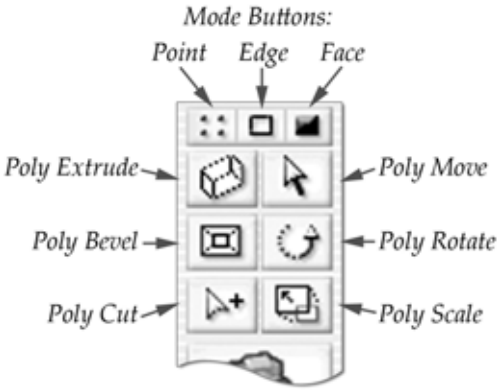
Using the Polygon Reshape editor

The polygon reshape editor can edit polygon objects or the cage of a Polyspline object. The polygon reshape editor is designed to allow you to modify the shape of an existing polygon-based object by moving, rotating, scaling and adding and deleting points, edges and faces – the basic "elements" of polygon editing.

To begin editing a polygon-based object, double-click the object, select the Reshape command in the Modeling menu or click on the Reshape button on the Button Bar. If you use the Reshape command, or Button Bar button, the object will be reshaped directly in the Modeling window. If you double-click on the object (using any of the three Object Manipulation tools) the object will open in a separate window where it can be edited without the clutter of any other objects.

When you go into reshape mode the Tool palette will change to provide appropriate tools. The top six tools – the View and Object Manipulation tools – remain at the top of the palette. Just below the manipulation tools you'll find the tools and controls specific to the polygon reshape modeler.



Modeling Modes

Polygon surfaces and cages are made up of points (also known as "vertices"), edges (lines connecting vertices) and faces ("polygons", which are defined by three or more edges). The polygon editor operates in modes that allow you to work on each of these three types of basic elements.

To change from one mode to another click on one of the three mode buttons at the top of the polygon tool section of the Tool palette. These mode buttons are Point, Edge and Face.

Each of the modeling tools operates according to the mode the modeler is in. For example, when in point mode (the left most mode button) the Poly Move tool will only select and move points.

Selecting Elements

The Poly Move, Poly Rotate and Poly Scale tools can be used to select elements (points, edges and faces). To select an element simply click directly on it. You can also region select elements. To region-select drag a selection marquee around the element or elements you want to select.

Normally, an element is selected only when completely enclosed within the marquee. However, by holding down the Command key (Mac) or the Ctrl key (PC), all items touched by the selection marquee are also selected. Once an element is selected it is marked in red.

Expanding and contracting selections

There are two methods you can use add elements to a selection. You can add to a selection using the mouse by holding down the Shift key while clicking or region-selecting. You can also deselect elements with this same method by holding down the Shift key while clicking or dragging a marquee. When performing this procedure, elements that were selected will become unselected and elements that were not selected will become selected.

The second method you can use to extend or contract a selection is to use the "+" and "-" keys. To use this method simply select one or more elements and hit the "+" or "-" key. The selection will expand or contract to the outermost adjoining element each time you press the key.

The exception to the hotkey method of expanding or contracting a selection is if you have Gravity turned on and you are in Point mode. When Gravity is on, and the modeler is in Point mode, the "+" and "-" keys expand and contract the influence of the gravity. Gravity is turned on and off while in point mode by hitting the "v" key.

NOTE: You can only mouse select elements that are visible, so you must be in Wireframe, Outline, or PointCloud display mode in order to select backfacing elements. In addition, the Backface Culling option on the Windows tab of the Preferences dialog must be disabled to select backfacing elements. You can always select backfacing elements by using a view that displays the back side.

Changing modes while elements are selected

If you change modes while one or more elements are selected the selected elements will change to reflect the new mode. For example, if you are in Point mode with one point selected, and you change the mode to Edge, the edges that connect to that point will become selected. If you then change to Face mode, the faces that are connected to the selected edges will become selected.

Manipulating elements

The five poly manipulation tools (Poly Move, Rotate, Scale, Extrude or Bevel) all work on the same basic principles. First you must select an element, then you can manipulate the selected elements using the specified tool. Selecting and manipulating can be done in one move.

Manipulate selected elements by clicking directly on one of the selected elements and "gesturing", or dragging, in the direction you wish the action to go. The standard behavior is for

the action to move the selected elements as a group about an average central point, or axis, relative to the active grid.

Perpendicular to the active grid

You can also manipulate selected elements perpendicular to the active grid by first holding down two modifier keys – Command Shift on the Mac or Ctrl Shift on PC. A temporary grid line appears to assist you in the proper placement of the selected elements.

Normal relative

An alternative behavior to grid relative manipulation is "normal" relative. A normal can be thought of as a line that extends perpendicular from the face or faces associated with the element, pointing directly away from the element. Each action (move, rotate, scale, extrude or bevel) happens around the selected element's own normal-relative point or axis – unless there are two or more adjoining selected elements, in which case the adjoining elements move as a group about an average point or axis based on the normals of those adjoining elements.

To perform the manipulation as normal relative hold, down the Command key (Mac) or Ctrl key (PC) modifier keys before you begin the action.

Nudging elements

With one or more elements selected you can "nudge" them using the four up/down and left/right arrow keys. The nudge action is based on which tool is selected – Poly Move, Rotate, Scale, Extrude or Bevel.

Just as in nudging whole selected objects, the Nudge keys move the selected elements in the expected direction in both the top and front views when the active grids are parallel to the view. These directions stay consistent – regardless of the view you are in.

For example, if you have the Poly Move tool selected and you change your view to "Back" the left nudge arrow key will actually nudge the selected elements to the right and visa versa.

If you hold down the perpendicular modifier keys (Ctrl Shift on PC and Command Shift on the Mac) the nudge keys will move the elements up and down that temporary grid line. If you hold down the Command key on the Mac, or Ctrl key on PC, the nudge keys will nudge each selected element along its own normal.

To decrease the amount of the nudge to $1/10^{th}$ its normal amount hold down the Option key (Mac) or Alt key (PC).

When the Poly Move, Extrude or Bevel tool is selected, nudge moves the selected element the distance defined in the Set Units dialog. The Set Units dialog can be accessed from the Edit menu.

When the Poly Rotate tool is selected nudge rotates the selected elements 10 degrees. If the Option key (Mac) or Alt key (PC) is held down, nudge rotates the selected elements only 1 degree (one tenth the normal amount).

When the Poly Scale tool is selected nudge will scale the selected elements up or down by 10%. If the Option key (Mac) or Alt key (PC) is held down, nudge scales the selected elements by only 1% (again, one tenth the normal amount).

Point Gravity

When Point Gravity is enabled points close to the selected point will move, rotate, scale or bevel along with the selected point, but to a lesser degree.

To turn Gravity on and off hit the "v" hot key. You will note that when Gravity is on the points adjacent to the selected point (or points) become tinted with the red selection color.

You can increase or decrease the amount of the gravity for the selected points by using the "+" and "-" keys on your keyboard. As you increase the gravity you will notice that the red tint will increase in the points closest to the selected point. You will also notice that the tint extends to more and more points. The closer the tint gets to full red, the higher the level of gravity.

Transform Modifications

Moving, rotating and scaling selected elements – also known as transforming – are the basic manipulation operations in the Polygon Reshape modeler.

Moving Elements

You can use the Poly Move tool to move selected elements relative to the active grid, perpendicular to the active grid, relative to the element normals or nudge. Select the elements you want to move, click directly on an element and drag. Use the modifier keys – Command key (Mac) or Ctrl key (PC) to move "normal" relative and Ctrl Shift (PC) or Command Shift (Mac) to move perpendicular to the active grid. Use the nudge keys for precise control.

Rotating Elements

Rotating works much like moving elements. To use the Poly Rotate tool, click on one of the selected elements and drag in the general direction you wish to rotate.

By default the elements will rotate as a group around an axis central to the selected elements. The axis will be perpendicular to the active grid. To change the orientation of the axis, simply change the active grid.

You may also rotate around the individual surface normals of the selected elements. To rotate around the "normal" axis simply mouse down on one of the selected elements, hold down the Command key on the Mac, or Ctrl key on PC, and drag in the general direction you wish to rotate.

Each selected element will rotate about its own normal unless two or more are adjoining. If two or more are adjoining they will rotate about an axis that is the average of the adjoining selected elements' normals.

You can also use the nudge keys to rotate the selected elements around an axis perpendicular to the active grid or, by using the Command key on the Mac, or Ctrl key on PC, around the "normal" axis.

Scaling Elements

Again, scaling works much like moving and rotating. Use the Poly Scale Tool to mouse on one of the selected elements. Selection and scale can be done in one move. Next, drag in the general direction toward or away from the center of the selected elements.

You may also scale the individual selected elements around their own center point. To scale them individually, simply mouse down on one of the selected elements, hold down the Command key on the Mac, or Ctrl key on PC, and drag in the general direction you wish to scale. Each selected element will scale around its own center unless two or more are adjoining. If two or more are adjoining they will scale around a point that is the average of the adjoining selected elements' centers.

Use the nudge keys for precise scaling control.

Surface Modifications

These tools are used to add to or extend the complexity of the polygon surface or cage.

Extrude

As with the other Poly Tools discussed, the Poly Extrude tool operates on one or more selected elements. You can also use the Poly Extrude tool to select and extrude in one move. Points, edges and faces can be extruded by clicking directly on that element and dragging in the direction you wish to extrude. The tool will extrude relative to the active grid, perpendicular to the active grid or relative to the selected elements' normals, depending on which modifier keys, if any, you use.

To extrude multiple elements first select the elements you want to extrude. You can make your selections using one of the Poly Transform tools or you can use the Poly Extrude tool. Once you have selected the elements you want to extrude, use the Poly Extrude tool and click on one of the selected elements and drag in the general direction you wish to extrude. You can also use the standard modifier keys to extrude perpendicular to the grid or along the normal of the selected element.

When extruding points and edges you will note that the tool "breaks" the surfaces around the point or edge. The initial distance of this break is defined by the nudge distance (set using the Set Units dialog box, accessed from the Edit menu). For example, if the Units are set to Inches and the Nudge sub-divisions are set to 10, then this initial break distance will be $1/10^{th}$ of an inch.

You can alter the distance of this break line immediately after performing the extrude operation by tapping on the left and right arrow keys on your keyboard. Each tap of a key will move the break line towards or away from the extruding element one "nudge sub-division". Again, this can be changed using the Set Units dialog.

You can also use the extrude tool to break the surface around a point, edge or face without moving the element. To do this select the element, then select the Poly Extrude tool. Next, without dragging the element, use the right or left arrow keys to create the break line. Once the break line has been created you can continue to move the break line using the arrow keys. You can also move the original element itself after the break line has been created by using the Poly Extrude tool to drag the element in the direction you wish.

Bevel

As with the Poly Extrude tool, you can use the Poly Bevel tool on multiple selected elements or on a single element. The Poly Bevel tool can also select and bevel in one move. To bevel multiple elements, first select the elements you want to bevel. Then use Poly Bevel tool to click on one of the selected elements and drag in the general direction you wish to bevel. Beveling points and edges flattens the surface in the direction of the normal of the selected element. Beveling faces chamfers the edges surrounding the face.

Cut

The Poly Cut tool is used to cut edges and faces.

To add a point to an edge, simply select the Poly Cut tool and click on the desired edge.

To add a point to a face, just click on the desired position within the face. A new point will be added and new faces will be created joining the point with the surrounding edges.

You can also use the Poly Cut tool to connect two points to create a new edge on an existing face. To create the new edge using the Poly Cut tool:

1) Select the first point you want to cut *from* by clicking on the point, then;

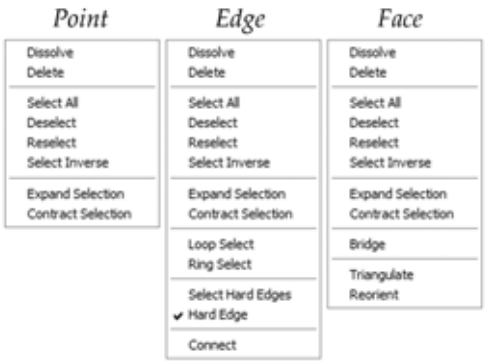
2) Click on the second point (on the same face) that you want to cut *to*. A new edge will be cut into the face of the polygon.

The second point you select must lie on the same face as the first in order to create a new edge. If the second point does not lie on the same face as the first, a new edge will not be created – the point will simply become the first point for a new cut operation.

Context menus

In addition to the direct manipulation modifications described above, you can also do a number of modifications to selected elements using context based commands. The context menu is accessed by using the right mouse button (Control-click on Macs with a single button mouse). The menu displays next to the cursor position.

Context Menus:



Some of the contents of the menu changes depending on which of the three modes (point, edge, face) you're in. Also, the way the commands function are relative to the mode you're in, and based on any selection you may have made. For example, if you're in point mode and you choose Select All, all the points for the object will be selected – not the edges or faces.

• Dissolve. This command attempts to remove the selected element(s) while leaving behind the surrounding structural elements. You can use the Delete and Backspace keys on your keyboard to achieve the same result.

• Delete. This command deletes the selected element(s). Using Delete can result in a hole in your surface. While holding down the Option key (Mac) or Alt key (PC) the Delete and Backspace keys will achieve the same result as the Delete command.

• Select All. This commands selects all of the points, edges or faces for the object, depending on which mode you are in.

• Deselect. This commands deselects any elements of your object that may have been selected.

• Reselect. This command reselects any elements that may have been selected prior to any deselect operation – whether the de-selection was a result of clicking off of the object or using the Deselect command. This can be especially helpful if you had a complex selection made and you accidentally deselect.

• Select Inverse. This command selects all of the elements of your object that were not previously selected. Any elements that were selected will become unselected. If no elements were selected then all will be selected.

• Expand Selection. This command expands the selection to adjoining elements. For points, this would mean that each time you use this command the unselected points closest to the select points would become selected. The selection grows by one level each time you use the command. This is similar to using the "+" key on your keyboard.

• Contract Selection. This command is the inverse of the Expand Selection command. With each use of this command the selection will be reduced from its boarders inward by one set of elements each time. This is similar to using the "-" key on your keyboard.

• Loop Select (edge mode only). This command attempts to extend an existing selection of an edge to adjacent edges that share a common point. If the end point of the selected edge is shared by multiple adjacent edges, unpredictable selections can occur.

• Ring Select (edge mode only). This command attempts to select edges that are parallel to the selected edge and that are connected on either side by joining edges. For example, if you select an edge on a cube shaped object, Ring Select will select the three edges that are parallel to the first edge, going around the cube.

• Select Hard Edges (edge mode only). This command provides a way to select only those edges marked as "Hard".

• Hard Edge (edge mode only). This command marks the selected edge(s) as "Hard". This command is useful for defining a sharp or hard edge.

For Polyspline objects this will create a sharp edge that the surface will be pulled up to.

For standard polygon objects Hard will tell the renderer not to smooth across this edge (or "average the normals" as it is technically known) – regardless of what the "Smooth Angle" is set to in the Object Properties palette. The edge will be rendered as a sharp edge.

When a selected edge is hard the command will be marked with a checkmark. To remove the hard mark from the edge just select the edge and choose the command again.

• Connect (edge mode only). This command connects two or more selected edges by creating new edges. The new edges are created by joining the center point of the selected edges to the center point of the other edges. Connect only works if the selected edges are on the same face.

• Bridge (face mode only). This command creates a tunnel-like bridge between two selected faces. The two faces must be made up of the same number of points or verticies.

• Triangulate (face mode only). This command breaks non-triangular faces (faces with four or more edges) into three sided triangles.

• Reorient (face mode only). This command changes the orientation of the subdivision triangles for the selected face. Specifically, when you apply the Subdivide command to the polygon mesh object, new, additional triangles are created for each face in the existing cage. The Reorient command changes the way in which these triangles are generated.

Polygon Reshape modifier keys

Modifier keys used with Polygon Reshape:

▪ Delete or Backspace key

Using the Delete or Backspace key attempts to remove the selected element(s) while leaving behind the surrounding structural elements.

▪ Delete or Backspace key and Option (Mac), Alt (PC) key

Pressing the Delete or Backspace key while holding down the Option key (Mac) or Alt key (PC) deletes the selected element(s). Deleting an element can result in a hole in the surface.

▪ Shift key

Extends the selection of elements. Without the Shift key single clicks select only one element at a time. With the Shift key held down, if you select an element that is already selected, that element becomes deselected. Using the Shift key while doing a drag select adds to an existing selection.

▪ Command key (Mac), Ctrl key (PC)

Performs the tool operation relative to the "normal". A normal can be thought of as a line that extends perpendicular from the face or faces associated with the element, pointing directly away from the element.

▪ Option key (Mac), Alt key (PC)

Holding down the Option or Alt key decreases the amount of change that a single nudge key hit will produce to 1/10th its normal amount.

Ending Polygon Reshape

When you're finished reshaping the selected object, choose the End Reshape/Edit command from the Modeling menu, click on the Reshape button on the Button Bar or, if you entered reshape mode by double-clicking the object, you can simply close the temporary Modeling window used for the reshape. Your changes will appear in the model.