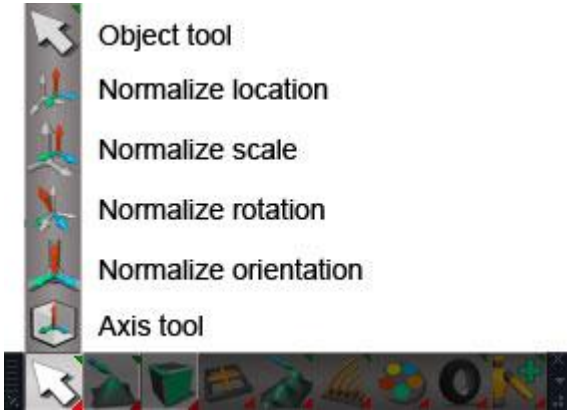
Chapter 3 MODELING - Workspace

3.1 Object Tools



The object tools allow for basic manipulation of the object itself. The tools to do this are found under the first fly out on the main modeling toolbar, as seen in the image on the left.

Below you will find a description of each individual tool on this fly out.

3.1.1 Object

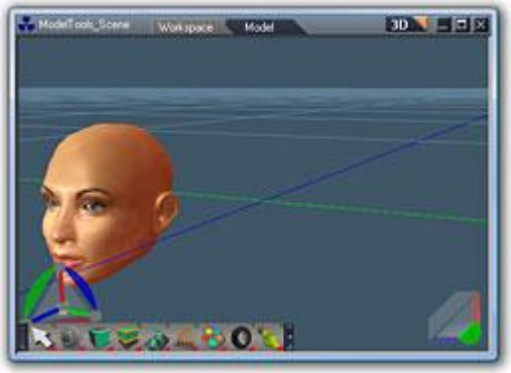
The Object tool is used to select an object. Once an object has been selected, the remaining object tools can be used. Choose the Object tool and left click on an object in the Workspace to select it.

Once an object is selected, it will show the Object Navigation Controller which can be used to move, rotate and scale the object. The Object Navigation Controller is highlighted in the image below:

Object tool used to select the head object

3.1.2 Normalize Location

The Normalize Location tool allows you to move either the object, or its axes if the Axis Tool has been activated, to the world origin at co-ordinates of (x=0, y=0, z=0).



Using the Normalize Location tool moves the head from its position in space (left) to the world center (right). Note that the object is moved so that its axis are on the world origin.

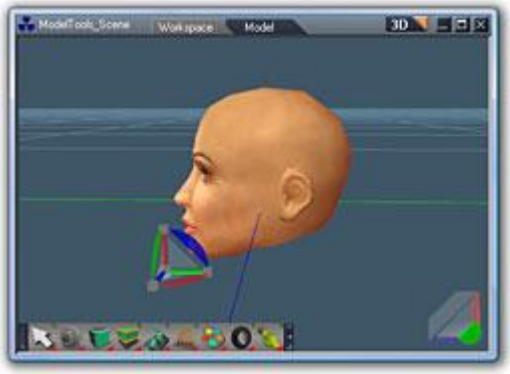
3.1.3 Normalize Scale

The Normalize Scale tool allows you to normalize the scale of the object. There are times when an object will for instance not be entirely symmetrical.

Using the Normalize Scale tool resets the head's dimensions from "squashed" (left) to a scale of 1 in each direction, restoring it to normal proportions.

3.1.4 Normalize Rotation

The Normalize Rotation tool is used to orient the object's axes to the orientation of the World Axis. You may also Show Axes (direct access to the axes) and use Normalize Rotation to normalize the rotation of the object's axes only, without changing the rotation of the object itself.

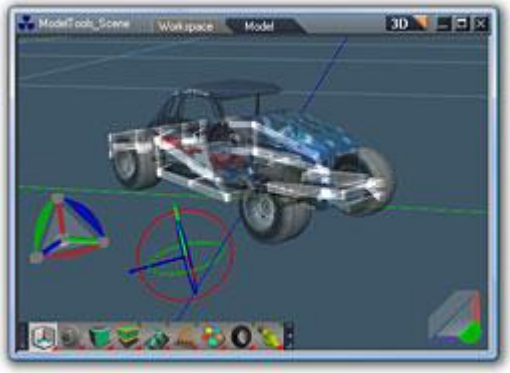


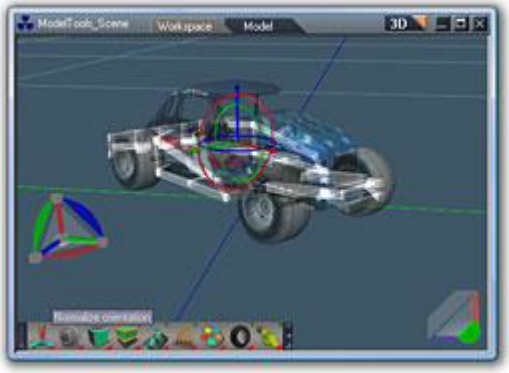
Using the Normalize Rotation tool resets the head's rotation

3.1.5 Normalize Orientation

This tool does not affect the object itself, but rather the axis for the object. When used, Normalize Orientation will move the axis to the center of the object, and rotate them to align with the object.

To view the axis, use the Axis Tool, described in the following section.



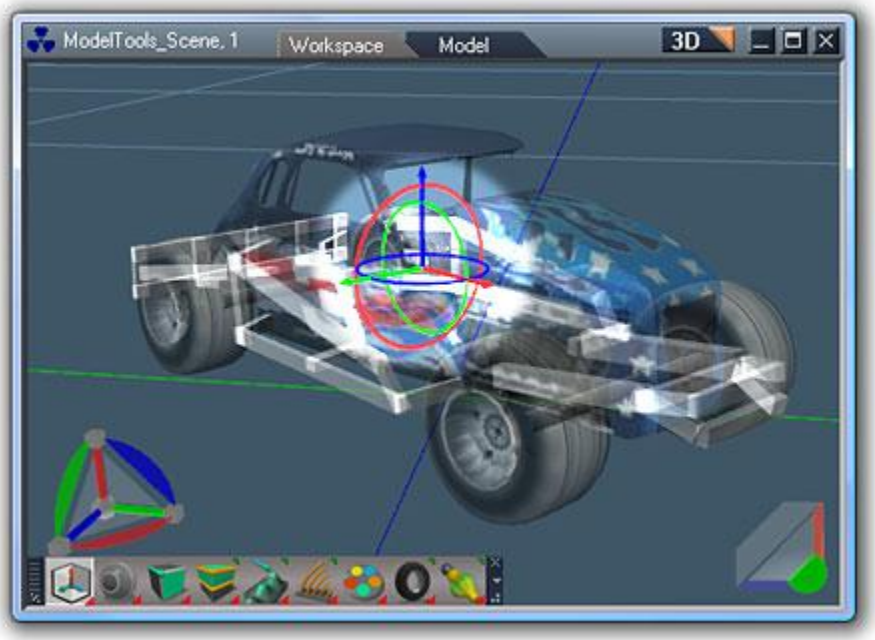


Moved and rotated axes on left; on right Normalize Orientation applied

3.1.6 Axis Tool

The Axis Tool will display the axis for the currently selected object. As shown in the illustration below, the Axis Controller will then be shown at the location of the axis for the object.

This allows you to manipulate the axis for the object using the move and rotate tools, which can be accessed directly using the Axis Controller. You can also use the Normalize Location, Normalize Rotation and Normalize Orientation tools to adjust the axis. Note that the actual object itself cannot be manipulated while the axis is shown. Once you have finished working with the axis, left click on the Axis Tool again to close the Axis Controller and return to working with the object itself.



The Axis Tool displays the Axis Controller (highlighted) to manipulate the axis for the selected object

3.2 Point Edit Selection Tools

An object's Mesh can contain combinations of elements. Those elements are Vertices, Edges and Faces. These basic elements form the foundation for creation of complex meshes/objects in trueSpace.

Point editing in trueSpace is handled by a wide range of tools which let you select a group of vertices, edges or faces to work with. To enter point edit mode, right click on the selected object. If your object is a procedural one, for example a new primitive that can be adjusted using the various settings, then you will receive a warning telling you that the object will be converted into an editable mesh, as seen below.

To enter Point Edit mode, click "Yes". Note however that this will "freeze" the object into a regular polygonal form. You will no longer be able to use the controls for primitives to adjust the shape for example. If you want to keep using those controls, you can click "No" to cancel entering Point Edit mode. You can also choose whether trueSpace should display this warning each time, using the "Do not show this message again" checkbox.

Once you click on "Yes" you can begin to select and work with collections of vertices, edges or faces. For all Point Edit selection tools, you can control whether you add to, remove from, or replace the current selection. By holding down the Control key and clicking, you can add additional elements to the selection. By holding down the Shift key while clicking on already selected elements, they are removed from the current selection. If you click without holding down any key, then any previous selection is replaced with the new selection you make.

Once you have made a selection, a navigation widget appears in location near the selected elements. This

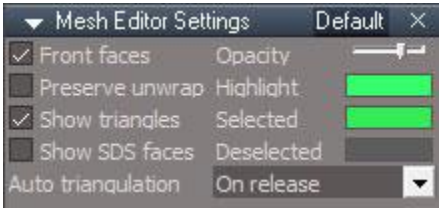
navigation widget is used to move, rotate and scale the selected elements. Note that you can disable the view of this widget by pressing the TAB key. This can make it easier to make selections or to work with certain tools. To re-enable display of the widget, press the TAB key again, which can make it easier to manipulate and work with a selection.

3.2.0 Mesh Editor Settings

There are many options and settings that will control how Point Edit works, adjusting everything from the colors used in making a selection, to how certain tools work. This section details those options before we get into looking at the tools themselves. Where the options apply to a particular tool, you will find them repeated under that tool's description.

The Default aspect

This aspect is shown on activating Point Edit mode.



The Default aspect of the Mesh Editor Settings panel.

- **Front Faces –** If checked, selection tools will only select elements that are facing your current view. This is useful when working on the surface of a model and you do not want to accidentally select vertices, edges or faces on the back of the model. This is the same as Select Visible Geometry mode – checking this option will highlight that icon (or choosing that icon will check this parameter).

  If unchecked, the selection tools will select all elements whether they are facing the current view or not, and whether they are visible or not. This is useful when wanting to select whole areas of a model, including the front and back. This is the same as Select All Geometry mode – un-checking this option will highlight that icon (or choosing that icon will un-check this parameter).

- **Opacity –** This controls how transparent the solid surface of an object is during Point Editing. Lower values make the surface more transparent, with zero giving you wireframe editing. Higher values make the surface more solid, with 1 giving you an entirely solid appearance. Adjusting this is useful for

controlling the view, with a more solid surface ensuring you have less visual clutter from vertices, edges and faces at the back of the object (handy if you are working with Front Faces checked or Select Visible Geometry active), and a more transparent view letting you see those vertices, edges and faces at the back of the object (useful when working with Front Faces unchecked or Select All Geometry active).

- **Preserve Unwrap -** If checked, then when you move a vertex its UV coordinates are updated so that texture is not distorted. If a vertex shares UV coordinates (2 adjacent faces with welded adjacent edges also in UV space) then the calculated UV is averaged for all those faces

The UV map texture applied to a cube, with the top face subdivided, and a vertex selected for moving (highlighted).

With Preserve Unwrap un-checked, the vertex "drags" the UV map with it when moved (left). With Preserve Unwrap checked, the vertex is moved, but the UV map is not "dragged" along with it (right). The highlight shows the final location for the vertex.

- **Show Triangles –** In order to ensure correct rendering, trueSpace automatically triangulates all models. Normally option is unchecked, which means that this "behind the scenes" triangulation is hidden, showing you only the edges and faces you have created and are working with directly. If you check this option, then you will see the triangulation that trueSpace uses. Note that this is a visual item only, you cannot then select those triangles directly - you must use the Select Triangle Faces or Select Triangle Edges tools to work with the underlying triangulation. Checking this option is useful if you are going to be using those tools.

- **Show SDS Faces –** On Point Editing an object with one or more SDS layers, by default this option is unchecked and trueSpace only shows the base layer faces, and not the extra faces and geometry added by the SDS tool. If you check this option, then trueSpace will display those faces. Note that this is a visual item only, and you can still only select the faces from the base layer and not the extra faces and geometry added by the SDS layer(s).

- **Auto Triangulation -** When you move a vertex, this controls when affected polygon gets re-triangulated.
  Continuous: Auto-triangulation happens as you move the vertex.
  On Release: Auto-triangulation occurs only after you release the mouse button.
  None: No auto-triangulation is done.

- **Highlight –** This sets the color used for highlighted vertices, edges and / or faces. A highlighted item is

one beneath the mouse cursor, to show what element would be selected if you clicked on the mouse at that location. You can adjust this color to best suit your needs, usually depending on the lighting in the scene, and the colors of the object and the background.

- **Selected –** This sets the color for selected vertices, edges and / or faces. You can adjust this color to best suit your needs, usually depending on the lighting in the scene, and the colors of the object and the background.

- **Deselected -** This sets the color for vertices, edges and / or faces that are neither highlighted nor selected (ie the default color for those elements while Point Editing). You can adjust this color to best suit your needs, usually depending on the lighting in the scene, and the colors of the object and the background.

The Soft aspect

This aspect must be selected manually. This section is repeated under the Soft Selection tool write up.

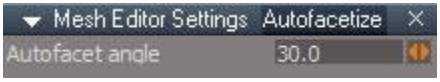
The Soft aspect of the Mesh Editor Settings panel.

- **Point Size –** This controls the size of the vertices in Point Edit mode. Note that this is controlled separately from the size of the vertices outside of Point Edit (which is set in the Scene dialog in the Settings aspect of the Stack). This affects all Point Edit modes, and not just Soft Selection mode.

- **Soft Selection Gradient** – These three colors are used to show points that are weakly selected (left most value), regularly selected (middle value) or strongly selected (right more value). You can edit these to your personal preference. These values only affect Soft Selection mode.

The Autofacetize aspect

This aspect is shown with a right click on the Auto Facet Normals tool, or can be selected manually. The value has no effect while actually using Point Edit mode, and only has an effect when Auto Facet Normals is clicked on.

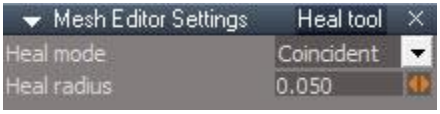


The Autofacetize aspect of the Mesh Editor Settings panel.

This controls the angle below which the Auto Facet Normal tool will treat faces as requiring smoothed normals (above this angle, the faces will be faceted). A higher value will give more faces that are smoothed, and a lower value will give less faces that are smoothed.

The Heal Tool aspect

This aspect can be selected manually, or opened with a right click on the Heal Tool. This section is repeated under the Heal Tool write up.

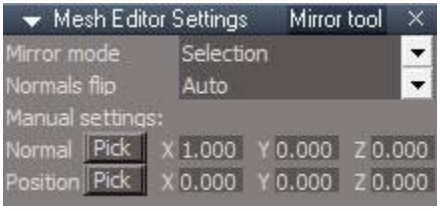


The Heal aspect of the Mesh Editor Settings panel.

- **Heal Mode**– This parameter controls how the Heal Tool will join vertices together. For full details, see the write-up under the Heal tool.

The Mirror Tool aspect

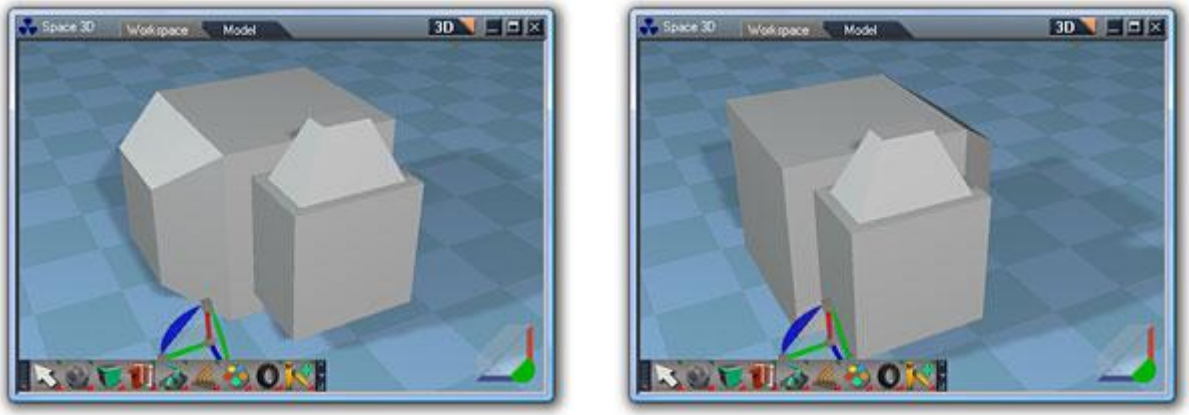
This aspect can be selected manually, or opened with a right click on the Mirror Tool. This section is repeated under the Mirror Tool write up. Note that these settings apply solely to the Mirror Tool, and not the Mirror Modeler.



The Mirror Tool aspect of the Mesh Editor Settings panel.

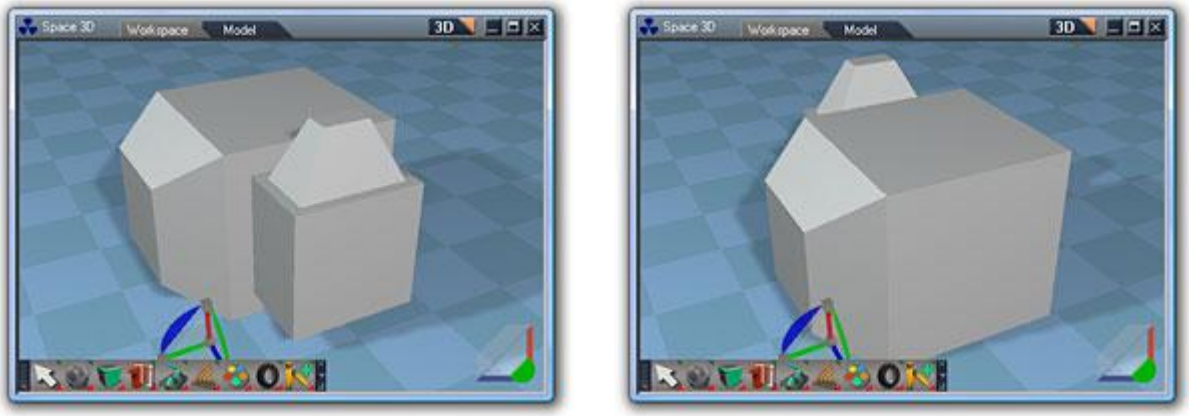
- **Mirror Mode -** This controls how the mirror result is calculated. The options are:
  Selection: The object or selected elements will be mirrored around the axis of the object or selected elements.
  World X Axis: The object or selected elements will be mirrored around the world X axis (flipping the

object left to right).



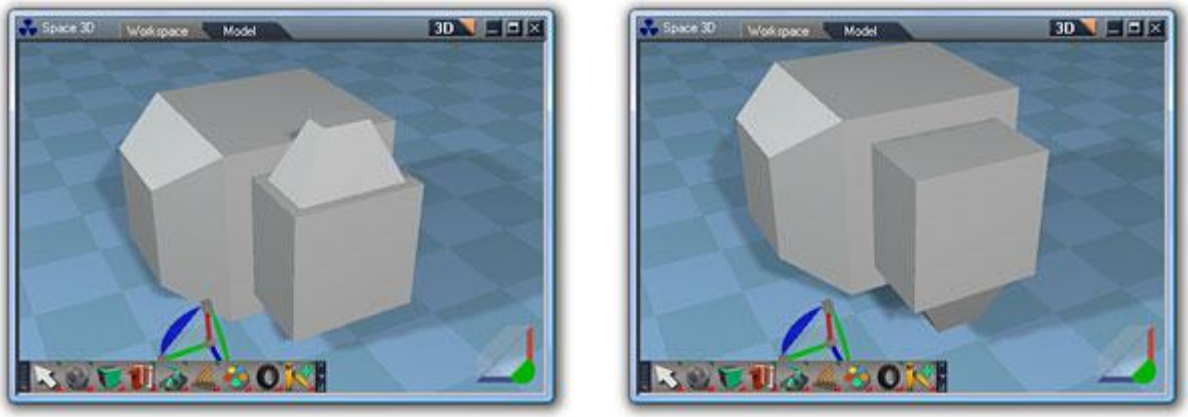
The original object (left) and the result of the Mirror Tool with World X Axis chosen (right).

World Y Axis: The object or selected elements will be mirrored around the world Y axis (flipping the object front to back).



The original object (left) and the result of the Mirror Tool with WorldYX Axis chosen (right).

World Z Axis: The object or selected elements will be mirrored around the world Z axis (flipping the object top to bottom).



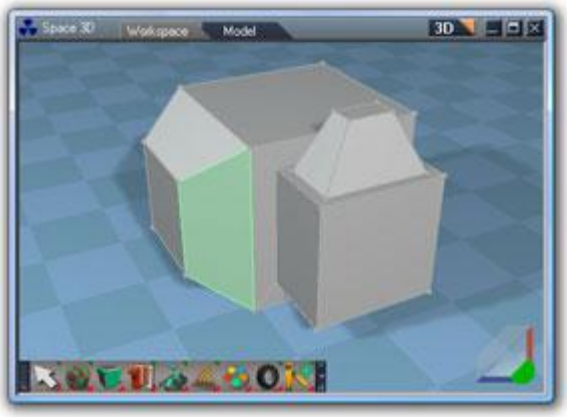
The original object (left) and the result of the Mirror Tool with World Z Axis chosen (right).

Manual: The object or selected elements will be mirrored around the axis set using the Normal and Position values. The three position values set the x, y and z location for the mirror plane in the world space, while the three normal values set the direction of the mirror plane.

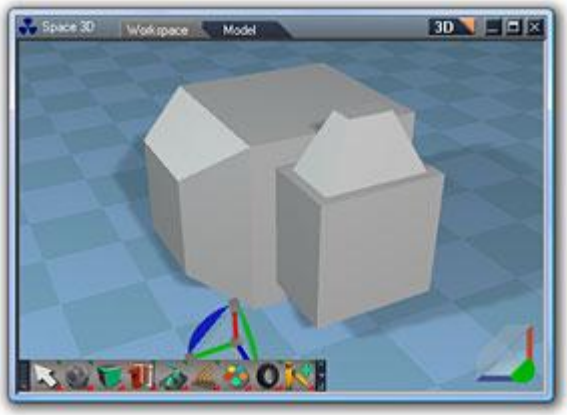
- **Normals Flip –** This applies when mirroring selected elements in an object, and not when mirroring the whole object.
  Auto: trueSpace will calculate whether or not to flip the normals for the mirrored elements.
  Flip: This forces the normals to be flipped on the mirrored elements.
  *Keep:*This keeps the normals on the mirrored elements the same as they were originally.

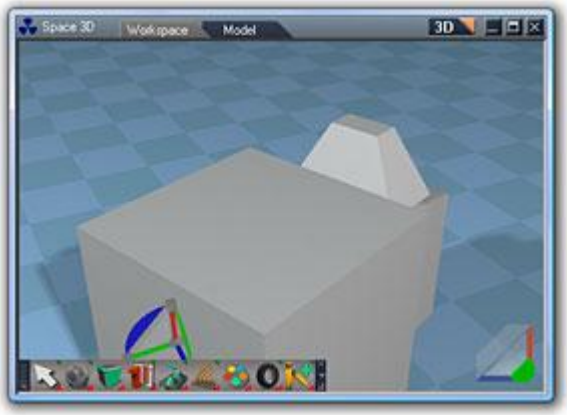
- **Manual Settings –** These parameters define the mirror plane for when the Mirror Mode was set to manual, and they allow you to set the mirror plane that should be used. The first three parameters control the normal, that is the direction that the mirror plane is facing in world space. The next three parameters control the location in world space of the mirror plane.

  You can either manually enter the values, or you can choose an object or element such as a face, and then use the Pick buttons to copy the normal or location of that object or selected element. For example, you could pick a face on the object, use Pick to choose its location and its normals, and then the Manual mode will in effect mirror the object around that chosen face. Note that using either of the Pick buttons will automatically set the Model Mode to manual.



Selecting a face on the object (left) then using the Pick option for Normal and Position of the mirror plane captures the location and facing of that face to use when mirroring (right).

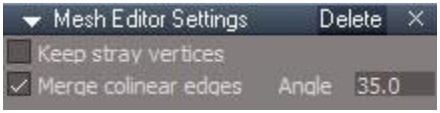




Exiting Point Edit mode (left) lets us mirror the whole object at once with the Mirror Tool – the object is now effectively mirrored through the plane we had previously selected (right).

The Delete aspect

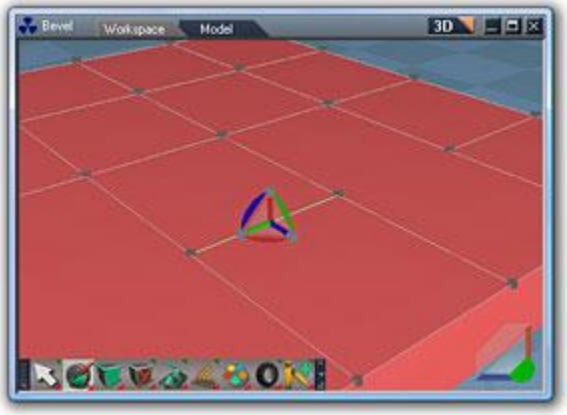
This aspect can be selected manually, or opened with a right click on the Delete Selected Elements tool. This section is repeated under the Delete Selected Elements write up. Note that these settings apply solely to the Delete Selected Elements tool and not to regular object delete outside of Point Edit.



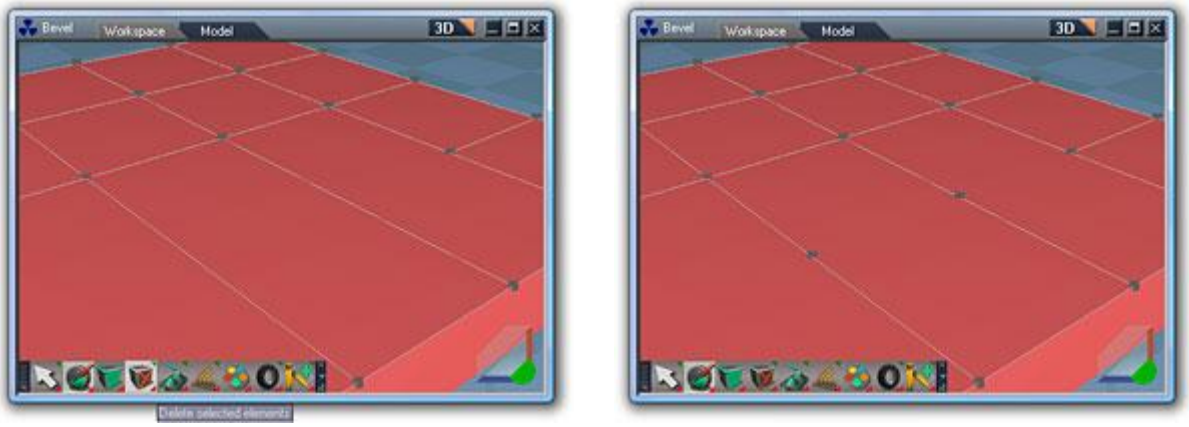
The Delete aspect of the Mesh Editor Settings panel.

- **Keep stray vertices–** If un-checked (the default), then any "unnecessary" vertices are removed as part of the delete operation. If checked, these vertices are kept even if they are no longer necessary, allowing you to continue working with them. The simplest example is where you delete an edge, and the vertices on the ends would simply divide another existing edge if left.

  Note that when checked, this option will override Merge Collinear Edges – vertices will be kept even if the Merge Collinear Edges setting would normally have removed them.



The initial selection of an edge.

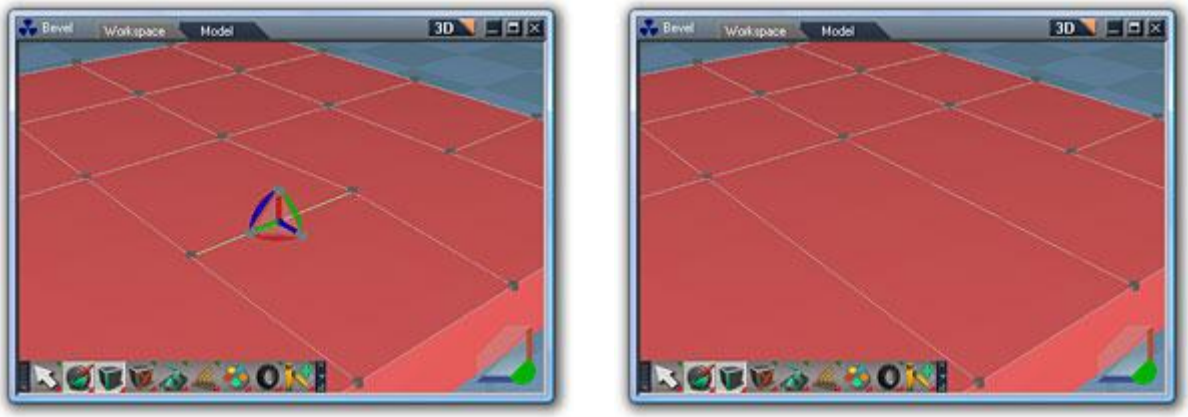


With Stray Edges un-checked, the vertices on the ends of the edge are deleted when the edge is deleted, since they are not required to define the remaining geometry (left). When checked, the vertices are kept, even though they are "unnecessary" to define the geometry, allowing you to continue working with them (left).

- **Merge collinear edges** – If checked, then edges that almost form a straight line after the deletion will be merged into just one edge. It un-checked, then those edges will be kept as separate. How close to a straight line the edges need to be is defined by the Angle parameter (see examples below Angle parameter).

  Note that Keep Stray Vertices will override this setting, resulting in vertices being kept even if this parameter is checked and would normally have removed them.

- **Angle –** Edges that meet at an angle lower than this value will be treated as collinear, those that meet at an angle above this value will be treated as separate edges. Only has an effect when Merge Collinear Edges is checked.



Our initial selection of an edge – notice how the lower left edges that the selected edge connects to are in a straight line, but the top left edges the selected edge connects to form a shallow angle (left). With Merge Collinear Edges checked and an Angle of 35, both pairs of edges are treated as making a straight line so have their component edges merged (right).

With Merge Collinear Edges un-checked, neither pair of edges are merged, leaving them intact (left). With Merge Collinear Edges checked and an adjustment to the angle, now set to 5, only the lower left pair of edges are now considered to make a straight line, so they are merged while the other pair of edges remain separate (right).

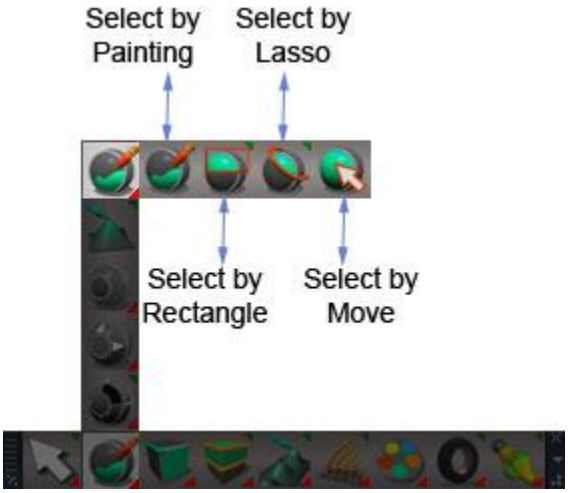
The Selected Materials aspect

This aspect can be selected manually, or opened with a right click on the Select By Materials tool. This section is repeated under the Select By Materials write up.

The Select Materials aspect of the Mesh Editor Settings panel.

This controls how the Select By Materials tool works, and has only one parameter. If this is checked, then the Select By Materials tool will choose all elements painted with that material so long as they are touching the initial selection – other elements which are not touching the initial selection will not be selected, even if they have the same material. If unchecked, then all elements on the object that use the same material as the initial selection will be selected, whether or not they are touching.

The following tools can be used to make your Point Edit selection:



The basic selection tools for Point Editing.

3.2.1 Select By Painting

This selection tool allows you to pick (but not instantly move) one or several of the selected elements. Holding the left mouse button will let you paint over the surface to select all the elements you move across.

3.2.2 Select By Rectangle

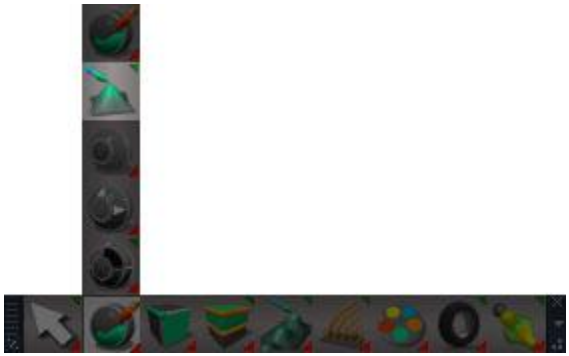
This tool allows you to draw a rectangle around elements to select them. Any elements within the rectangle become selected.

3.2.3 Select By Lasso

Select By Lasso allows you to left-click-drag your mouse pointer around elements, creating a lasso. Any elements within the lasso become selected.

3.2.4 Select By Move

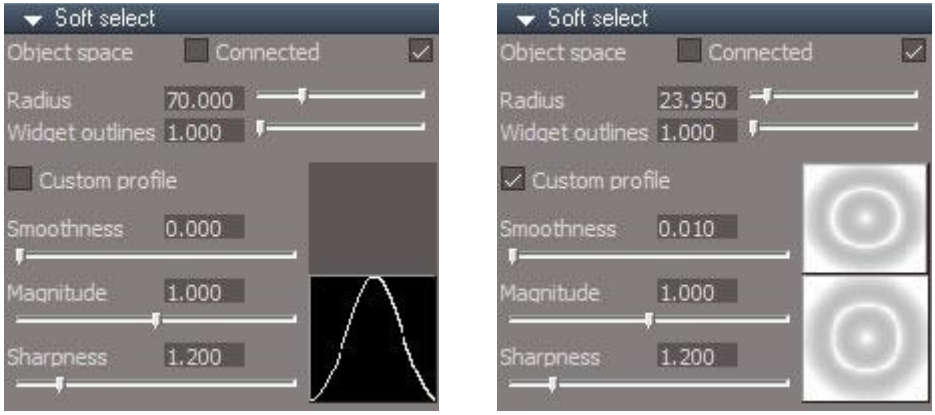
This tool will select an element, based on your choice of Vertices, Edges or Faces and begin moving the element immediately. You simply left-click and drag, to select and move the element.



The Soft Select tool

3.2.5 Soft Selection

Soft Selection projects a gradient on the mesh and assigns evaluated weights to the touched vertices. As you transform the selected vertices, they are affected according to their weight. This means that some vertices, edges or faces will be strongly affected by any edits you make, while others will only be weakly affected. This gives a much more organic or rounded edit.



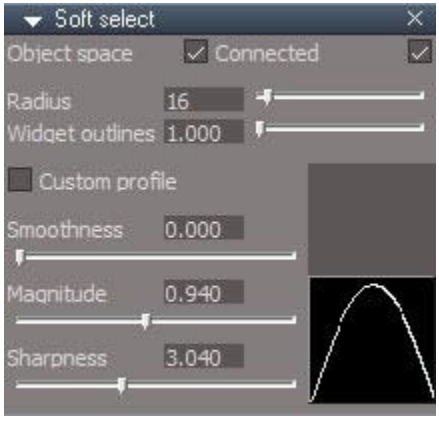
The Soft selection settings panel – right hand image shows a Custom Profile being used

- **Object space -** Determines if Object or World space will be used to map the Soft Selection onto the object.
- **Connected** – This checkbox determines if the selection is allowed to select other object's elements or not. Imagine a character's upper and lower parts of the torso are separate meshes attached to same skeleton. This checkbox determines if you can select elements on both upper and lower torso, or if only elements of one object can be selected.
- **Radius -** provides control over the overall size of the soft selection brush.
- **Widget Outlines -** provides control over widget/controller inference lines. This only affects how the brush is displayed.
- **Custom profile -** allows you to import images via the image area to the right of Smoothness slider. Hold the Control key and double click to open the Load Image dialog box. Note that images should be grayscale. White on the outside and darker on the inside will give a shaped brush (darker areas are more strongly selected than lighter areas).
- **Smoothness –** This setting has only has an effect when a Custom Profile is used, and it controls the rotation of the custom profile as you move.
- **Magnitude –** Controls the maximum strength of the brush. At values of less than 1, no points will be

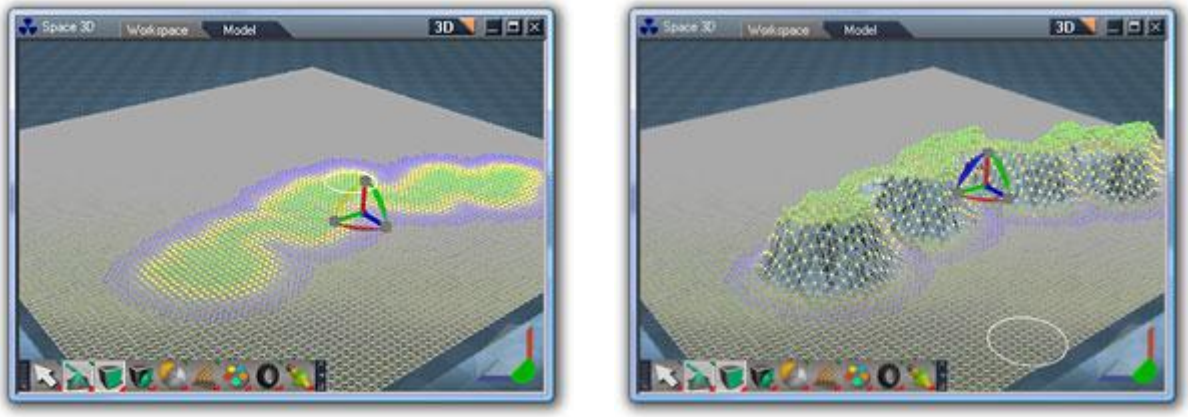
"fully selected" resulting in a selection area that is blue through to yellow, with no green. Above 1, there will be fewer points with weaker selections, making most points fully selected (in other words, there will be a sharper boundary edge to the selection at values of above 1)

- **Sharpness –** Adjusts the sharpness of the brush. Higher values will result in a brush that has more points strongly selected, and less points weakly selected around the edge (this will look like a wider, broader shape in the graph window), so that edits and manipulations will have a sharper defined edge. Lower values will result in more points around the edge being weakly selected (which will look like a narrower, sharper curve in the graph window), which will result in edits and manipulations having a softer, smoother edge. This setting has no effect when a Custom Profile is used.

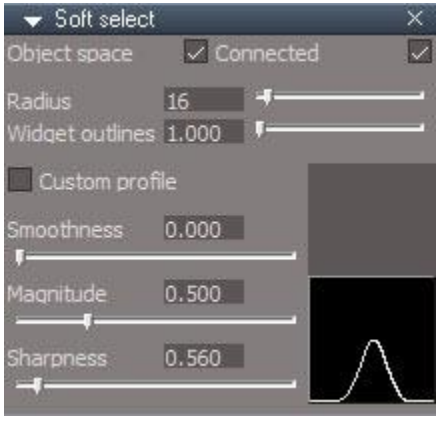
Loading the Terrain object from the Script Objects library, and flattening it, gives a good starting point for modeling out own landscape (left). A right click activates point edit, revealing a fairly dense mesh, perfect for working with Soft Selection brushes (right).



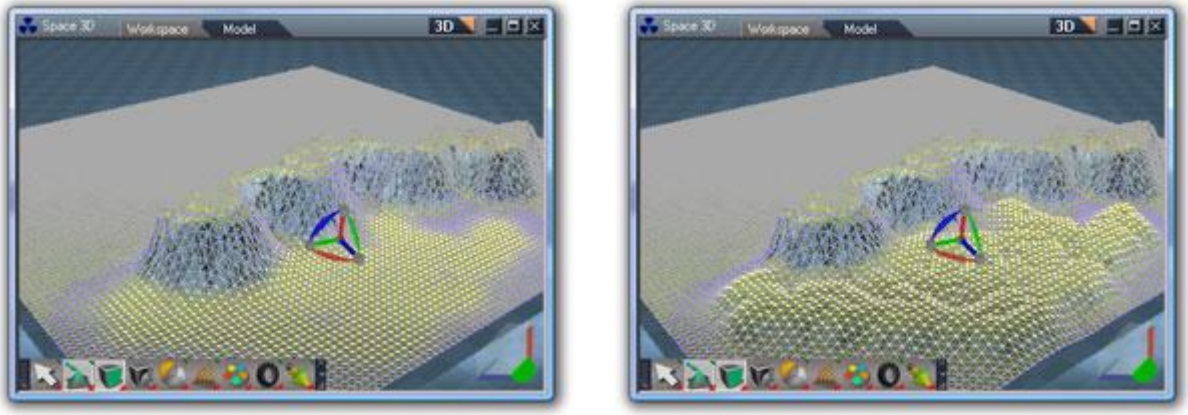
This shows the parameters used for the Soft Select tool in this first part of the example.



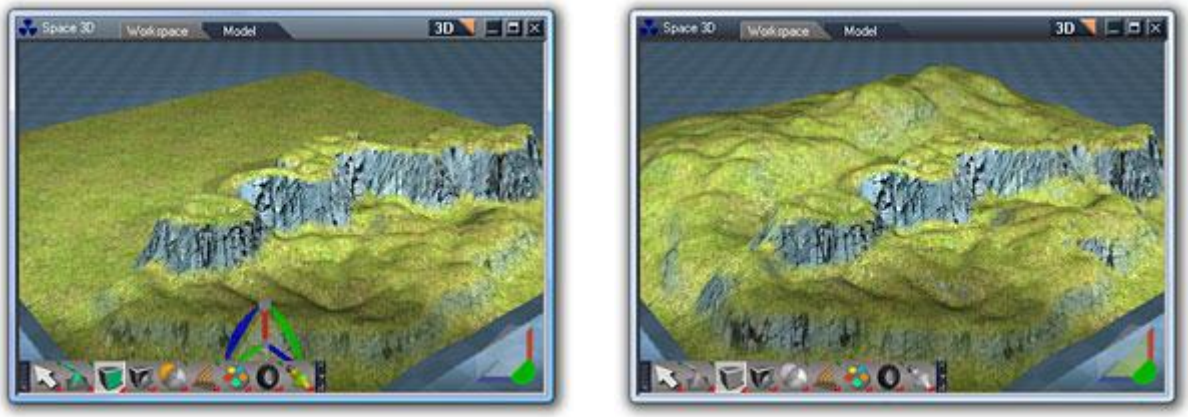
Left click and drag to paint over the surface. Green points are strongly selected; yellow less strongly selected; and blue are weakly selected (left). We can use the widget to manipulate the points, pulling them up from the surface. This Magnitude gives quite a sharp edge to the resulting mountains (right).



This shows the new parameters used for the remainder of the example.



Changing the parameters to give a less sharp, less strong brush lets us make a new selection with a left click and drag to paint over the surface (left). Now when we manipulate the points, we get rounder, softer shapes on our landscape (right).



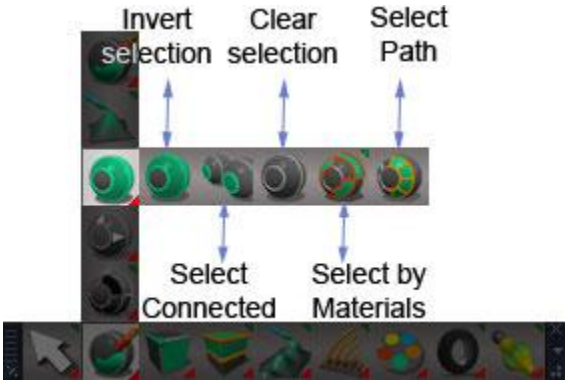
Exiting point edit lets us see our new shapes (left). Continuing with the same settings, we can select and manipulate repeatedly to build up a pleasing landscape shape (right).

The Soft Selection tool has options to control the colors used. These are found in the Mesh Editor Settings options panel in the stack, under the Soft aspect:

The Soft aspect of the Mesh Editor Settings panel.

- **Point Size –** This controls the size of the vertices in Point Edit mode. Note that this is controlled separately from the size of the vertices outside of Point Edit (which is set in the Scene dialog in the Settings aspect of the Stack). This affects all Point Edit modes, and not just Soft Selection mode.

- **Soft Selection Gradient** – These three colors are used to show points that are weakly selected (left most value), regularly selected (middle value) or strongly selected (right more value). You can edit these to your personal preference. These values only affect Soft Selection mode.



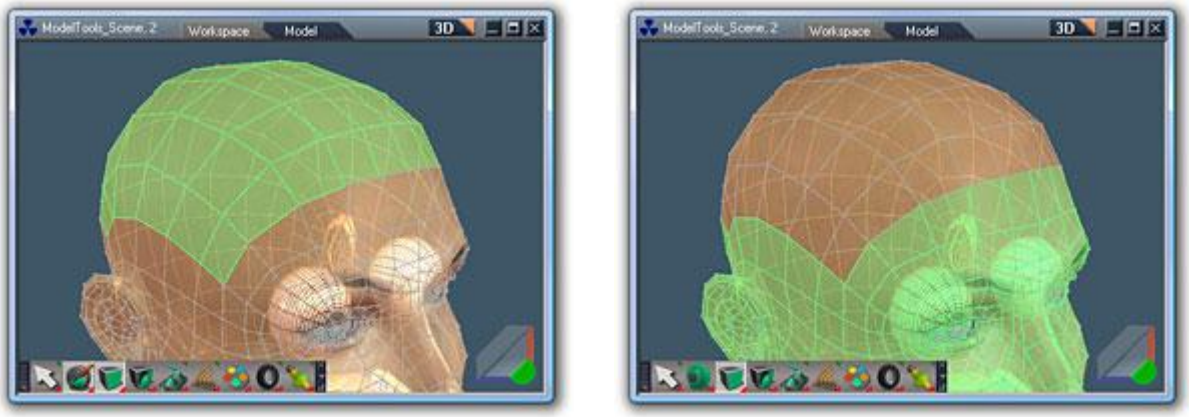
The secondary select and transform selection tools.

3.2.6 Invert Selection

This unselects all currently selected elements, and selects all currently unselected elements. If the initial selection is all of one type, then the new selection will be of the same type.

If the initial selection is of mixed type, the final selection will be of all one type. For the final selection, faces take priority over edges and vertices, and edges take priority over vertices. This means if the mixed selection had any faces, then the final selection will be faces; if the mixed selection had no faces, but did have edges, then the final selection type will be edges.

Invert Selection works across the whole mesh, including unconnected areas.



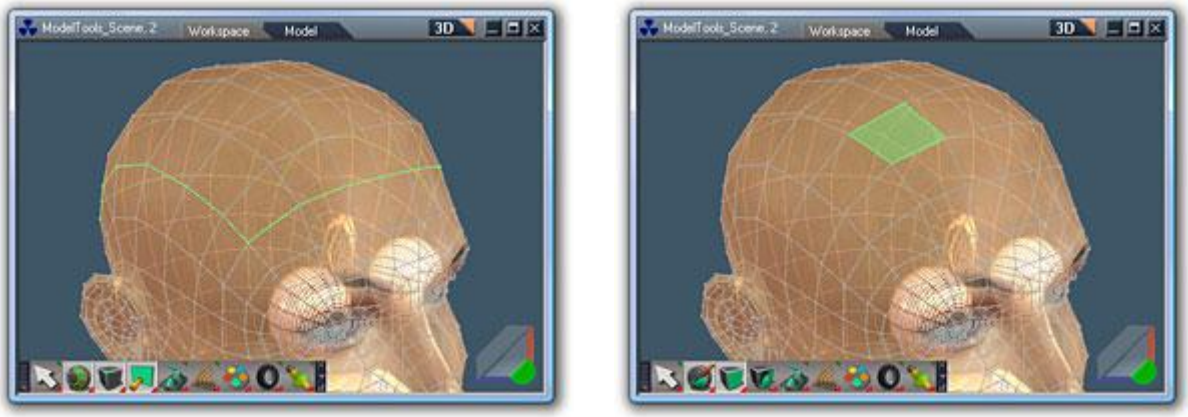
With a set of faces selected (left), the Invert Selection tool swaps which faces are selected and which unselected (right). Note how unconnected areas, such as the eyes, are included in the new selection.

3.2.7 Select connected

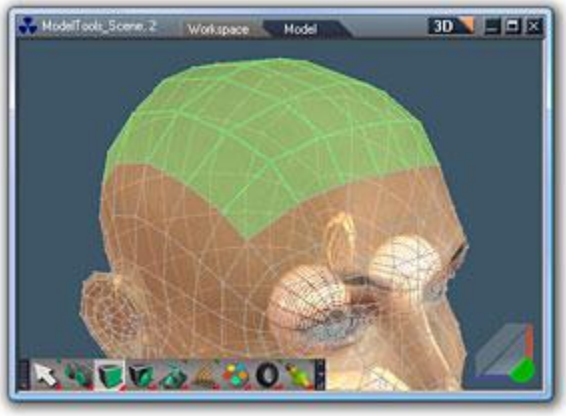
This expands the current selection to include all connected elements of the same current type. Unconnected elements will not be included in the new selection.

Unconnected elements can take several different forms. For example, if you Boolean Union two non-touching object together, then the elements on each remain unconnected, even though they are now counted as one object. The Cut Selected Edges tool can also leave you with one object which has unconnected elements, for example if you selected an Edge Loop, then used Cut Selected Edges, then you end up with two "halves" in the same object.

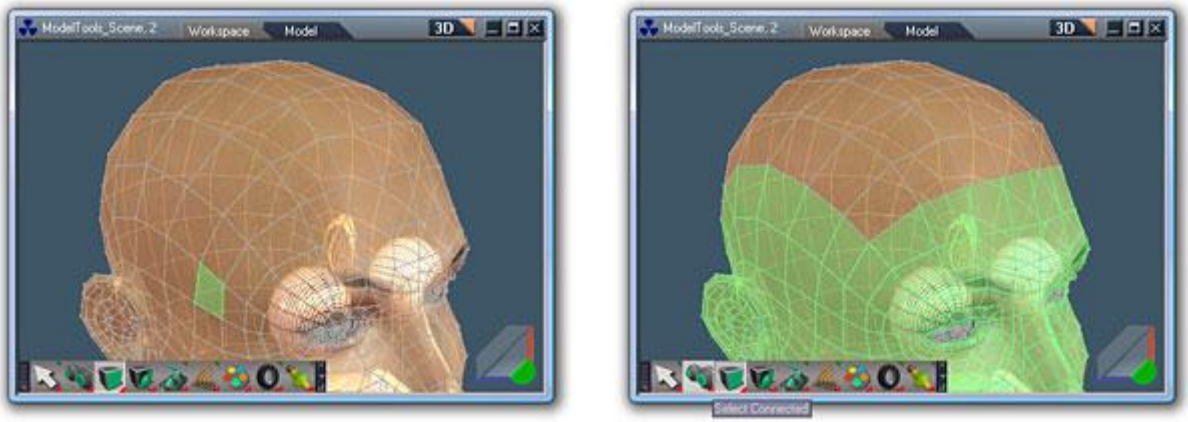
If the object you are editing has been sliced apart using Scissor tool for instance, the entire object is not connected and the result may look like the image below, where a sphere was sliced in half. In such a case only the connected elements will be selected.



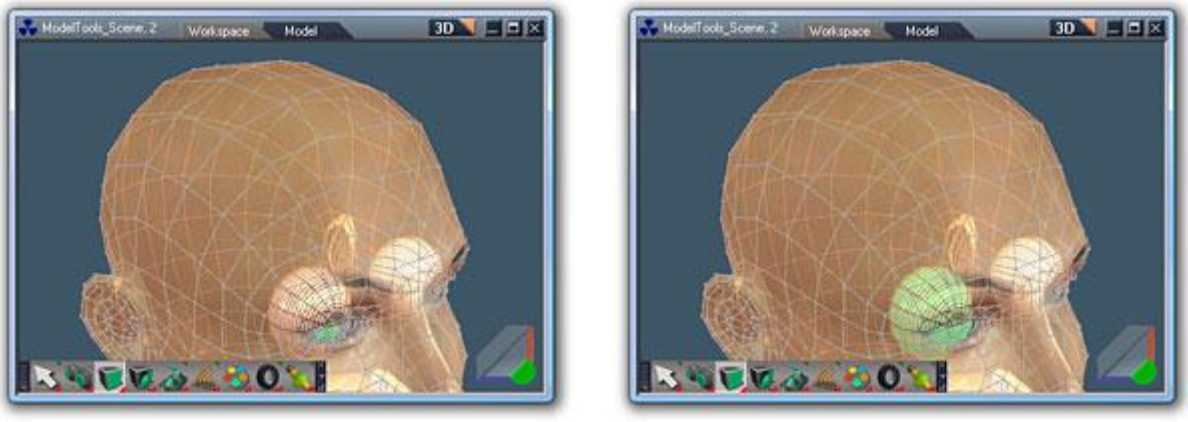
Using Select Path with edges followed by the Cut Selected Edges tool "separates" the top of the head (left). A single face is then selected on this part of the mesh (right).



The Connect Selected tool then selects all faces on this part of the model, but not on the rest of the head.



Clearing the selection, then selecting a different face on the other section of the model (left) gives a different result from the Connect Selected tool (right). Note how the eyes are not selected, as there too are unconnected objects connected via Boolean Union.



Clearing the selection and selecting some faces on one eye (left) results in only that eye being selected when Connect Selected is used (right).

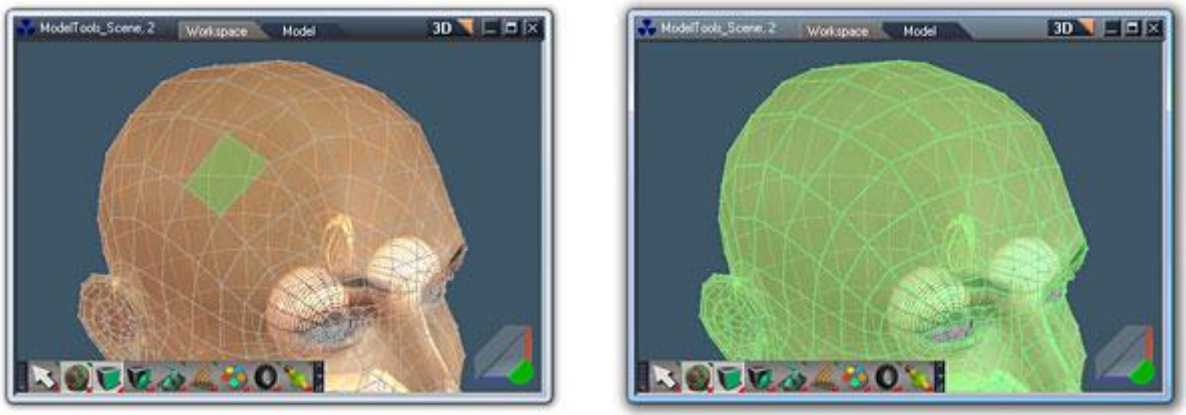
3.2.8 Clear Selection

This clears the current selection, without needing to leave Point Edit mode. You can then start a new selection afresh.

3.2.9 Select By Materials

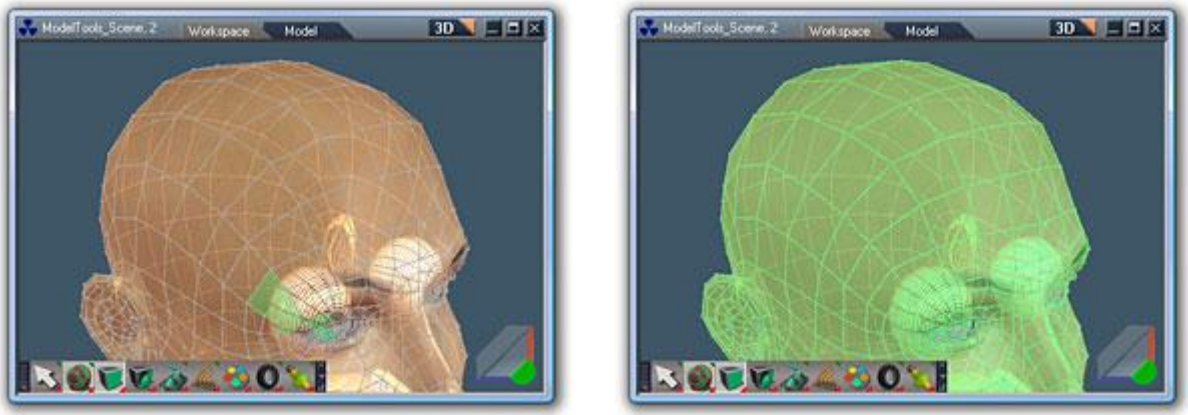
This tool will select all faces that have the same material. It will only work with faces, and not with edges and vertices.

If you activate this tool before making a selection, then it will select all faces with the same material as the next face or faces you select. With the tool active and no selection made, you can left click and drag to use a rectangle select to select one or more faces. If more than one material is included in that selection, then the final selection will include all faces with any of those materials.



Left clicking to select this face (left) will select all faces with the same material. The same effect is seen if the face is already selected and then the Select By Material tool is used. Notice the eyes are not selected.

If you activate this tool after a selection has already been made, then it will extend that selection to include all faces that have the same materials. If the original selection had faces with more than one material, then the final selection will include all faces with any of those materials.



Left click and dragging to select multiple faces (left) will select all faces with any of the materials in this selection; this time the eyes are selected also as their material is included. The same effect is seen if the selection is already made before using Select By Material.

The Select By Materials tool has one option, which can be accessed by choosing the Select Materials aspect in the Mesh Editor Settings panel in the stack, or with a right click on the Select By Materials tool.

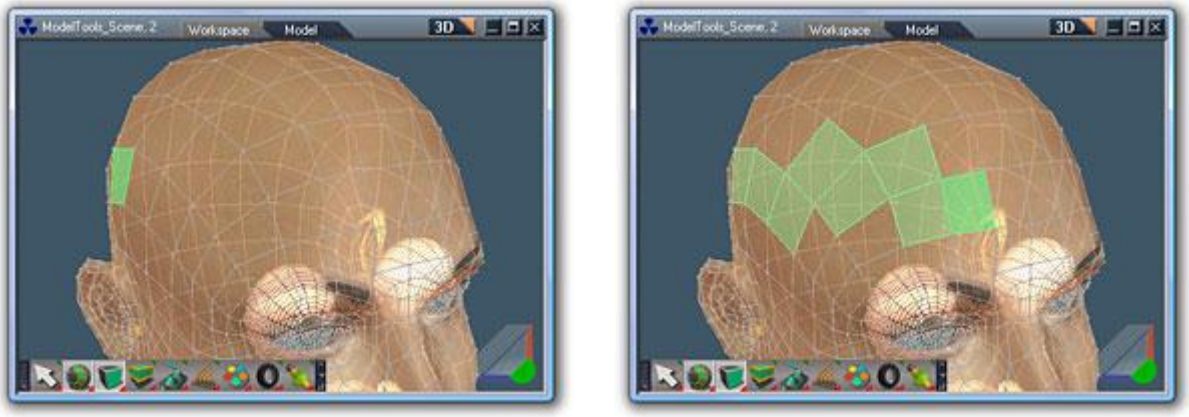
The Select Materials aspect of the Mesh Editor Settings panel.

There is only one parameter. If this is checked, then the Select By Materials tool will choose all elements painted with that material so long as they are touching the initial selection – other elements which are not touching the initial selection will not be selected, even if they have the same material. If unchecked, then all elements on the object that use the same material as the initial selection will be selected, whether or not they are touching.

3.2.10 Select Path

This tool works with vertices and faces, and requires two (or more) clicks. The first click will select one face or vertex; a second click will then cause trueSpace to create a selected path between the first and second selection.

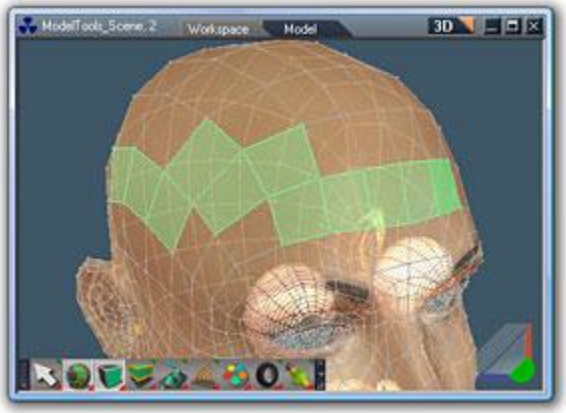
When working with vertices, the resulting selection will be edges joining the selected vertices together. When working with faces, the resulting selection will be faces. If the selection type is changed to edges, then clicking will not add a path, but will add the selected edge only.



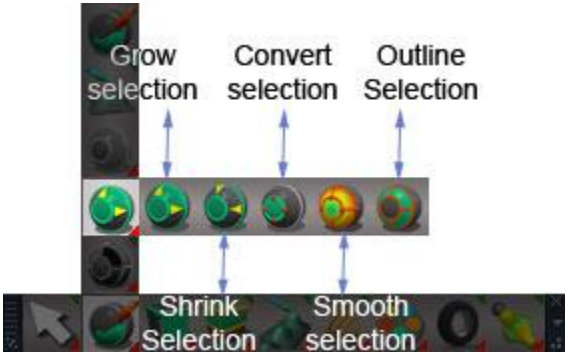
With Select Path active, the first face is selected (left); with a second click on a distant face, trueSpace creates a selection of faces along a path from the first to the second face (right).

Unlike the other selection tools, you can continue to add more to your selection with a left click without holding the CTRL key. Extra clicks will continue the path from where the nearest current end of the path; sometimes this will involve retracing the path along already selected elements, giving the appearance of a branch in the middle of the path.

You can hold the Shift key to remove individual elements only, you cannot remove a path at once. Note that using this feature may give unpredictable results, and it is suggested you exit Select Path mode before refining the selection by removing elements.



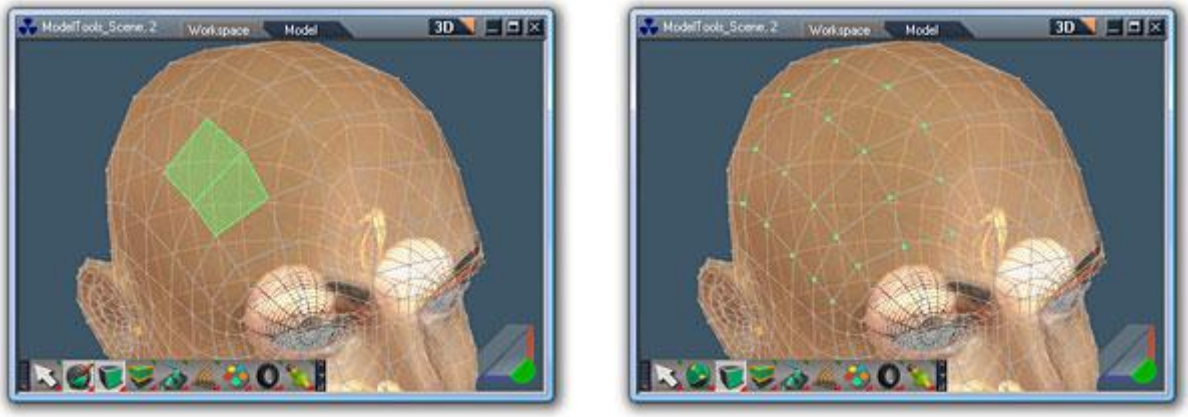
Another click continues our path from the previous selection (with no need to hold the CTRL key.)



The main selection modifier tools

3.2.11 Grow Selection

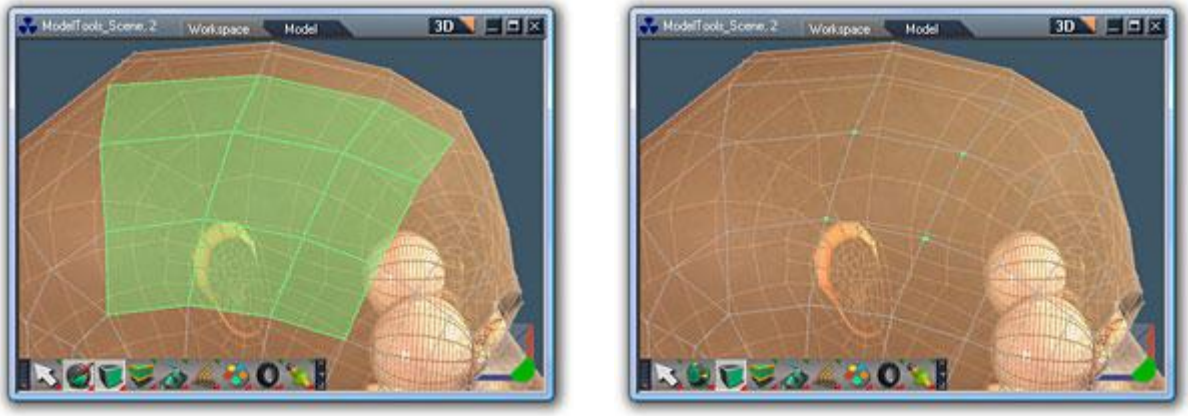
The Grow Selection tool first converts the current selection to vertices, and then expands it selection to include surrounding neighbor vertices. Note that the resulting selection is always a vertex selection, regardless of whether the initial selection was vertices, edges or faces.



With some faces selected, the Grow Selection tool turns this into a vertex selection, and then expands the selection to include the nearest neighbours.

3.2.12 Shrink Selection

The Shrink Selection tool first converts the current selection to vertices, and then shrinks that selection by removing the outer vertices. Note that the resulting selection is always a vertex selection, regardless of whether the initial selection was vertices, edges or faces.



With a group of faces selected, the Shrink Selection tool turns this into a vertex selection, and then shrinks the selection by removing the edge vertices from the selection, leaving only the central vertices still selected.

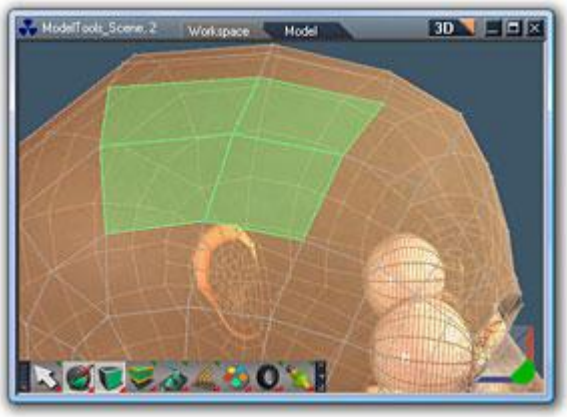
3.2.13 Convert Selection

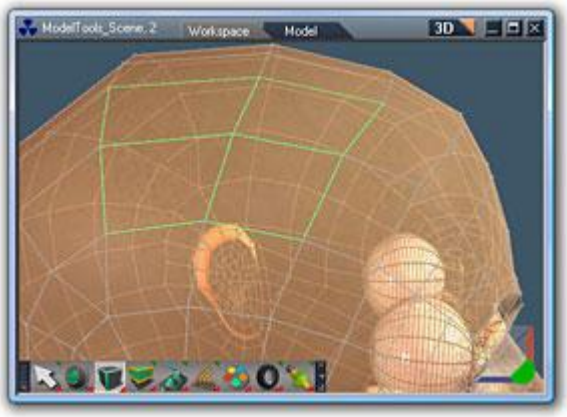
Converts the current selection into whatever type is currently chosen. For example, if you use vertices to make a selection, then change the selection type to faces, the Convert Selection tool will transform the current selection into faces rather than vertices.

It is important to note that when converting from vertices or edges to faces that only completely enclosed faces will be counted as being in the new selection. Also, certain patterns of "open" selections can result in no faces being selected, or all faces being selected.

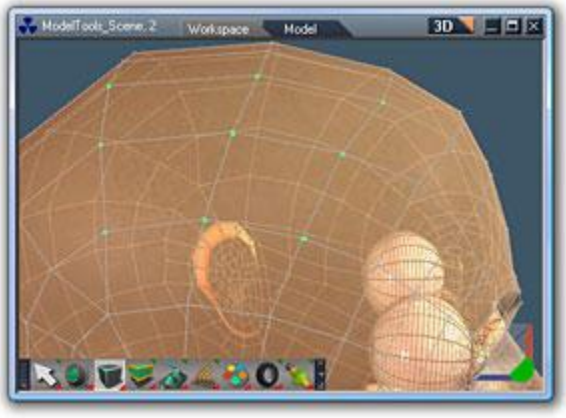
As you might expect, when converting from faces to edges or vertices, this is not a problem, since a selected face is always made up from a precisely defined set of edges or vertices.

This tool can be especially useful for converting mixed selections into just one type.





With some faces selected, changing the selection type to edges then clicking Convert Selection turns the current selection into edges.

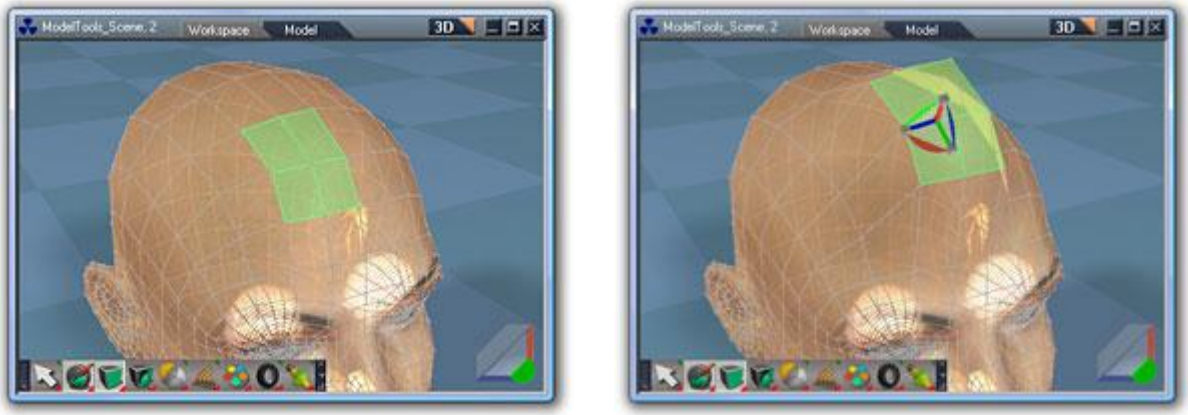


Changing selection type to vertices then clicking Convert Selection once more turns the current selection into vertices.

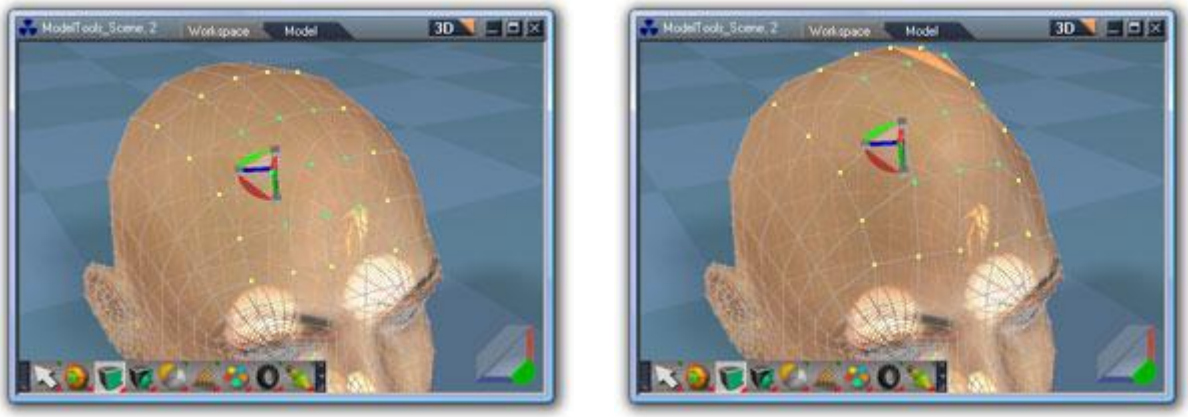
3.2.14 Smooth Selection

This transforms the current selection into a soft selection, where points have varying degrees or strengths of selection. It always turns the selection into vertices, regardless of what the initial selection type was.

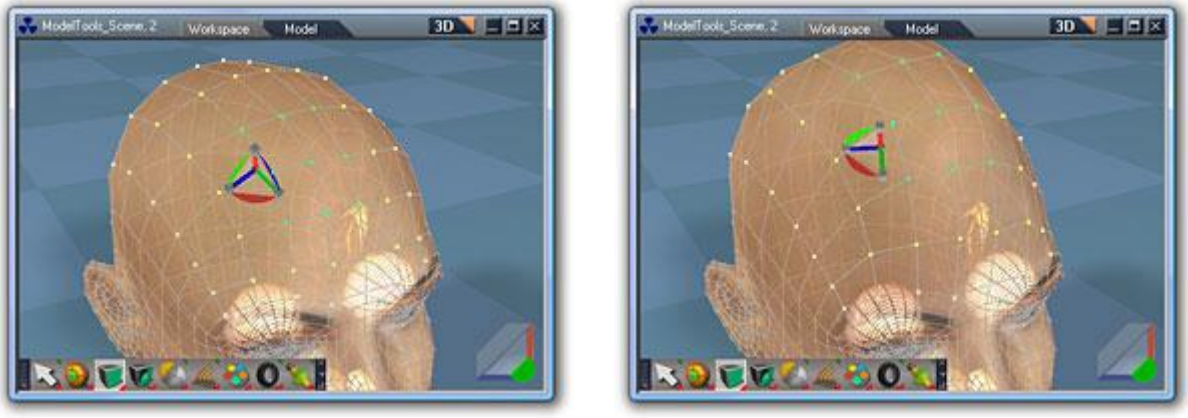
It also always expands the current selection rather like the Grow Selection tool, except in this case the new vertices being added having a "weaker" selection that the original points. The color of each vertex indicates how strongly it is selected, and so how strongly it will be influenced by edits such as moving, rotating or scaling. Green represents full selection strength, with yellow being partially selection, and blue being lightly selected (see Soft Selection for a more detailed description and examples).



Starting with a regular selection of faces (left), moving these gives a sharp edged and unnatural deformation to our object (right).



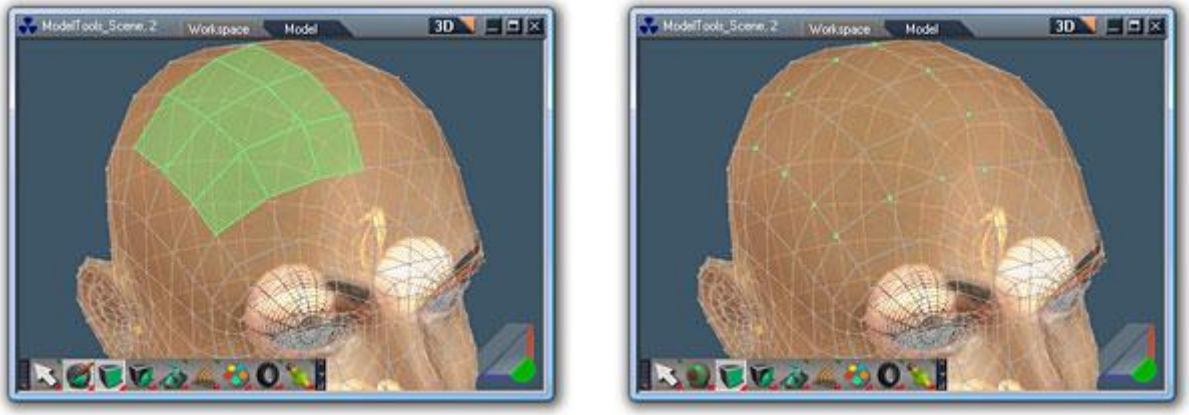
By using Smooth Selection on our original selection of faces, we transform it into a selection with soft edges (left). Now when we manipulate these edges, our deformation has a smoothed edged to it, and looks less harsh and unnatural (right).



Applying a second smooth select before making our transform softens the edge of the selection even further, extending it to include more vertices (left). Now the final transform is even more smooth and natural looking for the mesh. (right).

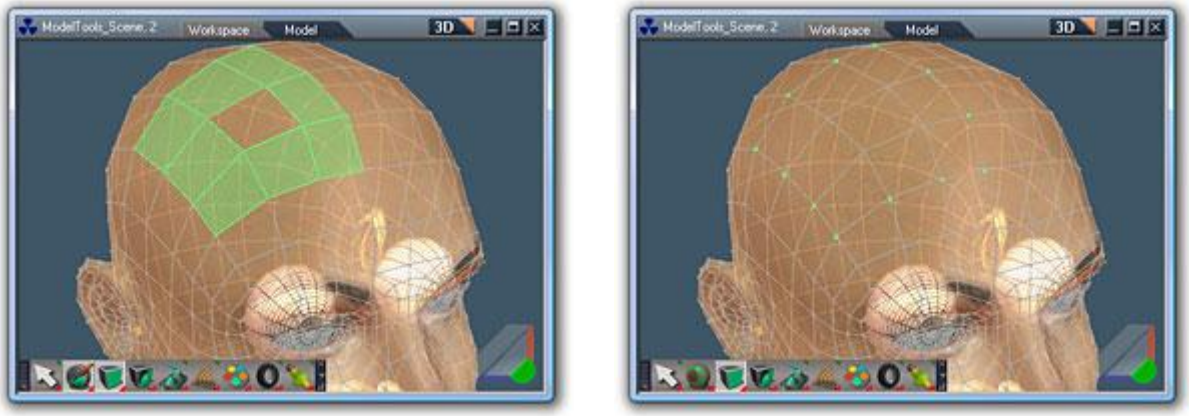
3.2.15 Outline Selection

This takes the current selection, and selects the vertices that outline that original selection. This leaves only the vertices from the edge of the previous selection in the final selection.



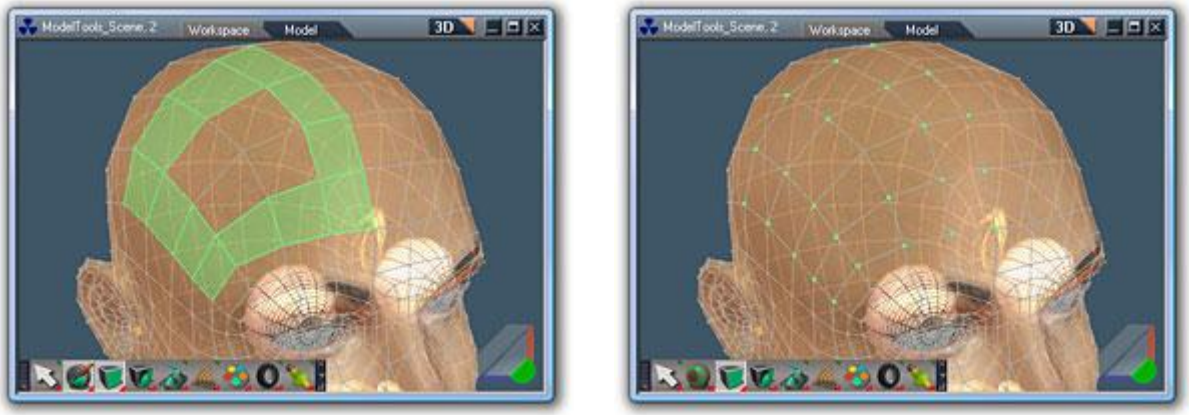
With a selection made (left), the Outline Selection transforms this to leave only the edge vertices selected (right).

When the original selection contains a "hole", if this is small, then the Outline Selection tool will give the same result as if the hole was not there.

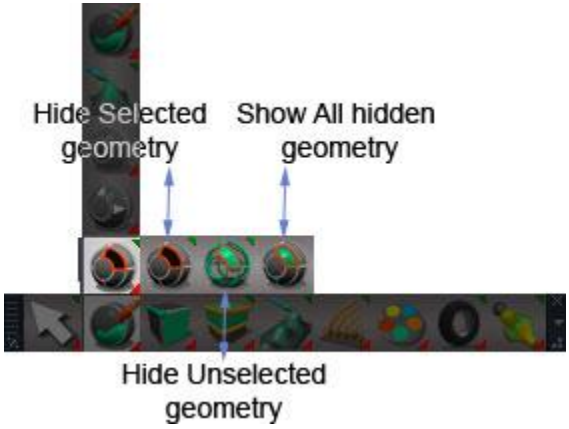


A small "hole" in the original selection (left) will not be treated as an outer edge by the Outline Selection tool (right). Notice that this is the same result as in the previous example.

With a larger hole however, the Outline Selection tool will include the vertices around the hole as being on the edge, so will include them in the new selection.



With a larger "hole" in the original selection (left) the Outline Selection tool will include the vertices around the hole in the final selection (right).

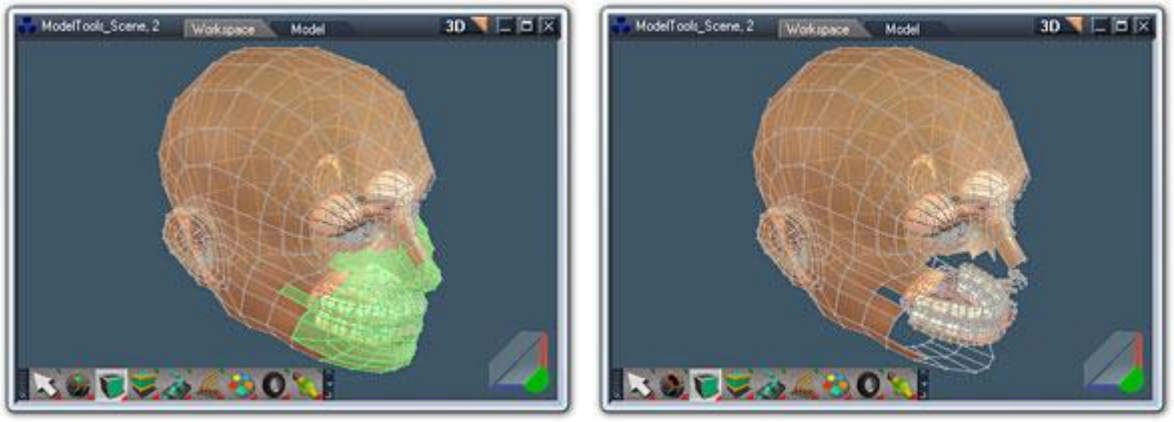


The Hide / Show selected geometry tools

3.2.16 Hide Selected Geometry

This will hide the currently selected elements so that they are no longer rendered in the real-time view, and so they can no longer be selected or edited. This can be useful for hiding the geometry on the outside of an object so that you can select, edit and work with geometry inside the object.

Note that you cannot select an object with the Object tool if you click on an area of hidden geometry – only by clicking on the visible geometry can you select an object.



Selecting the outside faces with the rectangle select tool and then using Hide Selected gives unrestricted access to the teeth and mouth so that we can work with them.

3.2.17 Hide Unselected Geometry

This hides the unselected elements, so that the selected elements are the only ones that remain visible, and are the only ones that can be selected and edited. This is useful for focusing work on a particular area of an object, without the distraction of other elements being visible in the scene.

When working with a complex piece of a model such as an ear, it can help to hide the rest of the object to give an uncluttered view. Selecting the part of the model we want to work with then using Hide Unselected makes this easy.

3.2.18 Show All Hidden Geometry

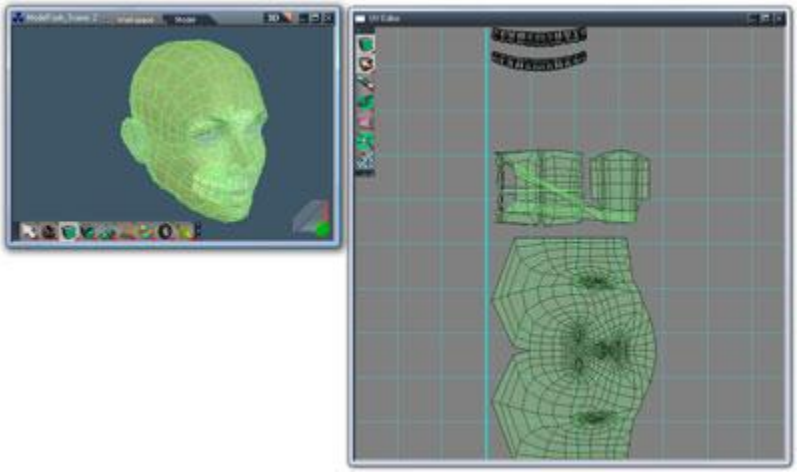
This shows all hidden geometry, undoing the effects of either of the Hide tools, so that the whole object is visible and can be selected and edited once more.

Note that using this tool after using one of the Hide tools does not restore the selection that was used to hide the geometry. If you have only just used one of the Hide tools and wish to change the selection to refine what is hidden, use Undo to step backward, removing the effect of the Hide tool as well as restoring the selection used during the Hide step.

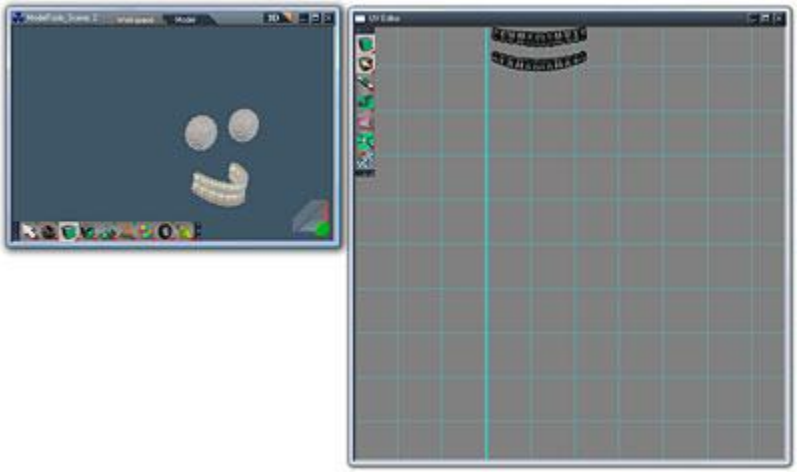
3.2.19 The Hide Tools and the UV Editor

Note that the Hide tools will also hide the faces in the UV Editor. This can be helpful in simplifying the information shown in the UV Editor so that you can work more easily with certain parts of the mesh. The Unhide

tool will then unhide the geometry in the UV Editor also. This can be especially useful early in UV mapping when you need to lay out your UV map. Using tools such as Select By Material and Select Connected can be helpful in isolating parts of the model to show or hide.



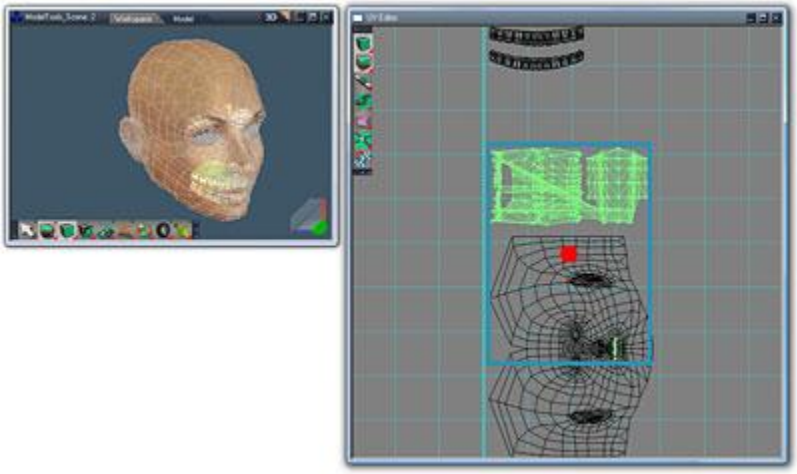
Using Select Connected, the faces on the head are selected, but the teeth are left unselected – this can be seen in the UV Editor.



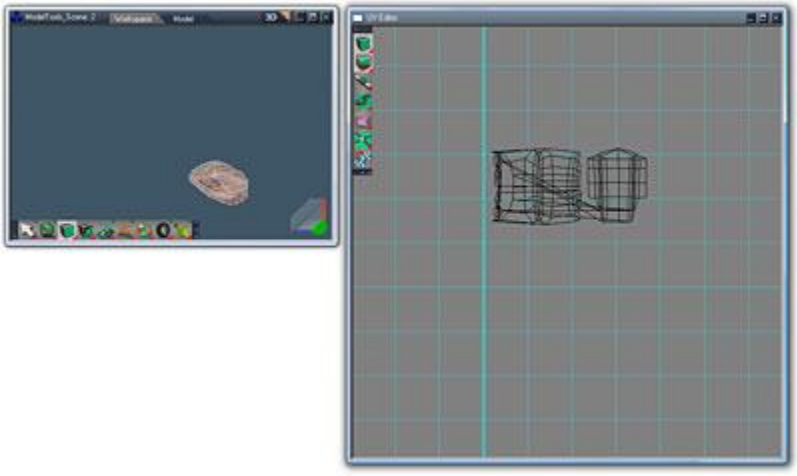
Now using Hide Selected not only hides the geometry in the 3D window, but also in the UV Editor window.

3.2.20 Using the UV Editor for Selections

The UV Editor can be a very useful away to select geometry to work with on your model once the UV Map is laid out. This will let you quickly and easily select parts of your model to work with in Point Edit.



The UV Editor can be a powerful selection tool during Point Edit. Using the Rectangle Select in the UVE makes it easy to select the faces for the interior of the mouth.



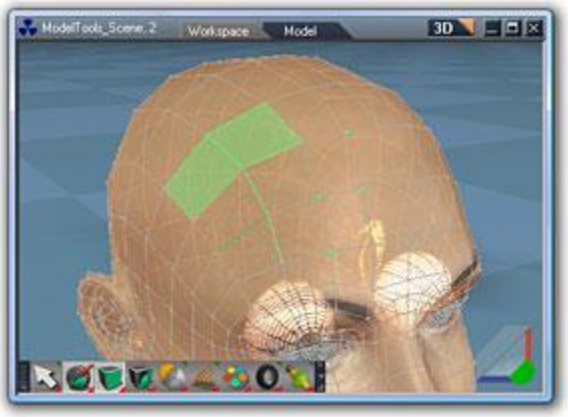
Then using the Point Edit Hide Unselected tools, you can clear your 3D view to easily work with those faces.

3.3 Selection Items

When working with any of the selection tools, such as Select By Painting, Select By Rectangle, etc, you need to define what type of element you want to select. You can work with vertices (points), edges, or faces, and these tools let you specify the kind of element you wish to select. The selection tools are:

3.3.1 Select Context

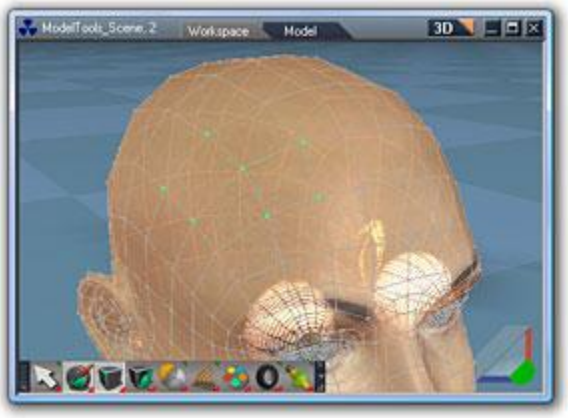
This tool will let you select whatever kind of element you point at, changing the select type "on the fly" to the context of what you are pointing at. This means if you point at an edge, it will let you select that edge; point at a vertex, and it will select that vertex; or point at a face, and it will select that face.



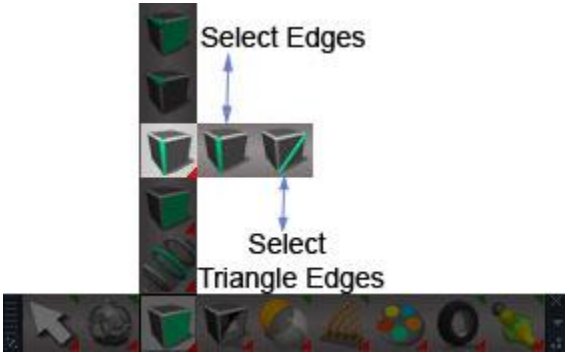
Select Context used to select a range of faces, edges and vertices.

3.3.2 Select Vertices

This selection type lets you only select vertices (points).



Using the select tools with a selection type set to vertices.



3.3.3 Select Edges

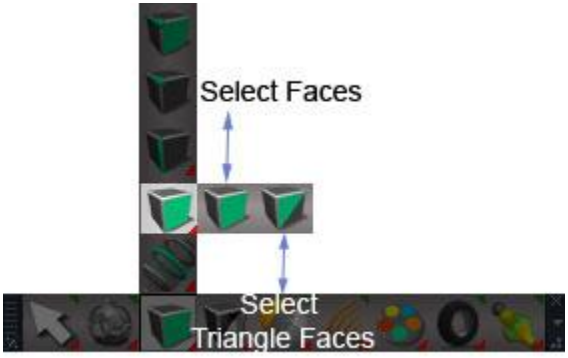
This selection type lets you only select edges.

Using the select tools with a selection type set to edges.

3.3.4 Select Triangle Edges

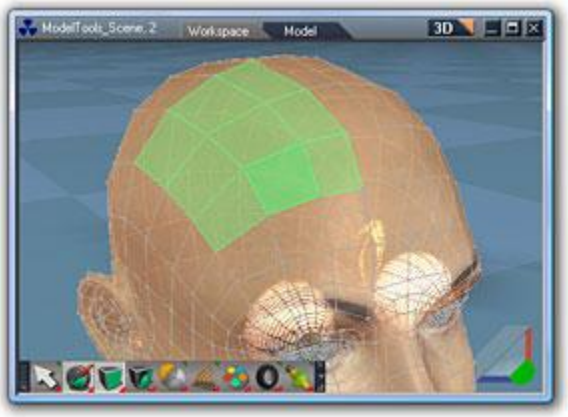
This selection type lets you only select edges, including the ones trueSpace uses to triangulate the mesh. By default, these extra edges for triangulation are not shown in trueSpace, and this selection type overrides that default and allows you to see and select the triangle edges of the object.

Using the select tools with a selection type set to triangle edges.



3.3.5 Select Faces

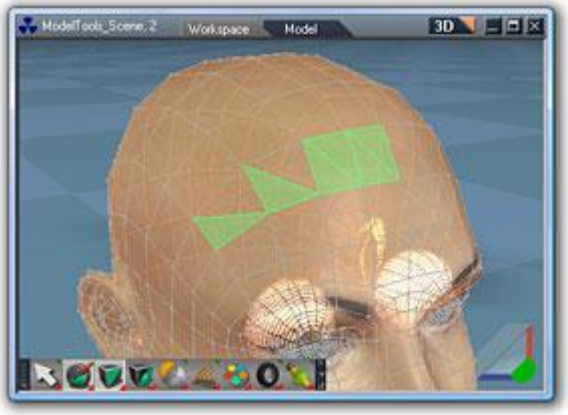
This selection type lets you only select faces.



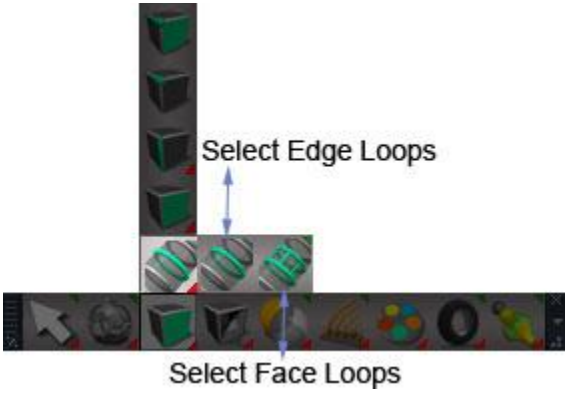
Using the select tools with a selection type set to faces.

3.3.6 Select Triangle Faces

This selection type lets you only select faces, including the ones that result from trueSpace triangulating the mesh. By default, these extra triangulated faces are not shown in trueSpace, and this selection type overrides that default and allows you to see and select the triangle faces of the object.

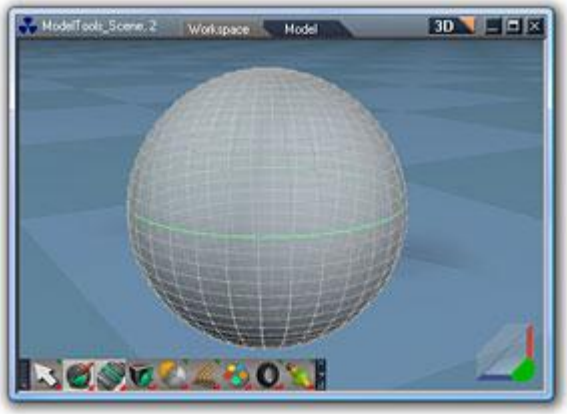


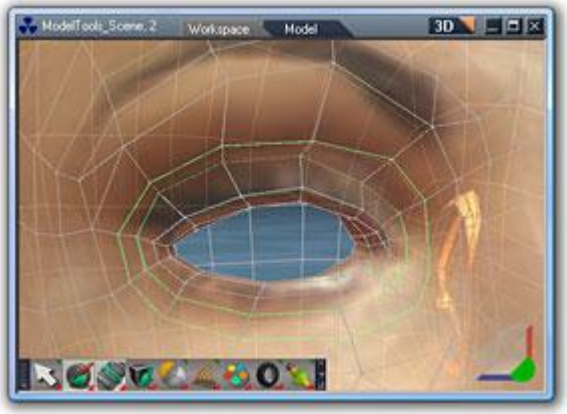
Using the select tools with a selection type set to triangle faces.



3.3.7 Select Edge Loops

This selection type lets you select edges that form a “loop”. While this loop often goes around an object, there are times when it will be more complex, for example a loop constructed around an eye on a character.

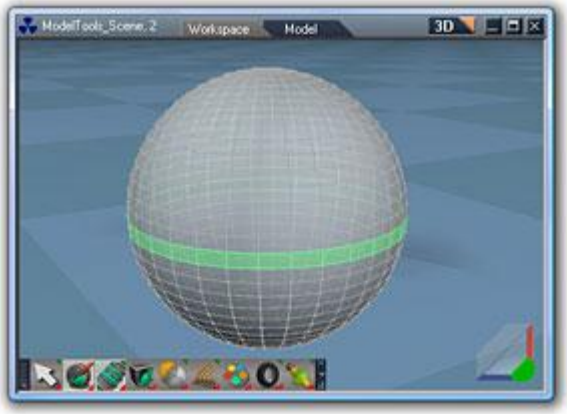


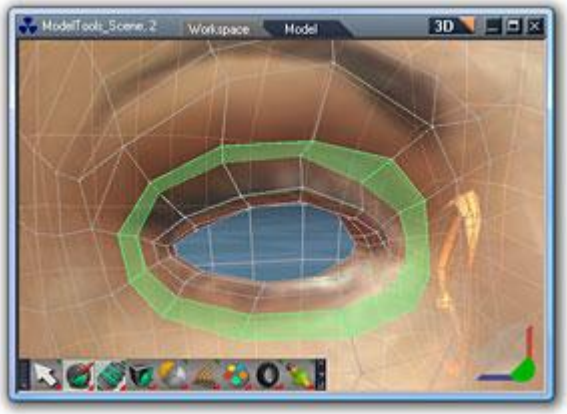


A simple edge loop will run all the way around an object; a more complex edge loop may encircle part of the geometry of an object, such as around the eye socket on a character. Using Edge Loops as the selection type will select these loops of edges with a single click.

3.3.8 Select Face Loops

This selection type lets you select faces that form a “loop”. While this loop often goes around an object, there are times when it will be more complex, for example a loop constructed around an eye on a character.

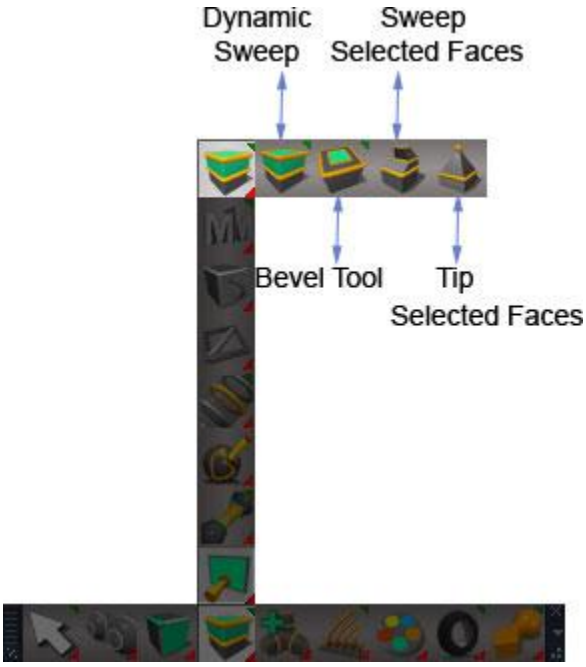




A simple face loop will run all the way around an object; a more complex edge loop may encircle part of the geometry of an object, such as around the eye socket on a character. Using Face Loops as the selection type will select these loops of edges with a single click.

3.4 Sweep, Draw, Topology Tools

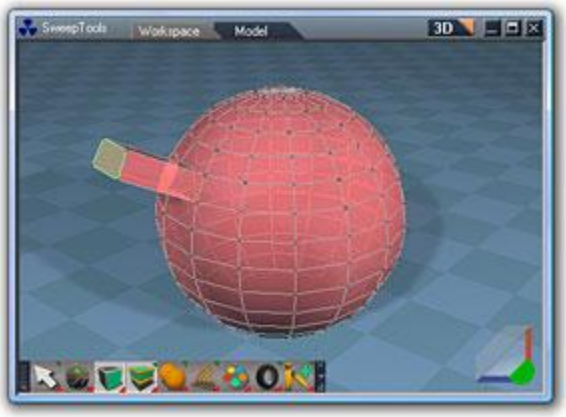
The Point Edit tools allow you to perform tasks on your mesh to change the geometry. These tools are used in conjunction with the Select and Context Point Edit tools to provide you with essential mesh-editing tools. The Point Edit Operations tools are as follows:



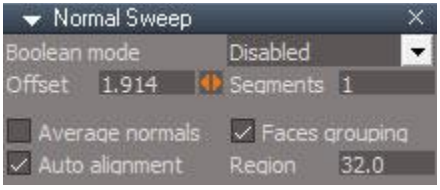
The sweep, bevel and tip tools, are explained below.

3.4.1 Dynamic Sweep

The Dynamic Sweep tool will allow you to sweep faces in the direction of their normals. A normal refers to a face's direction, which by default is perpendicular to the surface of the face. In easy terms, the sweep will occur in the same direction as the face is pointing.



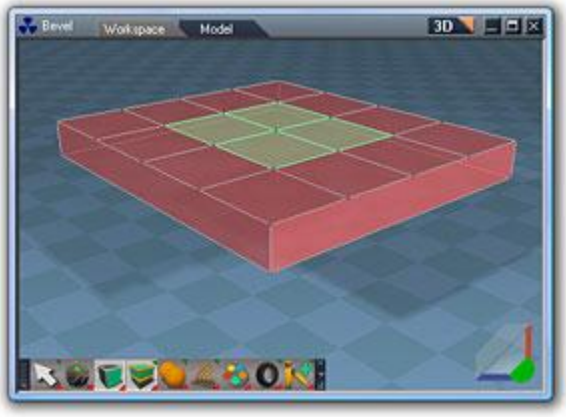
Using the Dynamic Sweep tool.



The Dynamic Sweep settings panel.

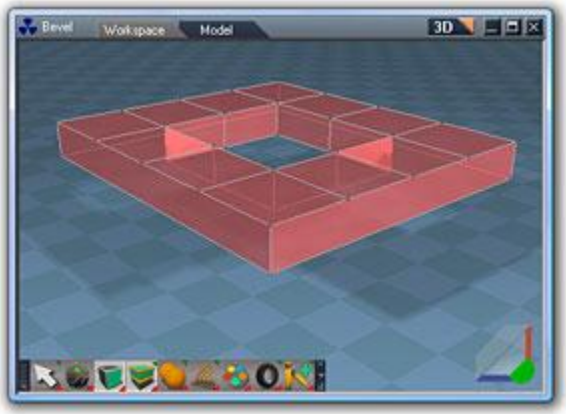
The Normal Sweep settings panel has the following attributes:

- **Boolean mode**: You can select between four modes. Examples are given below.



An initial selection is made, ready to sweep.

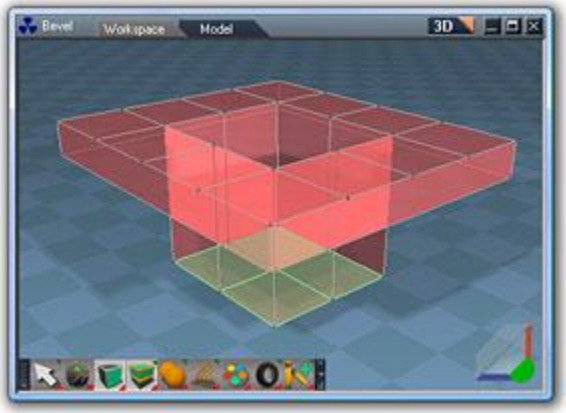
Boolean – In this mode, if you sweep a face through a part of the object, then the sweep will actually "cut a hole" through the face you sweep it through. This is very useful for drilling a hole through an object, or cutting out a part of a shelled object.



Sweeping our selection downward with Boolean mode active gives a hole through the object.

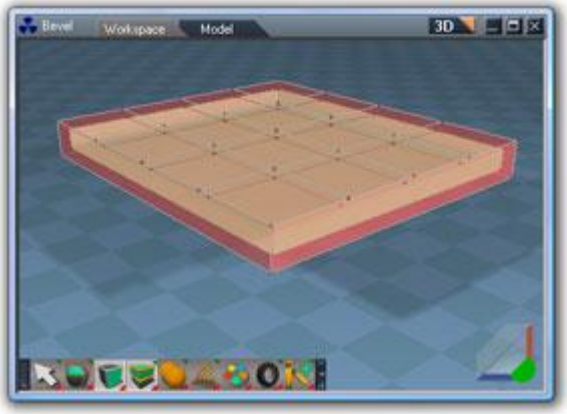
Boolean on Release – This carries out the Boolean operation as with the first setting, but the results of the Boolean are not shown in real-time and will only be shown once the mouse button is released. This allows for greater real-time performance on older hardware or with particularly complex Boolean sweeps. When this option is used, the screen will look like the sweep is in Disabled mode, until the mouse button is released when the effect of the Boolean will become apparent.

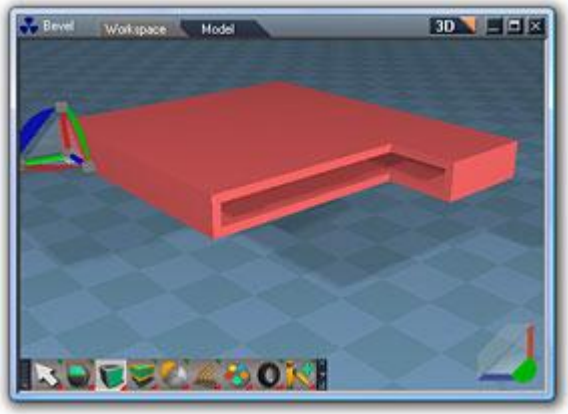
Disabled – The sweep is carried out normally, with no Boolean operations done at all. If you sweep one face through another, then you will end up with overlapping geometry. This mode is most useful when you are not sweeping so far as to go "through" another part of the object



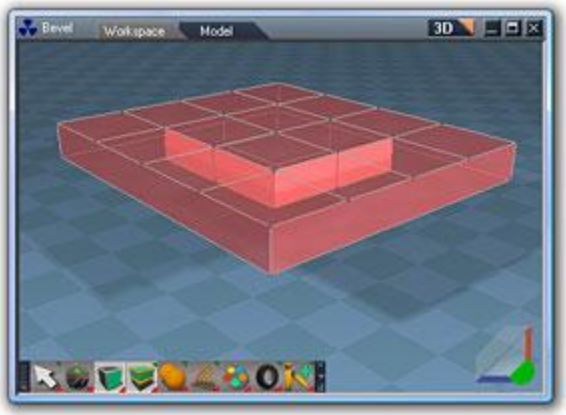
Sweeping our selection downward with the sweep Boolean mode set to Disabled does not create a hole, but does create overlapping geometry which could be problematic.

Shell – This option lets you create a shell either inside or outside of the original object. This works best if all faces on the object are selected, results may be unpredictable or hard to work with if you use this option with partial selections. Sweeping inward will maintain the original surface as the outside, and allow you to create a new surface for the inside. Sweeping outward will make the original surface the inside faces, and add a new exterior surface.



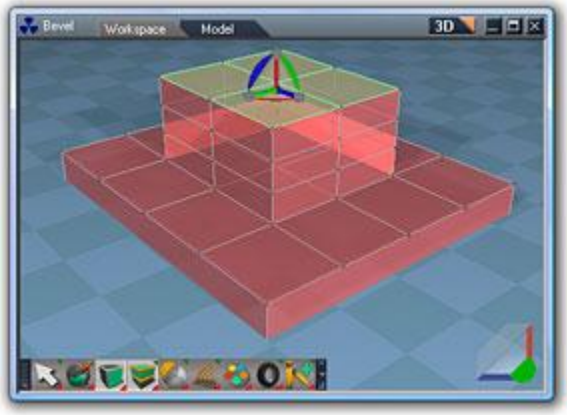


The Shell option works best if all faces are selected. Sweeping inward creates a hollow shell, with the original surface providing the outside, and the new sweep surface providing the inner faces (left). Cutting away part of the object with a Boolean afterward reveals the hollowed-out structure that results.



Sweeping our selection downward with the Shell option leaves the outer faces intact, and creates a new set of inner faces. This is generally not desired, unless you plan to work further with the geometry to restore it to a "valid" state.

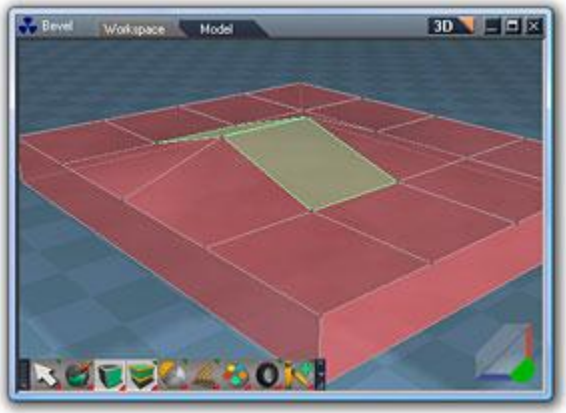
- **Offset**: This lets you enter a numerical value for the sweep. If you single click on a selected face, then this is the value that will be used to determine the distance the face will be swept. If you click and drag to set the sweep visually, then this value is updated with current sweep distance when you release the mouse button, letting you duplicate the same sweep distance on another face with a single click.
- **Segments**: Sets how many segments the final sweep is made up from.



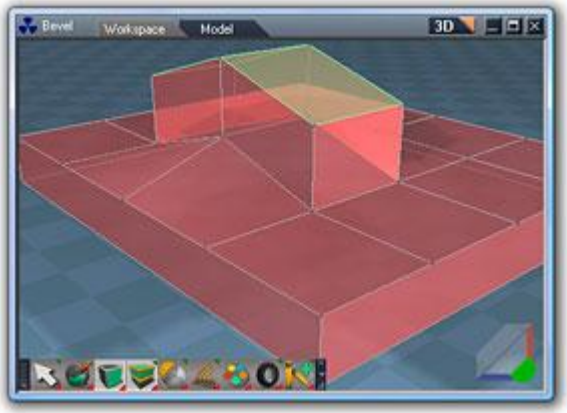
With Segments set to 3, the sweep produces three segments, useful for manipulating the swept area later.

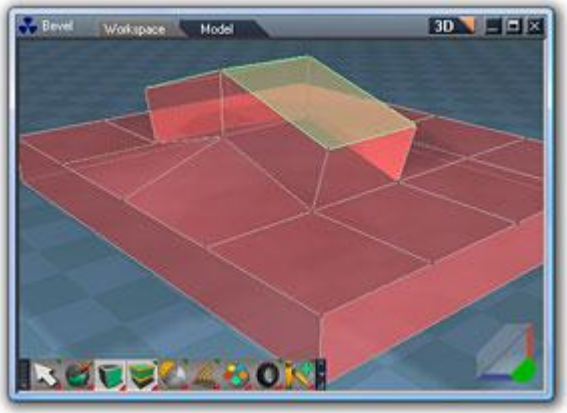
- **Average Normals**: When checked, the sweep will average the normals for the patch (the area of

selected faces) and use that to sweep the vertices of the faces. When unchecked, the actual normal of each individual vertex will be used – this can result in the vertices sweeping "outward" or "inward", as seen in the comparison below.



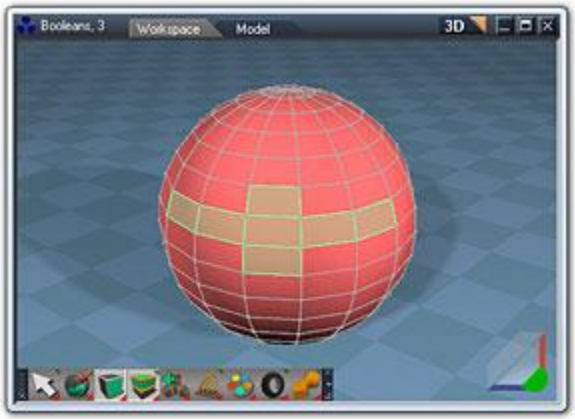
For this example, one edge was selected and raised, then two faces selected for sweeping.



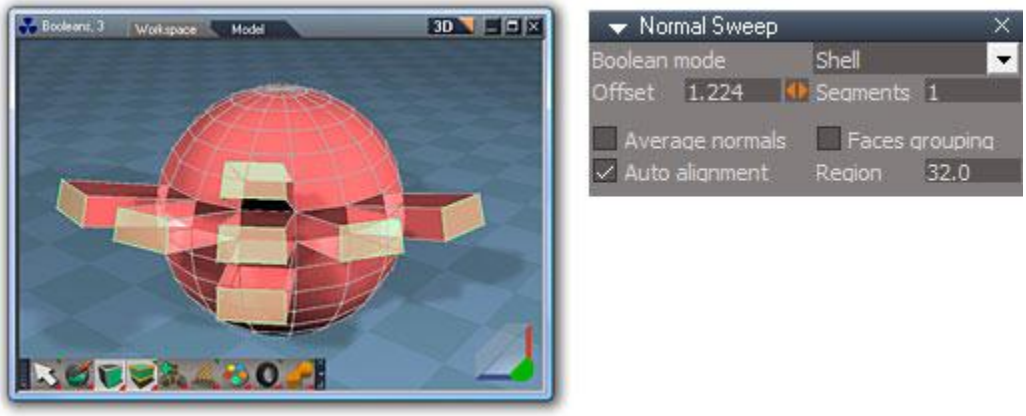


With Average Normals checked, the vertices are swept according to the averaged normals for the patch (left). When unchecked, each vertex sweeps along its own normal – since the faces were angled, the vertices at the edges have normals facing in a direction other than vertical, so they sweep outward along that direction (right).

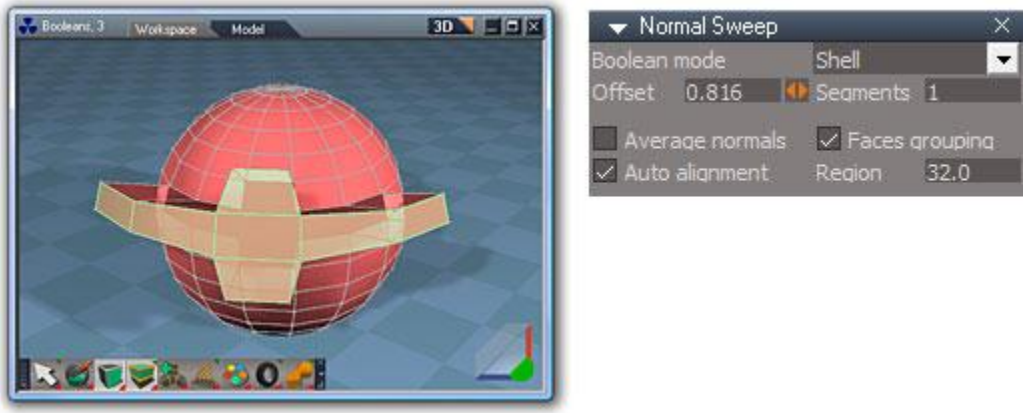
- **Faces grouping**: If more than one face is selected, you may or may not wish for the selection to be swept as a group. You may wish to have each face in selection, swept individually. This allows for each face to move in its own normal direction and maintaining its original shape/size. When Grouping is checked, the selection as a whole is moved in the direction of each face's normal, with adjustment of each face to keep the selection "together".



The initial selection of faces

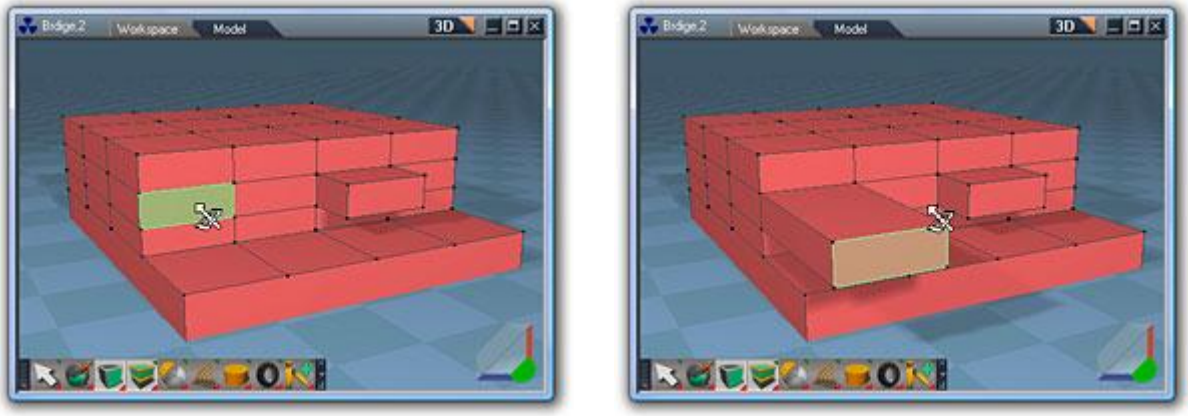


With Faces Grouping unchecked, the faces sweep separately.

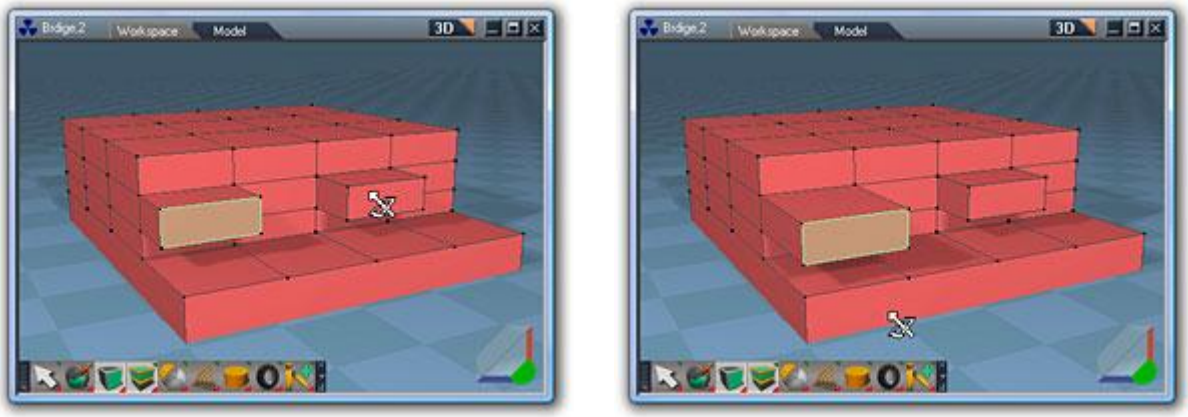


With Faces Grouping checked, the faces sweep together as one, adjusting to stay in touch with each other at the edges.

- **Auto alignment**: When this is checked, the sweep will snap to faces underneath the mouse pointer. This lets you begin to drag the sweep, then point at a particular face, and have the sweep snap to match it. It works in conjunction with the Region setting.

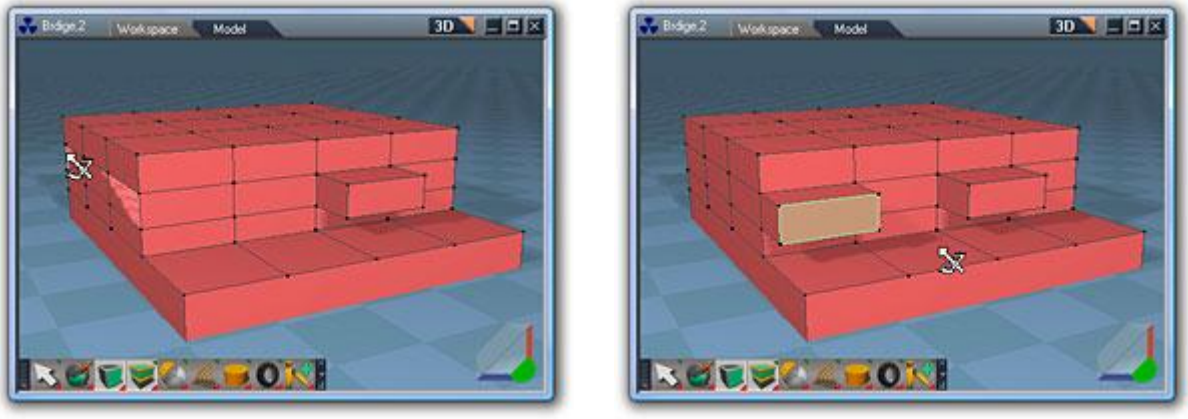


With a face selected, the Dynamic Sweep tool is activated (left). A left click and drag will sweep the face as expected (right).



Moving the mouse pointer to point at an existing face, such as the earlier sweep seen on the right in the image, makes the new sweep snap to match the face beneath the mouse pointer (left). Pointing at a different face, such as the end of the object, causes the sweep to snap to that location (right).

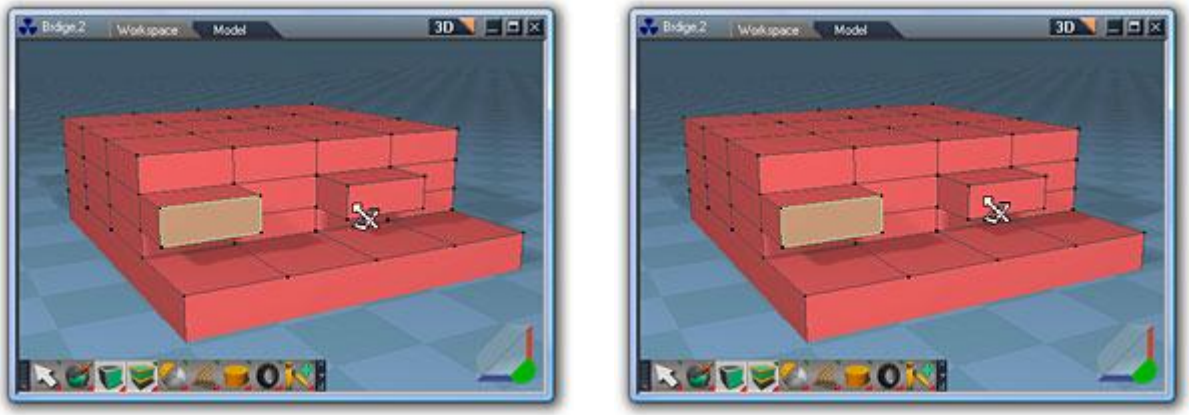
Note that the snap is done to the face that is visible beneath the mouse pointer. This means you cannot snap to faces that are pointing away from the current angle of view - in the image below, the face beneath the mouse pointer is not the reverse one on the opposite side of the model, but is the visible one at the side of the model. Snapping to faces that are pointing in a different direction from the sweep will not give expected results.



The sweep cannot snap to faces that are not underneath the mouse cursor, such as those facing away from the current point of view (left), nor can it sweep to faces which are pointing in an inappropriate direction (right).

- **Region**: This sets a region in screen pixels around the face normal where auto alignment is disabled.

This means that the lower the value, the closer to the face normal the mouse cursor has to be for the face to be used in snapping. This lets you leave Auto Align checked, and still only have snapping to faces where it is desired, so that you do not have to continually activate or deactivate Auto Alignment. Too low a value in the Region parameter, and Auto Align would try to snap to any face that happened to be under the mouse cursor. Too high a value in the Region parameter and no snapping will take place. The default value of 32 is usually the best to use.

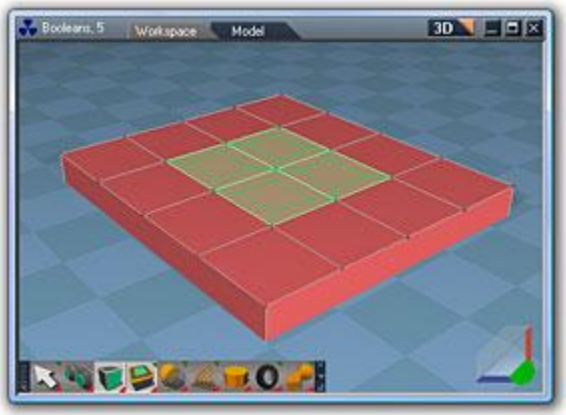


With Region set at the default value of 32,the sweep snaps as soon as we point at the face (left). Raising this value to 80 makes the snap "less sensitive", now the mouse cursor only triggers the sweep when it points further inside the face. (right). With higher values still, the snap may never happen.

3.4.2 Bevel Tool

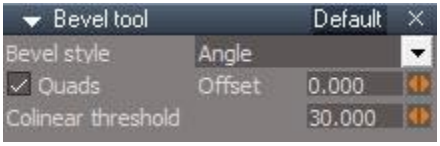
The Bevel tool is used in conjunction with selected faces or edges. Left click and drag to size the new faces or beveled edge, and release the mouse button to finalize the bevel.

When more than one face is selected, the bevel tool is applied universally across all selected faces – each face is beveled separately, rather than the whole group being beveled as one. The section on this tool is divided into two parts, the first will cover beveling faces, the second will look at beveling edges.



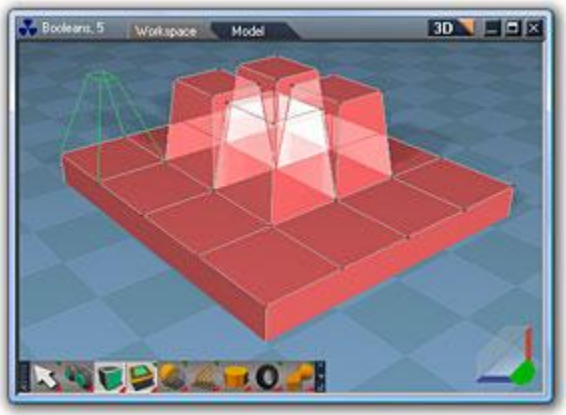
Adding bevel to selected faces.

Bevel Settings Panel .When you activate the Bevel tool, your Object Stack view shows the Bevel tool settings panel.



Bevel tool settings

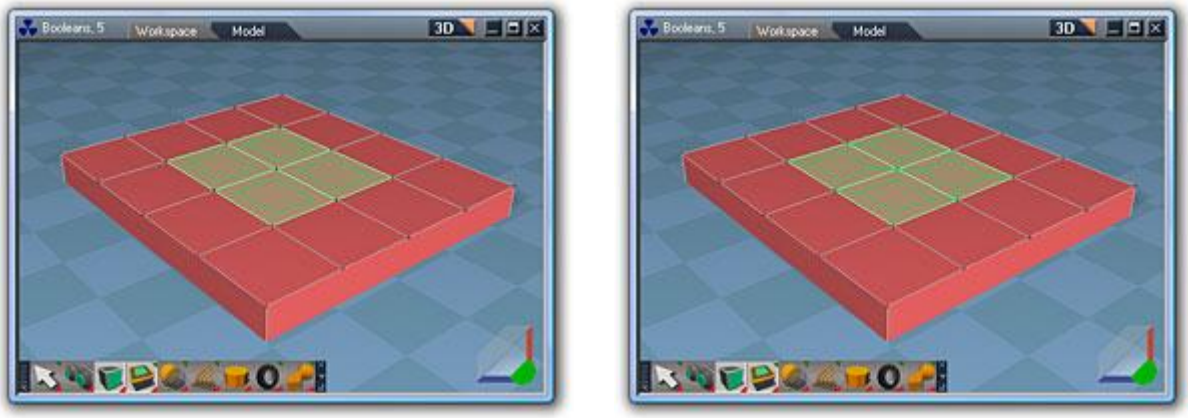
- **Bevel Style**: There are three different bevel styles to choose from **:**
  Angle – The Offset value is used to set the angle (in degrees) of the bevel. You then use the mouse to choose in real-time the height of the bevel. You can choose angles from 0 to 89, where 0 will give a bevel flat to the surface, and the closer to 90 the value gets, the result gets closer to an entirely vertical bevel (in effect, a sweep). Note that a value of 90 and above will give an "infinitely tall" bevel so those values are to be avoided.
  Height – As well as being angled, the bevel is also raised or lowered from the surface of the face. The height is controlled by the Offset value (values of between 0 and 1 are usually best), and the mouse then lets you set the angle. After choosing the desired angle, you can left click and drag to adjust the height visually in real-time, overriding the initial height set using the Offset value. Once you have selected a height visually in real-time, that value is stored in the Offset parameter, so you can automatically apply it to any subsequent bevels if desired.



Using Height mode lets you sweep as well as bevel. With a height set visually for the middle four faces, the same height is automatically applied to the next bevel, seen un-finalized at the back left.

Inset – This bevels the faces inward, leaving them flat on the surface with no change in height. The Offset parameter has no effect with this setting.

- **Quads**: when checked, the new face created will be connected to the original outer face. If unchecked, the new face will be created without vertex to vertex connections, leaving it "floating" on the surface of the original face. The illustration below shows how the Quad mode setting affects how the bevel is drawn on the faces.



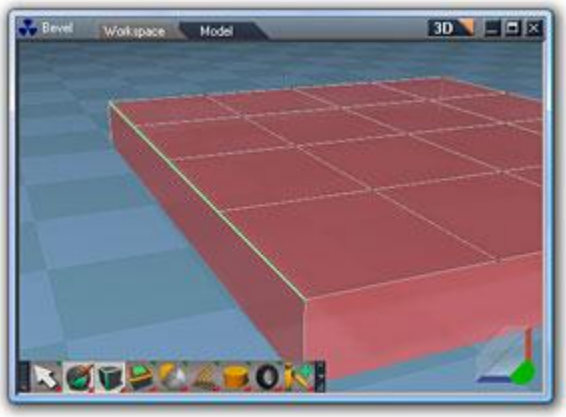
With Quad mode unchecked, the new faces are not connected to the outer edges of the original faces (left) When Quad mode is checked, then the new faces are connected to the outer edges (right).

- **Offset**: This value controls either the height of the bevel (in Height mode) or the angle of the bevel (in Angle mode). It has no effect on Inset mode.

- **Colinear threshold**: This is used to remove redundant vertices after beveling an edge. If two edges form an angle below this threshold, they will be combined into one edge.

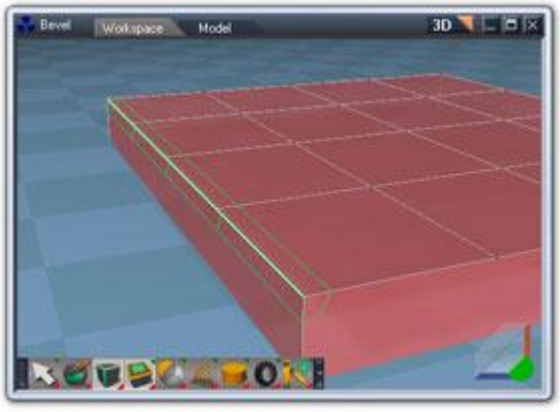
Beveling Edges

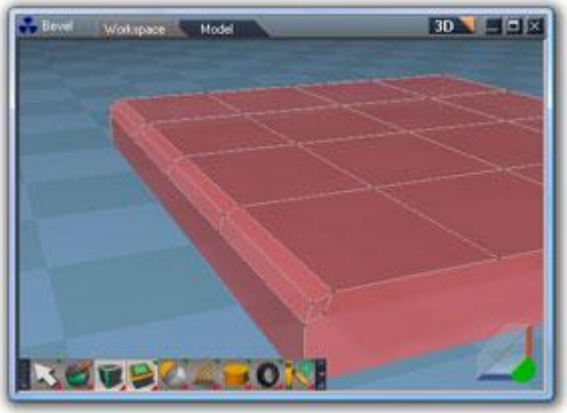
When beveling edges, the Angle mode is the one you are most likely to want to use. This will let you "round off" an edge to give it a smoothed appearance.



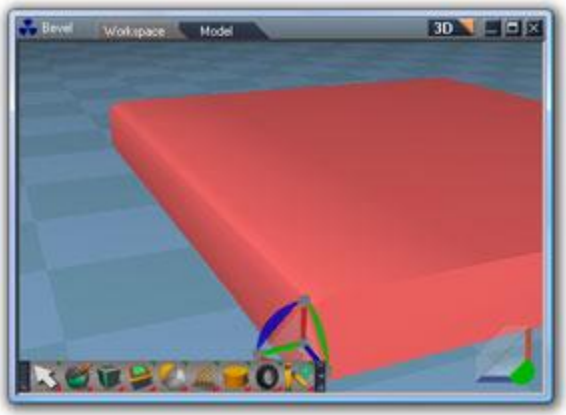
Our line of edges selected ready to be beveled.

If you want to round off an edge, for best results with Angle mode, use an Offset of -10 to -22.



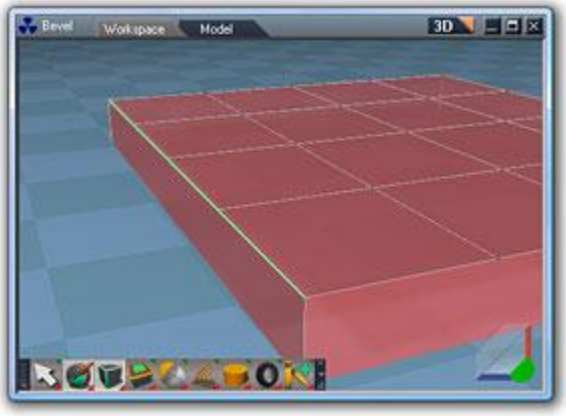


Mouse movements will control the range of the bevel (left), and then a click will set the bevel. This example uses an offset of -15 to give a rounded result.

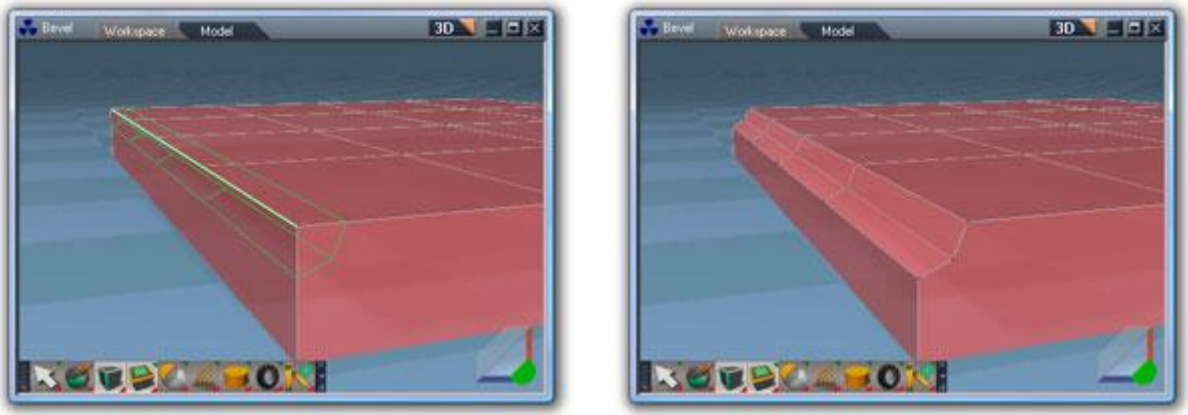


Exiting Point Edit mode, and using the Auto Facet Normals tool shows the rounded result.

Using Offset values of -23 to -27 will give an almost flat face. Offset values of -28 to -35 will give an "inverted" beveled edge, which dips inward rather than rounds outward.

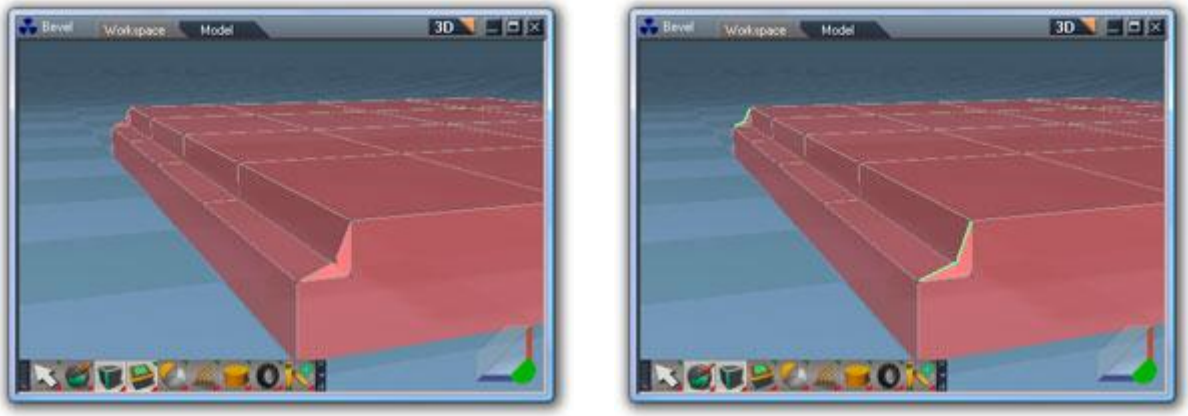


Starting from the original selection once more.

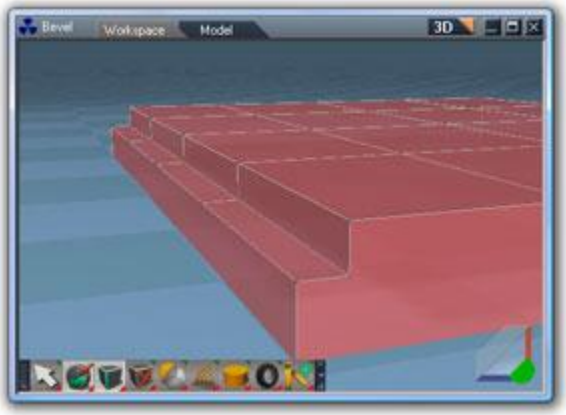


This time using an Offset of -35 in Angle mode (left), our bevel is inverted (right).

This continues in strength from -36 downward, with an offset of -45 giving a right angled corner – note though that the ends of the edges may need editing after the bevel as the outer edge of the bevel will now have recessed in further than the other connecting edges, giving an overlap (see below).



With an Offset of -45, we get a right angle, but we have some overlap at the end (left). Selecting those four edges lets us prepare to delete them (right).



Now Delete Selected Elements leaves a clean 45 degree inward bevel.

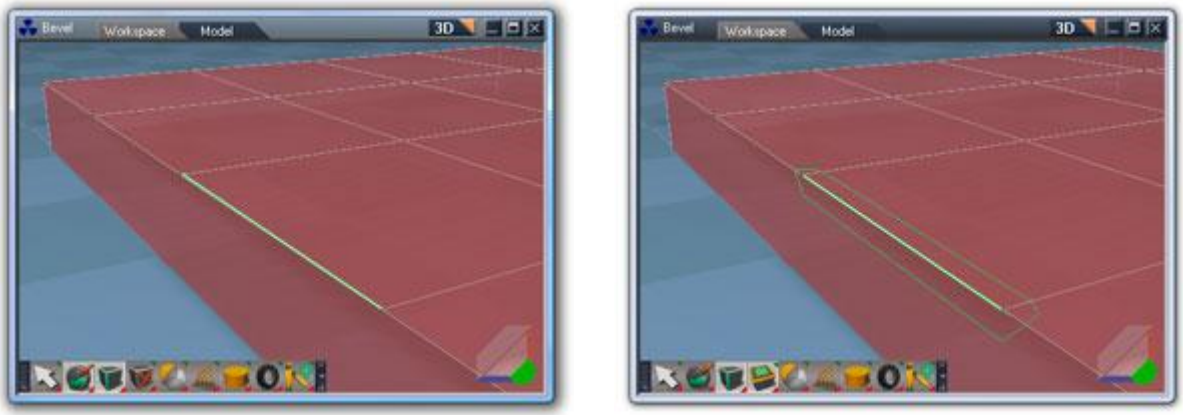
If you use the Height mode, then you can create the same effects as with Angle, but the values used in offset need to be much smaller making it easier to work in Angle mode. Using inset mode will create a new set of edges on the surface of the object, but will not adjust the original edge's location. You can of course adjust the edge position after using the Bevel tool, though normally it is easier to do both at once by using the Angle setting.

Note that the Bevel tool does not allow you to set how many segments to use in the resulting bevel, and will always create three edges in place of the first single edge. If you want to create a smoother look for your bevel, you can repeat using the Bevel tool on the original edge, again creating three edges and so adding more segments to the bevel for a more rounded result.

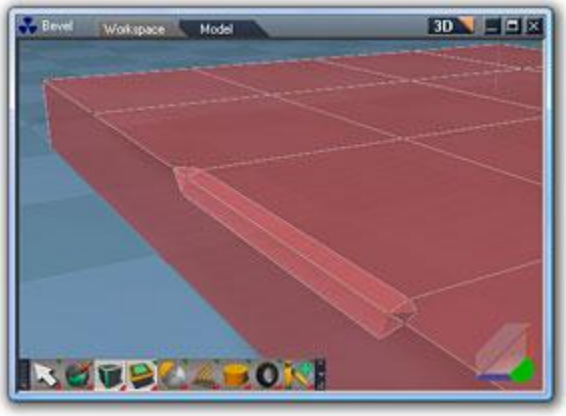
With the middle edge selected from the first bevel (left), we can apply a second bevel (right).

A click creates the bevel (left) – exiting Point Edit mode and using Auto Facet Normals shows the more rounded result.

Best results are usually achieved beveling across selections of edges as seen above. You can bevel a single edge, but the results may be harder to work with, you can see an example below.



With one edge selected (left) we can still apply a bevel (right).

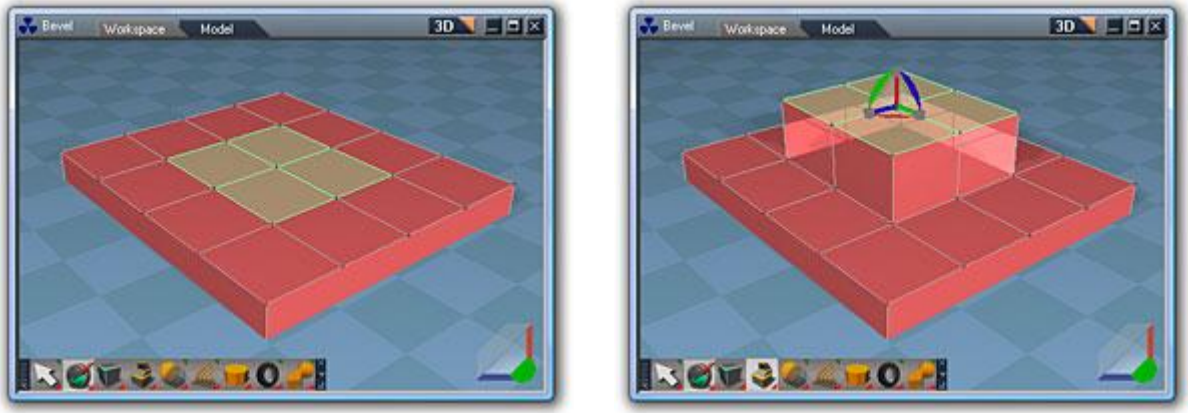


The result is more complex than beveling the entire line of edges, and may require editing depending on your desired result.

3.4.3 Sweep

The Sweep tool is used in conjunction with selected face(s). Sweep or Loft the face(s), by first selecting the face(s) and then press the Sweep tool.

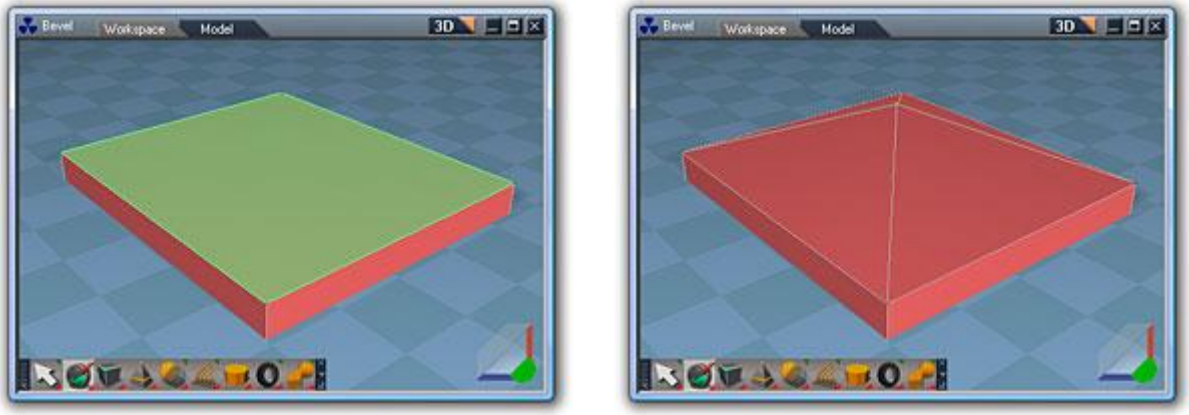
Subsequent clicks on the Sweep tool will continue sweeping the selection. On subsequent sweeps, the Sweep tool will exhibit a "memory" of how the face was created. It will repeat the same "operation" on the subsequent sweep.



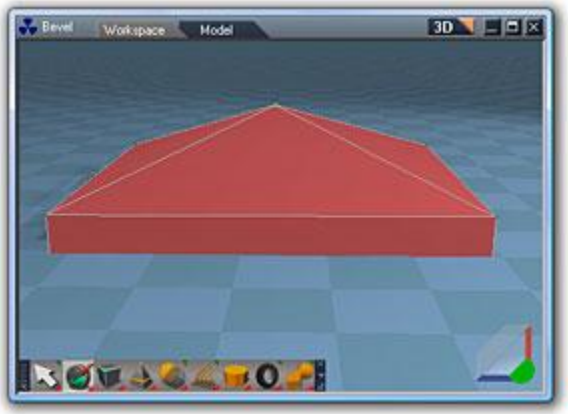
With four faces selected (left), the Sweep tool sweeps all four faces – you can adjust the height of the sweep with the Point Edit widget (right).

3.4.4 Tip

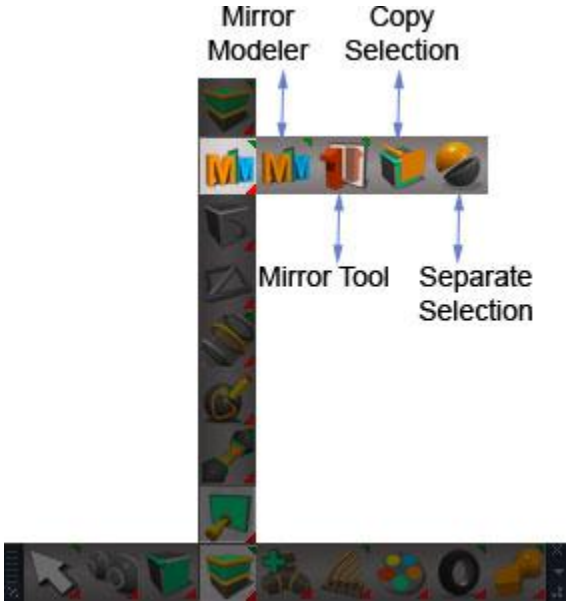
The Tip tool is used to create a vertex with edges between all original vertices on selected face(s). This creates a single point, either flat on the original face, or raised or lowered from the surface, giving a pointed shape as a result.



With a face selected (left), the Tip tool joins all the vertices to a single point in the center and raises the point. (right).



A view from a different angle of the result of the Tip tool.



3.4.5 Mirror Modeler

The Mirror Modeler tool allows you to model across a “mirror-plane”. This allows you the ability to model symmetrical objects such as characters, heads and similar by working on only one half of the object, while the Mirror Modeler tool takes care of making another identical half.

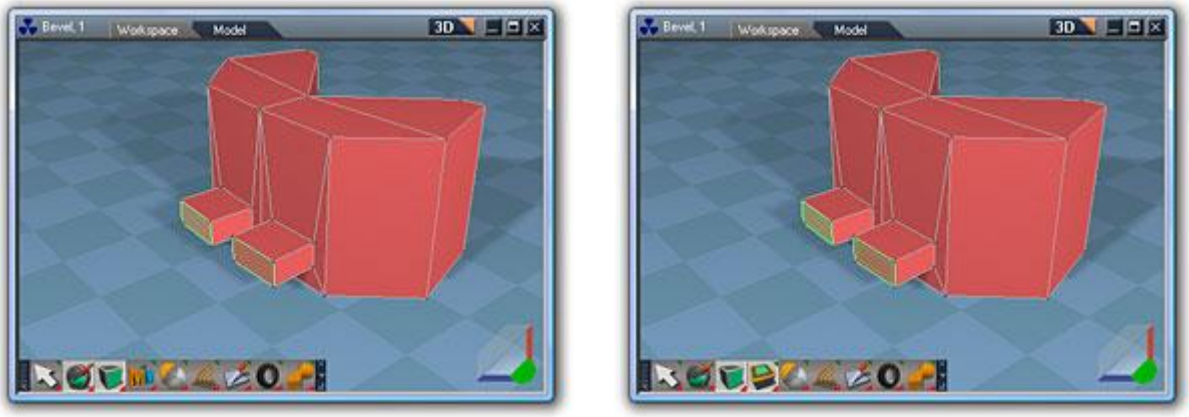
You may select one or more “elements” to act as the mirror plane. This means you can select vertices, edges, faces, or any combination.

Not all combinations will work well, however you have the ability to experiment as desired. The safest and most basic form is to use a face as the mirror plane selection. Once you decide on the “mirroring plane”, press the Mirror Modeler tool to start the process. From that point on, you may work on either side of the mirror plane and model as desired, with your modeling being mirrored on the other half of the object on the other side of the mirror-plane.

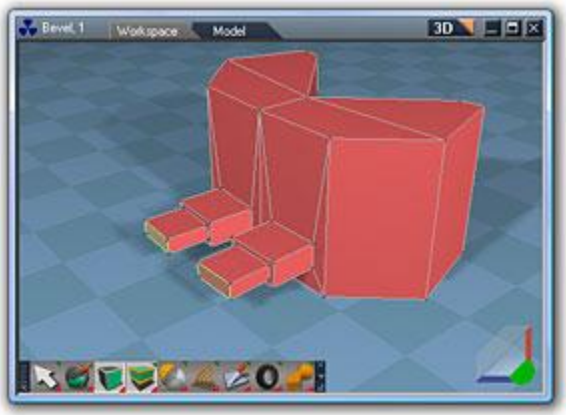
If you need to remove the procedural effects of Mirror Modeler, you use the Flatten History tool. This is necessary if you want to edit one half of the model separately from the other, or if you want to export to Virtual Earth, X format, etc.

Selecting a plane (left) then clicking Mirror Model duplicates the entire model using the selected plane as the "mirror" (right)

Once you have created this initial Mirror Modeler scenario, selecting elements on one side of the object, automatically selects the mirrored elements (or vice-versa). The full compliment of Point Editing tools is available to use on selections. The Selection Navigation Controller, will always show up on the original half of the object.

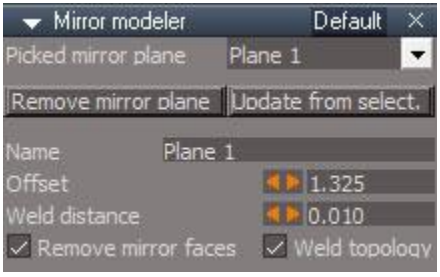


Point Edit selections made on one side of the model are mirrored to the other side automatically (left). Then the full range of Point Edit tools can be used, for example applying a bevel to one side causes the bevel to occur on the other side of the model also (right).



Now sweeping one of the new beveled faces causes the sweep to be mirrored. This allows you to mirror the object while you work, rather than wait until one half is completed.

The Mirror Modeler tool has a settings panel associated with it. After you have activated the Mirror Modeler tool, right-click on the Mirror Modeler icon to load the settings panel into the Objects aspect of the Stack area.



The Default aspect of the Mirror Modeler options panel

The settings panel has two aspects as illustrated above. Either "Default" aspect or "Selection" aspect will be showing. On the "Default" aspect, you will find the following attributes:

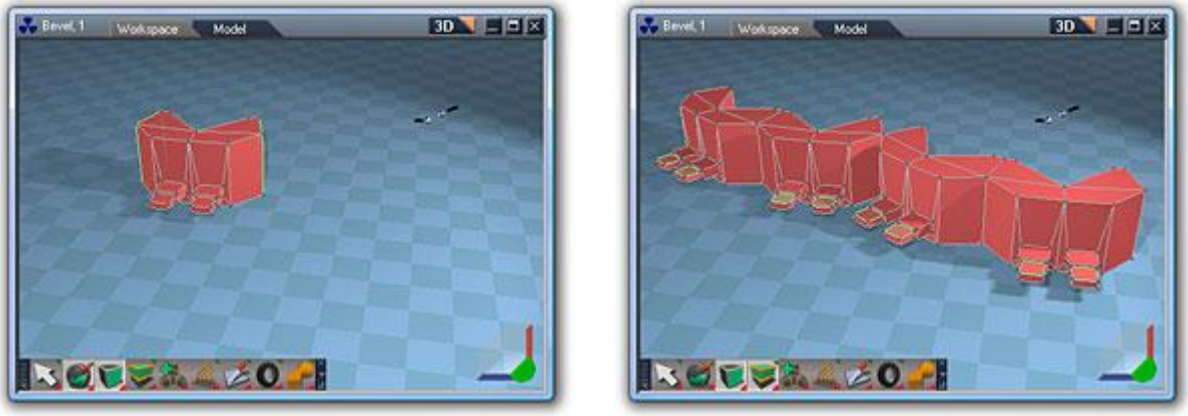
- **Picked mirror plane:** you may have more than one plane, which the object(s) are mirrored from. With each subsequent plane, the entire object (original + mirror) is then mirrored. You can create quite a complex object using multiple planes. You will populate the drop-down list box to the right of Picked mirror plane with subsequent planes. You are able to select whichever plane you wish to edit.
- **Remove mirror plane:** removes the currently selected plane in Picked mirror plane drop-down list.
- **Update from selection:** the Update button will allow you to select a different element(s) on your object and will update the mirror accordingly. You may not select the proper element the first time,

so you have ability to change afterwards if desired. Hitting the Update button will update the scenario for you.

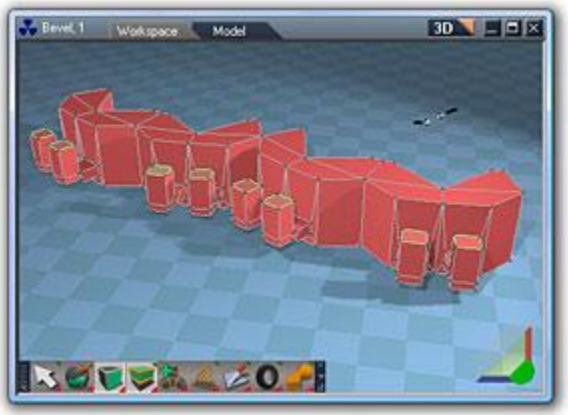
- **Name:** you may set the name of the Picked mirror plane here for easy reference.
- **Offset:** you may set the Offset value as desired. This value will move the objects closer or further away from each other, depending how you adjust this setting. The Offset will work off the mirror plane's normal direction.
- **Weld distance:** this settings allows you to tweak how large an area the original and mirror objects will overlap. As you increase the value, trueSpace builds geometry between the objects associated with the "plane" you have selected.
- **Remove mirror faces:** When unchecked, objects are joined by elements on a common face, with each object having its own face at point of mirror. When checked, a common face joins objects.
- **Weld topology:** will remove the mirror faces from the geometry. Toggle this setting on/off and you should see faces appear and disappear as you toggle.

The Selection aspect of the Mirror Modeler options panel

- **Desaturation:** this setting controls the saturation the selected elements, on the mirror side of object. It allows you to have feedback on what is actually being selected.



Selecting a face at the side of the model while still in Mirror Modeler mode (left) then applying two new layers of Mirror Modeler duplicates our object further (right). Notice how selected one face causes all eight faces to be selected.

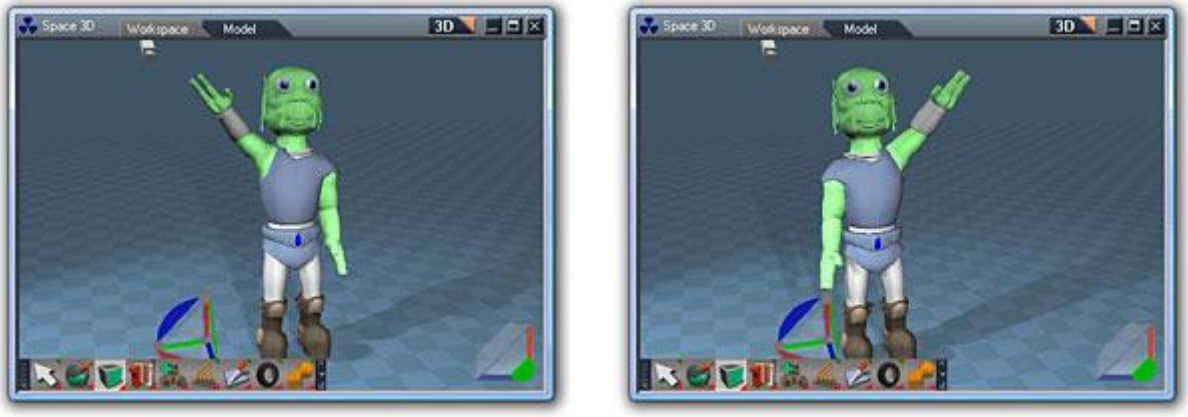


Now the Sweep tool causes all eight faces to be swept. Using multiple layers of mirroring like this can let you build complex shapes quickly.

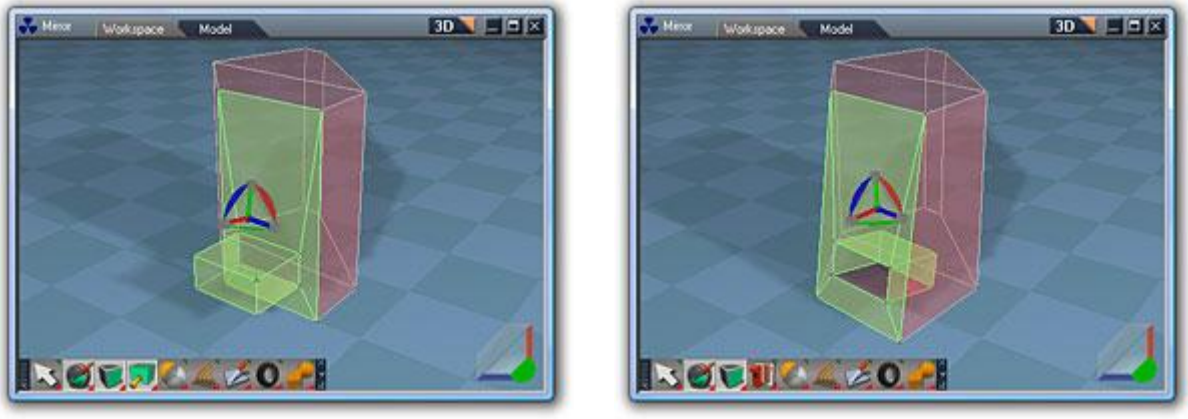
If you are finished modeling and no longer require the interactive mirroring and want to create a final object, use the Flatten History tool. Note that this removes all interactive mirroring, and gives you a final, static polygonal object.

3.4.6 Mirror Tool

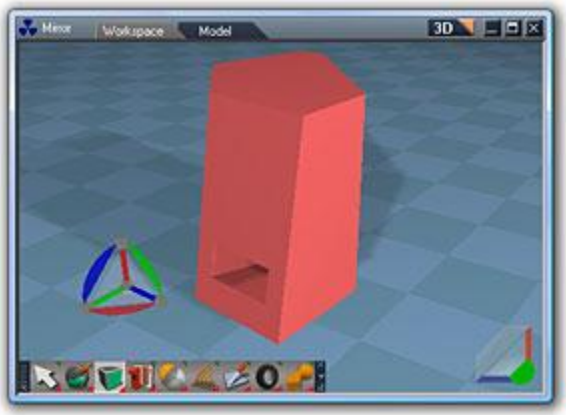
The Mirror Tool allows you to make a selection of elements on an object and Mirror that selection. If no selection of elements is made, the entire object is mirrored across the x-axis.



With no faces selected (left), the Mirror tool mirrors the whole object (right).

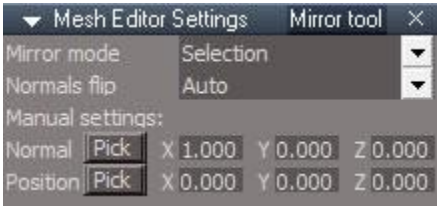


With particular faces selected (left), the Mirror tool mirrors just those faces (right). Note that some selections may result in inverted normals, or "twists" in the object's mesh.



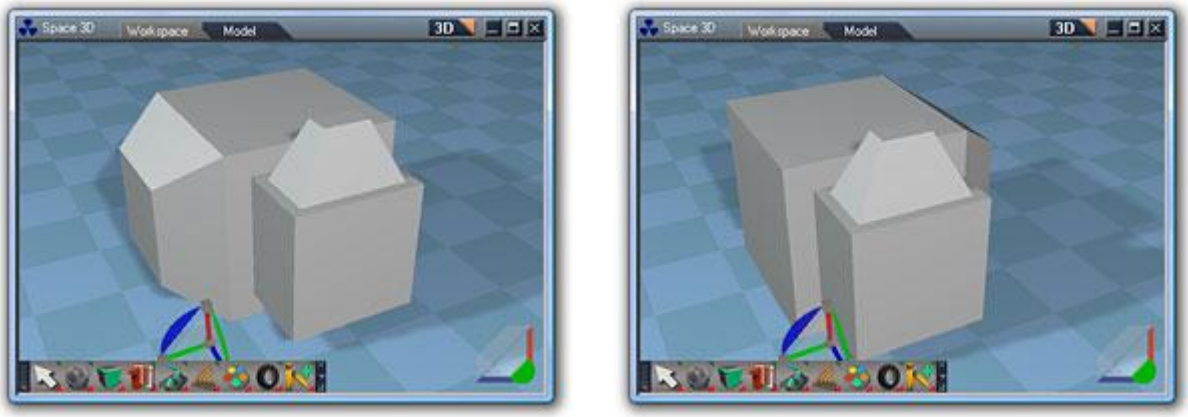
Exiting Point Edit mode lets us see the object now the selected faces are mirrored.

The Mirror Tool has some options associated with it. These can be selected manually in the Mirror Tool aspect of the Mesh Editor Settings option panel in the stack, or opened with a right click on the Mirror Tool.



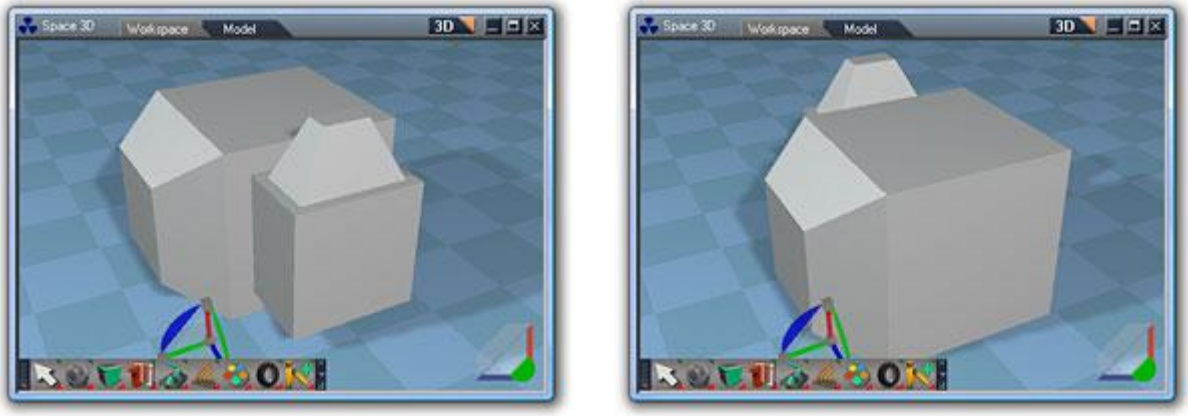
The Mirror Tool aspect of the Mesh Editor Settings panel.

- **Mirror Mode -** This controls how the mirror result is calculated. The options are:
  Selection: The object or selected elements will be mirrored around the axis of the object or selected elements.
  World X Axis: The object or selected elements will be mirrored around the world X axis (flipping the object left to right).



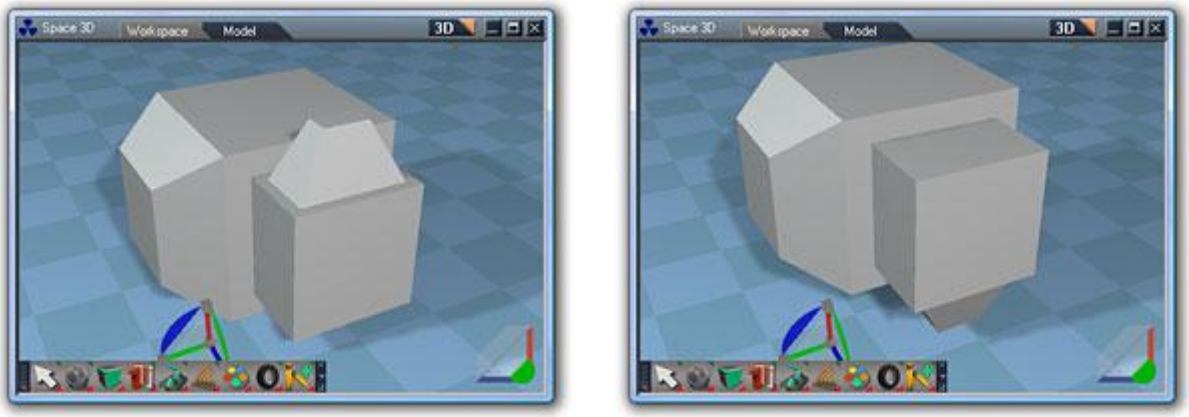
The original object (left) and the result of the Mirror Tool with World X Axis chosen (right).

World Y Axis: The object or selected elements will be mirrored around the world Y axis (flipping the object front to back).



The original object (left) and the result of the Mirror Tool with WorldYX Axis chosen (right).

World Z Axis: The object or selected elements will be mirrored around the world Z axis (flipping the object top to bottom).



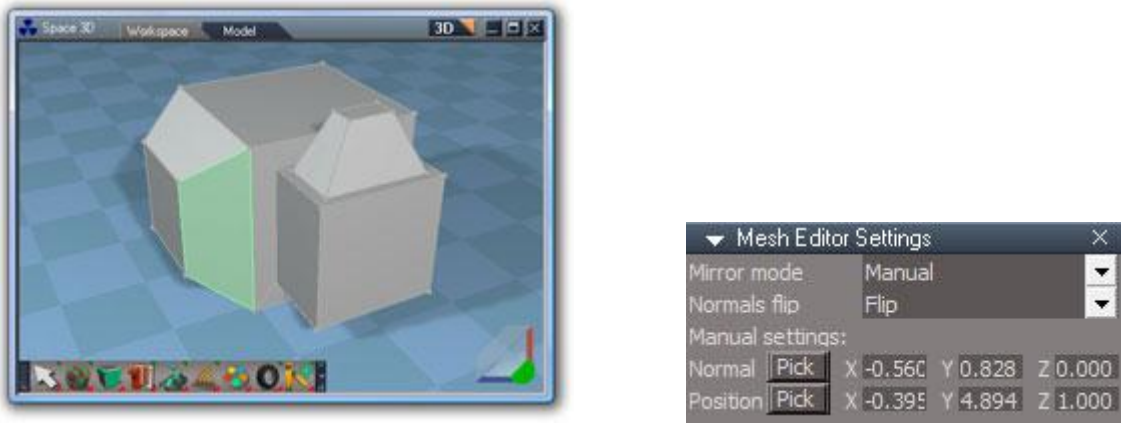
The original object (left) and the result of the Mirror Tool with World Z Axis chosen (right).

Manual: The object or selected elements will be mirrored around the axis set using the Normal and Position values. The three position values set the x, y and z location for the mirror plane in the world space, while the three normal values set the direction of the mirror plane.

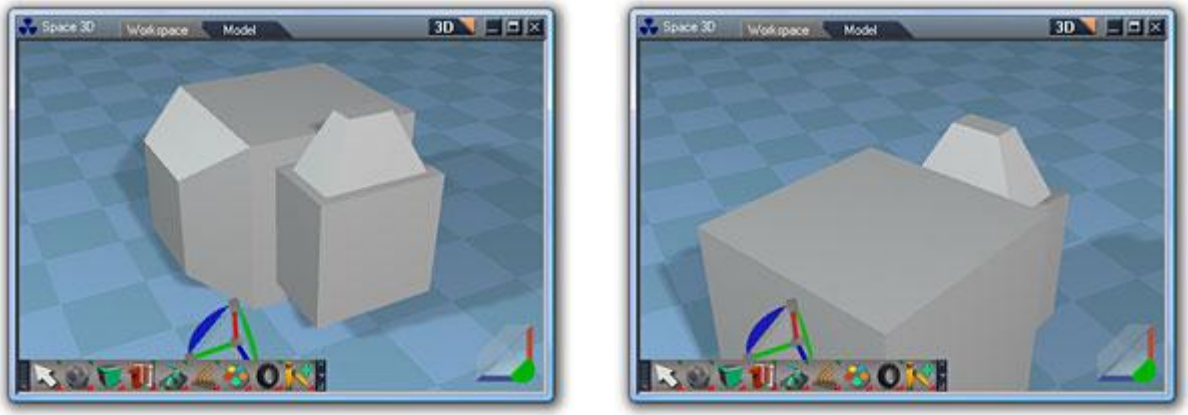
- **Normals Flip –** This applies when mirroring selected elements in an object, and not when mirroring the whole object.
  Auto: trueSpace will calculate whether or not to flip the normals for the mirrored elements.
  Flip: This forces the normals to be flipped on the mirrored elements.
  *Keep:*This keeps the normals on the mirrored elements the same as they were originally.

- **Manual Settings –** These parameters define the mirror plane for when the Mirror Mode was set to manual, and they allow you to set the mirror plane that should be used. The first three parameters control the normal, that is the direction that the mirror plane is facing in world space. The next three parameters control the location in world space of the mirror plane.

  You can either manually enter the values, or you can choose an object or element such as a face, and then use the Pick buttons to copy the normal or location of that object or selected element. For example, you could pick a face on the object, use Pick to choose its location and its normals, and then the Manual mode will in effect mirror the object around that chosen face. Note that using either of the Pick buttons will automatically set the Model Mode to manual.



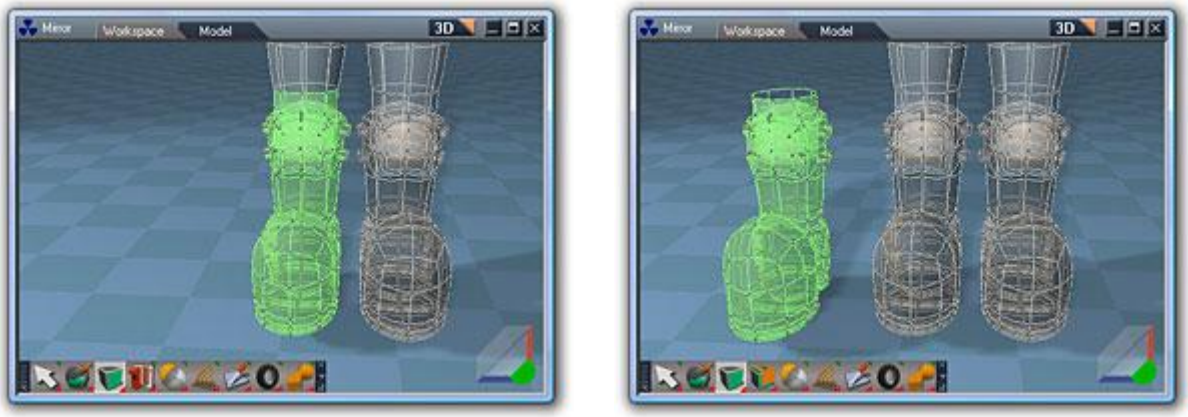
Selecting a face on the object (left) then using the Pick option for Normal and Position of the mirror plane captures the location and facing of that face to use when mirroring (right).



Exiting Point Edit mode (left) lets us mirror the whole object at once with the Mirror Tool – the object is now effectively mirrored through the plane we had previously selected (right).

3.4.7 Copy Selection

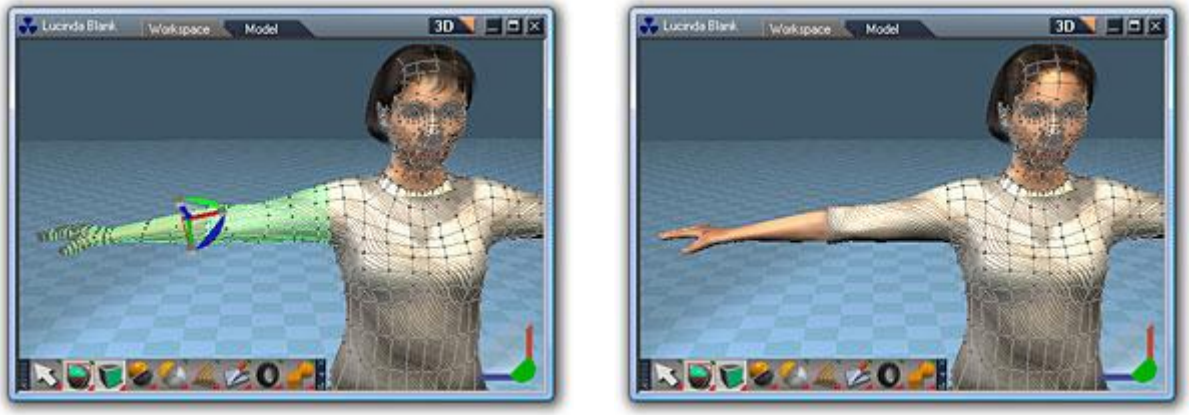
The Copy tool allows you to copy the current selected geometry elements. The illustration below shows a simple copy of faces, followed by movement away from their origin to demonstrate.



With particular faces selected (left), the Copy Selection tool will create a new copy of those faces, which we can then move away from the original (right). Note that the new faces still belong to the same object even though they are appear to be no longer attached to the rest of the object.

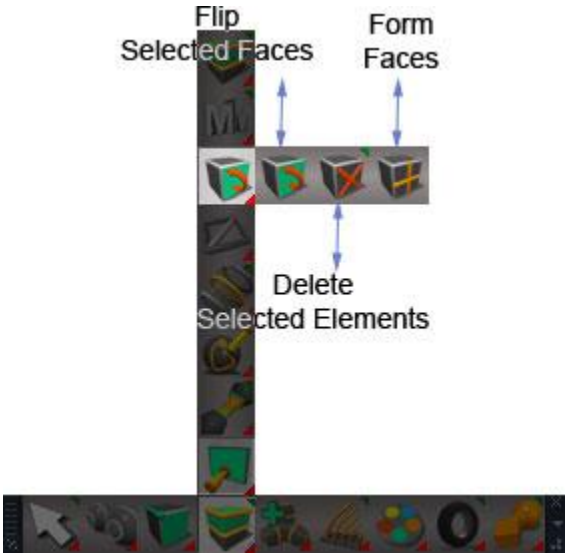
3.4.8 Separate Selection

This separates a selection, breaking it off into a separate model. Note that it acts as a cut, the original model "loses" the selected faces. You can use Copy Selection first, and then use Separate Selection to preserve the original object and create a new independent copy of part of the object.



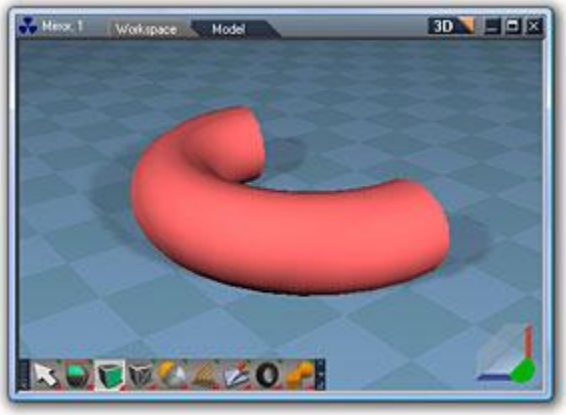
With particular faces selected (left), the Separate Selection tool detaches them from the original object (right). Note how the original object is still in Point Edit mode, while the now separate arm is not.

With the arm now separated, we can move, edit and manipulate it independently of the original object. Note that separate acts like a cut and not like a copy.

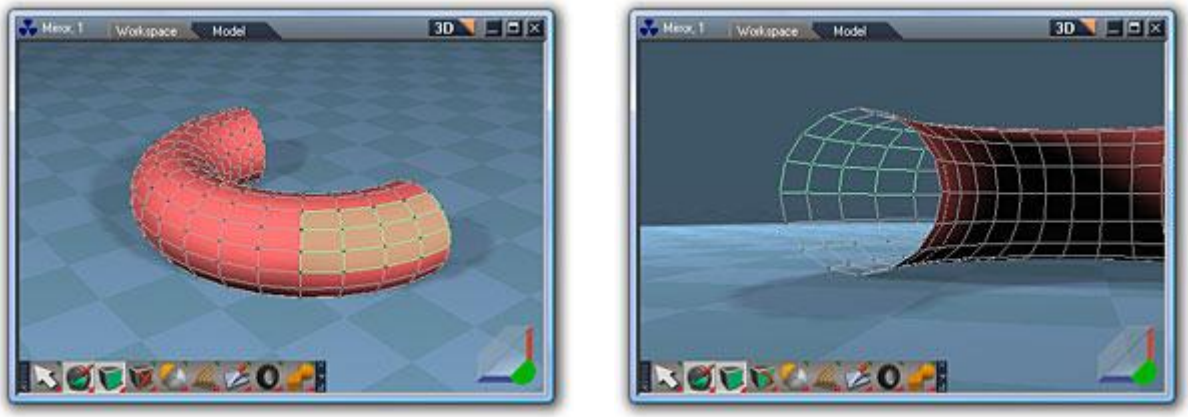


3.4.9 Flip Selected Faces

The Flip Selected Faces tool will flip the normals of the selected faces, so that they are facing in the opposite direction. In the first image below, a grouping of faces was selected and the flip tool was used. Immediately, you see through the faces selected, indicating that they have indeed been flipped. The second image shows the view of the object with faces flipped once point edit mode has been exited.



With some faces deleted from a torus, we have a good test object to show the Flip faces tool at work.

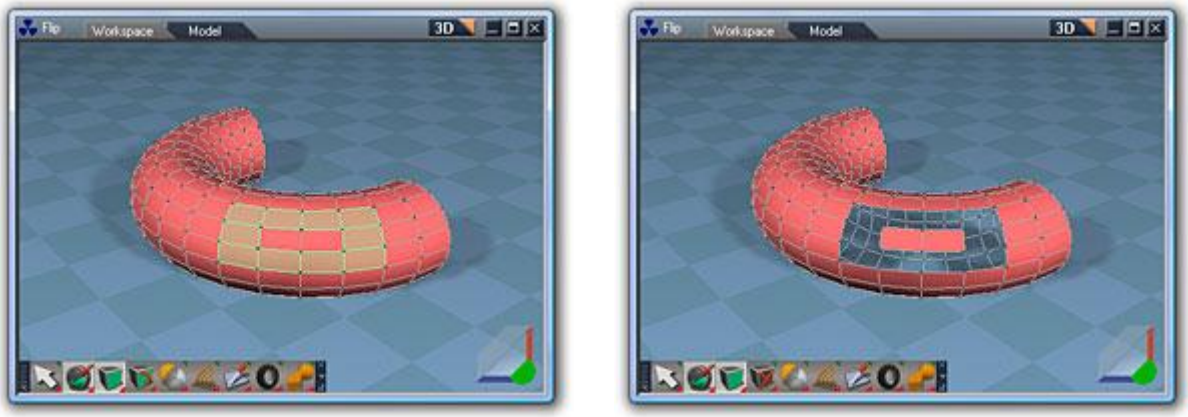


Selecting some faces (left) when we look inside we see the faces are not visible from the back (right).

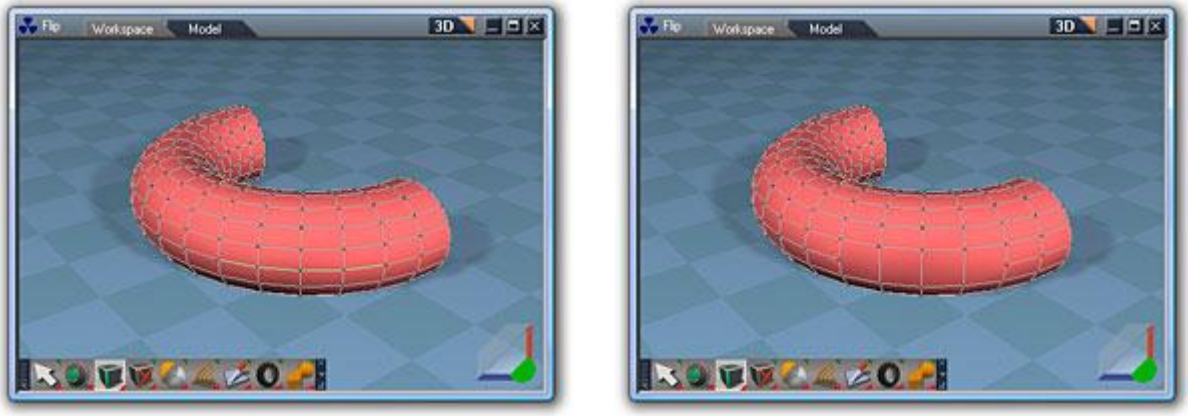
Using the Flip Face tool, the faces now have their normals facing the other way. Now the faces are invisible from in front (left), but visible from the back (right).

3.4.10 Delete Selected Elements

The Delete tool allows you to delete any selected elements. In the images below, some faces are first selected and then deleted. Vertices and edges may also be selected, although trueSpace will refuse to delete if bad geometry would result.



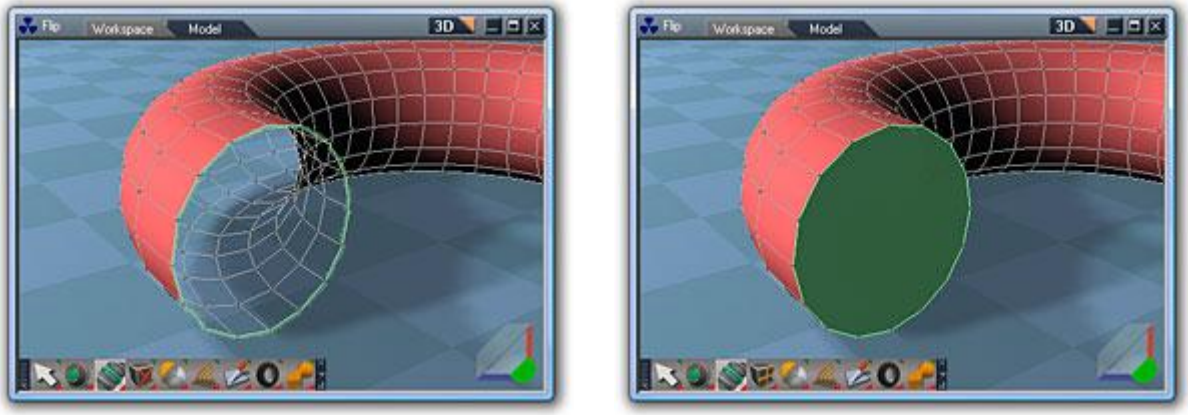
With some faces selected (left), the Delete Selected Elements tool removes those (right).



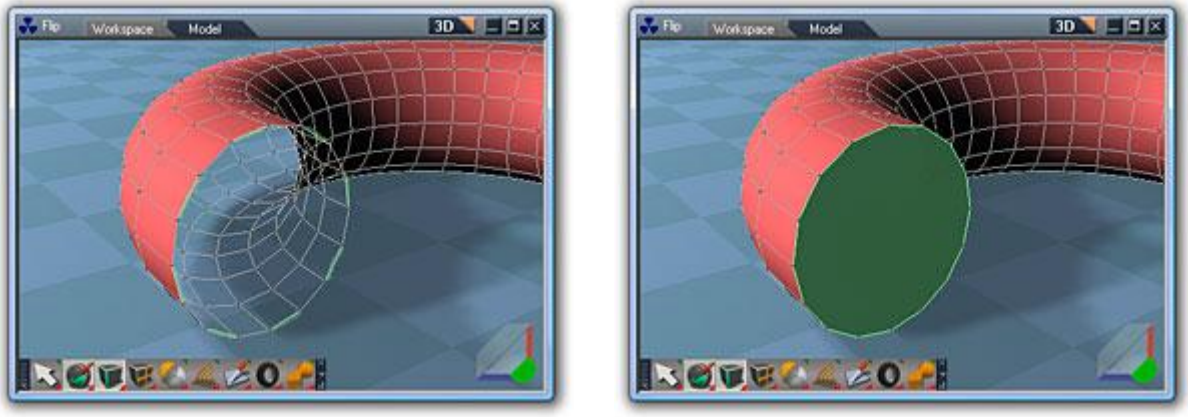
With some edges selected (left), the Delete Selected Elements tool removes those (right).

3.4.11 Form face

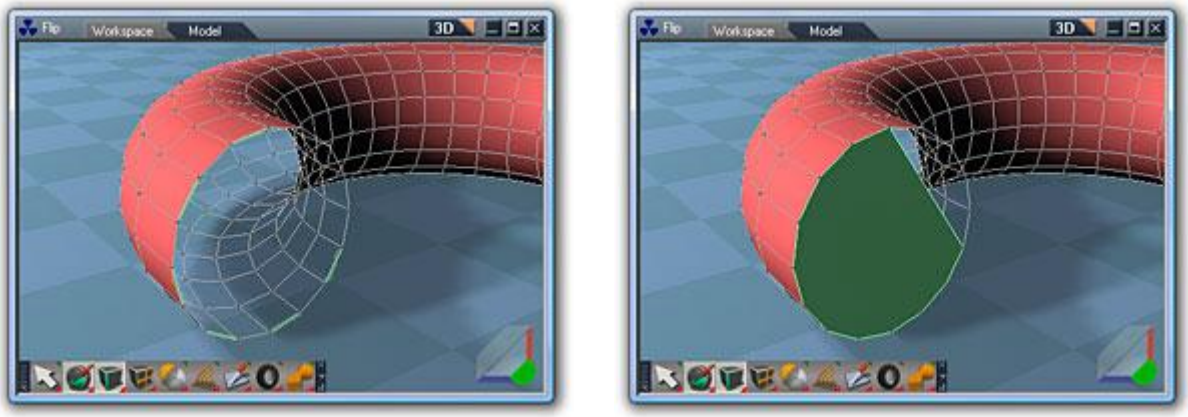
The Form face tool allows you to select a group of edges, vertices or a combo of both, and create a new face. Notice the second row of images below shows selection of every second edge. The Form face tool will do some geometric calculations to create the face from an "incomplete" set of elements.



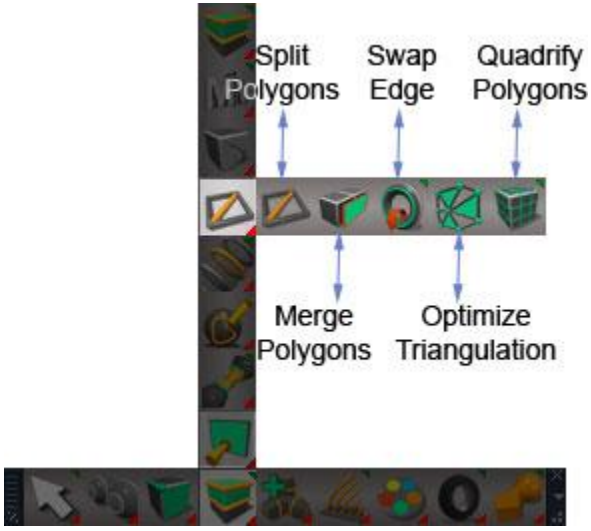
Using Edge Loop selection, it was easy to grab the ring of edges (left). Now the Form Face tool creates a solid face across the end of the half-torus (right).



The tool will work with partial selections, here every second edge has been manually selected (left), and the Form Face tool still creates the complete end cap (right).

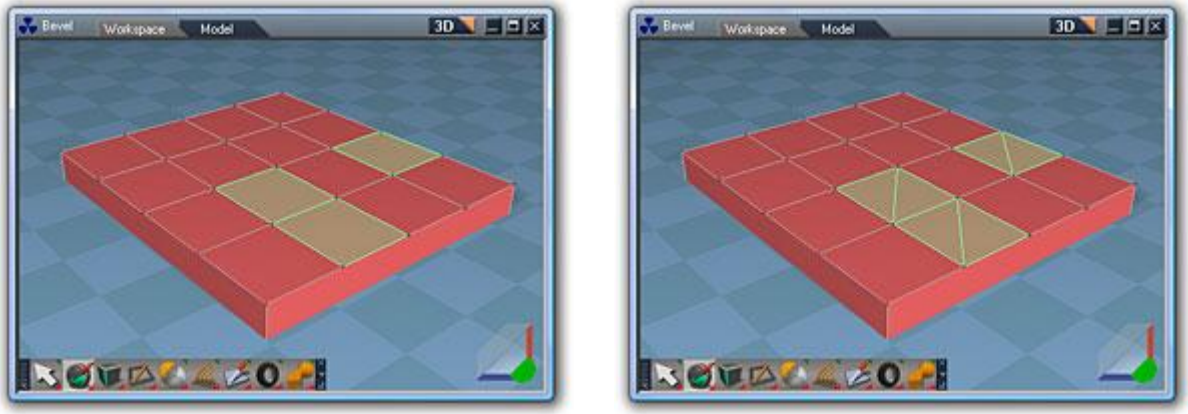


Not all partial selections will give the desired result. Here several edges were not included in the selection (left) and the Form Face tool creates only a partial cap (right). It is usually best to select as much of the desired area as you can to ensure the desired result

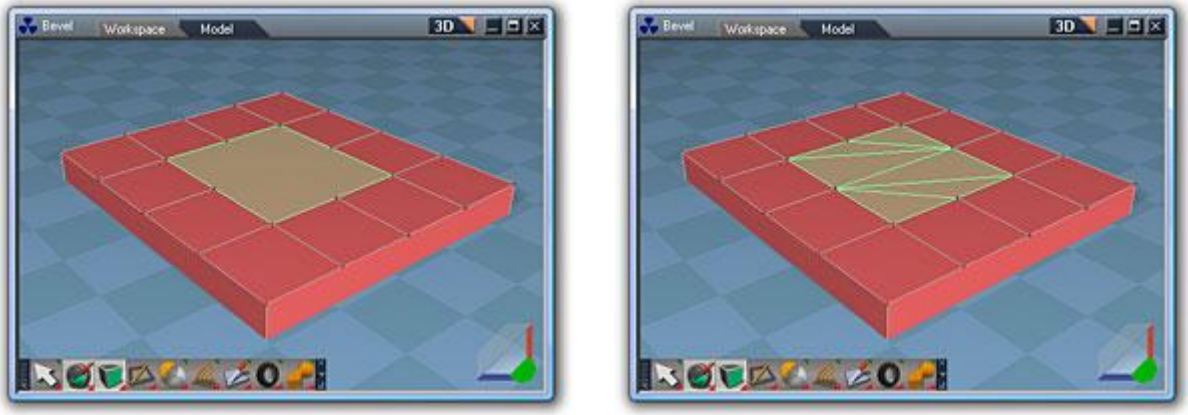


3.4.12 Split polygons

The Split polygons tool will take selected faces/polygons and split them using triangulation calculations. The illustration below (left hand image) shows result of Split polygons tool being used on top face of a cube primitive. More complex faces will be divided using multiple triangles as required.



Selecting multiple faces (left), the Split Polygons tool works on each individually (right).

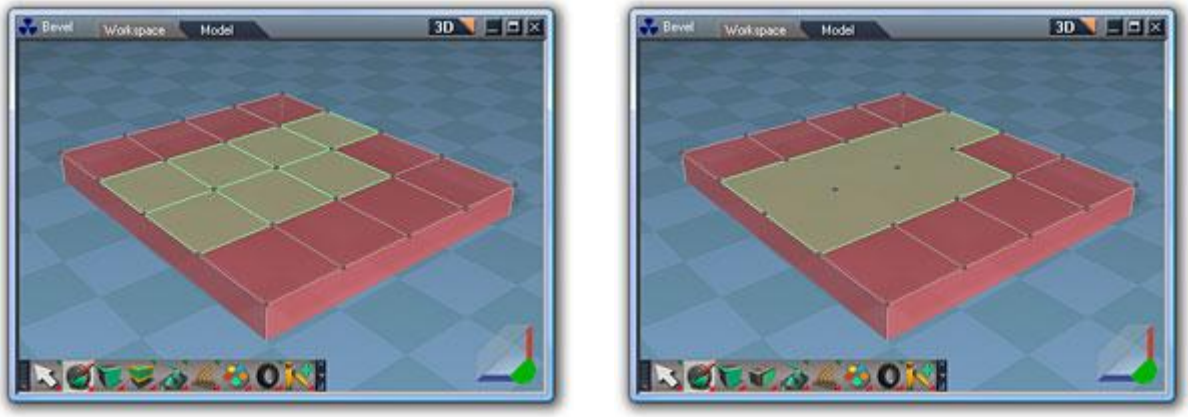


On a more complex face, in this case created by deleting a vertex in the middle of a face (left), more complex triangulation is created by the Split Polygons tool (left).

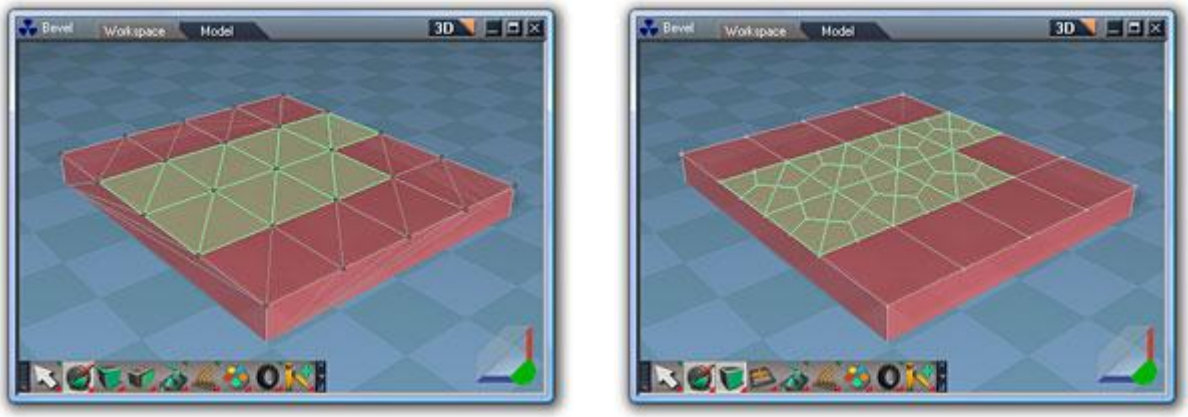
3.4.13 Merge polygons

The Merge polygons tool allows you to merge selected polygons into one single face.

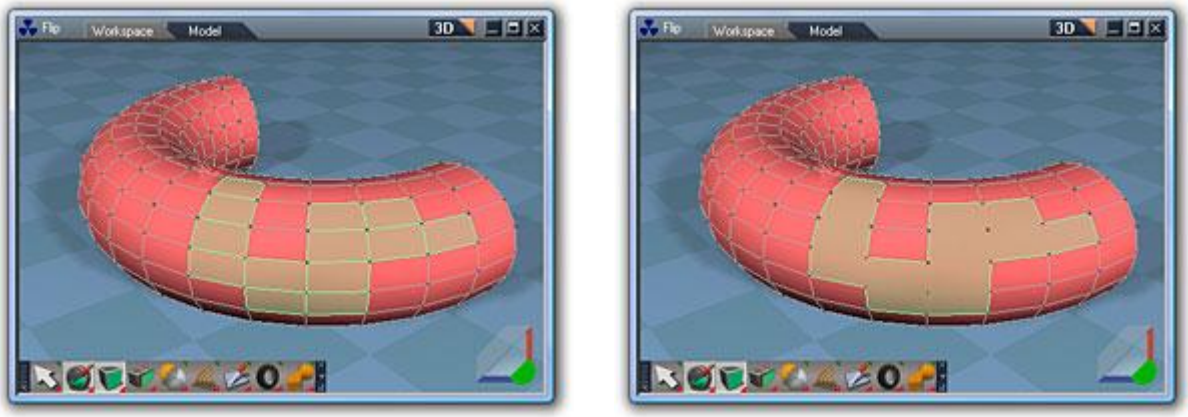
Note: the tool leaves the underlying edges in place and does not remove those – you can see this as the internal vertices remain visible. This will affect the operation of some tools such as Quadrify Polygons, while other tools such as Sweep or Tip will still give expected results. You can manually select and delete the "floating vertices" that remain in the merged face, which will then give expected results on using all tools. Alternatively, rather than use the Merge Polygons tool, you can select and delete vertices or edges manually to begin with.



Selecting multiple faces (left), the Merge Polygons tool joins them together into one face (right). Note how the internal vertices are still visible (the size has been increased in the Soft aspect of the Mesh Editor Settings panel for visibility)



Checking "Show Triangles" in the Mesh Editor Settings panel displays the underlying geometry – note that Merge Polygons leaves this unchanged (left). This will give unexpected results with some tools, such as the Quadrify Polygons tool (right). To end up with one face on the exposed and the underlying geometry, either delete the internal vertices manually after using Merge Polygons, or simply select and delete vertices and edges in place of the Merge Polygons tool initially.

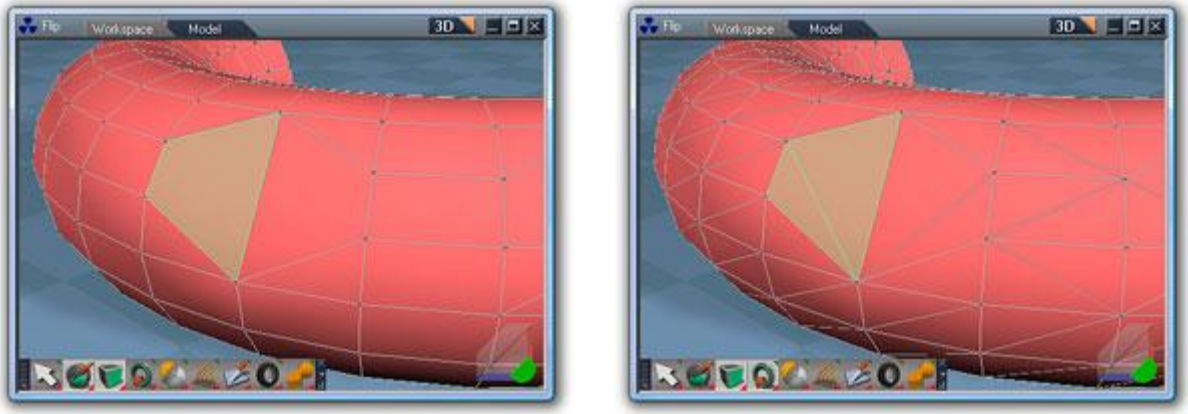


Even with a more unusual selection of faces (left), the Merge Polygons tool still joins them together into one face (right). Again notice how the internal vertices are still present, as the underlying geometry is unchanged.

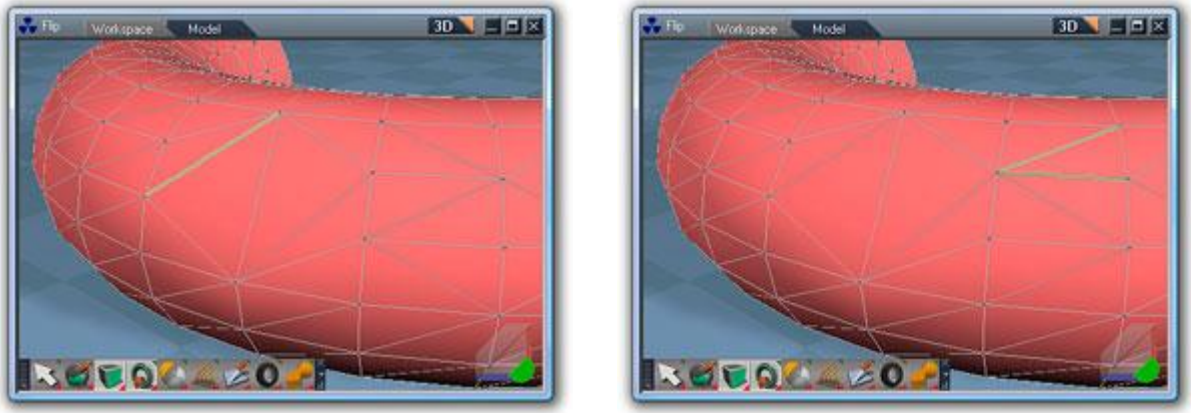
3.4.14 Swap Edge

Every model is triangulated automatically by trueSpace for display in the real-time and offline rendering engines. This tool shows the underlying triangulation, and lets you "flip" the direction of the triangulated edge on a particular face.

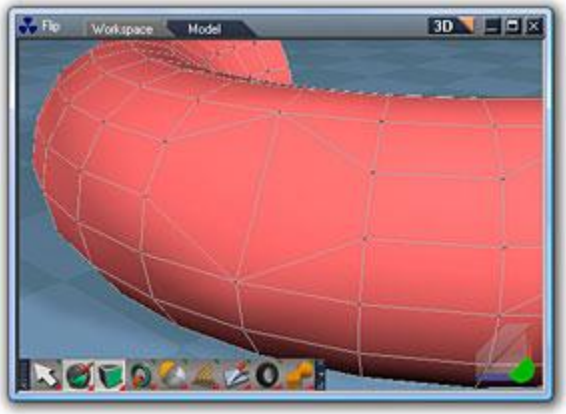
This can be useful to ensure the smoothing algorithms in the shaders work well to give the desired rounding of the faces.



In this case, a face has been selected to highlight where we will be working (left). Activating the Swap Edges tool shows the underlying triangulation of the model (right). Note that no triangulation has been applied at this step, this is the triangulation that trueSpace uses when rendering.



With Swap Edges activated, clicking on the edge changes the direction it runs in across the face (left). We can continue clicking on other edges to flip those to, in this case to the right of the image (right).



Notice when we exit Swap Edge, the triangulation returns to being invisible once more. Remember, this tool does not add triangulation to the mesh, but lets you control the underlying triangulation trueSpace always uses for all models.

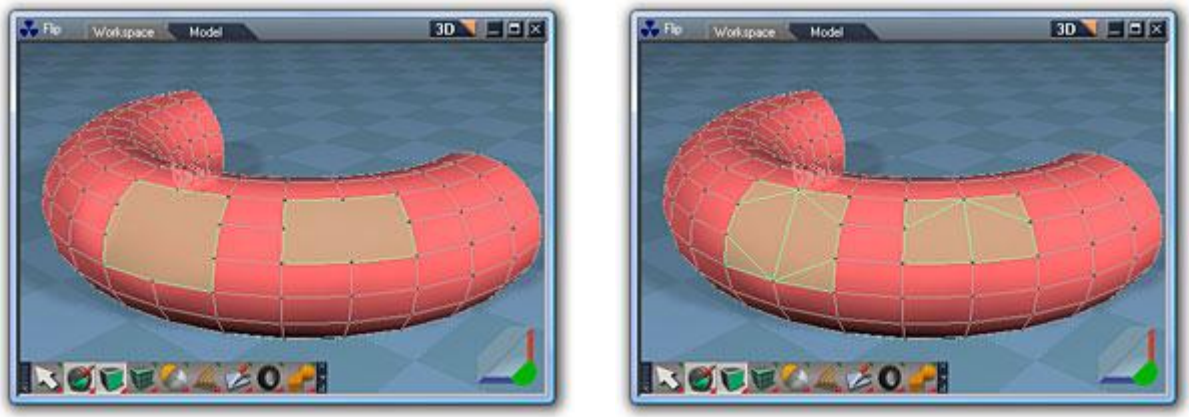
3.4.15 Optimize Triangulation

This tool will rework the triangulation on a mesh to optimize it. This is useful when exporting to other applications, to ensure your mesh is correctly and efficiently triangulated, or after importing a mesh to ensure its triangulation is correct and efficient for use in trueSpace.

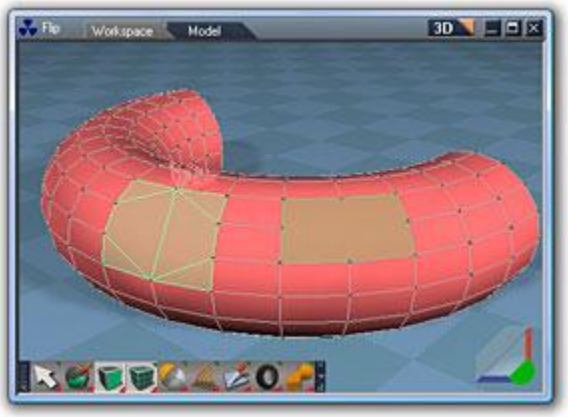
3.4.16 Quadrify Polygons

The Quadrify Polygons tool will convert selected polygons into quads (faces with four sides). This is helpful as some 3D packages or render engines cannot handle faces with more than four sides. It can also be useful for models that you have imported into trueSpace.

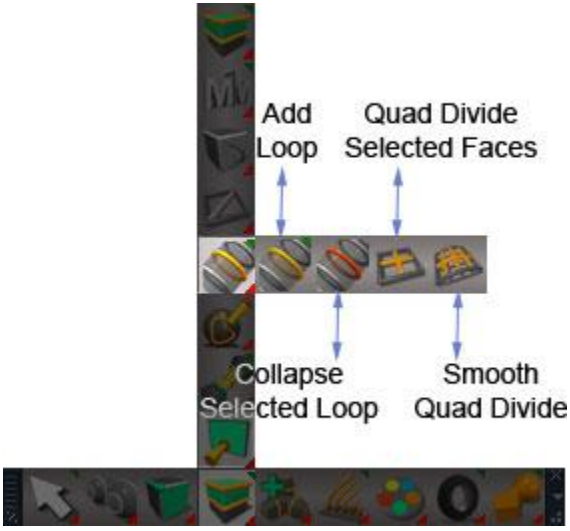
You can begin by selected faces, including the whole object if desire, then using the Quadrify Polygons tool. Alternatively, with no faces selected, you can activate the Quadrify Polygons tool and click on any face you wish to turn into quads.



With two faces selected at once, here created using Merge Polygons, the Quadrify tool divides the faces into Quads.



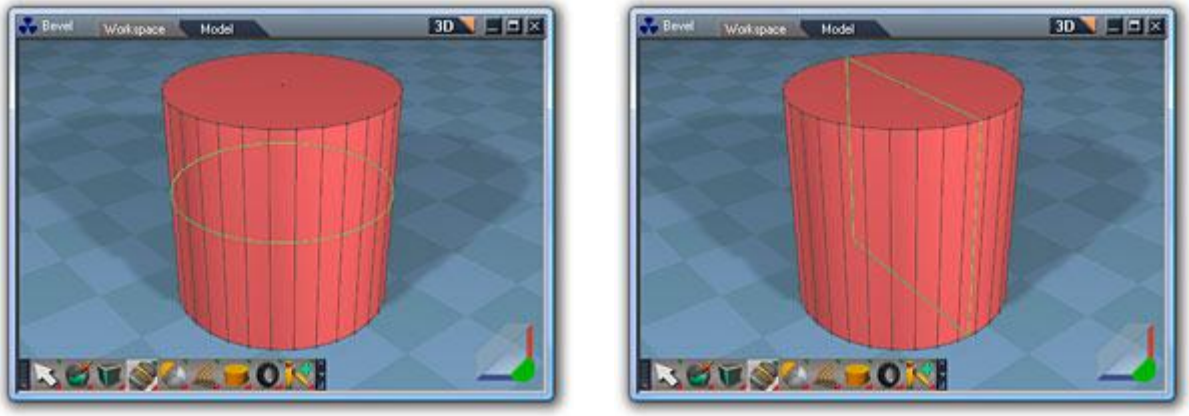
Here, no faces were selected, and the Quadrify Polygons tool was activated. A click on the leftmost face split it into quads, and now the rightmost face is highlighted, ready for another click to quadrify it.



3.4.17 Add Loop

The Add Loop tool allows you to create a new edge-loop around the geometry. The illustration below illustrates a horizontal loop on a cylinder primitive. It is possible to create vertical edge-loops, where the geometry will permit.

The loop the tool makes will be determined by where you point the mouse. trueSpace will try to add a loop even on complex geometry, making this a powerful tool for adding new geometry to work with.



The direction of the loop is determined by the edge you point at with the mouse, with the loop being created across the edge you point at; so pointing at one of the vertical edges would add a horizontal loop (left), and at one of the horizontal edges would add a vertical loop (right).

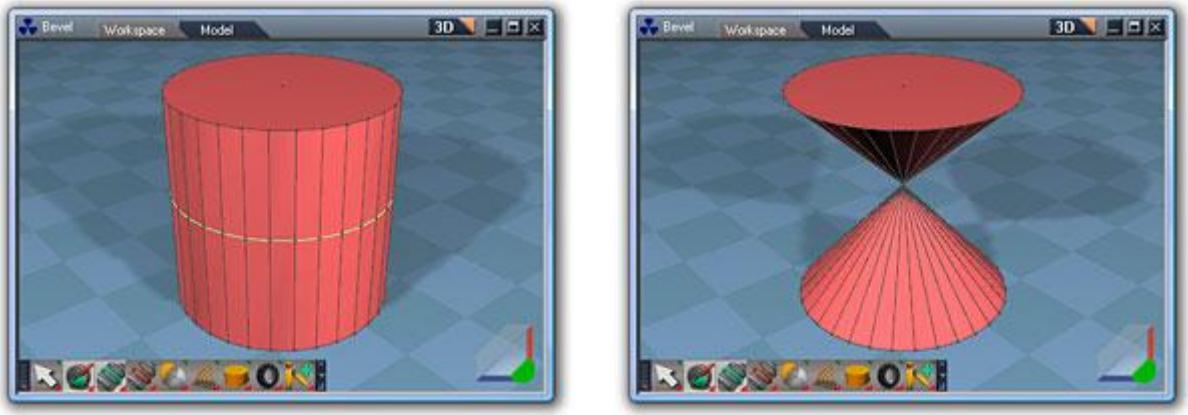
The Add Loop tool can add loops even on complex geometry, in ways that are more useful than just surrounding the

circumference of the object – here a new loop would be added around the eye, following the flow of the geometry.

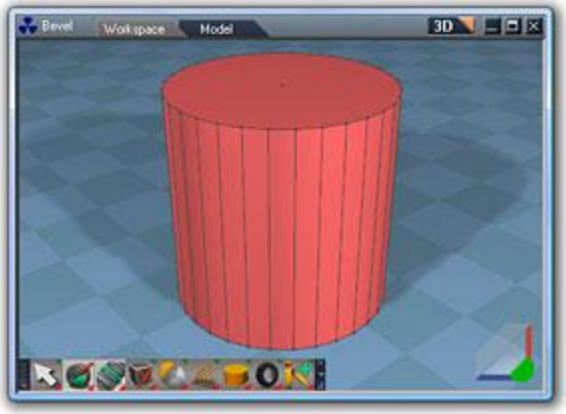
3.4.18 Collapse Loop

The Collapse Loop tool will collapse the selected loop down to a single vertex, or collapse a face loop down to an edge loop.

Note that if you want to remove an edge loop but keep the remaining geometry, you should select the loop using Select Loop and then use Delete Selected – this will delete the edges and vertices and leave other geometry. The Collapse Loop tool however will fuse connecting edges to a single point.

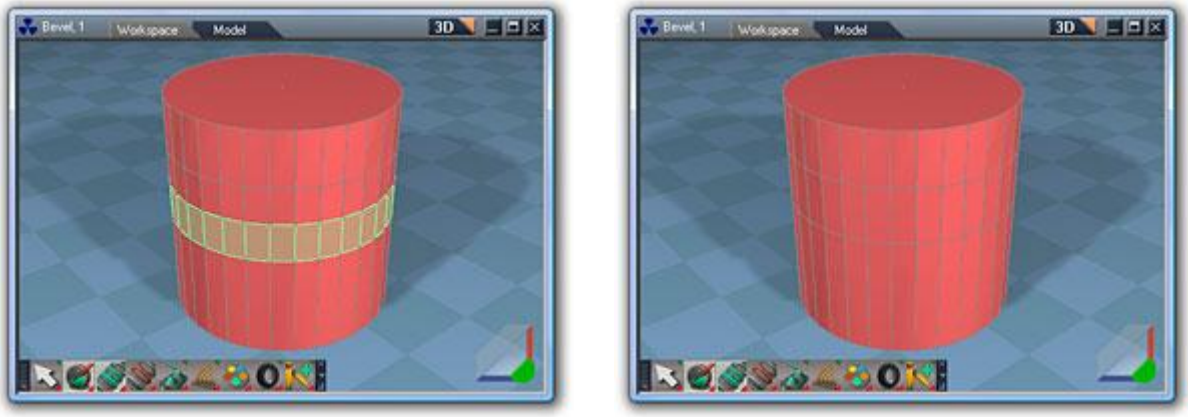


With a loop selected (left), the Collapse Loop tool collapses it to one single vertex (right).

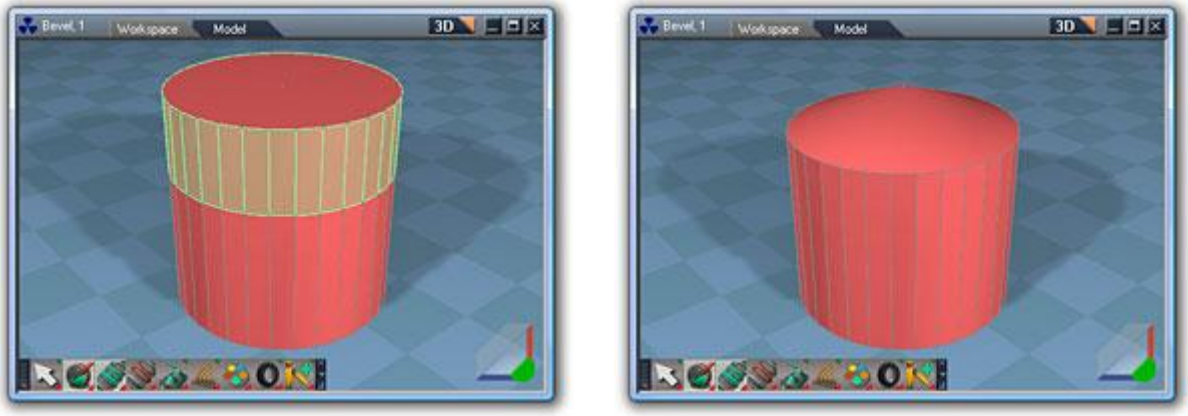


Starting with the same selected loop, using Delete Selected Elements removes the loop and leaves

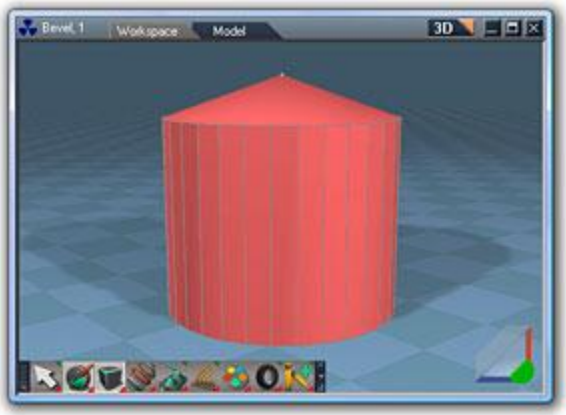
the other geometry intact; contrast this with the result from the Collapse Loop tool.



With a face loop selected (left), the Collapse Loop tool collapses it to an edge loop (right) Note how the other edge loop remains untouched.



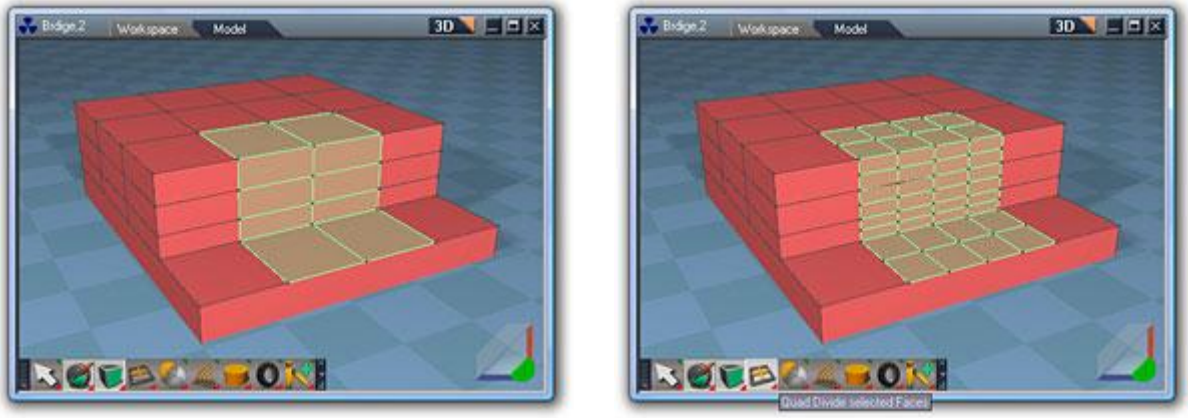
You can even collapse a face loop that runs along the end of an object, such as this one selected here (left). In this instance, the loop is collapsed to a single point, giving a "tip" to the object (right).



A different angle of view, plus selecting the vertex, shows what this last Collapse Loop operation achieved.

3.4.19 Quad Divide Selected Faces

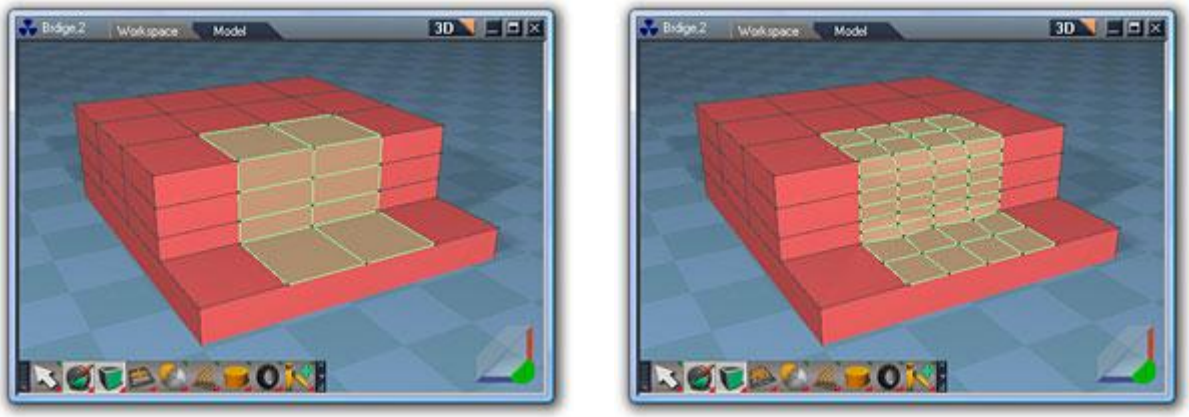
The Quad Divide Selected Faces tool uses each edge of a selected face and divides that edge equally, inserts a vertex at the center of that edge, then creates an edge, which extends to a common vertex for all edges of that face. The result is an equal division of selected faces. The image below illustrates several varieties of subdivided selections.



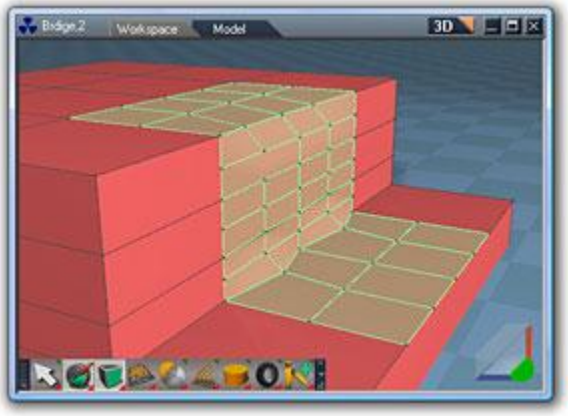
With some selected faces (left), Quad Divide Selected Faces divides each face into four (right).

3.4.20 Smooth Quad Divide

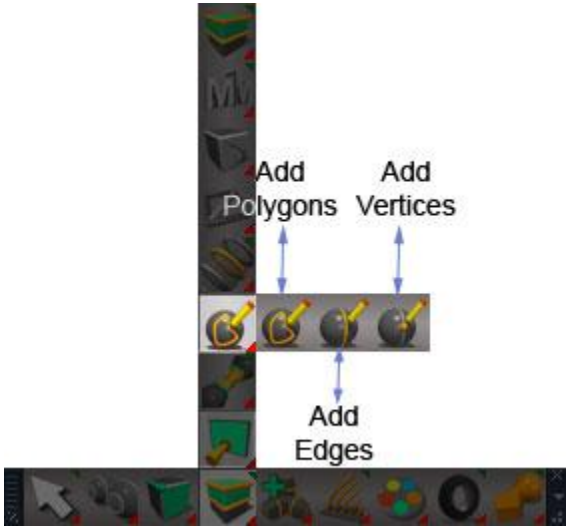
Smooth Quad Divide works just as the Quad Divide Selected Faces tool works, except at very end when it will run an SDS-style algorithm to smooth and round out the resulting geometry.



With the same faces selected as for the Quad Divide Selected example (left), the Smooth Quad Divide tool divides each face into four but also rounds the result to smooth it out (right).



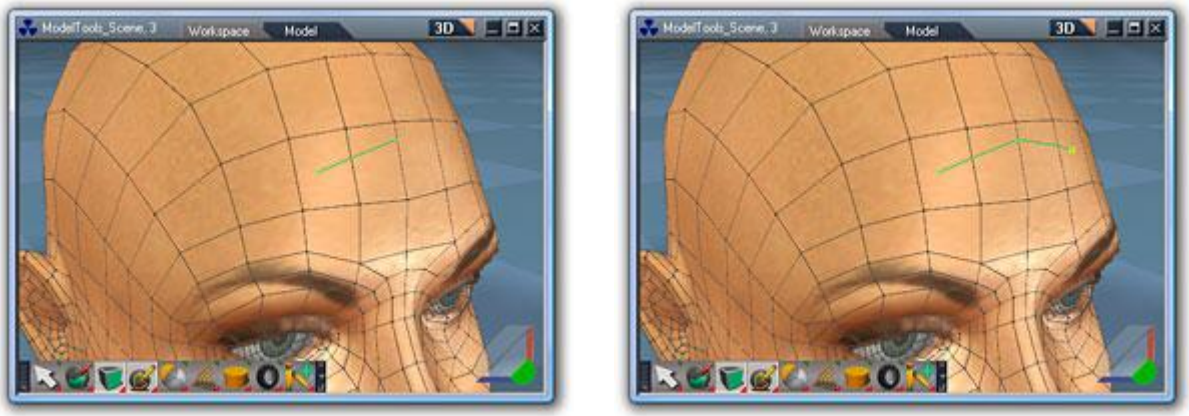
The result of Smooth Quad Divide from another angle. Note that you could apply the Smooth Quad Divide tool repeatedly to continue adding more geometry and smoothing.


Add
Polygons
Add
Vertices
Add
Edges

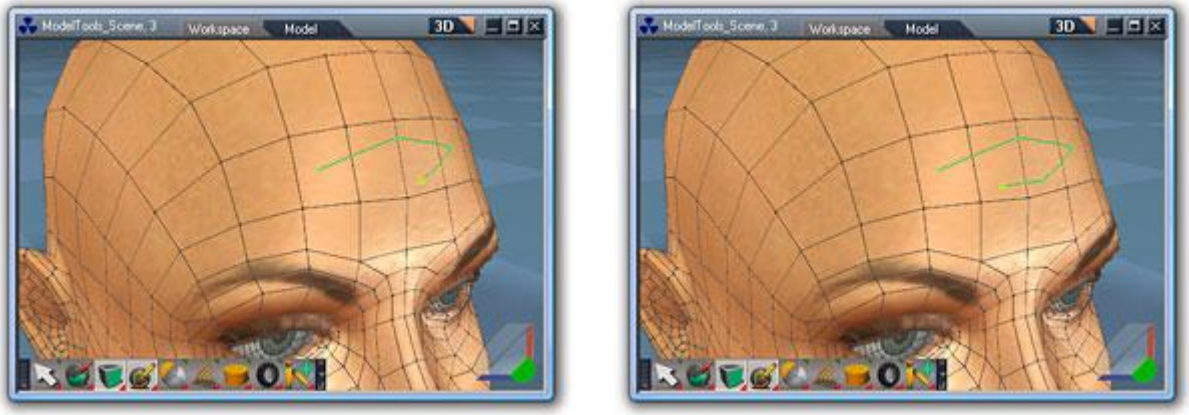
3.4.21 Add Polygons

The Add Polygons tool allows you to create a polygon on existing geometry. You can begin on an existing edge or vertex, or start in the middle of an existing face.

The tool will let you continue to click to add new vertices, connecting them to the previous last vertex with an edge, until you click on the initial vertex to close the shape. You can add vertices even across several faces. A right click before closing the shape will cancel the Add Polygons tool. Alternatively you can use Undo to step back through the points you have added.



In this example, the Add Polygons tool is used to start in the middle of a face, crossing over an existing edge to join to another existing edge (left). Another click adds a similar set of edges on the other half of the model right).

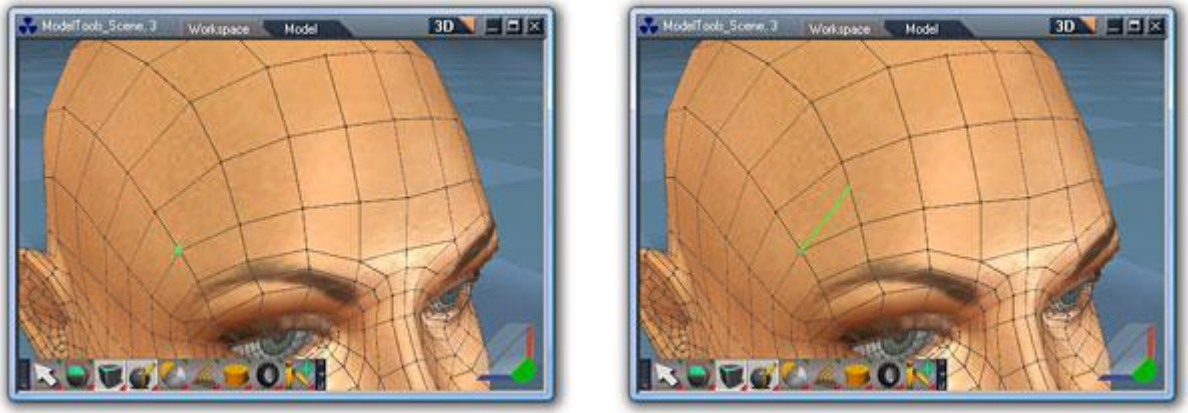


More clicks continue the construction of the desired shape.

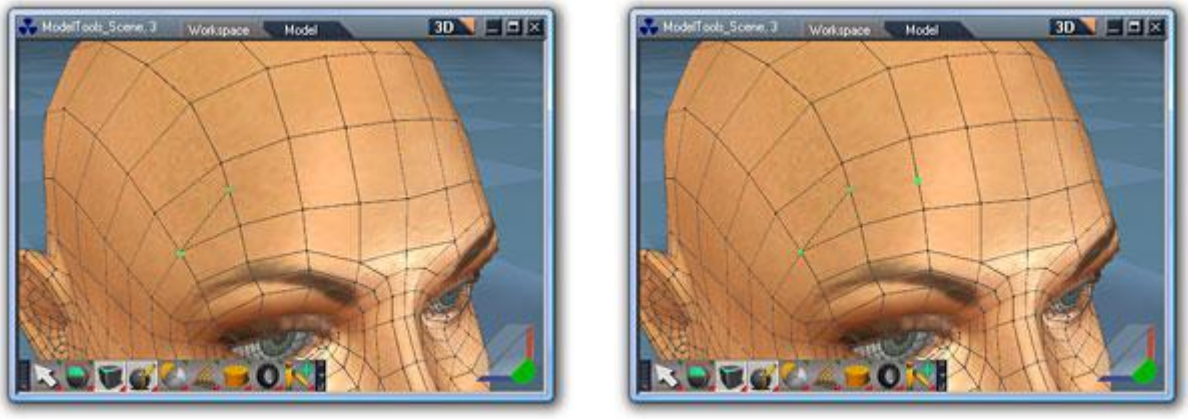
Clicking on the starting vertex closes the shape, leaving all the faces for that shape selected (left). At this point, the Add Polygons tool could be used to start a new shape – in this example though, we have activated Dynamic Sweep and pulled out and scaled down the selection left from this use of the Add Polygons tool (right).

3.4.22 Add edges

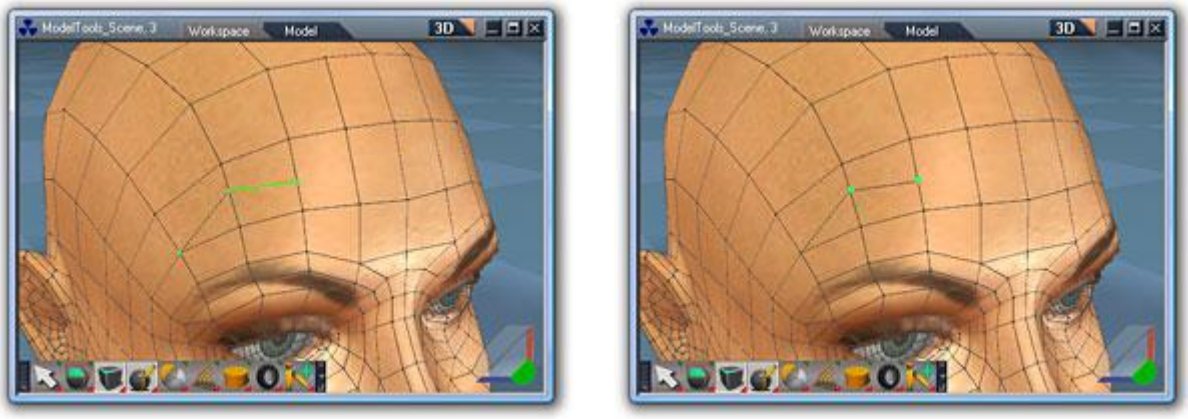
The Add edges tool allows you to add edges to existing geometry. You can begin on an existing edge or vertex, as seen in the first examples below.



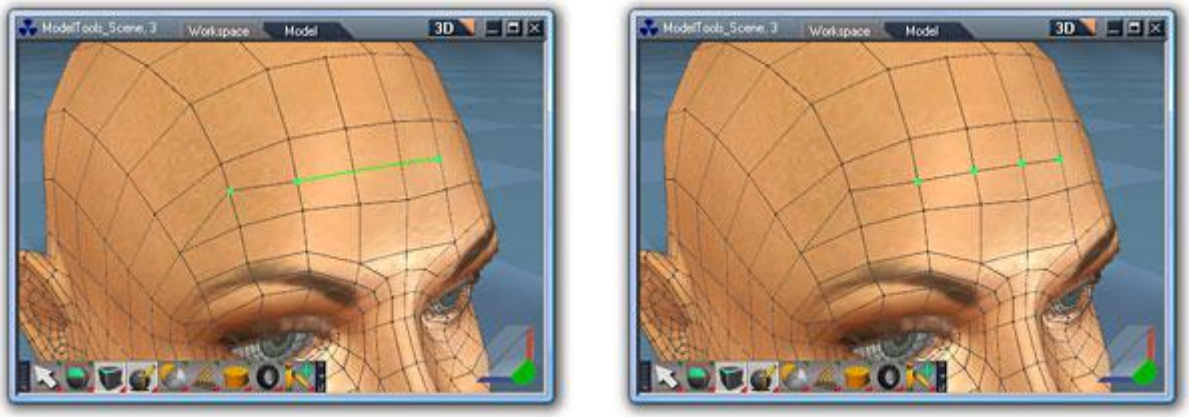
With Add Edges selected, you can start by clicking on an edge to create a new vertex, or selecting an existing vertex as has been done here (left). Moving the mouse lets you choose where to place the end of the edge (right).



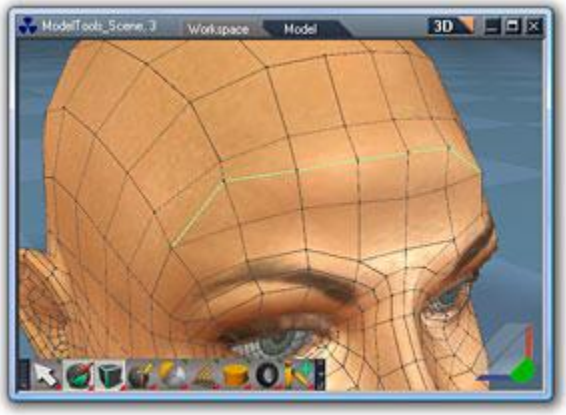
A left click sets the end of the edge, and it becomes finalized (left). A new click on another edge creates a new vertex, the beginning of a new edge – note how it does not connect with the last vertex we added (right).



Moving the mouse lets us snap the end of this edge to the end of our last edge (left). A left click finalizes our new edge, connecting it to our previous (right).

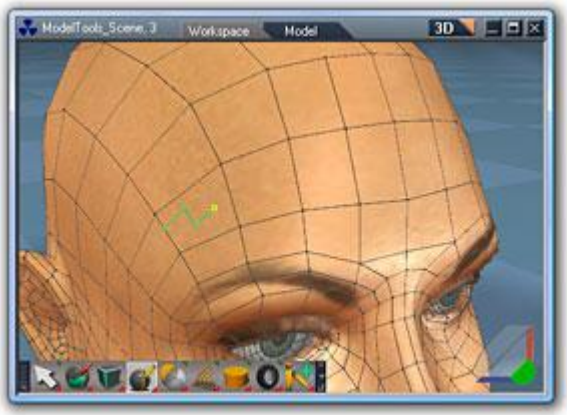


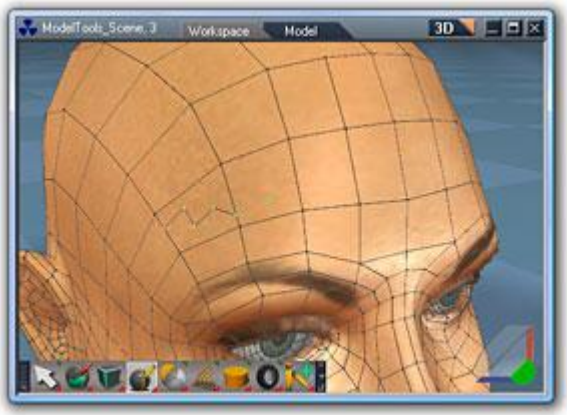
Selecting the end vertex of our last edge, we can move the mouse across several faces at once (left). A left click finalizes the edge, which will cross over the faces, creating vertices at each existing edge it intersects, much faster than drawing the edges individually (right).



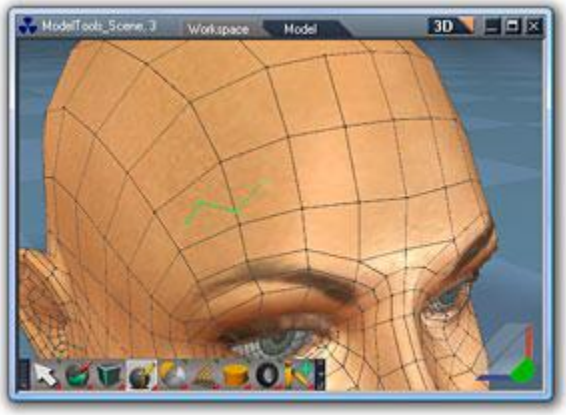
Adding a final edge, and then selecting all the edges we have added, we can manipulate those to begin to add some detail to the forehead, perhaps changing it into something more alien!

If you begin the Add Edges tool on an existing vertex or edge, then you can keep adding edges that continue on from the end of the last edge with just a single click, even if the edge crosses over several faces. However, when you click on an existing vertex or edge, effectively closing the shape you are drawing, then the tool will no longer continue to add edges from the end of the previous edge, and the tool restarts by selecting the beginning of a new edge.





Starting on an existing edge or vertex, you can keep clicking and drawing a new edge from the last point you drew (left). When you connect an edge to an existing edge or vertex, then the tool restarts and your next click will begin a new edge (right).



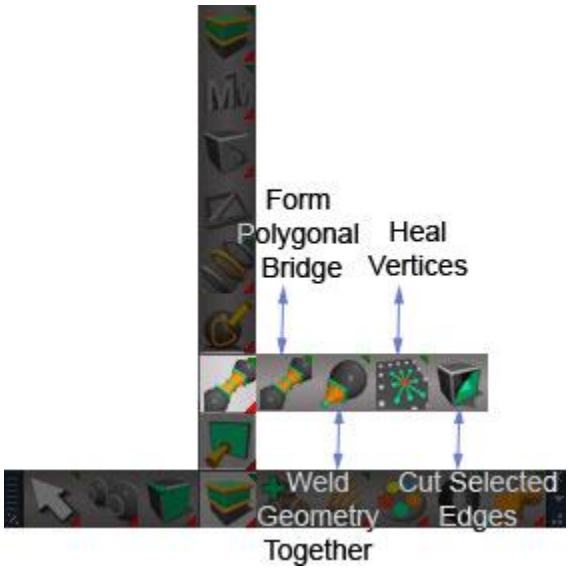
Starting in the middle of a face, unconnected to an existing edge, will let you click on an existing edge without "restarting" the tool – your next click will add a new edge that continues on automatically from the end of the last edge. Starting with the tool in this way makes it more similar to the Add Polygons tool

3.4.23 Add vertices

The Add vertices tool allows you to create new vertices on existing geometry. You can either add a vertex on an existing edge, or in the middle of an existing face.

With the Add Vertex tool active, clicking on an edge adds a new vertex (left). You can also click anywhere on a face to add a vertex (right).You can keep clicking to add more vertices.

Here the Rectangle Select tool has been used to highlight the vertices we just added. Notice that the Add Vertex tool does not connect vertices to each other, or to existing geometry (unless you click on an existing edge)



3.4.24 Form Polygonal Bridge

The Form Polygon Bridge tool allows you to create geometry between two or more viable faces. It can also be used to attach various mesh parts together. This tool will also work on SDS meshes, and this allows you to smoothly connect variously shaped parts/meshes.

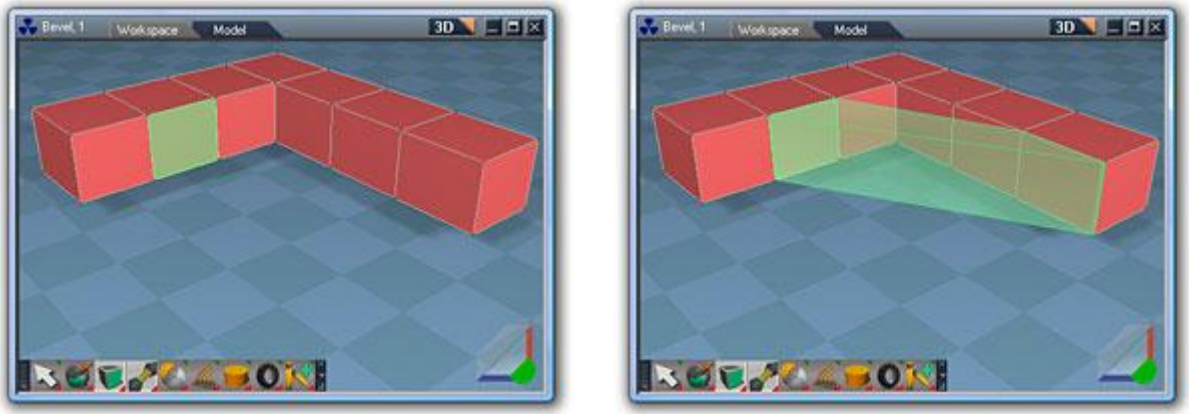
Note: when blending SDS faces, both polygons must be part of the same object. You can merge SDS objects together by removing SDS layers and merging objects together using Boolean operations in Model view.

Where only two faces are used, a bridge is created between them where possible. If more than two faces are used, a combination of blending and bridging is used to create the geometry.

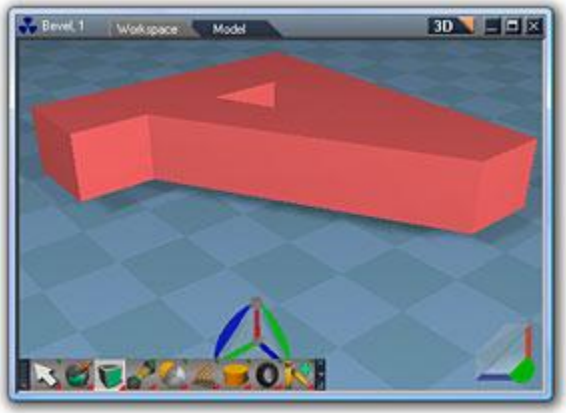
To use the tool, you can select some faces then activate the tool, or activate it without a selection being made and then left click and drag to select the initial face or faces that you want the bridge / blend to start from, and then release the mouse button once the selection is made. The next step is to left click again and drag to select the face or faces you want the bridge to connect to. You will see the bridge displayed in real-time as you do this. Release the mouse button once you are satisfied with the result.

A right click at this point will cancel the bridge, or you can left click and drag on more faces to extend the bridge

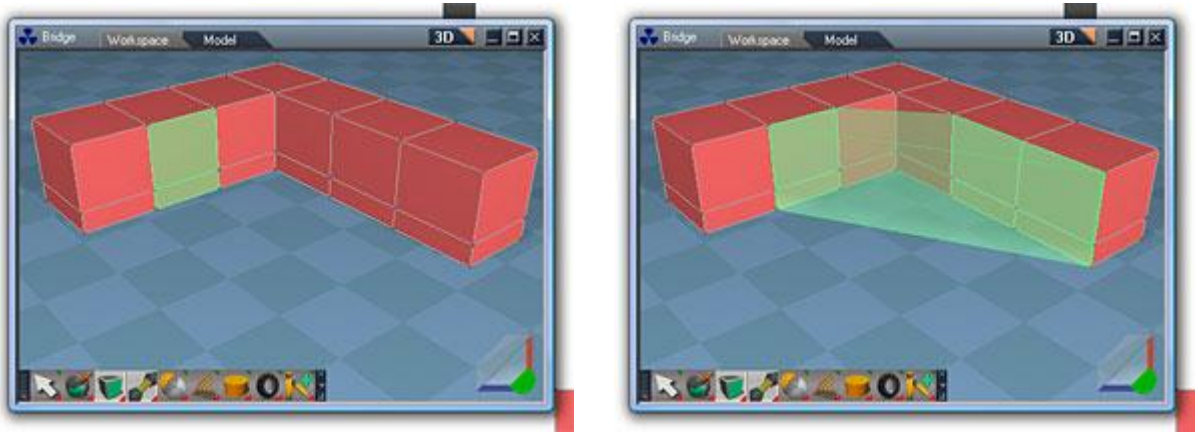
to include those. If the bridge is finished, then you can left click on the Form Polygonal Bridge icon, or on the Object Select icon in order to finalize the bridge and exit point edit mode..



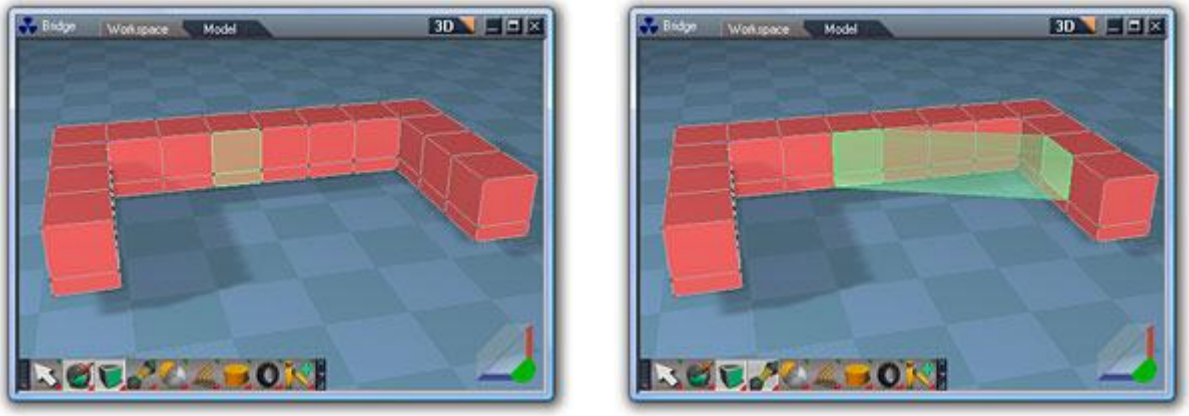
With the first face selected,(either using the Point Edit selection tools, or by activating Form Polygonal Bridge and selecting the face (left), selecting another face with a left click shows the bridge that will be made.



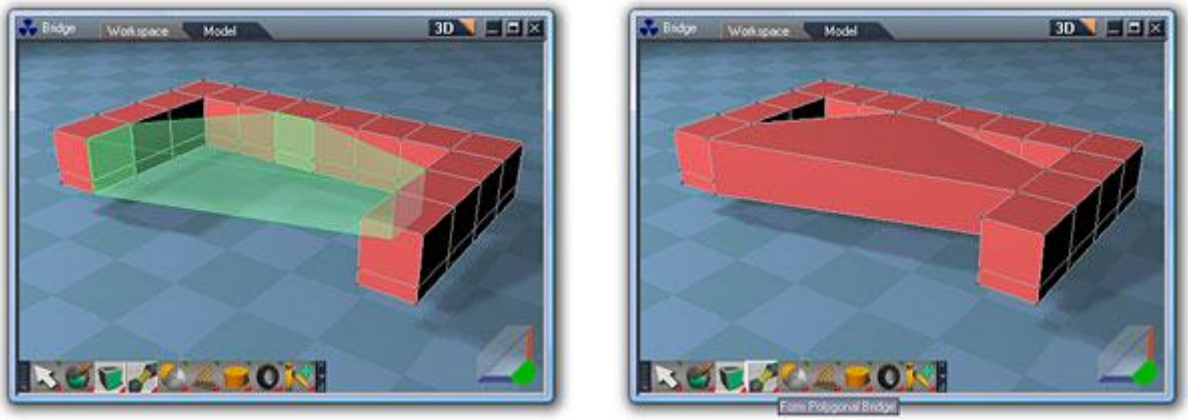
A left click on the Object tool or on the Form Polygonal Bridge tool finalizes the bridge and exits Point Edit mode.



With more than one face selected (left), a bridge can be made to another selection of more than one face (right). Note that the number of faces at either end of the bridge do not have to match.

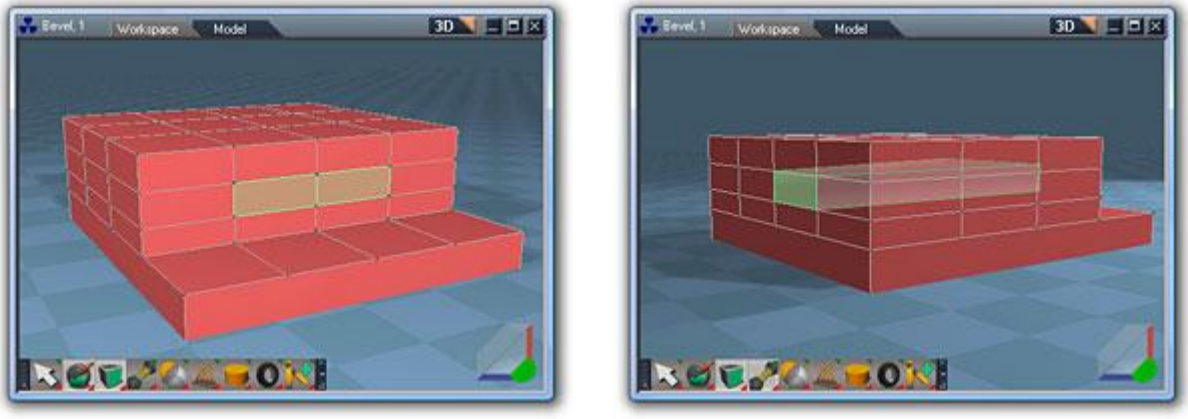


Starting with a different shape (left) a bridge is made between different numbers of face (right).

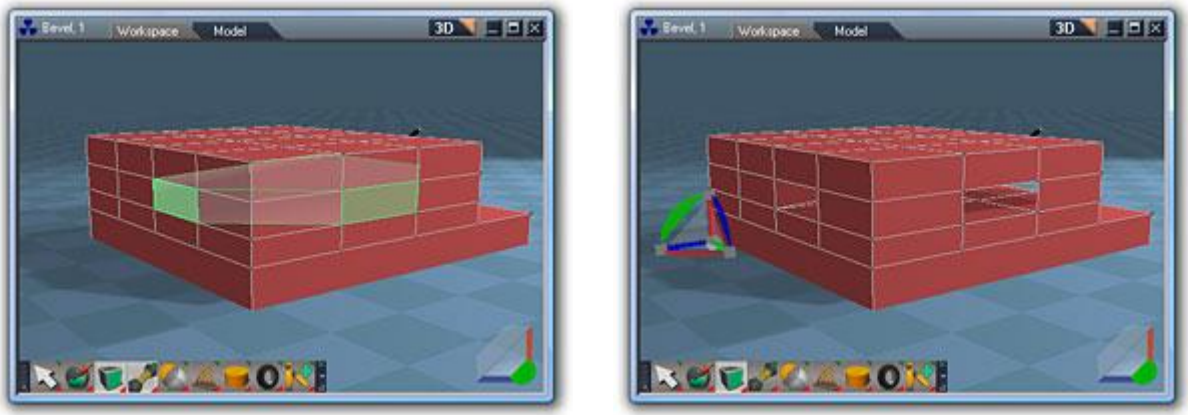


Rather than finalize the bridge at this point, we left click and drag to select more faces and the bridge extends to include those (left). We could continue to add other face selections if desired, but for this example a left click on the Object tool or the Form Polygonal Bridge tool finalizes the result (right).

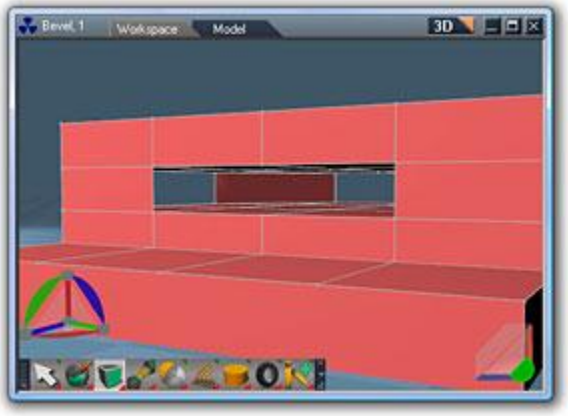
If the faces selected are facing opposite directions, a hole is created rather than a "bridge". By selecting faces that are facing away each other, the tool tries to create hole instead of shape. To create a hole, simply select faces that face away each other. If the detection routines fail, you can manually use the Invert option on the properties panel.



To make a hole, simply select faces on a different side of the same object. Beginning with a selection of faces (left), a second selection is made with the Form Polygonal Bridge tool (right).



Another face is added to the selection (left), and then on finalizing the bridge with a left click on the Object tool, the holes become visible (right).



Moving to a different angle shows how the area has been hollowed out.

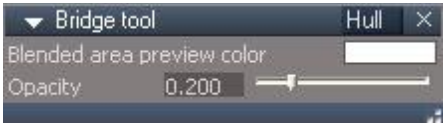
Polygon bridge/blend settings panel

The Form Polygonal Bridge settings panel has the following attributes:

- **Auto invert**: enables the inversion detection routine, which detects if you are creating holes or

connecting shapes. If the algorithm fails to detect the operation you desire, you can use the manual setting by un-checking Auto Invert, and manually checking the Invert option for holes, or un-checking the Invert option for a solid bridge.

- **Create Caps**: When you edit multiple objects at once, this setting tells the tool to end the created hull on the other object faces with a cap.
- **Delete inner polygons**: If checked, then the original selected polygons are removed before applying the tool. This avoids leaving the original faces "inside" the final object.
- **Invert**: If checked, this forces hull inversion during computation, which allows you to choose two faces on the same object to create a hole through it. If unchecked, then the tool will create new geometry to bridge between two faces. You can use this option to manually choose what you want the tool to do if the Auto Invert option does not give the desired function.
- **Keep triangles**: If checked, the new geometry created by the tool will be triangulated. If unchecked, then the new geometry will not be triangulated.
- **Max non-planarity**: Specifies the largest angle deviation for merging triangles to polygons. When a surface in the new geometry has an angle above this level, then the triangles will be retained; with an angle below this level, the triangles will be merged into a new single face.

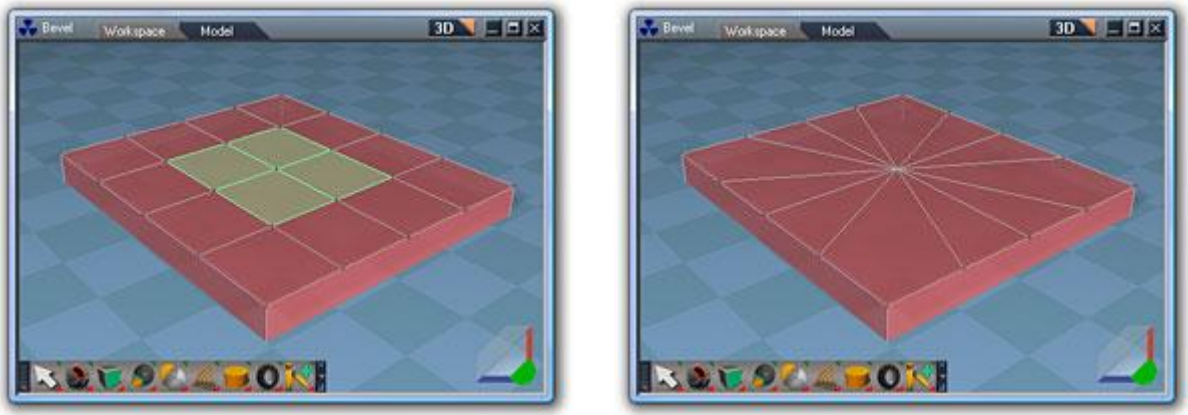


Hull aspect of Polygon bridge/blend settings panel

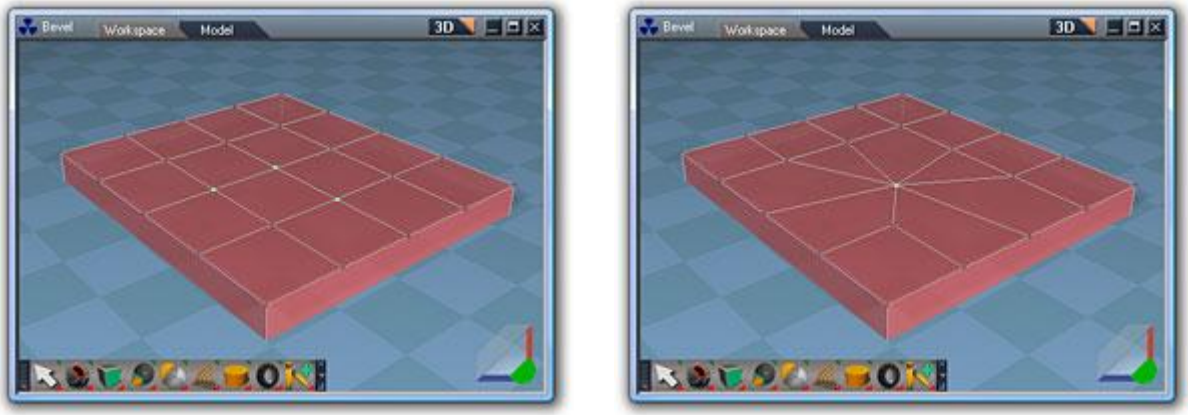
- **Blended area preview color - S**elects the color of the preview hull.
- **Opacity -** Specifies the transparency of the preview hull. It can be set either by a numeric value or by the slider.

3.4.25 Weld Geometry Together

The Weld Geometry Together tool contracts all selected elements to a single point. You can begin with a selection of faces, edges or vertices, then a click on the Weld Geometry tool will collapse the selection down to one single vertex.

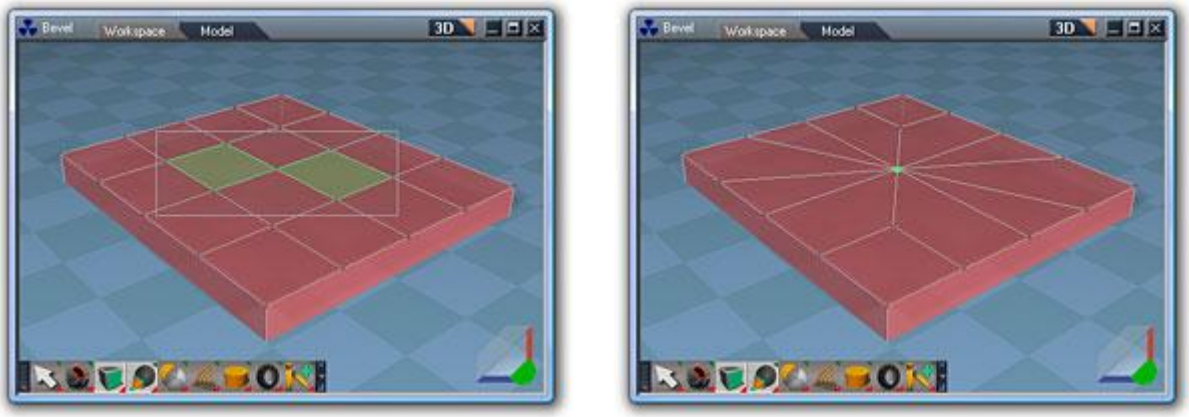


With four faces selected, the Weld Geometry fuses all the vertices on those faces down to one single vertex, retaining the connections to other vertices.



With three vertices selected, the Weld Geometry fuses them down to one single vertex, retaining the connections to other vertices.

If you enter Point Edit mode and go straight to the Weld Geometry tool without first making a selection, then you can select geometry using a rectangle selection – on release, the Weld tool will instantly weld the selection you made. This rectangle selection will work using the current selection type set for Point Editing, ie Context, Vertices, Edges or Faces.



Starting the Weld Vertices tool with no selection lets you use a rectangle select to make a selection; the selection is based on the current selection type in the Point Edit tools, in this case faces (left). On release, the selection is collapsed to one vertex (right). You can then continue using the rectangle select mode to select and collapse more vertices.

3.4.26 Heal Vertices

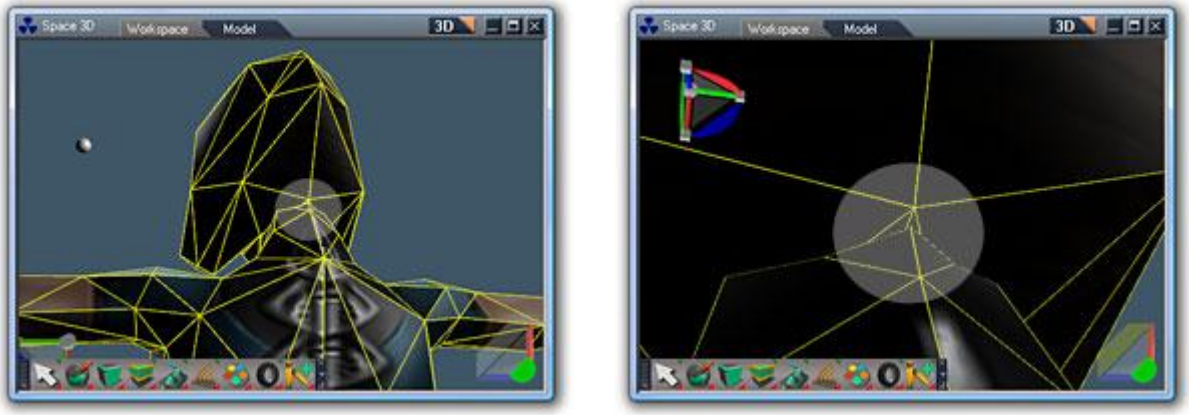
The Heal Vertices tool is used to automatically check the selected elements and join together any vertices that are within a certain radius of each other. This is useful for joining vertices that are very close together, or "collapsing" faces that are very small, etc.

In effect, you rebuild an area of the mesh, and are able to do this automatically rather than having to manually select groups of vertices and weld them together. This can be useful in several examples. First, it can help clean up bad geometry, which may be helpful with an imported model. You may want to run the Heal Vertices tool on the entire mesh in situations such as this.

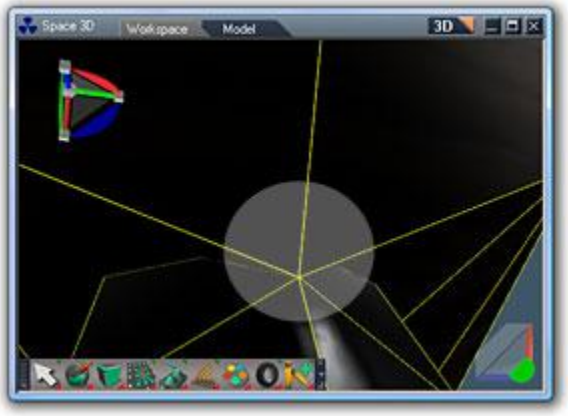
Next, it can be helpful when you Boolean two objects together. If you have faces that exactly match in shape, it can be hard or impossible to place the faces exactly together for the Boolean union to work, and using the Heal Vertices tool can tidy up if there was a small overlap, or even better, you can ensure the faces are close together but not touching. In both cases, the matching vertices on the faces will be close enough to be joined together by the Heal operation. You may want to run the Heal Vertices tool on just the area where the objects joined, selecting the vertices with the loop or lasso tool.

Where faces do not match, Booleans can sometimes produce poor geometry at the scenes, with small triangles and other areas that almost but did not quite line up. The Heal Vertices tool will tidy up these areas, giving you cleaner

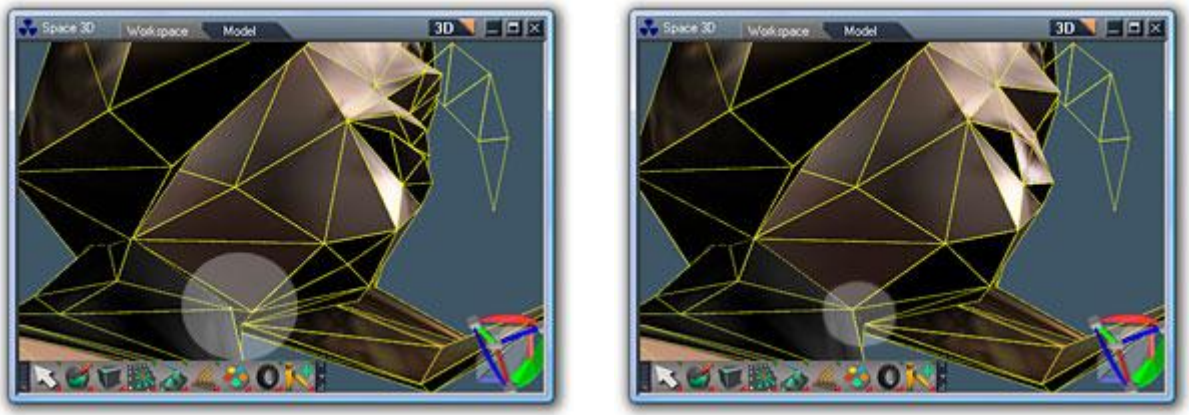
geometry that is easier to work with. An example of this is shown below.



This character from the character library was made with a separate torso and head, and for this example the head was moved downward, and then Boolean Union used to join the two together, but there are some problem areas highlighted, (left). The end result is shown in close up, where we can see some small triangles, and other geometry that could be problematic and hard to work with (highlighted, right).



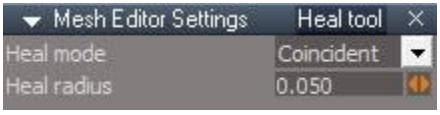
After using the Heal Vertices tool, this area of the mesh is cleaned up, restoring simple geometry that will give us less problems, and that is easier to work with should we need to make edits (highlighted)



The same character after the Boolean Union and before the Heal Vertices tool, again with some geometry from the Union that is not as clean or useful as it could be (highlighted, left). The Heal Vertices tool helps tidy this up (highlighted, right).

The Heal Tool options

This aspect can be selected manually in the Mesh Editor Settings options in the stack, or opened with a right click on the Heal Tool.



The Heal aspect of the Mesh Editor Settings panel.

- **Heal Mode**– This parameter controls the location of the new vertices created when the Heal Tool joins the original vertices together. For each option, two examples are shown, one applied to a pair of vertices, and one applied to the whole object. In both cases, a large Heal Radius was used so that the tool would work on vertices that are far apart, for ease of viewing. The starting conditions are shown below:

The two initial conditions, with two vertices selected so Heal Vertices will only affect those (left), or no vertices selected for applying Heal Vertices to the whole object (right).

Center: Vertices are joined together and the resulting final vertex appears in the center of the joined vertices.

The Center method of operation moves the final vertex to the center of the vertices joined together by the Heal Vertices operation.

First: Vertices are joined together and the final vertex is placed at the location of the first vertex from the ones joined together by the Heal Vertices operation. Which vertex is first is calculated by the algorithm used in the Heal Vertices operation.

The First method of operation moves the final vertex to the first vertex (as determined by the algorithm) from the ones joined together by the Heal Vertices operation.

Last: Vertices are joined together and the final vertex is placed at the location of the last vertex from the ones joined together by the Heal Vertices operation. Which vertex is last is calculated by the algorithm used in the Heal Vertices operation.

The Last method of operation moves the final vertex to the last vertex (as determined by the algorithm) from the ones joined together by the Heal Vertices operation.

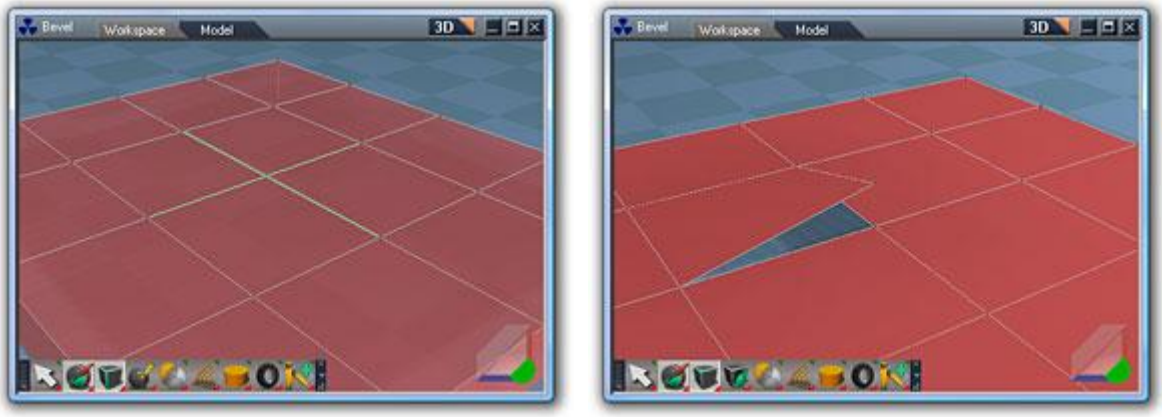
Coincident: Vertices are joined together and the final vertex is placed at the nearest vertex in the set of vertices that have been processed. Since vertices are processed from 1st to last, this means if you have 2 meshes merged together then the 1st mesh will stay intact, and the vertex from the 2nd mesh will be welded to the first one.

The Coincident method of operation moves the final vertex to the nearest vertex in the set of vertices that have been processed.

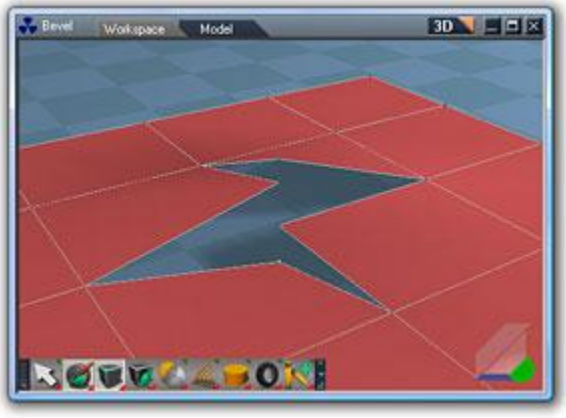
- **Heal Radius –** This value controls how wide the area is used to look around a vertex to find other vertices that it should be joined with. A smaller value will only heal (join together) vertices that are very close together, while larger values will heal vertices that are farther apart. Smaller values are usually best, as you only want to fuse vertices that are so close that they would be better handled by one vertex rather than many.

3.4.27 Cut Selected Edges

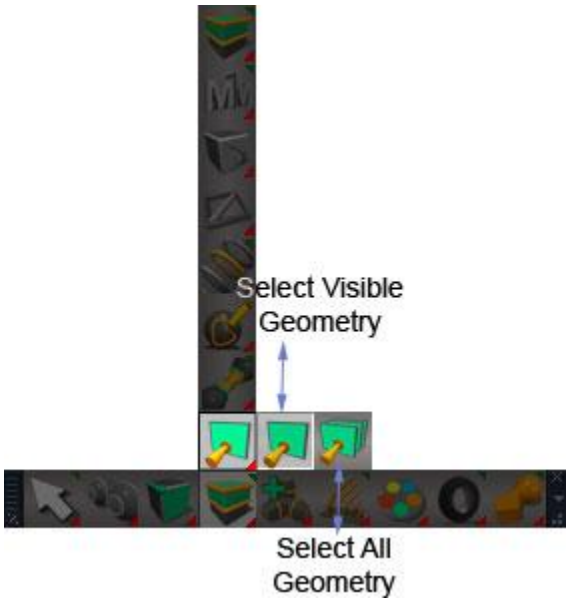
The Cut Selected Edges tool slices selected edges (or edges around a face if a face is selected) to separate them from the rest of the object. You can think of this as using scissors to cut along the edges



With four edges selected, the Cut Selected Edges tool is applied (left). Now using Select Vertices, clicking on the center vertex and raising it up shows that the vertex is now separated from the others (right).

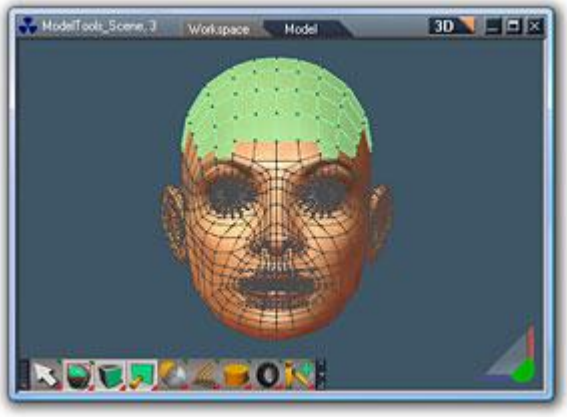


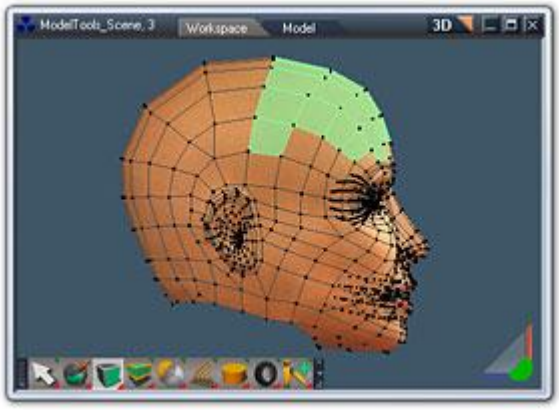
In fact, the one central vertex is now four separate vertices, as we can see here where each has been moved to a new height.



3.4.28 Select Visible Geometry

With this setting active, the selection tools will only select elements that are facing your current view. This is useful when working on the surface of a model and you do not want to accidentally select vertices, edges or faces on the back of the model.

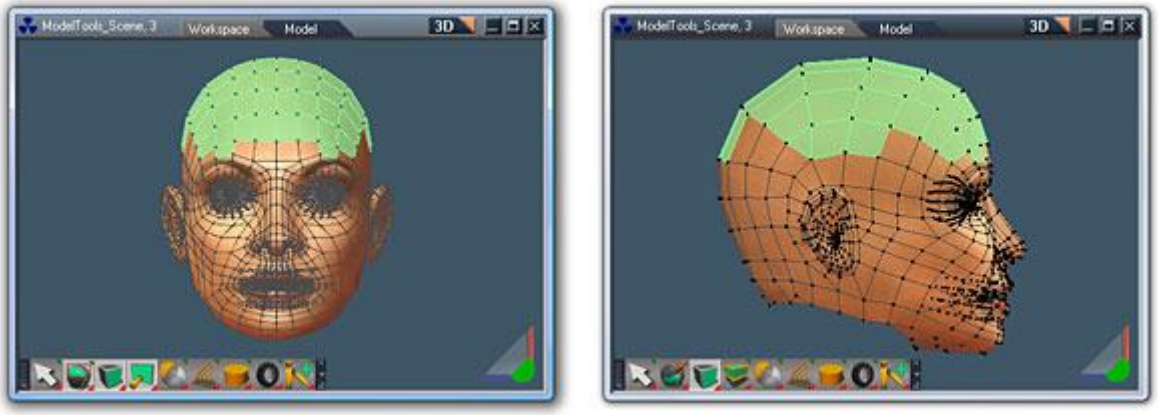




Using Select Visible Geometry setting and the Rectangle Select tool in the front view (left), only the visible faces are included in the selection (right).

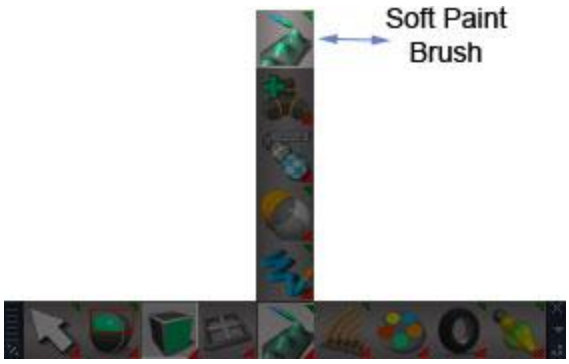
3.4.29 Select All Geometry

With this setting active, the selection tools will select all elements whether they are facing the current view or not, and whether they are visible or not. This is useful when wanting to select whole areas of a model, including the front and back.



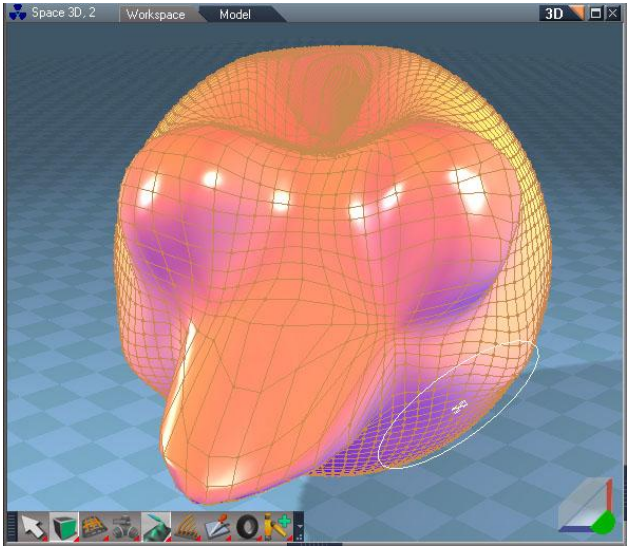
Using the Select All Geometry setting and the Rectangle Select tool in the front view to make the "same" selection (left), this time all faces on the front and back are selected (right).

3.5 Soft Paint



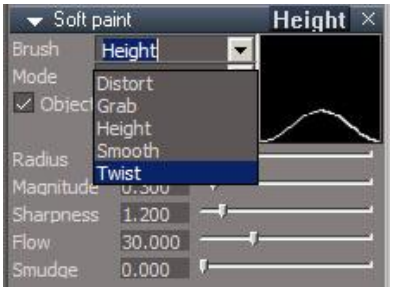
Unlike displacement paint, Soft Paint does not apply displacement defined by its simple gradient brush to a bitmap, rather it moves vertices of objects underlying mesh directly, usually along the direction of surface normal.

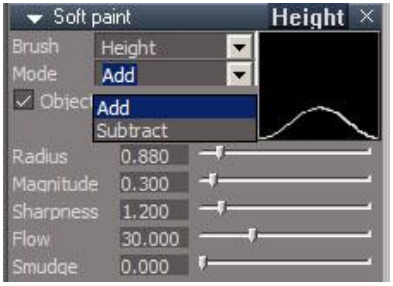
This gives it greater flexibility and ability to make bolder, more expressive strokes. Below is a sphere after several soft paint brushes were applied.



There are several brushes in Soft Paint Brush panel, te **Height** brush, **Distort** brush, **Grab** brush, **Smooth** brush and **Twist** brush. Most have two or more modes. You can see that Height brush has **Add** and **Subtract** mode for

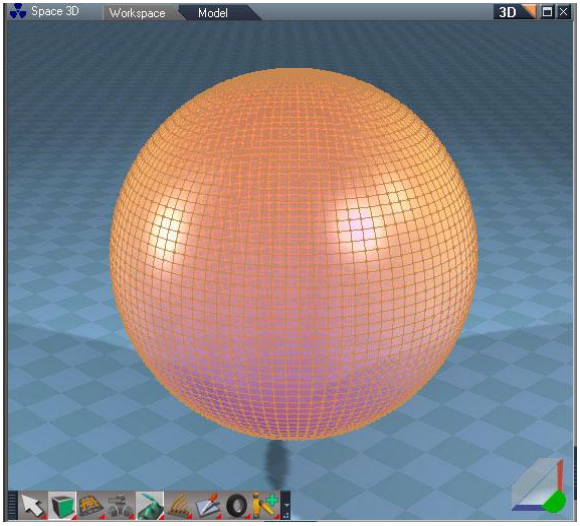
example.



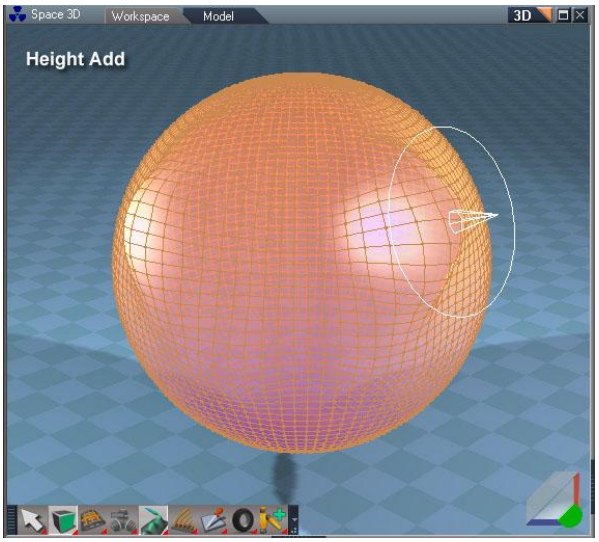


3.5.1 Painting with Soft brushes

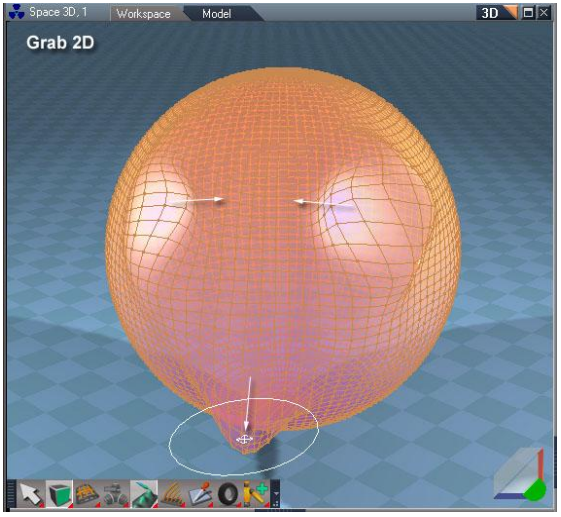
Load the PaintSphere object into workspace and select height brush. Default mode for Height brush is Add.



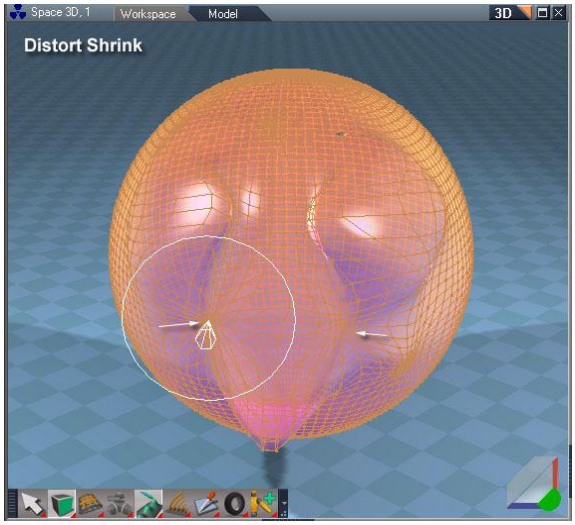
Gently apply brush strokes to left and right side of the sphere. Immediately you will see smooth bulges appearing on the sphere surface. Bulges height will accumulate as you go over same spots over again.



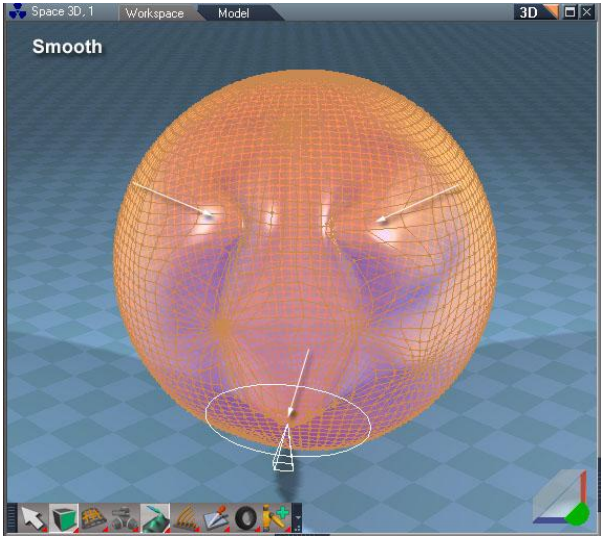
Next apply Grab brush which allows you to pull area under brush either along surface normal (1D) or freely in 2D. Using 2D mode we can easily pull tips of both bulges closer together.



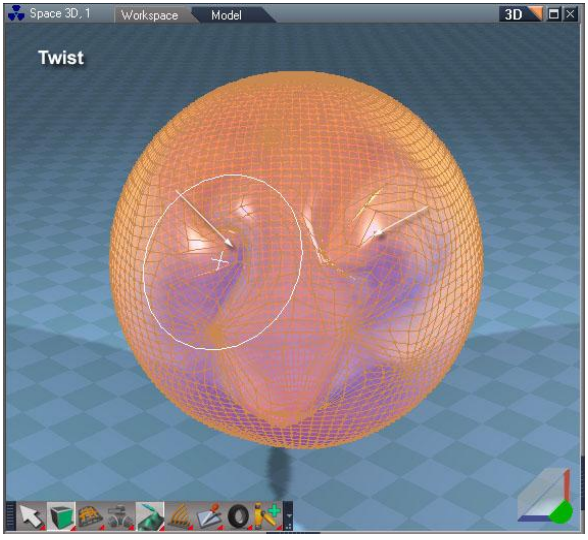
Distort brush allows you to squeeze vertices into a center of the Distort brush along the surface (Shrink) or push them away from brush center still maintaining general surface direction (Expand) In the image below Shrink mode was used on several areas.

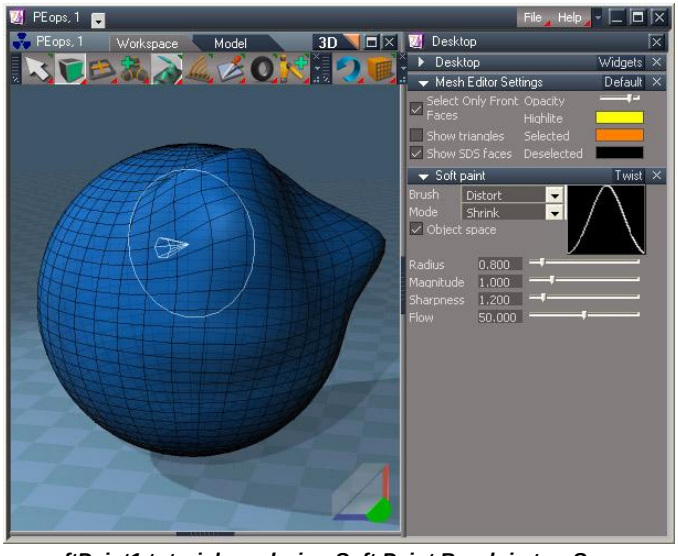


The Smoothing brush will average surface roughness (smooth) or increase it (sharpen).



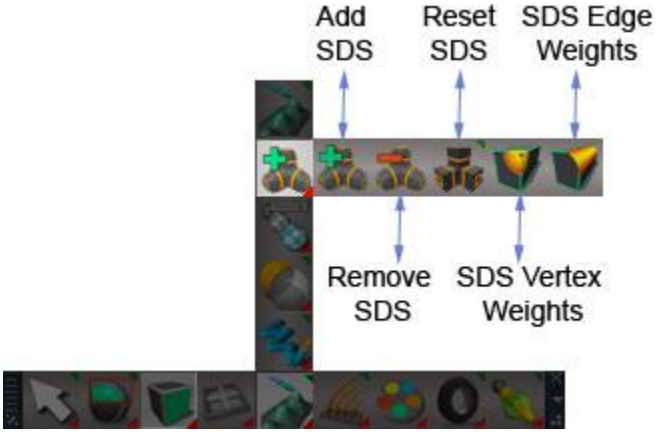
Twist is similar to Distort but will rotate vertices inside brush circle along brush center, clockwise or counterclockwise based on the direction of mouse movement after you press mouse button.





softPaint1 tutorial: exploring Soft Paint Brush in trueSpace

3.6 Subdivision Surfaces



The trueSpace Subdivision Surfaces (SDS) tools allow you to take a basic mesh that can seem quite boxy and give a model that is much more smooth and organic. You can apply SDS evenly across an entire object, or you can apply it selectively and in different levels to specific selections of faces, edges and vertices.

The subdivision level is changed using the Add SS and Remove SS tools. Adding SDS will add an extra layer of smoothing, resulting in a more rounded shape with more geometry, while removing SDS will reduce the level of smoothing and leave less geometry. Add and Remove work on the selected elements (faces, edges or vertices), and if no elements are selected or you are outside point edit mode, then the SDS level for the whole mesh is changed. These tools will also update the Link Editor (LE) topology if required.

If you are finished with SDS and want to work with the final polygonal version of the smoothed object, you use the Flatten History tool. This will “freeze” the object in its current form, making it impossible to remove SDS or work with the original underlying simple control cage mesh. This can be useful for moving on to add smaller details on the mesh, using the Soft Brush tool, or when you need to export the object to Virtual Earth, X format, etc.

3.6.1 Add SS

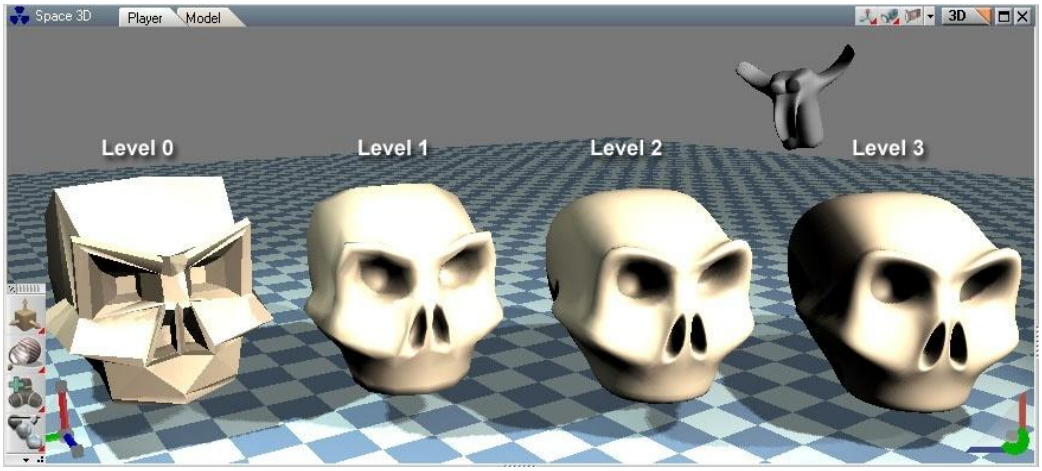
In conjunction with the Add SS tool, the Mesh Editor Settings panel has option to turn on/off the display of SDS faces. Of course there are circumstances when showing all the SDS faces is not required, in which case you can easily turn them off. For illustration purposes we turn them on to show the geometry created when using the Add SS tool.

The series of images below show levels of SS added to a cube shape. You can easily see how the cube becomes rounded and smooth as you apply additional layers of Subdivision Surfaces.


Space 3D
Workspace
Model
3D
One level of SS added


Space 3D
Workspace
Model
3D
Four levels of SS added

As mentioned, you can selectively choose faces, edges and vertices for exposure to the Add SS or Remove SS tools. The illustrations above applied SS to the entire object.



SDS subdivision levels on Skull object

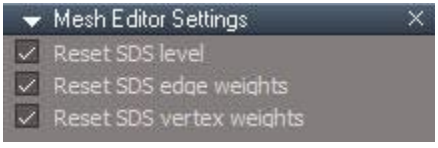
3.6.2 Remove SDS

The Remove SS tool allows you to select elements (faces, edges and vertices) and remove levels of Subdivision on the selection. The image below illustrates the selection of a face and removal of several levels of subdivision.

3.6.3 Reset SDS

This tool will reset all SDS on the object. By default, the tool will remove all layers of SDS, and reset all edge weights and vertex weights too.

A right click will open the options panel for the tool. Here you can choose to enable or disable what items are reset when the Reset SDS tool is used. You can also select the Reset SDS aspect of the Mesh Editor Settings panel.



3.6.4 Vertex Weight

The Vertex Weight tool allows you to adjust the influence/sharpness of the selected vertex on the SDS control mesh. Left-click-hold-drag to the left to increase sharpness/influence, or to the right to decrease the influence. The images below show the extremes of SDS Vertex Weight influence on a cone primitive with one level of SDS applied.

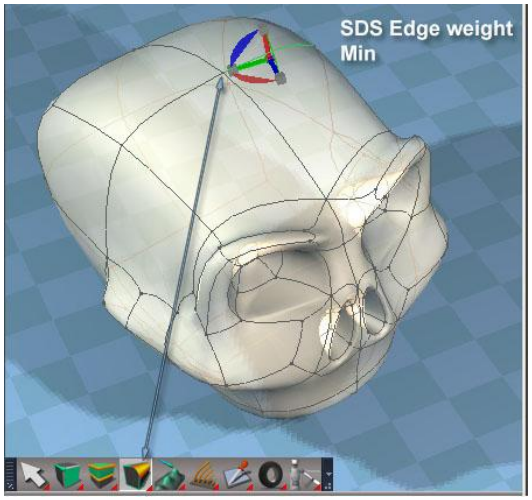

Space 3D
Workspace
Model
3D
SDS Vertex Weight
Cone obj with SDS applied

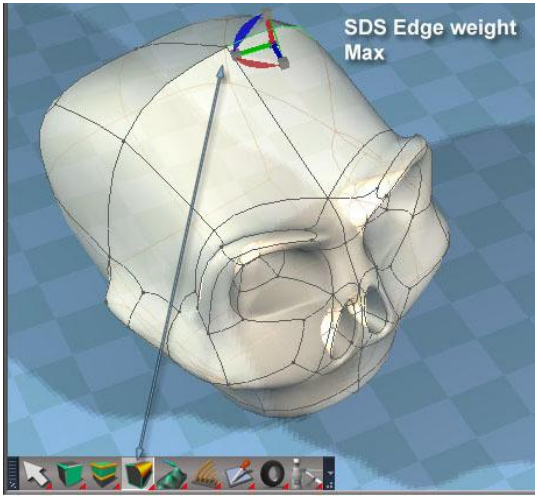

Space 3D
Workspace
Model
3D
SDS Vertex Weight
Maximum value shows very sharp vertices

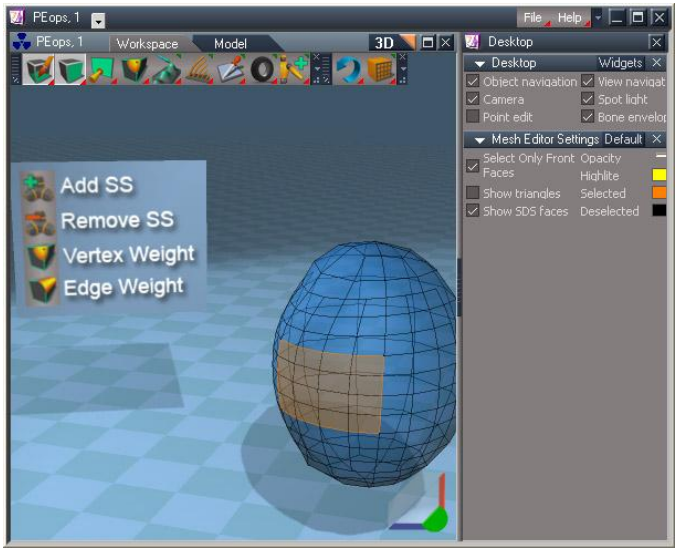

Space 3D
Workspace
Model
3D
SDS Vertex Weight
Minimum value shows smooth vertices

3.6.5 Edge Weight

The Edge Weight tool allows you to adjust the influence/sharpness of selected edges on the SDS control mesh. In the illustrations below, a skull object is used and Add SS tool used on the skull. The Edge Weight tool was selected and both extremes are shown.



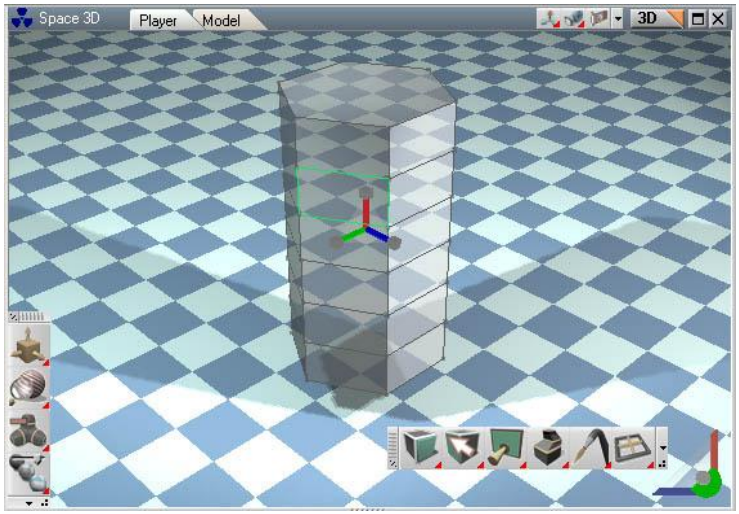




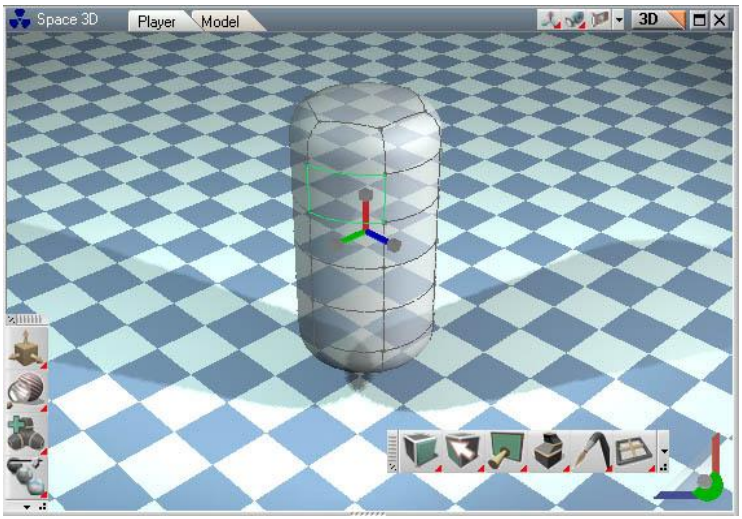
Sds1 tutorial: exploring SDS in trueSpace

3.6.6 Tutorial: Making of Zumbo

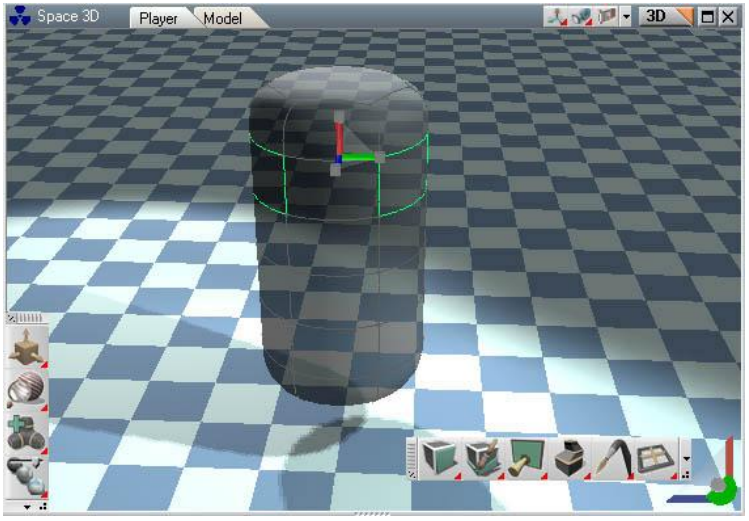
You do not have to wait for a Stork to bring a friendly little creature with big, floppy ears and a snout to life.



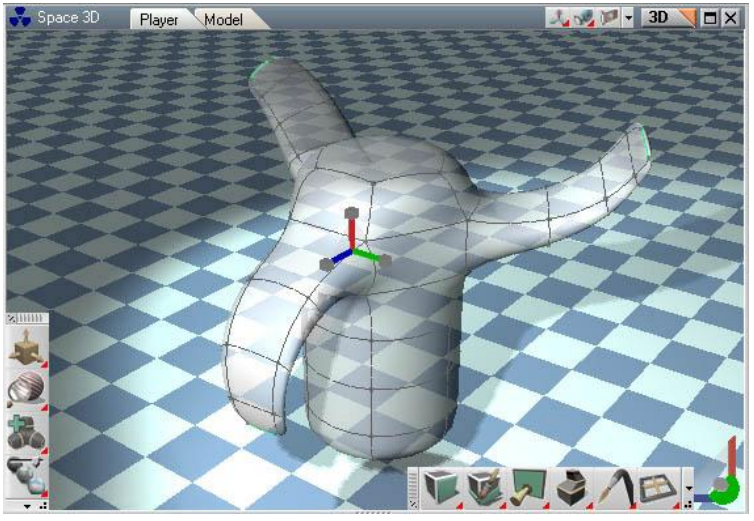
Step 1: Load a simple 6-sided cylinder with 6 vertical slices. Right-click on it to enter **point edit mode**. You will see that cylinder turns transparent with a dark polygon outline, and a point edit toolbar appears on screen with simple selection mode set to face selection. With a left-click you can select a polygon.



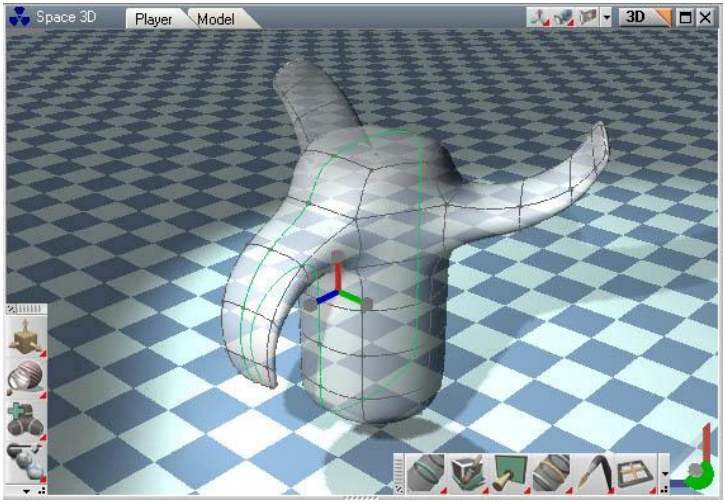
Step 2: Click the **SDS+** icon in the vertical toolbar on the left side of Workspace view twice. Now the cylinder will become perfectly smooth, but will have the same number of dark outlines (which now appear curved).



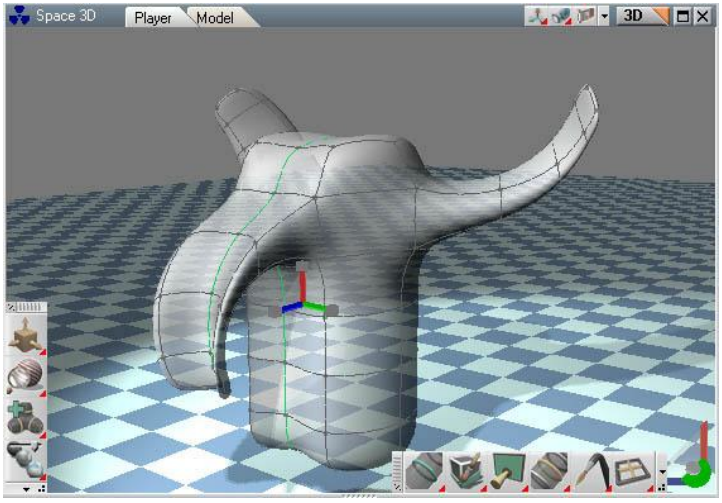
Step 3: Encircle your view around the cylinder and select every other face around its perimeter using CTRL+left-click.



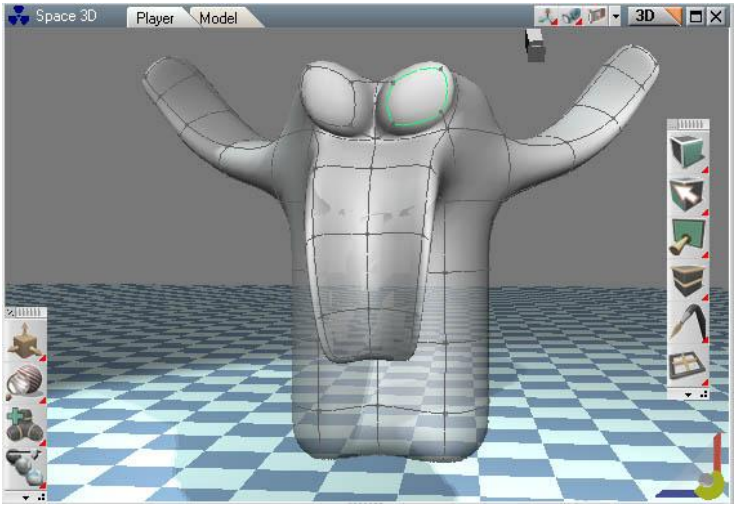
Step 4: Left-click on the **Memory Sweep** icon (4th from the left, above) a few times. After the first sweep, rotate and scale, then repeat the sweep 3 more times.



Step 5: Select the **Add Loop** tool (4th from the left, above), and place your cursor so that the previewed vertical slice runs right through the center of Zumbo's snout. Left-click to make the addition of the new loop permanent. Note that new loop will flatten the curvature between existing curves.

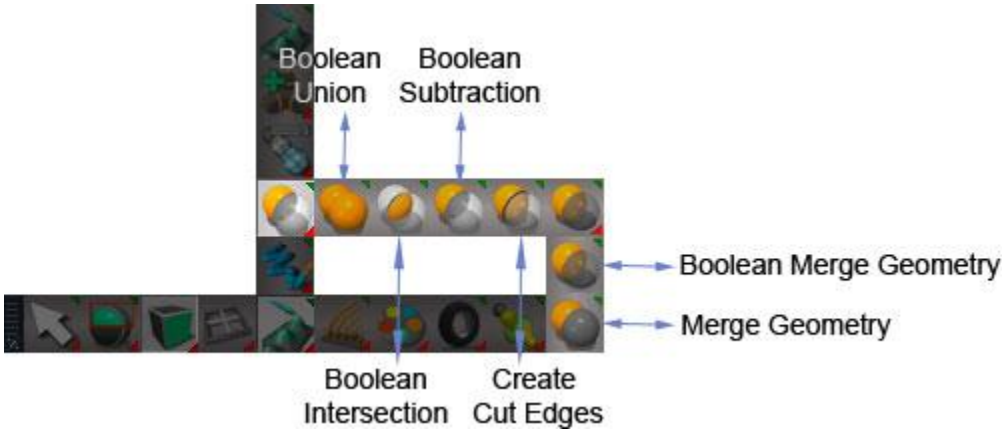


Step 6: With the loop still selected, scale the loop smaller and move it using the PE NAV widget to get nice indentation in the snout. (If you lost your loop selection, simply use **Select Loop** to select it again.)



Step 7: Click on the small black triangle on the PE toolbar to rotate the toolbar 90 degrees and get it out of the way. Select both front facing polygons above the snout individually, and sweep each with a simple sweep. There, we are done. My, what big eyes you have, Zumbo!

3.7 Boolean Tools



Boolean tools let you combine objects in various ways, by adding them together, subtracting one object from another, keeping only where they overlap, and so on. They are used to cut holes in objects, or to fuse one object into another.

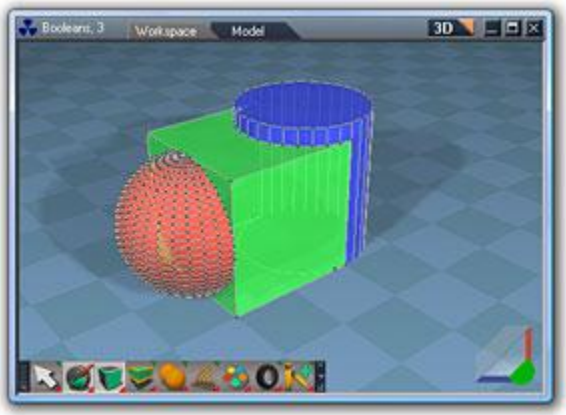
Below you will find a description of each tool. At the end of this section, you will find a description of the options available on the Boolean Panel and how those affect the Boolean tools. All Boolean operations are performed on a base object, which is the object selected at the time the Boolean tool is activated. This base object is then modified by a drill object, which is the object clicked on after the Boolean tool is activated.

3.7.1 Boolean Union

The Boolean Union tool adds two objects together, adding the drill object onto the base object and fusing their geometry into one object. Select the first object, then activate the Boolean Union tool, and then select a second object you want it joined to.

You can continue to click on other objects to union those to the new object created by the last mouse click. A right click will exit Boolean Union mode, leaving the newly created object selected.

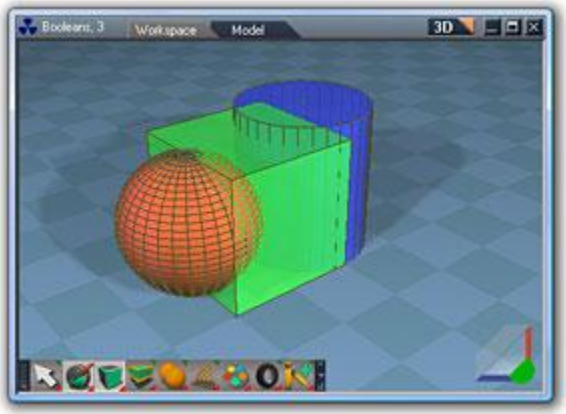
It is important to notice that the Boolean Union tool differs from the Encapsulate In 3D tool. The Encapsulate tool makes a group, and within that group each original object is still a separate individual entity, which can be manipulated separately from the other objects in the encapsulated group.



Starting with the sphere, then clicking the cube, then the cylinder, the Boolean Union tool joins these three objects together, as can be seen when we enter Point Edit mode.

With Boolean Union, there is no group – the final result is one object, and the original separate objects base and rill objects can no longer be selected or edited independently (although see section 3.7.8 Booleans With History for information on manipulating and editing objects after doing Boolean operations).

The Union will be performed even if the base and drill objects did not overlap or touch in space, and the result will still be one object.

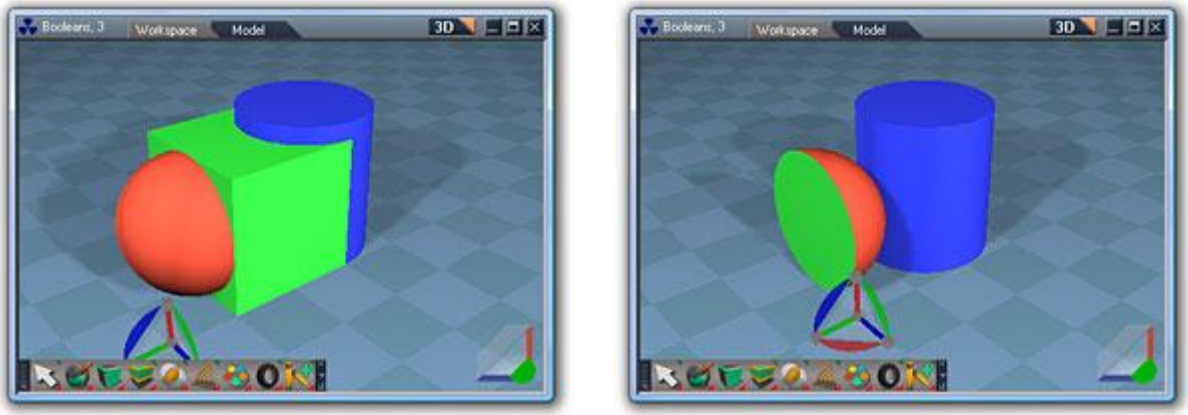


Contrast the previous image with this, where Encapsulate in 3D was used – note how the sphere and cylinder still have their separate geometry, even inside the cube, as they are still fully separate objects.

3.7.2 Boolean Intersection

The Boolean Intersection tool keeps only where two objects overlap, deleting the rest of the geometry. If you click on an object that does not overlap (intersect) with the current object, then the tool does nothing – this avoids unintentionally deleting two objects and ending up with an empty result.

You can continue to click on other objects to add further Boolean Intersection operations with new object created by the last mouse click. A right click will exit the Boolean Intersection tool, leaving the newly created object selected.

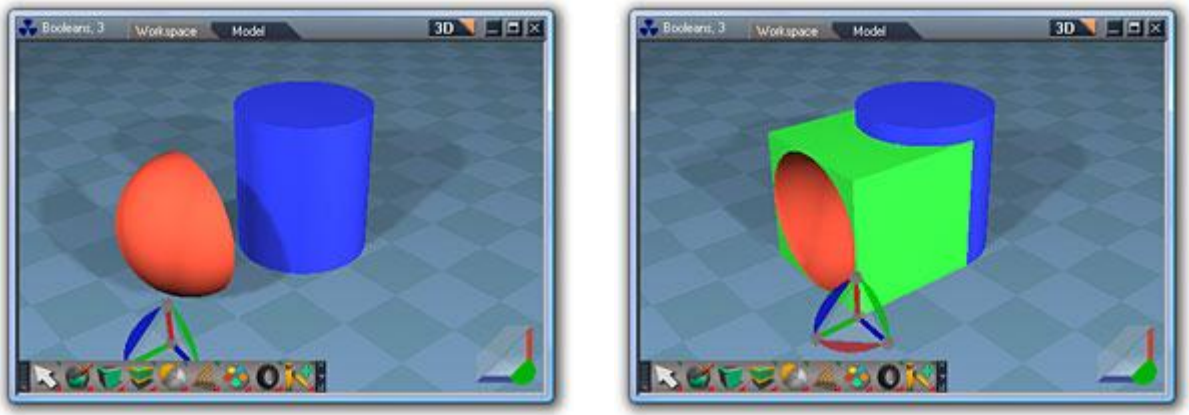


With the sphere selected (left) and clicking on the cube, the Boolean Intersection tool keep only the area where the two objects overlapped, deleting the rest of the objects (right).

3.7.3 Boolean Subtraction

The Boolean Subtraction tool subtracts the drill from the base object. Unlike other tools, the order in which you select your objects is critical for Boolean Subtraction

Begin by selecting the object you want to subtract FROM. For example, if you are subtracting a cube from a wall to make a window, you begin by selecting the wall. Now with your base object selected, activate the Boolean Subtraction tool, and then click on the object that you want to subtract from the currently selected object. This second object is referred to as the drill, as it is used to drill a hole into the first selected object.



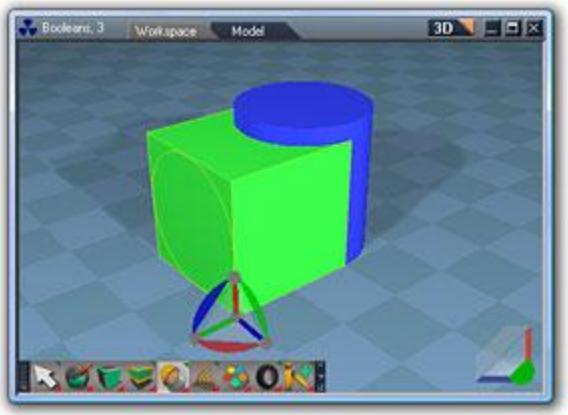
With the sphere selected and clicking on the cube, the Boolean Subtraction tool uses the cube as a drill to cut away parts of the sphere (left). With the cube selected, clicking on the sphere uses the sphere to cut away parts of the cube(right).

The second object is always subtracted from the first, so it is important to select the objects in the correct order. You can continue to click on other objects, and those too will be subtracted from the new object created by the last mouse click. A right click will exit Boolean Subtraction mode and leave the newly created object selected.

3.7.4 Create Cut Edges

This creates new edges on the surface of the base object, where the drill object cut into it. No geometry is deleted or lost from the base object.

You can continue to click on other objects, and those too will cut new edges on the surface of the new object created by the last mouse click. A right click will exit Create Cut Edges mode and leave the newly created object selected.



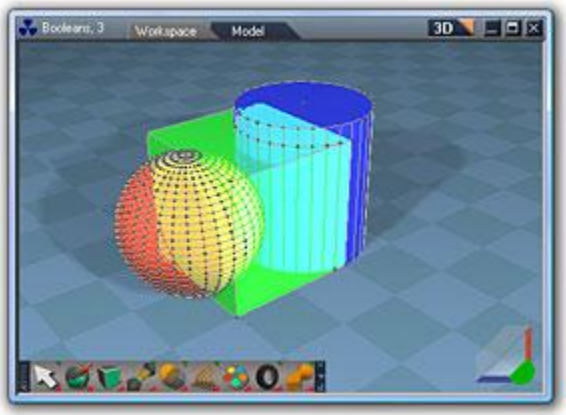
With the cube selected, using Cut Edges leaves the edges from the sphere cut into the surface of the cube, without deleting any geometry from the cube.

3.7.5 Boolean Merge Geometry

This offers another way to join objects together. With this tool, the result is one object, same as the Boolean Union tool (and unlike with the Encapsulate In 3D tool). However, unlike the Boolean Union tool, the geometry of the objects is not fused together, and overlapping faces are preserved.

While the geometry is not merged, the faces on the objects will have edges cut into them where the overlap with other objects occurred – in the example below, note how the cube has new edges cut into it where it overlapped with the sphere and cylinder. This is unlike the Merge Geometry tool, which does not cut new edges into the object surfaces. Unlike the Merge Geometry tool, you cannot manipulate the objects separately any more. Using Select Connected will select the entire object, and not the original separate objects.

Note that edges are cut into both objects involved in the operation – in the image below, the cube has new edges and vertices cut into it from the cylinder, and the cylinder has new edges and vertices cut into it from the cube (the same is true of the cube and cylinder).

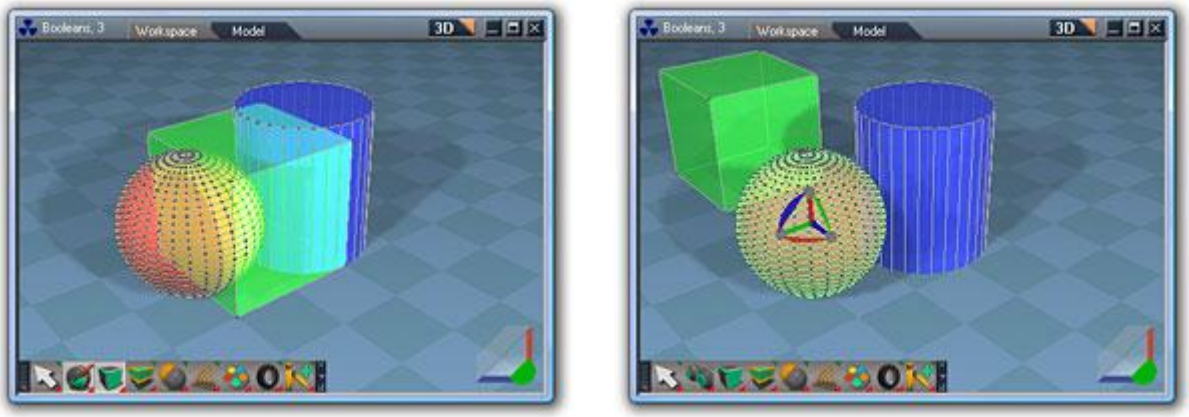


Using Boolean Merge Geometry with the sphere selected and clicking on the cube then the cylinder, gives one object but preserves the separate faces of each as seen on entering point edit. Also note how the shape of the cylinder has been cut into the surface of the cube as new edges.

3.7.6 Merge Geometry

This offers another way to join objects together. With this tool, the result is one object, same as the Boolean Union tool (and unlike with the Encapsulate In 3D tool). However, unlike the Boolean Union tool, the geometry of the objects is not fused together, and unlike the Boolean Merge Geometry tool, you can continue to manipulate objects separate, and new edges are not cut into the objects' faces.

While the end result is one object, the fact that the geometry is not merged means you can still select the original shapes by selecting one element (e.g. a face) on a shape, and using the Select Connected tool. Since the geometry has not been fused together, this will select only the geometry that belonged to that original shape, and you can then manipulate those separately from the rest of the object. This is unlike the Boolean Merge Geometry tool, which does not let you use Select Connected to manipulate the objects separately.



Using Merge Geometry with the sphere selected and clicking on the cube then the cylinder, gives one object but preserves the separate faces of each as seen on entering point edit (left). Using the Select Connected tool means you can select all faces for the cube and move it away, then select all faces for the sphere (right).

While the end result looks similar to grouping using Encapsulate In 3D, you cannot navigate between the objects using the arrow keys as there is no hierarchy – the objects are fused together into one object even though there geometry is not changed. This allows you to use tools such as the Morph tools, which cannot be activated on an encapsulated group, but can be used on an object made with Merge Geometry.

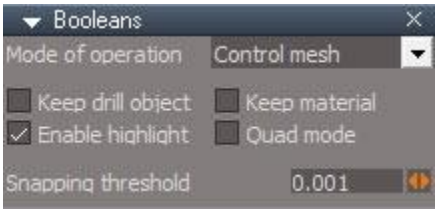
Note – when to use each of the union and merge tools:

You would use Boolean Union where reducing unnecessary geometry is useful (or even critical as you need the surfaces to be combined for further editing, animation, etc), and when you have no need to keep the objects separated at all.

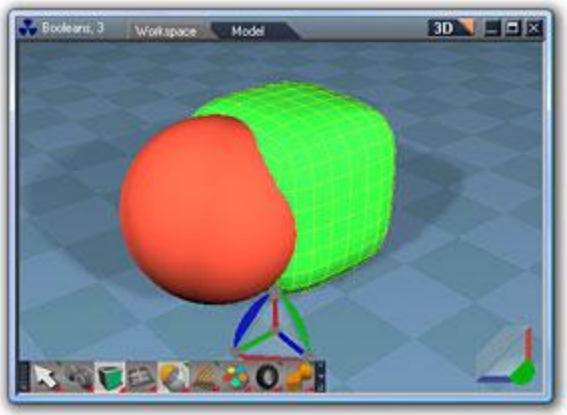
You would use Boolean Merge Geometry in place of Boolean Union where you want to preserve overlapping faces (which become internal faces in the final object), and where you need the edges cut into the objects for further manipulation. This is useful where you want to preserve separate faces and geometry for the objects you are joining, but you do want to treat them as one object for using tools such as Morphs or for processing using scripts (so that Encapsulate in 3D is not a solution).

You would use Merge Geometry in place of Boolean Union where it is important to preserve the separate faces and geometry for the objects you are joining, where you need to manipulate the objects separately at times, but you do want to treat them as one object for using tools such as Morphs or for processing using scripts (so that Encapsulate in 3D is not a solution), and when having the edges cut into the surface is not important.

3.7.7 Boolean Options Panel

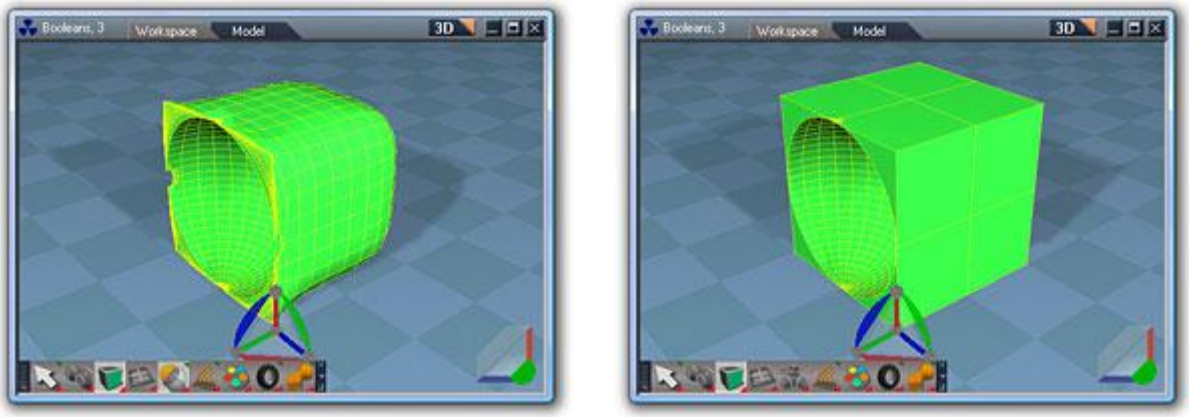


- **Mode of operation** – This value controls how SDS for the base object and Boolean history are handled, and has three possible settings



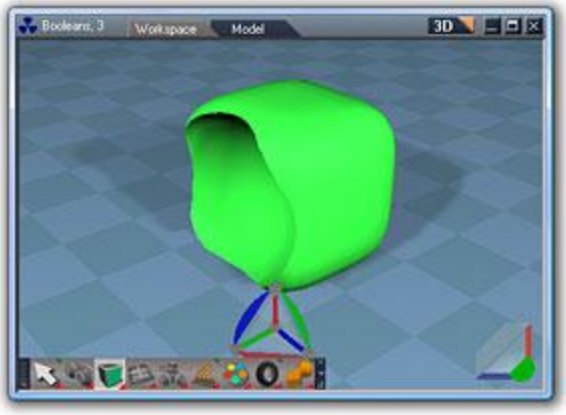
Sample scene with a cube with two layers of SDS applied. The cube has been quad divided prior to having SDS applied so that it gives a rounded cube shape rather than a sphere. With the cube selected, Boolean Subtraction is used to cut the sphere from the cube, and the results are shown below depending on the Mode used.

  - ***Control Mesh*** – If selected, when the base object is an SDS object, then the drill is subtracted from the control mesh of the base object, and not from the final mesh resulting from the SDS. SDS is then "re-applied" to this new control mesh, and you can remove SDS layers or work with the control mesh for the resulting object. History is not kept for the Boolean operation.



With Mode of Operation set to Control Mesh, the sphere is cut from the underlying control mesh, and the final SDS object changes as a result (left). Since the cube remains as an SDS object, the SDS layers can be removed to see the underlying control mesh (right).

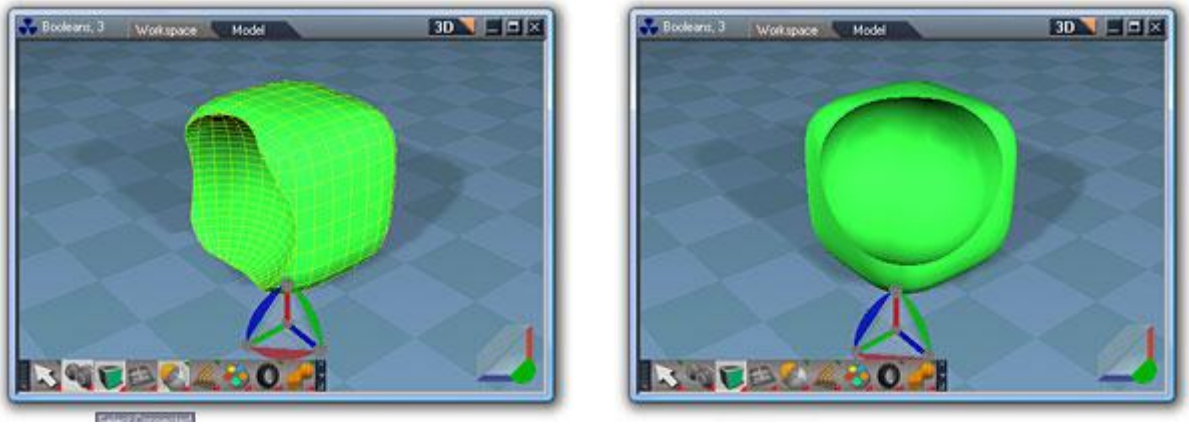
- ***Flatten Result*** – If selected, then the Boolean operation is performed on the final mesh resulting from SDS. This finalizes the SDS prior to performing the Boolean operation, so you will no longer be able to remove SDS layers or edit the control mesh. History is not kept for the Boolean operation.



With Mode of Operation set to Flatten History, the SDS on the cube is finalized, and the sphere is subtracted from that. SDS layers cannot be removed from the final object, as it is no longer an SDS object.

- ***Keep History*** – If selected, this makes the Boolean operations non-destructive, storing the history so that you can change the results later by moving or editing the drill. If the base object has SDS applied, this is

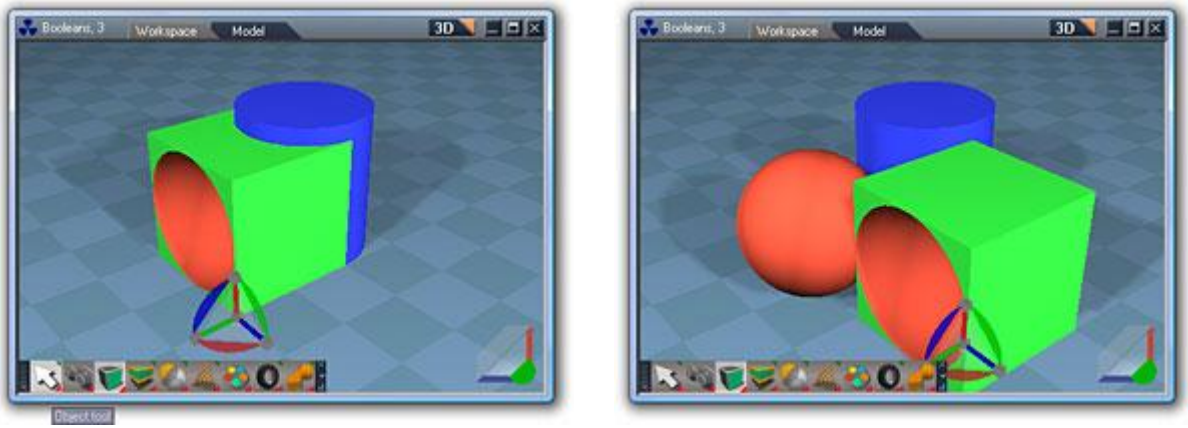
still finalized before performing the Boolean operation, so you will be unable to remove SDS layers or edit the control mesh afterward.



With Mode of Operation set to Keep History, again the SDS on the cube is finalized, and the sphere is subtracted from that (left). However, we can now select the sphere and move it, changing the result of the Boolean operation (right).

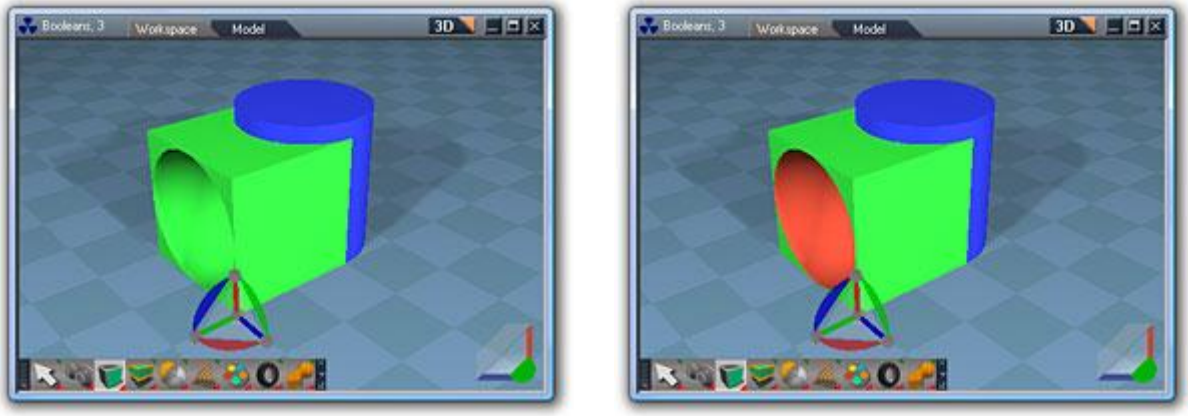
If the drill was an SDS object, then you can still work with the drill after the Boolean operation to remove SDS layers or manipulate the control mesh for that object, and the result of the Boolean operation will update accordingly. See section 3.7.8 "Booleans with History" for more information on the Keep History setting.

- **Keep drill object** – If this is checked, then the object used as the drill (i.e. the second object selected in a Boolean operation) will be preserved. Otherwise it will be deleted as part of the Boolean operation. This applies to all Boolean operations. Note that the first selected object is always "lost" during the Boolean operation, as it is transformed into the new object – if you need to preserve this main, base object, simply take a copy of it or save it to a library before beginning Boolean operations.



With cube selected, clicking on the sphere with Boolean Subtract cuts the sphere from the cube. If Keep Drill is unchecked then the sphere is deleted (left). If Keep Drill is checked, the sphere is kept (right - the cube has been moved after the Boolean Subtraction so that you can see the subtraction was still performed).

- **Keep Material** – If checked, then the material(s) from the drill object will be kept on the faces of the final object resulting from the Boolean operation. If unchecked, then the final object will take its materials from the base object only, ignoring any materials from the drill object.



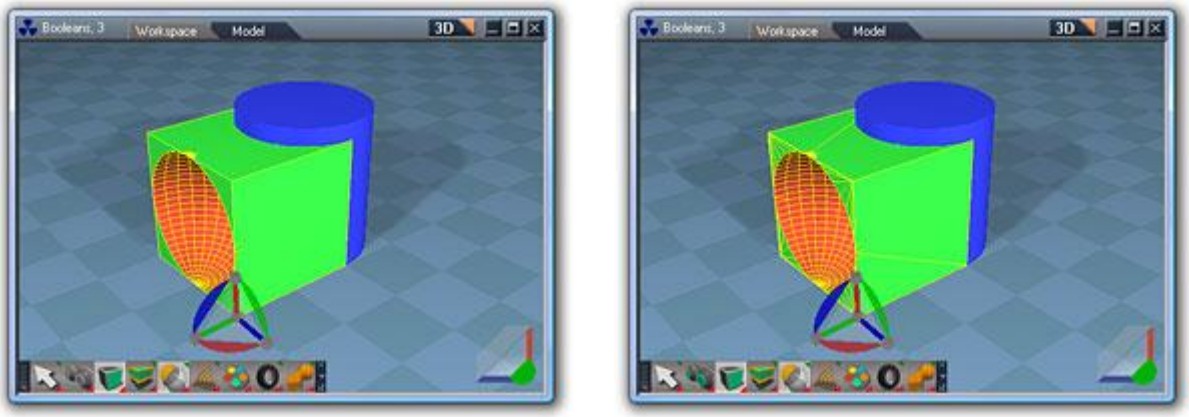
With cube selected, clicking on the sphere with Boolean Subtract cuts the sphere from the cube. If Keep Material is unchecked, then the cube retains its own original material and ignores the material on the sphere (left). If Keep Material is checked, then the material of the sphere is used on the faces created by the Boolean operation. (right).

- **Enable highlight** – When enabled, the base object will be highlighted, and then any object you mouse over will be highlighted. This lets you be certain of the object you are about to choose as your drill. When

unchecked, the Boolean operation will still work as normal, but there will be no highlighting to show which object you are about to select.

- **Quad mode** – When enabled, the resulting object will have edges added to ensure that all faces are Quads. This avoids the Boolean operation resulting in "n-gon" faces, i.e. faces that have many vertices and edges, and also avoid any floating vertices that might appear in the middle of a face, unconnected to any edge. Both of these results can sometimes be problematic for some render engines, or when exporting.

  When disabled, the resulting object will not have any extra processing done. This can make the object easier to work with in trueSpace.



With cube selected, clicking on the sphere with Boolean Subtract cuts the sphere from the cube. If Quad Mode is unchecked, no extra edges are created and only those on the original objects are used (left). If Quad Mode is checked then extra edges are added to ensure the geometry is made from four or three sided faces only (right).

- **Snapping threshold** – This parameter determines the distance below which two vertices will be merged. This lets you avoid two vertices very close together as a result of the Boolean operation. A larger value will merge vertices that are further apart, while a smaller value will only merge those vertices that are closer together.

3.7.8 Booleans with History

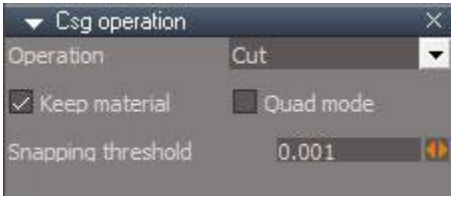
One of the most powerful features of the Boolean tools in the workspace (as opposed to those found in the Model aspect) is that you can keep the history. This means that you can return to any Boolean operation and edit either the drill or the base object, using the Move, Rotate or Scale tools, or even point editing the object or

adding and removing SDS to a drill object. This gives a different result from the Boolean operation, in real-time, just as if those edits had been done prior to carrying out the Boolean operation.

You can even change the type of Boolean operation that was done, changing a Subtraction into an Intersection. The history of Boolean operations stacks, so you can return to the first of five Boolean operations and edit that, and the results of the subsequent four operations will also change accordingly.

Note that when point editing a drill object in a subtraction or intersection, you will not be able to see the mesh, but you will still be able to select faces, edges and vertices which will highlight when moused over.

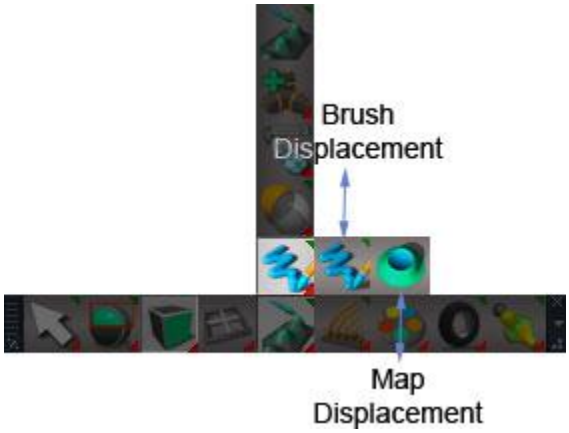
When you select an object with Boolean history stored for it, the CSG Operation panel will be displayed in the Stack (CSG stands for Constructive Solid Geometry). This panel lets you change some values, altering those originally used during the Boolean operation.



This panel has the following options:

- **Operation** – Here you can change the Boolean operation that was carried out, swapping a Subtraction into an Addition or Edge Cut etc.
- **Keep Material** – This lets you adjust whether the drill material is used for the Boolean operation, or if materials are taken entirely from the base object. This changes whatever value you had set when you carried out the Boolean operation.
- **Quad Mode** – This lets you adjust whether or not Quad Mode is used for the Boolean operation. This changes whatever value you had set when you carried out the Boolean operation.
- **Snapping Threshold**– This lets you specify the Snapping Threshold used for the Boolean operation. This changes whatever value you had set when you carried out the Boolean operation.

3.8 Displacement Paint

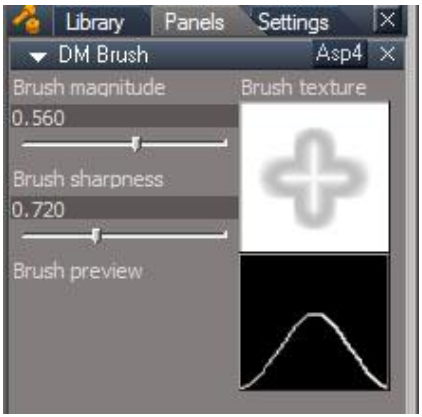


The main idea behind displacement paint is to create an additional geometrical detail on the object using a bitmap brush as a modeling tool. You can place a bitmap on the surfaces just once, like a stamp or you can refine the underlying surface mesh by continuous motion of paintbrush over the object surfaces. This works best with a simple gradient brush which allows you to literally sculpt the surface by painting peaks and valleys.

3.8.1 Brush Displacement

The Brush Displacement tool is a smaller bitmap used to “paint” values into an underlying larger bitmap wrapped around the object.

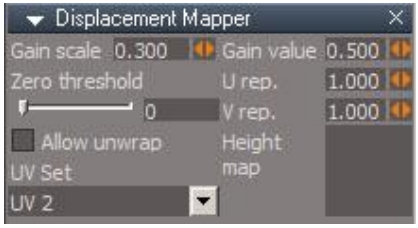
Its associated panel will allow you to make local changes on your “paintbrush” such as magnitude (height) or Sharpness (slope of a simple gradient brush which is generated procedurally or any bitmap brush you can easily load from file dialogue).



3.8.2 Map Displacement

The Map Displacement tool will create a larger bitmap which is wrapped around the object's mesh. This bitmap is stored together with the object mesh and is used at render time to add more polygons to the base object mesh, to add more detail.

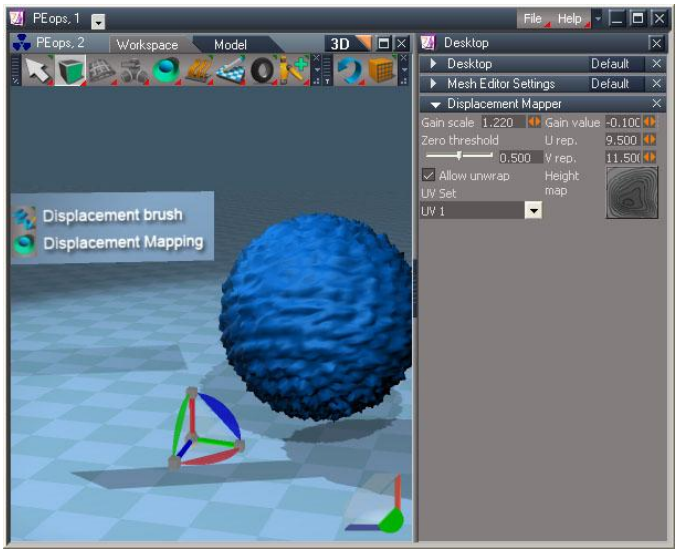
The associated panel will allow you to influence the appearance of surface detail uniformly and globally, i.e. the overall magnitude, scale and threshold where the surface starts to bend.



Gain scale: Rough tuning of total displacement amount
Gain value: Fine tuning of total displacement
Zero threshold : Pixel value considered to be at zero displacement level. If particular pixel value is less than Zero threshold, it is displaced into the object.
UV Set: UV coordinates used for displacement mapping. Enables user to choose other than diffuse map UV set. If chosen UV mapping does not exist, no displacement is performed.
U rep. / V rep: Allows tiling displacement texture in specified scale

Height map: Texture used as a height map for displacement. Can be grayscale or colored. Alpha channel is taken into account.

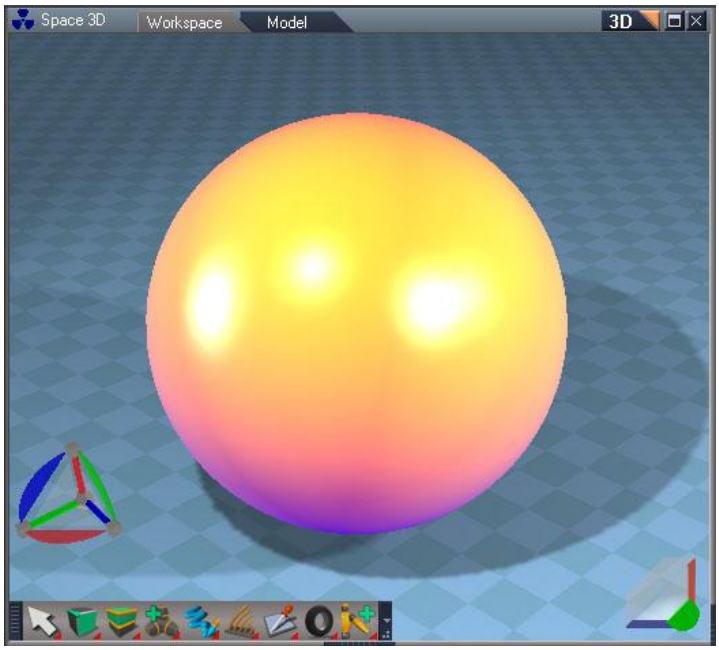
Allow unwrap: If enabled, consequent use of displacement brush will alter selected UV mapping to optimally place triangles in texture space.



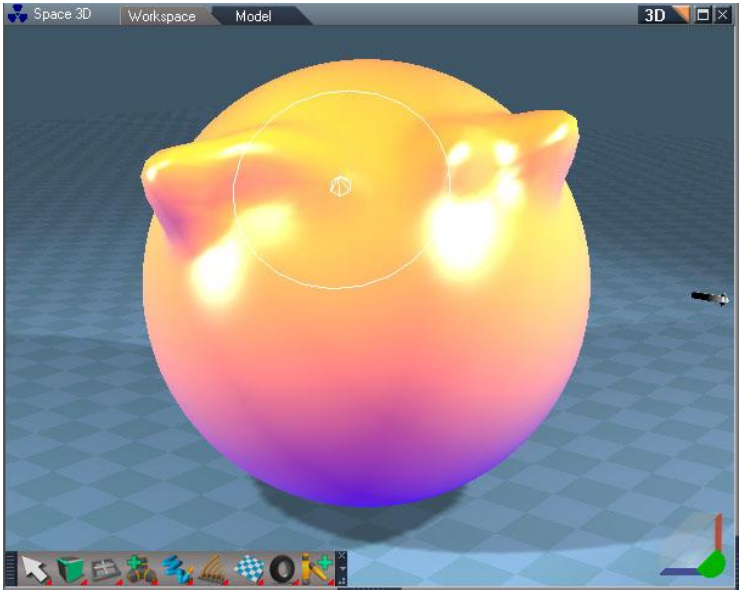
dispMapping tutorial: explore Displacement Mapping in trueSpace

3.8.3 Painting with a Gradient Brush

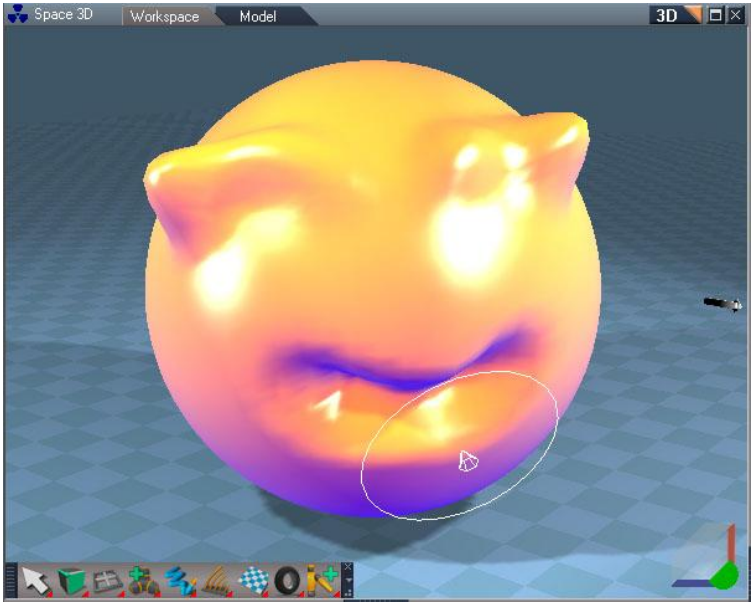
Load PaintSphere object into workspace and select simple gradient brush.



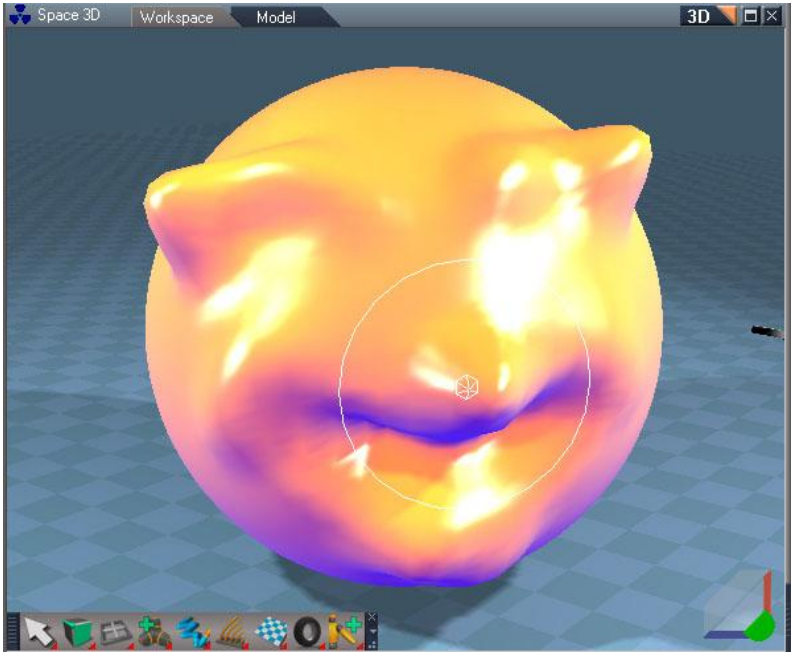
Select the Map Displacement brush  and apply it to sphere surface with Left Drag of the mouse. The small white cone in the middle will show you the magnitude of your strokes on the surface of the sphere. With the default **Positive magnitude** you can quickly draw some peaks on the sphere surface as seen below:



Now, click on the middle mouse button to reverse the direction of the paintbrush. Now you can paint valleys with **negative magnitude** brush on the sphere surface right next to the peaks you painted previously.

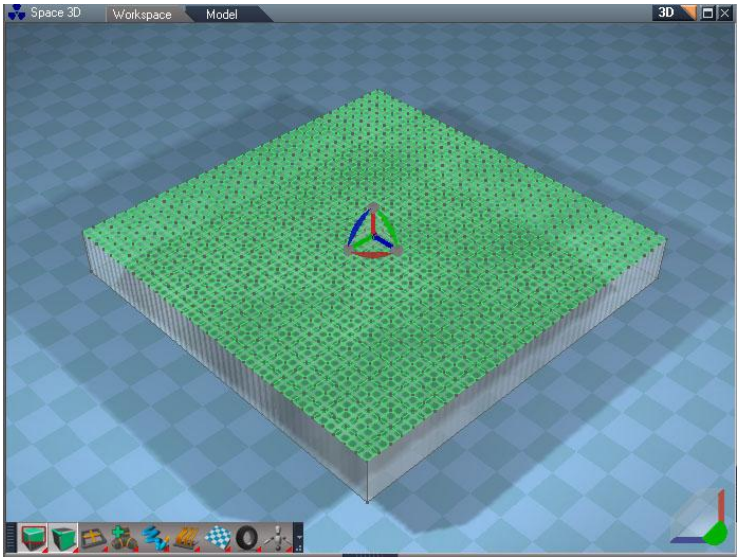


Let us switch back to paint some more peaks to create a vague impression of a cat like, animal face.

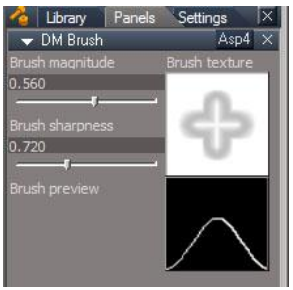


3.8.4 Painting with a Bitmap Brush

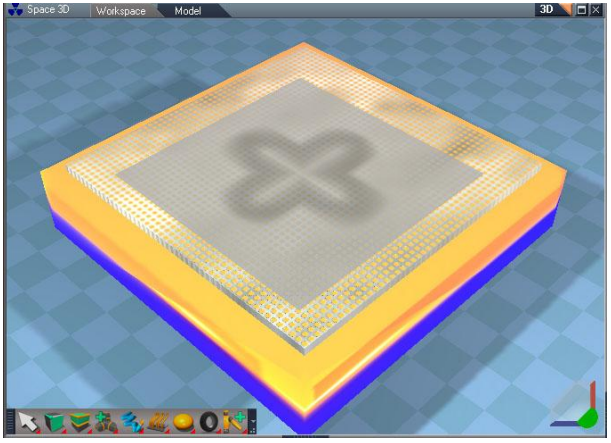
Load a default cube object, scale it vertically and subdivide the top face a few times:



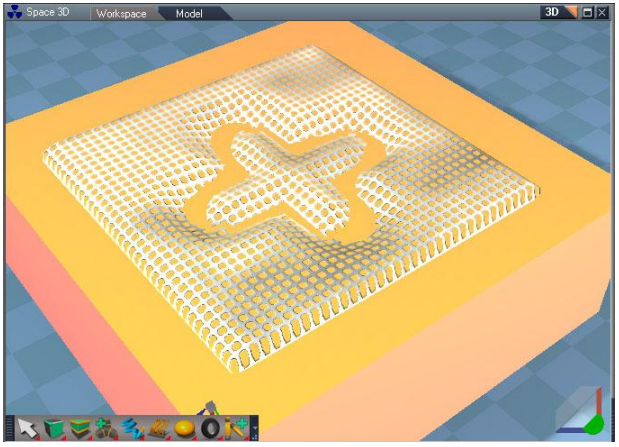
Next, load a bitmap into a brush by double clicking on the brush texture rectangle on the Map Displacement panel. We chose a simple cross bitmap.



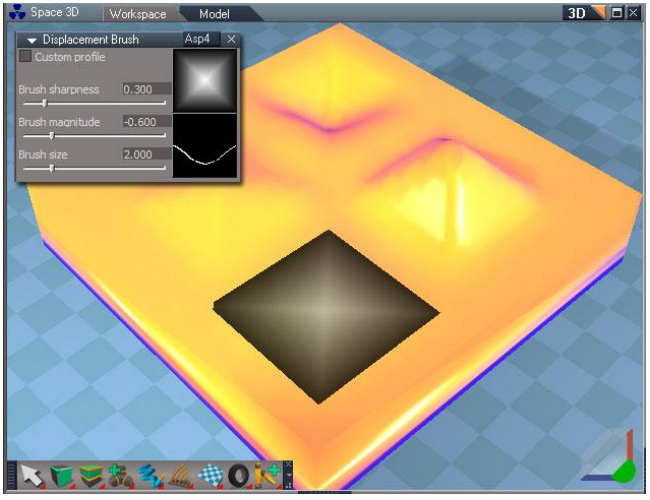
You can then position, rotate and scale the bitmap brush using right drag on a mouse. In the image below, we positioned am orange cube inside default cube to better highlight displacement.



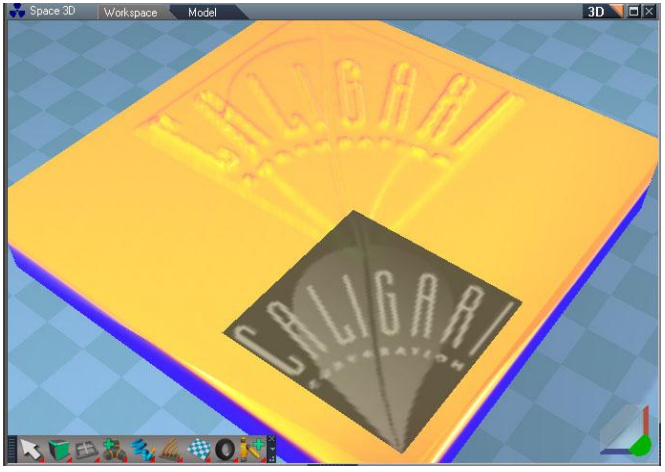
Finally you can press left mouse and drag to push the shape of the brush to deform the cube mesh.

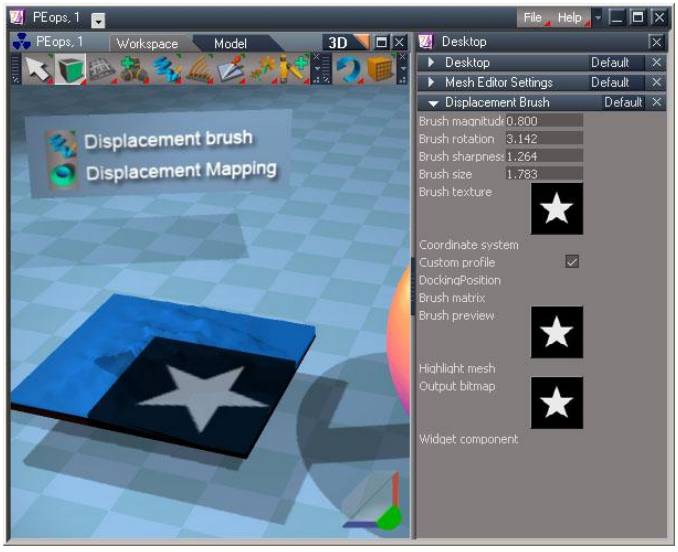


In most cases it will be better to use bitmaps with a black background. Here we created a few surface indentations using diagonal gradient bitmap with positive and negative brush magnitude.



In the image below we created a simple relief imprint using the Caligari Logo bitmap. For this example it was necessary to subdivide top face of the cube one more time to capture the resolution of bitmap image.



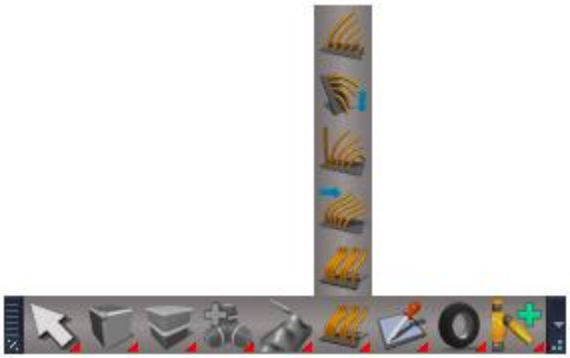


dispBrush tutorial: explore the Displacement Brush in trueSpace

3.9 Hair Tools

New features in trueSpace 7.5 are the hair generation tools which can be used to create a wide variety of hair and fur effects. Here we will look at some of the basic tools for this new feature.

The hair tools can be found in the main toolbar at the bottom of the workspace window. If no object is selected then the tools will be in their inactive state and grayed out. Once an object is selected, the tools become available for use.



Hair tools in main toolbar

When the hair tools are active the panel settings in the stack become available. These settings control the overall aspects of the hair such as length, curliness, color etc. while the tools themselves allow more fine control over the hair.

Hair settings panel

You can quickly and easily change the effect of any hair you have generated using the settings in this panel and you can use the brush settings to refine the hair as it is generated. For instance, the brush magnitude affects just how much hair is generated as you move the cursor over the object while the radius sets the area that will be covered.

In order to show these settings in more detail we can load a basic head from the character library supplied with trueSpace 7.5.

Character Library

In the stack view choose the library aspect and load the HeadEyes1 object; you should have a scene similar to the one below. Now we are ready to make some hair.

A simple scene with the head object inserted in the workspace

3.9.1 Generating hair

In this tutorial you will learn how to generate hair on an object and then use the hair tools to fine tune how the hair looks. The easiest way to start is to choose the density brush  from the hair tools menu which we can use to draw areas of hair onto our model. Once you activate the tool a cursor will appear where the standard cursor was and indicates the radius of the brush, the direction of the hair and where the hair will be applied. You can adjust both the magnitude and brush radius setting from the hair control panel shown previously.

Generating and manipulating hair can use up system resources quickly so save frequently.

You can also adjust brush settings with the mouse. Holding the right mouse button down while moving the mouse horizontally will adjust the radius of the brush. Moving vertically will adjust the magnitude of the brush. These changes are reflected in the hair control panel.

The hair generation cursor shows where hair will be applied

We can now start painting hair onto the object, for now it will be the default color and length but we can adjust that later. Don't worry if the hair looks a little wild, we can easily adjust this later. By rotating our view around the object we can access all areas of the model and paint a basic coverage of hair where we want it to appear.

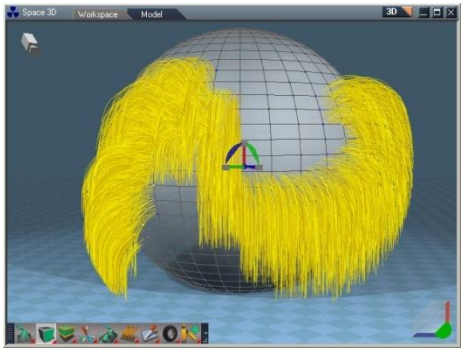
Although the hair is produced on the object's faces, distribution of the hair is determined by the vertices. For that reason it is much easier to accurately place hair if the opaque-wireframe mode  is used when applying hair.

Another option is to use the polygon draw tool  to define a scalp line on the model. For even greater accuracy, point edit can be used after a hair tool is activated to select a specific face or group of faces where the hair is to be applied.

In point edit, either paint selection  or soft selection  can be used to quickly define the areas on the object where the hair is to be applied. To initiate point edit selection and application of hair, activate a hair brush then click on one of the point edit selection tools. Paint the area where you want the hair applied (remember that control- select adds to the selection and shift-select removes from the selection). When you've

defined the area, click again on the hair brush and fill in your hair. Right click to exit the hair brush. You can either then select another brush or right-click again to exit point edit. The blow dryer is the only hair tool that cannot be masked using point edit selection.

Using point-edit paint selection to select specific faces for hair application



Using point-edit soft selection to quickly paint areas for hair application

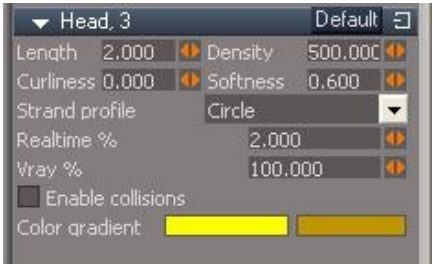
Basic hair generated using the density brush

Once we have hair covering the object we can start to make adjustments to the hair itself. Don't worry if you need to go back and refine where the hair is applied, you can use the density brush at any time to generate more hair.

Save your file and take some time at this point to adjust the sliders in the hair control panel and see how they affect the hair. By now you've probably noticed that when you're editing the hair, it's displayed as lines. When it's not being edited, the default profile for the hair is 'circle'. Before proceeding to 'style' the hair, you may want to make some adjustments to the panel settings. Try reducing the Realtime percentage of hair displayed from 10% to 2% for faster system response.

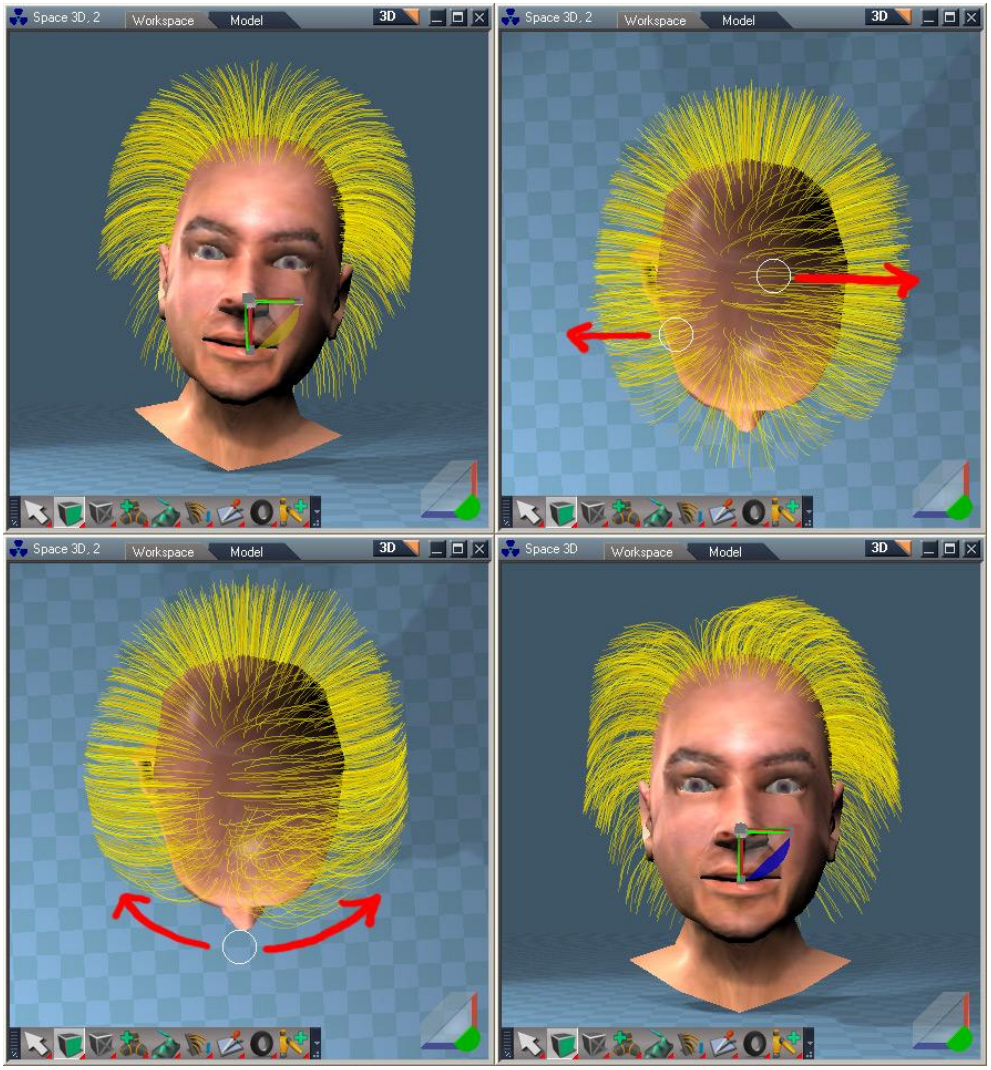
The Direction Brush  affects the root end of the hair and the Blow Dryer  affects the tips of the hair. A softer hair setting will cause the Direction brush to take effect further out from the root of the hair. Conversely, it will cause the Blow Dryer to affect the hair closer to the root. Naturally, gravity also has a greater effect on a softer hair setting.

Adjust the settings in the hair control panel to reflect a Softness setting of 0.6 and a Realtime display of 2%.



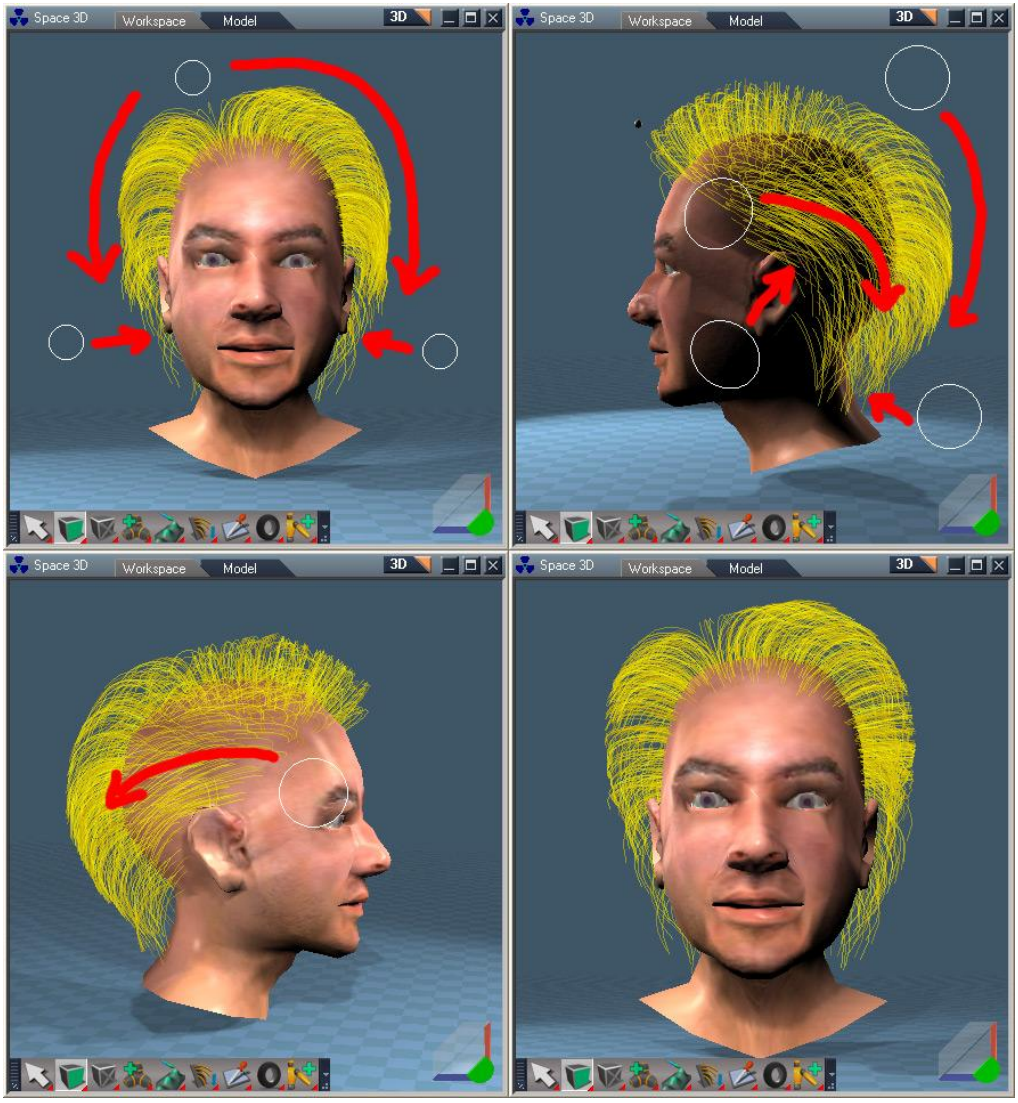
Adjust hair settings

Tilt the head over on the Y-axis about -5.0 degrees and gently nudge the ends of the hair with the Blow Dryer to start to give the effect of parting the hair. Then you can remove the tilt to the head and return it to its normal orientation.



Starting to style the hair

Change your softness setting to 0.4 and continue directing and shaping the hair with the Blow Dryer. Don't forget that you can adjust the magnitude of the brush to adjust the affect it has on the hair. Remember that the blow dryer affects the tips of the hair, so sweeping it along the edge of the hair has the most controlled effect.



Adding shape and direction to the hair

On areas where the hair needs more of a push to put it into place, rotate your view so that you see the edge of the hair and use the blow dryer to tap the edge of the hair into place.

If even a very slight amount of curl is applied to the hair, the blow dryer can also be used in small motions and taps to direct and encourage curls in areas of the hair.

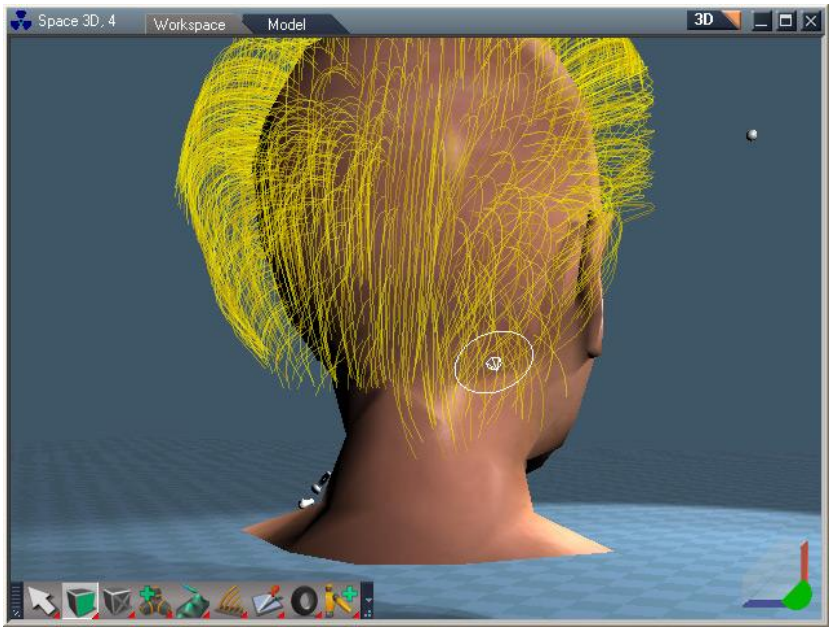
Change the Soften setting to 0.6 and you'll see that the hair style is starting to take shape.

Change Softness to 0.6 to see the results so far

We can now use the length brush  to add or subtract length from the hair. You can choose add or subtract from the hair control panel and then use the hair tool as before but this time the hair will grow or shrink where you use the cursor depending on which setting you chose. This allows you to fine tune the length of the hair in different places, a bit like having a haircut. Remember that you can add or subtract hair at any time if you feel you have taken too much or added too much on in any particular place.

The Hair Length tool also has a Max Length setting on the control panel. This allows it to be used to cut or grow hair to a pre-determined length. To use this feature the length brush mode needs to be 'add' whether you

want the hair longer or shorter. The max length setting determines the length the brush applies. If the max setting is shorter than the length setting in the hair control panel, the hair will be shortened.



Trimming hair with the Hair Length tool

Once you're finished trimming the hair, change the softness setting to 0.8 and use the Softness brush  around the neck and the bottom half of the back of the head to further relax the hair.

With the additional softening, you can use the Direction brush  to comb back the hair that's right behind the ears and on the sides of the neck.

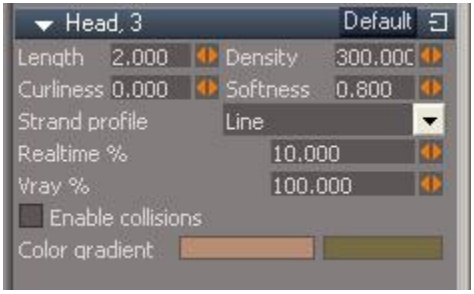
Ready for the finishing touches

Once we have a basic hairstyle we can start to play around with a few other tools in order to get the required look. If we want to change the whole hairstyle we can change the parameters in the hair control panel. These will affect the whole hairstyle while the individual tools allow you to apply that feature to selected areas of hair.

The basic style is finished. But there are still some final touches that you can add to make your hair look realistic.

The color gradient swatches on the control panel determine the two ends of the gradient spectrum used to color the hair. By double-clicking on those boxes you can change the color gradient that shades your hair.

Click on the drop-down selection to go to the advanced control panel. From there you can tell your hair to cast shadows, select the thickness of the hair root and tip, add random direction and add randomness to the hair length.



Change color gradient. Click on Default for pull-down to the Advanced pane

Change the thickness of the hair root and tip

vRay render of the finished hair

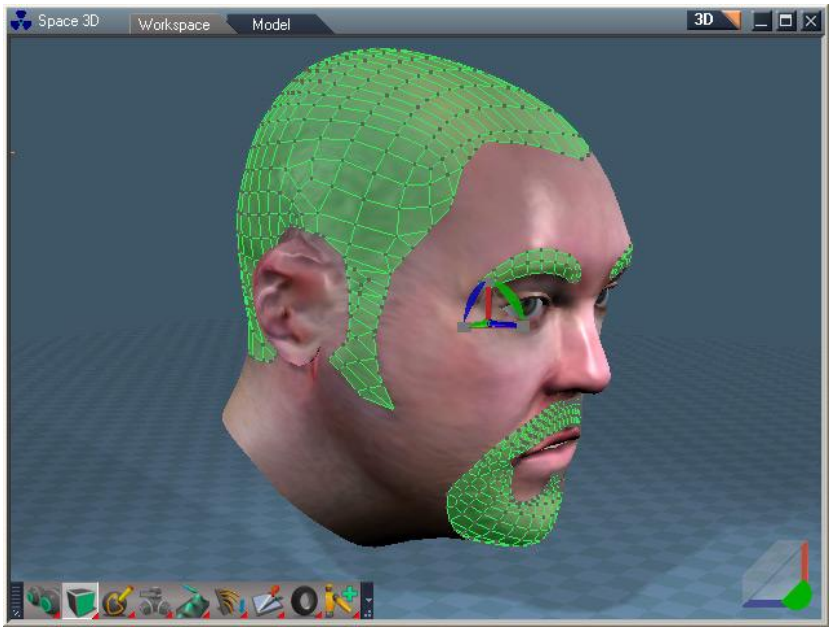
Once you have a hairstyle you are happy with, it can be saved with your scene or object, or even saved as a hairstyle in the libraries which you can then apply to other objects. This way you can build up a library of hairstyles that you can interchange between characters and objects.

On the subject of rendering hair…the Line profile in the hair control panel is best for displaying hair in the Workspace. The Circle profile will give better rendered results, particularly if you use the Lightworks render engine.

When rendering hair in Lightworks, remember that the render engine 'sees' the density as it is displayed in the Workspace Workspace. For that reason you're going to want to increase the Realtime percentage in the control panel prior to rendering. Depending on your hair object and your system resources, also experiment with decreasing the density setting and increasing the Realtime percentage.

3.9.2 Advanced Hair Generation

Once you are familiar with the basic hair tools, you may want to try different methods of hair application. One of these methods is to create a 'scalps' for applying hair to your figure. By using scalps your character can have a full head of hair, wispy beard, curly sideburns and bushy eyebrows. Also, because the scalp is an independent object, it can be further modified with the point edit tools even after hair has been applied to it.



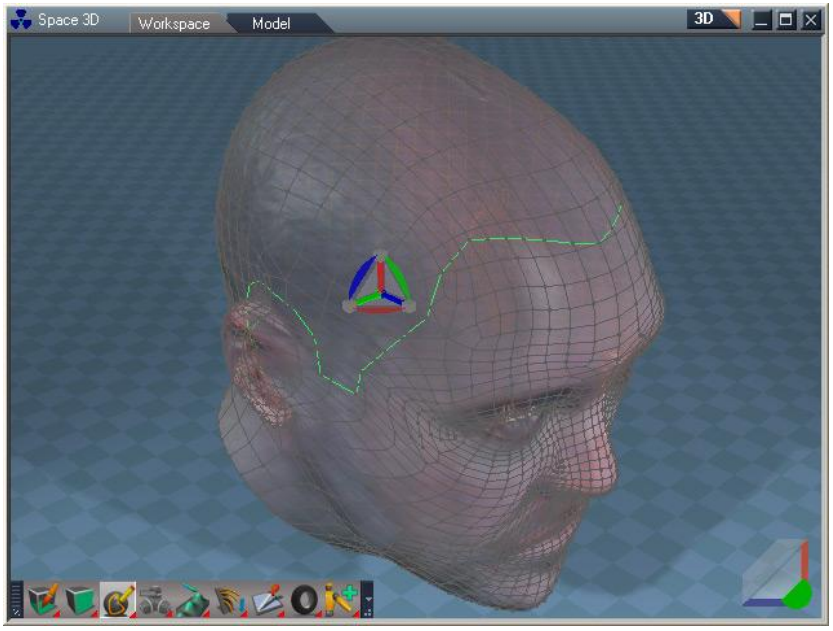
Scalp creation for the application of hair

We're going to use the point edit tools to slice off part of the head to make a new scalp object. Hair can then be applied independently to that object.

Start by saving a copy of your head to a library as an object. That's going to be our base and we're going to call it back into the scene after our new scalp is created.

Right-click on your object to enter point edit mode. Click on 'Select Nearest Element'  Next, select the Polydraw tool  to literally start drawing a scalp on your object. If your scalp uses existing edges,

you may need to right-click to exit this tool and then re-activate it to continue drawing new edges. If you make a mistake, Undo  will delete a drawn segment at a time, starting with the last-drawn segment.

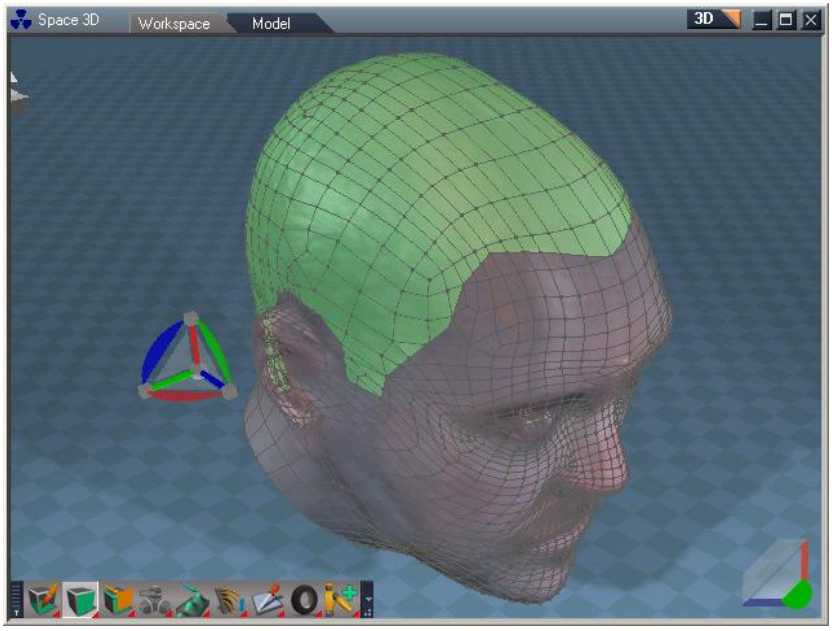


Use the Polydraw tool in point edit to draw the scalp on your object

When you've finished drawing a scalp on your object, you may want to save this copy of your object to the library in addition to the base copy you saved in the beginning.

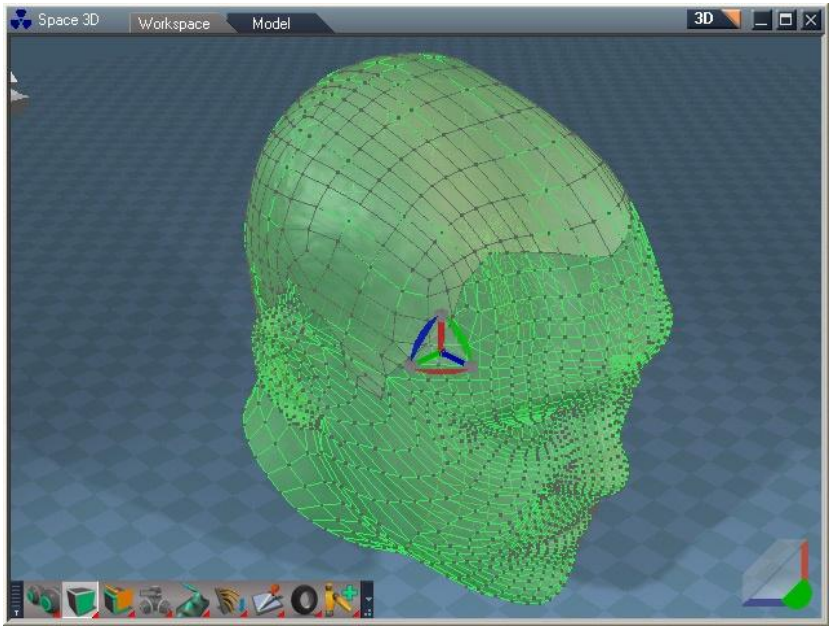
The next step is to select all the faces within the scalp that you've drawn. You may find it quickest to use the Paint Selection  tool to select the faces around the edge of the scalp and switch to the Rectangle or Lasso Selection for the broader areas. Remember that control-select adds to selection and shift-select removes from selection.

Once you have all of the faces within the scalp area selected, use the Copy tool  to copy the selected faces and right-click.



Copy the selected faces

Now we're going to separate your new scalp from the rest of the head. Select any face not within the area of the scalp. Use the Extend Selection to Connected  tool to select all the faces that are not part of your new scalp.



Select all faces that are not part of the copied scalp

Select the point-edit Delete tool  to delete these faces. Now all that remains is your new scalp. Right-click to exit point edit and give your scalp a new name in the Info Panel. Save it as an object in your library.

When you double-click the base object in the library that you originally saved, your new scalp should be a perfect fit. Also, when you render, you'll find that it already has the texture or material of the original object applied to it.

Your scalp and base object should be a perfect fit

With the scalp selected, you can click on the Blow Dryer  hair tool to automatically populate your scalp with hair and you're ready to start styling. This automatic fill does not populate the hair at the full density setting. If you decide that you want to increase the density, in specific areas or overall, you can use a broad density brush on the scalp without concern about stray hair getting on the base object.

Sometimes it's easier to work with less hair density. You can always add density later and the added hair will follow the styling that you've already done.

Populate your entire scalp with hair with a single click

Use this technique to create additional scalps for hair objects to complete your character's look.

hairTools tutorial: exploring the Hair tools in trueSpace

3.10 Modeling with Procedures

The new command-based architecture in trueSpace makes it possible to create objects procedurally – i.e. executing a series of commands that automatically create your object instead of performing modeling tasks manually. There are many advantages to defining an object procedurally:

- **Compact:** A three-line procedure can create an entire forest of trees that can be stored in a small fraction of the space that polygonal representations would require.
- **Dynamic:** You can easily add parameters (for instance "age" for an Oak tree) to a procedural object which can be animated and constrained to other variables to change the nature of an object.
- **Flexible:** You can create procedural objects in a number of ways (plugins, scripts, Link Editor structures), and you can define exactly how they work to fit the specific needs of your project.

You can create procedural objects in trueSpace via a couple of different methods. One is to use a **script object**. Script objects can define a model by creating a mesh from scratch, or by creating and attaching sub-objects (e.g. creating a series of spheres to represent a molecule). By exposing various script attributes you can let the user of your object easily change how the object is created. ConeObj, GearObj, and WavyPillar are all good examples of procedural models using only scripts. For more information on using scripting you should also read through **developer's Guide ChApter 6: sCript editor.**

You can also use **compound** objects for the task. By linking together a series of scripts and other objects in the **Link Editor**, you can create a compound object that executes a set of commands to build your procedural model. Take a look at the Tree Generator object for an example of this method.

Finally, you can modify existing objects and meshes using **scripts**. Look inside the Terrain System object for an example of this – a flat, grid mesh is modified to apply terrain height data to it, creating a hilly patch. **Vertex shaders** can also be used to procedurally modify the appearance of a model (in the DirectX Workspace view) as in the FeedTheDinoGPU example. For more information on using vertex shaders you should read through **developer's Guide ChApter 5: mAteriAl editor.**

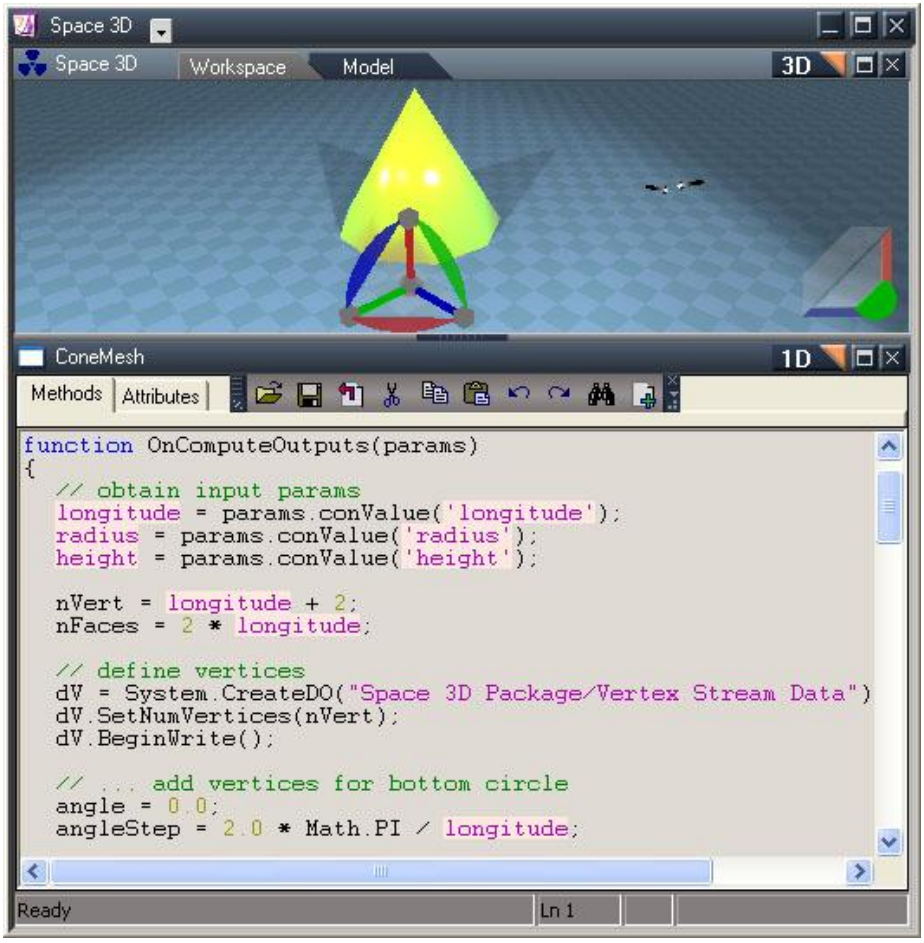
The various trueSpace libraries contain a number of examples of procedural objects, and several of these are discussed below. The best way to learn about these objects is to drag them into your scene and play with their panel controls to see how the changes affect the final model. When you are ready to go further with procedurally creating or modifying objects, you can try changing the scripts and structures of the example objects, and then move on to creating your own from scratch.

ConeObj – Script-Generated Mesh

The ConeObj is a procedural model that uses a script object to create a 3D representation of a cone. The object is located in the Objects library under Script Objects. To examine it, drag it into the Link Editor or into the Workspace view.

If you want to see how the three sliders affect the creation of the model, just move them left and right and observe the result. Changing the **Height** slider, not surprisingly, makes the cone taller. Similarly, moving the

Radius slider changes the size of the cone's base. The **Longitude** slider adds more points, and thus more detail, around the base of the object. The more points you add, the smoother the cone appears.

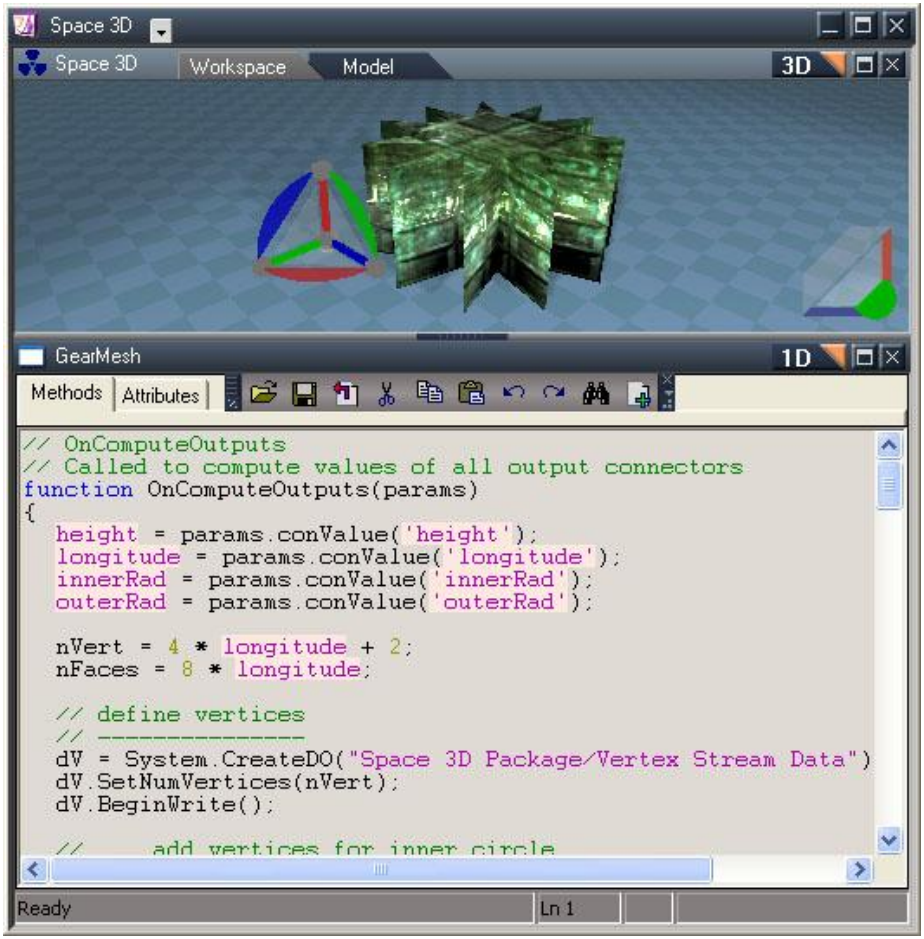


Objects – Script objects library: ConeMesh script is located inside the ConeObj

The inner-workings of ConeObj are explored more fully in **developer's Guide ChApter 6: sCript editor** if you would like to try your hand at modifying the script that creates the cone mesh.

GearObj – Script-Generated Mesh

The GearObj works in much the same way as the ConeObj – using a script object to create a mesh from scratch. It is located in the Objects library under Script Objects alongside ConeObj. Drag it into the Workspace view or the Link Editor to see its panel and the resulting model (shown in the image below).



Objects – Script objects library: GearObj shown in Workspace view and the Script Editor

Here the script writer has exposed four attributes and linked them to sliders on the object's outer panel. Changing the **Height** slider, of course, alters the height of the model. The **Inner** and **Outer Radius** sliders change the overall size of the gear and the depth of its teeth. If you move the **Inner Radius** slider to near the same value as **Outer Radius**, you will see that the teeth shrink to nothing.

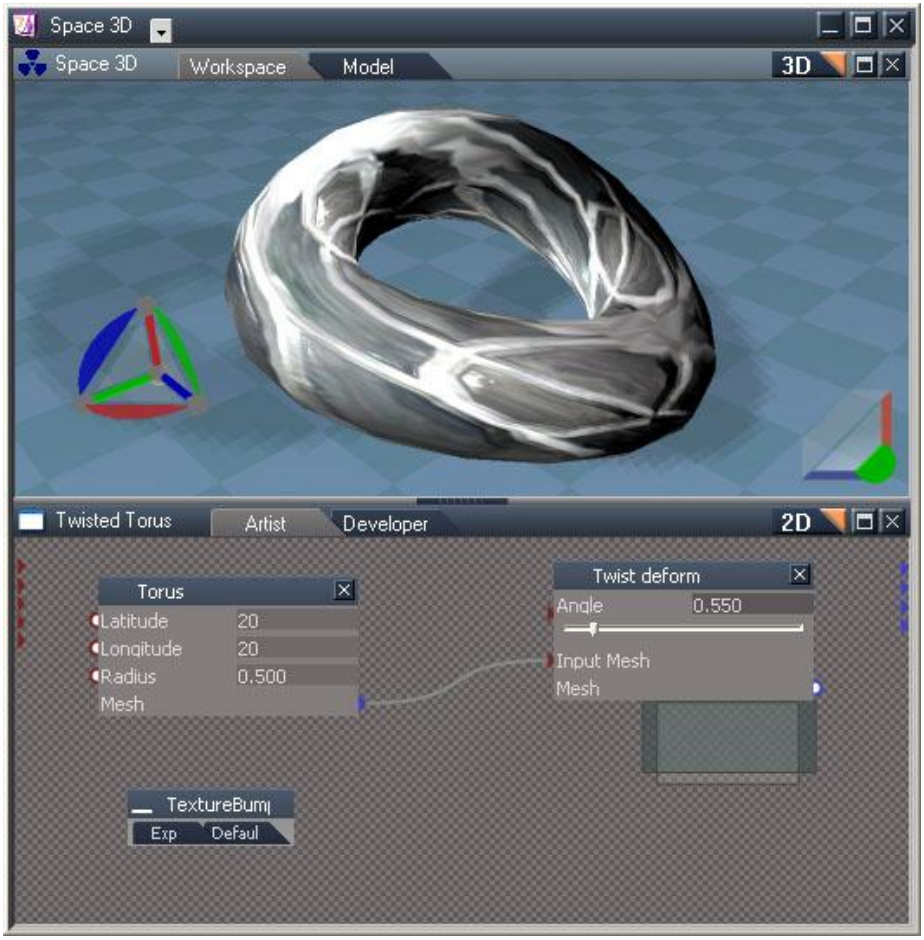
As with the ConeObj, changing the value of the **Longitude** slider alters the number of points along the outer radius of the gear. Since these are used to define the teeth of the gear, increasing Longitude results in more teeth around the gear model.

If you would like to try modifying the way the gear is constructed you should read through the details of how the script in ConeObj works (see **developer's Guide ChApter 6: sCript editor**) to get an idea of how this object is being

created. The principles are the same. Using ConeObj, GearObj, and other objects from the library as examples, you can explore ways to build your own from-scratch meshes using Script Objects in trueSpace.

Twist Deform – Mesh Modifier

The Twist Deform object is a mesh modifier object. It takes an input mesh and outputs a new, modified mesh object. You can see it at work by dragging in the Twisted Torus object from the Objects library under Base. If you enter Twisted Torus you should see something like the image below, with the Torus mesh feeding through the Twist Deform object and emerging modified from the other side.



Twisted Torus shown in Workspace view and the Link Editor

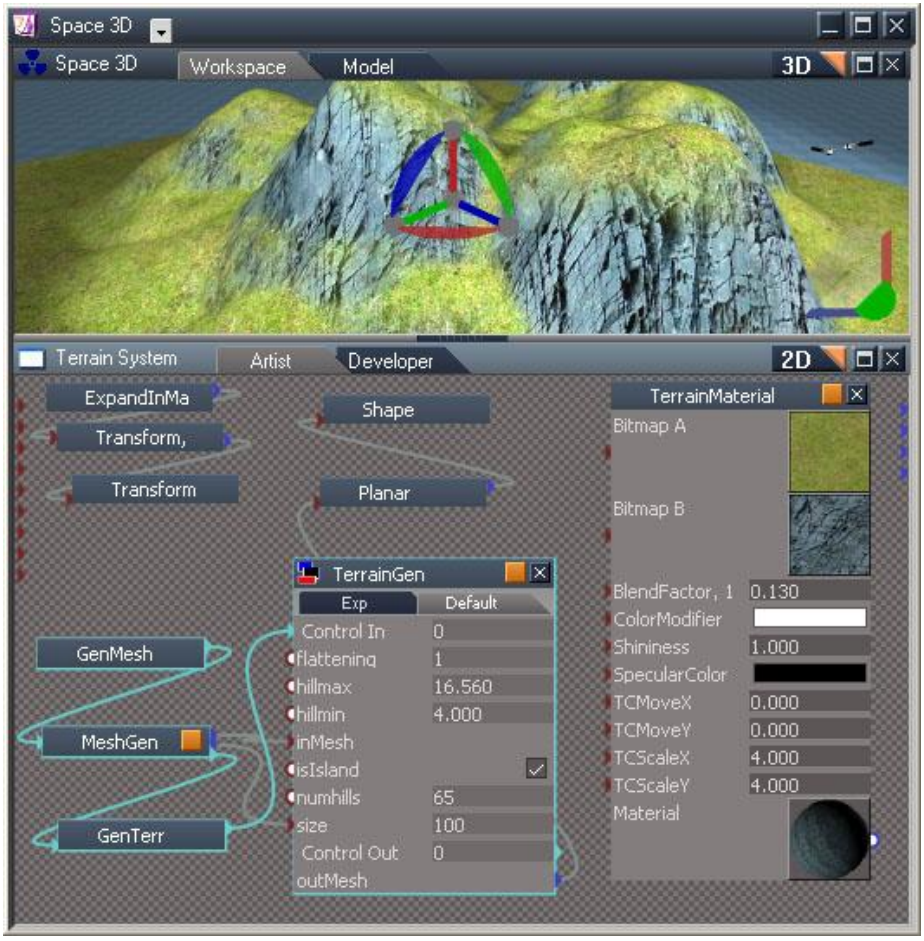
The Twist Deform object itself can be found in the Objects library under Tutorial Objects. You can add it to any object that exports a Mesh attribute. In the case of Twisted Torus, the object exports the Angle attribute from

the Twist Deform object, allowing the user of Twisted Torus to change it easily.

Twist Deform is a **compiled** object, meaning that you cannot change how it works internally. The object provides you with access to its Angle attribute, letting you change how much the mesh is twisted. To see an object that modifies a mesh with a script, read through the next section about the Terrain System object.

Terrain System – Script-Modified Mesh

This object generates a textured terrain patch procedurally. To examine this object, locate it in the Object libraries under Script Objects then drag it into the Link Editor or Workspace view. After the object initializes, you should see in the Workspace window a terrain like the image below.



TerrainGen modifies a flat grid mesh with height data from the terrain algorithm

Terrain generation is accomplished with an algorithm adapted from Bob Nystrom (http://www.robot-frog.com/3d/index.html). The algorithm iteratively places "hill" objects on a flat terrain (picture dropping balls of soft clay on a board), effectively building up a soft, rolling terrain. Following generation of hills, the terrain is iteratively flattened and then normalized to scale the heights to a range of 0 to 1.

Functionally, it is built with two JScript Script Command objects. One creates a flat grid mesh of a specified size, while the other calculates the terrain data and then alters the original mesh by moving its vertices upward according to the terrain data. You could change the effect of this object by editing the script that generates the data. For instance, you could substitute an algorithm to simulate ripples in a pool.

The features of the terrain are controlled by the control panel in the Default aspect (shown below).

The following parameters and commands are available:

- **Size:** This slider allows you to resize the terrain mesh between 10 and 100 divisions in the X and Y axes. A mesh that has 10 divisions will take up 10x10 units in world space. After changing the slider you should select the **Make/Remake Mesh** button.
- **Make/Remake Mesh:** This button recreates the terrain mesh with the number of divisions chosen with the Size slider. Following mesh construction this command will call a routine to regenerate the terrain data for the new size.
- **Hills:** This slider changes the number of hills that will be added to the terrain. The value can range from 10 to 400.
- **Hill Min Size:** This slider changes the minimum size of generated hills. The value can range from 4.0 to 15.0.
- **Hill Max Size:** This slider changes the maximum size of generated hills. The value can range from 16.0 to 30.0.

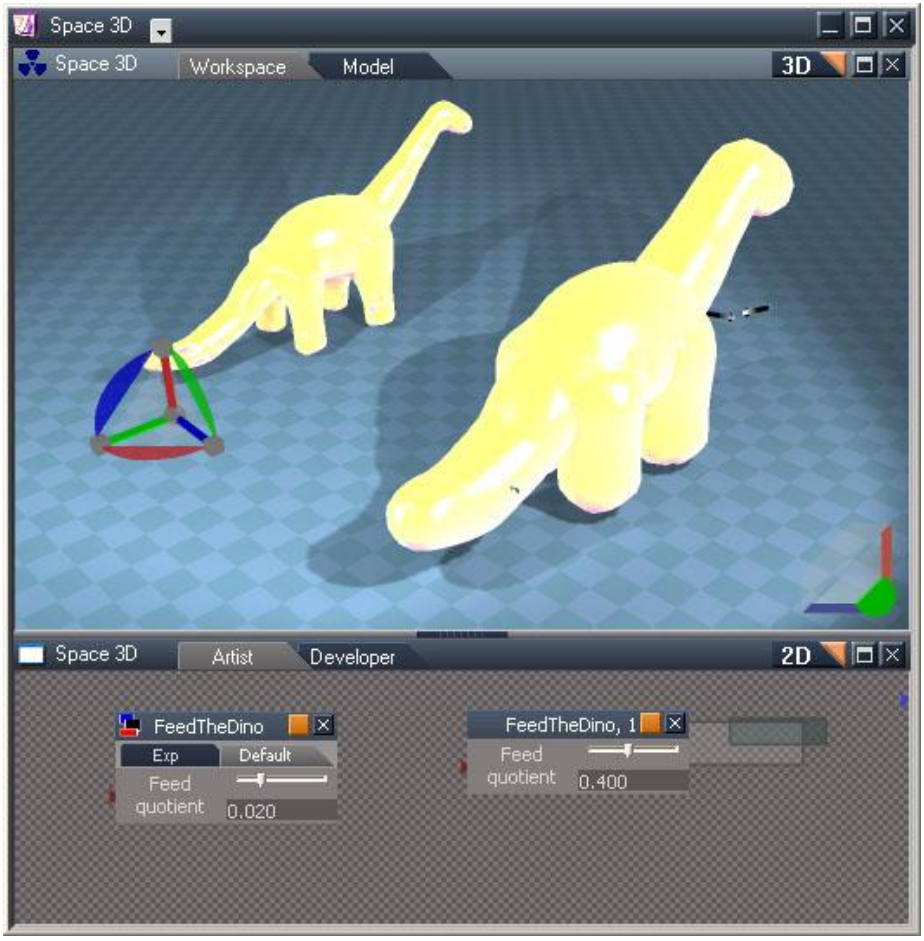
- **Make Island:** Checking this option will confine hill generation to the center area of the terrain mesh, resulting in an island-style terrain.
- **Flattening:** This slider changes the number of "flattening loops" executed by the terrain generation script. Low-lying terrain areas will become flatter, resulting in more distinct hill forms surrounded by low terrain. The value can range from 1 to 10.
- **Z Scale:** This slider simply changes the Z scaling of the final terrain object. Low settings result in flatter terrain. The value can range from 1.0 to 20.0.
- **Generate Terrain:** This button regenerates only terrain data – the mesh is not altered otherwise. Select the Generate Terrain button to see the results of any options changes.

Also included in this object is an adapted version of the Layered Plastic material that interpolates between two bitmaps (grass and rock are included but can be changed) based on the surface normal of the terrain. Normals pointing upward result in grass, and normals pointing "to the side" result in rock texture. Normals in between these directions result in an appropriate blending between grass and rock.

Other terrain generation algorithms or height map interpretation could be substituted for the included method. To do this, alter the TerrainGen JScript object or replace it entirely with an object that reads in a greyscale bitmap and alters the Z component of the input mesh appropriately. Similarly, the included material could be modified to blend between additional textures or perform other processing based on altitude and surface normal. Textures can be changed quite simply by double-clicking on the bitmap image.

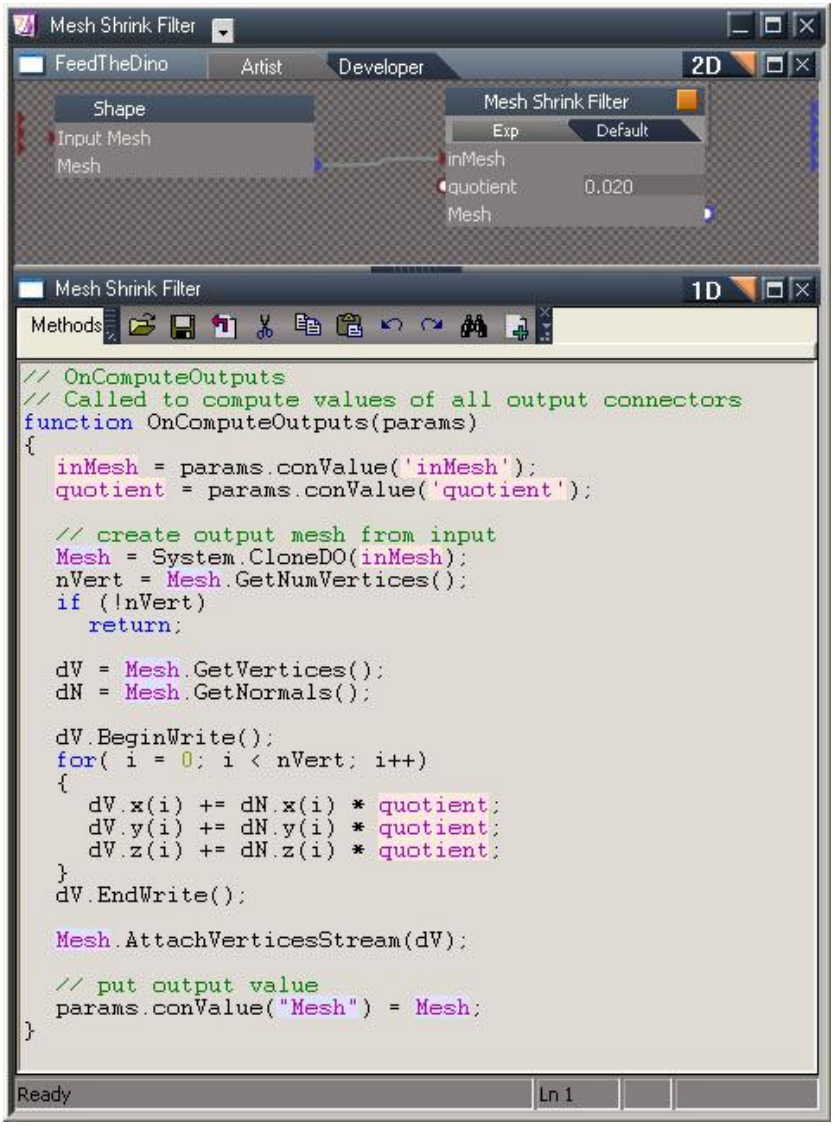
FeedTheDino – Script-Modified Mesh

The FeedTheDino object, also located in the Objects library under Script Objects, is another example of a script-modified mesh, this time using an input number (Feed quotient) to move the mesh's vertices along the surface normal at that point. To examine the object, drag it from the library into the Link Editor or the Workspace view. You should see something close to the image below.



FeedTheDino modifies a mesh by moving its vertices along its surface normals

This object has a slider labeled Feed Quotient on its front panel. Change the slider to see how the object's script reacts. You should see the dinosaur grow skinnier as you move the slider left and fatter as you move it right. To see how it works, enter it by clicking on its orange enter triangle at the upper right of the panel. You should be able to locate two linked objects: Shape, which is the dinosaur mesh, and a script object called Mesh Shrink Filter. These are shown in the image below.



Shape is the dinosaur mesh, and Mesh Shrink Filter Is a script that modifies it

If you examine the script inside Mesh Shrink Filter you will see how the object accomplishes its magic. In short, the script gets a list of vertices and normals for the mesh, and then processes each of those vertices by moving them along their normals by an amount equal to the attribute quotient, which is exported to the front panel as the Feed Quotient slider.

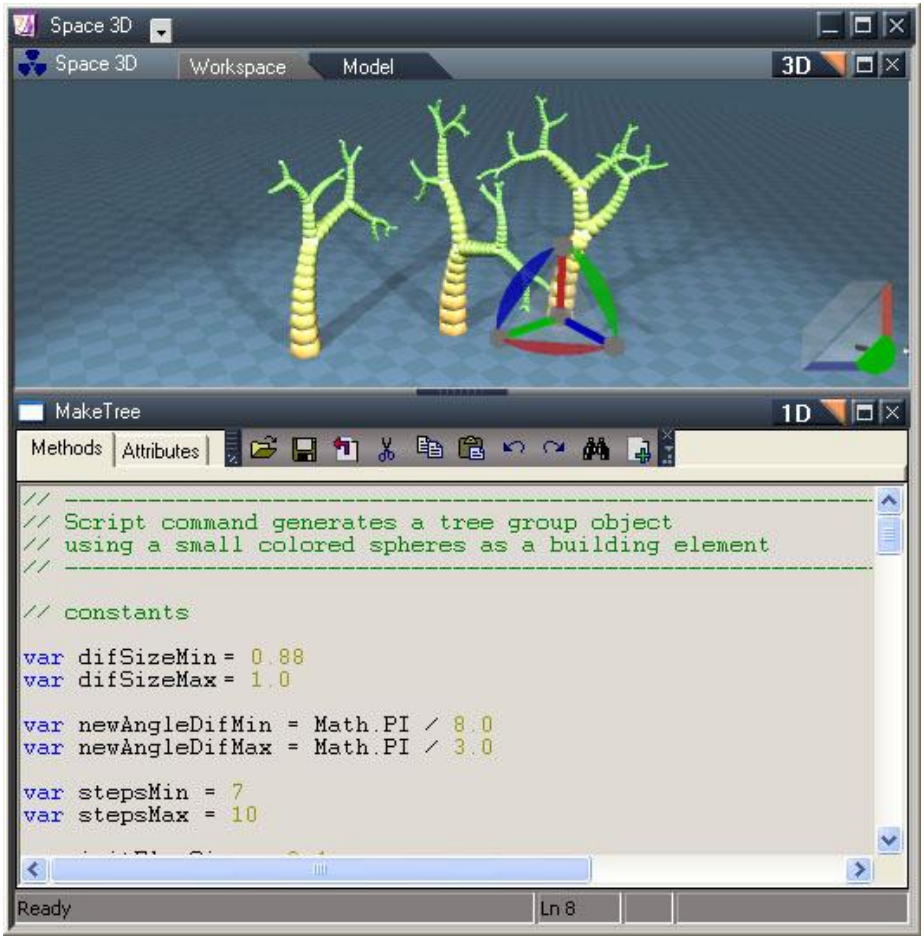
MakeTree – Script-Generated Group
The MakeTree demo produces nicely colored and shaped tree objects. Trees are generated by using a random fractal technique, so each time you run the generator the final tree object will be different.

After pressing the "Make one tree" button, you may have to wait a little while for the tree to be generated. (It can take more than 10 seconds depending on your machine and the parameters, so please be patient.) The final tree object is placed in a separate encapsulator in the scene called Tree object (unlike for the Terrain generator demo, where the terrain object is placed inside the main object). To generate another tree object, press the "Make one tree" button again.

When you enter the generated Tree object using the LE, you can see many (several hundreds) sphere elements placed here, as the tree consists of small spheres

The MakeTree object's panel allows you to change generator's parameters. The following parameters are available:

- **Complexity of the tree:** This slider allows you to set the complexity of the tree. Higher values mean more complex results, but also more time required to generate the tree.
- **Root color / Leaves color:** Allow you to change the colors used for the entire tree.



Several instances of tree, created by MakeTree script object

Also see the Make Crystal and Cube Array generators. They use similar techniques to a generate crystal-like molecular structure, and a simple array of given elements.

3.11 Flatten History

The location of the Flatten History tool

The Flatten History tool is used to remove any construction history and procedural modeling, giving a final polygonal mesh. Note that Undo History remains in place even after using this tool, however it will affect procedural modeling techniques such as those described in the last chapter.

Note – when using Export to X format, or Export to Virtual Earth, you do not need to use Flatten History prior to export. The export process only works with the final geometry, ensuring compatibility with the export without the need to actually flatten the object first. This lets you export to X format or Virtual Earth, getting the expected final geometry in the exported file, while keeping your object in a procedural state for further work in trueSpace.

The Flatten History tool is useful for when you want to move onto a particular kind of modeling that you can't do while the object is procedural, for reducing file size on disk or in a library where you only need to store the final polygonal geometry, and for reducing upload and download sizes for objects in shared spaces.

Here are the main cases where you might want to use the Flatten History tool:

- **Finalizing SDS** – If you require a regular polygonal mesh rather than an active SDS mesh, using Flatten History will remove all SDS layers and leave the final smoothed mesh. This means you can no longer use Remove SDS layer, or edit the underlying control cage.

  Note that for objects in a shared space, this could result in a larger object that will take longer to upload and download. An SDS object only needs to send the underlying control cage geometry, plus SDS information, which is usually less data than describing the full polygonal geometry of the final smoothed mesh.

- **Finalizing Mirror Modeling** – If you have used the Mirror Modeler and are happy with the result and want to produce a final polygonal mesh, then Flatten History will remove the active mirroring and leave one object made from the two original halves. Using the tool means that Mirror Modeling will no longer

apply, and each half of the model can be - and indeed has to be - modified separately.

Note that for objects in a shared space, this could result in a larger object that will take longer to upload and download. A Mirror Model object only needs to send one half of the geometry plus the mirroring set up, which will be less data than describing the full polygonal geometry of the final mesh. The more levels of Mirror Modeling that are applied, the more significant this difference becomes.

- **Finalizing Procedural Modeling** – if you have used a procedural object and are happy with the result and want to produce a final polygonal mesh, the Flatten History tool will create the final mesh, and remove all procedural / scripting nodes from inside the object. The tool does not remove any interface for the procedural object, so sliders and values may still be present in the object's Link Editor panel – hwoever, these values will do nothing, and you will not be able to change the object using them, since the procedural parts of the object will have been removed.

  Here the tool will most likely simplify the object for use in shared space, depending on just what the object was. With most procedural objects, the geometry remains the same, but the new finalized version will be smaller in terms of its data as it will no longer have the scripting and procedural parts inside it.

- **Finalizing Booleans** –Booleans on the workspace side are procedural and can be changed even after carrying out the Boolean. If you are happy with the result and want to produce a final polygonal mesh from a Boolean operation, the Flatten History tool will achieve this. This should reduce the size of an object for use in shared space, since it will store only the final geometry and not all the separate geometries used to carry out the Boolean.

- **Finalizing Mesh Simplifier / Normal Mapping** – Both these tools are procedural and keep a copy of the high polygon count version of the object. If you are happy with the result and will no longer want to change it, the Flatten History tool will remove the high polygon copy. This is useful before including the object in a shared space.

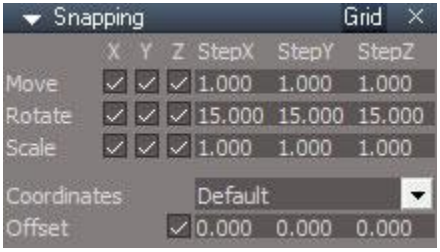
3.12 Snapping and Distance Tools

The location of the snapping tools

3.12.1 Grid Snapping

Grid Snapping lets you control whether edits to an object's position, rotation or size happen smoothly, or whether they snap to preset values and amounts.

By default, movement will allow smooth movement through space, but will snap to a value when that value is approached. Rotation and Scale however will not allow smooth movement between snap values, and instead will simply jump from one snap value to another when the mouse is moved far enough.



The Grid Snapping options panel.

- **Move** – Checkboxes and values control whether or not Move edits are affected by snapping.
- **Rotate** – Checkboxes and values control whether or not Rotate edits are affected by snapping.
- **Scale** – Checkboxes and values control whether or not Scale edits are affected by snapping.
- **X, Y, Z** – These checkboxes control whether snapping affects the edit in the X, Y and / or Z directions. These can be set independently for the Move, Rotate and Scale tools.
- **StepX, StepY, StepZ** – These parameters control the value that the tools will snap to. For movement and scale, these are distance values, while for rotation these are angles in degrees.
- **Coordinates** – This controls the coordinates used for snapping.
  Default – The snapping is based on the current settings for trueSpace – if you are working in World

mode, then the snapping will be to the World grid; if you are working in Object mode, snapping will be to a grid aligned with the object.
Local – Ignores current settings in trueSpace, and orients snapping to a grid aligned with the object (even if trueSpace is set to use World co-ordinates).
World - Ignores current settings in trueSpace, and orients snapping to a grid aligned with the world (even if trueSpace is set to use Object co-ordinates).

- **Offset** – When unchecked, the object will snap to settings based on its current position, rotation or scale. For example, if it starts at an X value of 1.5 with a StepX of 1, the object will snap to 2.5, 3.5, etc, or 0.5, -0.5, etc. The object will always snap relative to its initial position, rotation or scale.

  When checked, the object will snap to settings based on a world grid, independent of its own current position, rotation or scale. In our previous example, the object starting at an X value of 1.5 and a StepX of 1 and a default Offset value in X of 0.000 will snap to values of 2, 3, 4 etc, or 1, 0, -1. The object will always snap to these preset values, regardless of its initial position, rotation or scale.

  The offset parameters let you change where the object snaps to by offsetting the origin for the world snap values. These values only apply when Offset is checked. For example, with a StepX of 5, and an Offset X value of 0, the object will snap to -10, -5, 0, 5, 10, etc. With StepX of 5and an Offset X value of 1, the object will snap to -9, -4, 1, 6, 11, etc – the grid the object snaps to has been moved by 1. If the Offset X value was changed to 2, then the object would snap to -8, -3, 2, 7, 12 etc, and so on.

3.12.2 Other Snapping Options

The Snapping panel has other aspects that let you control other options for snapping. These are listed below (except Dimensions, which is listed under the Distance Feedback Display section).

Default Aspect

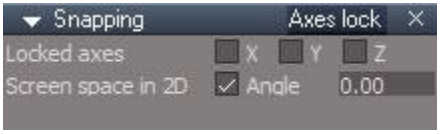
This lets you enable and disable the three snapping types directly, as an option to using the icons on the main toolbar. Using the toolbar icons will change the checkboxes on this panel, and using the checkboxes on this panel will highlight or de-highlight the icons. You can enable or disable any or all of these at one time.

The Default aspect of the Snapping options panel.

- **Grid Snapping** – If checked, Grid Snapping is enabled, otherwise it is disabled.
- **Distance Feedback** – If checked, Distance Feedback Display is enabled, otherwise it is disabled.
- **Point Edit Snapping** – If checked, Point Edit Snapping is enabled, otherwise it is disabled.

Axes Lock Aspect

This lets you lock out movement in certain directions, and control movement in the orthogonal views. Note that these settings affect movement even when Grid Snap is NOT enabled.

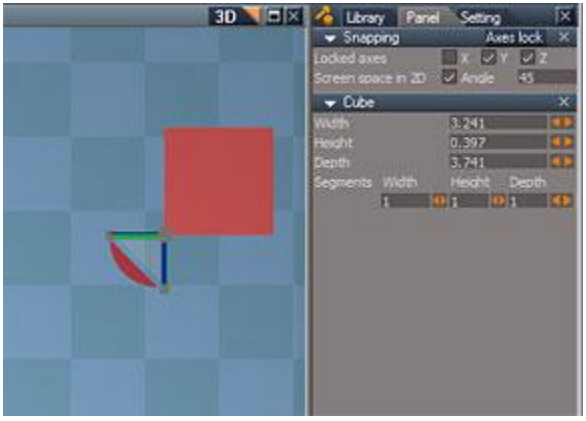


The Axes Lock aspect of the Snapping options panel.

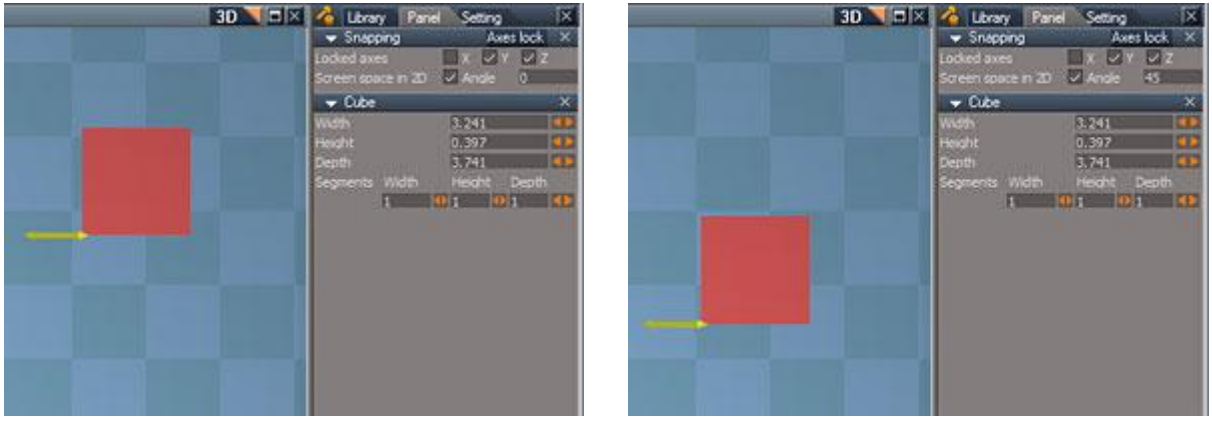
- **Locked Axes** – This locks changes in the X, Y or Z directions, and is the same as activating or deactivating the X, Y and Z locks on the main toolbar. Activating or deactivating these checkboxes will highlight or un-highlight the icon on the main toolbar, and using the icons on the main toolbar will check or un-check these parameters.

- **Screen Space in 2D** – This has an effect in the orthogonal views (top, front, side) only. When unchecked, the X and Y constraints apply to the world X and Y, meaning you may not be able to move the object in the X direction on screen from the angle you are looking at even if the constraint for X is not checked. When checked, then the X and Y constraints apply to the on-screen X and Y, irrespective of world X and Y, so that you would be able to move the object in the X direction on screen if it is not locked, even if that is the Y or Z direction in World space.

- **Angle** – When Screen Space In 2D is checked, this allows you to rotate the axis by an angle so that movement along an axis occurs at that angle.



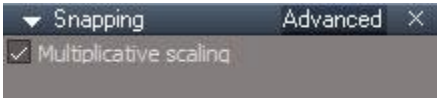
A cube viewed from the Top view, ready to move. Screen Space In 2D is checked, and all movement is constrained except along the X axis.



With an Angle of 0, movement occurs directly along the screen X axis, irrespective of what direction this might be in the World axis (left). By setting the Angle to 45, clicking on the X movement are of the widget this time moves the object along a line rotated 45 degrees (right).

Advanced Aspect

This aspect lets you control snapping with the Scale tool.



The Advanced aspect of the Snapping options panel.

- **Multiplicative Scaling** – When checked, a scale value of 1 will double the size of the object when scaling up, or halve the size of the object when scaling down. So an object with size 1 will scale in jumps to size 2, 4, 8, etc, or 0.5, 0.25, 0.125, etc. A scale value of 2 will make the object treble in size if scaling up, or become one third the size on scaling down, so an object with size 1 will scale in jumps to size 3, 9, 27, etc, or 0.333, 0.111, 0.037, etc. Similarly a scale value of 3 makes the object jump in steps four times the size, or one quarter the size, and so on.

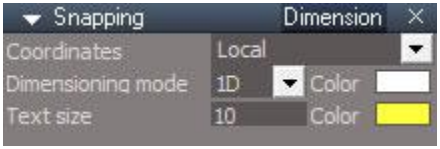
  When unchecked, with a scale of 1 an object will scale upward by one of its current size. So an object of size 1 will scale in jumps to 2, 3, 4, etc, while one of size 2 will scale in jumps from 2 to 4, 6, 8, and so on. With a scale value of 2, it would scale in jumps to 3, 5, 7, etc. When scaling down, the denominator of the fraction increases by the scale value, so with a scale value of 1, the object will scale to one half, one third, one quarter, one fifth, and so on; with a scale value of 2, the object will become on half, one quarter, one sixth, one eighth and so on.

  One important thing to note is that the scaling is dependent on the original size of the object when Multiplicative Scaling is disabled, so stopping and starting a scale operation has a different effect than carrying on through the snapping in one go. For example, an object of size 2 with a scale of 1 will scale upward to 4 on one step. If you keep the mouse button pressed and move to the next snap, the object will be size 6, the original size of 2 being added once again to the size of the object. However, if you release the mouse button at size 4 and then scale upward, the next snapping point will be 8 rather than 6, as the scaling is now adding 4 per step, the original size of the object when the scaling operation was started.

  When Multiplicative Scaling is checked, stopping and starting the scale operation does not have this effect.

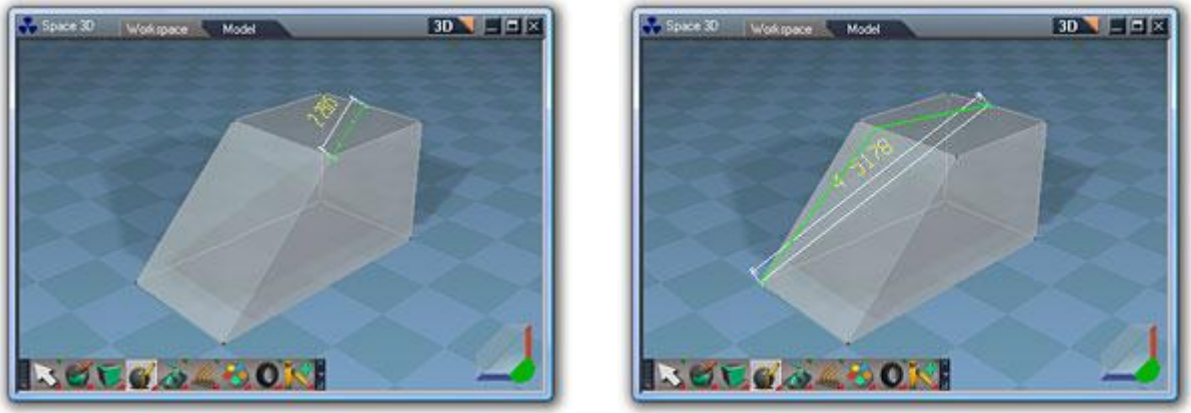
3.12.3 Distance Feedback Display

When enabled, Distance Feedback Display will show a numeric value in the 3D space for all relevant Point Editing operations. For example, if sweeping a face, it will give real-numeric time feedback showing how far the face is being swept, or if drawing an edge, the length of that edge, etc.



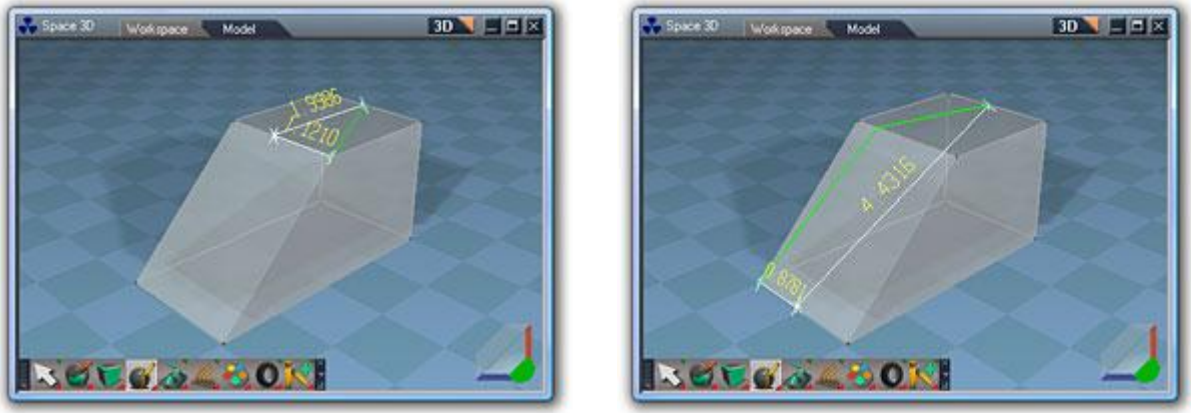
The Dimension aspect of the Snapping options panel.

- **Coordinates** –
  Default – This takes the axis from the current trueSpace setting, showing measurements in respect to either the World or Object co-ordinate system depending on what is currently in use.
  Local – This overrides the current trueSpace setting, showing measurements in respect to the Object co-ordinate system (even if trueSpace is currently set to use the World co-ordinate system).
  World - This overrides the current trueSpace setting, showing measurements in respect to the World co-ordinate system (even if trueSpace is currently set to use the Object co-ordinate system).
- **Dimensioning Mode** – This parameter has a drop down list, and controls what measures are shown by the Distance Feedback Display. The examples below show the tool in use with the Add Edges tool.
  1D: This shows one measurement only, the straight line distance between two points. In our example with Add Edges, this is the straight line distance between the initial point and the final point for the edge. If the edge is drawn on a flat face, this will be the length of the line itself. If the edge is drawn across faces, it will be the straight line through space between the start and end point.



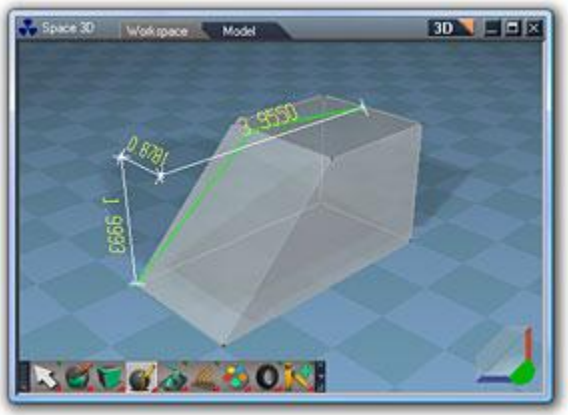
In 1D mode, the dimension tool shows the distance between the start and end point. Across one face, this is the same as the length of the new edge (left). Across multiple faces, the straight line distance between the two points may not follow the new edges that are added (right).

***2D*:** This shows measurement in two directions.



In 2D mode, the dimension tool shows 2D vectors between the start and end point, with results shown above adding an edge across one face (left) or multiple faces (right).

3D: This shows measurement in all three dimensions.

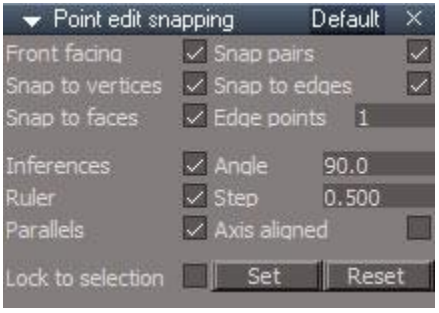


In 3D mode, the dimension tool shows 3D vectors between the start and end point. Across one face, the result is the same as 2D mode, so this is not shown. Across multiple faces it gives separate X, Y and Z value as seen above.

- **Color** – This upper color value controls the color of the lines.
- **Text Size** – This parameter lets you adjust the size of the text. This is particularly useful to compensate for being zoomed in close, or zoomed out far away.
- **Color** – This lower color value controls the color of the text.

3.12.4 Point Edit Snapping

Point Edit Snapping works when in Point Edit mode, and allows snapping when you are moving vertices, adding edges and loops, etc.



The Default aspect of the Point Edit Snapping options panel.

- **Front Facing** – Controls whether snapping is only done to front facing edges and faces (note that Snap To Vertices will be unaffected by this setting). When checked, snapping will only be to front facing elements, limiting snapping to visible elements facing the camera. When un-checked, snapping will work on elements that are not facing the current view, allowing snapping to faces and edges to apply to back faces on an object, etc.

- **Snap Pairs** – This parameter takes effect when you are working with selections of more than one element. If this is checked, then snapping occurs when any of the vertices in that selection gets close to a snapping point. If this is unchecked, then snapping only occurs when the widget for the selection gets close to a snapping point.

  An example is shown below. Note that for visibility, snapping is being done to an existing edge. In this case, this produces overlapping and invalid geometry, and the example is only shown for the visibility of the different snapping – most likely you would not want to overlap your geometry in this way!

The initial set up has four vertices selected for moving (left). With Snap Pairs disabled, only the widget will snap, as can be seen clearly when we cross over the existing edge – the first two vertices do not cause a snap, only when the widget nears the snapping point does snapping take place (right).

When Snap Pairs is enabled, the vertices themselves snap to the edge, resulting in two different snaps. The first occurs when the first set of vertices near the snapping point (left), and then the selection snaps again when the other vertices near the snapping point (right).

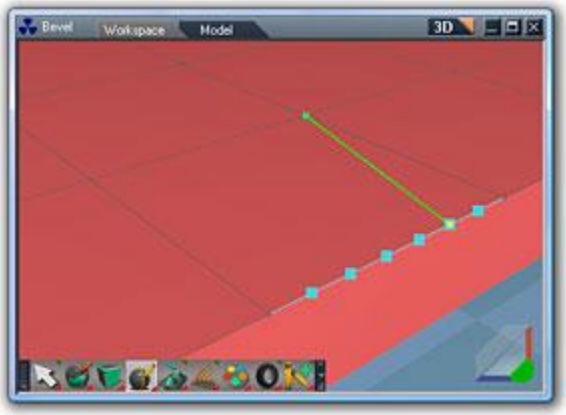
- **Snap To Vertices** – When checked, snapping will occur to nearby vertices. When un-checked, nearby vertices are ignored and will not cause snapping. Note that Snap To Vertices is not affected by the Front Facing flag, and when enabled will always allow snapping to vertices on the back of an object.

- **Snap To Edges** – When checked, snapping will occur to nearby edges. When un-checked, nearby edges are ignored and will not cause snapping. Snapping to edges on the back of an object will only occur if Front Facing is un-checked.

- **Snap To Faces** – When checked, snapping will occur to nearby faces. When un-checked, nearby faces are ignored and will not cause snapping. Snapping to faces on the back of an object will only occur if Front Facing is un-checked.

- **Edge Points** – When snapping to an edge, trueSpace will create a certain number of anchor points that divide that edge evenly. This parameter controls how many such points should be created along an edge. The default value of 1 will create 1 such point, which will be exactly in the center of the edge. A value of 2 will create two such points, dividing the edge into thirds, and so on. This is the same parameter as listed under the Vertex aspect, a change in either location will update the other parameter.

With Edge Points set to a value of 1, Edge Snapping will snap to a point that divides the edge exactly in half (left). With a value of 2, the edge is divided with two points, giving snapping points that split the edge into thirds (right).

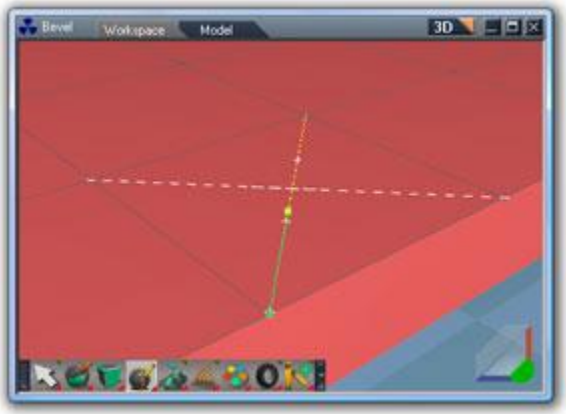


With Edge Points set to value of 6, the edge is divided into 7 equal sections, with 6 snapping points.

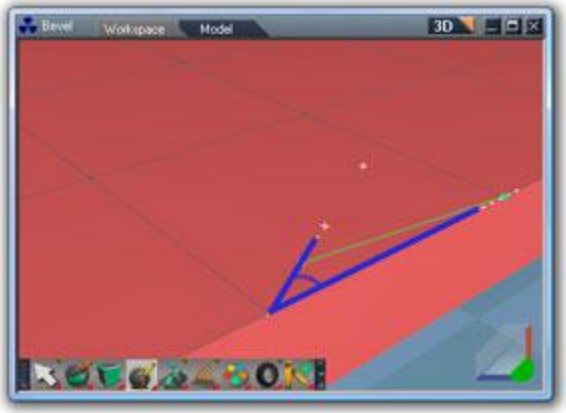
- **Inferences** – If checked, then inference lines will be shown and snapped to during Point Edit operations. Inference lines are extended from existing vertices on a face, at an angle from the incoming edges to that vertex. The angle is set by the Angle parameter. For most angles, most vertices will create two inference lines, one such line for each edge coming in to the vertex. If un-checked, then no inference lines are drawn or snapped to.

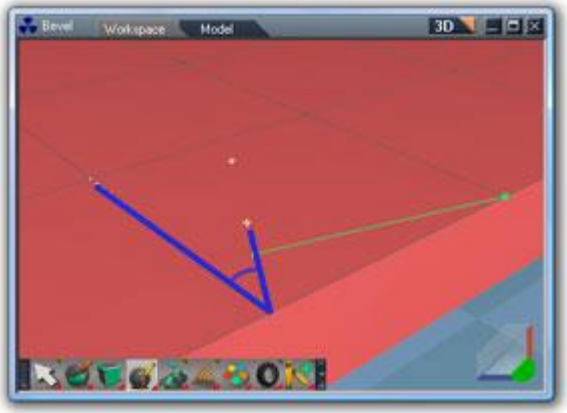
  This is the same parameter as shown on the Inferences aspect – changing the parameter in either aspect will change it in the other.

- **Angle** – This controls the angle between an existing edge coming into a vertex and the inference line coming out of the vertex.



With an angle of 45 degrees, and a face that is a perfect square, each vertex has only one inference line (and they meet in the center of the face).





With an angle of 30, each vertex now produces two inference lines. The angles have been drawn into the above images in blue, showing how the inference line is drawn at an angle of 30 to the edge coming into the vertex. With two edges coming into this vertex, there are two possible inference lines from it.

This is the same parameter as Angle Steps in the Inference aspect – changing the parameter in either aspect will change it in the other.

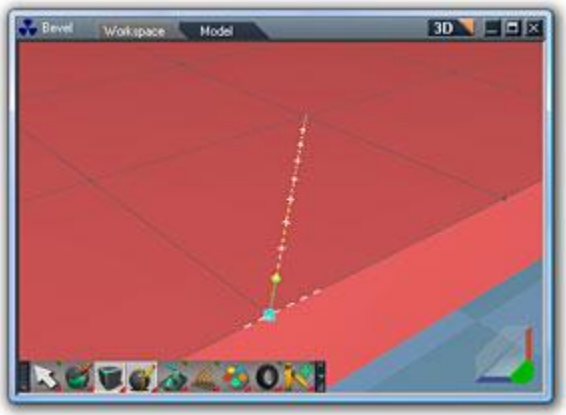
- **Ruler** – If checked, the inference lines will have snap points marked on them (the distance between these

snap points is determined by the Step parameter). If unchecked, the inference lines will not have snap points along their length.

This is the same parameter as shown on the Inference aspect – changing the parameter in either aspect will change it in the other.

With Ruler unchecked, inference lines do not have snapping points on them (left). With Ruler checked, then inference lines are divided up with snapping points along their length (right); the distance between the snapping points is determined by the Step parameter.

- **Step** – Inference lines created by Inferences, Parallels and Axis Aligned settings are divided along their length with specific points to snap to. This lets you snap not only to the line, but to specific measurements along that line. The Step value controls the distance between these points, so a smaller value will give more points along the inference lines which will be closer together, and a larger value will give fewer points along the inference lines which will be further apart.



A Step of 0.2 creates snapping points every 0.2 apart along the inference line.

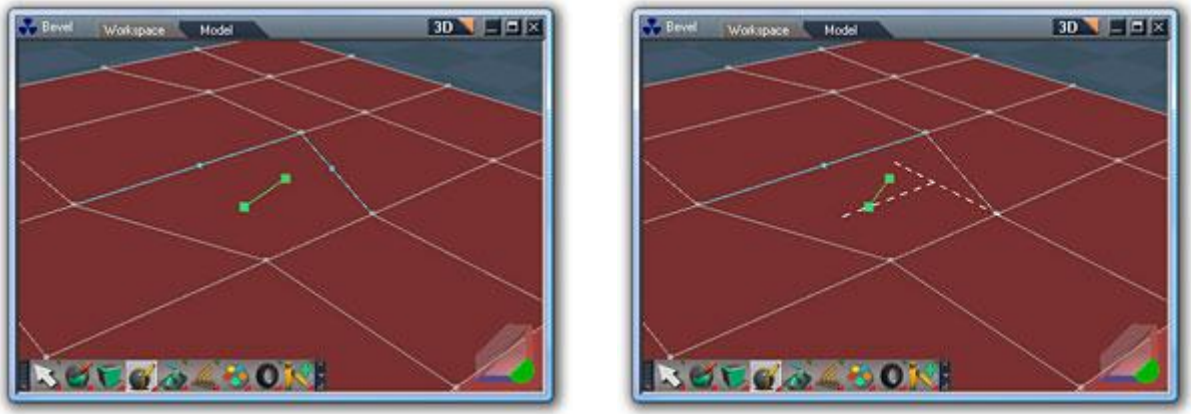
With a Step of 0.4, the snapping points are spaced out further apart along the inference line (left), and a Step of 0.7 gives even fewer snapping points due to the larger distance between them (right).

This is the same parameter as shown in the Inference aspect – changing the parameter in either aspect will change it in the other.

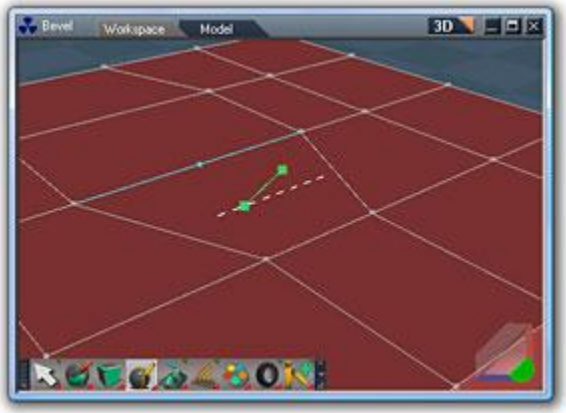
- **Parallels** – If checked, inference-like lines are drawn from a vertex parallel to the edges of the face. Point Edit operations will snap to these lines. Note that if the edges on the face are not parallel to each other, then you will see two parallels generated one parallel to one edge, one parallel to the other.

This is the same parameter as Parallels on the Inference aspect – changing the parameter in either aspect will change it in the other.

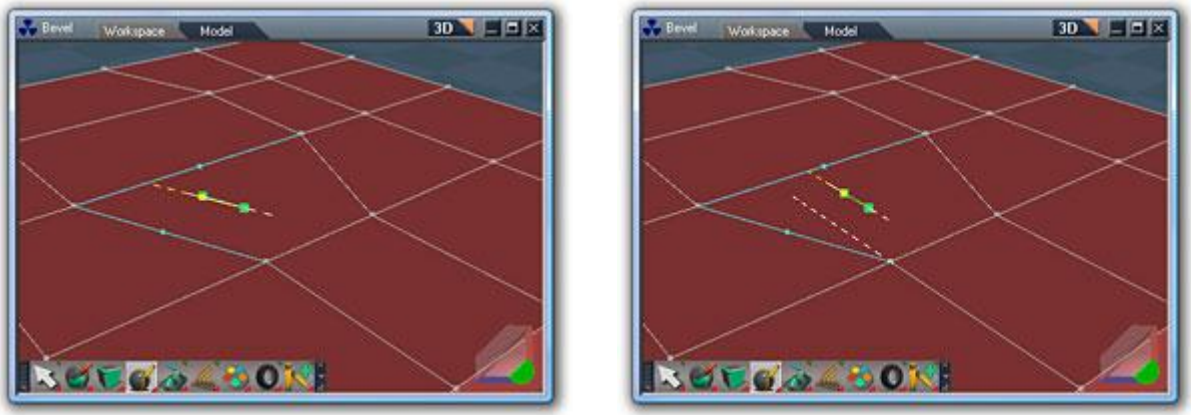
- **Axis Aligned** – When this is checked, lines are drawn based on the axis of vertices and snapping occurs to those lines. When unchecked, these lines are not drawn. This is the same parameter as Axis Aligned on the Default aspect – changing this parameter in either aspect will change it in the other.



All other lines are turned offer (inference, parallels) in these images. With Axis Aligned un-checked, not snapping lines are drawn (left). When enabled, snapping lines are drawn from the relevant vertices (right).



For comparison, here is the same situation but with Axis Aligned un-checked, and Parallels checked. Notice the difference – the vertex in the lower left of the face now generates a snap line parallel to the edge it is on (which in this case follows the edge itself), rather than generate a snapping line along its axis.



Another comparison between Parallels and Axis Aligned. On the left, Axis Aligned is disabled, and Parallels are enabled, and you can see how the snap line is parallel to the edge of the face (left). On the right, Axis Aligned is enabled, and Parallels disabled, giving snapping lines that are based on the axes of the vertices (right).

- **Lock to Selection** –This option lets you constrain editing in Point Editing to particular directions. For example, if you set a lock based on a polygon, then you will only be able to move points in the plane defined by that polygon (ie, in 2 directions), or if you set a lock based on an edge, you would only be able to move points in the direction defined by that edge.

  Once you have checked this option, you will need to make a selection on your object, and then use the

Set button to define the lock (or you can use the Set button first, and then check this box).

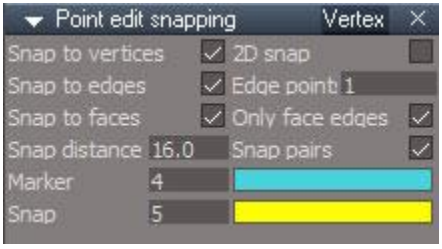
- **Set** – This takes the current selection in point edit, and uses it to define restrictions to the direction of editing. Clicking this button will define the restrictions, which will be shown as red arrows. Once the Lock To Selection checkbox is enabled, then point editing will be constrained to these directions.

  If restrictions are already set, using Set will replace those with new restrictions defined by the current selection.

- **Reset** – This clears the restrictions on direction for point editing, and clears the arrows indicating those restrictions. You will be able to point edit freely, even if Lock To Selection is checked.

Vertex Aspect

This aspect lets you set the options that affect vertex snapping.



The Vertex aspect of the Point Edit Snapping options panel

The following three checkboxes control the same settings as in the Default aspect – checking or un-checking these will also check or un-check these parameters in the Default aspect, and vice versa.

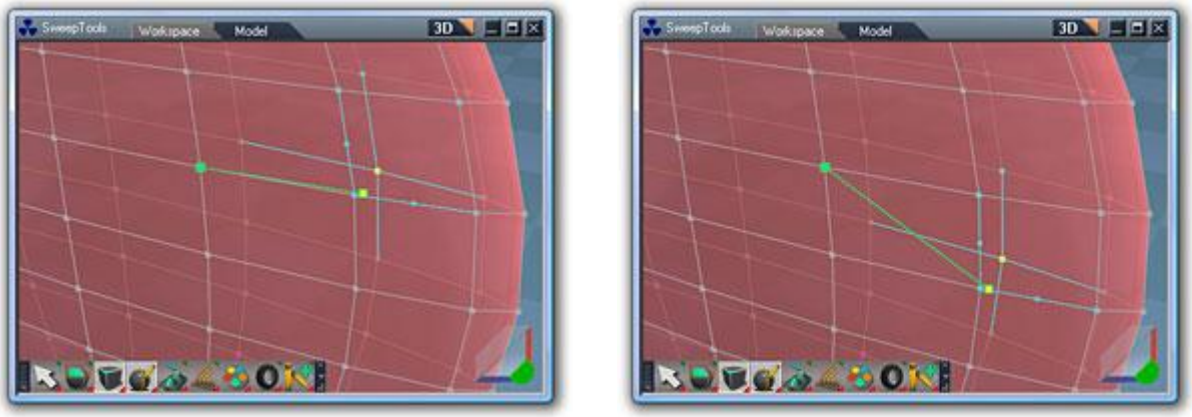
- **Snap to Vertices** – When checked, snapping will occur to nearby vertices. When un-checked, nearby vertices are ignored and will not cause snapping. Note that Snap To Vertices is not affected by the Front Facing flag in the Default aspect, and when enabled will always allow snapping to vertices on the back of an object.

- **Snap to Edges** – When checked, snapping will occur to nearby edges. When un-checked, nearby edges are ignored and will not cause snapping. Snapping to edges on the back of an object will only occur if Front Facing in the Default aspect is un-checked.

- **Snap to Faces** – When checked, snapping will occur to nearby faces. When un-checked, nearby faces are ignored and will not cause snapping. Snapping to faces on the back of an object will only occur if Front Facing in the Default aspect is un-checked.

- **2D Snap** – When checked, snapping will only occur to snapping points on the current face beneath the mouse pointer. When unchecked, snapping can occur to any snapping points beneath the mouse pointer, even those on a back face, so long as it is within the Snap Distance. This parameter is checked by default.

  This is the same parameter as shown on the Inference aspect – changing the parameter in either aspect will change it in the other. In the examples below, the Snap Distance was raised to 32 from the default of 16.

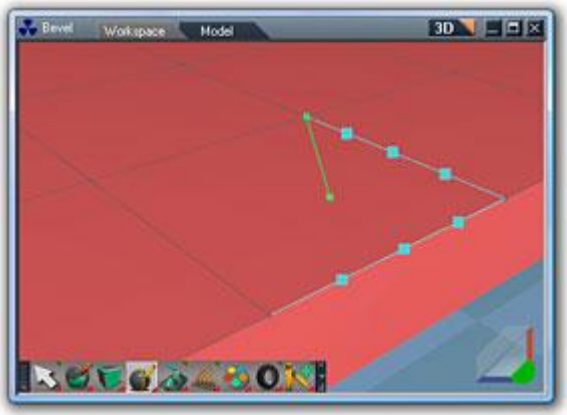


With 2D Snap disabled, when the mouse pointer passes over a vertex on the back face, snapping still occurs (left and right). Note that the Add Edges tool still only draws to the face beneath the mouse pointer even though the snapping is to a vertex on a back face.

With 2D Snap enabled, the mouse pointer in the same positions no longer snaps to the back vertices and edges (left and right).

- **Edge Points –** When snapping to an edge, trueSpace will create a certain number of anchor points that divide that edge evenly. This parameter controls how many such points should be created along an edge. The default value of 1 will create 1 such point, which will be exactly in the center of the edge. A value of 2 will create two such points, dividing the edge into thirds, and so on. This is the same parameter as listed under the Default aspect, a change in either location will update the other parameter (see example images under the Default aspect write up).

- **Only Face Edges –**If this is checked, then snapping will only occur to the geometry you create and work with. If un-checked, then snapping will also occur to the underlying triangulated geometry maintained "behind the scenes" by trueSpace. The default is that this is checked.



With "Only Face Edges" checked (the default), snapping occurs to the edges you work with.

Activating" Show Triangles" in the Mesh Editor Settings panel shows the underlying triangulation that trueSpace creates and maintains (left). Un-checking "Only Face Edges" allows snapping to occur to these underlying edges as well as the regularly visible edges (right).

- **Snap Distance –** This value controls how close to a snapping item you need to move before snapping will take place. It also controls the visibility of snapping points along existing edges. Smaller values will give more free movement, meaning you have to move closer to a snapping point before snapping takes place. You will also only see a limited range of snapping points. A larger value will give less free movement, and you will not have to be so close to a snapping point before snapping takes place. You will also see a wider range of snapping points. The default value of 16 is usually good, but you can vary this to suit your needs, in particular if your object is scaled particularly large or small.

- **Snap Pairs –** This parameter takes effect when you are working with selections of more than one element. If this is checked, then snapping occurs when any of the vertices in that selection gets close to a snapping point. If this is unchecked, then snapping only occurs when the widget for the selection gets close to a snapping point.

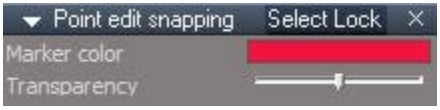
  This is the same parameter as Snap Pairs on the Default aspect – changing the parameter in either aspect will change it in the other. Please see the Default aspect write-up for illustrated examples.

- **Marker –** The numeric value specifies the size of the point to be drawn showing the markers along an edge where Point Edit operations will snap to. The color parameter sets which color to use when drawing the marker lines and points. Note that markers are only shown along existing edges, and not along inference lines.

- **Snap –** When a Point Edit operation actually snaps to an edge, inference line or point, the result is shown using the color set here. The numeric value controls the size used to draw the point being snapped to.

Select Lock aspect

This aspect lets you control the visual representation of the Select Lock including color and opacity.

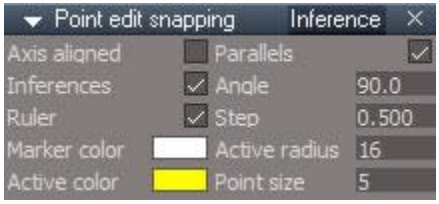


The Select Lock aspect of the Point Edit Snapping options panel

- **Marker Color** – This sets the color used with the Lock marker. This does not update in real-time (you will need to reset and then set the tool again to see the color change).

Inference aspect

This aspect lets you set the options that affect the display and use of inference lines.



The Inference aspect of the Point Edit Snapping options panel.

- **Axis Aligned** – When this is checked, lines are drawn based on the axis of vertices and snapping occurs to those lines. When unchecked, these lines are not drawn.

  This is the same parameter as Axis Aligned on the Default aspect – changing this parameter in either aspect will change it in the other. See examples under the Axis Aligned write-up for the Default aspect.

- **Parallels** – If checked, inference-like lines are drawn from a vertex parallel to the edges of the face. Point Edit operations will snap to these lines. Note that if the edges on the face are not parallel to each other, then you will see two parallels generated, one parallel to one edge, one parallel to the other.

  This is the same parameter as Parallels on the Default aspect – changing the parameter in either aspect will change it in the other.

- **Inference Lines** – If checked, then inference lines will be shown and snapped to during Point Edit operations. Inference lines are are extended from existing vertices on a face, at an angle from the incoming edges to that vertex. The angle is set by the Angle parameter. For most angles, most vertices will create two inference lines, one such line for each edge coming in to the vertex. If un-checked, then no inference lines are drawn or snapped to.

  This is the same parameter as shown on the Default aspect – changing the parameter in either aspect will change it in the other. Example images are shown under the Default aspect write-up.

- **Angle Step** – This controls the angle between an existing edge coming into a vertex and the inference line coming out of the vertex. This is the same parameter as Angle in the Default aspect – changing the parameter in either aspect will change it in the other. See the sample images under the Default aspect write up.

- **Ruler** – If checked, the inference lines will have snap points marked on them (the distance between these snap points is determined by the Step parameter). If unchecked, the inference lines will not have snap

points along their length.

This is the same parameter as shown on the Default aspect – changing the parameter in either aspect will change it in the other. Example images are shown under the Default aspect write-up.

- **Step** – Inference lines created by Inferences, Parallels and Axis Aligned settings are divided along their length with specific points to snap to. This lets you snap not only to the line, but to specific measurements along that line. The Step value controls the distance between these points, so a smaller value will give more points along the inference lines which will be closer together, and a larger value will give fewer points along the inference lines which will be further apart.

  This is the same parameter as shown in the Default aspect – changing the parameter in either aspect will change it in the other.

- **Marker Color** – This sets the color used to draw the inference lines and the snap points on them. The default color is white.

- **Active Color** – This sets the color used when a Point Edit operation snaps to an inference line. The default color is yellow. This can be set separately from the color used when snapping to an existing edge if desired.

- **Active Radius** – This value controls how close to a snapping item you need to move before snapping will take place. It also controls the visibility of the inference lines. Smaller values will give more free movement, meaning you have to move closer to a snapping point before snapping takes place. You will also only see a limited range of inference lines, those that are nearby the mouse pointer.

  A larger value will give less free movement, and you will not have to be so close to a snapping point before snapping takes place. You will also see a wider range of inference lines. The default value of 16 is usually good, but you can vary this to suit your needs, in particular if your object is scaled particularly large or small.

- **Point Size** – This sets the size of the points used on the inference lines. The default is 5.