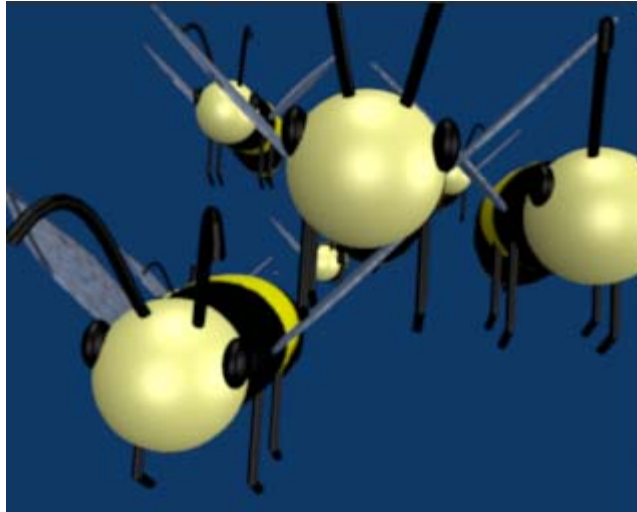


Course: 3D Design
Title: Particles – Swarm of Bees
Dropbox File: SwarmOfBees.zip
Blender: Version 2.41
Level: Beginning
Author; Neal Hirsig (nhirsig@tufts.edu)

Particles – Swarm of Bees

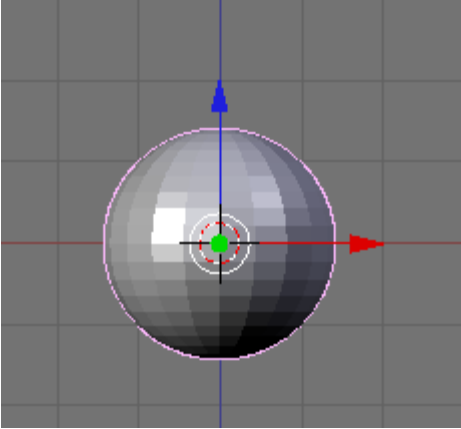


In this tutorial we will create a swarm of bees using Blender's Particle System.

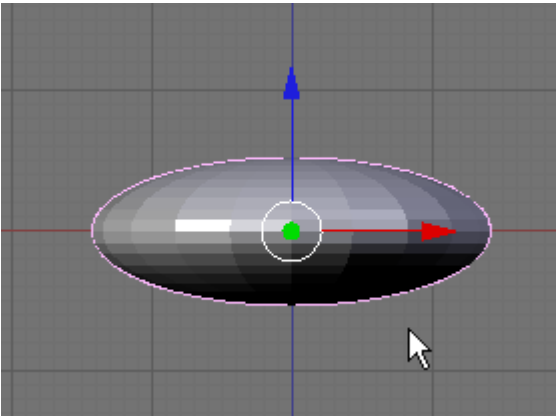
Open a new blank Blender file. If you are using the Blender default file which contains a cube object, select it and delete it.

We will first need to model a single bee as the prototype for the swarm. Place your cursor in the center of the display in **Top View (NUM7)**. Add a UV Sphere object with 20 segments and 20 rings (**Space / Add / Mesh / UV Sphere**).

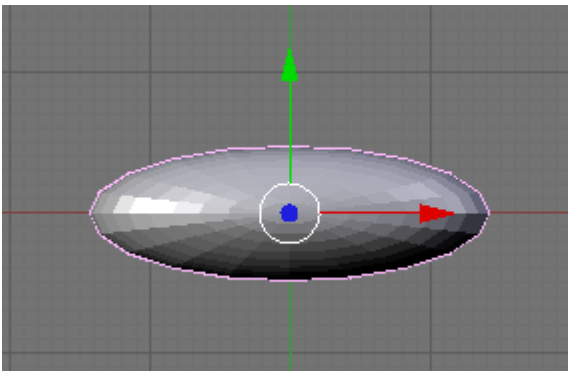
TAB out of Edit Mode and switch to **Front View (NUM1)**.



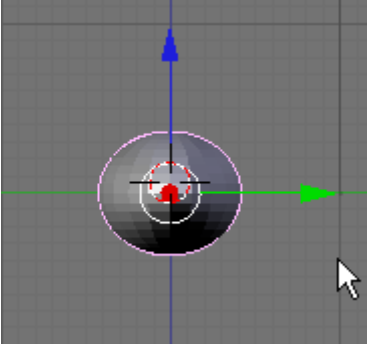
With the sphere object selected, press the **SKEY**, then press the **Z** Key and scale the sphere object down in the Z direction as shown below.



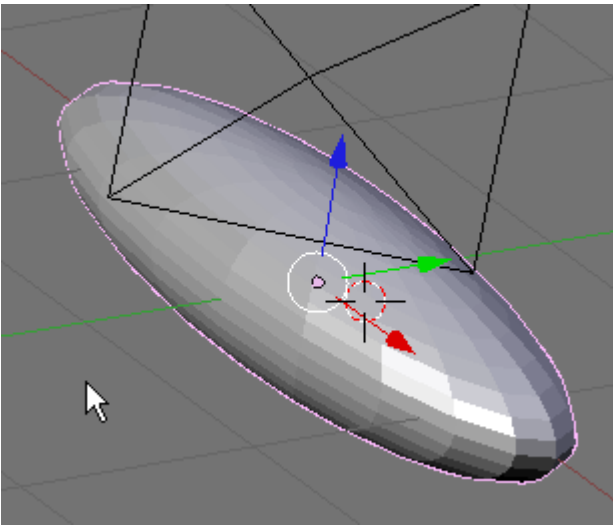
Switch to Top View (**NUM7**). With the sphere object selected, press the **SKEY**, then press the **Y** Key and scale the sphere object down in the Y direction as shown below.



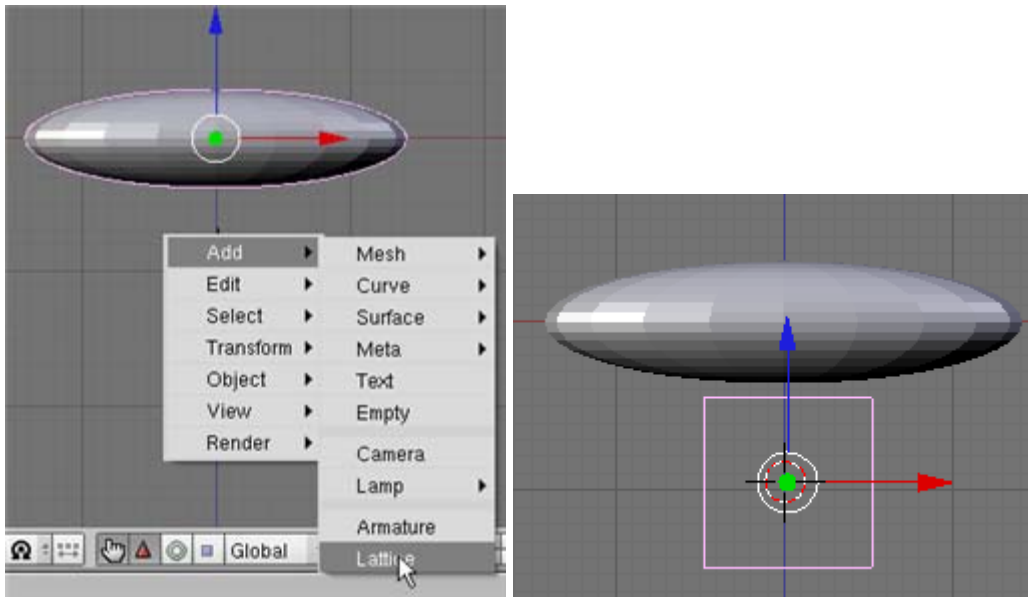
Switch to Side View (**NUM3**). With the sphere object selected, press the **SKEY**, then press the **Z** Key and scale the sphere object down in the Z direction as shown below.



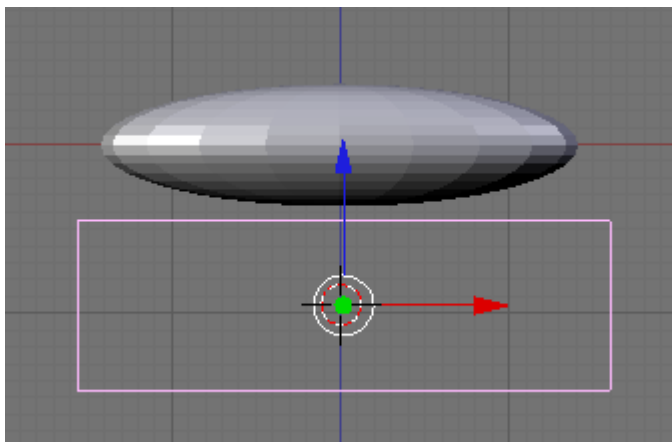
Switch to Front View (**NUM1**). Orbit your view a bit to see the sphere in 3 dimensions. It should look as shown below.



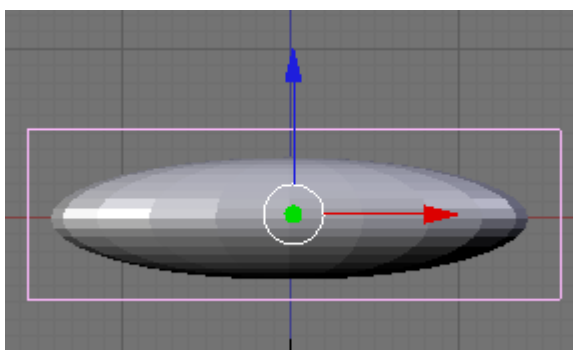
We will use a lattice deformation tool to form the bee's body. Switch to Front View (**NUM1**). Place your 3D cursor below the sphere and add a lattice object. (**Space / Add / Lattice**).



With the Lattice selected, press the **S**KEY then press the **X** Key and scale the lattice object up along the X axis as shown.

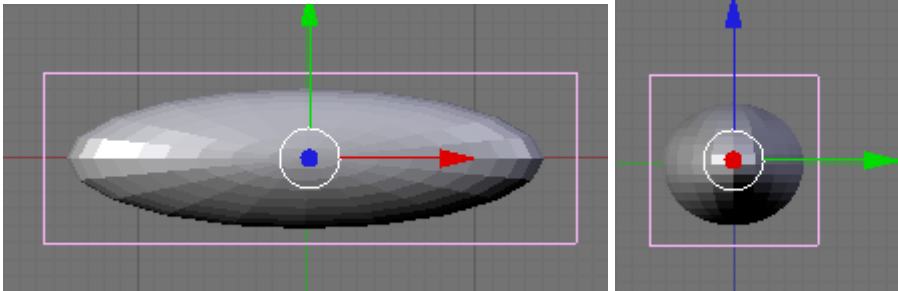


Grab the lattice object and center it on the sphere object.

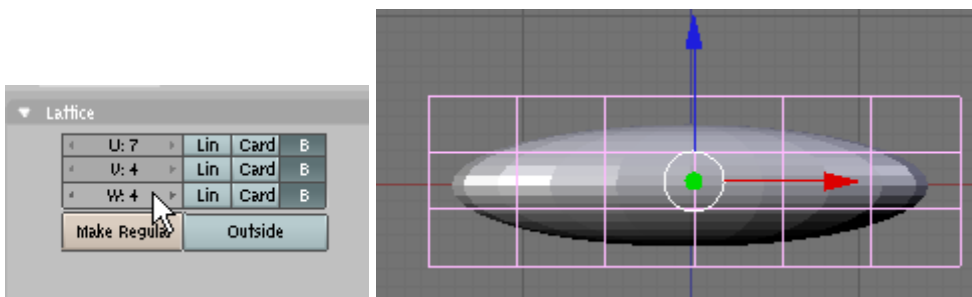


If the lattice does not totally encompass the sphere press the **S**KEY, then the **Z** Key and scale the lattice up so it encompasses the sphere.

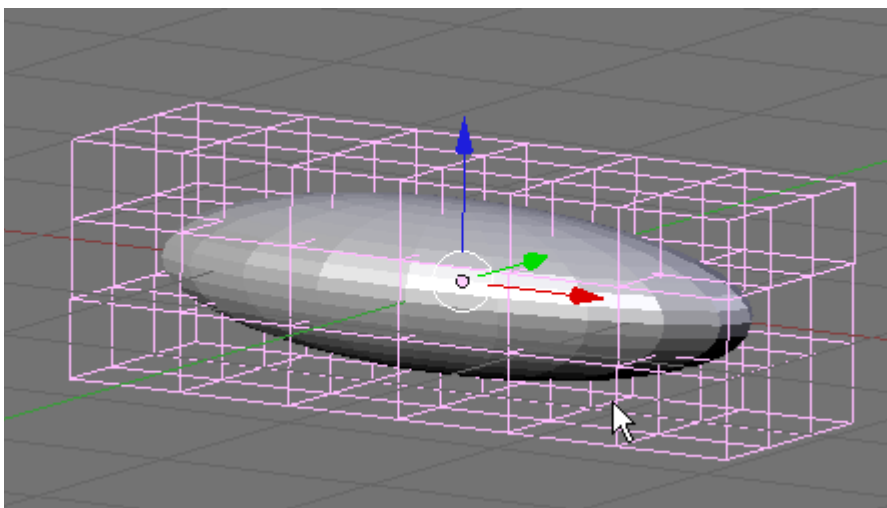
Check the Top View (**NUM7**) and the Side View (**NUM3**) and make sure the lattice completely encloses the sphere. If it does not you may have to move and /or scale the lattice in the appropriate direction.



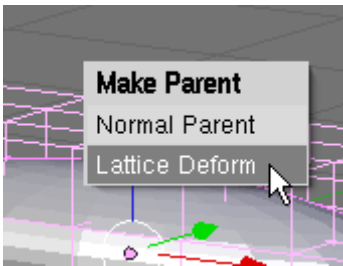
Switch to Front View (**NUM1**). Make sure the Editing Buttons are displayed (**F9**). In the Lattice Panel set the U setting to 7, the V setting to 4 and the W setting to 4.



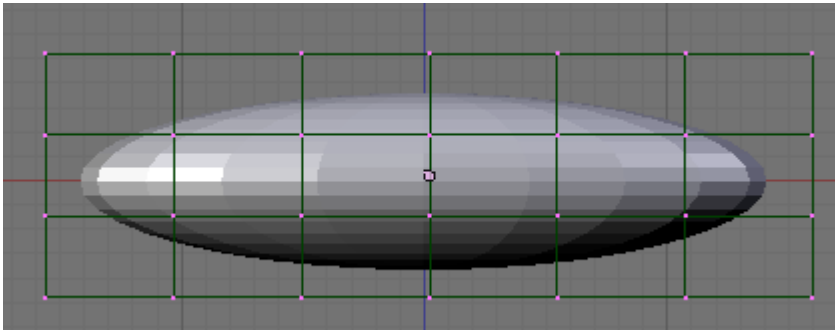
Orbit your view a bit to see how the lattice sits in relation to the sphere.



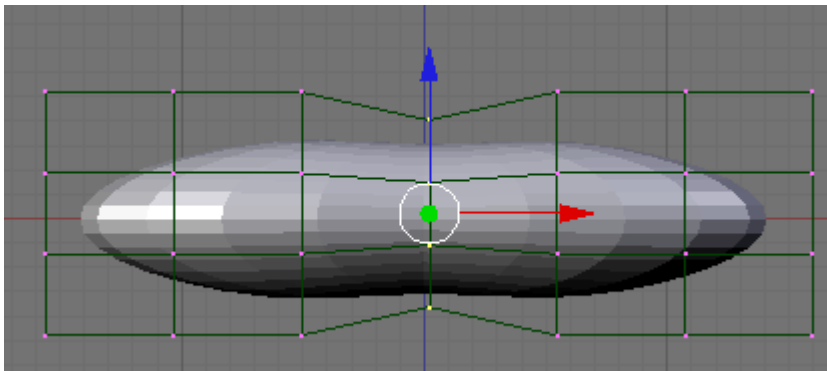
Next we need to make the sphere a child of the lattice object. Select the sphere alone, then holding your **SHIFT** Key down select the Lattice adding it to the selection. Press **CTRL-P** and choose Lattice Deform as the Parent Type.



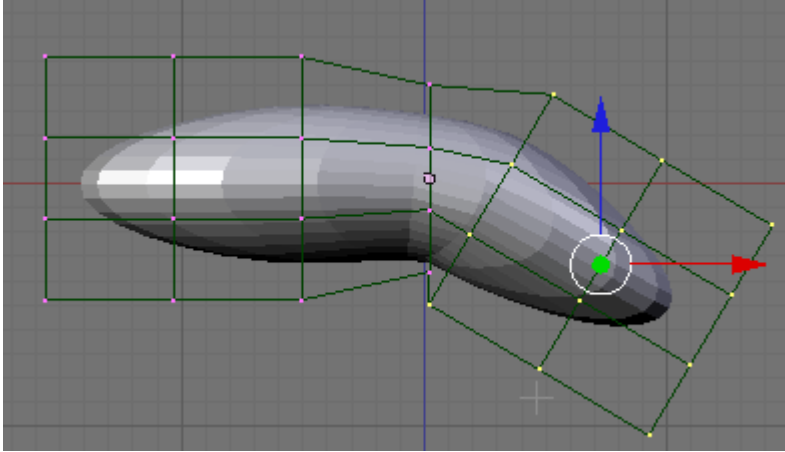
Switch to Front View (**NUM1**) **Select the Lattice only**. Press the **TAB** key to enter Edit Mode on the Lattice.



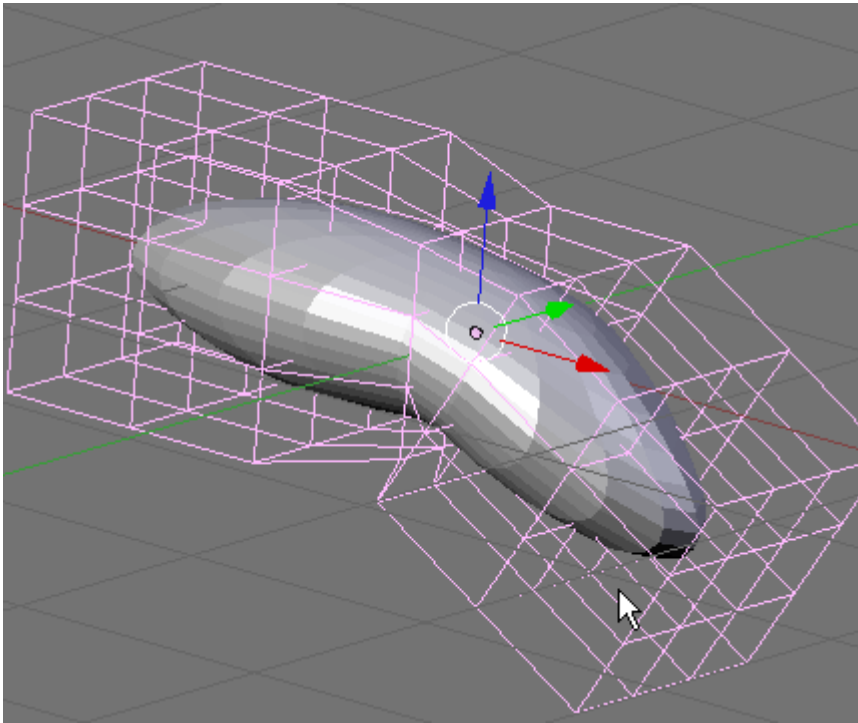
Box select the middle control vertices and Scale them down a bit as shown below.



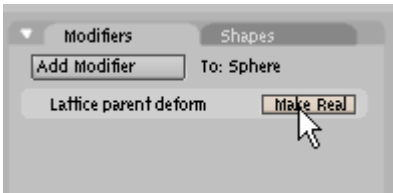
Select the 3 columns of vertices on the right and rotate them a bit and grab them and move them down as shown below.



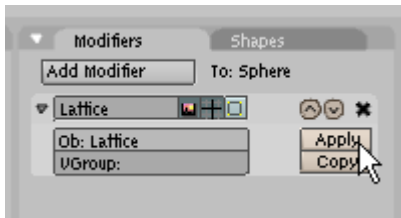
This provides the downward tilt of the bee's body. **TAB** out of Edit Mode. Orbit your Model a bit to see it dimensionally.



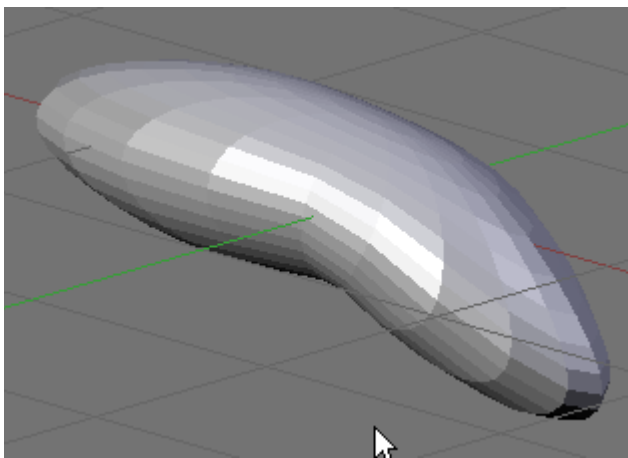
Select the Sphere object. In the Modifiers Panel press the **Make Real** Button



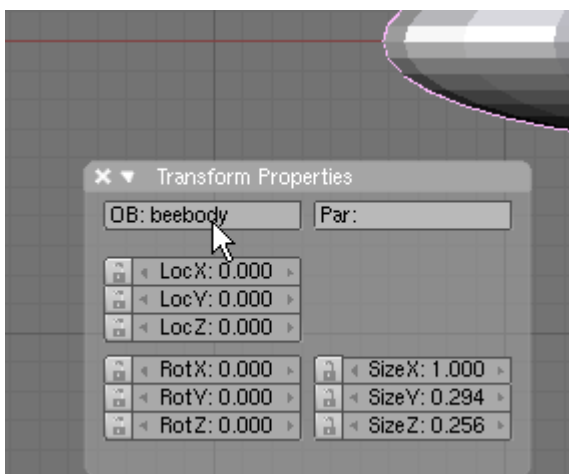
This makes the virtual Lattice a real lattice and displays the control buttons for the Lattice Modifier. Press the **Apply** button to apply the lattice deformation permanently to the sphere object.



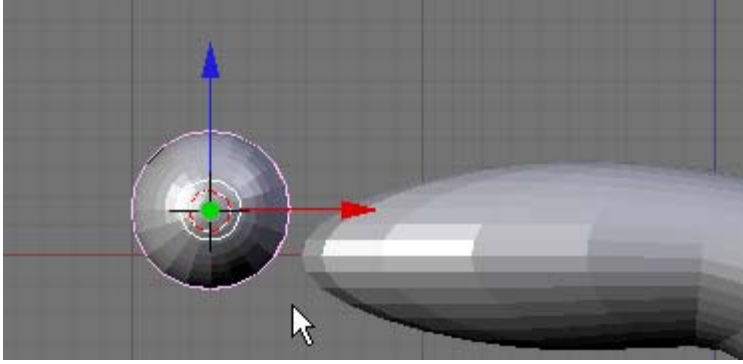
With the Lattice Modifier applied to the sphere, we no longer need the lattice. Select it (**ALONE!**) and delete it.



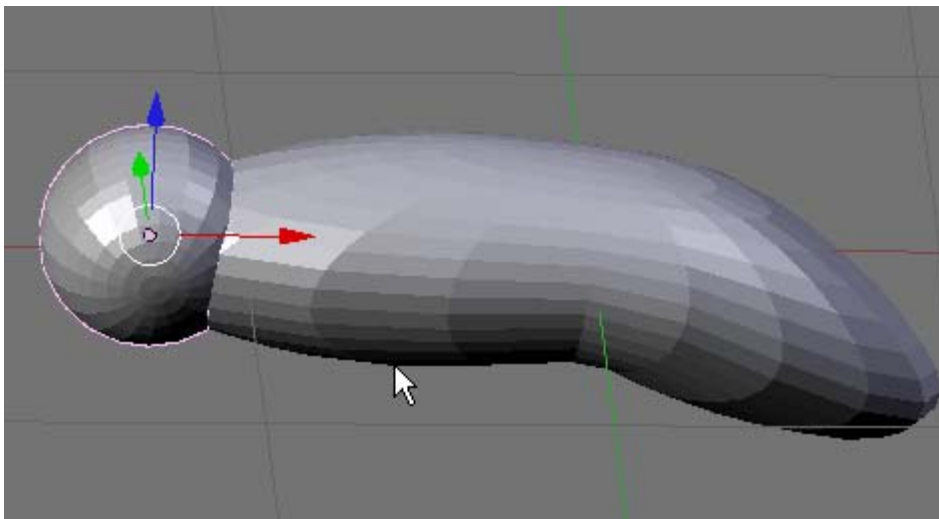
Switch to Front View (**NUM1**). Press the **NKEY** (Transform Properties). Name the sphere object beebody.



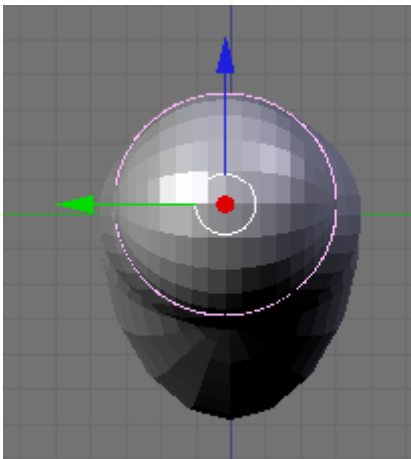
Place your 3D cursor to the left of the beebody. Add a UV Sphere (20 segments, 20 rings). **TAB** out of Edit Mode and scale the sphere down to a size as shown below.



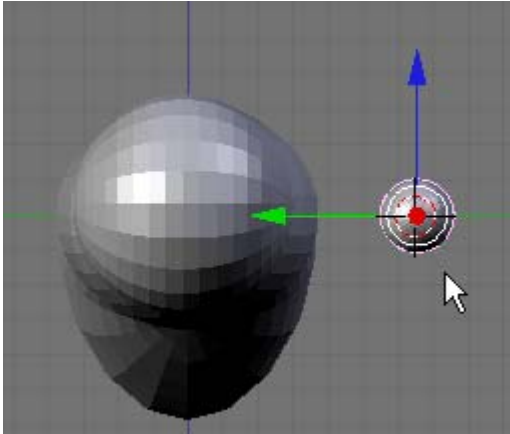
Grab the sphere and place it on the beebody object as shown. (You will have to switch views to properly place the sphere)



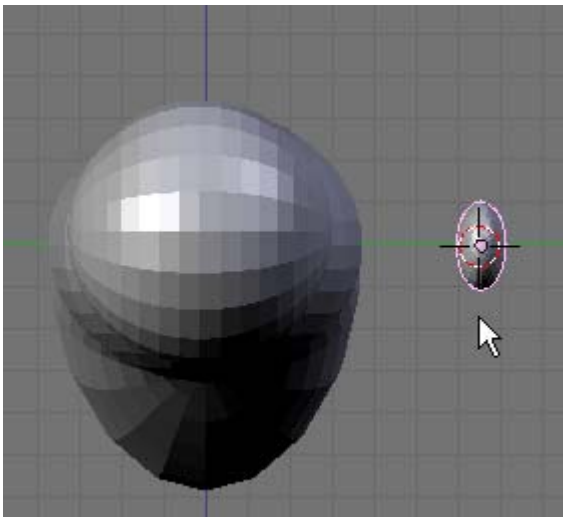
Name this object **beehead** in the Transform Properties Panel. Press **CTRL-NUM3** to switch to other side view looking straight on at the bee's head.



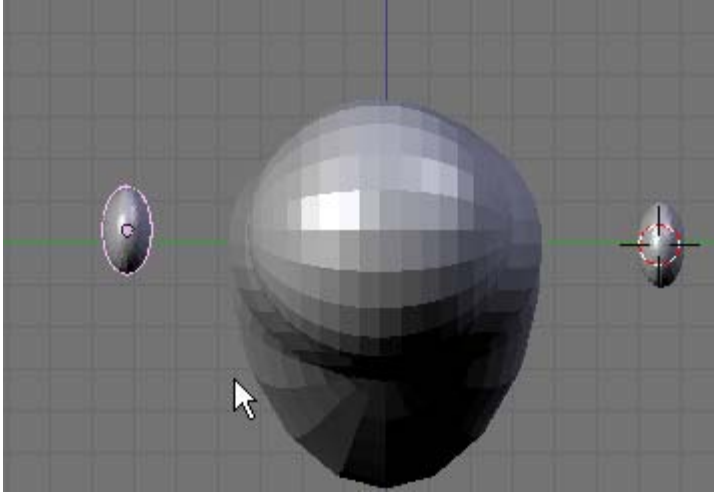
Place your cursor to the right of the bee's head. Add a UV sphere (20 segments and 20 rings) and scale it down as shown.



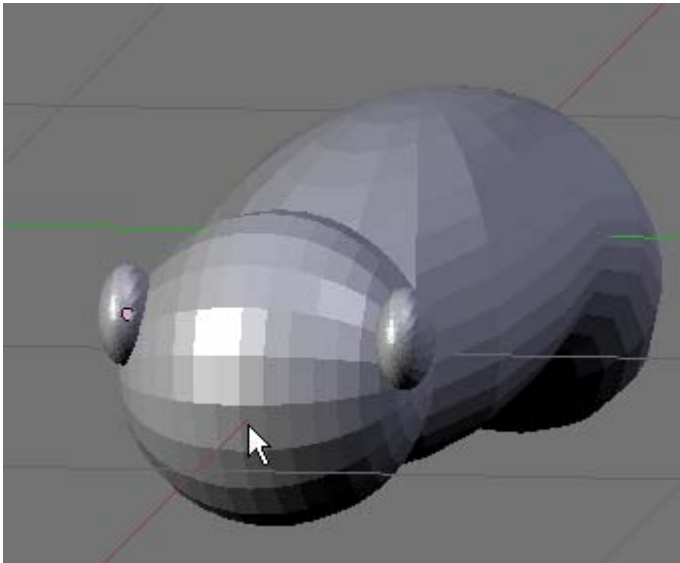
Scale the sphere object again this time along the Y axis as shown.



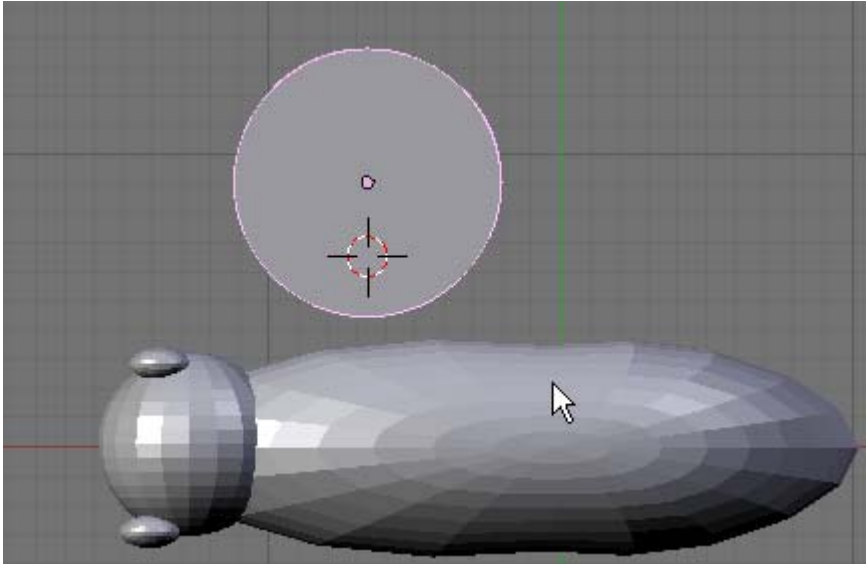
Press **SHIFT-D** to make a duplicate copy of the sphere. Move it to the other side of the bee's head.



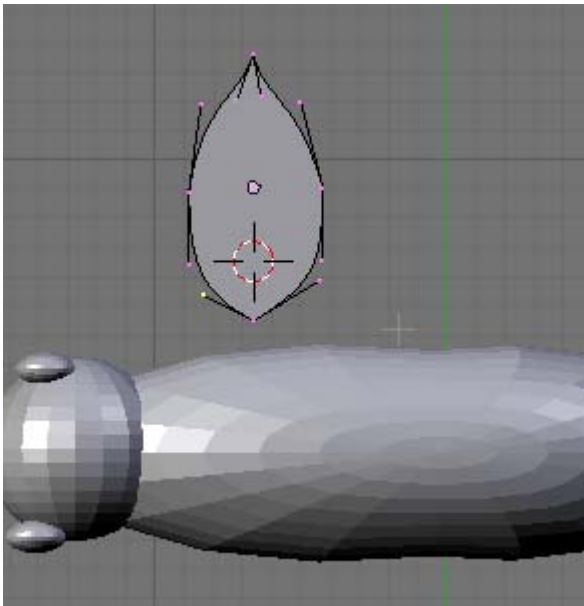
These spheres will serve as the bee's eyes. Position them as shown below.



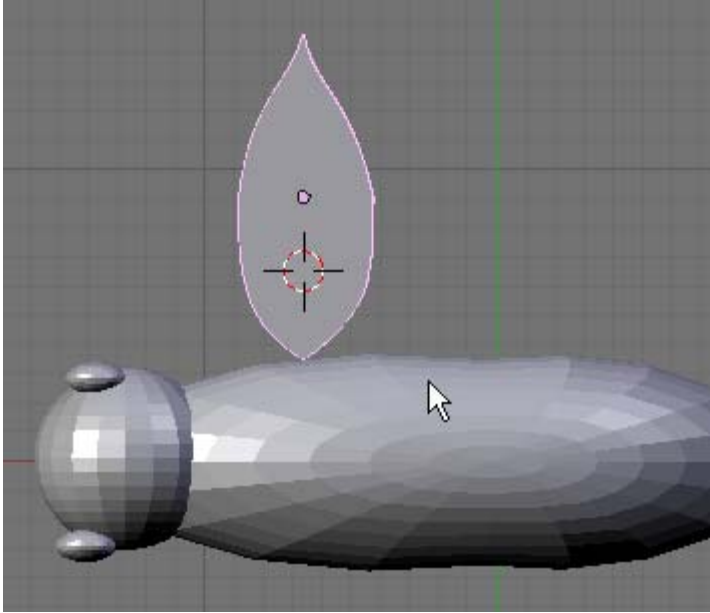
Name these objects **beeeye1** and **beeeye2** in the Transform Properties Panel. Switch to Top View (**NUM7**). Place your cursor above the beebody and add a **Bezier Circle**. **TAB** out of Edit Mode and scale it down as shown.



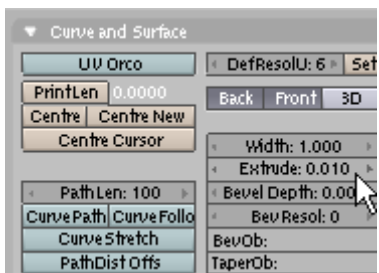
TAB into Edit Mode. With all of the vertices selected, press the **HKEY** to make the Bezier control handles “free”. Move the vertices and control handles to create a wing shape as shown below.



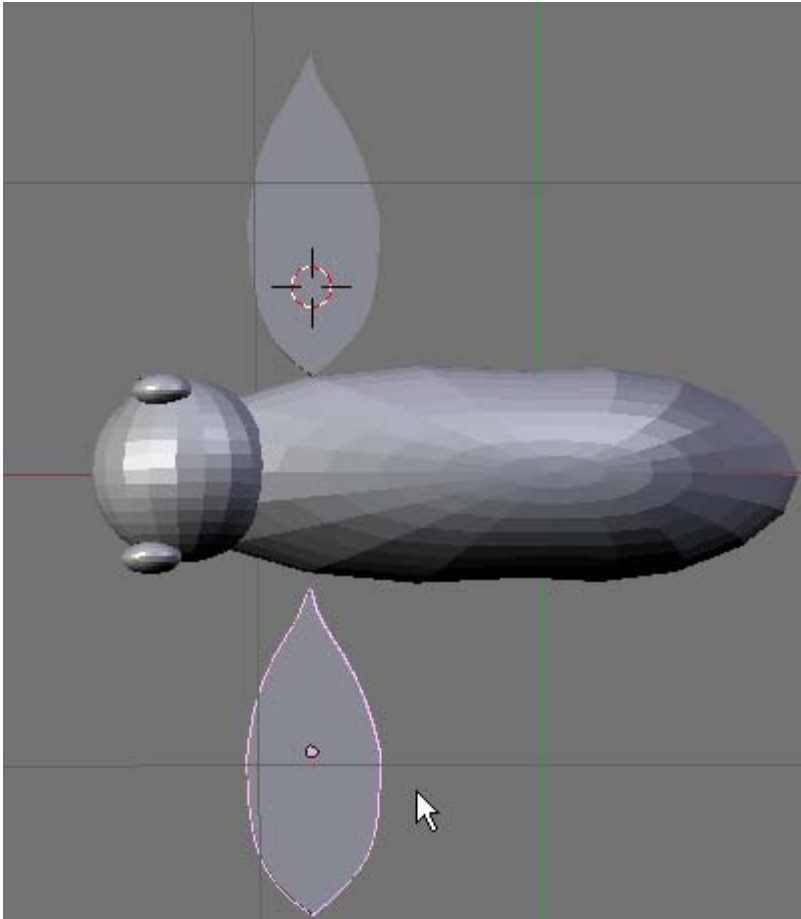
TAB out of edit Mode. If your wing is too small or large scale it in the appropriate direction.



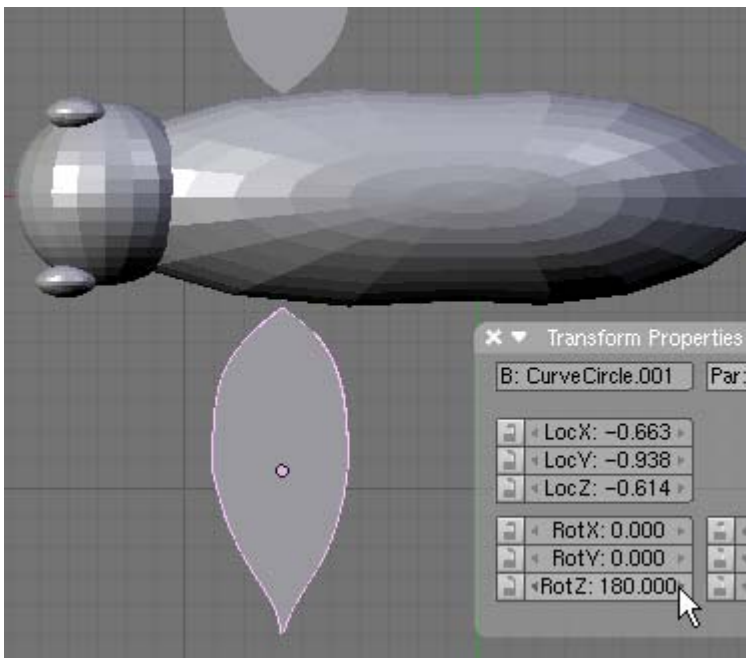
In the Curve and Surface panel, extrude the Bezier circle object .01 to give it just a slight bit of dimension.



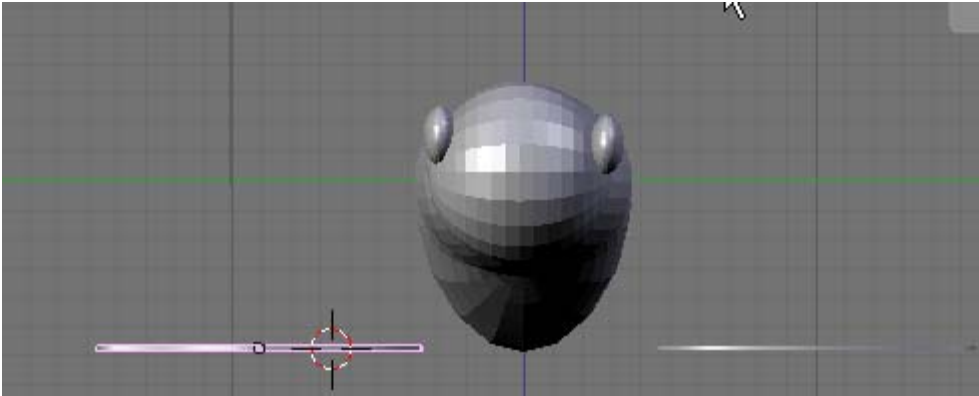
With the Bezier Circle selected, press **SHIFT-D** to make a duplicate. Move the duplicate to the other side of the beebody as shown.



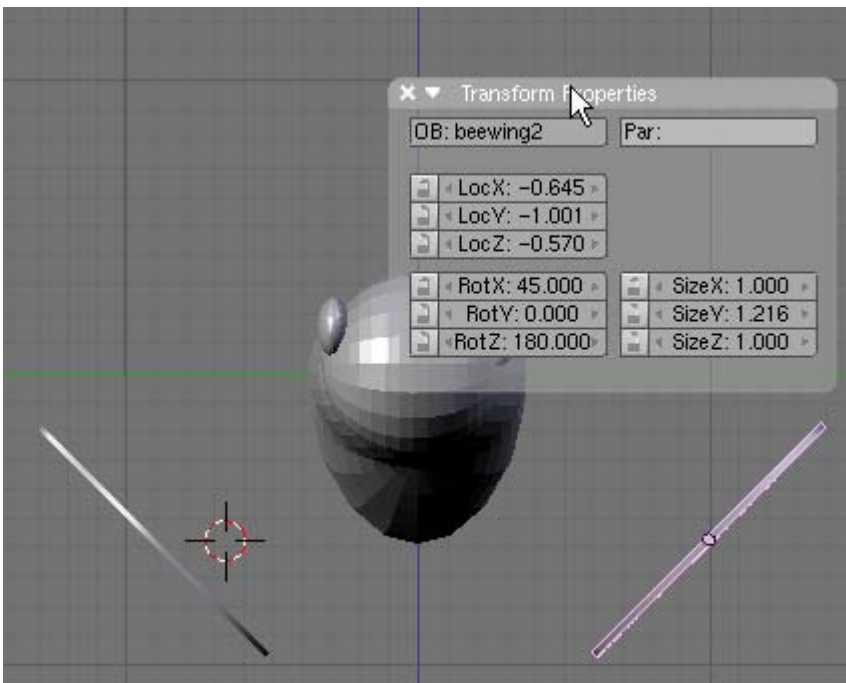
Rotate the duplicate object 180 degrees around the Z axis.



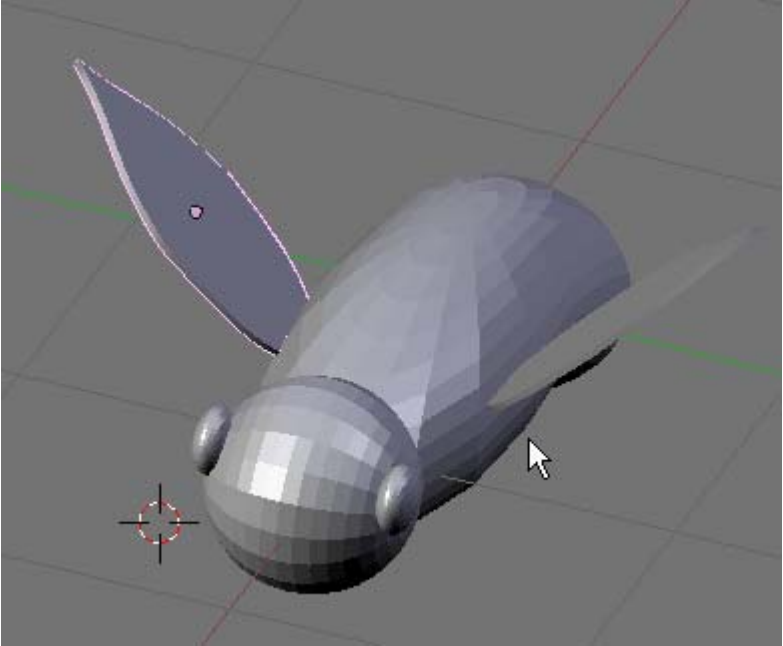
In the Transform Properties panel name one of these objects beewing1 and the other beewing2. Switch to other side view **CTRL-NUM3** (Looking straight on at the bee's head).



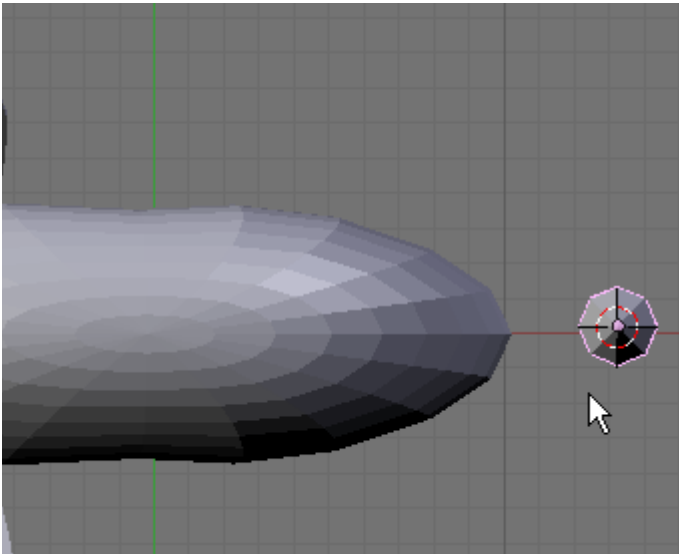
Select each beewing and rotate it 45 degrees on the X axis.



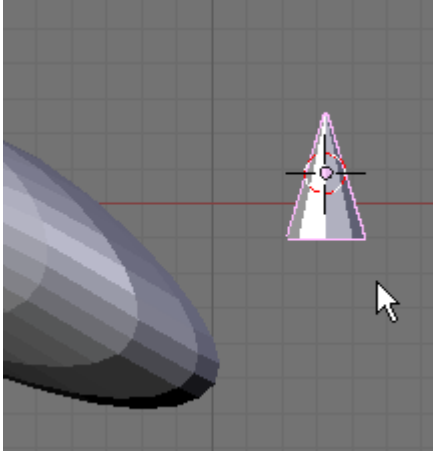
Move the bee wings in position with the beebody as shown below.



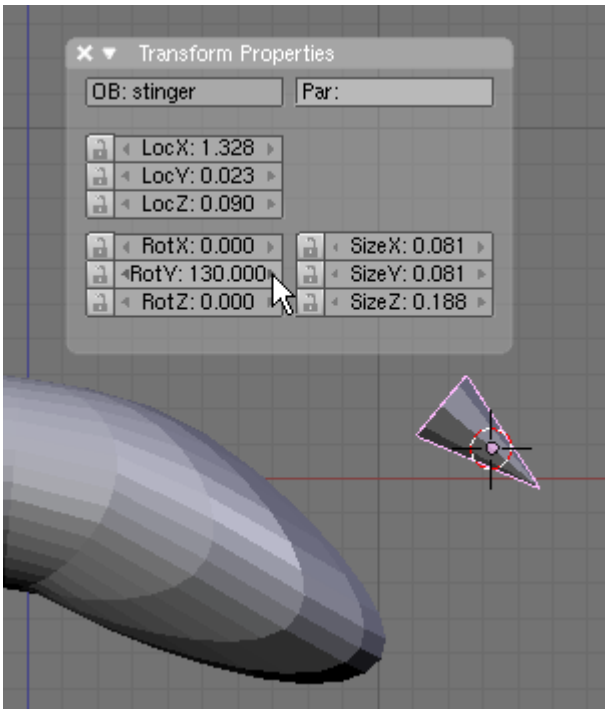
Switch to Top View (**NUM7**). Place your 3D cursor to the right of the beebody and add a cone object (8 segments). TAB out of Edit Mode. Scale the cone object as shown below.



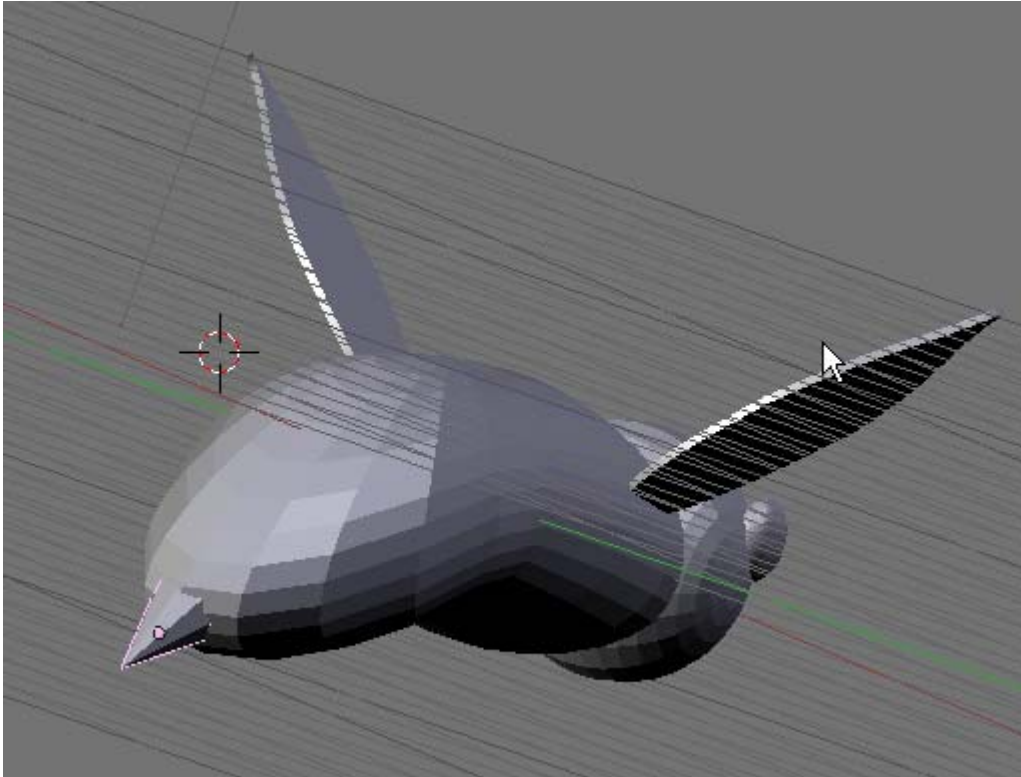
Switch to Front View (**NUM1**). Scale the cone along the Z axis as shown.



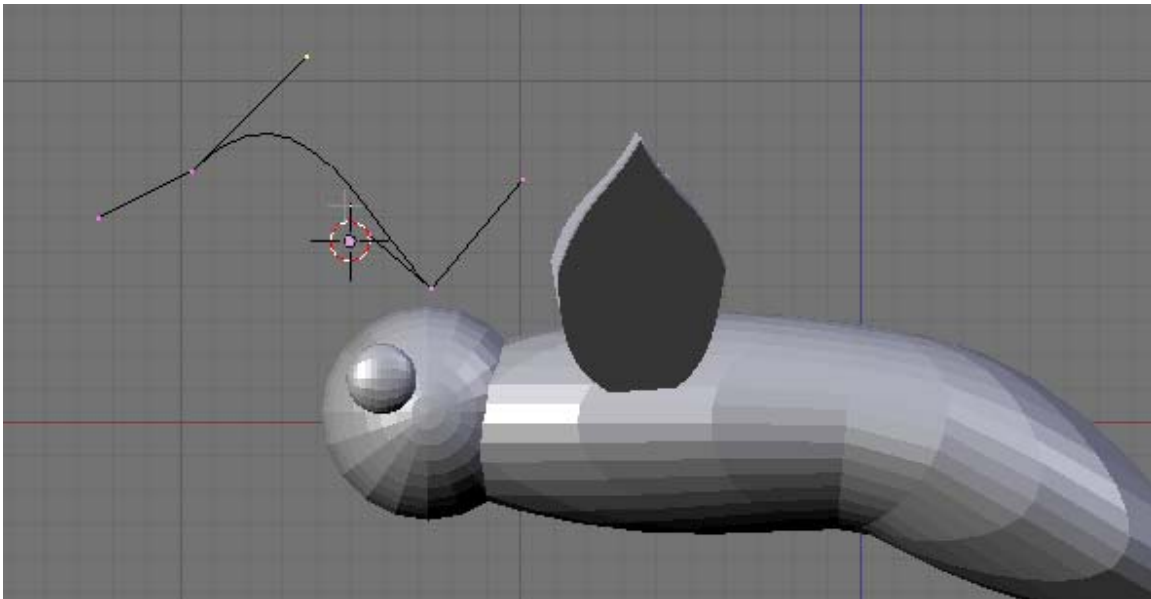
Press the **NKEY** (Transform Properties) if it is not already displayed. Name this object stinger. Rotate the stinger about the Y axis until it is about the same angle as the downward angle of the beebody (mine was 130 degrees).



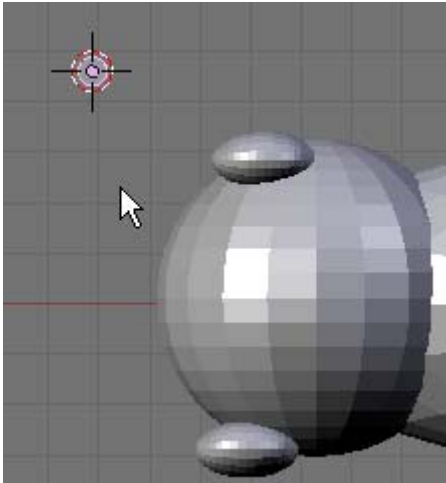
Place the stinger object on the beebody as shown.



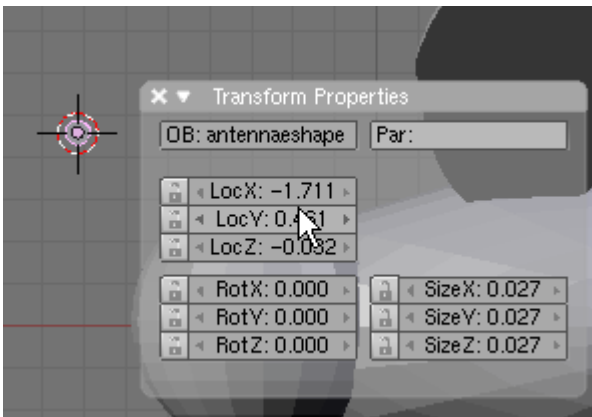
Switch to Front View (NUM1). Place your 3D cursor above the beehead and add a Bezier curve object. With all the control vertices selected, press the HKEY to make the handles “free”. Adjust the control vertices and handles to make an antennae shape as shown below.



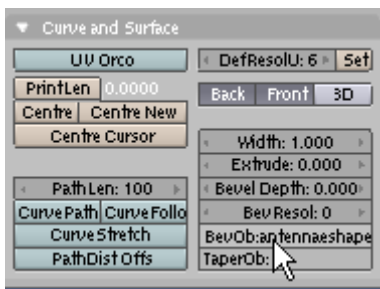
TAB out of Edit Mode. Switch to Top View (**NUM7**). Place your 3D cursor to the side of the beehead and add a Bezier circle. **TAB** out of edit mode and scale it down to a very small circle as shown.



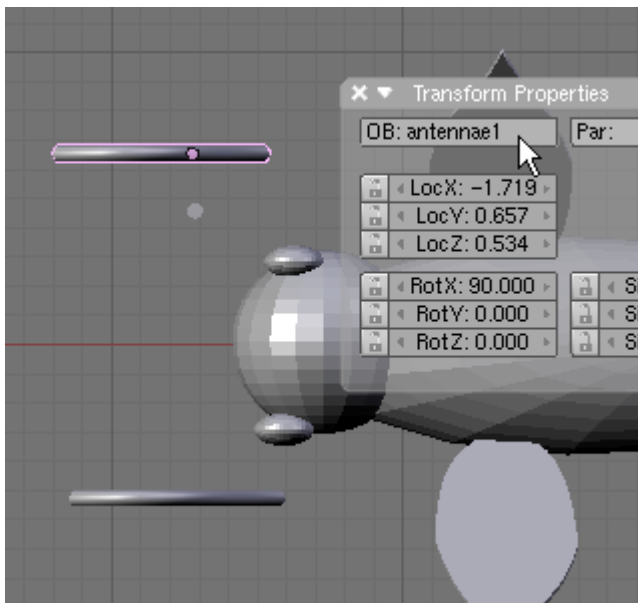
To loft the circle along the Bezier curve we must name shape to be lofted. In the Transform Properties Panel name this shape antennaeshape



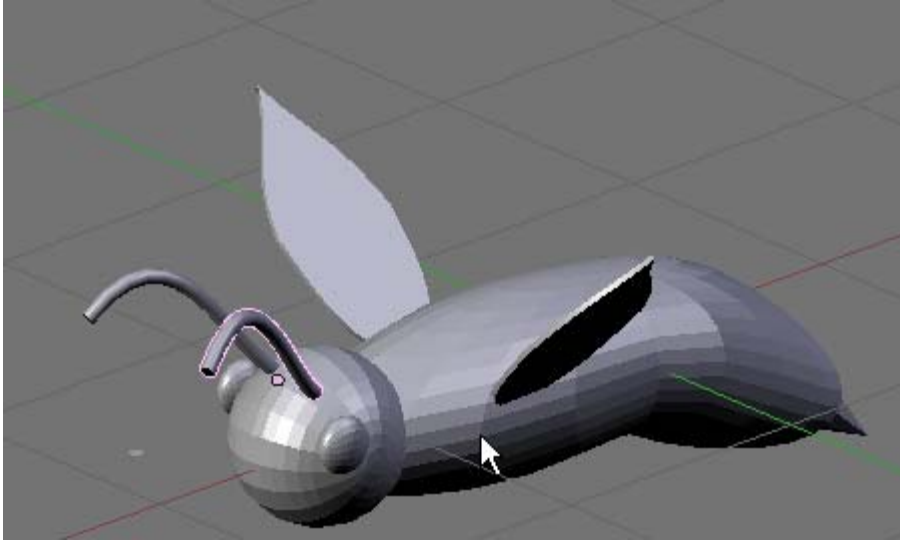
Switch to Front View (**NUM1**). Select the Bezier Curve (alone). In the Curve and Surfaces Panel name the BEVOb: antennaeshape. This will loft the antennaeshape object along the Bezier curve to form one of the bee's antennae.



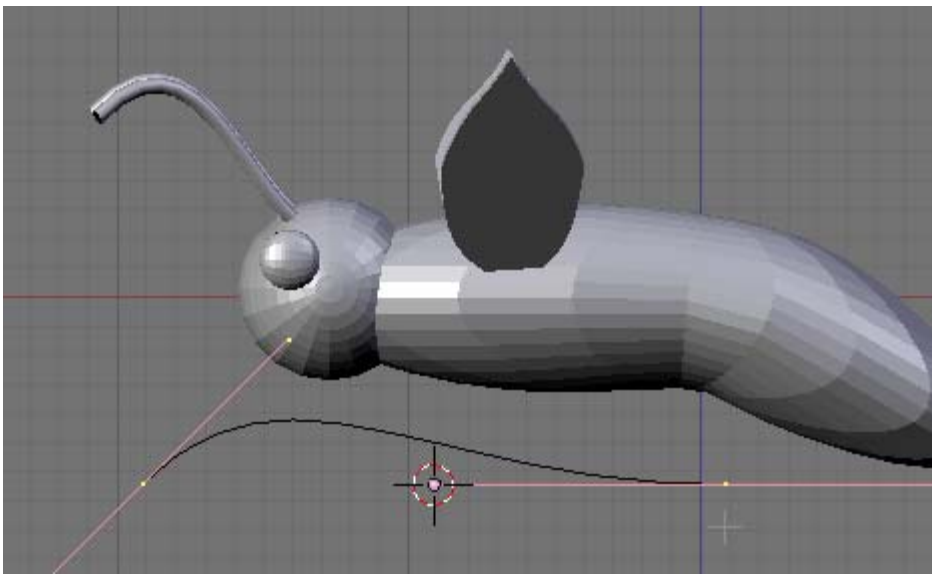
Switch to Top View (**NUM7**) and zoom out a bit. Select the Bezier Curve and press **SHIFT-D** (Duplicate). Move the duplicate Bezier Curve to the other side of the bee's head. Name one of the objects *antennae1* and the other *antennae2*.



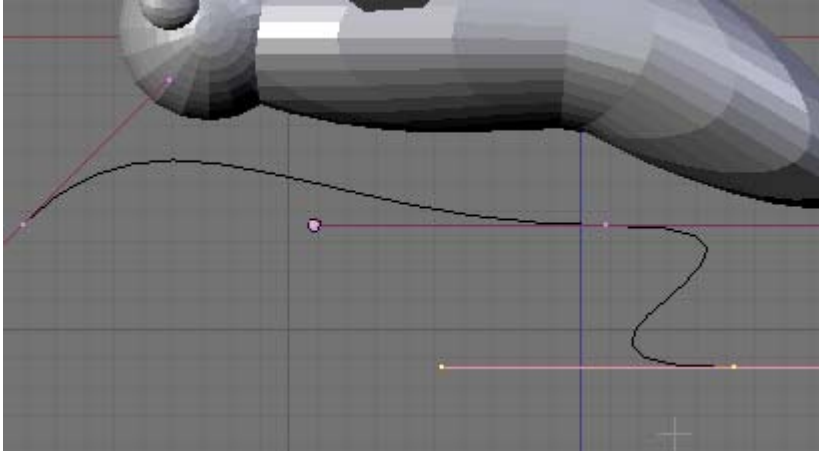
Position and rotate the antennae objects as shown below.



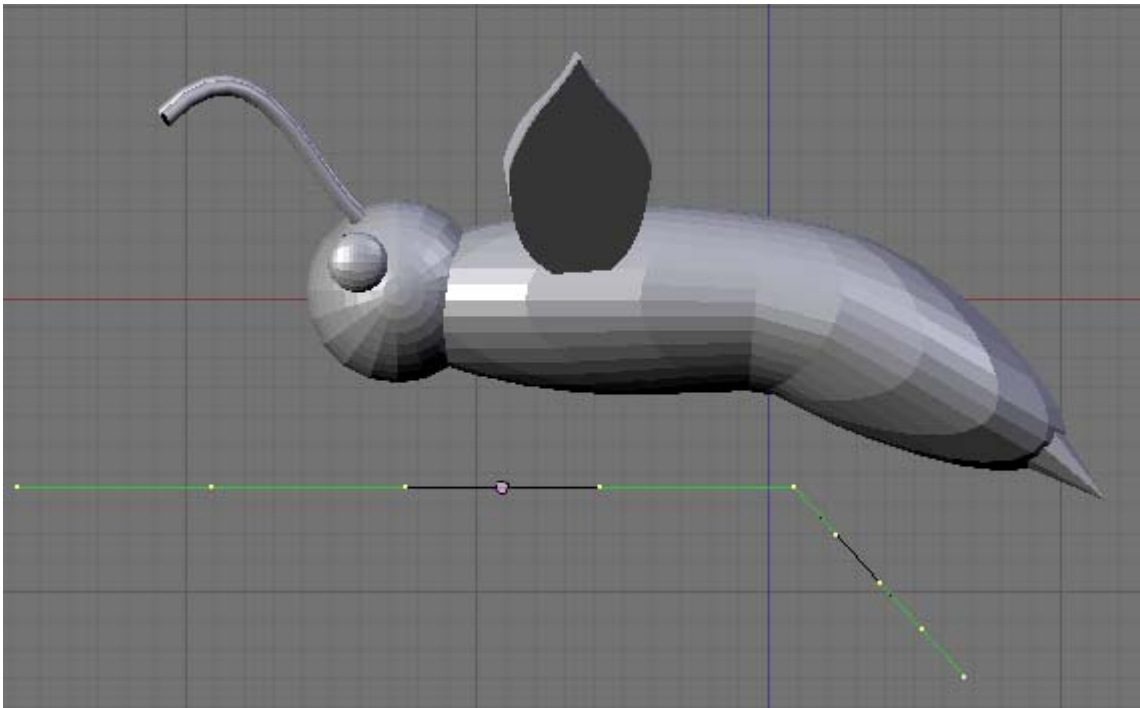
Switch to Front View (**NUM1**). Place your 3D cursor below the beebody and add another Bezier Curve.



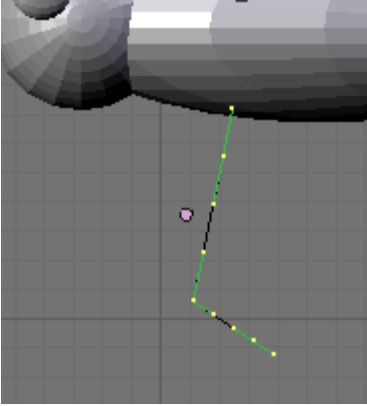
Select the vertex on the right of the curve (alone). Press the **EKEY** (Extrude). This will add a new vertex to the end and place it in “grab” mode. Move it down a bit.



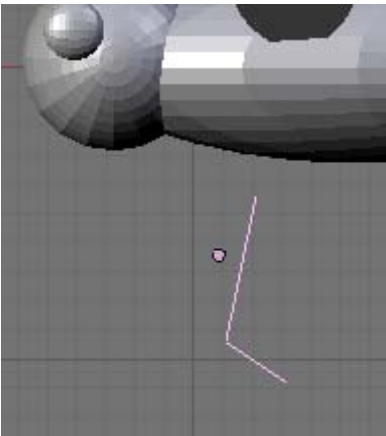
Press the **AKEY** twice to select all of the vertices and handles. Then press the **VKEY** to make the handles “vector” mode (straight lines).



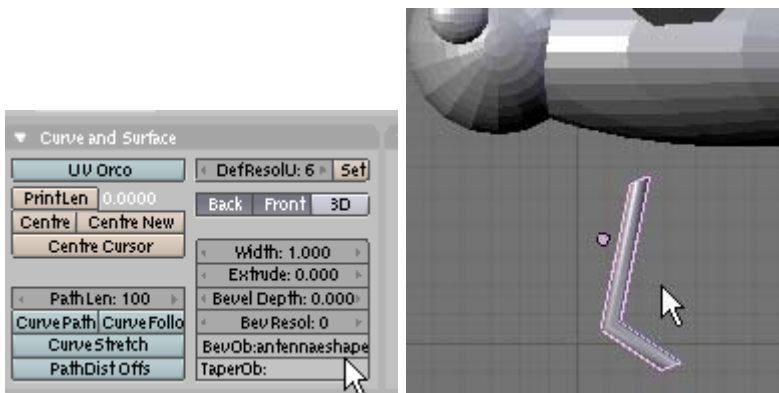
Grab each of the control vertices to make a leg shape as shown below.



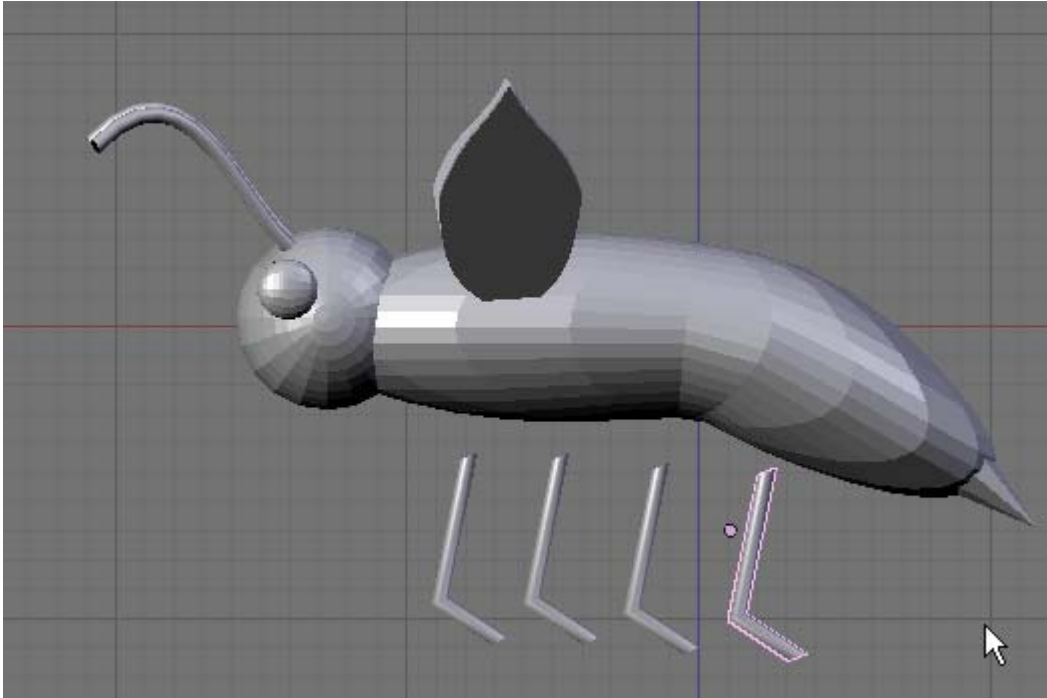
TAB out of Edit Mode.



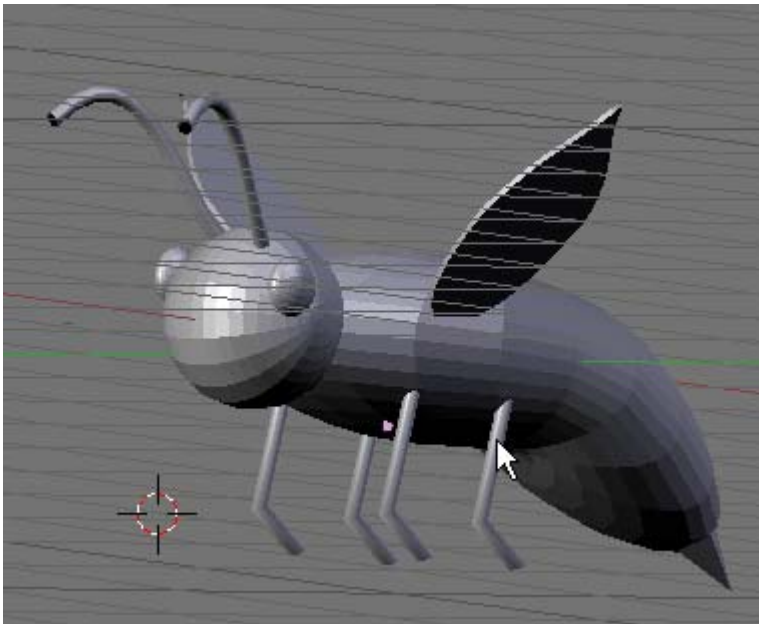
We will use the antennaeshape object to loft these bee legs. In the Curve and Surfaces Panel name the BEVOb: antennaeshape. This will loft the antennaeshape object along the Bezier curve to form one of the bee's legs.



Using the **SHIFT-D** (Duplicate) function make 3 duplicates of the object. Name these 4 objects as beeleg1, beeleg2, beeleg3 and beeleg4.

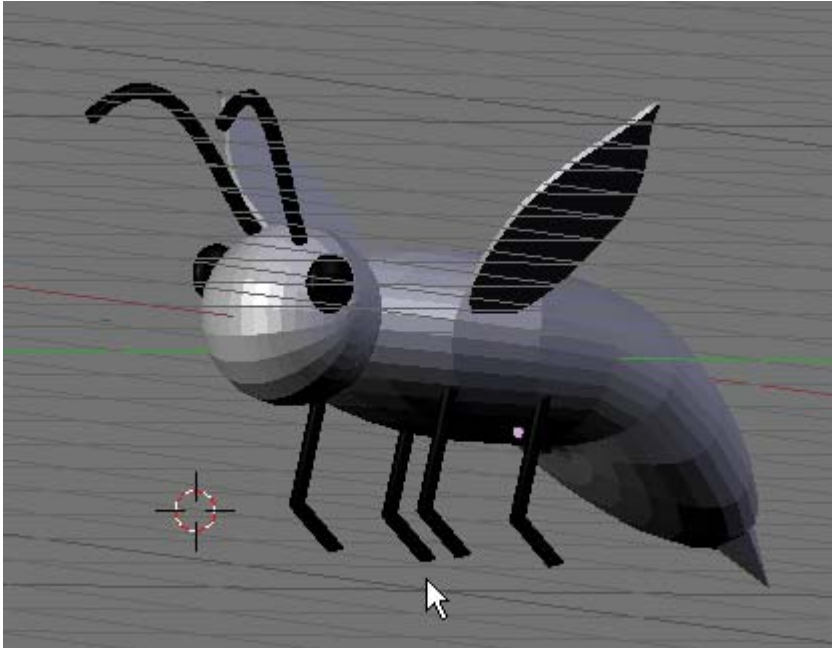


Position and rotate these legs in relation to the beebody as shown below.

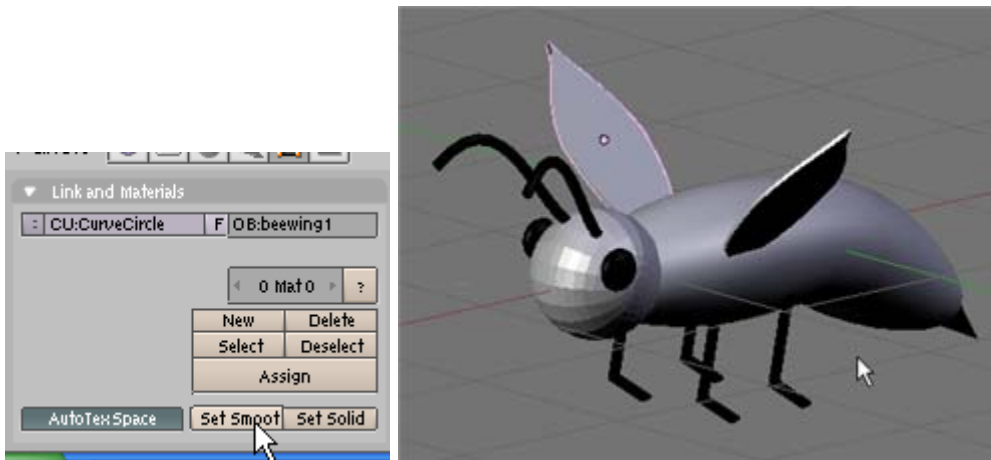


Save your blend file. **F2**.

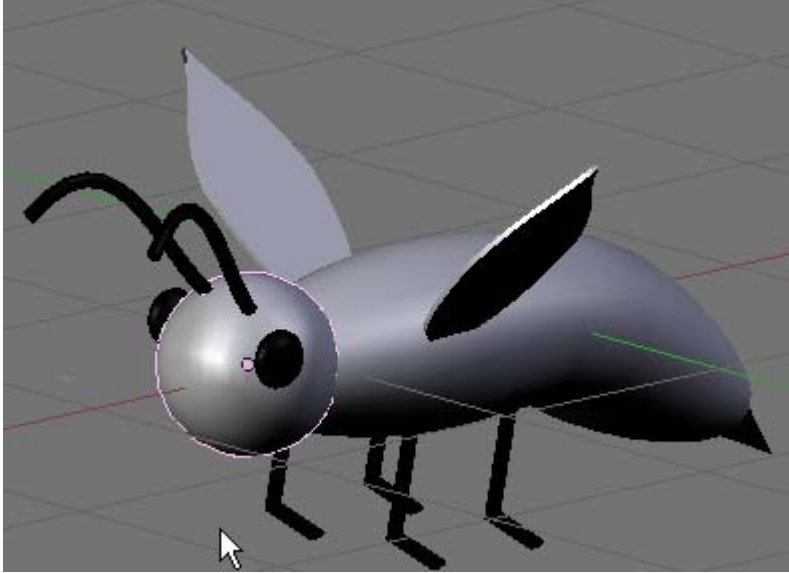
We will now add materials to the bee model. Select one of the bee's antennae. Press F5 (Shading). Add a new material and color it black. Name this material "Black" and assign it also to the other antennae, the 4 legs, the 2 eyes and the stinger.



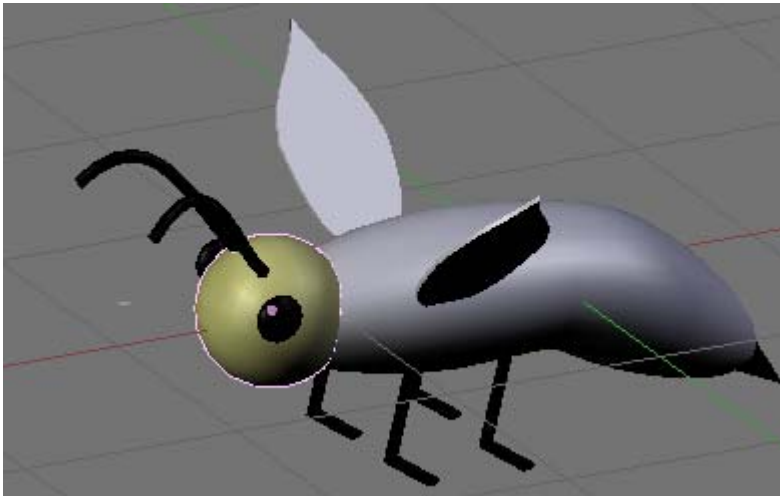
Select the beebody. Press **F9** (Editing) and in the Link and Materials Panel press the Set Smooth button.



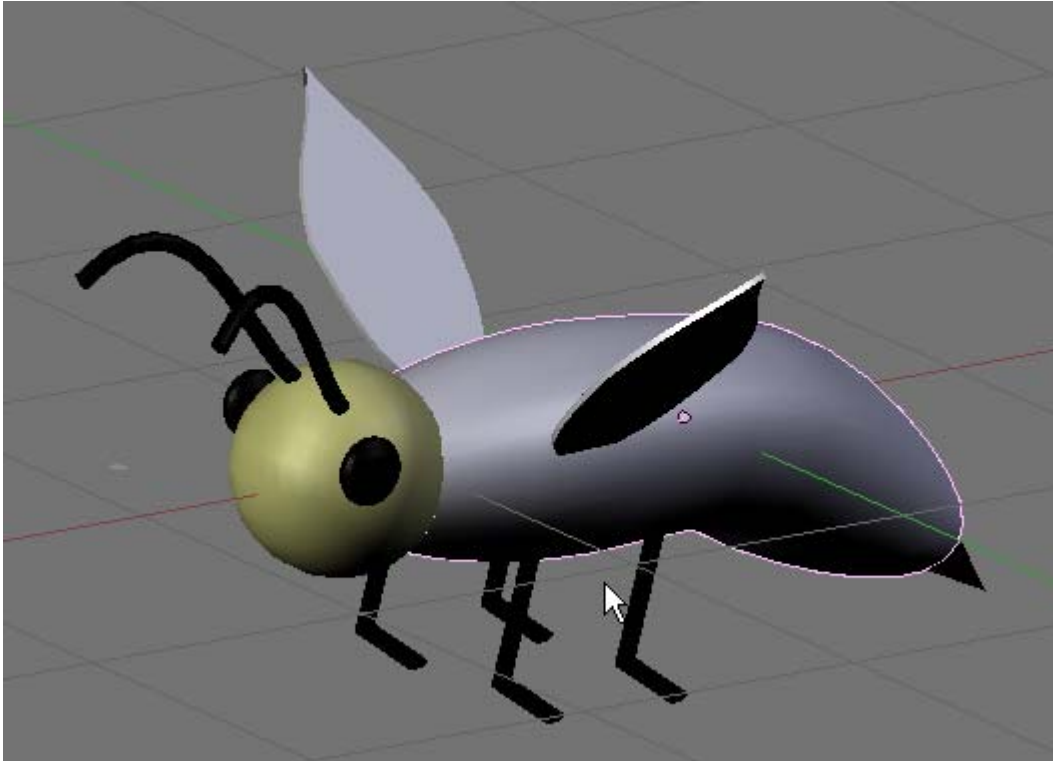
Select the beehead and then press the Set Smooth button again.



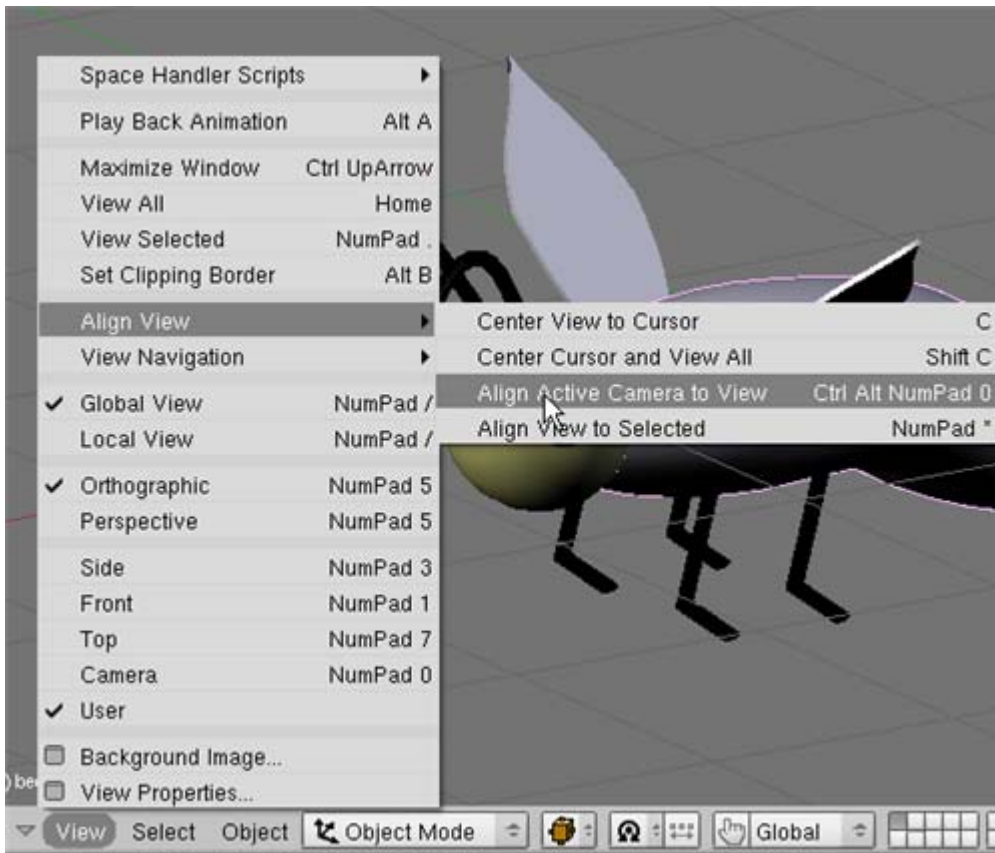
With the beehead selected, press **F5** (Shading). Add a new material and color it yellowish (R=1, G=1, B=.6)



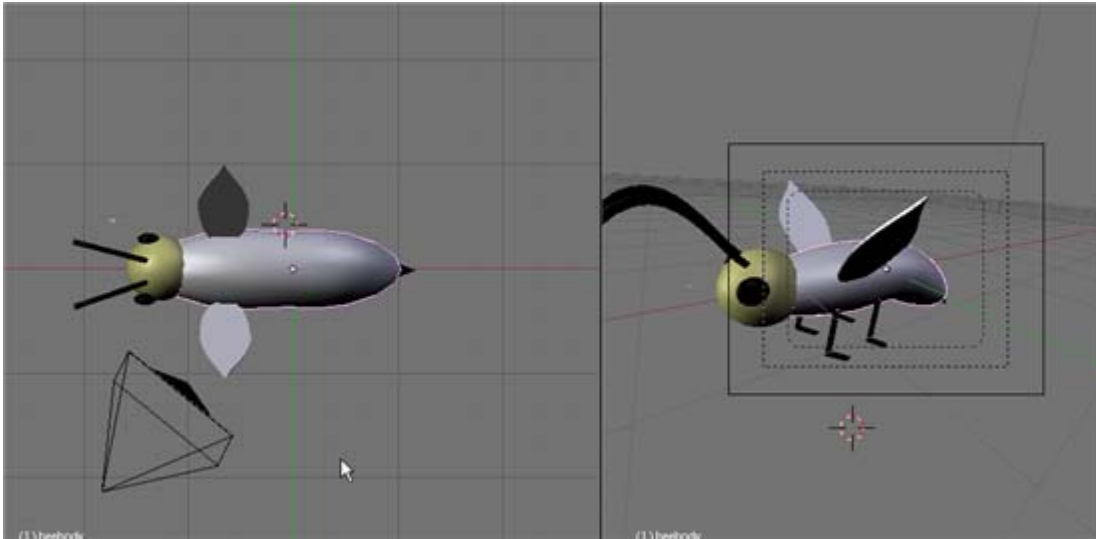
Before we can add the material to the bee's body we need to see the bee in camera view to check the rendered texture. Orbit your display of the bee into a suitable perspective.



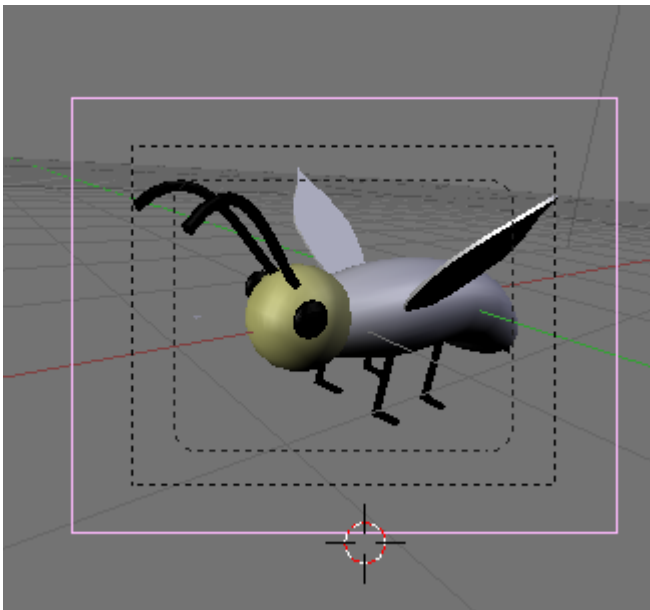
From the View Menu button choose Align View / Align Active Camera to View.



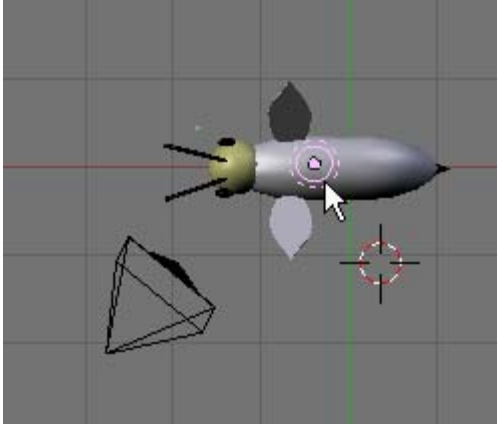
Split your 3D display vertically and place the camera view on the right and the top view on the left.



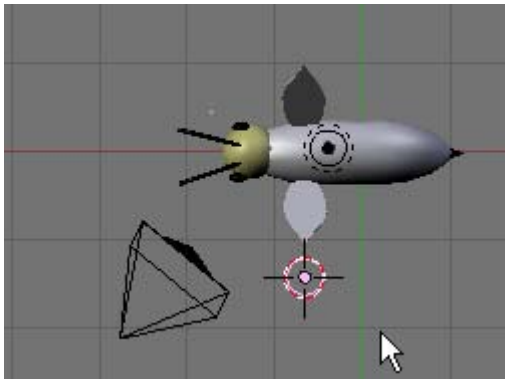
Select the camera in the top view and adjust it so you have a good image in the camera view (Do not attempt to move the bee).



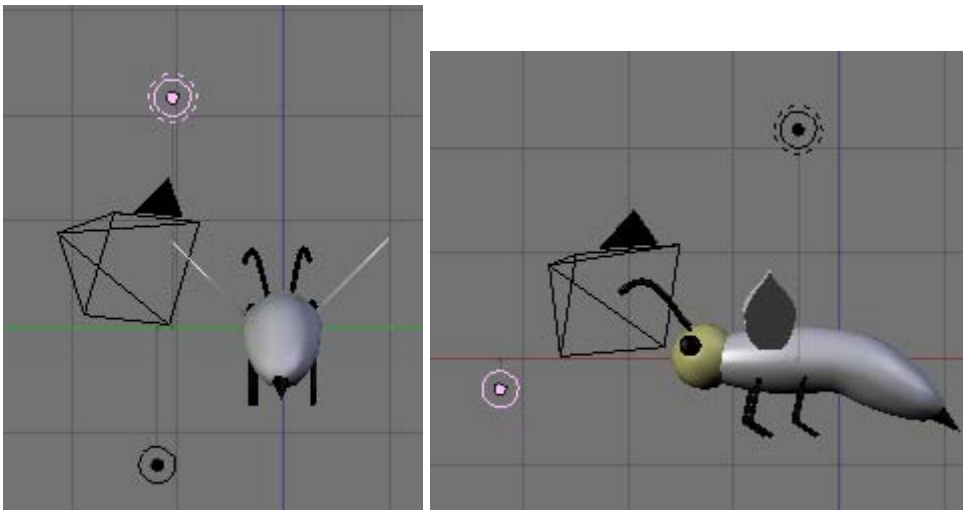
Zoom out a bit in the Top View. Grab the default Lamp object and place it over the bee.



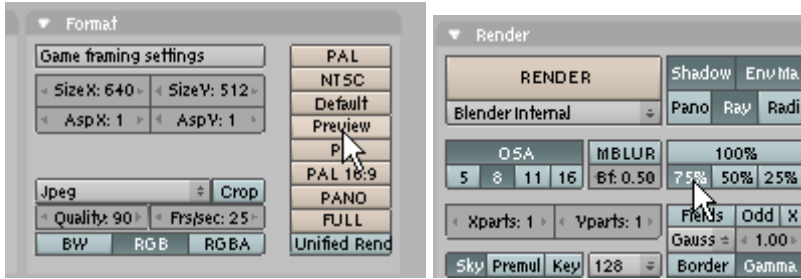
Place your 3D cursor by the camera and add another lamp object.



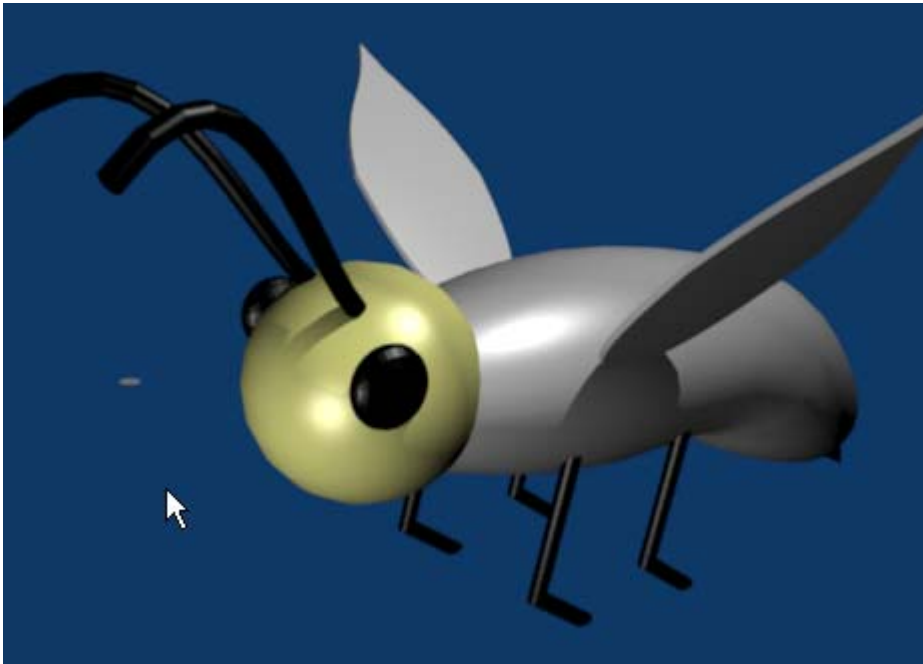
Go to Side View (**NUM3**) and adjust the placements of the lamps as shown.



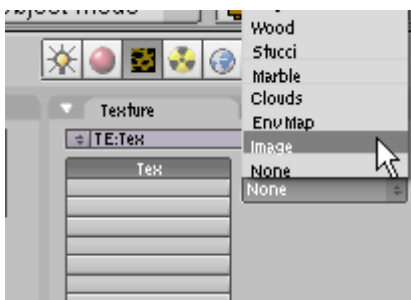
Press **F10** (Scene). Select the Preview preset in the Format panel and 75% in the Render Panel.



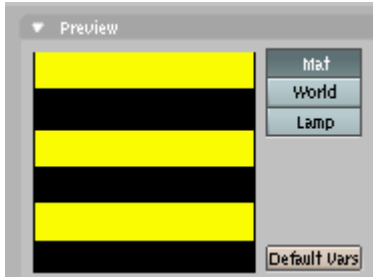
Press **F12** to Render. It should look something like below. (You may have to adjust the position of your lamp objects to get a good rendering).



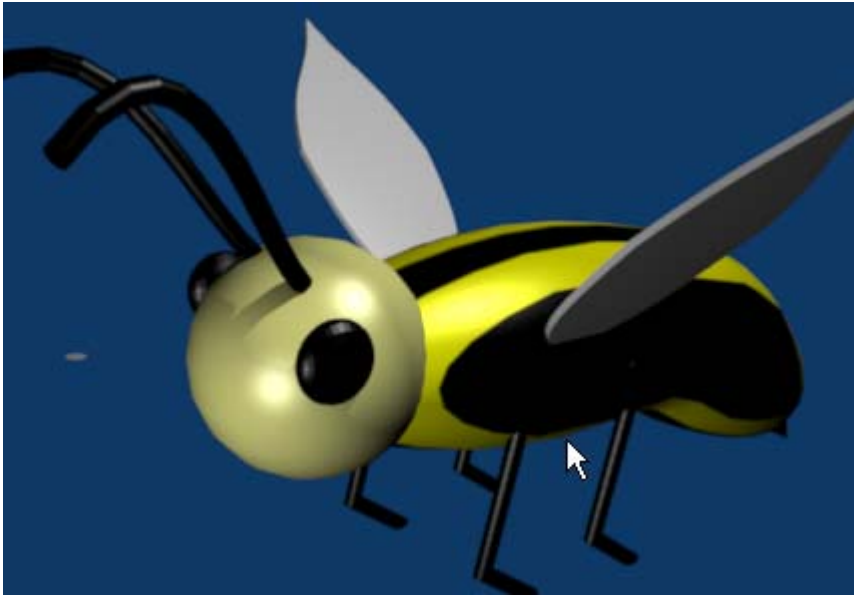
Select the beebody. Press **F5** (Shading). Add a new material. In the Texture Panel Press “Add New”. Press **F6** (Texture Buttons). Use the Texture Type dropdown box and select Image as the Texture Type.



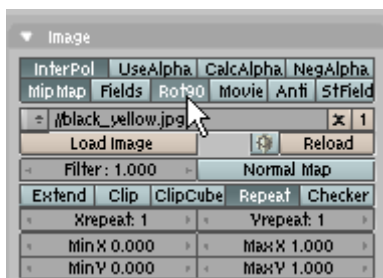
In the Image Panel press the Load Image button and load the black_yellow.jpg image file. This file is located in the SwarmOfBees.zip file.



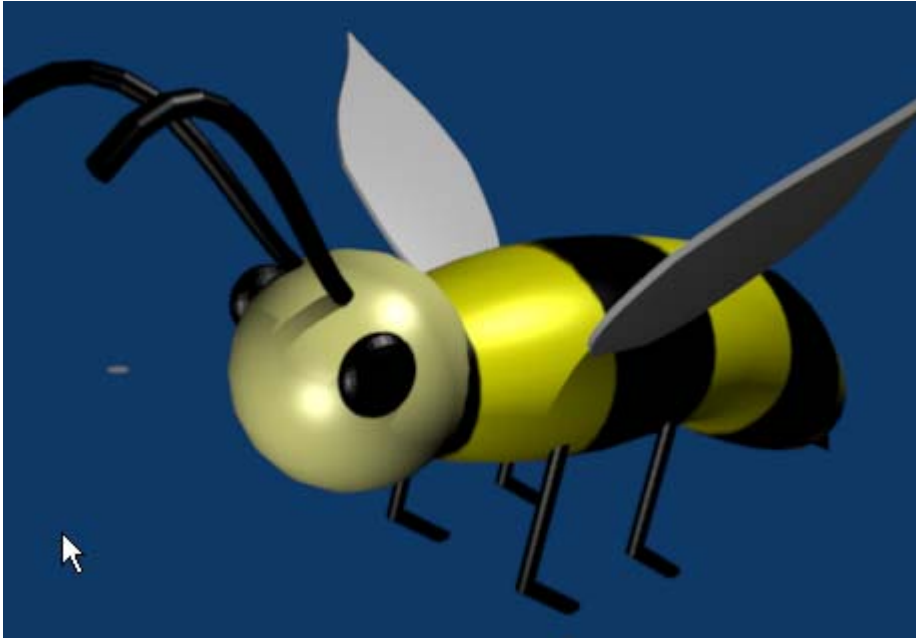
Press **F12** Render.



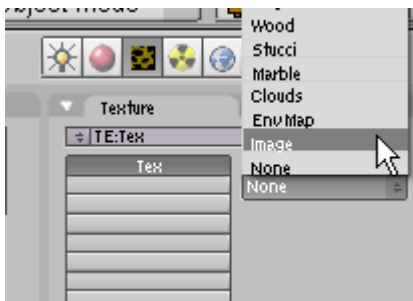
If your rendering is like mine the black and yellow strips are running in the wrong direction. To correct this Press the ROT90 button in the Image Panel.



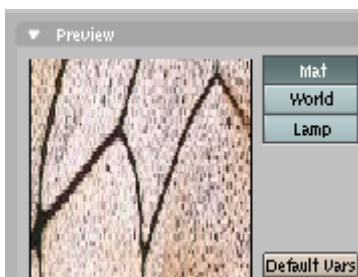
Render **F12**.



Select one of the bee's wings. Press **F5** (Shading) (You may need to click on the shading context button). Add a new material. In the Texture Panel Press "Add New". Press **F6** (Texture Buttons). Use the Texture Type dropdown box and select Image as the Texture Type.



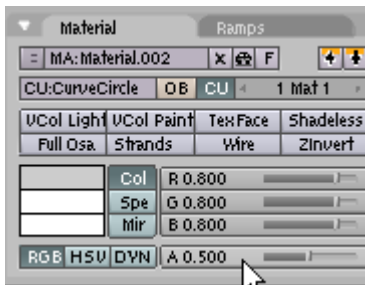
In the Image Panel press the Load Image button and load the beewing.jpg image file. This file is located in the SwarmOfBees.zip file.



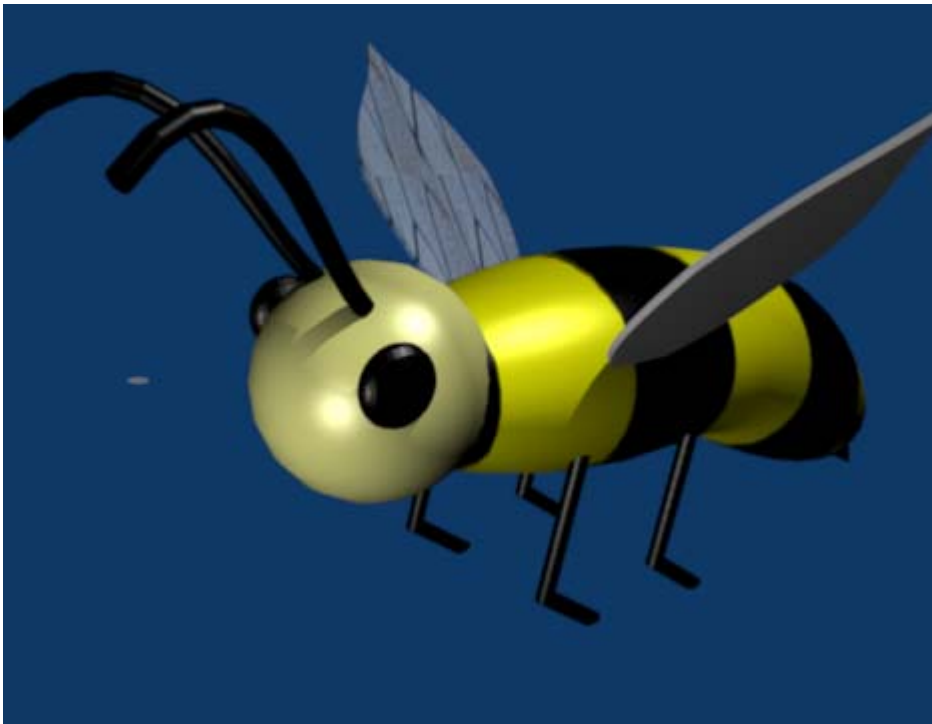
In the Image Panel set the XRepeat and YRepeat to 2



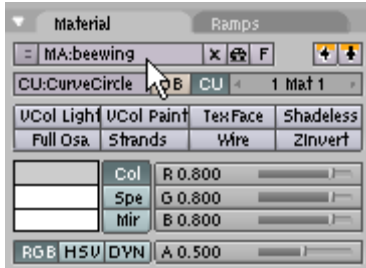
Go back to the Material Buttons (**F5**). In the Material Panel set the Alpha to .5



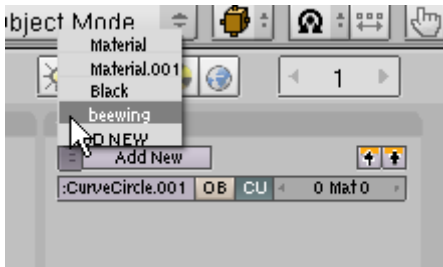
Render **F12**.



In the Material Panel name this Material beewing.



Select the other bee's wing object and apply this beewing material to it.



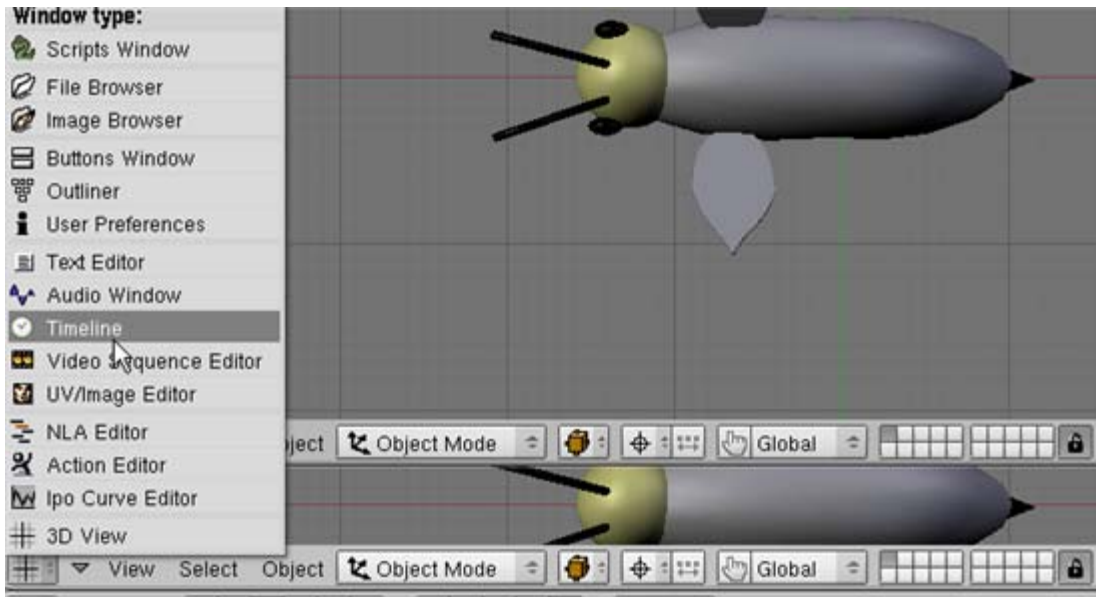
Save your file **CTRL-W**.

We now have the bee complete with its materials applied to each part. The next step is to prepare the model for the Blender Particle System.

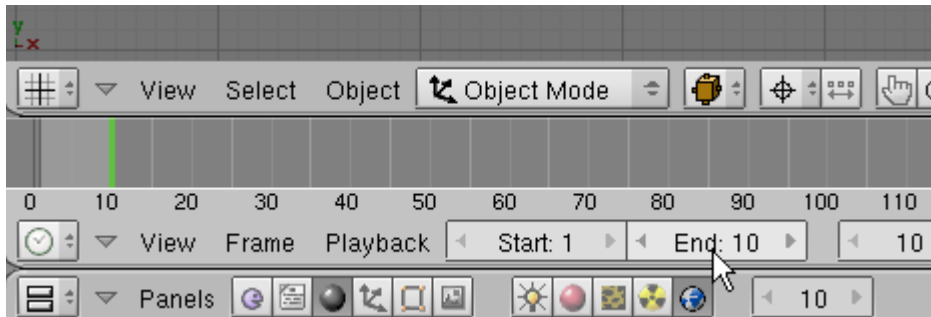
Switch to Top View (**NUM7**) and zoom out a bit. Select the 2 lamp objects and delete them.

Select the camera object and delete it.

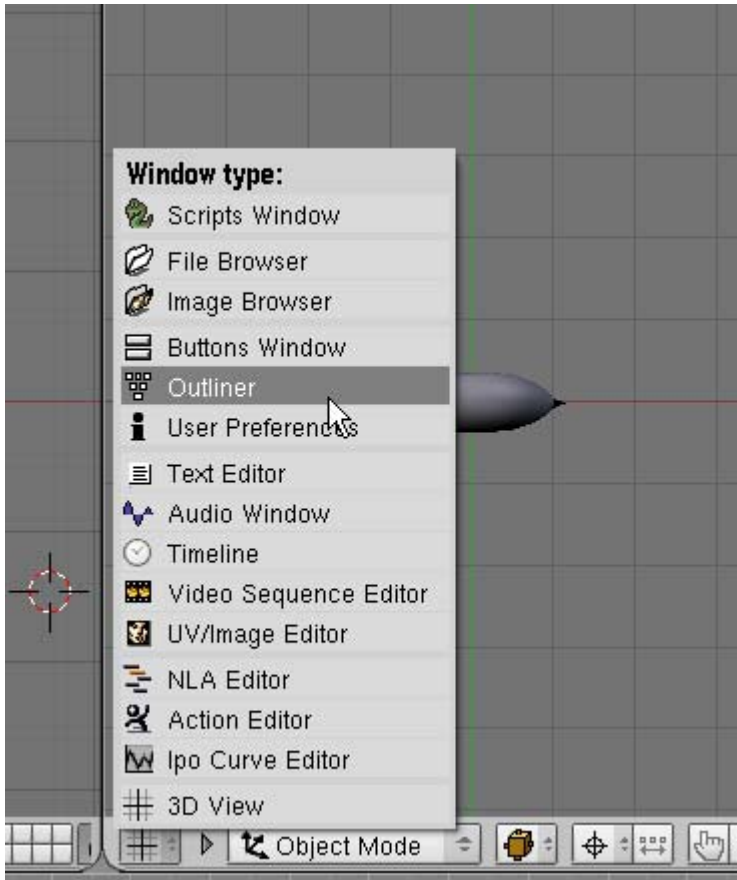
Split the 3D display horizontally. Use the Current Window button to select Timeline for the bottom window.



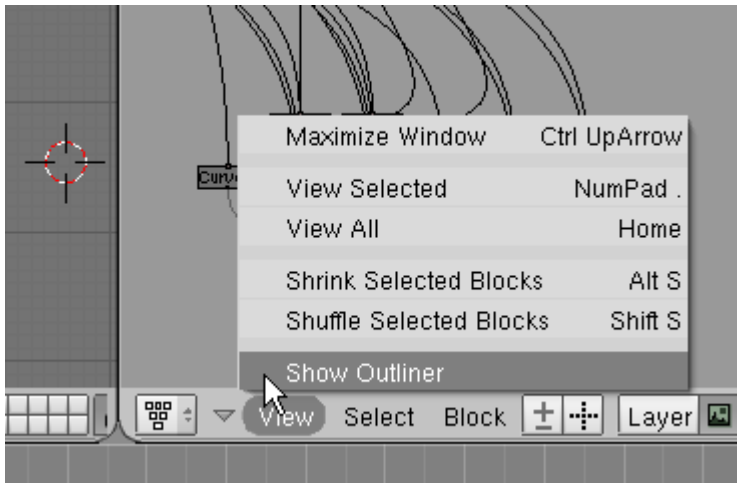
In the Timeline Window controls set the animation End to 10 frames.



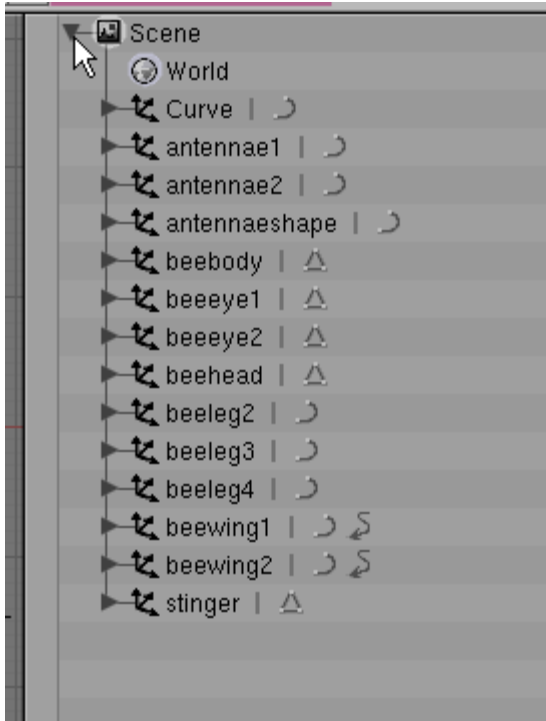
Split the top 3D display window vertically. Change the right side to an Outliner Window.



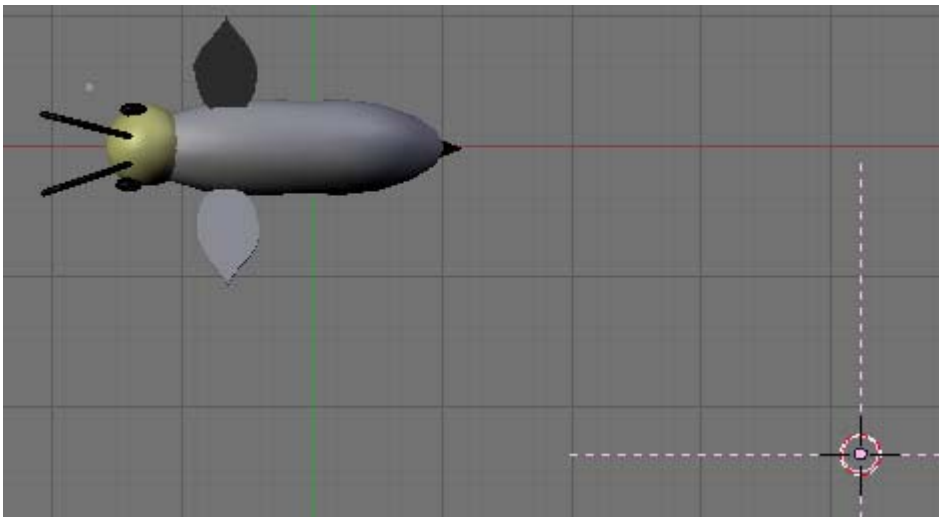
In the Outliner Window, click on the View Button and select “Show Outliner”.



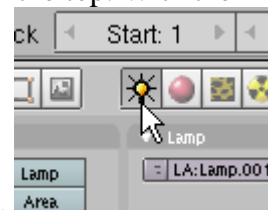
This will display the outline list of the objects in the scene. Click on the arrow to the left of the “Scene” entry to see all of the object names. Your outliner Window should look as below.



Make sure the left window is in Top View (**NUM7**). Off to the side, add a Hemi Lamp (**Space / Add / Lamp / Hemi**).

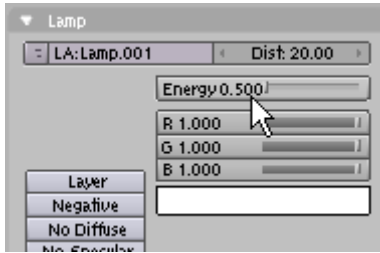


The Hemi Lamp (since it was inserted in the top view) will point straight down and illuminate all of the objects (no matter where) in the scene from the top. With the Hemi



Lamp selected press **F5** (Shading) then select the Lamp Button.

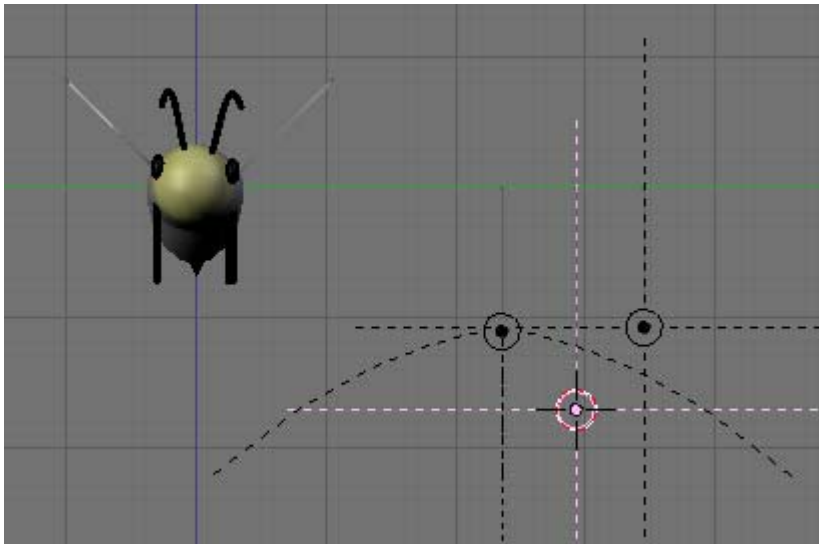
In the Lamp Panel set the energy for the Hemi Lamp to .5



Switch the 3D display to Side View (**NUM3**). Off to the side add another Hemi Lamp (**Space / Add / Lamp / Hemi**). Set this lamps energy level to .5.

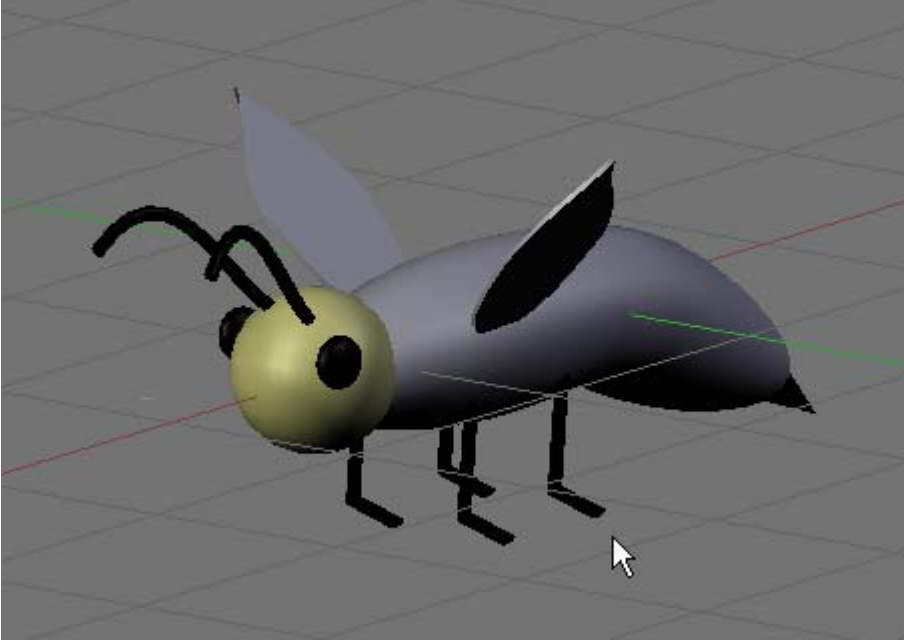
Switch the 3D display to Other Side View (**CTRL-NUM3**). Off to the side add another Hemi Lamp (**Space / Add / Lamp / Hemi**). Set this lamps energy level to .5.

We now have 3 Hemi Lamps (one pointing down, one pointing left and one pointing right) to illuminate the scene.

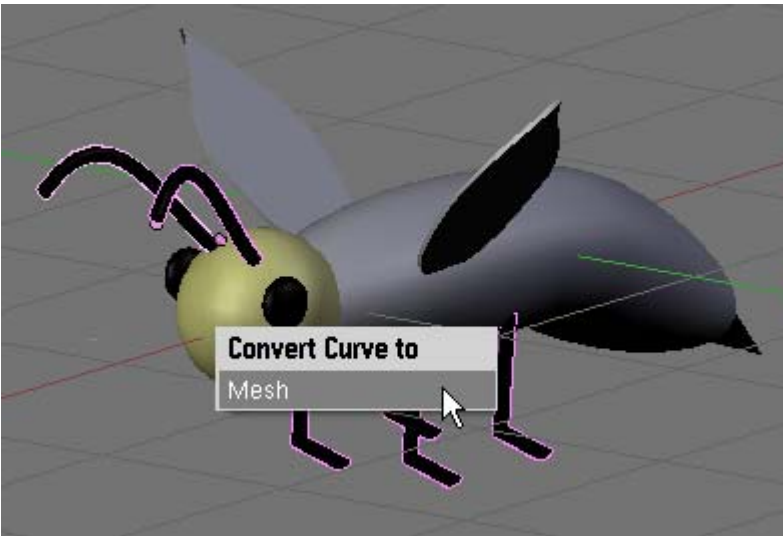


Save your file **CTRL-W**.

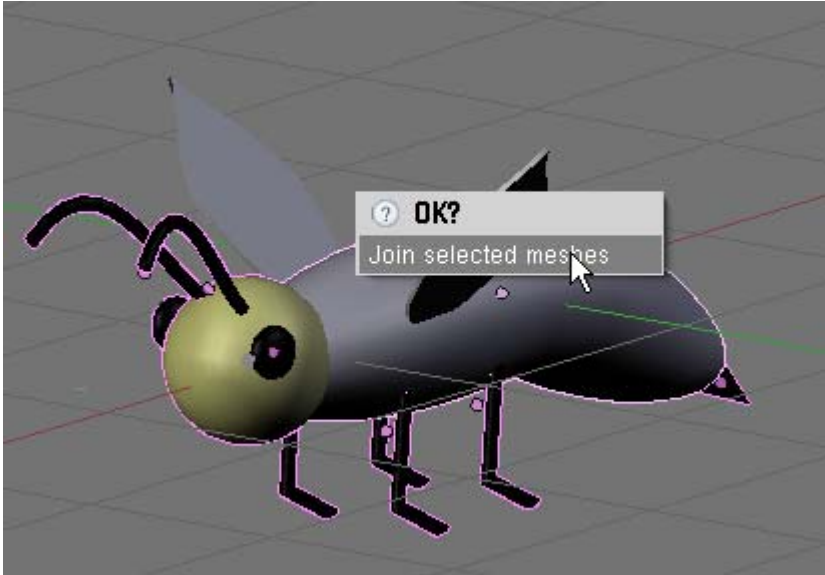
Switch the 3D display to Front View (**NUM1**). Orbit the view a bit so you can clearly see all of the objects that make up the bee.



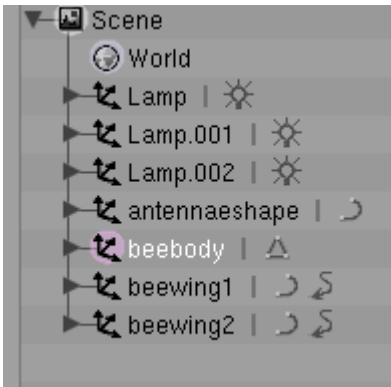
We now need to join the objects together. Before we can do that some need to be converted into mesh objects. Hold your **SHIFT** Key down and select the 4 beelegs and the 2 bee antennae. With these 6 objects selected press **ALT-C** (Convert) and convert these lofted objects to mesh objects.



The legs and antennae are now mesh objects. Add to the selection, the 2 eyes, the head and the stinger (You should now have the 4 legs, 2 antennae, 2 eyes, head and stinger selected). With these selected hold down the **SHIFT** Key and add the body to the selection. (You should now have all the parts selected except the wings). Press **CTRL-J** (Join) and join the objects into one object.

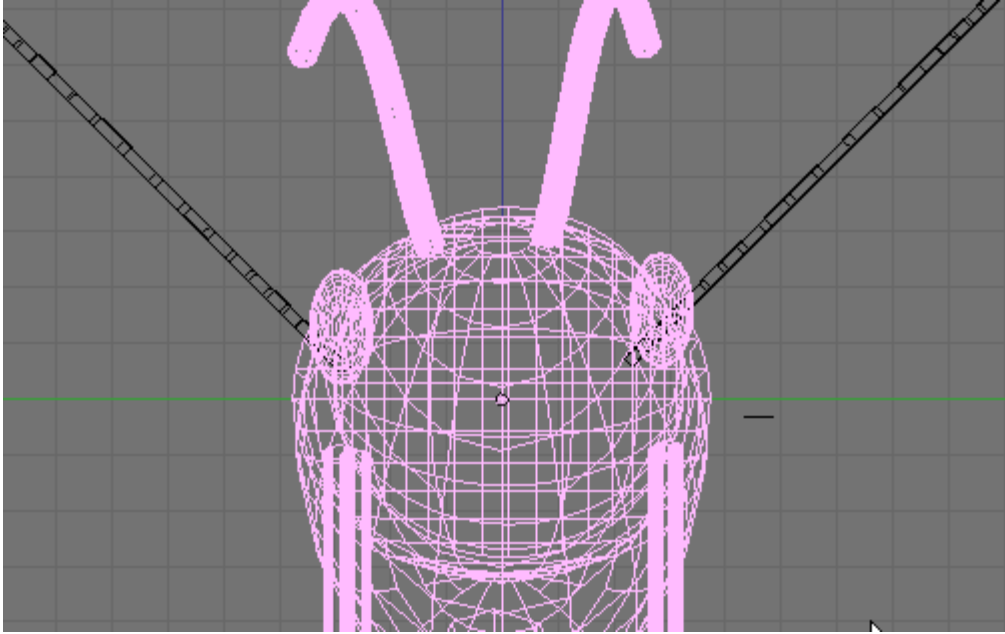


The objects are now one object. Note in the Outliner Window the bee is now comprised of 3 objects (beebody, beewing1 and beewing2).

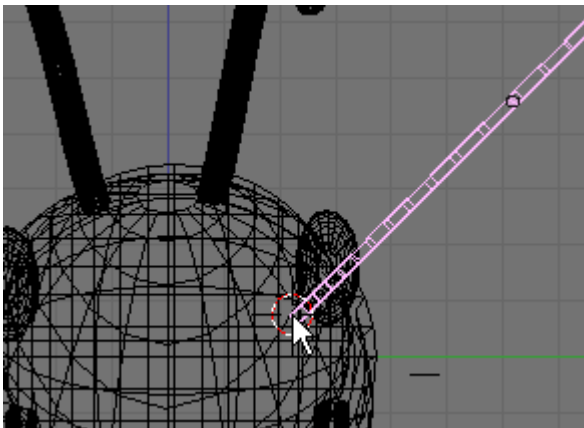


The wings now require some special attention. We want to animate them to flap but they still need to be part of the bee object so we can still use them as part of the Particle system.

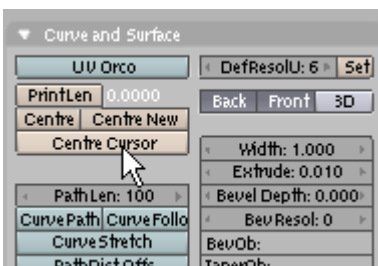
Switch the 3D display to side view (**NUM3**). Press the **ZKEY** to enter wireframe mode. Zoom in a bit so you can clearly see the wings.



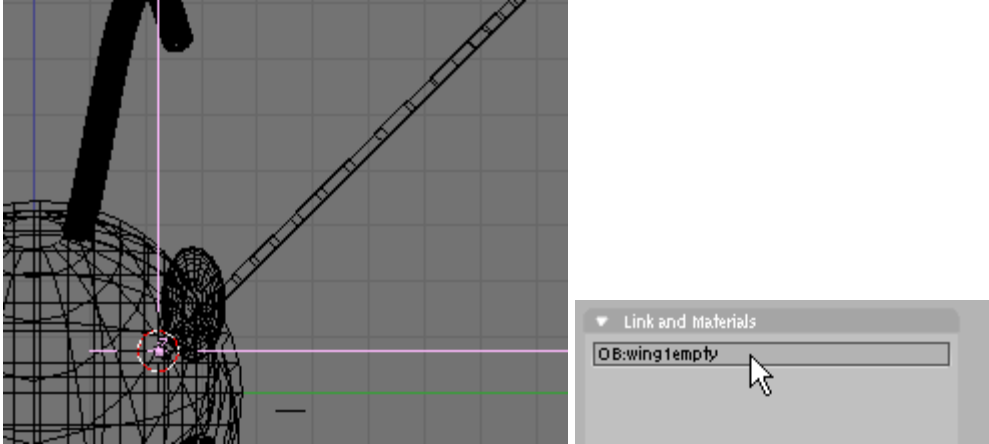
Select the wing on the right (This should be beewing1). Position your 3D cursor at the very bottom of the wing as shown.



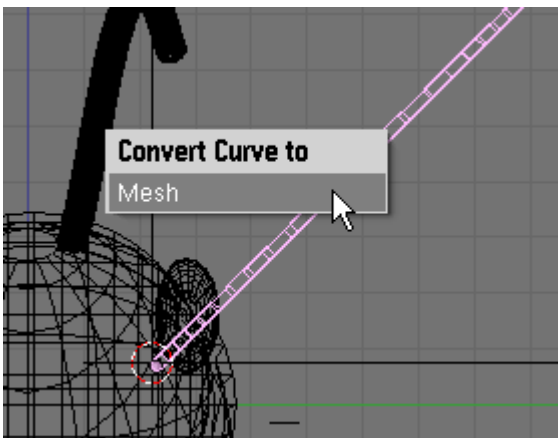
Press F9 (Editing) and in the Curve and Surfaces Panel press the Centre Cursor button.



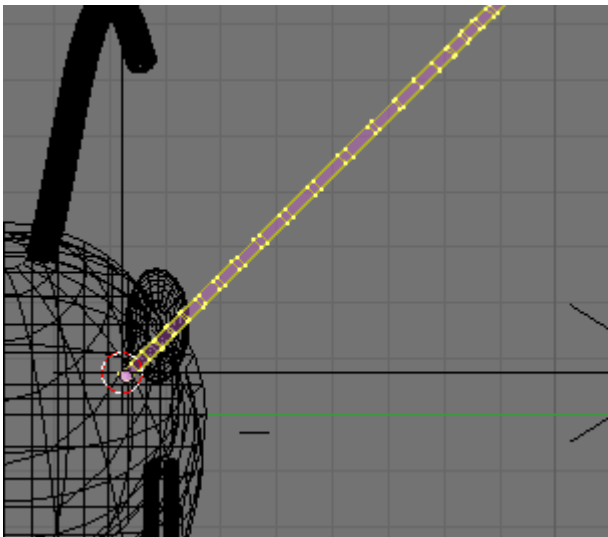
This moves the center of the wing to the cursor point. Leaving your cursor in that same position add an empty object (**space / add / empty**). Name this empty object wingempty.



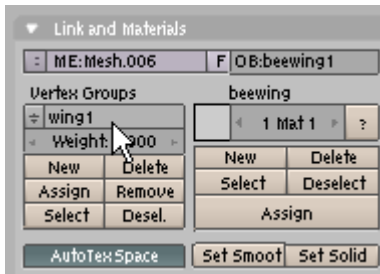
Select the wing1 object (alone). We need to first turn this into a mesh object. With the wing selected press **ALT-C** (Convert) and convert it to a Mesh



Now Press the **TAB** Key to enter Edit Mode on the wing and Press the **A**KEY to select all of the vertices.



In the Link and Materials Panel Click on the “New” vertex group and name the group wing1.

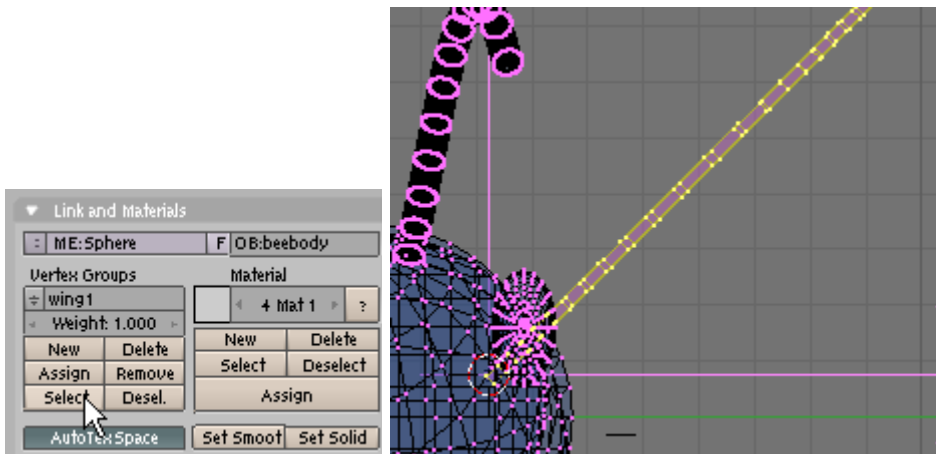


Now press the Assign button which will assign these vertices to the wing1 group.

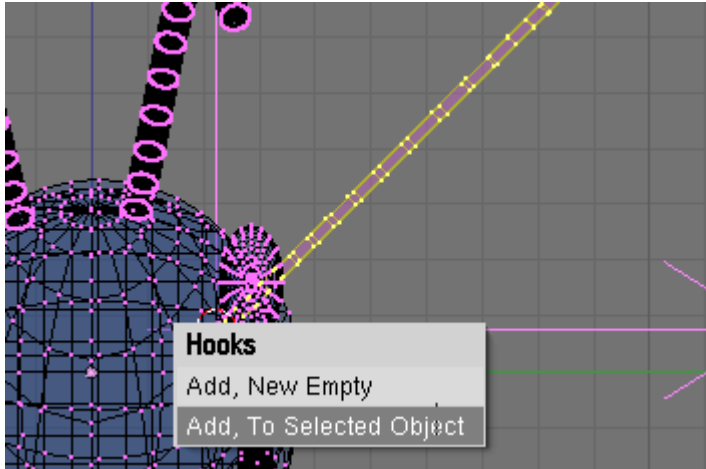
After you assign the vertices to the group **click on the deselect button** to deselect the vertices. Next press the **TAB** Key to exit Edit Mode. With the wing object selected hold the **SHIFT** Key down and add the beebody to the selection. Press **CTRL-J** and join the objects. Wing 1 is now part of the beebody mesh.

Now select the Wing1empty object (alone). Hold the **SHIFT** Key and add the beebody object to the selection. Now press the **TAB** Key to enter Edit Mode. Press the **A**KEY to deselect all the vertices.

In the Link and Material Panel, with the wing1 group listed, press the Select Button. This will select only the wing1 vertices from the whole object.

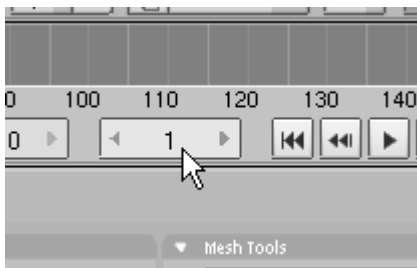


Press **CTRL-H** (Hook). Select “Add, To Selected Object”. This makes the wing1empty a “hook” for the wing1 vertices.

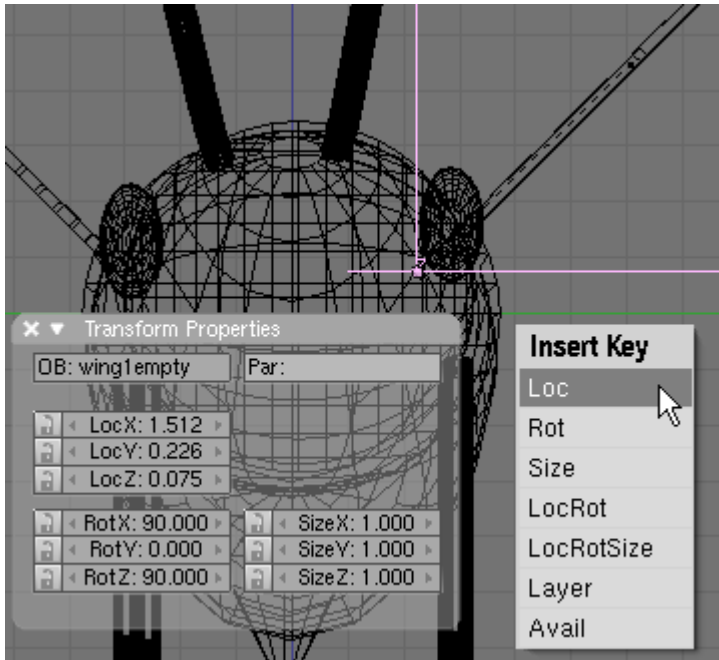


Press the deselect button to deselect the vertices.

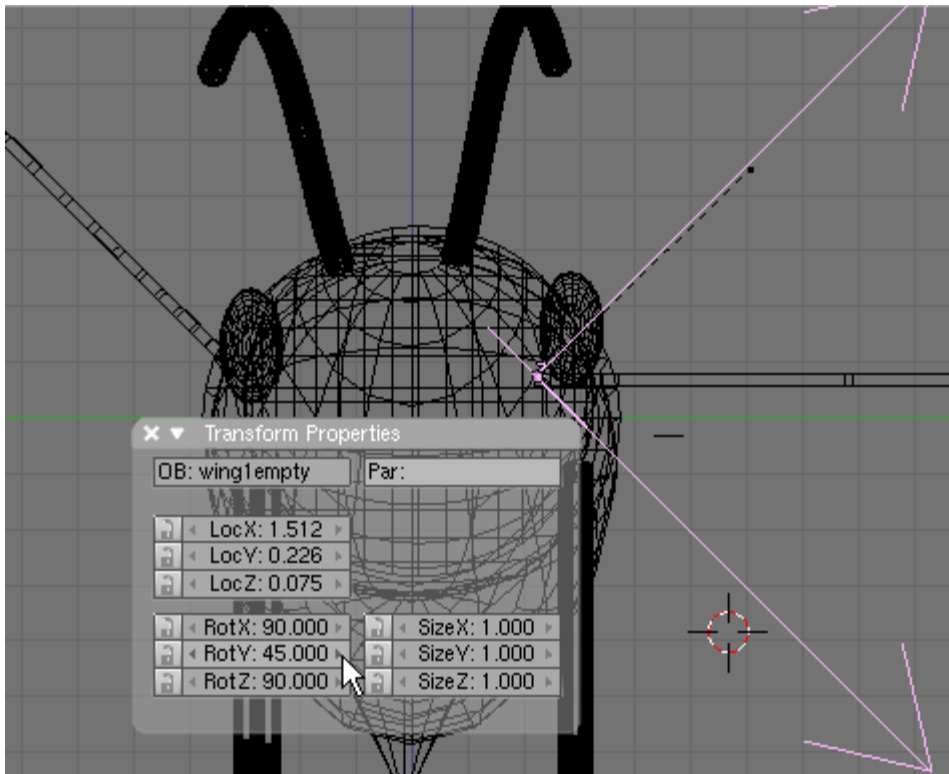
We can now animate the wing (by controlling the hook). Press the **TAB** Key to exit Edit Mode. Select the wing1empty object (alone). Make sure you are in frame 1.



Press the **NKEY** to display the Transform Properties for the wing1empty object. While in frame 1 press the **IKEY** and insert a ROT (Rotation) keyframe.



Advance to frame 5. Change the ROTY setting in the Transform Properties Panel to 45 degrees.



Press the **IKEY** and insert a **ROT** keyframe for the wing1empty object for frame 5.

Advance to frame 10. Set the ROTY setting for the wing1empty object to 0 degrees. Press the **IKEY** and insert a **ROT** keyframe for the wing1empty object for frame 10.

You should now be able to press the go button on the Timeline Window and run the animation from frames 1 to 10. The wing should flap to 45 degrees in 5 frames and back to its starting position in the next 5 frames.

Stop the animation (if it is running) and go to frame 1.

CTRL-W - Save your file.

Select the left wing alone. (This should be the beewing2 object). We now need to apply the same operations to the beewing2 object. The sequence is:

- 1 Position your 3D cursor at the very bottom of the wing.
- 2 Press F9 (Editing) and in the Curve and Surfaces Panel press the Centre Cursor button
- 3 Leaving your cursor in that same position add an empty object (**space / add / empty**). Name this empty object wing2empty.
- 4 Select the wing2 object (alone). With the wing selected press **ALT-C** (Convert) and convert it to a Mesh
- 5 Press the **TAB** Key to enter Edit Mode on the wing and Press the **AKEY** to select all of the vertices.
- 6 In the Link and Materials Panel Click on the “New” vertex group and name the group wing2.
- 7 Press the Assign button which will assign these vertices to the wing2 group.
- 8 Click on the deselect button to deselect the vertices.
- 9 Press the **TAB** Key to exit Edit Mode.
- 10 With the wing object selected hold the **SHIFT** Key down and add the beebody to the selection.
- 11 Press **CTRL-J** and join the objects. Wing 2 is now part of the beebody mesh.
- 12 Select the Wing2empty object (alone).
- 13 Hold the **SHIFT** Key and add the beebody object to the selection.
- 14 Press the **TAB** Key to enter Edit Mode.
- 15 Press the **AKEY** to deselect all the vertices (**MAKE SURE NO VERTICIES ARE SELECTED**).
- 16 In the Link and Material Panel, with the wing2 group listed, press the Select Button. This will select only the wing2 vertices from the whole object.
- 17 Press **CTRL-H** (Hook).
- 18 Select “Add, To Selected Object”. This makes the wing2empty a “hook” for the wing2 vertices. **Press the deselect button to deselect the vertices.**
- 19 Press the **TAB** Key to exit Edit Mode. Select the wing2empty object (alone). Make sure you are in frame 1.
- 20 Press the **NKEY** to display the Transform Properties for the wing2empty object (if not already displayed)
- 21 While in frame 1 press the **IKEY** and insert a ROT (Rotation) keyframe.

- 22 Advance to frame 5. Change the ROTY setting in the Transform Properties Panel to a -45 degrees.
- 23 Press the **IKEY** and insert a **ROT** keyframe for the wing2empty object for frame 5.
- 24 Advance to frame 10. Set the ROTY setting for the wing2empty object to 0 degrees.
- 25 Press the **IKEY** and insert a **ROT** keyframe for the wing2empty object for frame 10.
- 26 Select the wing2empty object.
- 27 Hold the **SHIFT** Key down and add the beebody to the selection.
- 28 Press **CTRL-P** and make the beebody a parent of the wing2empty object.

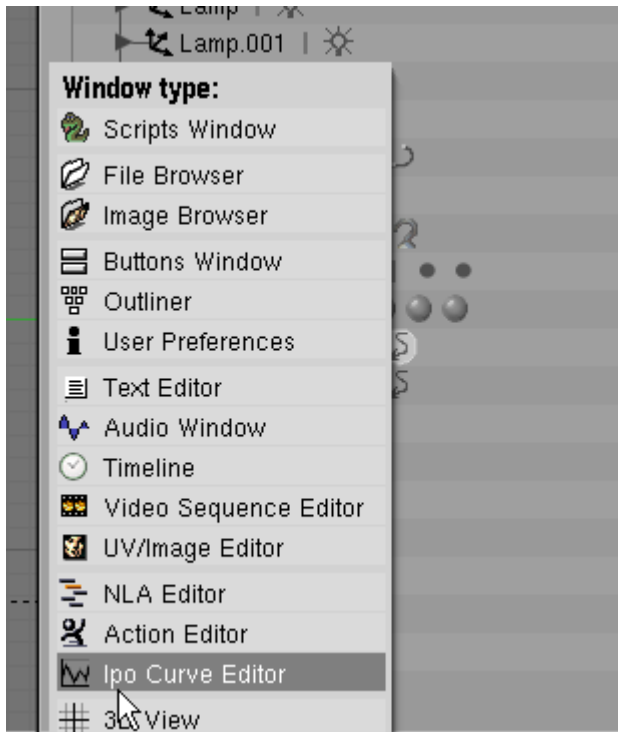
Both wings should now be animated from frames 1 to 10.

CTRL-W – Save your file.

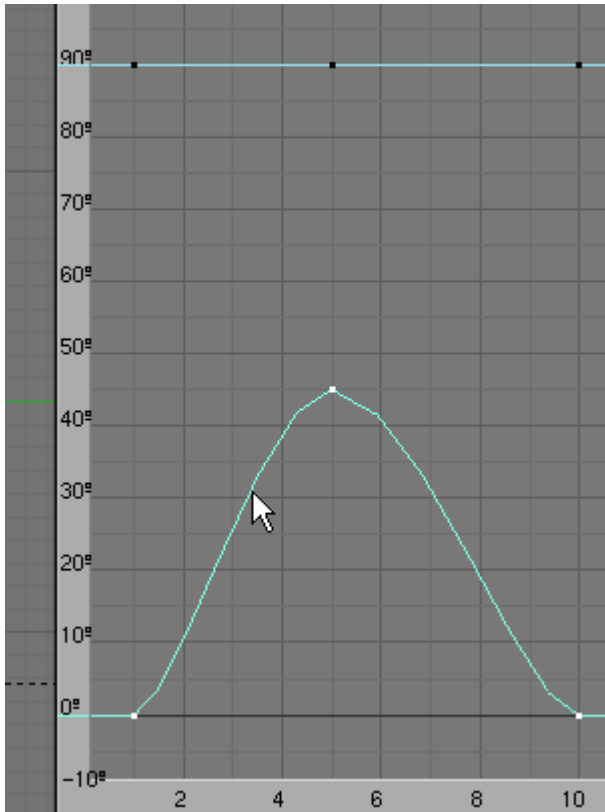
Hold the **SHIFT** Key down and select both empty objects (wing1empty and wing2empty). With the empty objects selected add the beebody to the selection. Press **CTRL-P** and make the beebody a Parent to the empty objects.

Press the **AKEY** to deselect all objects.

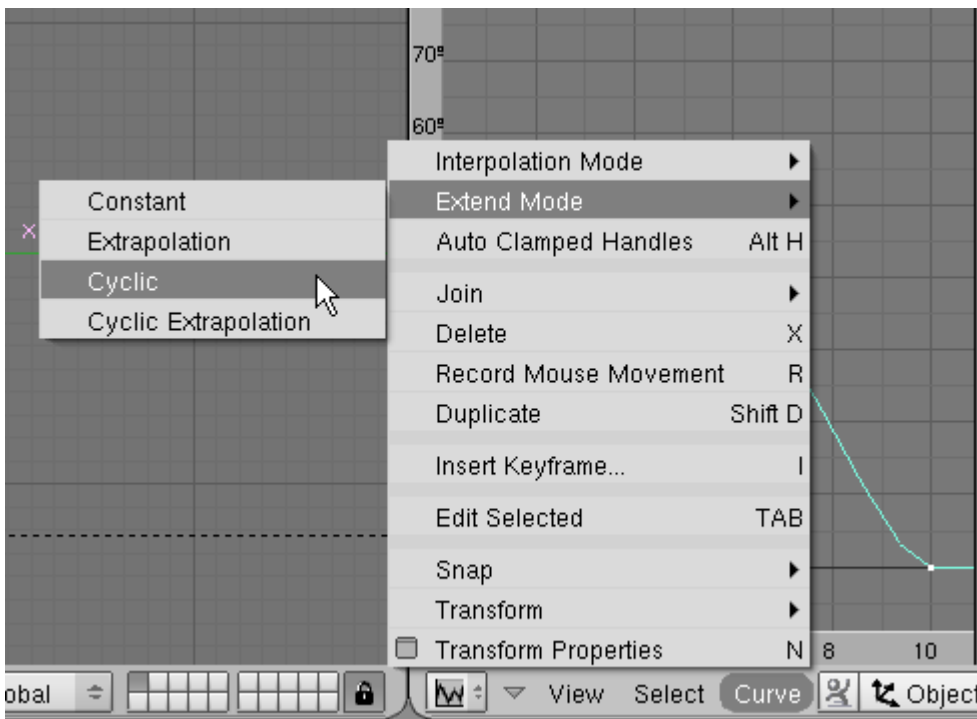
Change the right display window to IPO Curve Editor.



Select the wing1empty object. Click anywhere in the IPO window then click on the **HOME** Button. The animation curve will be fully displayed. Select (Right-Click) the animation curve.



Press the Curve button in the IPO Window and select Extended Mode / Cyclic.

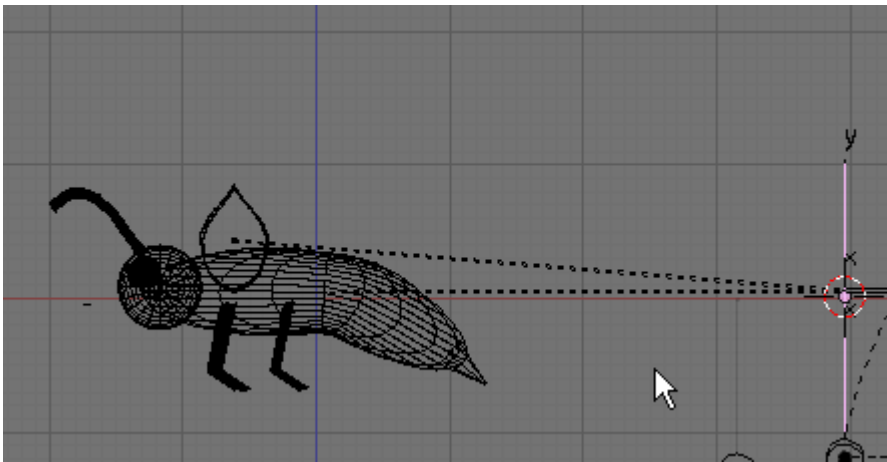


This will extend the wing animation for however long the animation lasts. Select the wing2empty object. Select its animation curve in the IPO window. Press Curve / Extended Mode / Cyclic. Both wings are now animated to keep flapping as long as the animation lasts.

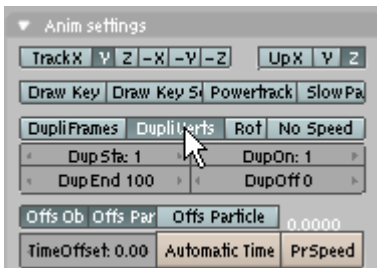
Return the right window to the Outliner Window.

Press the **AKEY** so nothing is selected.

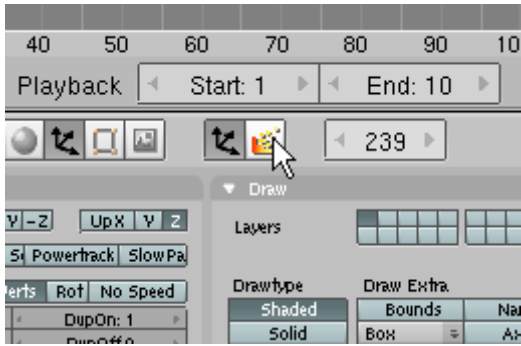
Place your 3D cursor in the center of the side view. Add a Plane object. (Space / Add / Mesh / Plane). **TAB** out of edit mode and switch to Front View (**NUM1**).



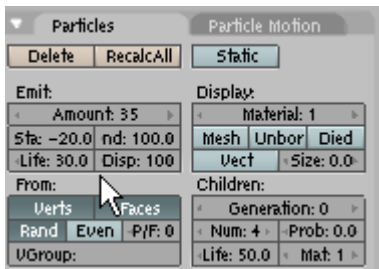
We will use the plane object as our particle emitter. With the plane selected press F7 (Object Buttons). In the Animations Settings Panel activate the DupliVerts button. This will allow the particle system to use objects.



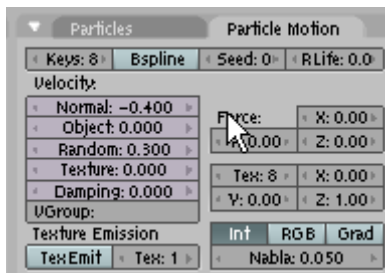
Next Press the physics button



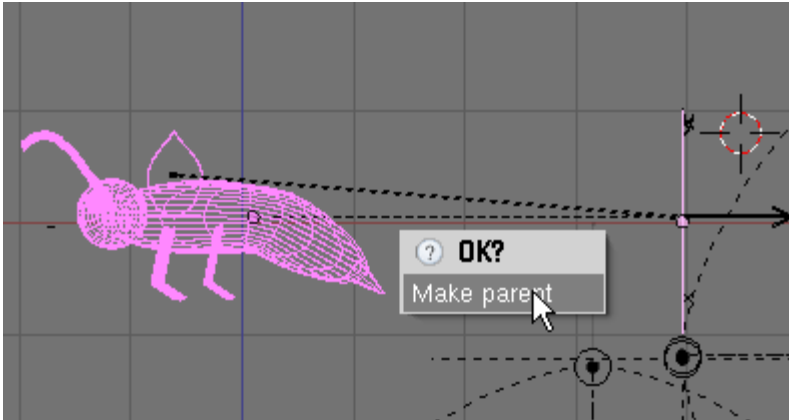
In the Particles Panel press the “new” button. In the Particles Tab set the Total to 35; set the Start to -20; set the Life to 30 and in the “From” section activate the RANDOM button.



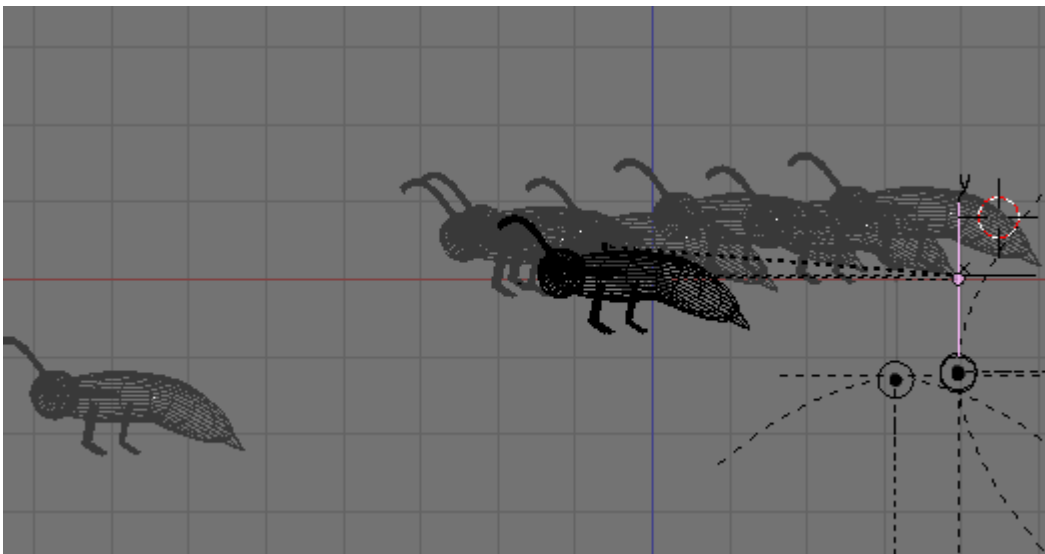
In the Particle Motion Tab set the Normal to -.4 and the Random to .3



Select the beebody object. Hold your **SHIFT** Key down and add the Plane object to the selection (you may have to click on it in the Outliner Window.) Press **CTRL-P** and make the Plane a Parent of the beebody.



Make sure you are in frame 1. You should see a few more bee objects emitted from the Plane object.

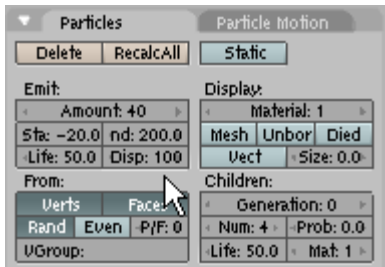


In the Timeline Window set the End of the animation to 200.



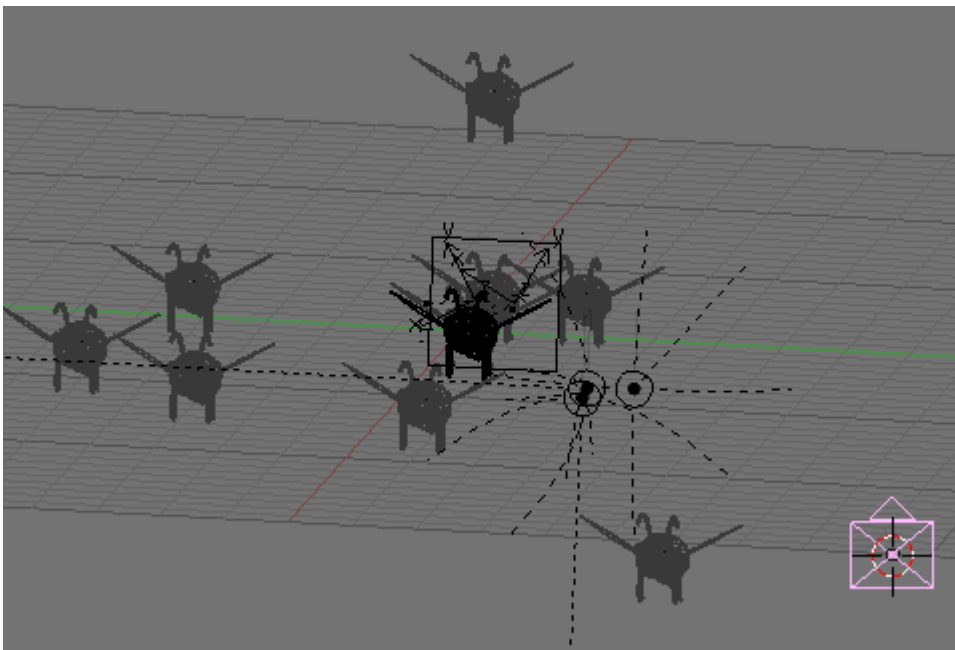
If you play the animation the bee objects (animated) are emitted from the Plane emitter.

We will make some changes in the Particles Panel. Set the Total to 40, the End to 200 and the Life to 50.

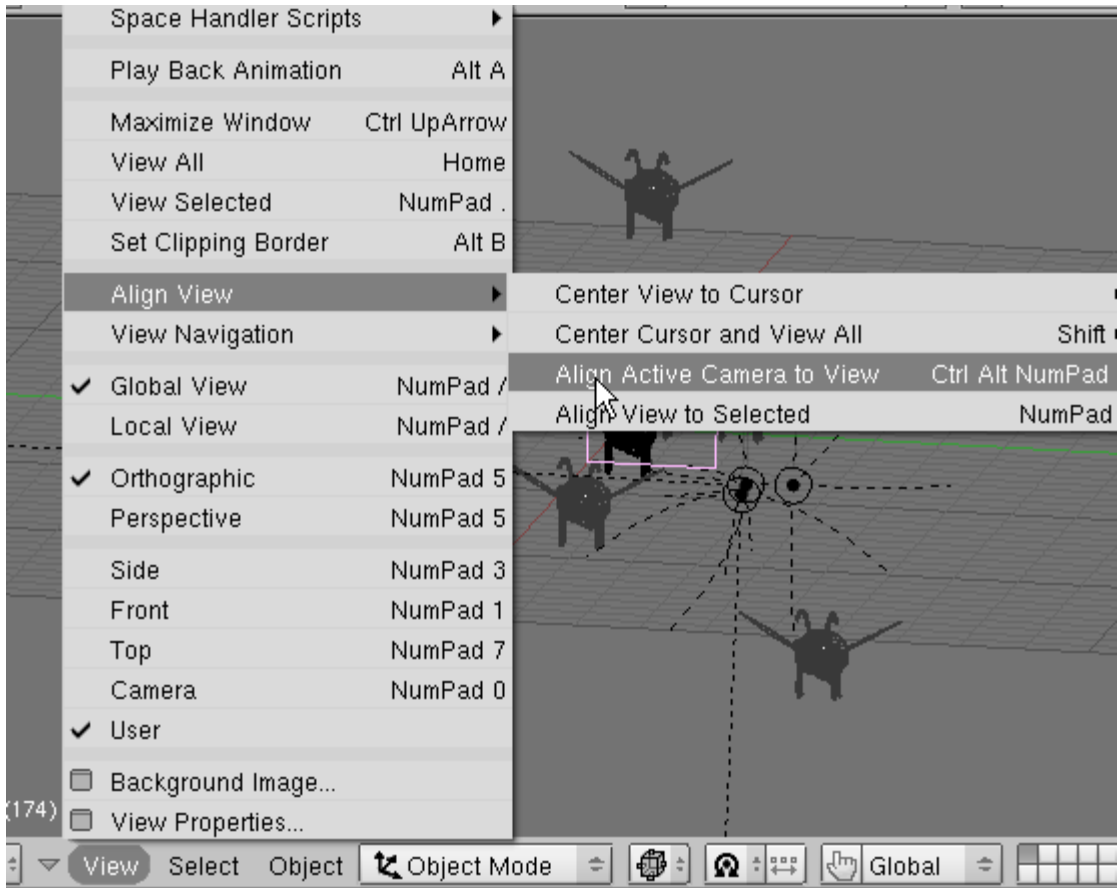


Play the animation. Notice that the original beebody object does not move.

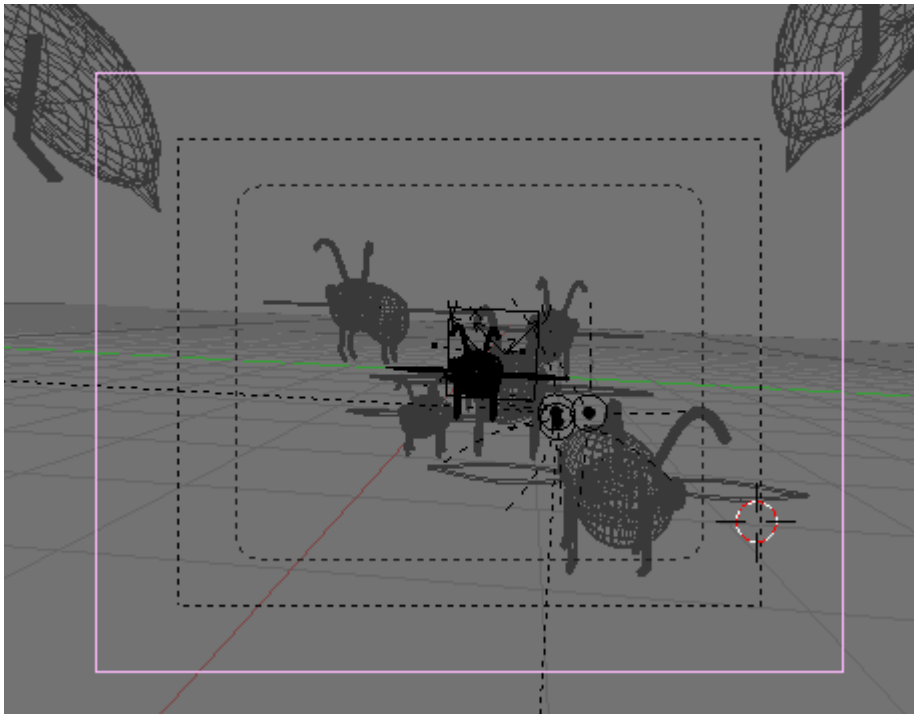
Switch to Other side View (**CTRL-NUM3**). Place your cursor anywhere in the display and add a camera object (Space / Add / Camera).



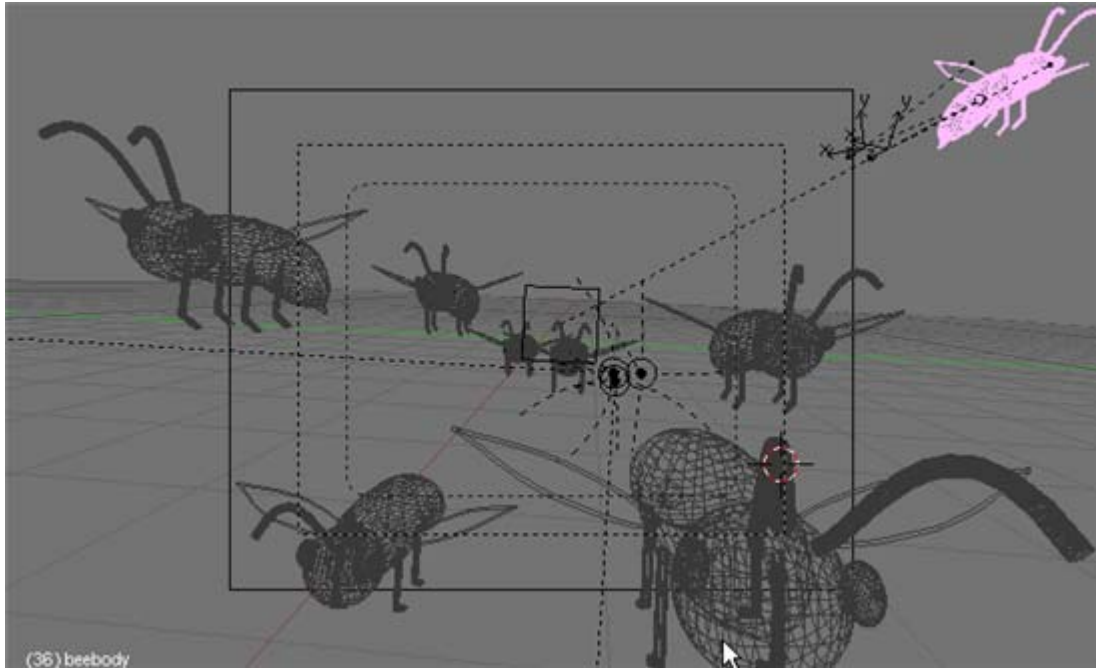
Orbit the view a slight bit and get a good view of the bees coming at you. Then press the View Button and select Align View / Align Active Camera to View.



Your camera view should look something like shown below.



Select the beebody object. Grab it and move it out of the camera view so it does not render.



Save your file – **CTRL-W**

Press F10 (Scene). Choose Preview as a preset at 50%. Select QuickTime as the file type. Select a location for your output file.



Click on the Animation button to render the animation. (You may want to play around with the Particle settings and the camera placement.)

A finished copy of this file is located in the SwarmOfBees.zip file named SwarmOfBeesComplete.blend.