Appendix G

Plug-in Geometries

Plug-in Geometries are plug-in tools that are used to create objects. When installed, they are located in the Tools palette.

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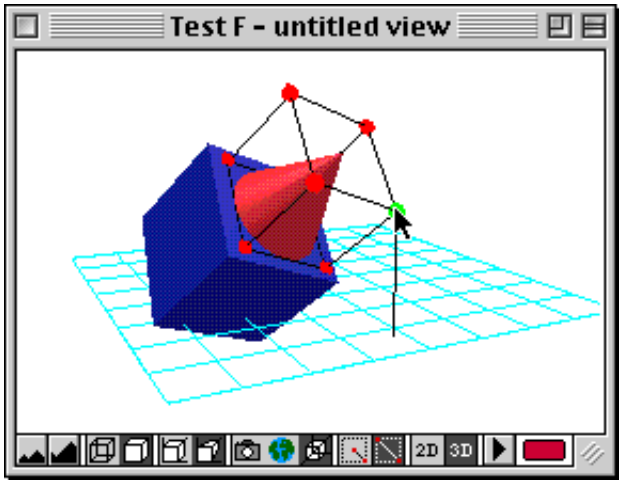
◆ Introduction

When loaded, Plug-in Geometries appear in the Tools palette. The position of each plug-in in the Tools palette will depend on how the user has configured the palette. *See Configuring The Tools Palette on page F-2 for more details.* The default arrangement is shown below.

Select the plug-in tool to use by clicking on its icon in the Tools palette.

Drawing Objects

Objects are drawn perpendicular to the surface clicked on when you begin drawing. For example, if you click on the grid or an empty area, the object will be drawn upright. If you click on the surface of a rotated object, the new object will be drawn perpendicular to that surface:



NURB Geometries

It is possible to draw Cone, Cube, Cylinder, Mountain, Mountains, Sphere and Torus geometries using NURBs. NURBs use very little memory compared to Polygon and Trigrid geometries and can produce smooth surfaces. NURBs are also more editable, but will take longer to render.

The Subdivision palette is used to specify what sort of internal geometries (polygons and trigrids, conic primitives or NURBs) 3D World will use to draw these geometries. *See Subdivision on page D-85 for more details.*

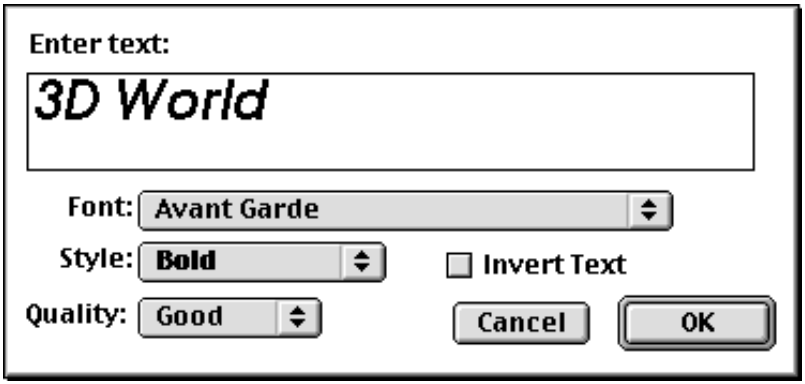
Note: NURBs — Non-Uniform Rational B-spline. This is the 3D equivalent of a Bezier curve.

◆ 3D Text

The 3D Text plug-in is used to create three dimensional text. Once created, the text can be manipulated like any other 3D object.

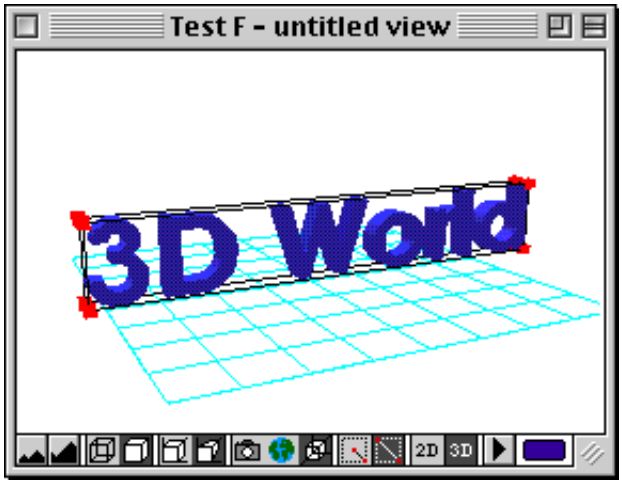
Select the 3D Text plug-in from the Tools palette and move the cursor over the document window. The cursor will change to a text insertion icon.

Click on the place you wish the text to appear. The Enter text dialog will display. Note: If you have a lot of fonts installed on your Mac, it may take a few seconds for this dialog to appear.

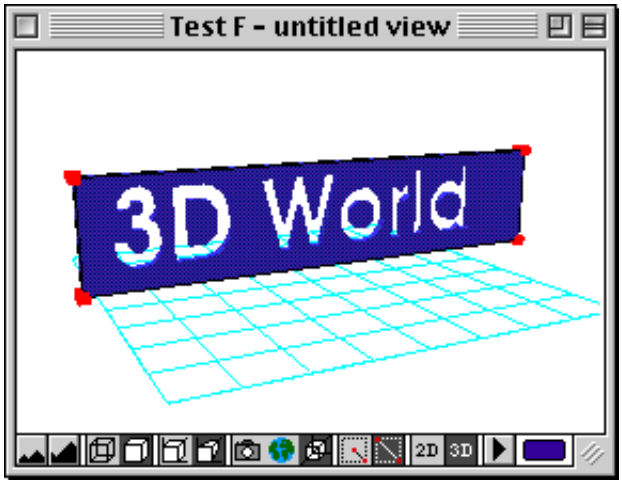


Enter the text in the top field and choose a font, style and text quality from the popup menus below. The higher the quality selected, the smoother the curves on the text will be drawn, but more memory will be required to display the text and it will be slower to display.

Leave the Invert Text check box unchecked to display your text as 3D letters. Click OK. The text will be placed in the document window:



Check the Invert Text check box and click OK. The text will be ‘punched out’ of a solid rectangle.

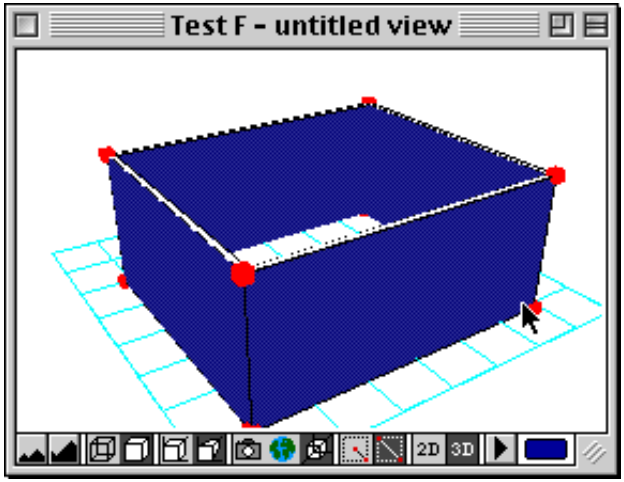


The text can be moved, resized and rotated, have colors, textures, images and sounds applied to it and the geometry path can be edited. You will not be able to ungroup a word to edit individual characters, although you can ungroup the front and back faces and extruded outlines. To do this you must flag the text as Dismantleable. *See Dismantleable on page 3-34 and Primitive/ Dismantleable Flag on page 4-19 for further details.* If you need to manipulate individual characters, they must be entered separately.

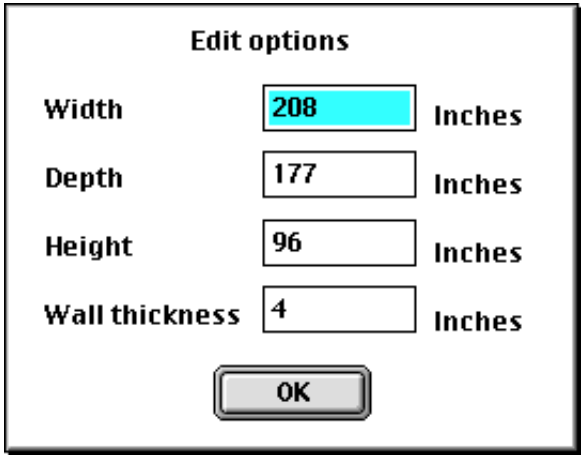
◆ 4 Walls

The 4 Walls plug-in is used to draw a regular, four-walled room.

1. Select the 4 Walls plug-in from the Tools palette.
2. Click on the grid and, holding down the mouse button, drag to draw 4 walls:

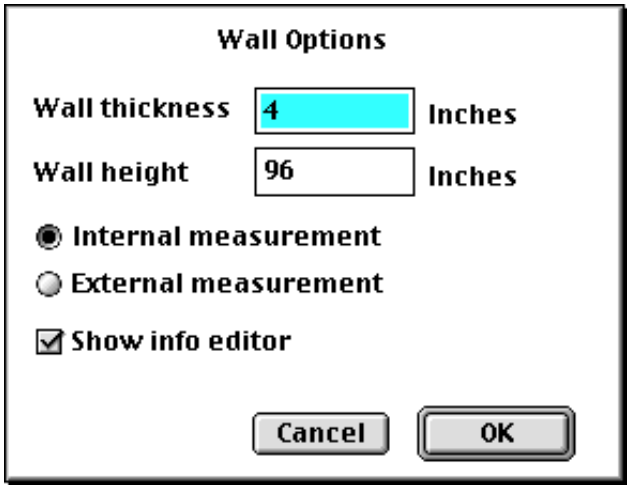


3. Release the mouse button and the Edit options dialog displays:



4. If necessary, enter values in the Width, Depth, Height and Wall thickness fields to specify the width and depth of the room, the height of the walls and the wall thickness.
5. Click OK and the walls will be adjusted to reflect the values entered.

To change the default settings for the 4 Walls plug-in, hold down the Option key and select the 4 Walls tool. The Wall Options dialog displays:

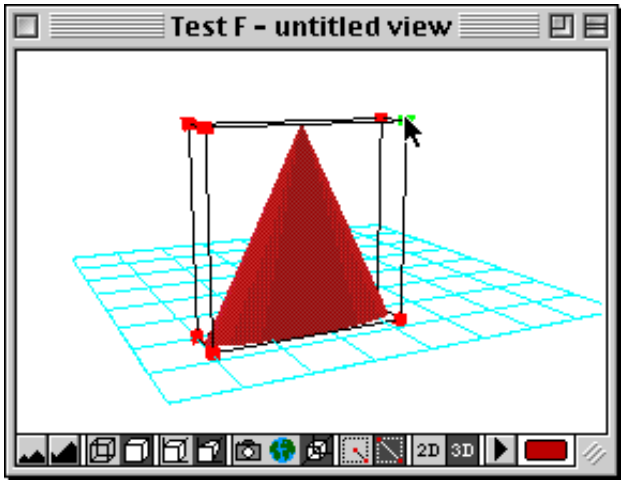


- **Wall thickness:** Enter a value to specify the default thickness for walls.
- **Wall height:** Enter a value to specify the default height for walls.
- **Internal measurement:** Click on the Internal measurement radio button to specify that values entered in the Entry options dialog (that displays after walls are drawn) relate to the measurements of the internal walls.
- **External measurement:** Click on the External measurement radio button to specify that values entered in the Entry options dialog (that displays after walls are drawn) relate to the measurements of the external walls.
- **Show info editor:** Check the Show info editor check box to specify that the Entry options dialog should appear after walls are drawn. Uncheck this check box if you do not want this dialog to display. Note: The width and depth of the room and the height of the walls can be adjusted at a later time using the Info palette or the Arrow tool, but the wall thickness will be scaled proportionally.

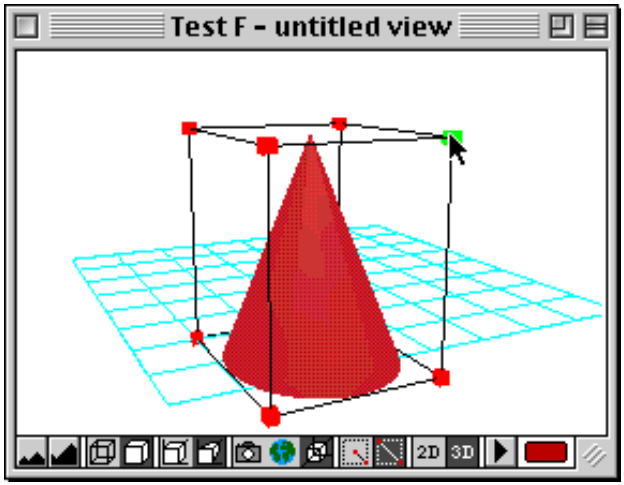
Cone

The Cone plug-in is used to draw cone geometries.

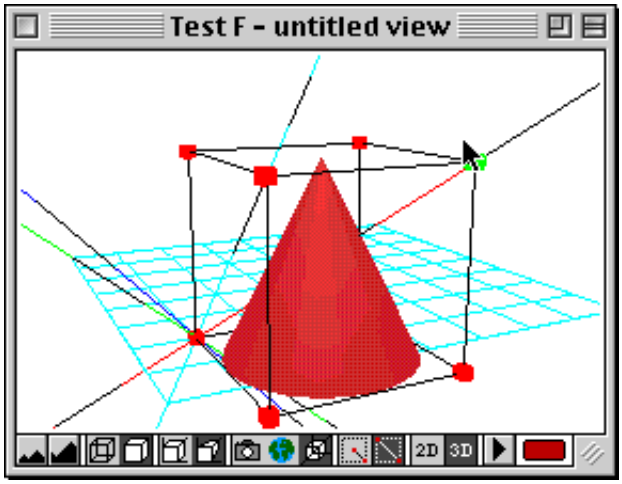
Place the cursor at the point you want to begin drawing, hold down the mouse button and drag to create a cone:



Hold down the Control key and move the mouse up or down to change the depth of the cone.



Holding down the Shift key to constrain the cross section of the cone to a circle, and the height of the cone to the diameter of the base:

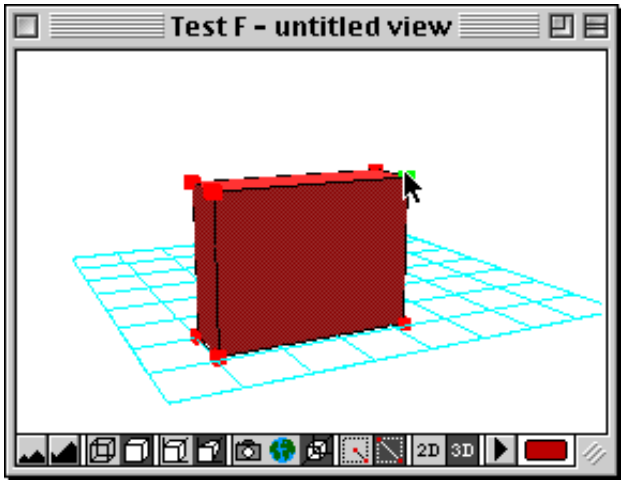


In 2D mode, you will not be able to create a 3D object and holding down the Shift key will constrain the object shape to a triangle with equal sides, or a circle, depending upon which plane you are drawing in. Using the Control key in 2D mode will not add depth to an object, but you can use it to draw your 2D shape in the Z dimension.

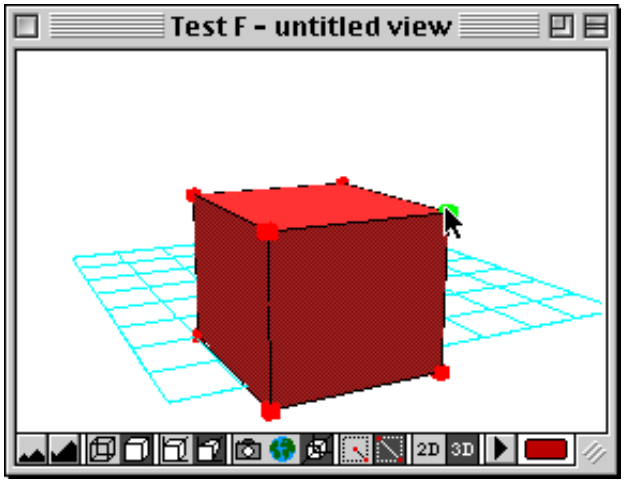
◆ Cube

The Cube plug-in is used to draw cube geometries.

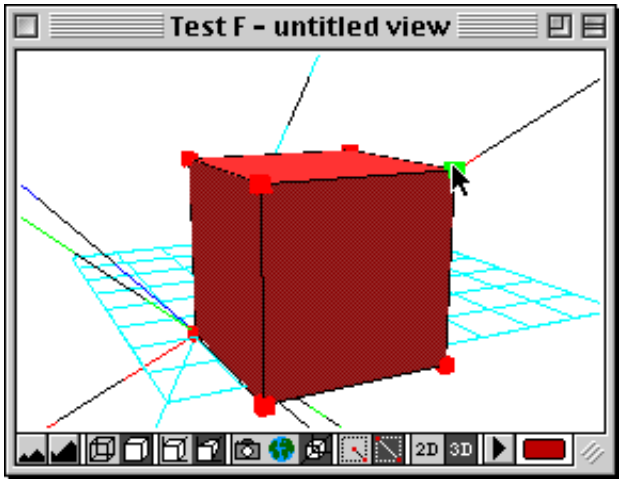
Select the Cube plug-in from the Tools palette. Position the cursor at the point you want to begin drawing and, holding down the mouse button, drag to create the cube geometry:



Hold down the Control key and move the cursor up or down to change the depth of the cube:



Hold down the Shift key while drawing to constrain the geometry to a cube:

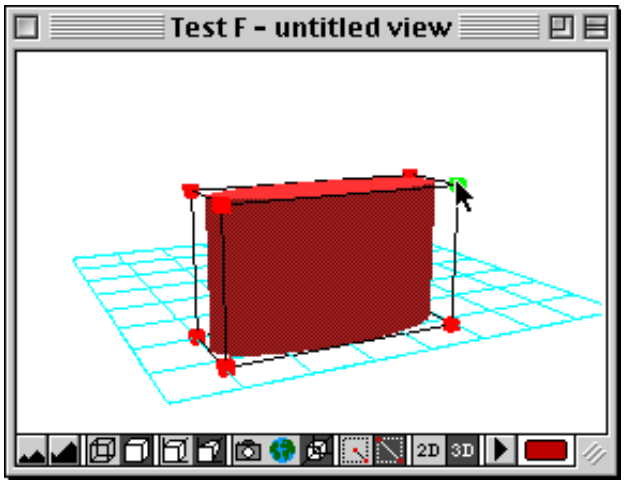


In 2D mode you will not be able to create a 3D object, and holding down the Shift key will constrain the object shape to a square. Using the Control key in 2D mode will not add depth to an object, but you can use it to draw your 2D shape in the Z dimension.

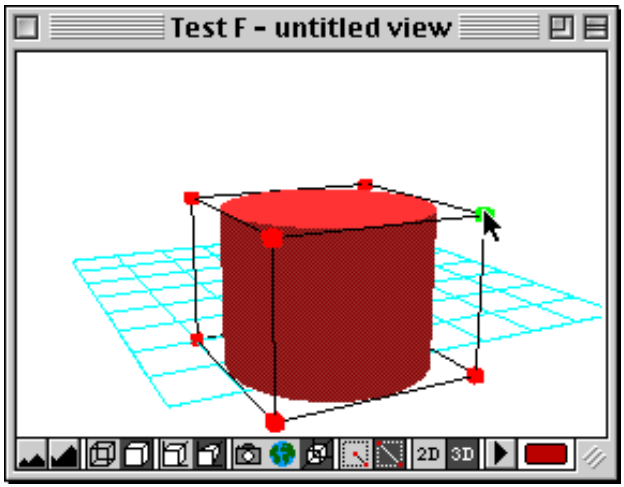
◆ Cylinder

The Cylinder plug-in is used to draw cylinder geometries.

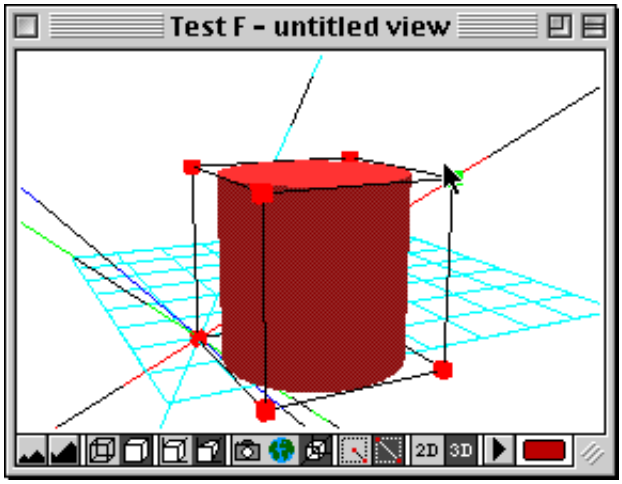
Select the Cylinder plug-in from the Tools palette. Place the cursor at the point you want to begin drawing and, holding down the mouse button, drag to create the cylinder geometry:



Hold down the Control key and move the mouse up or down to change the depth of the cylinder:



Hold down the Shift key while drawing the object to constrain the cross section of the cylinder to a circle, and the length of the cylinder to the diameter of the circle:



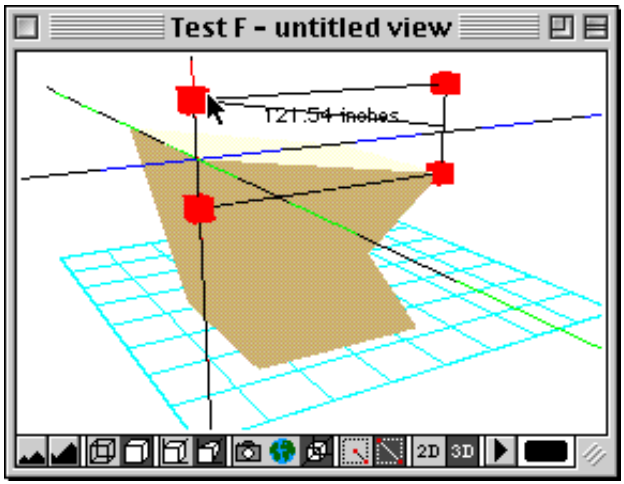
In 2D mode, you will not be able to create a 3D object, and holding down the Shift key will constrain the object shape to a square or circle depending on the plane you are drawing in. Using the Control key in 2D mode will not add depth to an object, but you can use it to draw your 2D shape in the Z dimension.

◆ Dimension

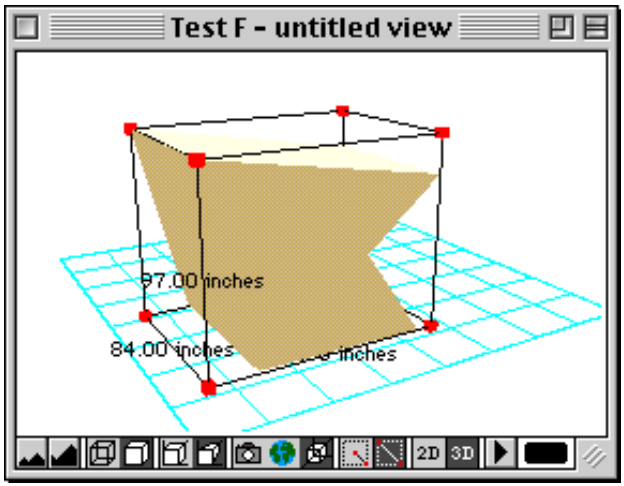
The Dimension plug-in is used to label objects with their dimension information.

1. Select the Dimension plug-in from the Tools palette.
2. Click on the point on an object to start measuring from. Holding down the mouse button, drag a dimension line out to the point on the object to measure to. When the cursor is over a vertex point it will change to a hollow cross. Let go of the mouse button to finish the dimension line.

3. To position the dimension line away from the object, click at the end of the dimension line and, holding down the mouse button, drag the dimension line away. A constraining line will display for each axis.



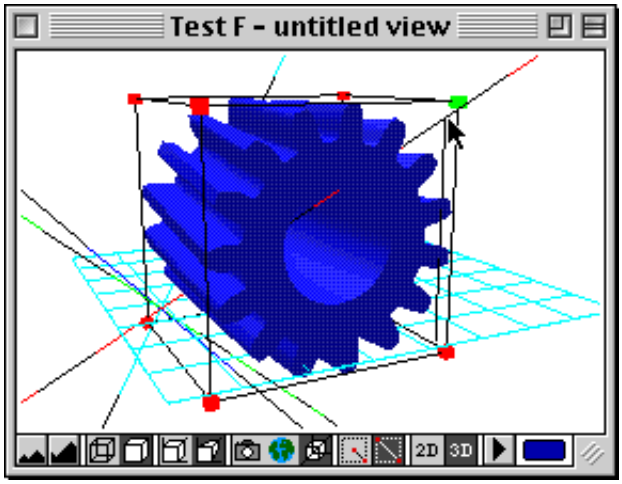
4. To automatically dimension the bounding box of an object, select the Dimension tool and click on the object.



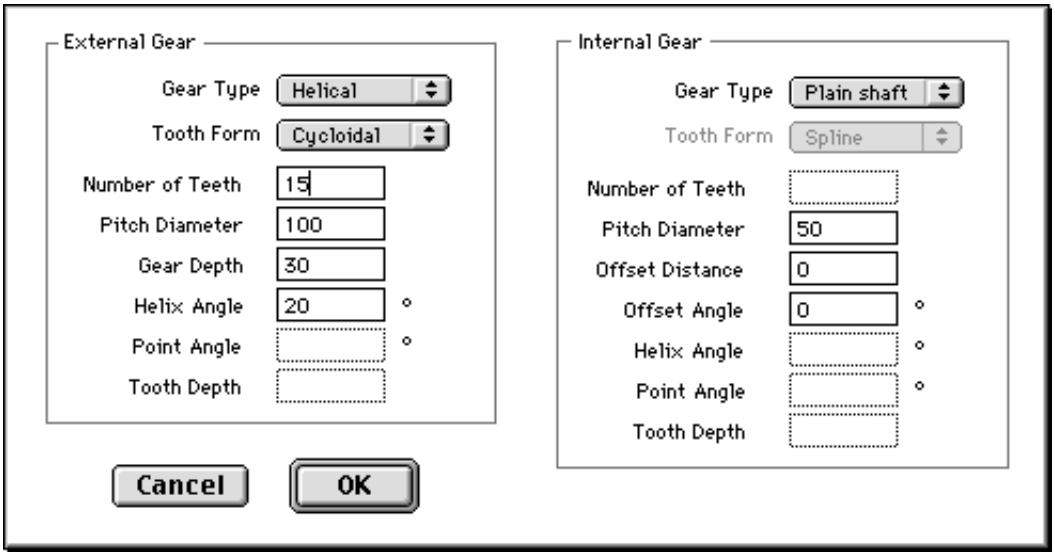
◆ Gears

The Gears plug-in is used to draw gears or cogs.

Select the Gears tool from the Tools palette. Click on the grid, hold down the mouse button, and drag to draw a gear geometry. The gear is automatically constrained to a shape of round cross-section and to the depth set in the Gear Options Dialog.



To change the Gear Options, hold down the Option key and click on the Gear tool again. The Gear Options Dialog displays:



External Gear

Values in this area of the dialog relate to the outside face of the gear shape.

Gear Type: Select a type from the Gear Type popup menu to specify the type of gear to draw.

- Spur: A Spur type gear has teeth that run from the front of the gear to the back, perpendicular to the plane defined by the front face of the gear.
- Helical: A Helical type gear has teeth that run from the front of the gear to the back, at an angle of up to 87° to the plane perpendicular to the front face of the gear.
- Plain shaft: A gear with a plain shaft has no teeth.

Tooth Form: Select an option from the Tooth Form popup menu to specify the type of teeth the gear should have. This menu will not be available if Plain shaft has been selected as the Gear Type.

- Cycloidal: This is a standard shape of gear tooth. The surfaces of the tooth are more curved than those of a tooth with an involute shape.
- Involute: This is a standard shape of gear tooth. The surfaces of the tooth are flatter than those of a tooth with a cycloidal shape

- Spline: Choose this option if you wish to draw a gear with square shaped teeth.
- Triangular: This option is not yet available and will be grayed out.

Number of Teeth: Enter a value between 10 and 300 to specify the number of teeth on the gear. This option is not available if Plain shaft has been selected as the Gear Type.

Pitch Diameter: Enter a value between 0 and 10000 in this field to specify the Pitch Diameter. This is defined as the distance from center to center of mating gears, and determines the width of a gear.

Gear Depth: Enter a value between 1 and 10000 to determine the depth of the gear. This is its measurement in the Z dimension.

Helix Angle: This option will only be available if Helical has been selected as the Gear Type. Enter a value between 0° and 87° to specify the angle of the line, defined by a gear tooth, to the plane perpendicular to the front face of the gear.

Point Angle: This option is not yet available and will be grayed out.

Tooth Depth: The Tooth Depth option will only be available if the Spline option has been selected in the Tooth Form popup menu. Enter a value less than the Pitch Diameter to determine the depth of gear's teeth.

Internal Gear

Values in this area relate to the internal face of the gear shape, the hole in the gear.

Gear Type: Select an option from the Gear Type popup menu to specify the type of internal gear to draw.

- Spur: A Spur type gear has teeth that run from the front of the gear to the back, perpendicular to the plane defined by the front face of the gear.
- Helical: A Helical type gear has teeth that run from the front of the gear to the back, at an angle of up to 87° to the plane perpendicular to the front face of the gear.
- Plain shaft: If you wish the gear to have a straight hole through it, select Plain shaft from the popup menu.
- None: If the gear is to be solid, with no hole in it, select None.

Tooth Form: The only option currently available in this menu is Spline. It will not be available if Plain shaft or None has been selected as the Gear Type.

- Spline: This option produces an internal gear with square shaped teeth.

Number of Teeth: Enter a value between 10 and 300 to specify the number of teeth on the internal gear. This option is not available if Plain shaft or None has been selected as the Gear Type.

Pitch Diameter: Enter a value in this field to specify the Pitch Diameter. This is defined as the distance from center to center of mating gears, and determines the width of the internal gear. The minimum value is 0, the maximum value is limited by the Pitch Diameter of the external gear. This option is not available if the Gear Type selected is None.

Offset Distance: The value entered in this field determines the distance the internal gear is offset from the center point of the external gear. The minimum value is 0 and the maximum value limited by the Pitch Diameter of the external gear. This option is not available if the Gear Type selected is None.

Offset Angle: Enter a value between -360 and 360 to position the internal gear the stated number of degrees around the face of the external gear, 0° being the 3 o'clock position looking at the front of the gear. This option is not available if the Gear Type selected is None.

Helix Angle: This option will only be available if Helical has been selected as the Internal Gear Type. Enter a value between 0° and 87° to specify the angle of the line, defined by an internal gear tooth, to the plane perpendicular to the front face of the gear.

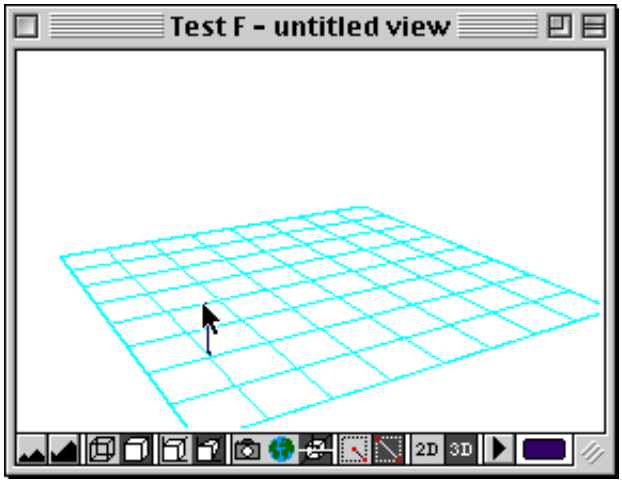
Point Angle: This option is not yet available and will be grayed out.

Tooth Depth: The Tooth Depth option will only be available if the Spline option has been selected. Enter a value less than the Internal Gear Pitch Diameter to determine the depth of the teeth of the gear.

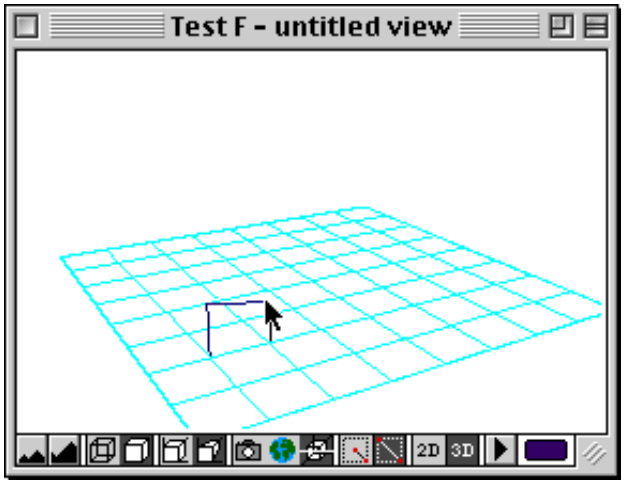
◆ Irregular Polygon

The Irregular Polygon plug-in is used to define a cross section, which is then extruded to create an irregular polygon geometry.

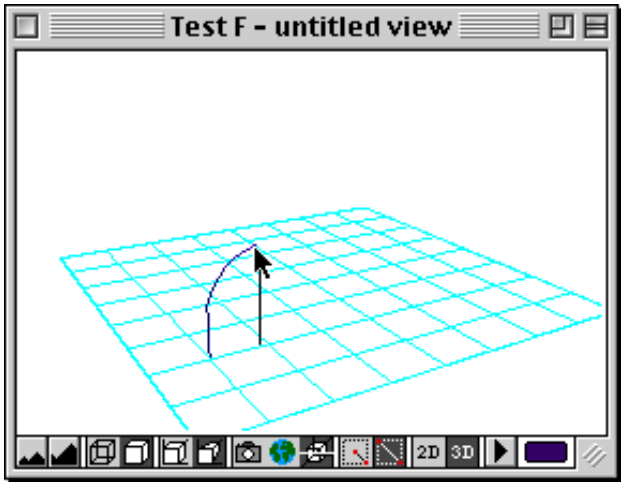
1. Position the cursor where you want to begin drawing, click the mouse button to place a vertex point, move the cursor and click again:



2. To draw an arc, hold down the Option key and click at the point that will represent the center of a circle.

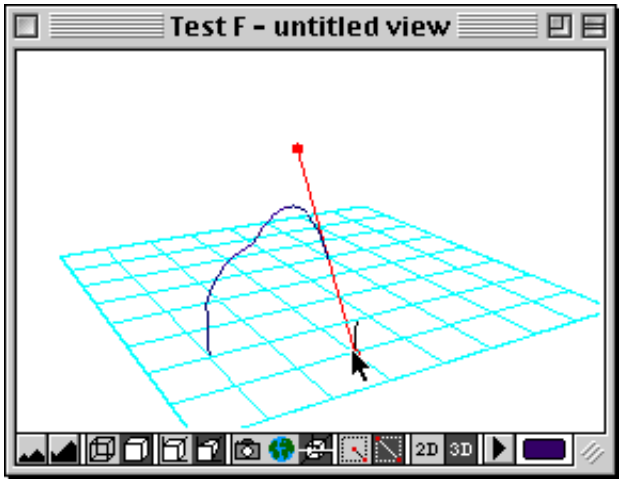


3. Release the Option key and mouse button and move the cursor ready to place the next point. The arc will display:

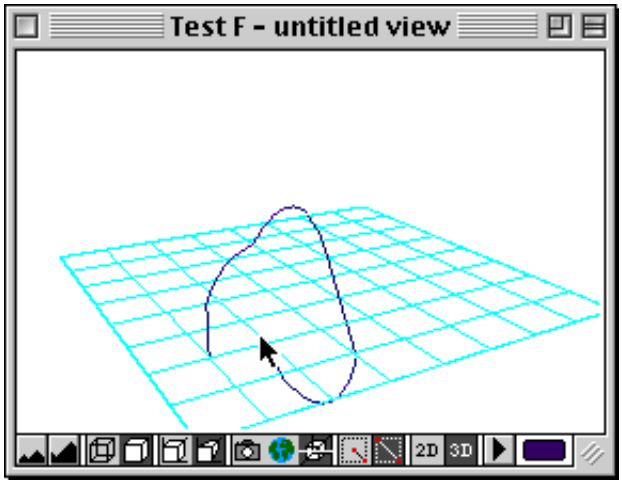


4. Click to place the next point at the end of the arc.

5. To draw a Bezier curve, click and drag the cursor.

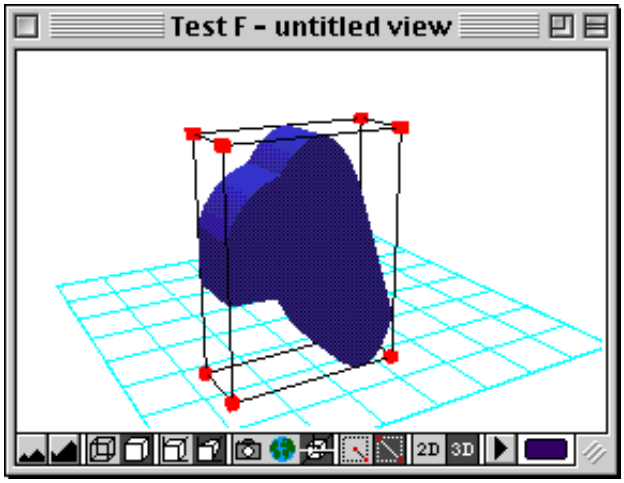


6. To draw a spline curve, hold down the Option key and click and drag the cursor.



7. Use the Delete key at any time to delete the last point placed.

8. Double-click at any time to complete the shape.



The following modifier keys can be used when drawing the irregular polygon cross section:

- **The Control key:** Use the Control key to adjust the position of the cursor in the third dimension when placing the first three points. This will define the plane in which the polygon is drawn.
- **The Shift key:** Hold down the Shift key to constrain lines to the two axes of the plane in which you are drawing. Constraining lines will display.
- **The Command key:** Hold down the Command key to draw a line tangent or perpendicular to the previous line or curve. Constraining lines will display.

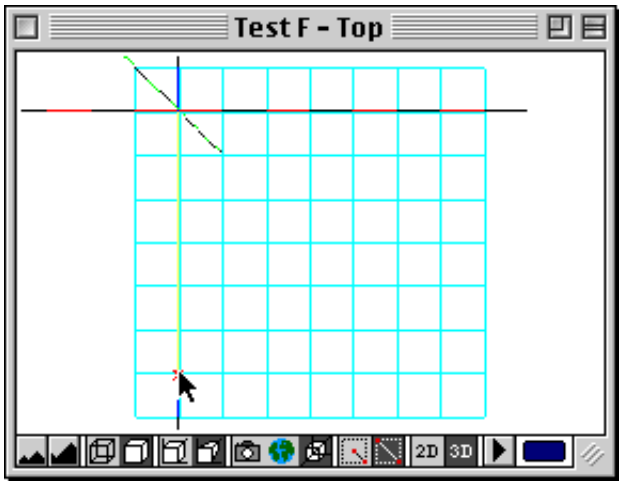
◆ Lathe

The Lathe plug-in is used to define a lathe template and produce a lathed geometry from it.

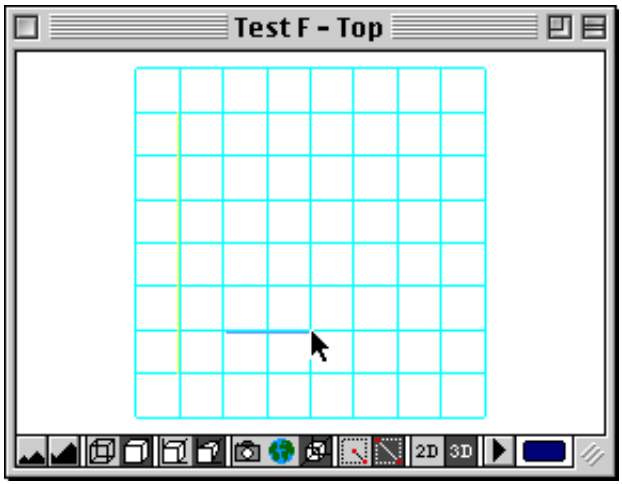
Drawing a Lathe Template

1. Select the Lathe plug-in from the Tools palette.

2. Determine the lathe axis by clicking once, moving the cursor, and clicking a second time. Note: The lathe axis is constrained to either the X, Y or Z axis. A yellow line representing the axis your object will be lathed around displays:

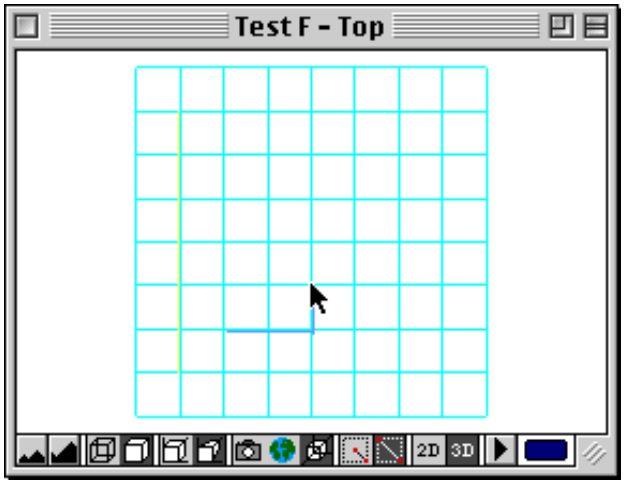


3. Position the cursor at the point to start drawing the lathe template. Click the mouse button to place a vertex point, move the cursor the desired distance and click again:

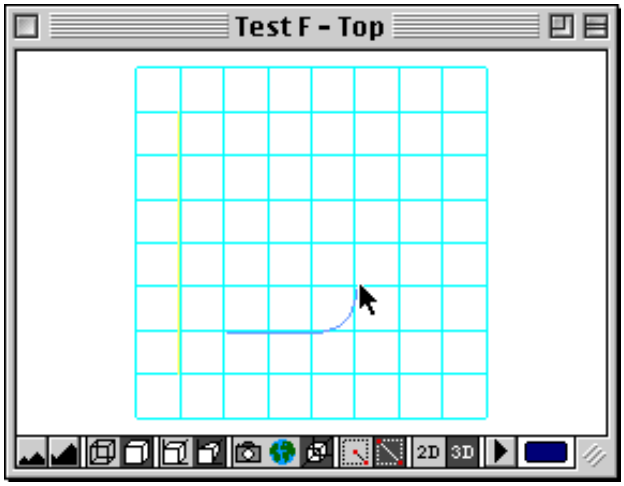


Note: To draw an object with have a hole in the middle, draw the lathe template so that it does not touch the lathe axis. If the template does touch the lathe axis at some point, the resulting geometry will not have a hole in the middle.

4. To draw an arc, hold down the Option key and click on the point that will represent the center of a circle:

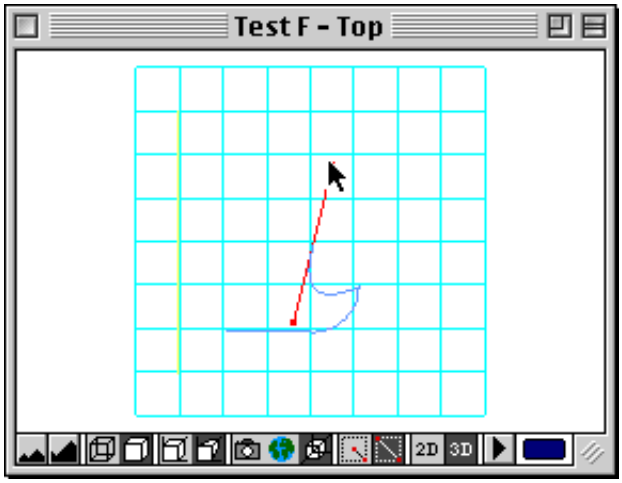


5. Release the Option key and the mouse button and move the cursor ready to place the next point. The arc will appear:

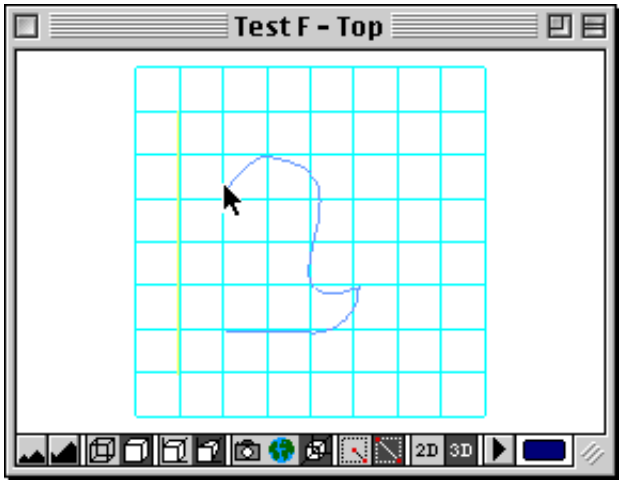


6. Click to place the next point at the end of the arc.

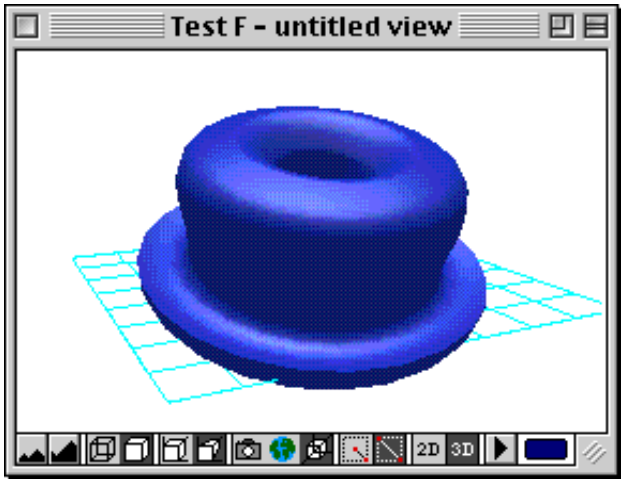
7. To draw a Bezier curve, click and drag the cursor:



8. To draw a spline curve, hold down the Option key and click and drag the cursor:



9. Double-click to lathe a geometry from the template:

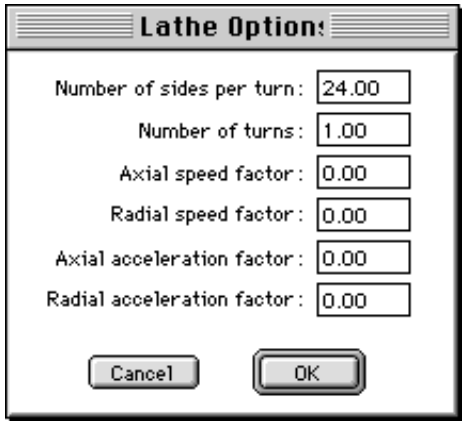


At any time while drawing the lathe template:

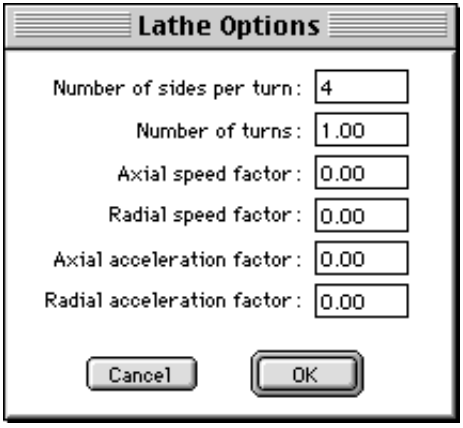
- Hold down the Shift key to constrain lines to one of the two axes of the plane you are drawing in.
- Hold down the Command key to draw a line tangent or perpendicular to the previous line or curve. Constraining lines will display.
- Use the Delete key to delete the last point placed.

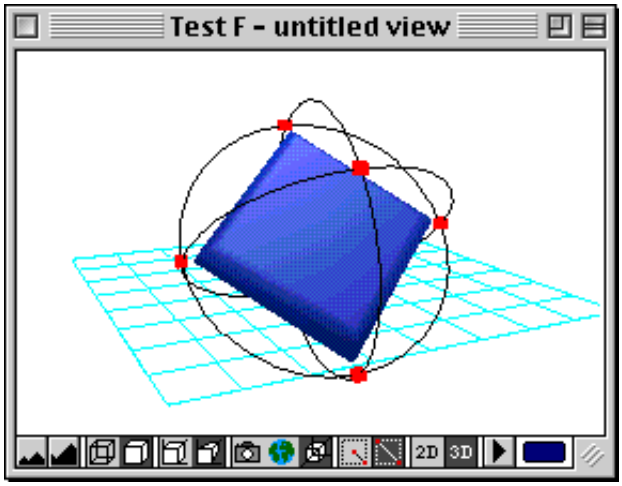
Lathe Options

Hold down the Option key and click on the Lathe tool to display the Lathing Options dialog:



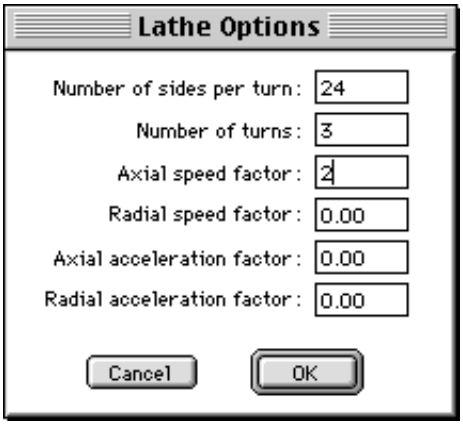
- **Number of sides per turn:** The number of sides the resulting lathed object will have. The default value is 24 which approximates to a circle. Type in a value for the number of sides, close the dialog and produce the lathed object.

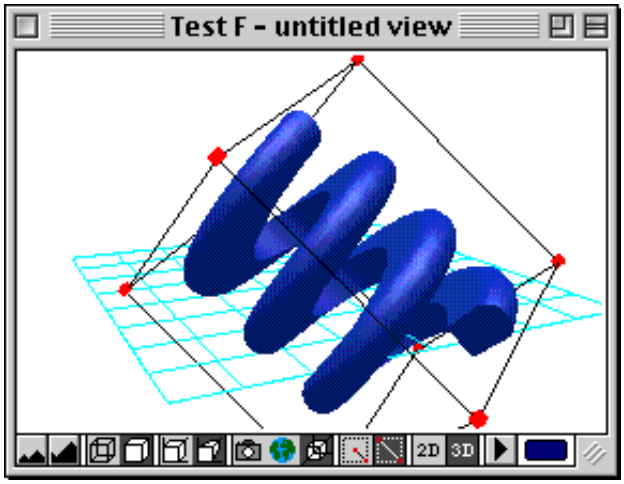




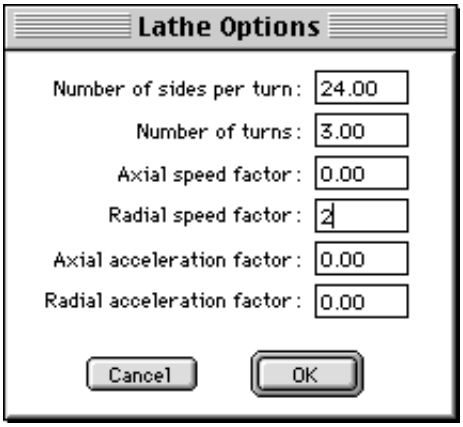
- **Number of Turns:** The number of times the lathed template should be turned. This option will have no effect unless at least one of the other Lathing Options is also changed.
- **Axial Speed Factor:** This is the initial speed of a lathe template along its axis. As an object is lathed, the template can be moved along the axis to produce a helix. The distance it is

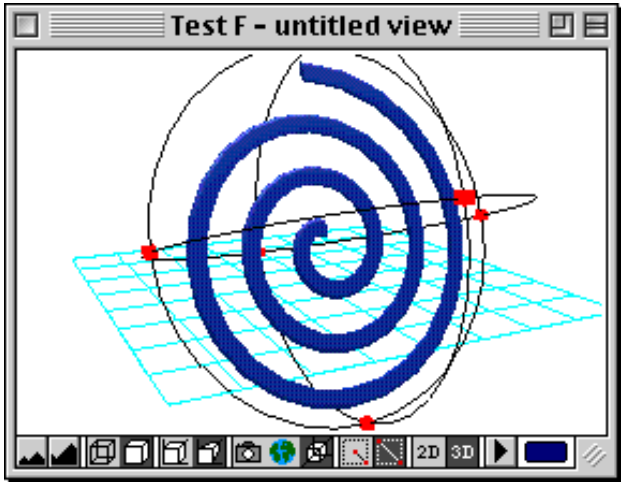
moved per turn is determined by the height of the lathe template multiplied by the axial speed factor:





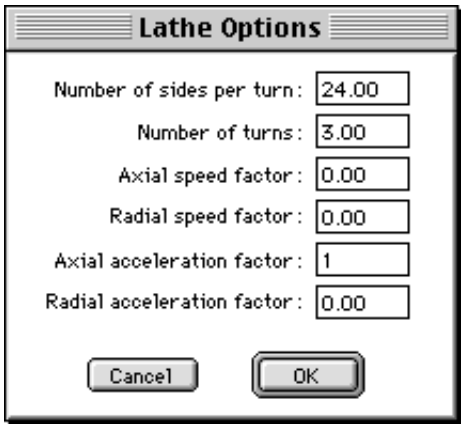
- **Radial Speed Factor:** As an object is lathed, the template can be moved away from or towards the axis to produce a spiral. The distance it is moved per turn is determined by the distance of the template's outside edge from the axis, multiplied by the radial speed factor. This is the initial speed of the template, perpendicular to its axis:

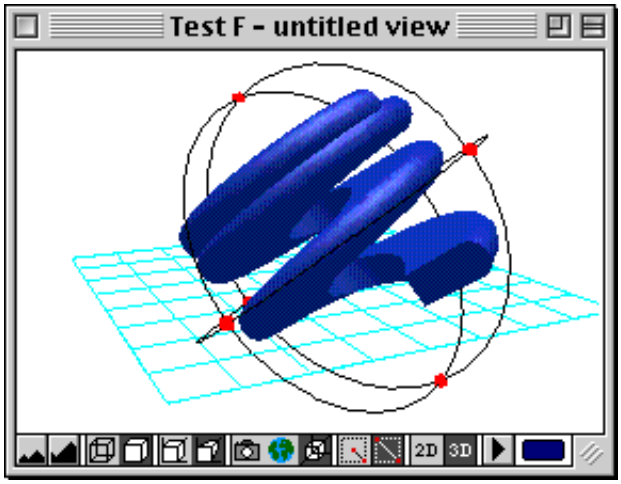




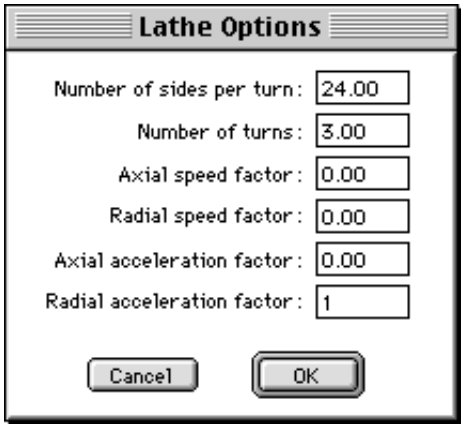
- **Axial Acceleration Factor:** As previously described, the axial speed factor allows you to set an initial speed for a lathe template moving along its axis. The axial acceleration factor allows you to specify whether this speed should increase or decrease with the number of

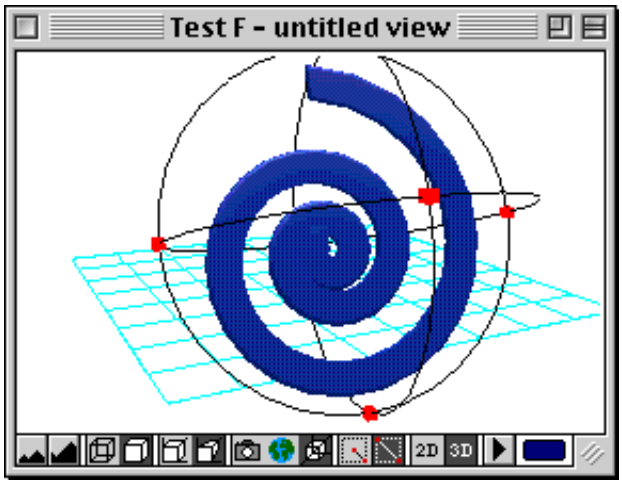
turns. The speed per turn is increased by the template's current height, multiplied by the axial acceleration factor:





- **Radial Acceleration Factor:** As previously described, the radial speed factor allows you to set an initial speed for a lathe template moving perpendicular to its axis. The radial acceleration factor allows you to specify whether this speed should increase or decrease with the number of turns. The speed per turn is increased by the current distance between the template's outside edge and the axis, multiplied by the radial acceleration factor:

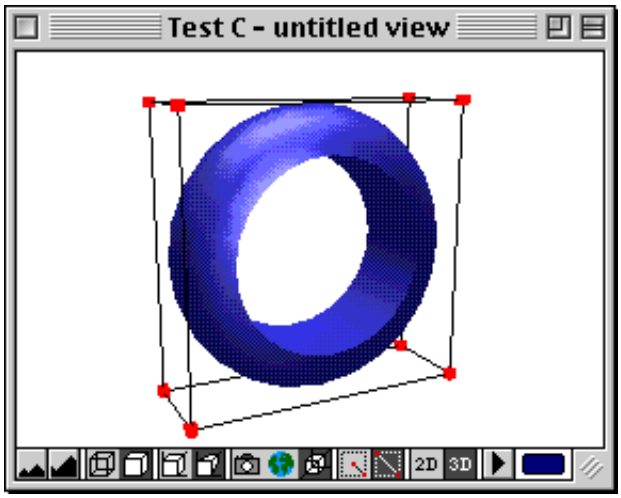


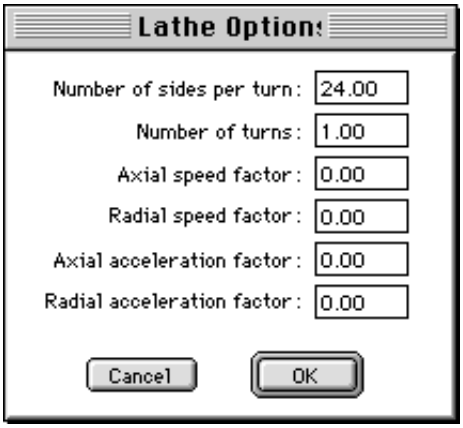


Editing Lathed Geometries

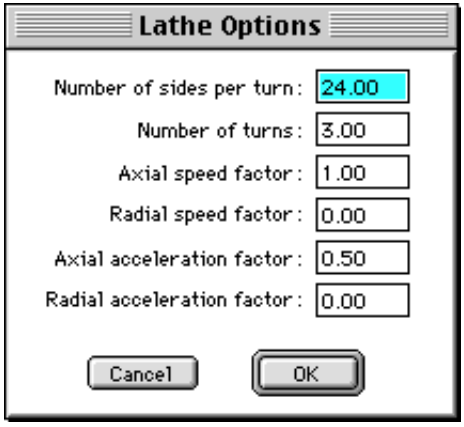
Lathed geometries can be altered after they have been drawn, by changing the Lathe Options.

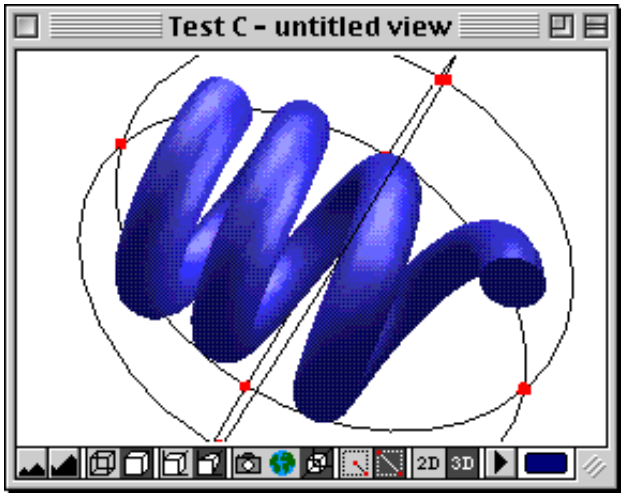
1. Select a lathed object in your 3D World document, hold down the Option key and click on the Lathe tool in the Tools Palette to display the Lathe Options dialog.





2. Change the settings in the dialog, click OK and the selected object will be re-lathed with reference to the new settings:



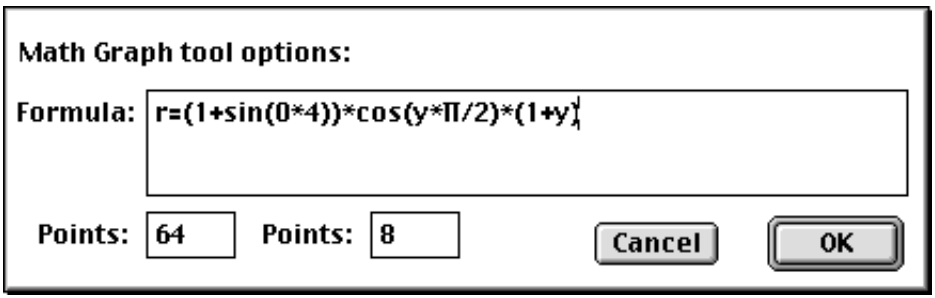


The path of a lathed geometry can be adjusted using the Edit Path tool to alter the axial and radial speed and acceleration and the number of turns of the lathe template. For some users this may provide a more intuitive method of adjusting a lathed object than using the Lathe Options. *See Editing the Path of a Lathed Object on page H-43 for more details.*

◆ Math Graph

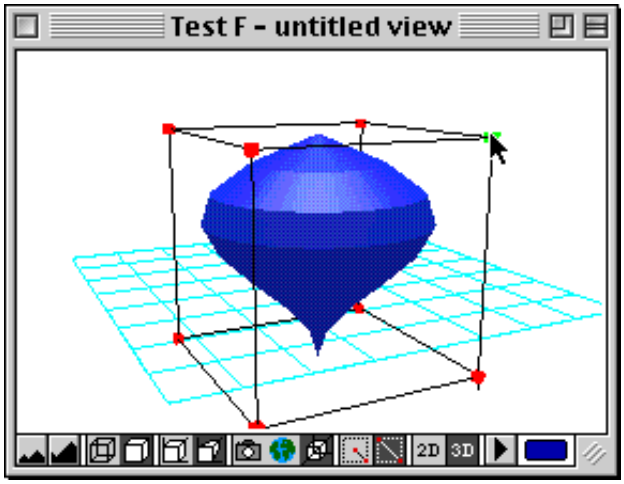
The Math Graph plug-in is used to enter a 3D geometry based on a mathematical formula.

1. Hold down the Option key and select the Math Graph plug-in in the Tools palette. The Math Graph tool options dialog displays:



2. Enter a formula in the Formula field and values in the points fields and click OK.

3. With the Math Graph tool selected, click in the document window and, holding down the mouse button, drag to create a geometry based on the formula.



The formula will remain as set until changed.

Formulae:

The formula can express either X, Y or Z in terms of the other two variables. The values of the two variables can range from -1 to +1, and the function value is scaled to fit within the same range. R and theta can also be used on the right hand side of the equation (the Ø symbol is used as there is not a real theta symbol in the Chicago font). Alternatively, R can be expressed in terms of theta and either X, Y or Z. At least one of X, Y or Z must be used to determine which axis R and theta are around, or 'Y*0+' can be used at the start of the equation. When entering formulae, the upper and lower case letters are equivalent.

Operators allowed in the function are:

(,) {sub expression}

^ {raise to power}

*, /, %, Mod {% is the 'C' modulo operator, and Mod is from Pascal}

+, -

>, <, =, ==, <=, ≤, >=, ≥, ≠, #, !=, <>

!, Not

&&, And

||, Or

value?value:value {C style conditional expression}

sin(radians), cos(radians)
atan(value), atan(value,value)
abs(value)
log(value)
exp(value)
sqrt(value)
max(value,.....,value)
min(value,.....,value)

Operands allowed in the function are:

constants e.g. 1, .1, 0.001, 1000.01
X, Y, Z
π or ∏ [option P]
ø or Ø {theta, which is atan2 (Y, X)}[option O]
R {sqrt(X*X + Y*Y)}
Rand {a random number -1 to +.999999}
T {time: current animation time expressed in seconds}

Some example formulae are:

Z=X^2+1/Y
Z=Sin(x*8*π)+Sin(x*8*π)
Z=r
Z=ø
Y=Rand?0:1
R=(sin(ø*14))+sqrt(1-y*y)*16

Note: in the first example there is a divide by zero in the first equation at Y=0, where a value of zero is assumed so that the surface can be whole.

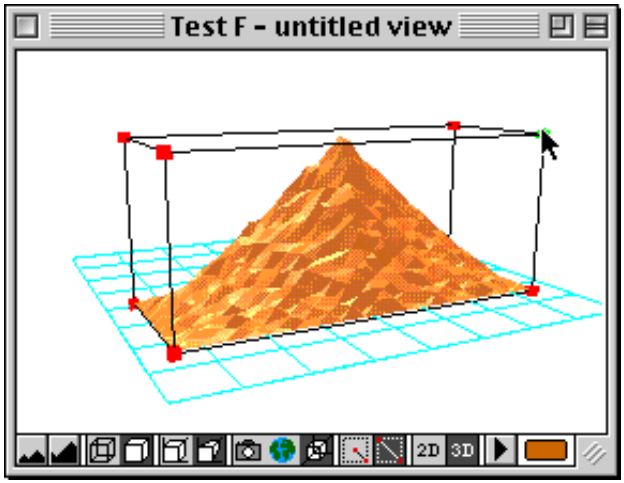
Points

The dialog allows you to enter two values, both called Points. These are the number of samples of each of the input parameters. The value they have depends on the combination used. The possible combinations are: XY, XZ, YZ, XØ, YØ, ZØ. In each case the left hand one of the pair maps to the left hand value in the dialog.

◆ Mountain

The Mountain plug-in is used to create a single mountain peak.

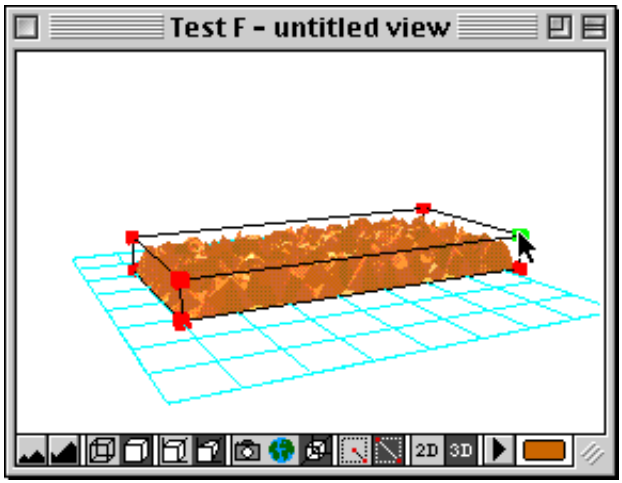
Select the Mountain plug-in from the Tools palette. Click on the grid and drag out a mountain geometry. This will have a classic “Mount Fuji” shape, although there will be a certain amount of randomness to the mountain’s slope.



Mountains

The Mountains plug-in is used to create a range of mountain peaks.

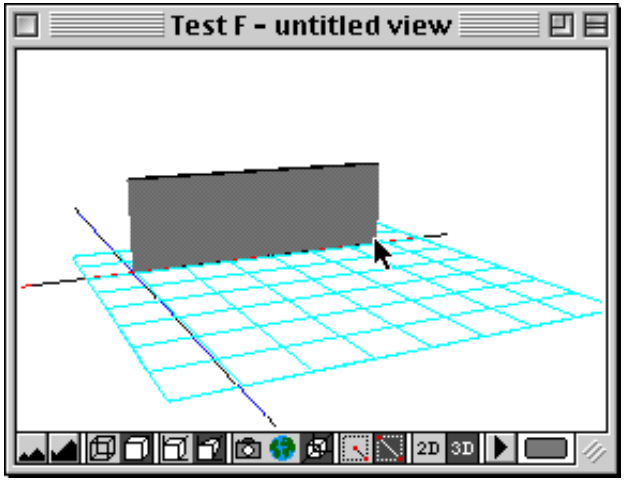
Select the Mountains plug-in from the Tools palette. Click on the document grid and drag out the mountains geometry, which is a random set of peaks.



◆ Multi Walls

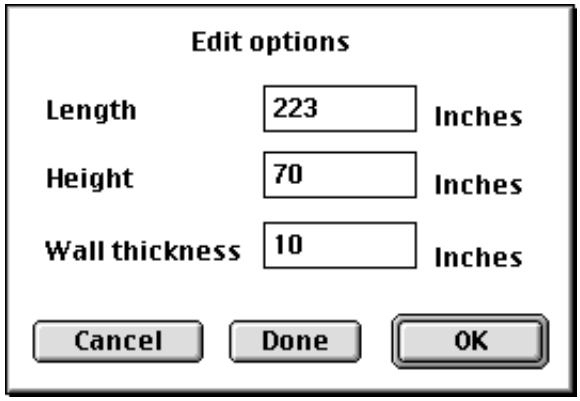
The Multi Walls plug-in is used to create rooms other than those with four regular walls.

1. Select the Multi Walls plug-in from the Tool palette.
2. Click in the 3D World document at the point you wish to start drawing a wall. Holding down the mouse button, drag along one of the constrainer lines that display to draw the wall.



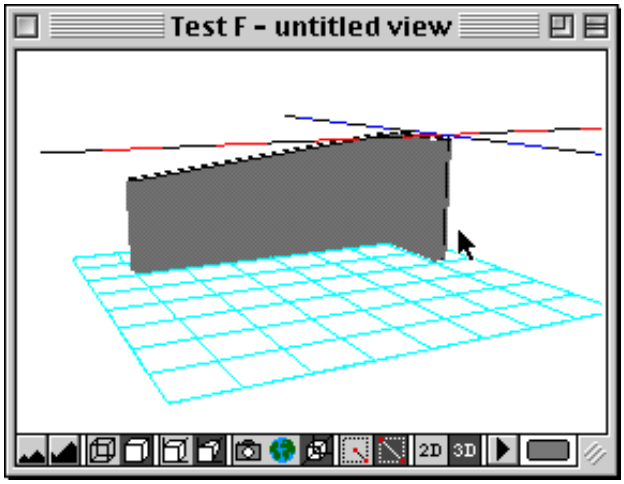
Note: Currently only perpendicular walls can be drawn. To enter walls with internal wall measurements, draw the room in a clockwise direction as viewed from above; to enter walls with external wall measurements, enter walls in an anti-clockwise direction as viewed from above.

3. Click at the point you want the wall to end. The Entry options dialog displays:

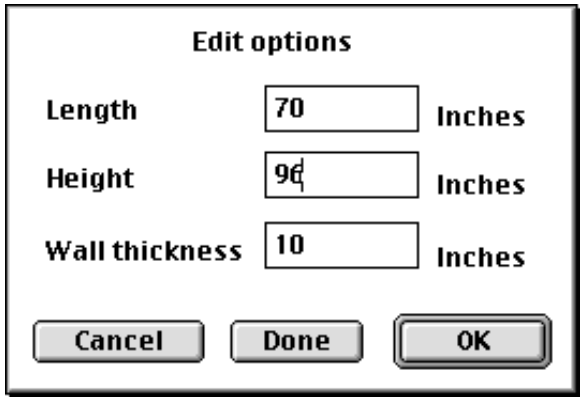


- If you have drawn the wall to exactly the correct length, and the default settings for the height and thickness of the wall are correct, click OK.
- To change any of the walls dimensions, enter new values in the Length, Height and Wall thickness fields and click OK.
- If this is the last wall to be drawn click on the Done button.
- To enter the wall again, click the cancel button.
- To prevent this dialog from displaying, hold the Option key down when clicking on the point you want the wall to end.

4. After closing the Edit options dialog, draw the next wall by dragging along one of the constrainer lines displayed:



5. Click at the point you want the wall to end. The Edit options dialog will display again. In this example, the height of the second wall has been increased.

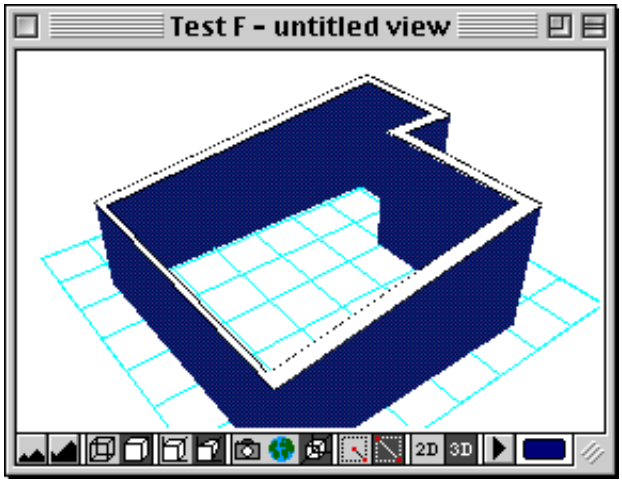


6. Continue drawing further walls in the same way, adjusting the height and thickness of the walls as required.

   While entering walls, if the cursor is aligned with another wall corner, an alignment line will display showing the alignment and the cursor will change to a hollow cross.

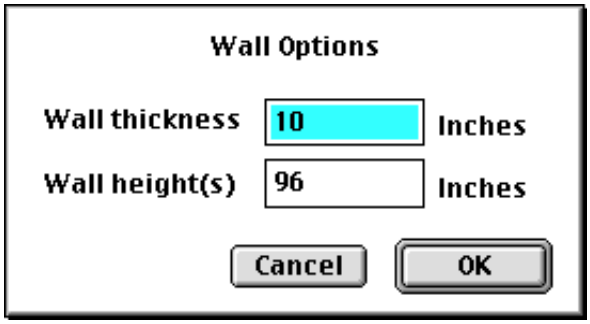
   Press the delete key at any time while entering walls to delete the wall currently being entered. The cursor will be move back to the previously entered wall.

7. When the last wall is drawn, click on the Done button in the Edit options dialog.



To change the default settings for wall height and thickness for the Multi Walls plug-in:

1. Hold down the Option key and select the Multi Walls tool to display the Wall Options dialog.

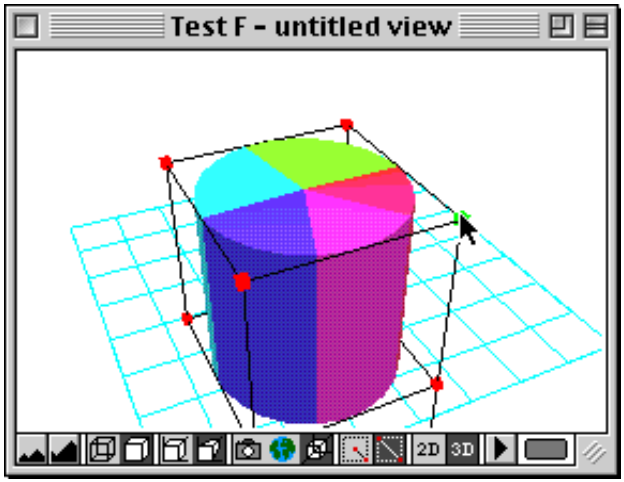


2. Enter a value in the Wall thickness field to specify the default thickness for walls.
3. Enter a value in the Wall height(s) field to specify the default height of the walls.

◆ Pie Chart

Use the Pie Chart plug-in to draw 3D Pie Charts.

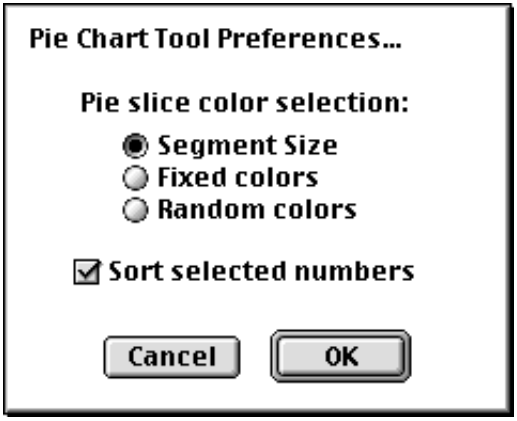
1. Copy the data you want to chart onto the Clipboard (this will probably be from a spreadsheet, although other similar tab delimited text formats can be used).
2. Select the Pie Chart tool from the Tools palette.
3. Click on the grid and drag out the pie chart. Hold down the shift key to constrain the cross-section to a circle, the height can be adjusted afterwards.



Pie charts are made up of slices of a cylinder. To move or change the color of any slice, flag the pie chart as Dismantleable, ungroup it and manipulate the slices independently. *See Dismantleable on page 3-34 and Primitive/Dismantleable Flag on page 4-19 for further details.*

To change the Pie Chart tool preferences:

1. Hold down the Option key and click on the Pie Chart tool. The Pie Chart Tool Preferences dialog displays:

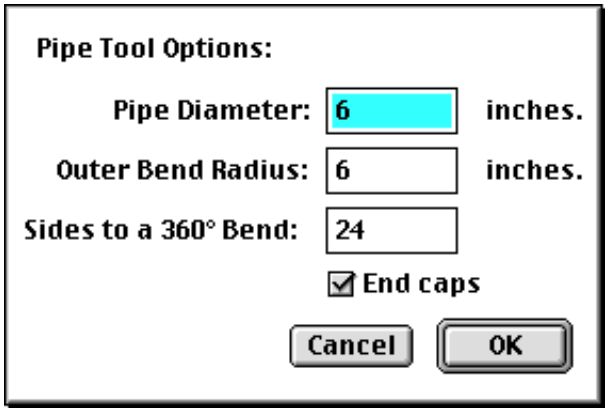


2. Click on one of the Pie slice color selection radio buttons to choose the colors to use for the pie chart.
   - **Segment Size:** This option specifies that a color should be applied to each segment according to the size of the segment and its position in the pie chart. The color used is calculated from the color wheel using the above factors.
   - **Fixed colors:** Choose this option to apply one of a set of seven basic colors to each slice of your pie chart. The Colors are applied in turn, the eighth slice is given the same color as the first slice, and so on.
   - **Random colors:** Click on this radio button to have random colors applied to each section of the pie chart.
3. Check the Sort selected numbers check box if you want the numbers used for the pie chart to be sorted into size order before the pie chart is drawn. In this case the slices of the pie chart will be arranged in size order.

◆ Pipes

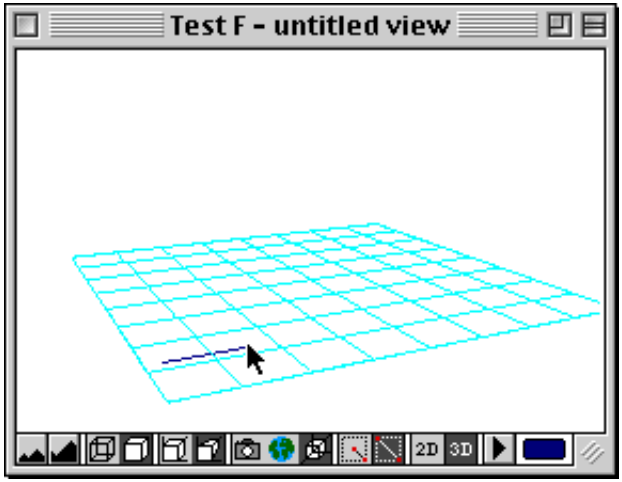
The Pipes plug-in is used to draw pipe geometries.

1. Hold down the Option key and select the Pipes tool from the Tools palette to display the Pipe Tool Options dialog:

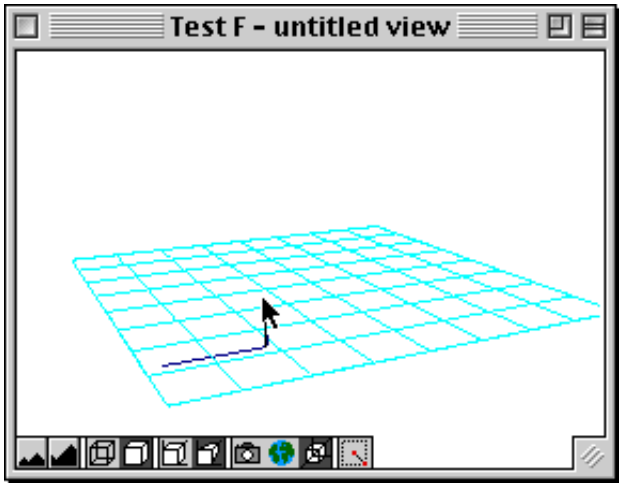


2. Enter a value in the Pipe Diameter field to specify the width of the pipe.
   - **Enter zero:** A polyline will be drawn. This will be drawn as one pixel thick, regardless of the view, and may be useful when defining a path to use with the animate camera or animate object plug-ins. *See Animate Camera on page C-3 and Animate Object on page H-23 for further details.*
3. Enter a value in the Outer Bend Radius field to specify how the bends in the pipe should be drawn.
   - **Enter zero:** Mitred joints will be generated.
   - **Enter half the pipe's diameter:** The outer half of the joint will be radiused and the inner half mitred — just like a pipe elbow.
   - **Enter a value more than the pipe's diameter:** Gradual bends will be generated (if there is not enough straight pipe on each side of the bend to generate gradual bends, the length of the curve will be reduced).

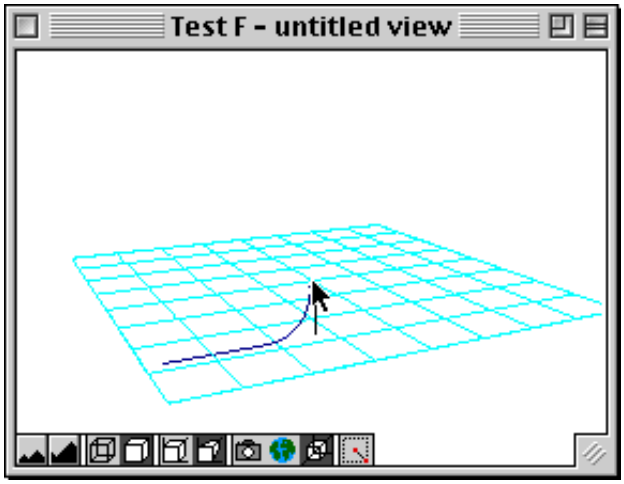
4. Enter a value in the Sides to a 360° Bend field to determine the accuracy with which bends in the pipe are formed. (The 3D World Edges to a circle preference controls the number of vertices used to form each cross section of pipe. *See Options on page 3-22 for further details.*)
5. Check the End caps checkbox if you wish the pipe to be sealed at both ends.
6. Click OK, the options will remain as set until changed.
7. With the Pipes tool still selected, position the cursor where you want to begin drawing, click the mouse button to place a vertex point, move the cursor and click again:



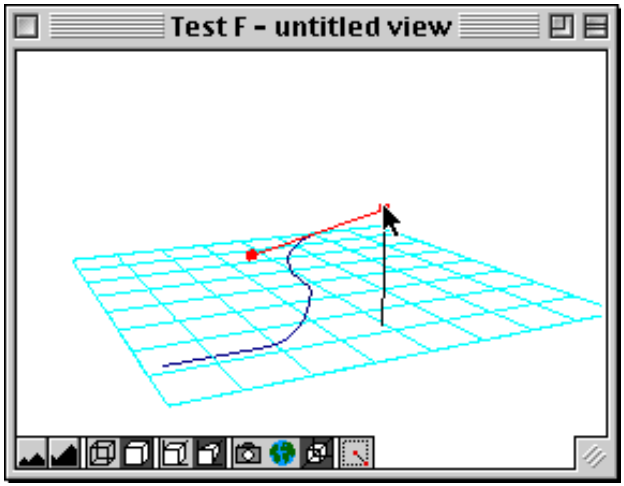
8. To draw an arc, hold down the Option key and click at the point that will represent the center of a circle:



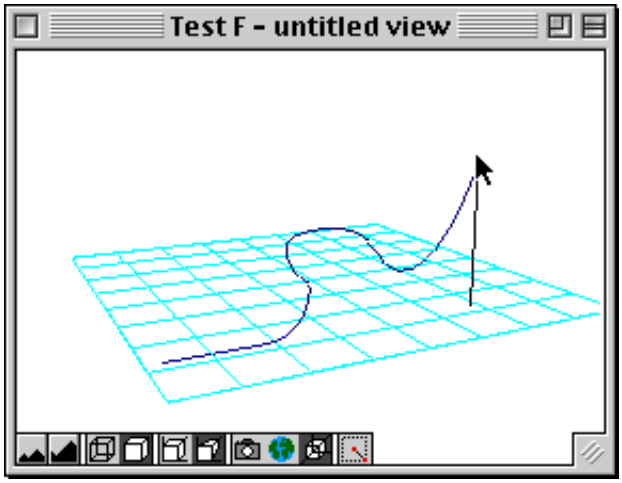
9. Release the Option key and mouse button and move the cursor ready to place the next point. The arc will display:



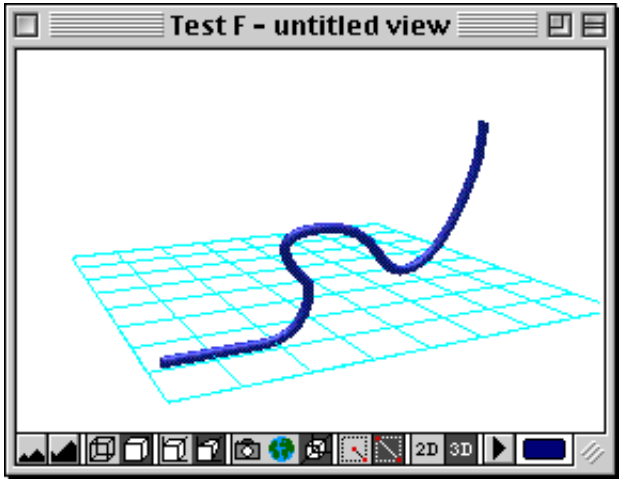
10. Click to place the next point at the end of the arc.
11. To draw a Bezier curve, click and drag the cursor:



12. To draw a spline curve, hold down the Option key and click and drag the cursor:



13. Use the Delete key at any time to delete the last point placed.
14. Double-click at any time to complete the shape:



Hold down the Shift key while drawing the pipe path to constrain the path to the X, Y, or Z axis. To move in the Z dimension, hold down the Control key.

To break the pipe down into the bends and straight sections that make it up, flag the pipe as Dismantleable and ungroup it. *See Dismantleable on page 3-34 and Primitive/Dismantleable*

Flag on page 4-19 for further details. Each component of the pipe can now be manipulated separately.

If you apply a pattern to a pipe, the number of pattern repeats along the pipe will be determined by the pipe's circumference.

◆ Point Light

Use the Point Light plug-in to place point lights in your 3D World document. Point lights radiate light in all directions.

Note: Light objects are visible by default. If you have turned off the Show Lights option in the Lights palette, the light objects will not be displayed. *See Lights on page D-60 for more details.*

Select the Point Light tool in the Tools palette and click in the document window. The light is placed at the point clicked.

A point light is displayed as a small sphere and when selected has a bounding sphere. Point lights cannot be resized, but can be moved and rotated like other objects. Note that rotating a point light will not have any affect on the lighting in the document.

Hold down the Command key when placing a point light and, if the scene is rendered using a LightWorks renderer, that particular light will not cast any shadows.

Hold down the Option key when placing a point light and a light with a negative brightness value will be placed in the document. The negative brightness value can be adjusted using the Brightness slider in the Info palette as usual. To adjust a light with a negative brightness value so that it has a positive brightness value, set the brightness to 0 in the Info palette, then adjust brightness as for an ordinary point light.

The Info Palette is used to specify the color and brightness of a selected point light. *See Info Palette on page 4-17 for further details.*

The color of the point light sphere is set in the Preferences dialog. *See Preferences on page 3-21 for further details.*

Lighting Control and Manipulation

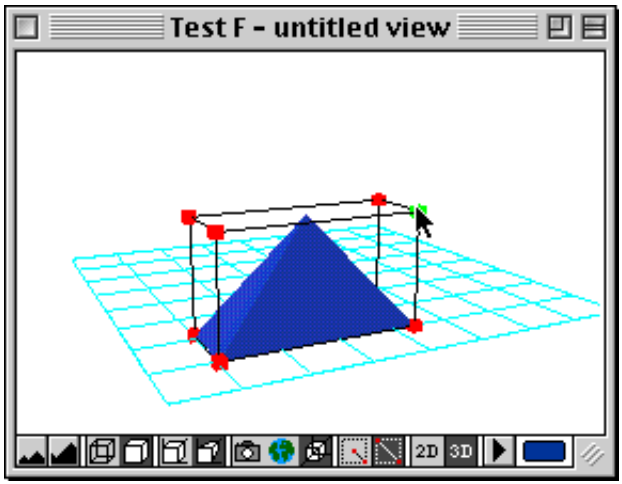
See Lights on page D-60 for more details.

◆ Pyramid

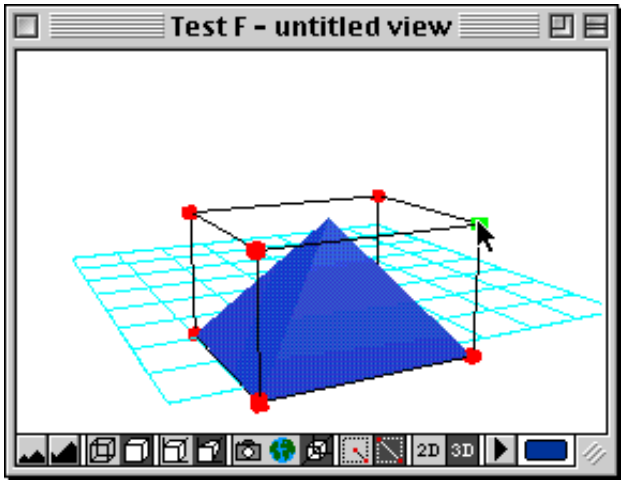
The Pyramid plug-in is used to draw pyramid geometries with a specified number of sides.

1. Hold down the Option key and select the Pyramid plug-in from the Tools palette to display the Pyramid Options dialog:

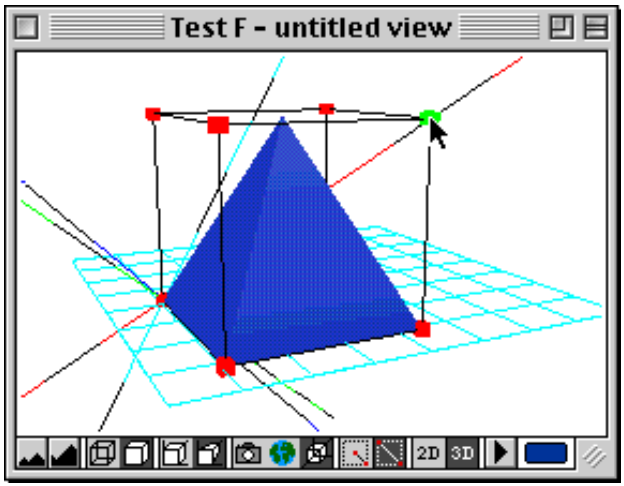
2. Enter a value in the Number of sides field to specify the number of sides the pyramid should have.
3. Place the cursor at the point to begin drawing, hold down the mouse button and drag to create the pyramid geometry:



4. Hold down the Control key and move the mouse up or down to change the depth of the pyramid. Release the mouse button when the pyramid reaches the desired size:



5. Hold down the Shift key while drawing the object to constrain the base of the pyramid so that each side is the same length, and constrain the height of the pyramid to the diameter of an imaginary circle that touches all the points of the base:

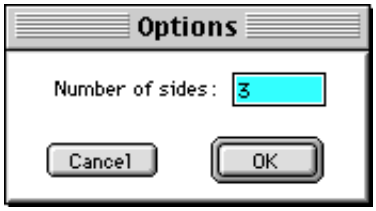


In 2D mode, you will not be able to create a 3D object, and holding down the Shift key will constrain the object shape to a polygon with equal sides, or to a triangle, depending upon which plane you are drawing in. Using the Control key in 2D mode will not add depth to an object, but you can use it to draw your 2D shape in the Z dimension.

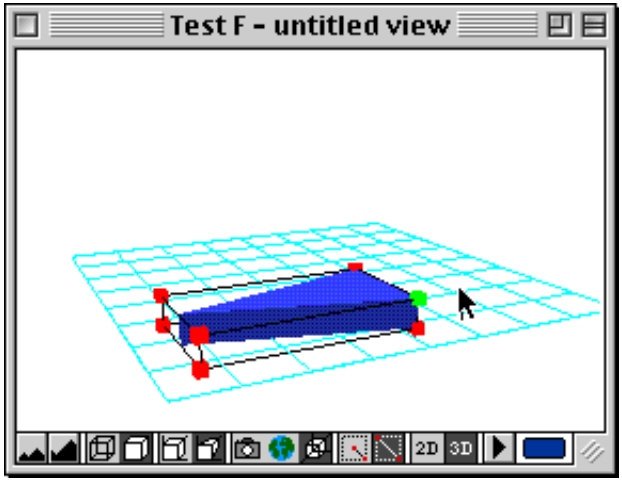
◆ Regular Polygon

The Regular Polygon plug-in is used to draw regular polygons with a specified number of sides.

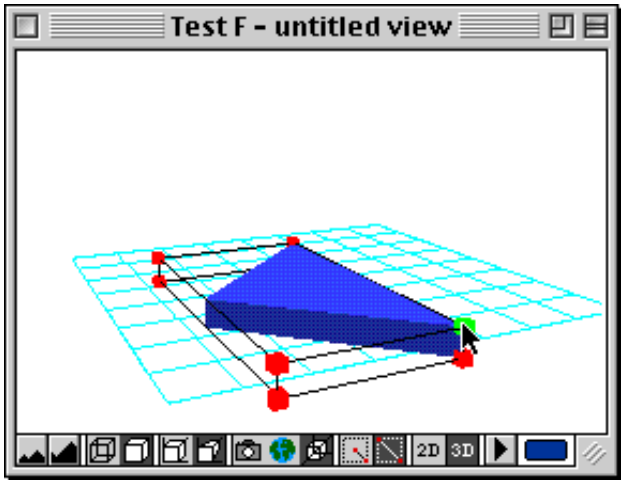
1. Hold down the Option key and select the Regular Polygon plug-in in the Tools palette to display the Regular Polygon Options dialog:



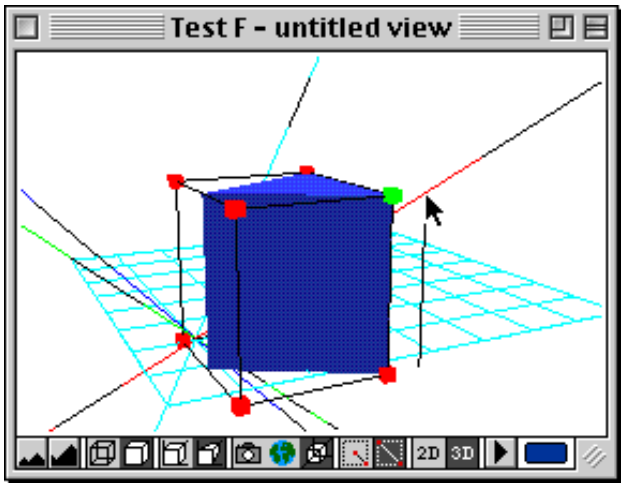
2. Enter a value in the Number of sides field to specify the number of sides the regular polygon should have. The number of sides will remain as specified until you change it.
3. Place the cursor at the point to begin drawing, hold down the mouse button and drag to create the regular polygon:



4. Hold down the Control key and move the mouse up or down to change the depth of the regular polygon. Release the mouse button when the polygon reaches the desired size:



5. Hold down the Shift key while drawing the object to constrain the cross section of the polygon so each side is the same length, and constrain the height of the shape to the diameter of an imaginary circle that touches each point of the base of the polygon:



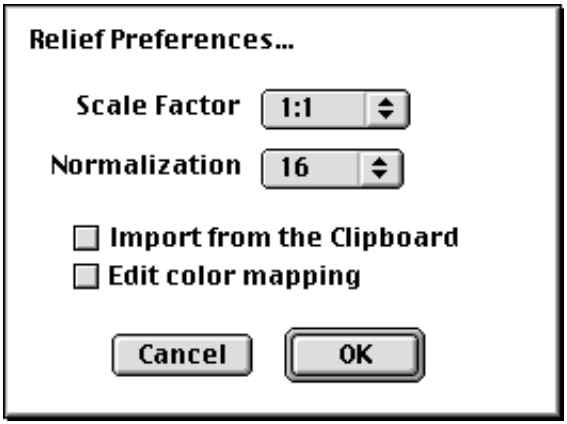
In 2D mode, you will not be able to create a 3D object and holding down the Shift key will constrain the object shape to a polygon with equal sides, or a square, depending upon which plane you are drawing in. Using the Control key in 2D mode will not add depth to an object, but you can use it to draw your 2D shape in the Z dimension.

◆ Relief

The Relief plug-in is used to create a 3D surface from a picture contained in a PICT file, the clipboard, or a picture clipping. Each pixel in the source picture is mapped onto a point on the 3D surface, the color of the pixel defining the height of that point.

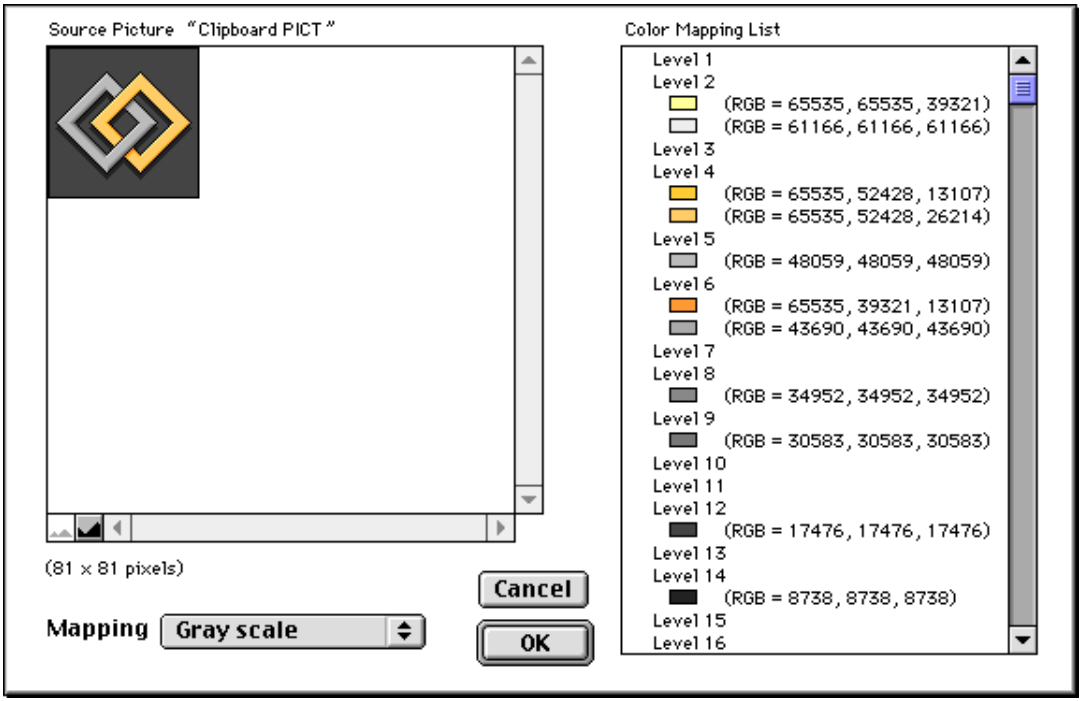
Using the default options, the source picture is converted into a gray scale image of 256 gray colors. The 3D surface will have 16 possible levels with level one being the lowest. Hence pixels in the source picture that convert to one of the 16 lightest gray colors will be plotted with the lowest height. Pixels that convert to the next 16 gray colors will be plotted at the second lowest height, etc. If the source picture contains only 16 gray colors then each shade of gray in the source picture will convert to an individual height, giving a direct mapping between gray color and height.

Select the Relief tool from the Tools palette. To change the Relief options, hold down the Option key and click on the Relief tool again. The Relief Preferences Dialog displays:



- **Scale Factor:** Select a scale factor from the Scale Factor popup menu to change the size of the source image before it is mapped as a 3D object.
- **Normalization:** Select a value from the Normalization popup menu to change the number of levels in the 3D surface. To perform a direct mapping of color to level for a source picture with 256 gray colors in it, select a normalization of 256. Note: The process of mapping colors to levels when there could be more colors than levels is called normalization.

- **Import from the Clipboard:** Click the Import from the Clipboard check box if the source picture is on the clipboard rather than in a file. If this checkbox is not checked, when you select the Relief tool and click in the document window, a standard dialog will display for you to locate the file to be mapped.
- **Edit color mapping:** Click the Edit color mapping check box to edit the mapping from colors in the source picture to levels in the 3D surface. If this checkbox is checked, after the source picture is selected and you click in the document window, the Color Mapping dialog will display:



The Color Mapping dialog allows you to manually adjust which color in the source picture maps onto which level in the 3D surface. The dialog contains the Mapping popup menu that allows the Mapping Lists to be saved, deleted or selected.

- **Viewer:** The viewer displays the source picture. Use the zoom in and zoom out buttons and the window scroll bars to change your view of the picture as required.
- **Color Mapping List:** Listed below each level and offset to the right are the colors that will be mapped at that level in the 3D surface. The default settings convert the image

to grayscale and map to 16 levels. As only the colors contained in the source picture are in the list, some levels may not contain any colors.

To change the level at which a color will be plotted, click on the color and, holding down the mouse button, drag it to the required level. As the cursor moves over the levels a red arrow will display to the left of the level. Release the mouse button when the red arrow is adjacent to the required level.

Use the Shift key to add further colors to your selection, and the Command key to deselect colors from a selection. To move all the selected colors, click on one of the colors and drag. Select all the colors in the list by typing Command-A, or all the colors in a level by clicking on the level. Colors in the list can also be selected by clicking on pixels in the source picture displayed in the viewer.

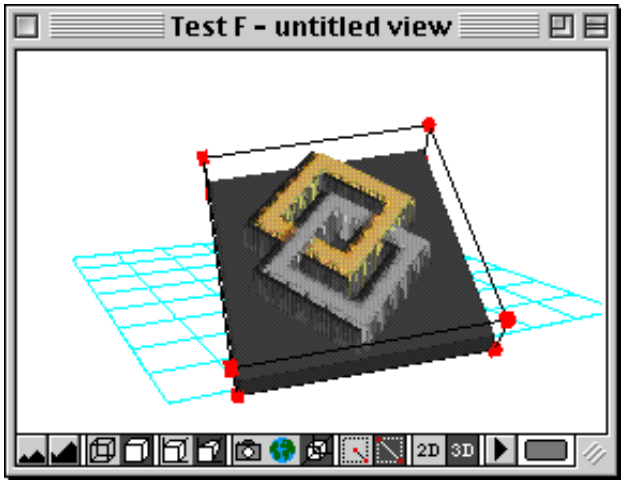
- **Mapping:** When you have finished editing the mapping of colors to levels, the list contents can be saved by selecting Save set from the Mapping popup menu.

  In the dialog that displays, enter a name for the mapping set and click Save. The new set will now be listed in the Mapping popup menu and can be used for other pictures to give the same result as the mapping for the first, assuming the pictures contain the same colors. If a subsequent picture contains a different color, that color will be mapped onto its default gray scale normalization level.

  To delete a saved mapping set, select Delete Set from the Mapping popup menu. A list of mapping sets that can be deleted will display. Select the appropriate set and click Delete to delete it.

Click OK in the Color Mapping dialog to accept the settings entered.

To draw the mapped 3D shape, select the Relief tool, click in the document window and drag out the shape, it can then be manipulated like any other 3D object.



Note: If the source picture is large, using this tool could require a lot of memory. The 3D surface plotted for a picture that is 80 by 80 pixels will contain 6400 points, for a picture that is 100 by 200 pixels, the surface will contain 20000 points. If the plot fails, reduce the size of the source picture by changing the scale in the Relief preferences dialog (this will decrease the resolution of the picture), or increase the application memory partition in the Get Info box for 3D World.

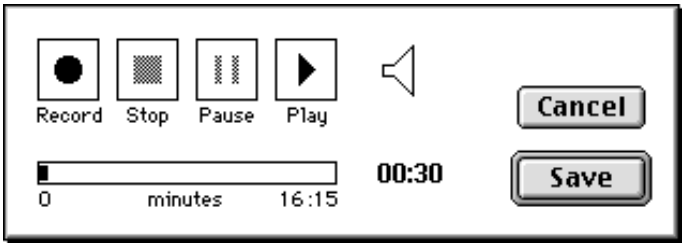
The Relief Import Plug-in

The Relief plug-in is available as an import plug-in, accessed via the Import submenu in the File menu as well as a Plug-in Geometry. When selected from the Import submenu, it uses the settings currently in the Relief Preferences dialog. To change the Relief options, hold down the Option key when selecting Relief from the Import submenu to display the Relief Preferences dialog.

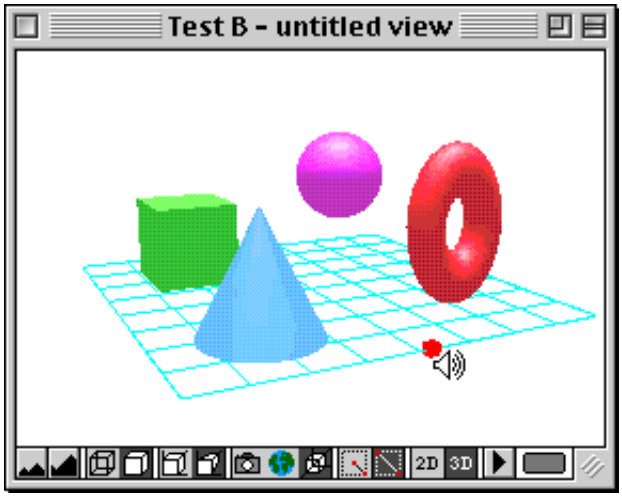
◆ Sound Marker

Use the Sound Marker plug-in to place sound markers in the 3D World document. Sound markers are placed in specific locations, but always display perpendicular to the camera. A sound marker displays as the standard Macintosh sound icon.

1. Select the Sound Marker tool in the Tools palette.
2. Move the cursor over the window, it will become a sound icon.
3. Click to place the sound marker and the Record dialog will display. Use the controls to record your sound.



4. Click on Save to close the dialog and place the sound marker in the document:

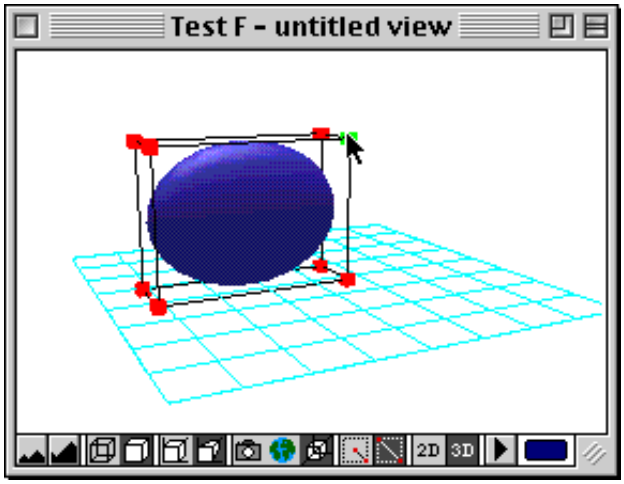


Double-click on the icon to play the sound. Ensure that the Sound On option is turned on in the Preferences dialog. *See Options on page 3-22 for further details.*

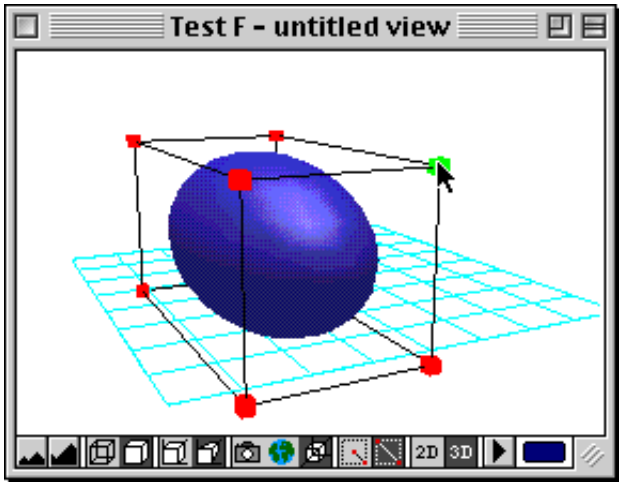
◆ Sphere

Use the Sphere plug-in to draw ellipses and spheres.

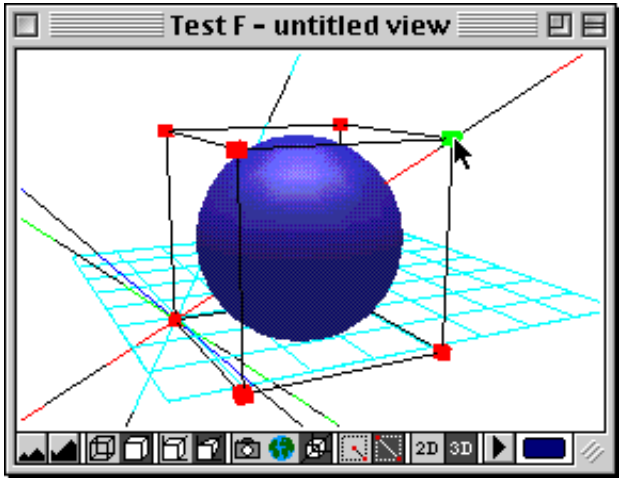
1. Place the cursor at the point you want to begin drawing, hold down the mouse button and drag to create an object:



2. Hold down the Control key and move the mouse up or down to change the object's depth. Release the mouse button when the ellipse/sphere reaches the desired size:



3. To constrain the shape of the object to a sphere, hold down the Shift key while drawing:



In 2D mode, you will not be able to create a 3D object, and holding down the Shift key will constrain the object shape to a circle. Using the Control key in 2D mode will not add depth to an object, but you can use it to draw your 2D shape in the Z dimension. *See 2D on page 4-34 for further details.*

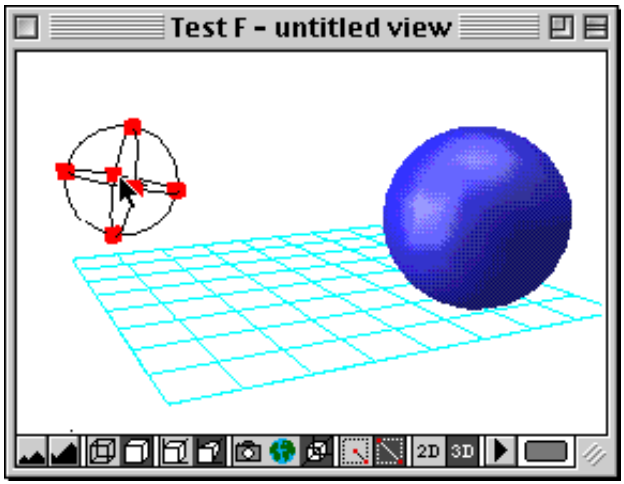
Spot Light

Use the Spot Light plug-in to place spot lights in your 3D World document. Spot lights have a directional shade around them which can be rotated to direct light in a specific direction.

Note: Light objects are visible by default. If you have turned off the Show Lights option in the Lights palette, the light objects will not be displayed. *See Lights on page D-60 for more details.*

Select the Spot Light tool in the Tools palette.

- **To place a spot light at a specific position in the document:** move the cursor to that point, click and release the mouse button.
- **To direct the light as you place it in the document:** click on the point you wish the spot light to shine and drag the light into position before releasing the mouse button. Hold down the Shift key when dragging the light to constrain it to an axis perpendicular to the surface clicked on.



A spot light is displayed as an open, four sided pyramid with a line coming out of it. The line indicates the direction the light is pointing. When a light is selected it displays with a bounding sphere. Spot lights cannot be resized, but can be moved and rotated like other objects.

Hold down the Command key when placing a spot light and, if the scene is rendered using a LightWorks renderer, that particular light will not cast any shadows.

Hold down the Option key when placing a spot light and a light with a negative brightness value will be placed in the document. The negative brightness value can be adjusted using the Brightness slider in the Info palette as usual. To adjust a light with a negative brightness value so that it has a positive brightness value, set the brightness to 0 in the Info palette, then adjust brightness as for an ordinary point light.

The Info Palette is used to specify the color, brightness, spread and sharpness of a selected spot light. The Spread control adjusts the lens angle, while the Sharpness control adjusts the focus. *See Info Palette on page 4-17 for further details.*

The color of the spot light pyramid is set in the Preferences dialog. *See Preferences on page 3-21 for further details.*

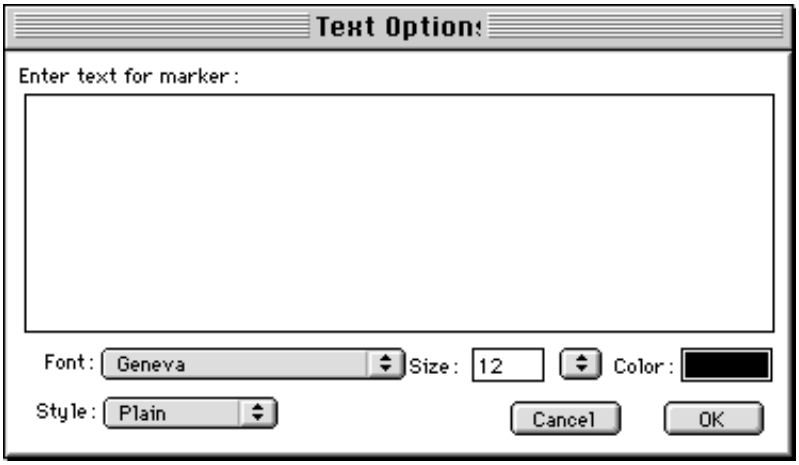
Lighting Control and Manipulation

See Lights on page D-60 for more details.

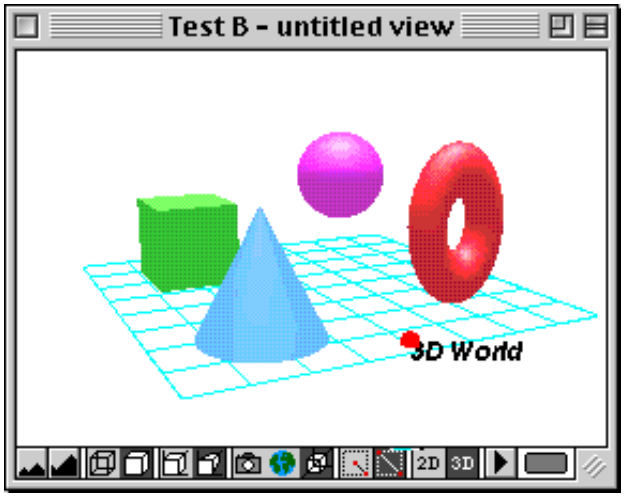
◆ Text Marker

Use the Text Marker plug-in to place text markers in your 3D World document. A text marker is placed in a specific location, but always displays perpendicular to the camera. Text markers display as an object handle with the specified text next to it.

1. Select the Text Marker tool in the Tools palette.
2. Move the cursor over the document window, it will display as a text insertion cursor.
3. Click to place the text marker and the Text Options dialog will display:



4. Enter the marker text, and select the font and style from the popup menus.
5. Enter a font size or select a size from the popup menu.
6. Click on the Color box to display the Color Picker if you wish to select another color for the text.
7. Click OK to close the dialog and place the text in your document:



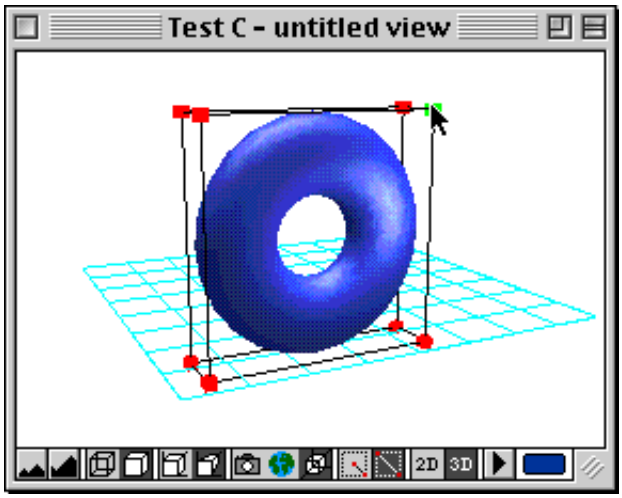
- **To move a text marker:** Select it and drag to reposition it, just as you would with any other object.

- **To edit a text marker:** Double-click on it to display the Text Edit dialog. Make your changes and close the dialog.
- **To change the color of a text marker:** Use drag and drop or the Info Palette, as with any other object. *See Info Palette on page 4-17 for further details.*

◆ Torus

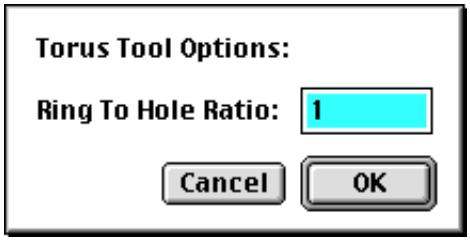
Use the Torus plug-in to draw a torus geometry which is a shape like a doughnut.

Select the Torus tool from the Tools palette. Click on the grid and drag out a torus shape.



The torus is drawn with reference to the 3D World preference Edges to a circle. *See Options on page 3-22 for further details.*

To change the Torus options, hold down the Option key and select the Torus tool from the Tools palette again. The Torus Tool Options dialog displays:



Enter a value in the Ring To Hole Ratio field to specify how thick the outer ring of the torus should be in relation to the diameter of the central hole.

- The default value of 1 will produce a torus where the thickness of the outer ring is the same as the diameter of the central hole.
- A value less than 1 will produce a torus where the thickness of the outer ring is the less than the diameter of the central hole.
- A value greater than 1 will produce a torus where the thickness of the outer ring is the more than the diameter of the central hole.