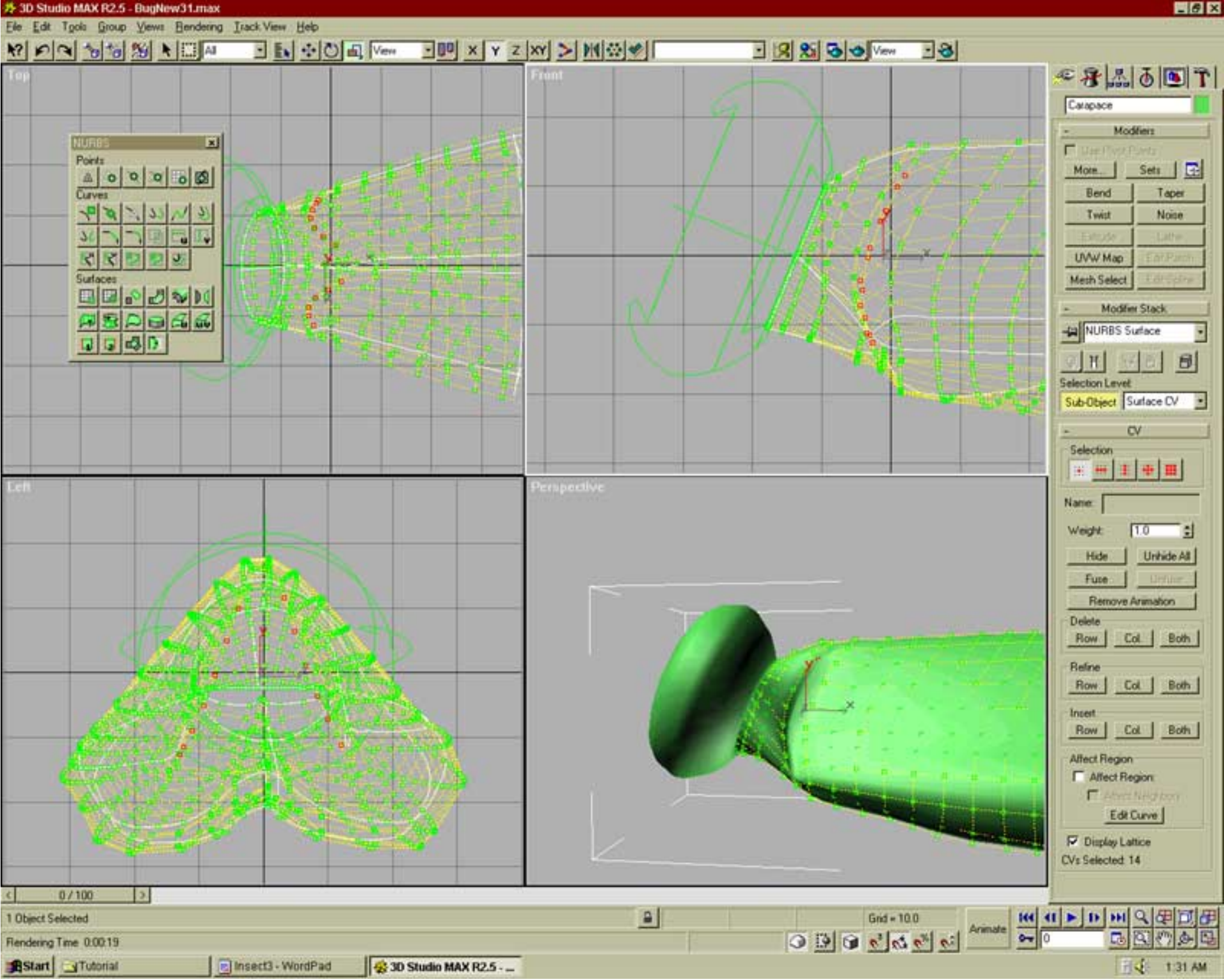
Remove

Refine

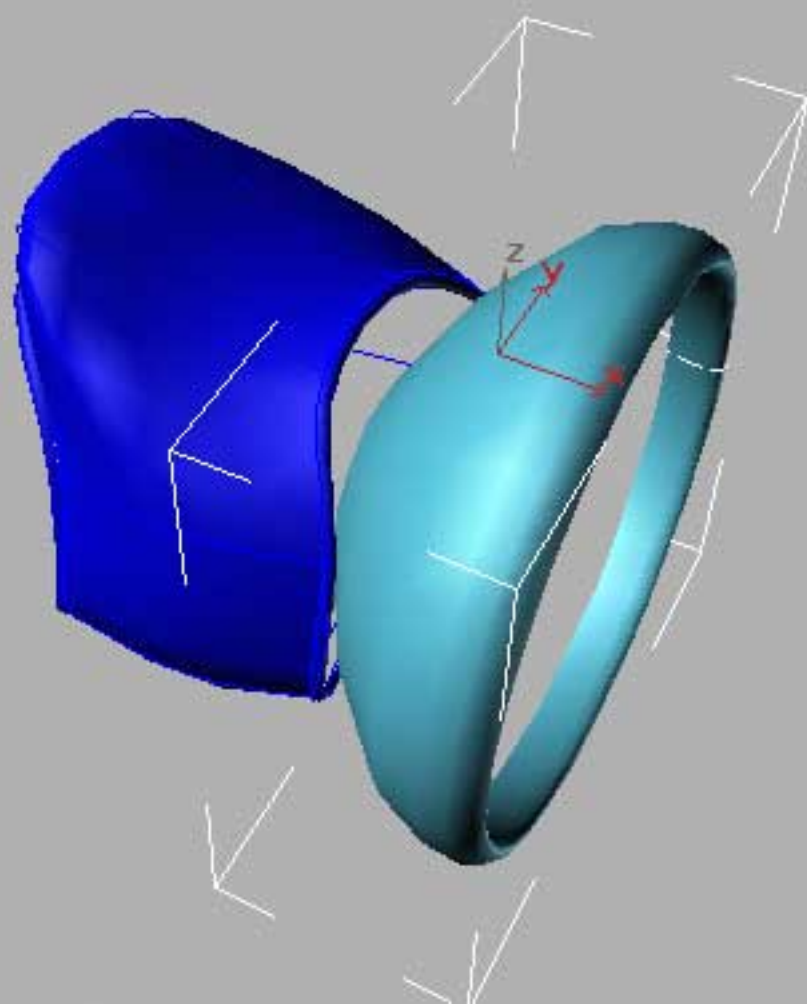
Replace

☒ Display Iso Curves

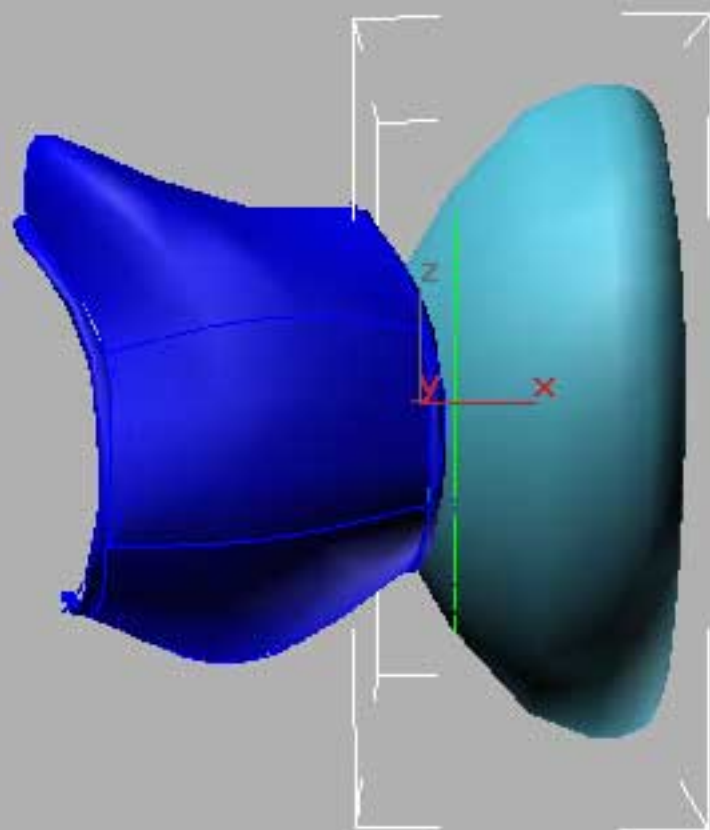
Edit Curves



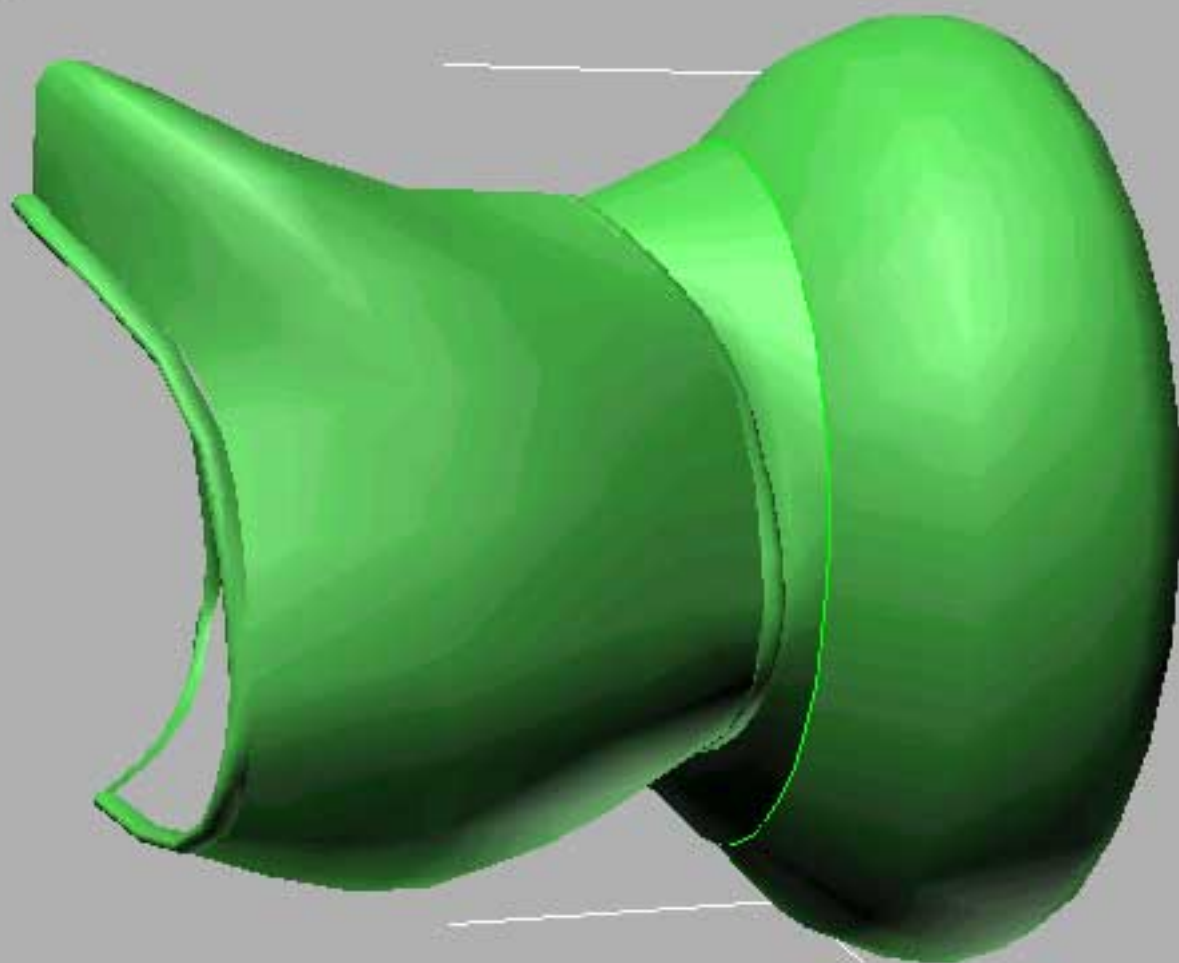
Perspective

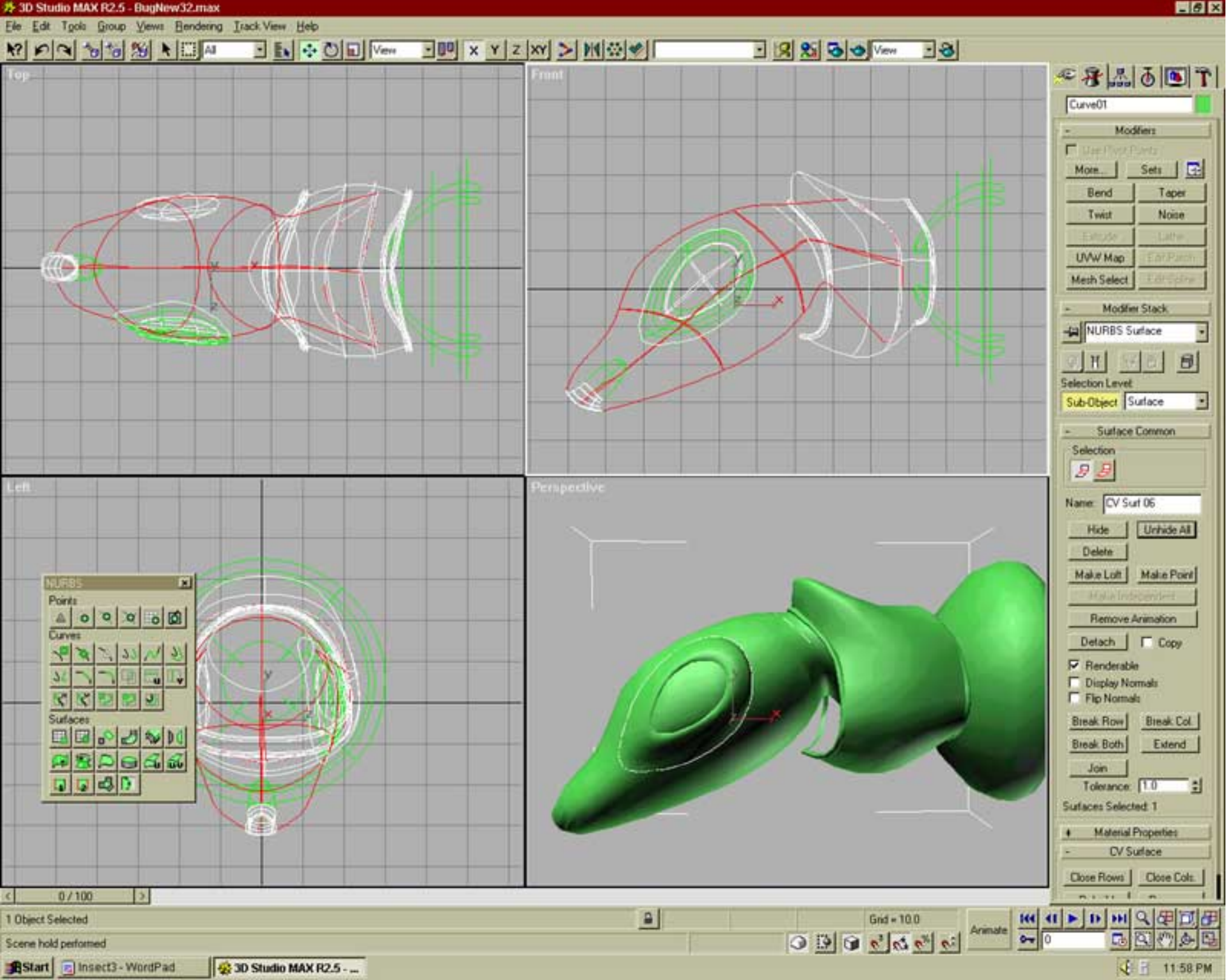


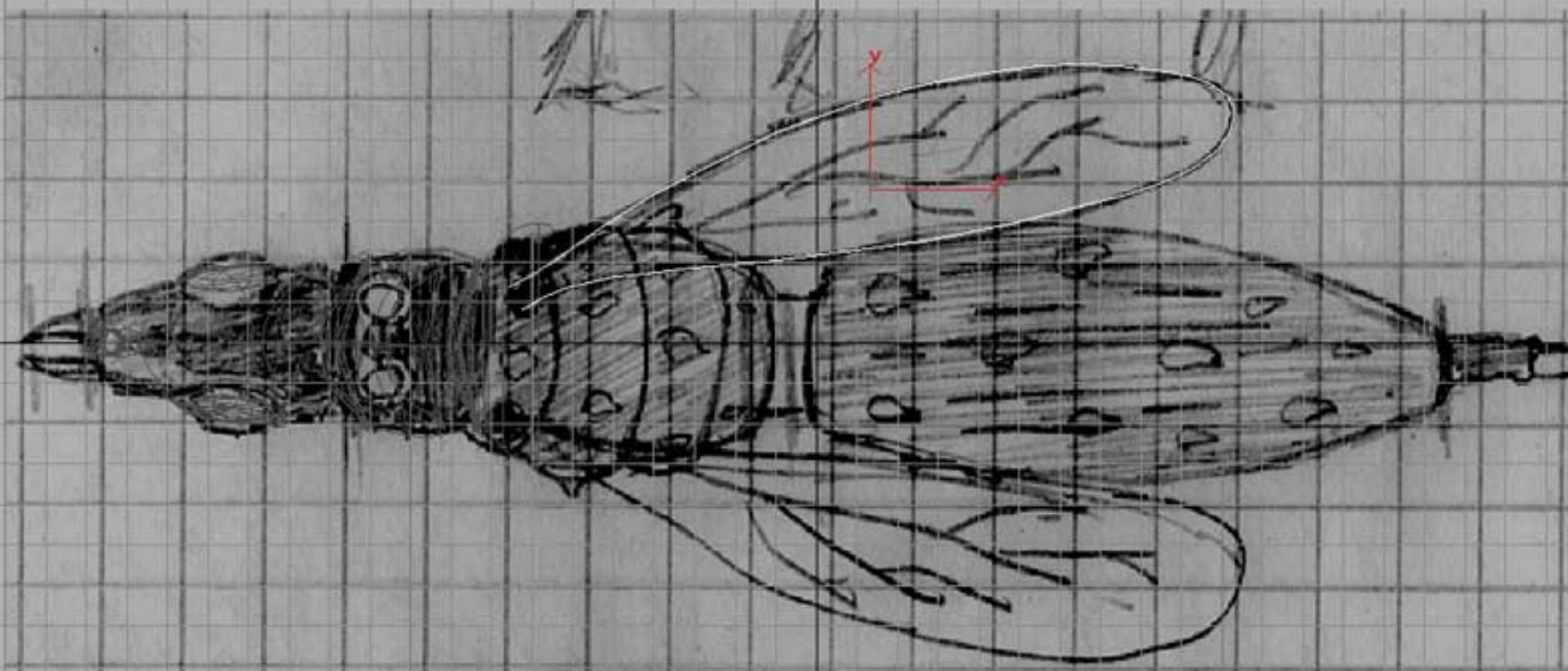
Perspective

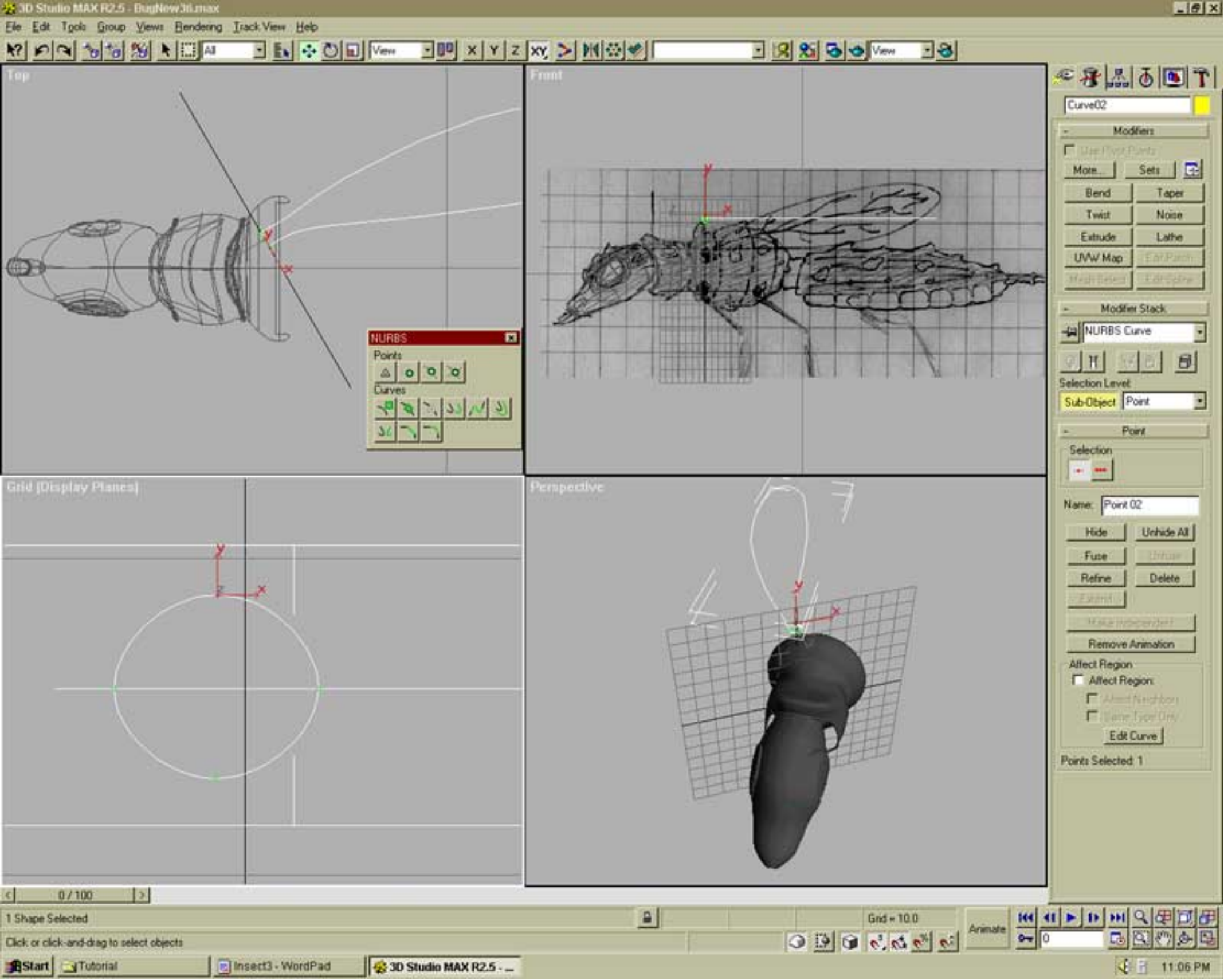


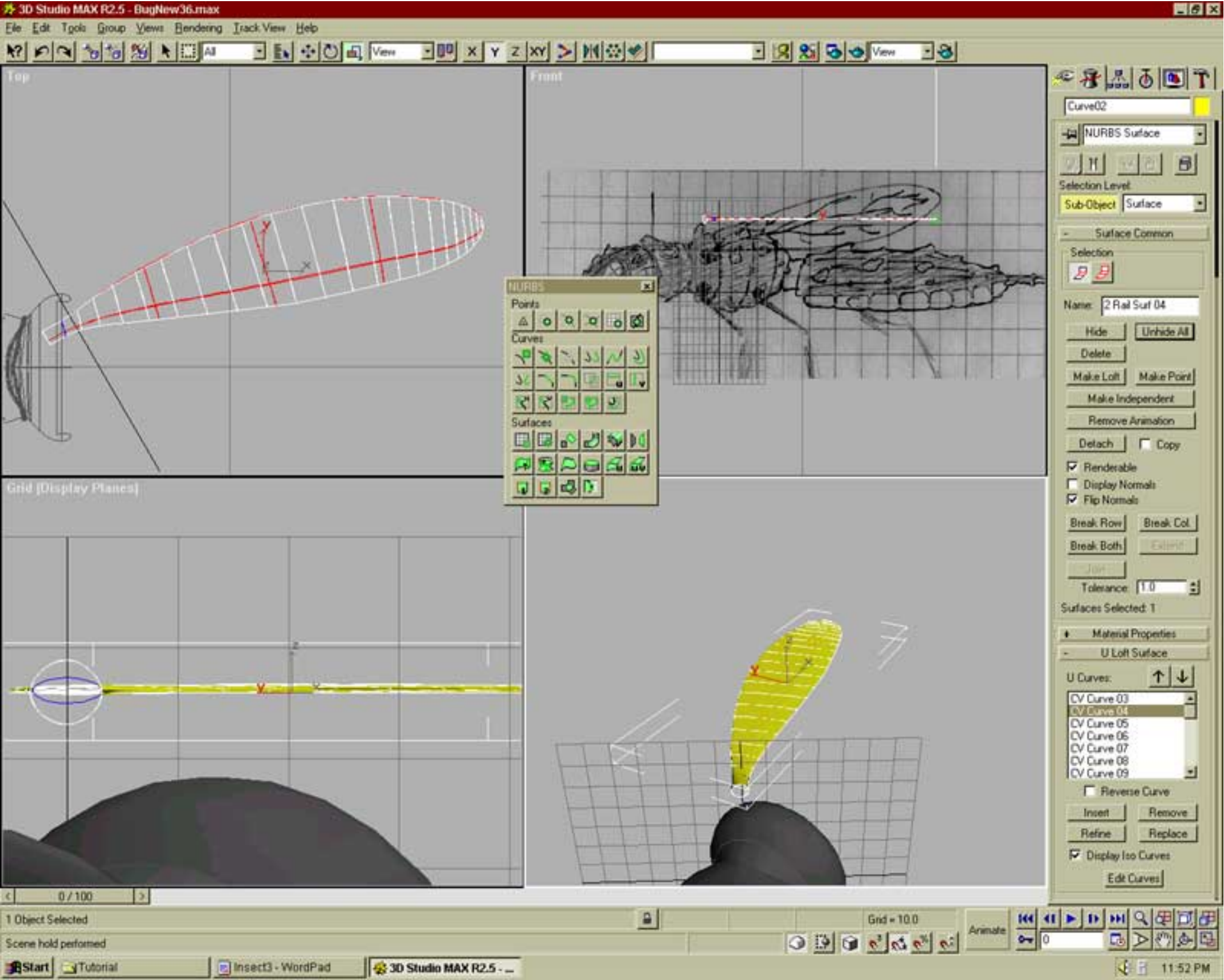
Perspective

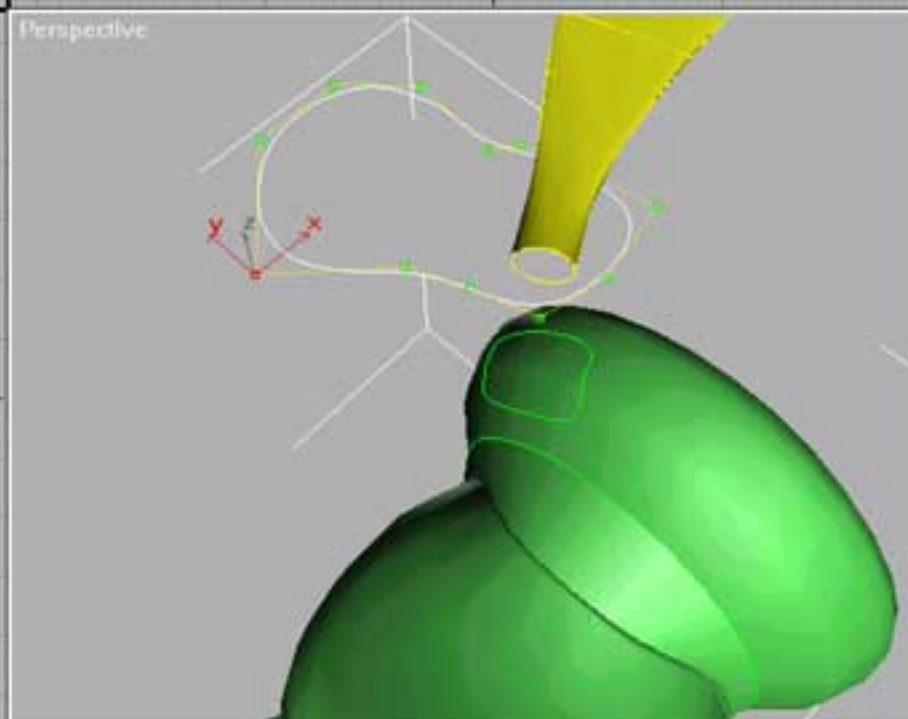
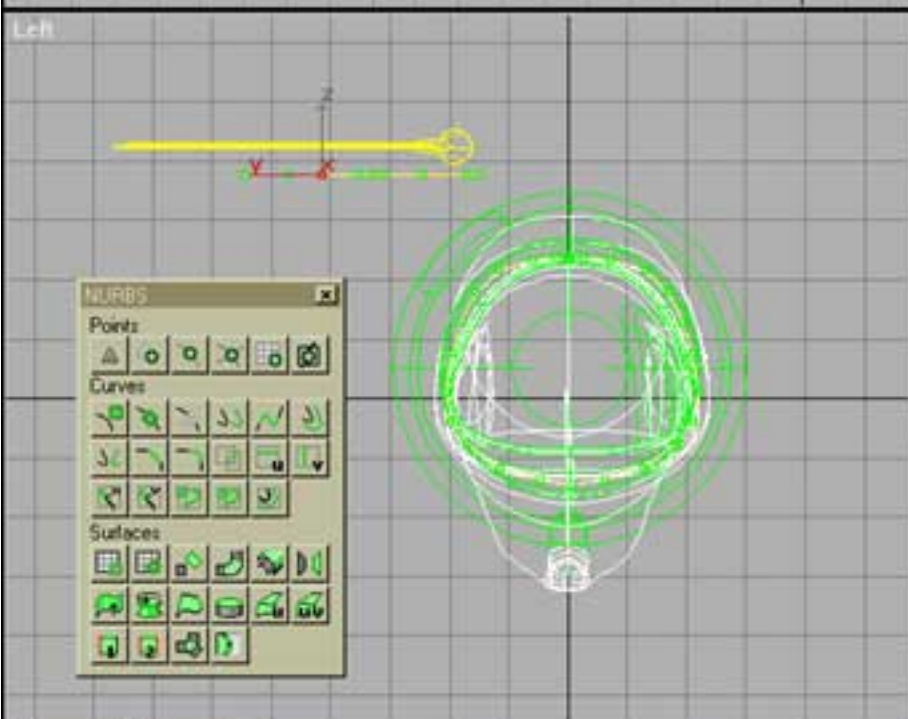
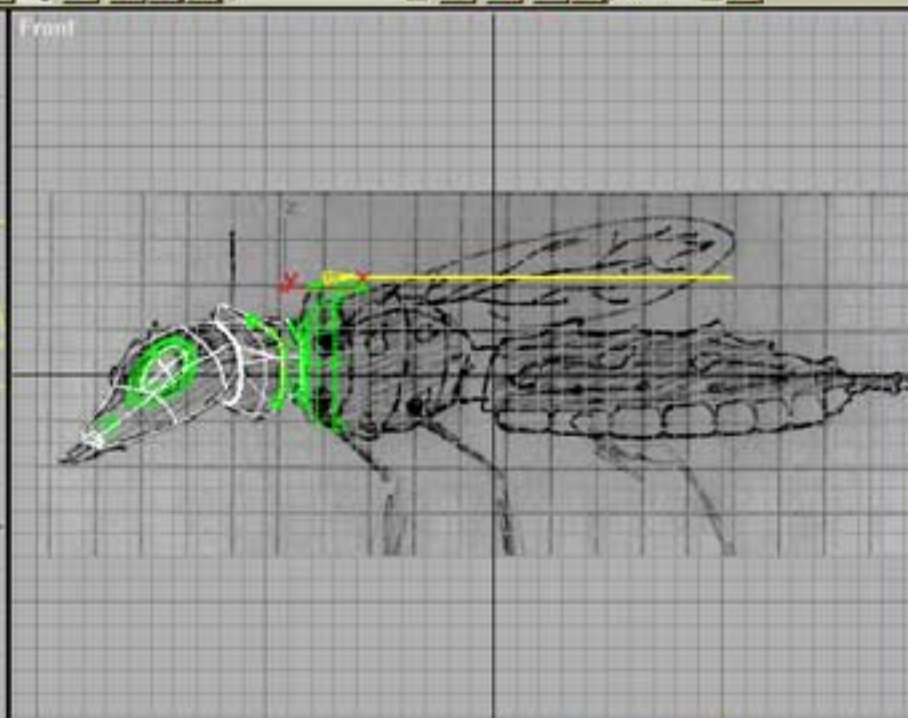
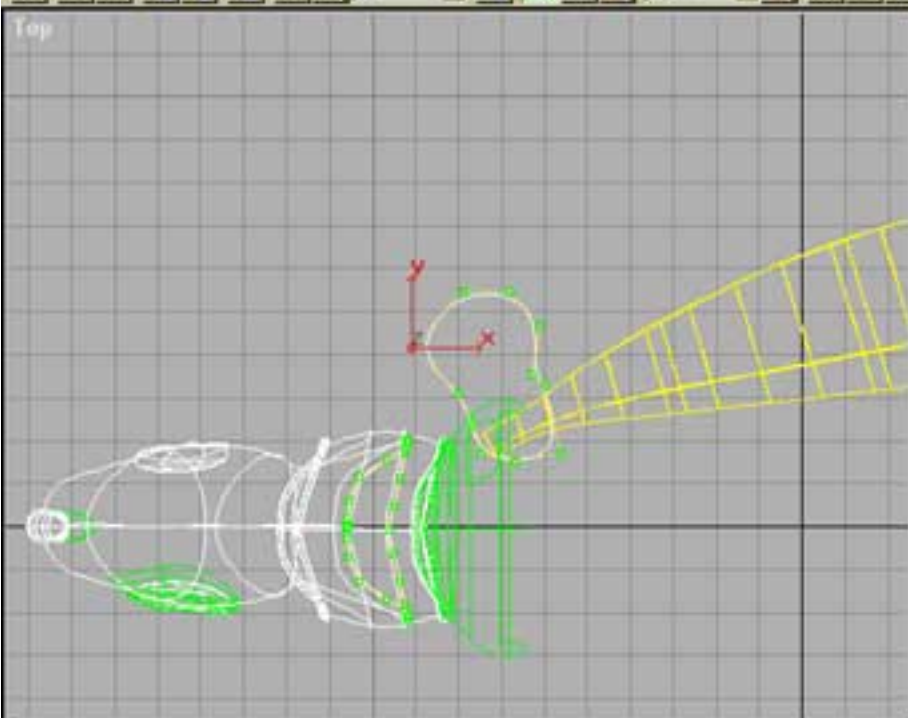












Curve01

Modifiers

☐ Use First Points

More... Sets

Bend Taper

Twist Noise

Extrude Lattice

UVW Map Edit Patch

Mesh Select Edit Outline

Modifier Stack

NURBS Surface

Selection Level

Sub-Object Curve CV

CV

Selection

Name: CV 3222

Weight: 1.0

Hide Unhide All

Fuse Unfuse

Refine Delete

Insert Extend

Remove Animation

Affect Region

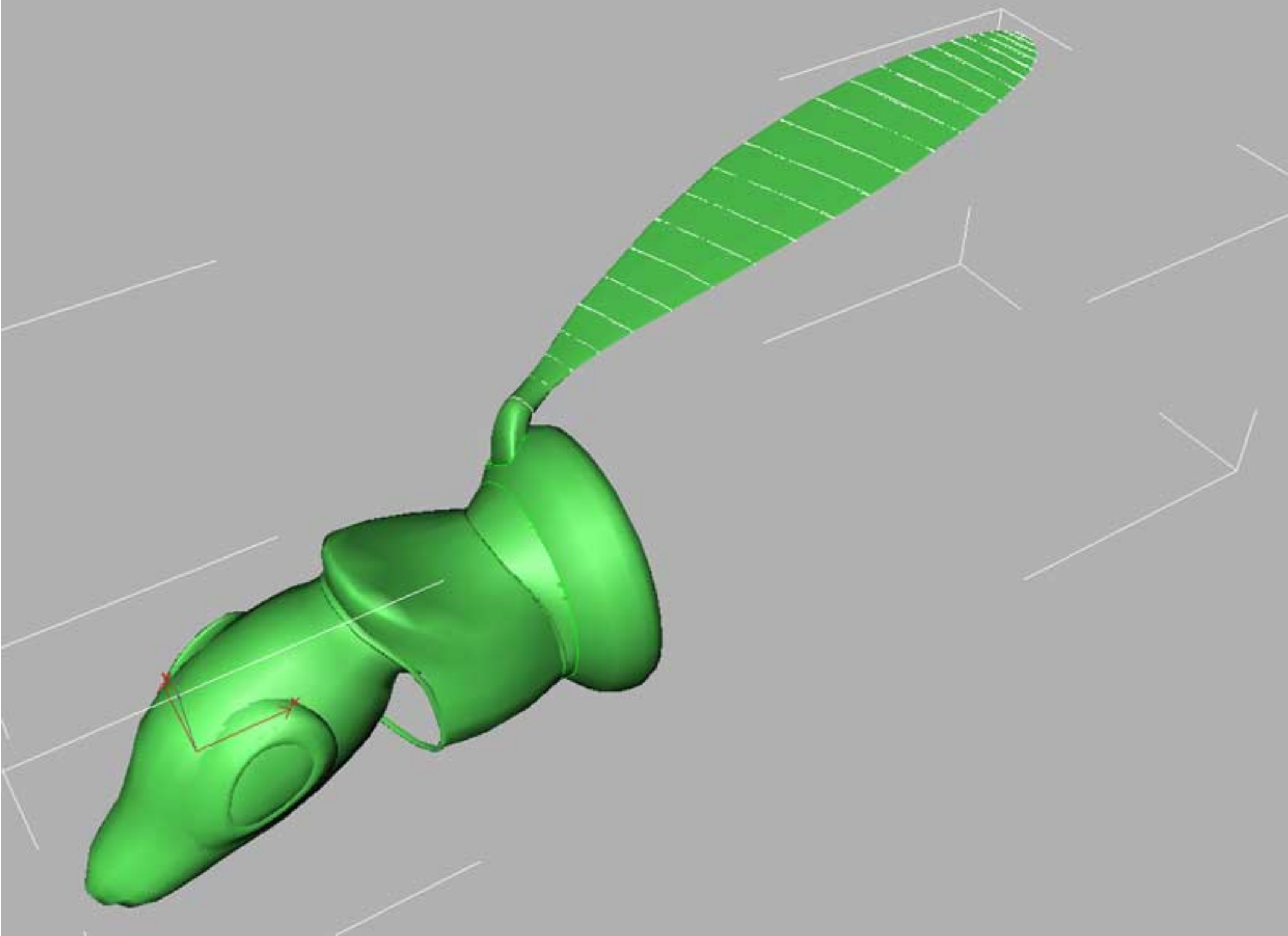
☒ Affect Region

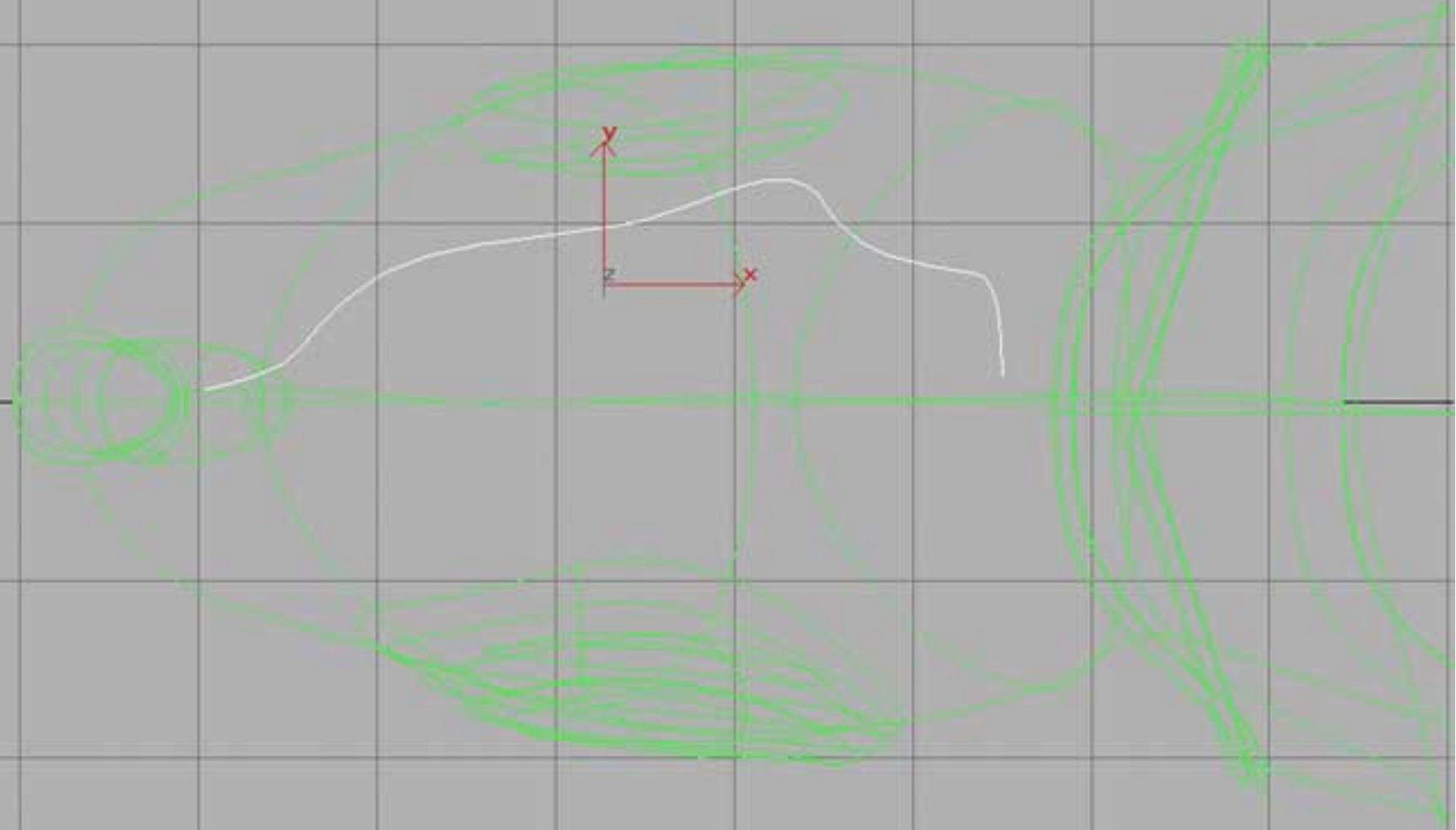
☐ Affect Neighbors

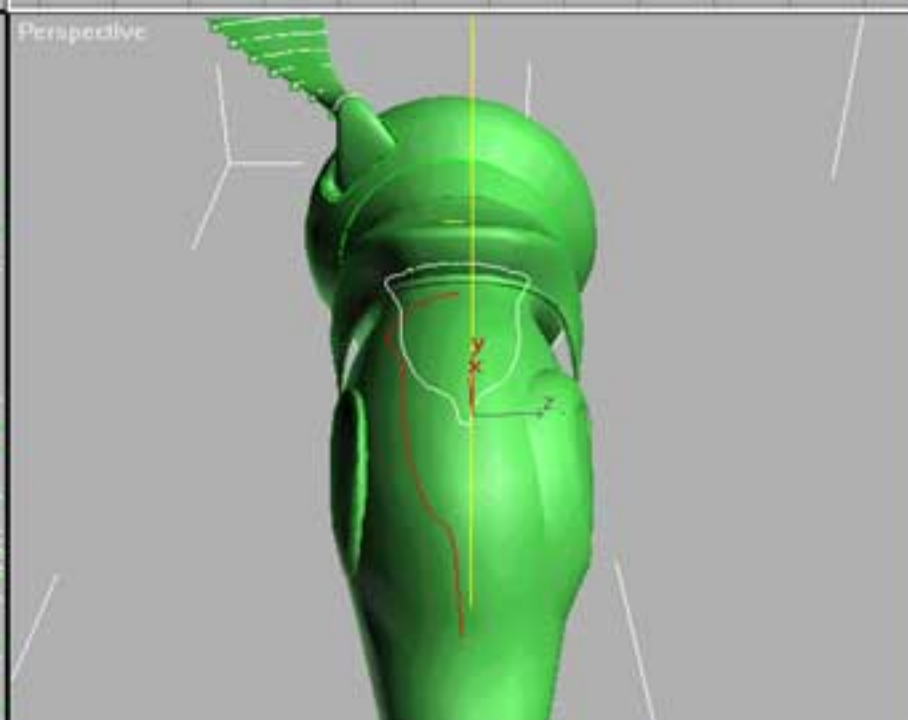
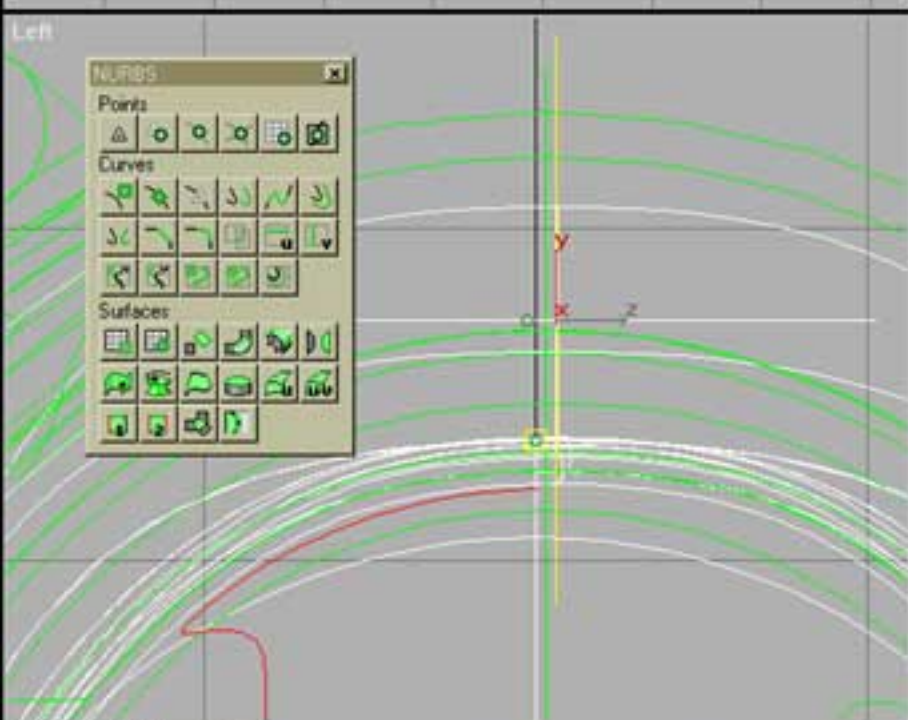
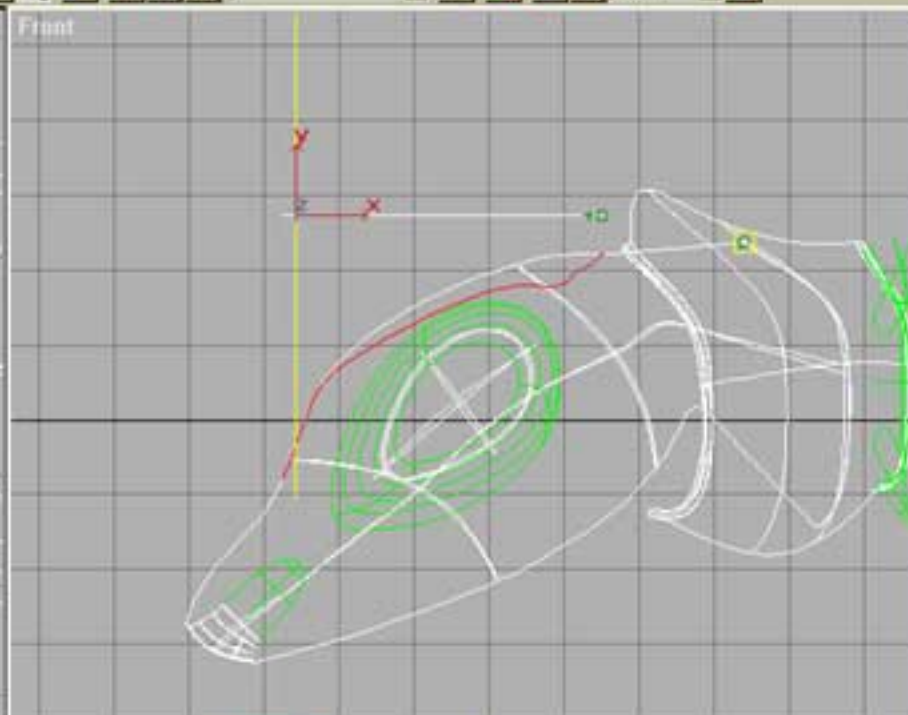
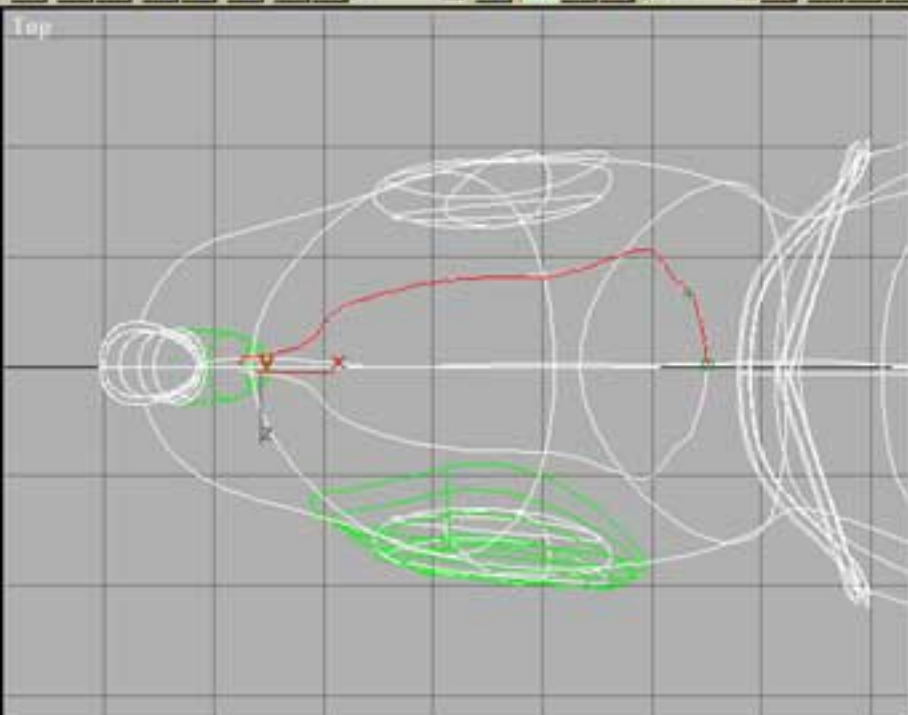
Edit Curve

☒ Display Lattice

CVs Selected: 1







Curve01

☐ Use Pivot Points

More... Sets

Bend Taper

Twist Noise

Extrude Lathe

UVW Map Edit Patch

Mesh Select Edit Spline

Modifier Stack

NURBS Surface

Selection Level

Sub-Object Curve

Curve Common

Selection

Name: Vector Projected Cur

Hide Unhide All

Delete Make Fit

Reverse Make CDS

Make Independent

Remove Animation

Detach ☐ Copy

Make First Break

Join

Tolerance: 1.0

Curves Selected: 1

Vector Projected Curve

Trim Controls

☐ Trim

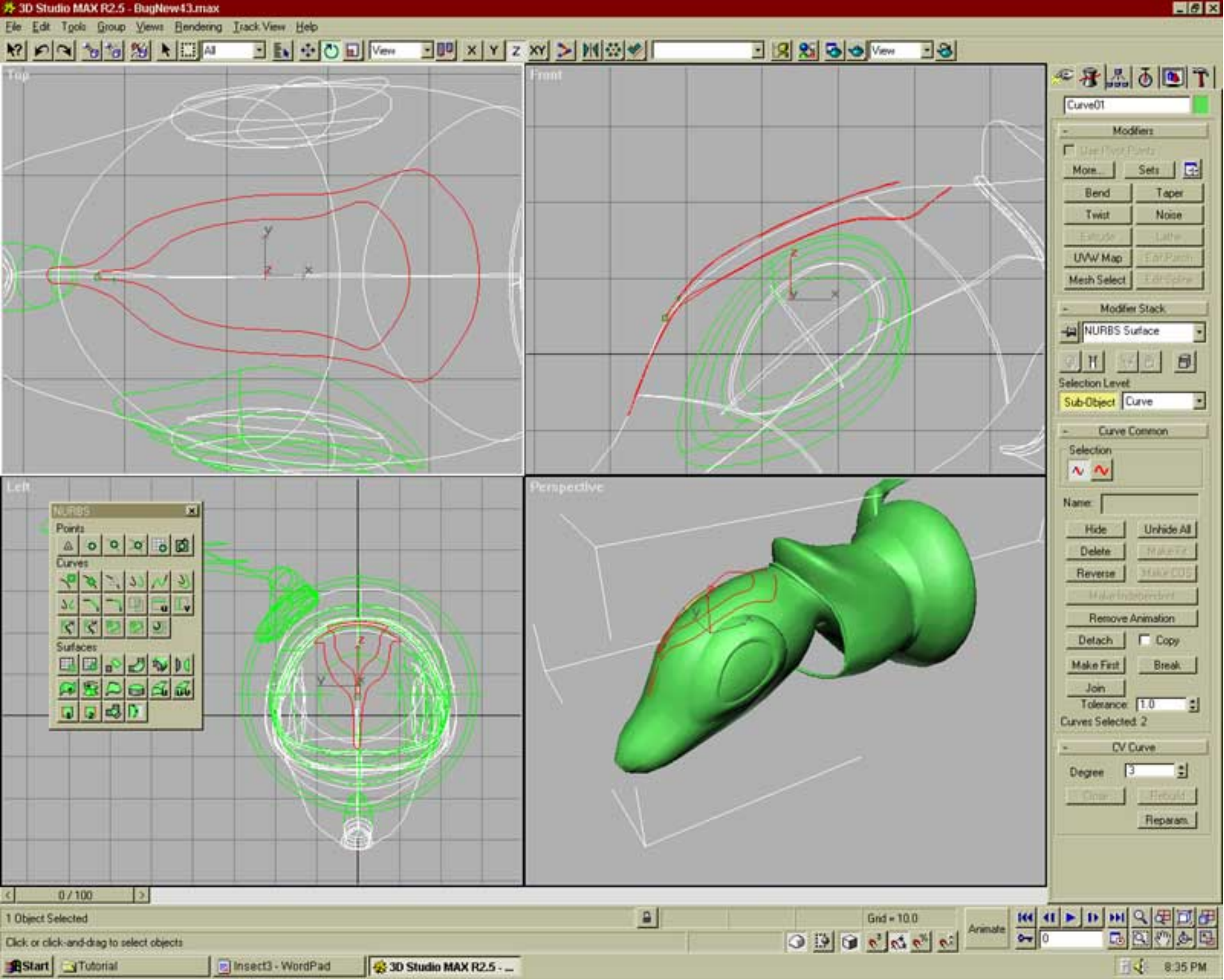
☐ Flip Trim

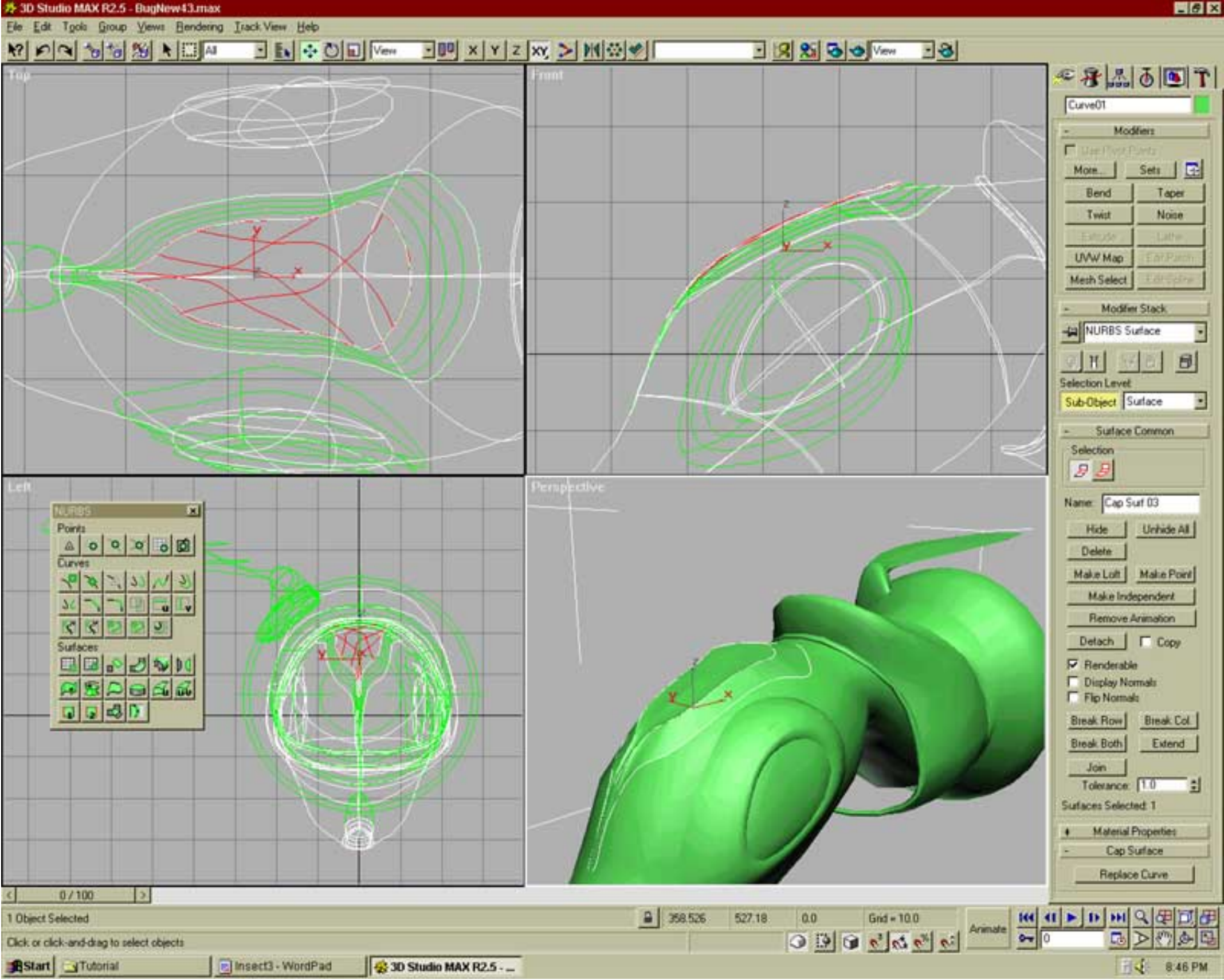
U Seed: 0.0

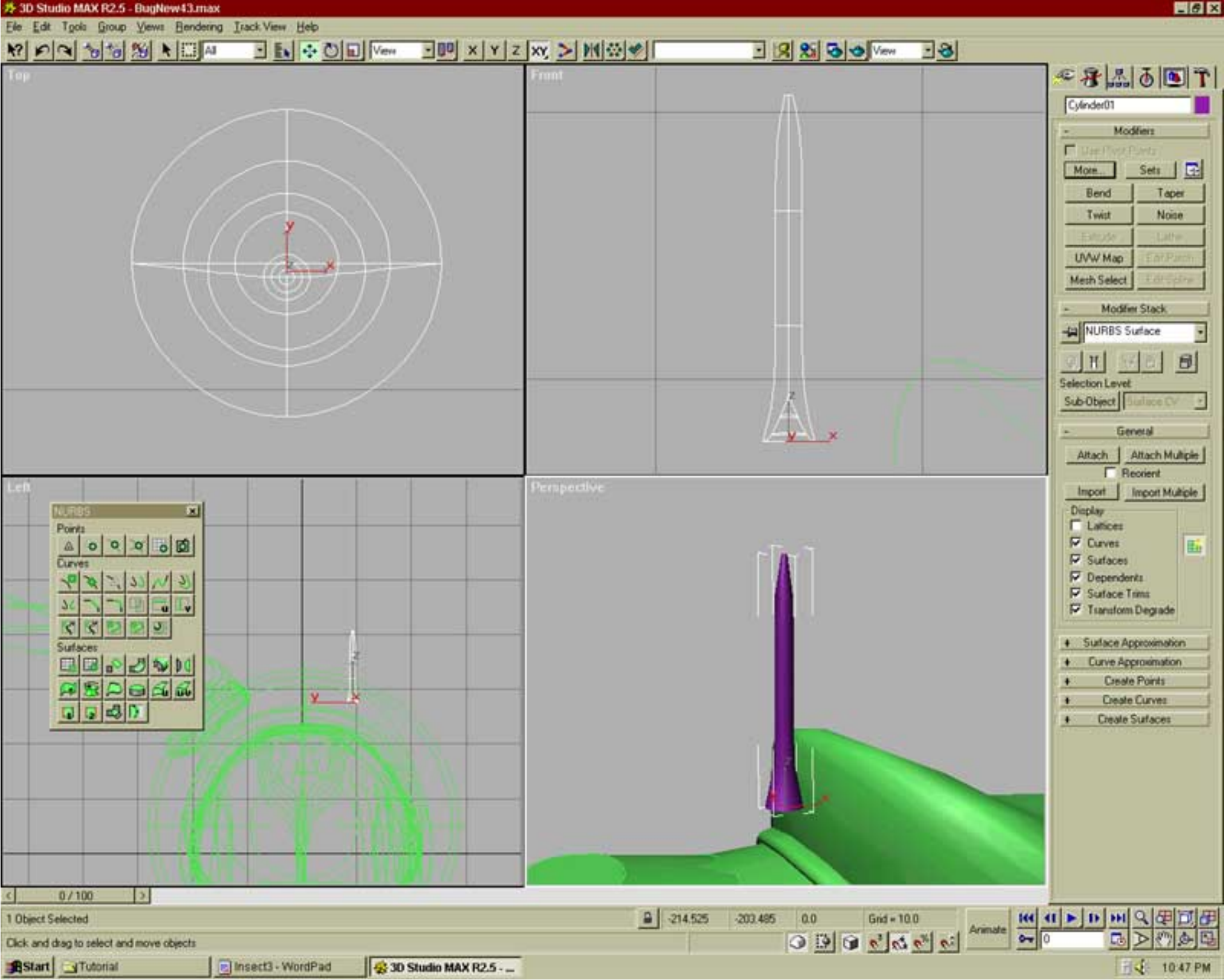
V Seed: 0.0

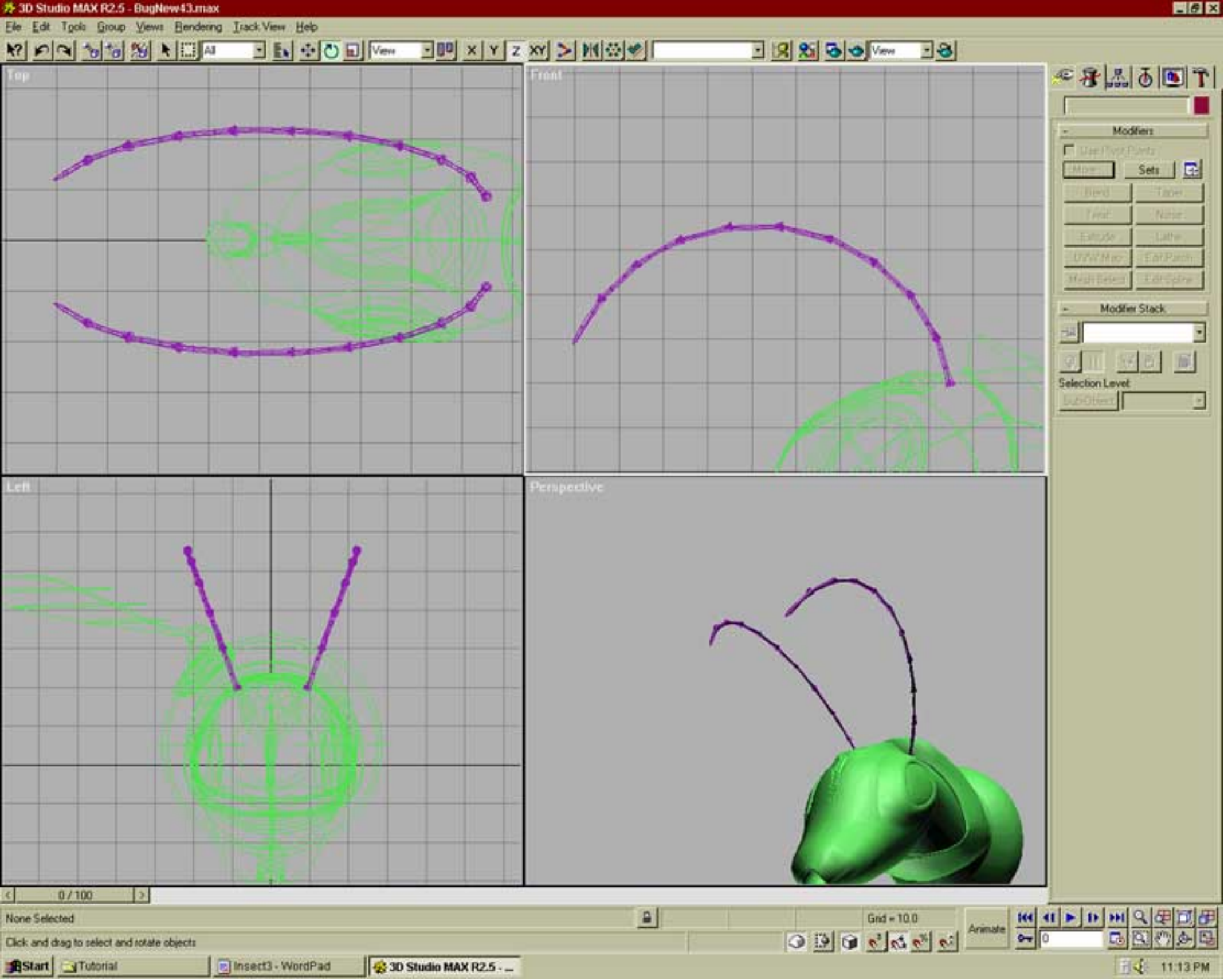
Replace Curve

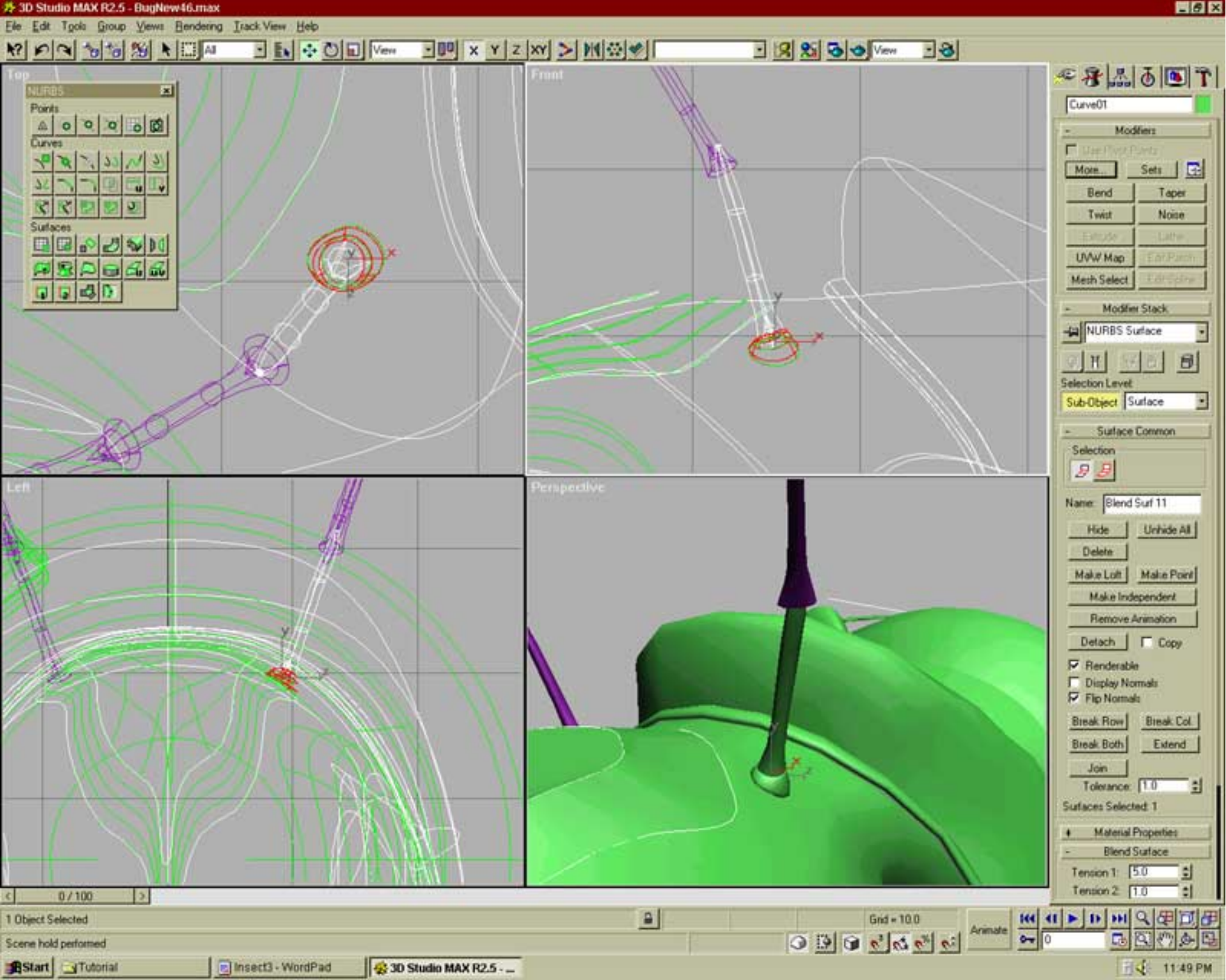
Replace Surface

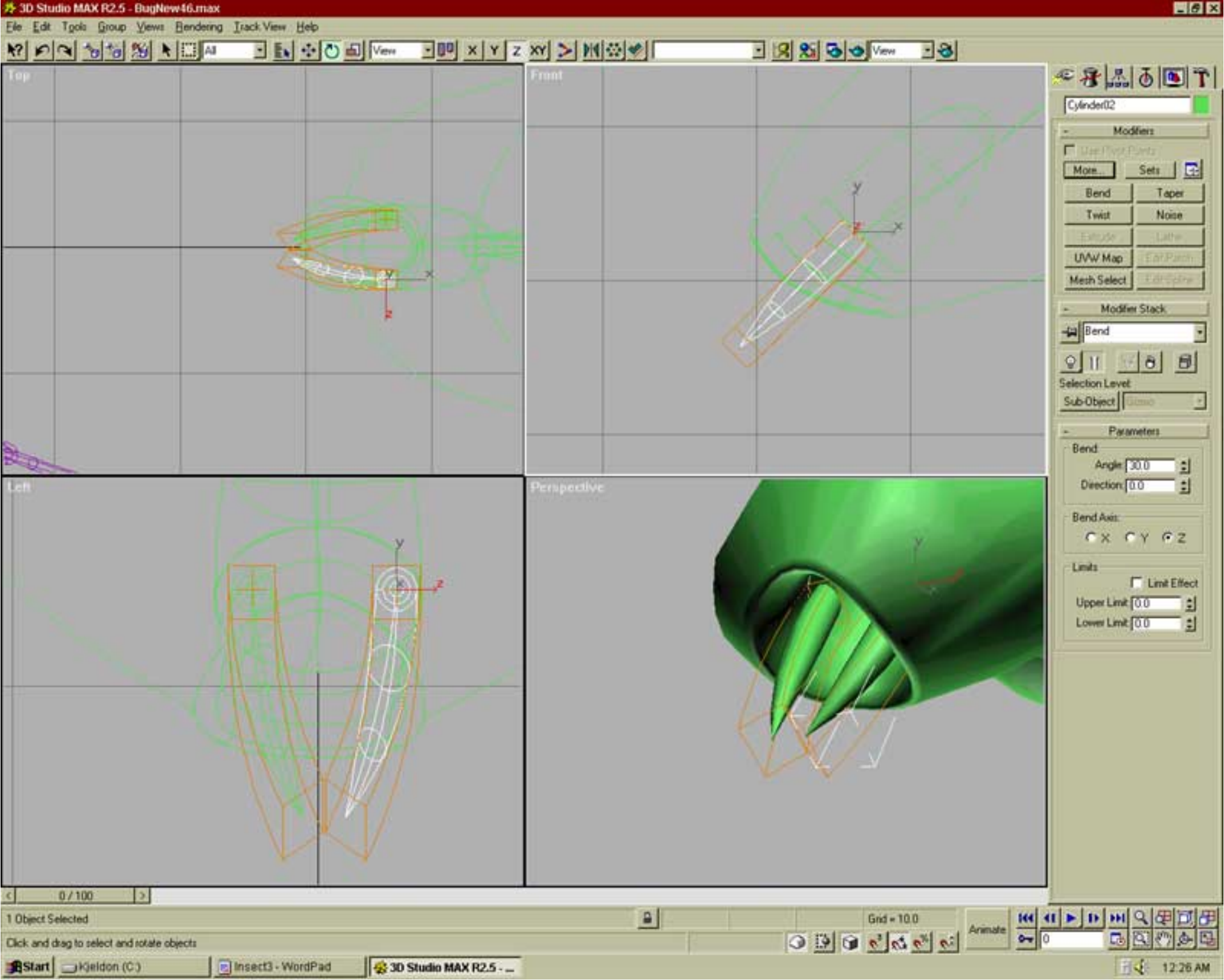




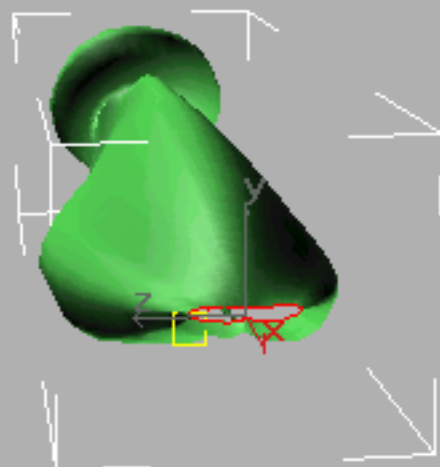








Perspective



Name: Iso Curve 01

Hide

Unhide All

Delete

Make Fit

Reverse

Make COS

Make Independent

Remove Animation

Detach

☐ Copy

Make First

Break

Join

Tolerance: 1.0

Curves Selected: 1

- Iso Curve

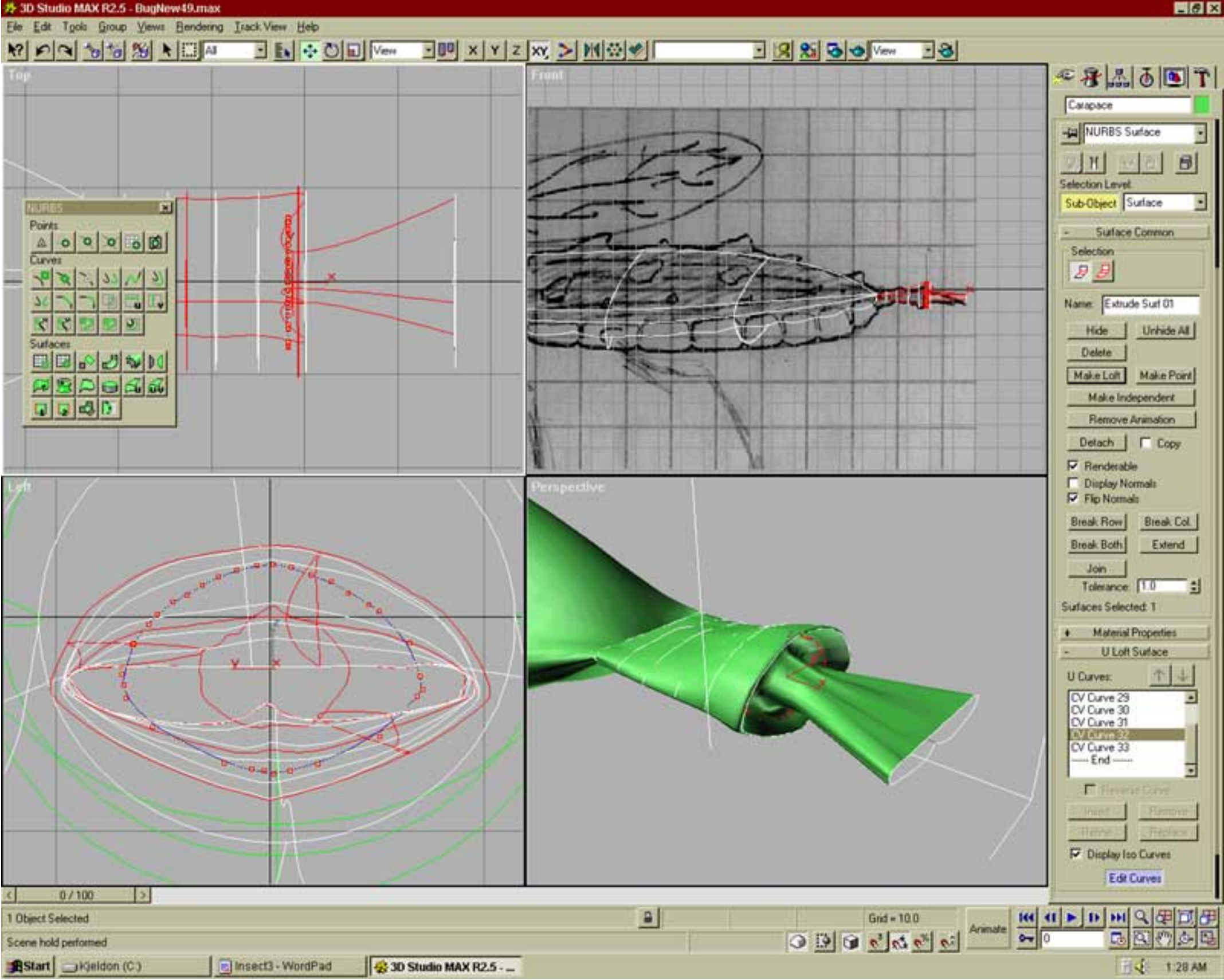
Position: 74.2

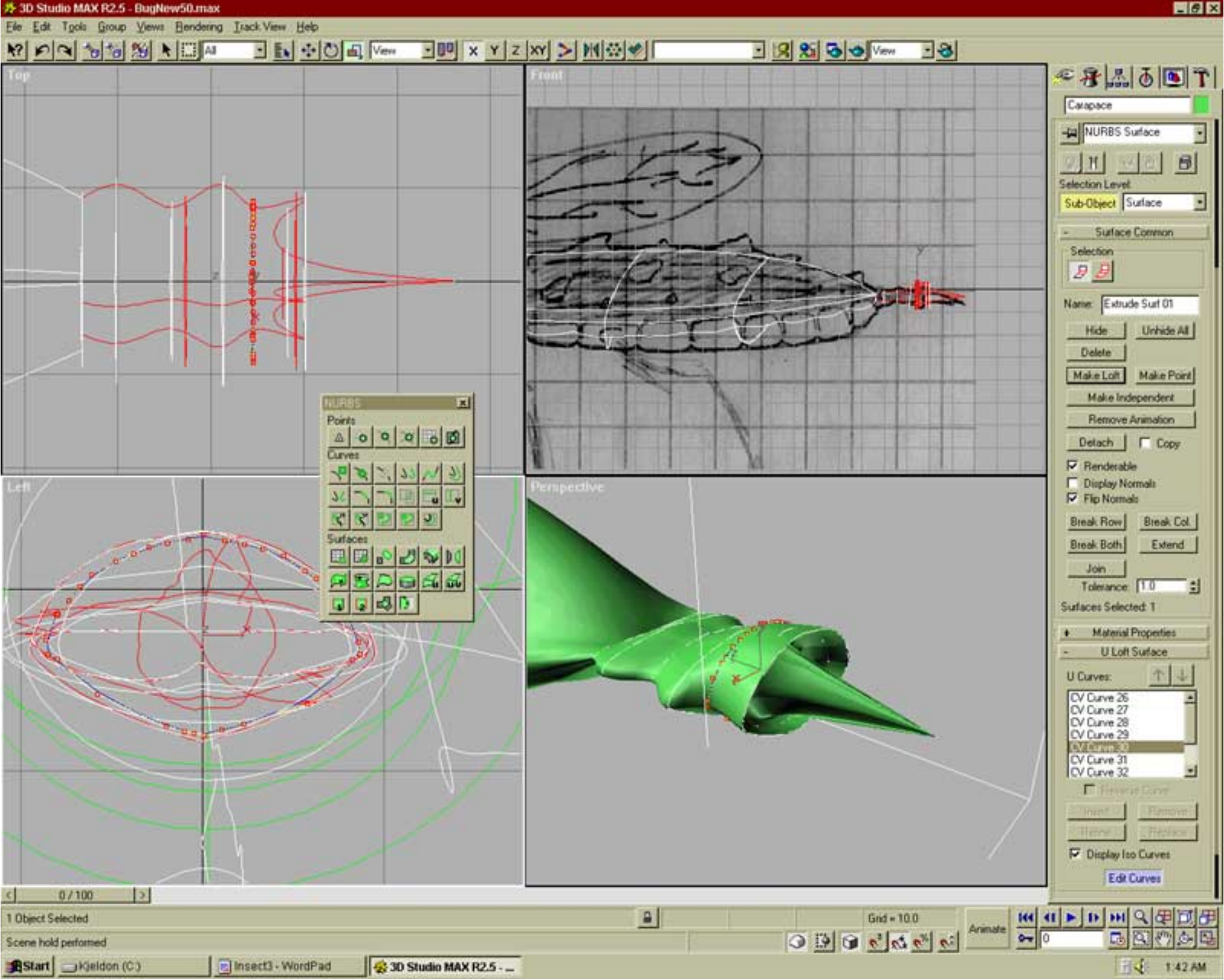
Trim Controls

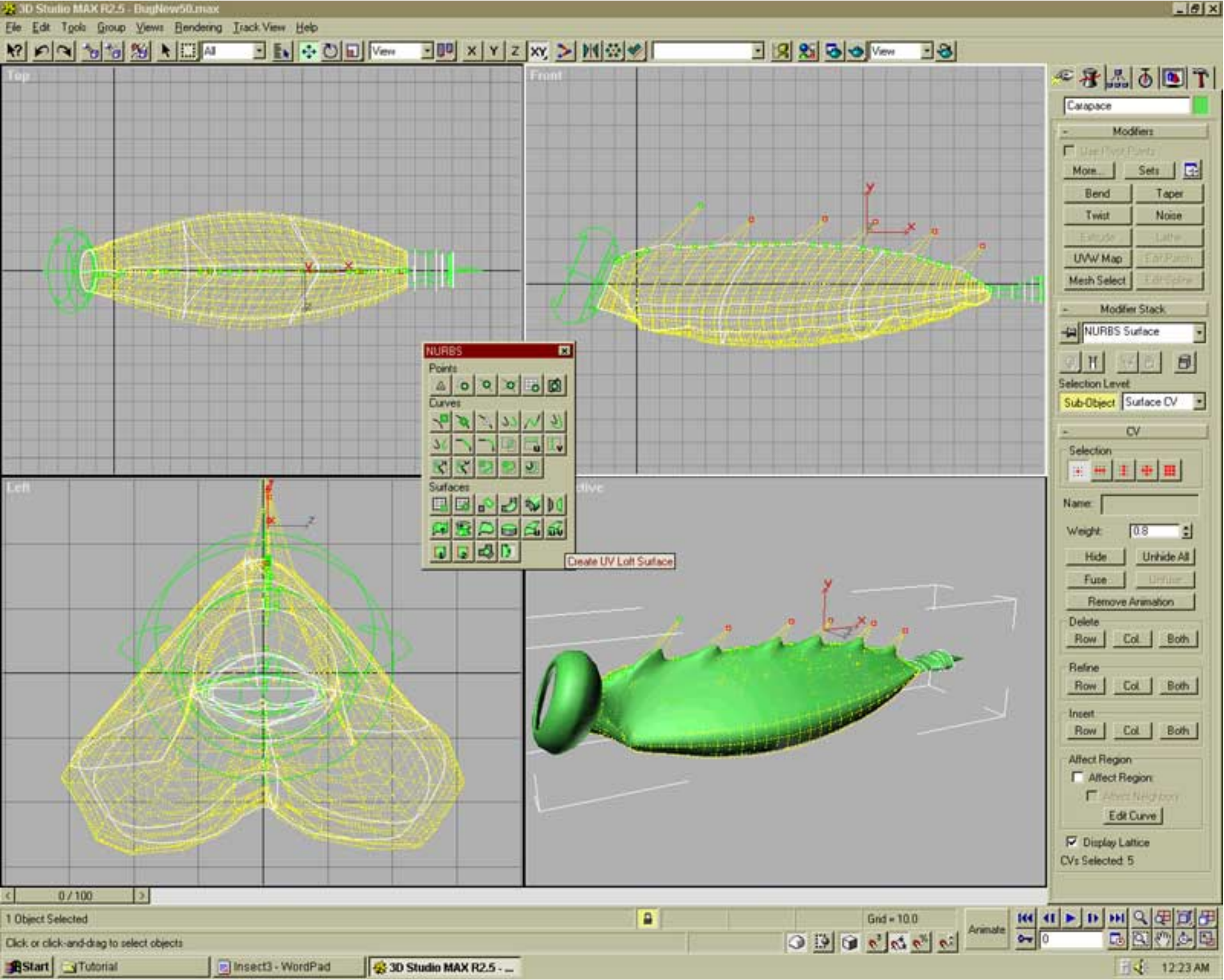
☐ Trim

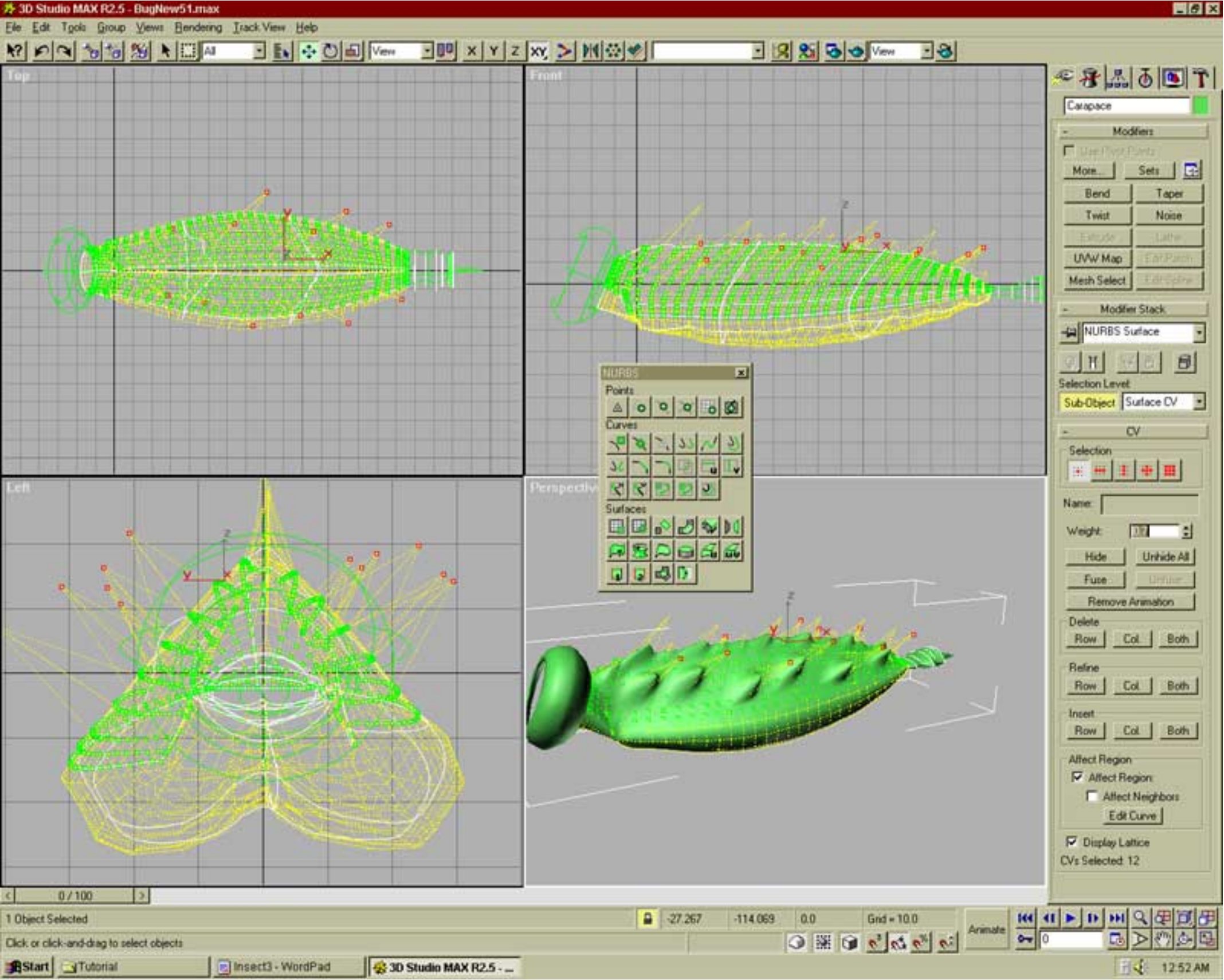
☐ Flip Trim

Replace Base Surface

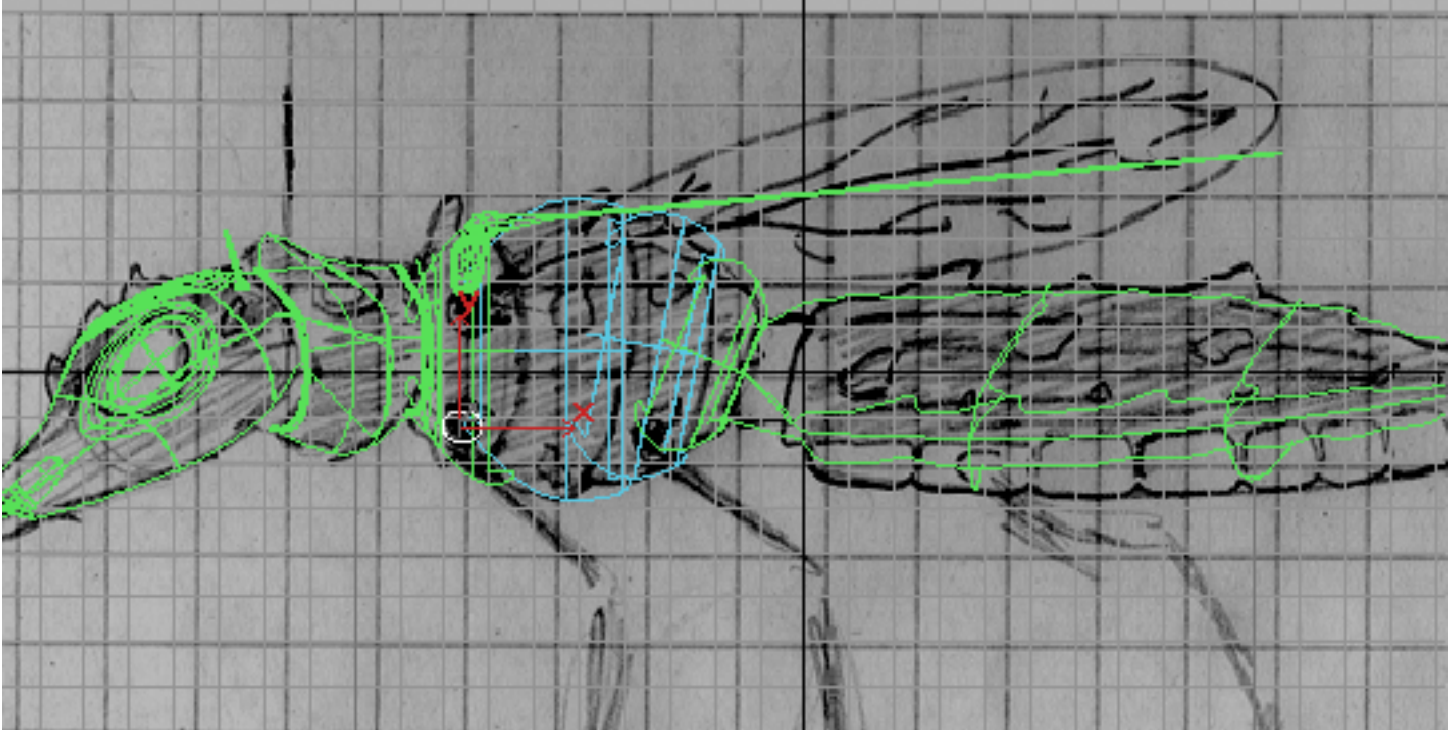


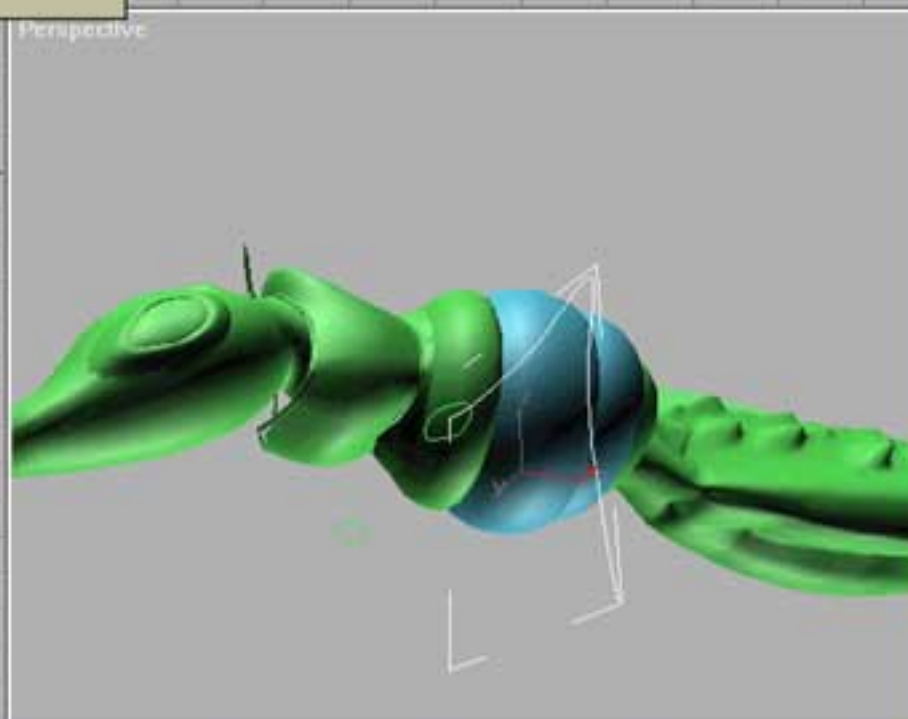
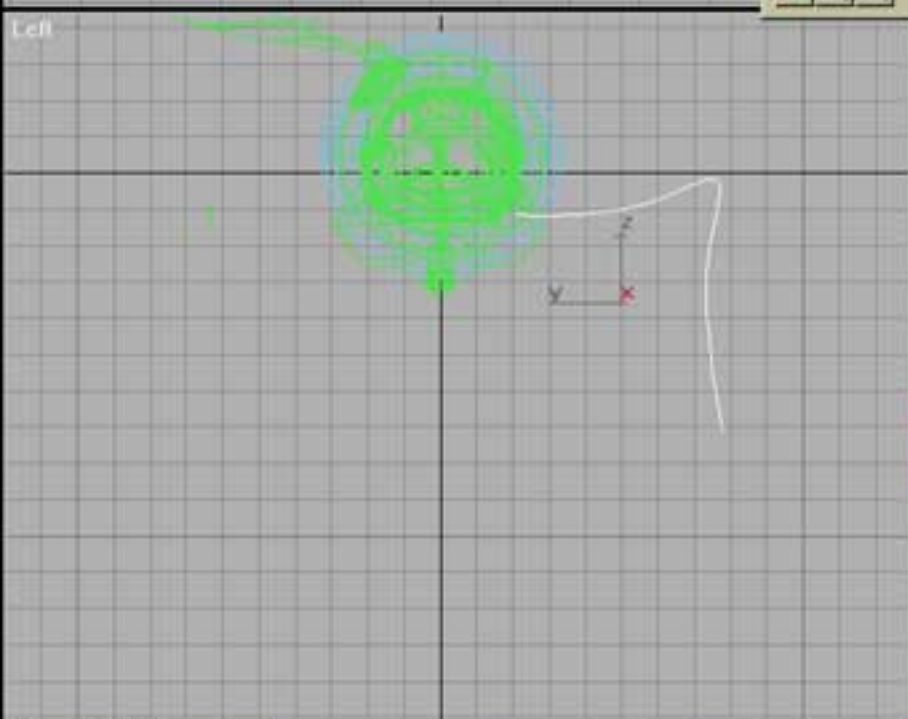
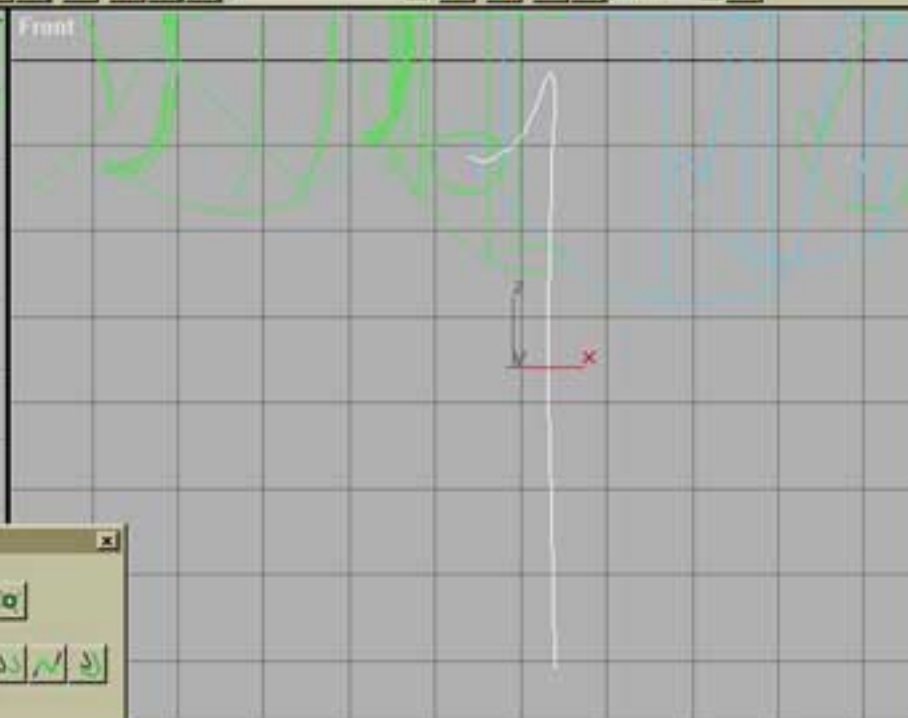
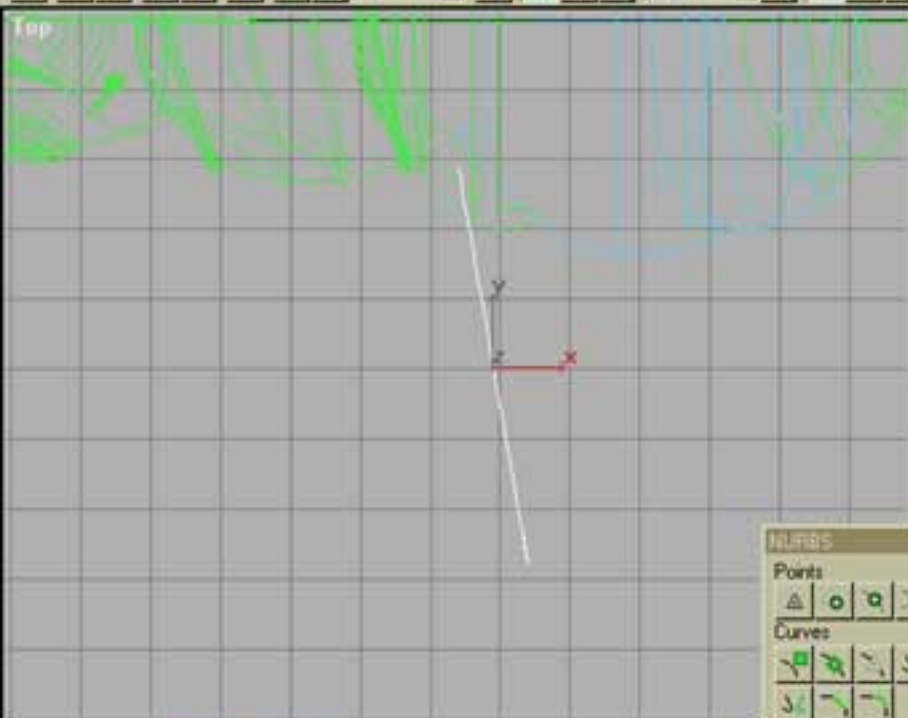


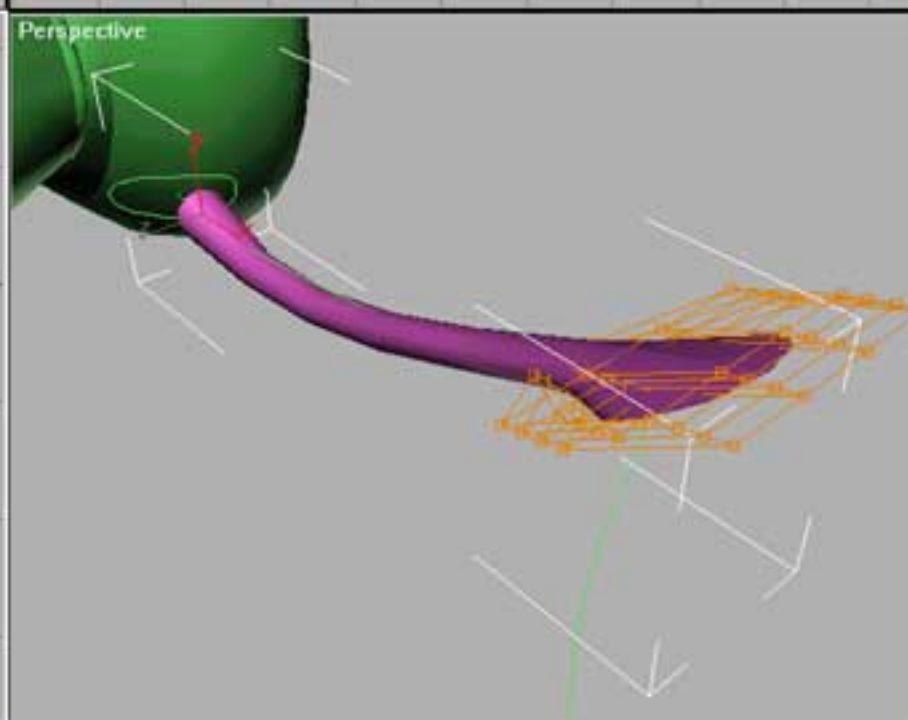
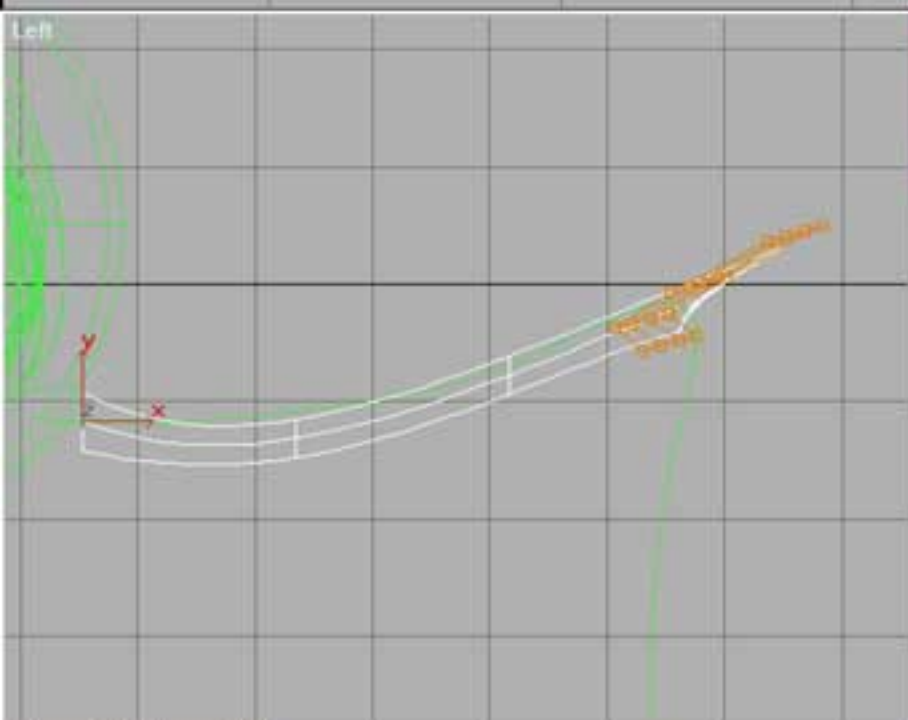
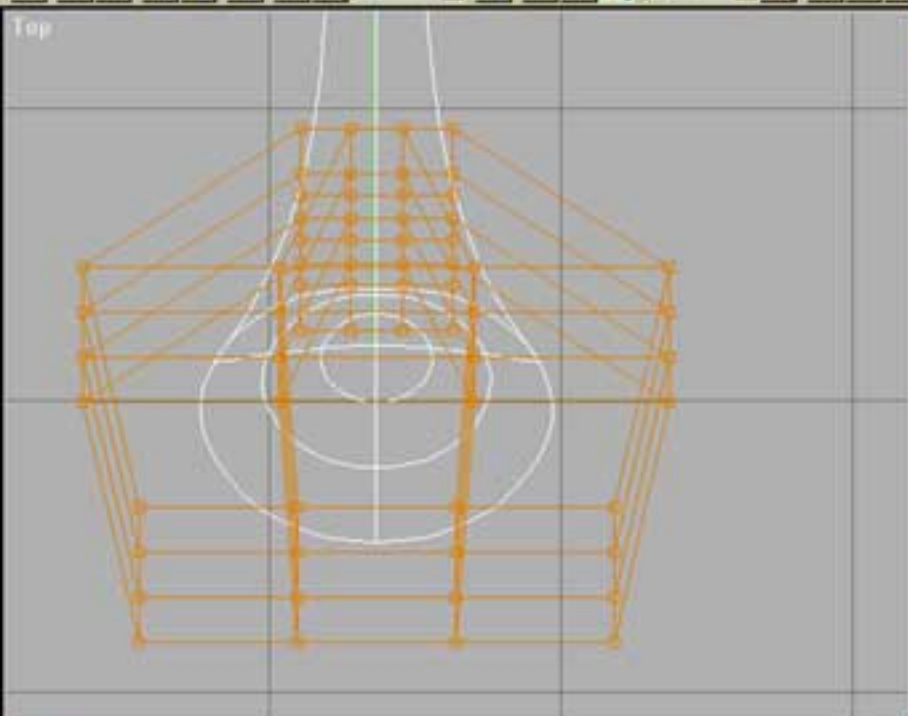


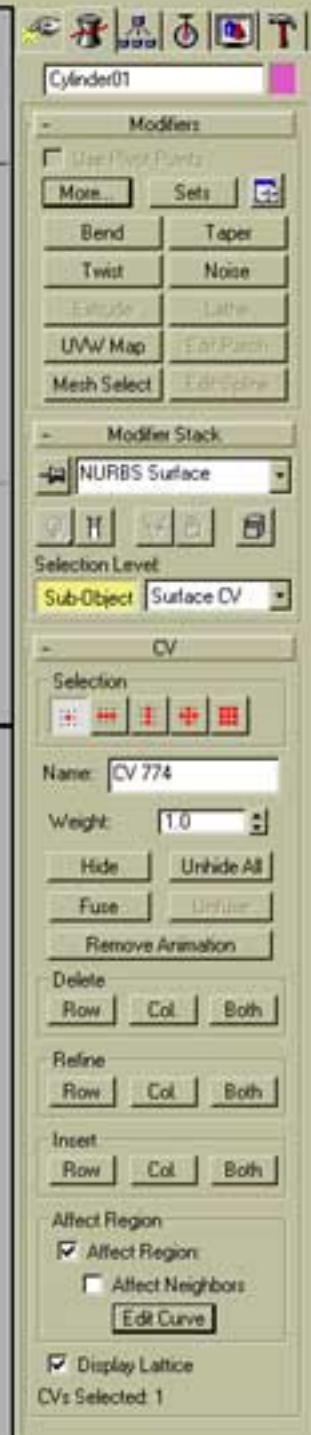
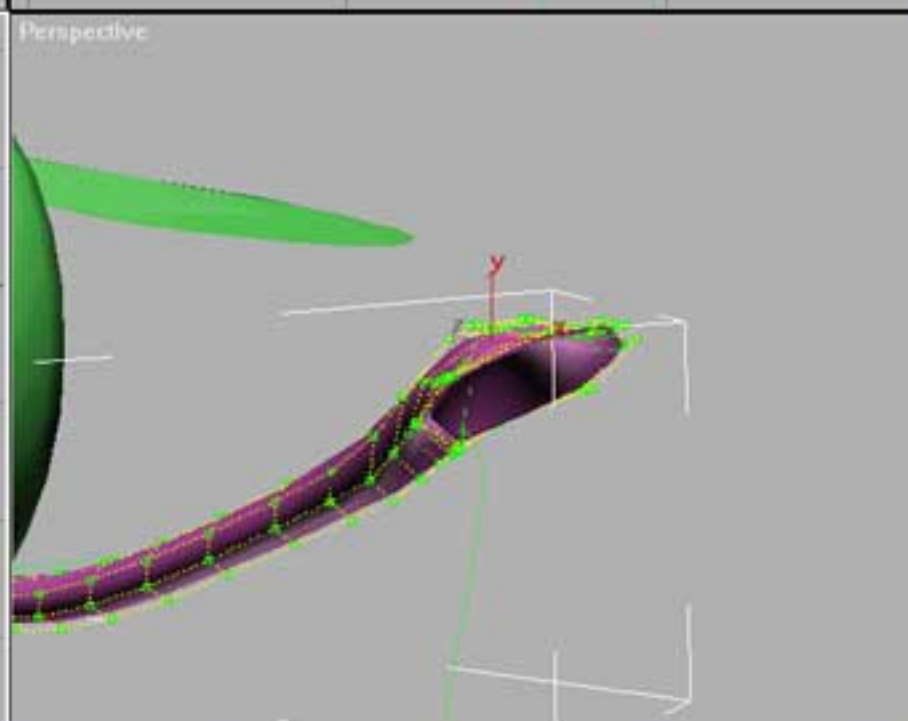
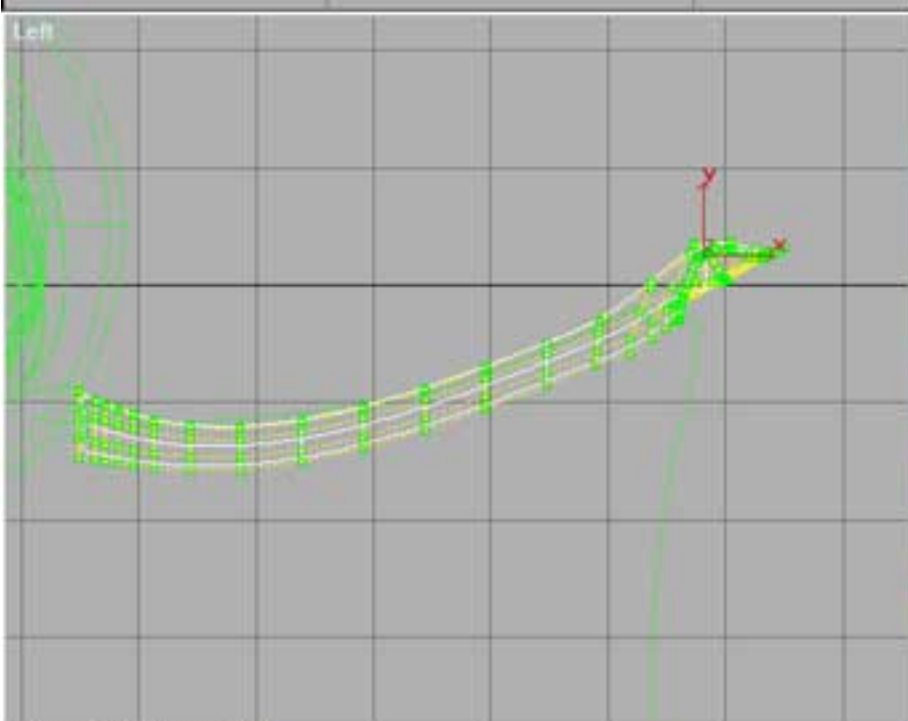
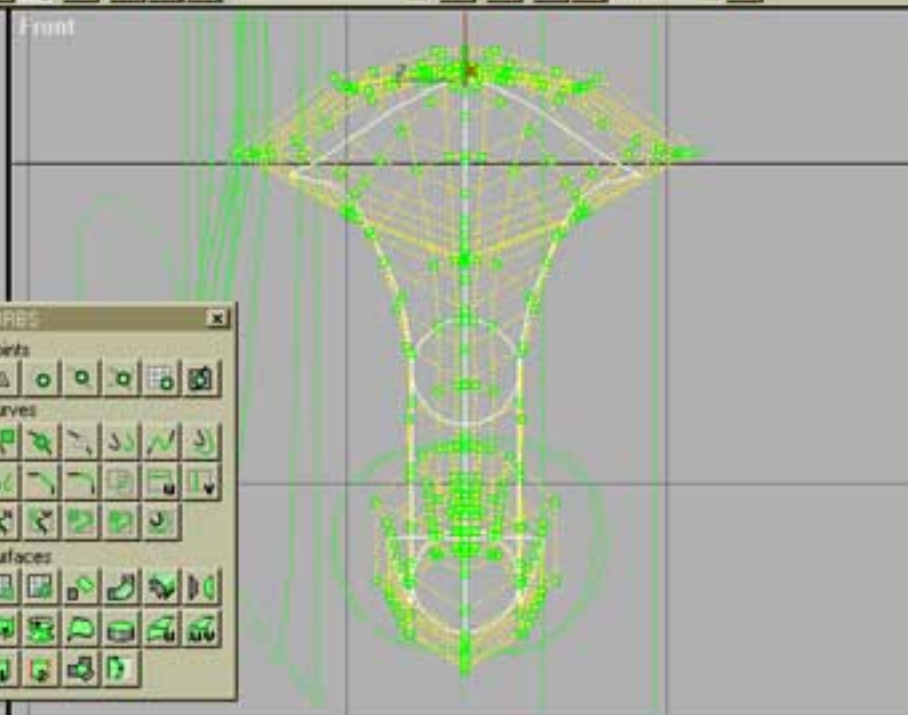
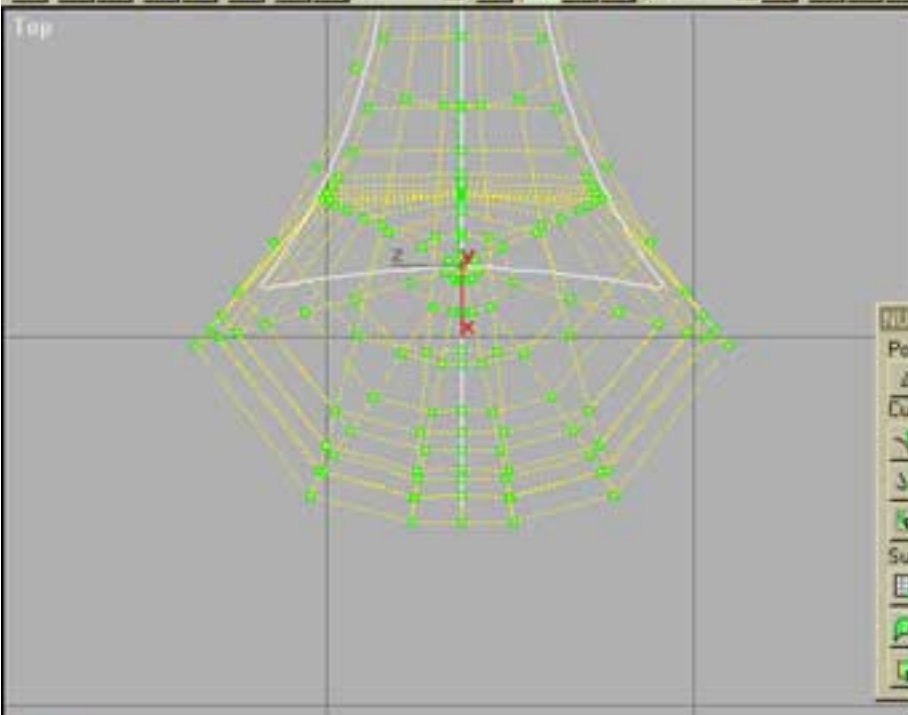


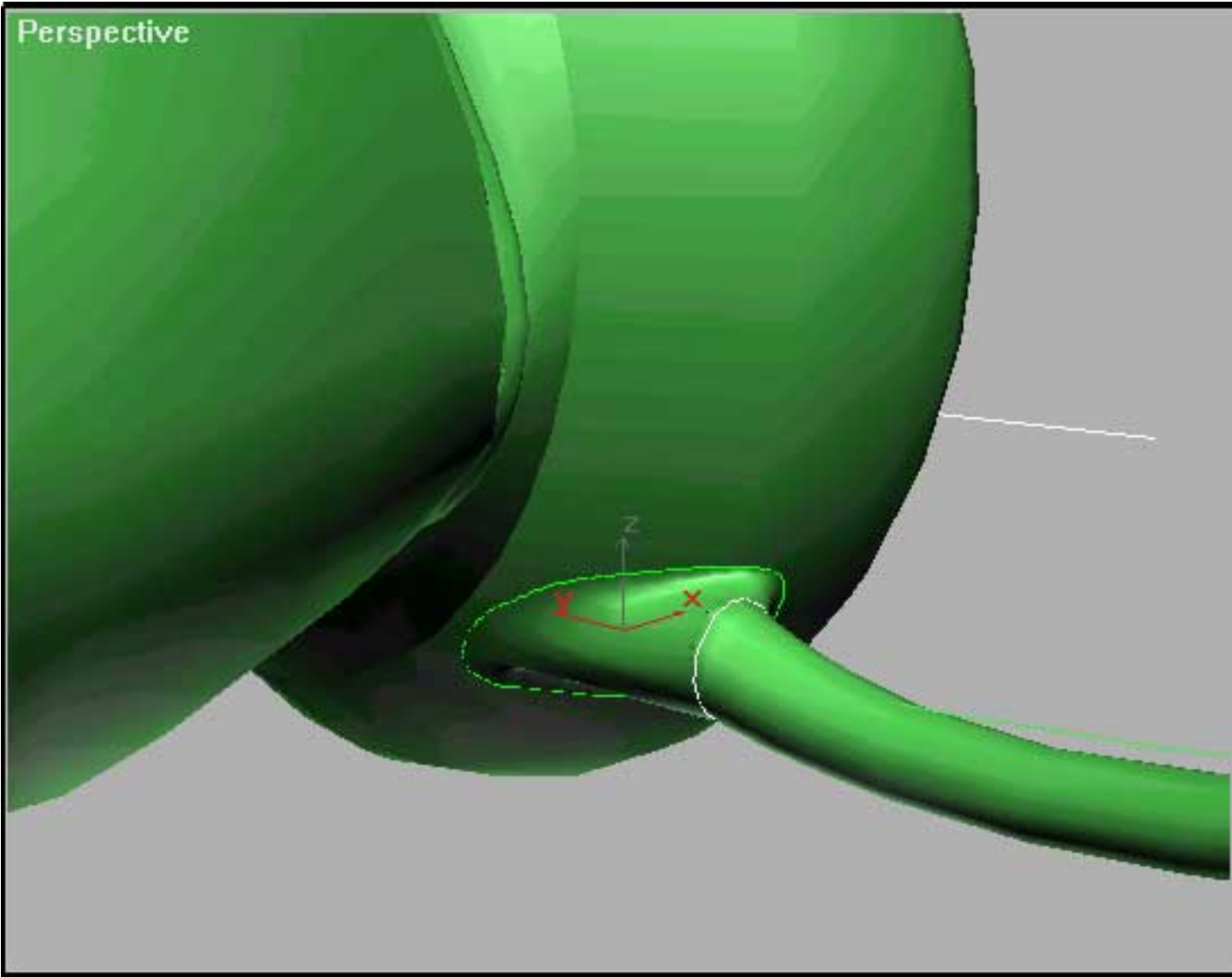
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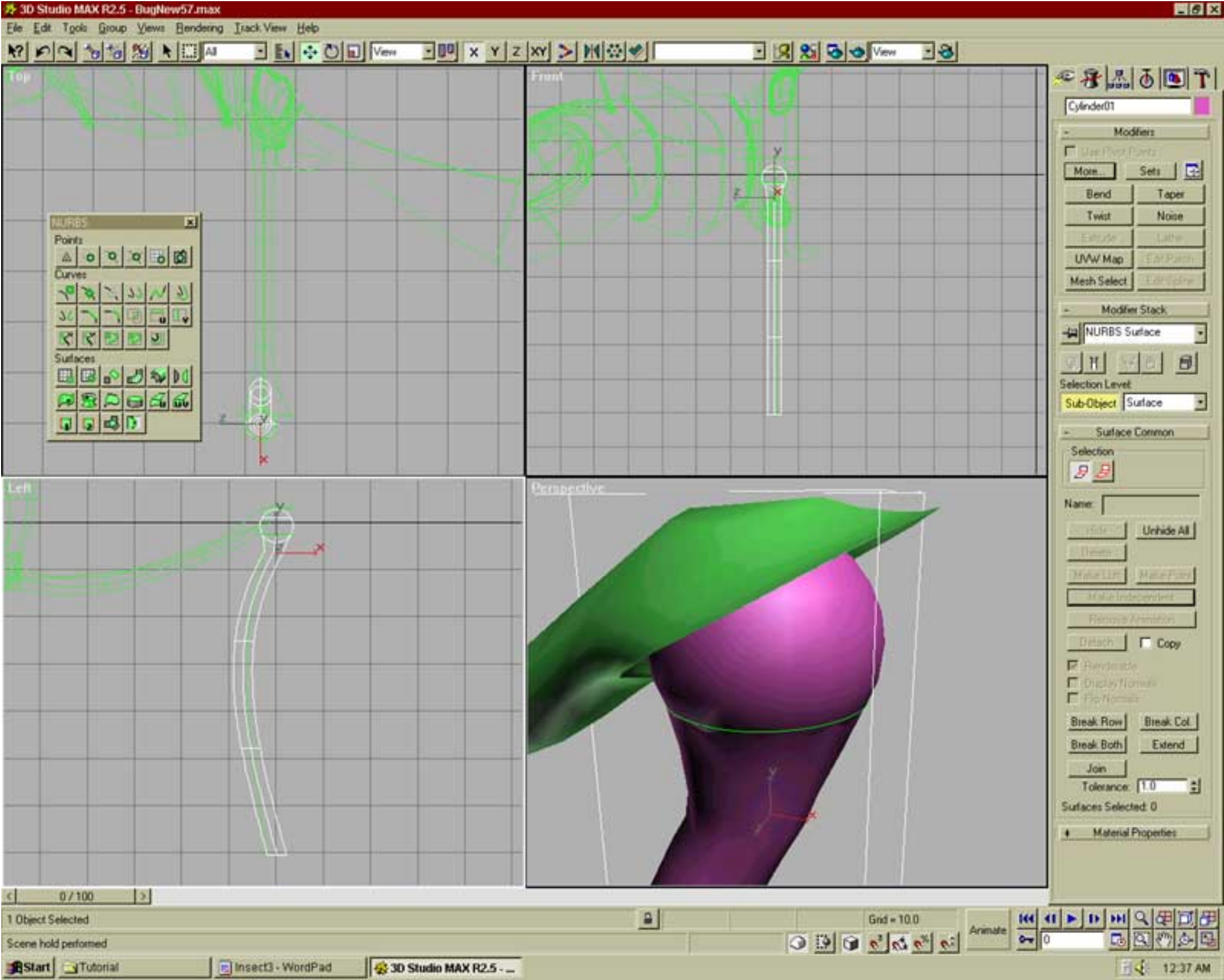


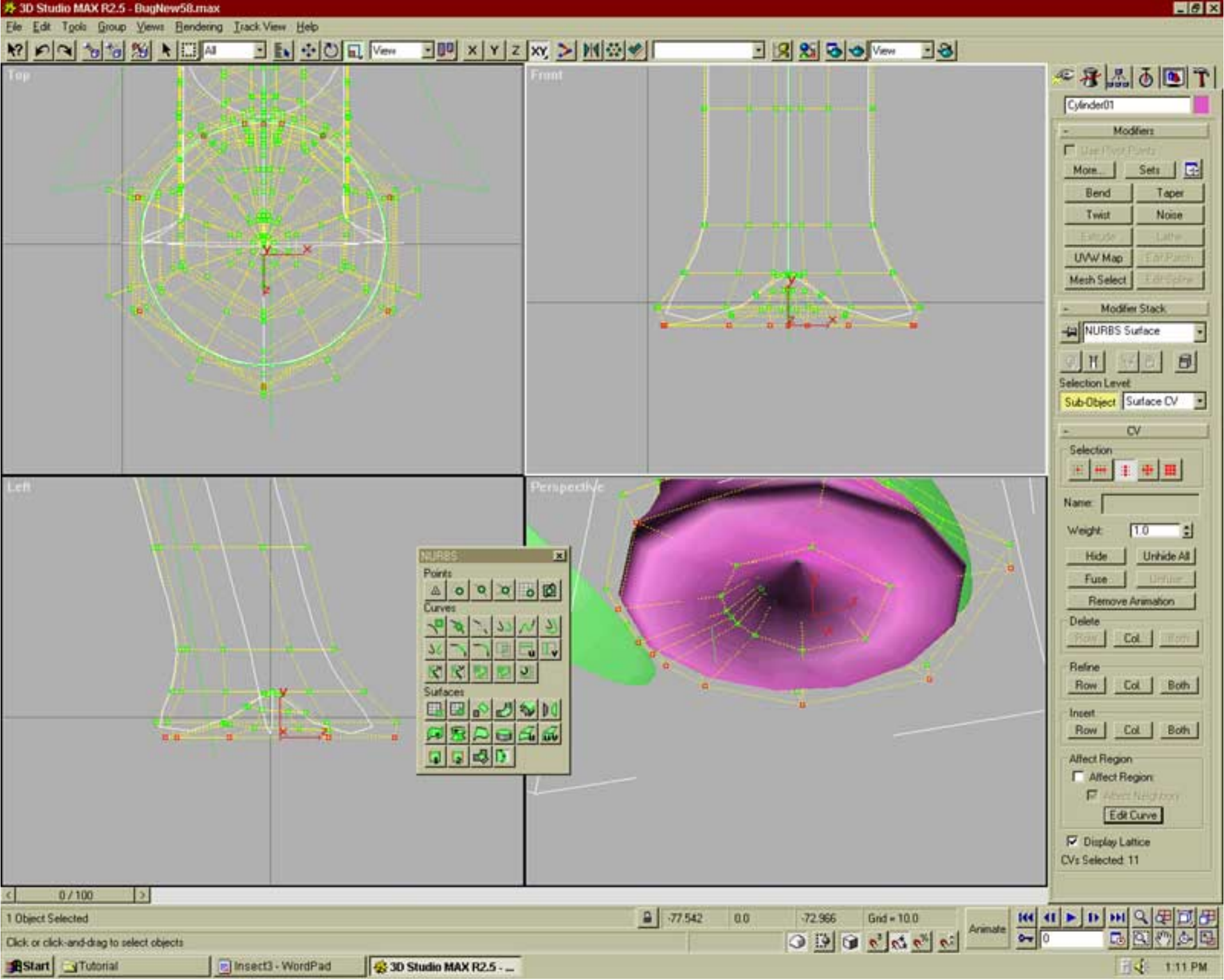












front



