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# PROTEAN™

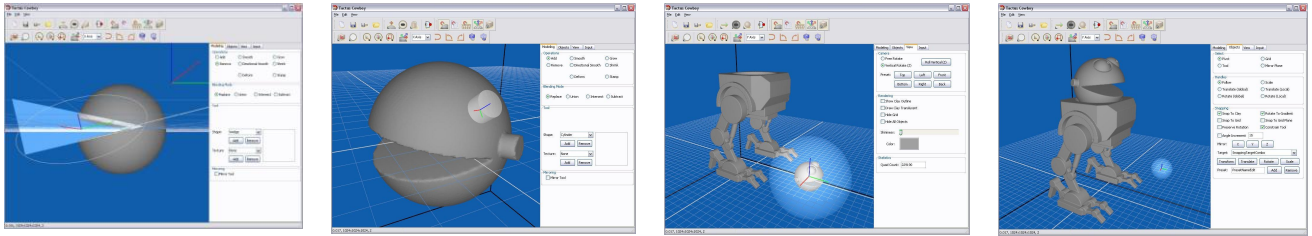
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## User Manual 1.0

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Build your first model

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# ***PROTEAN***

## ***User Manual***

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## GETTING STARTED:

### Screen Basics:

Once the software is installed, go to the *start menu* and select the *Run Clay* icon to start the program. The Protean software interface is comprised of four key areas (see *Figure 1*). The first is a drop-down menu located in the upper left hand corner of the screen. The *File* menu allows models to be created, saved, opened, and exported. The *Edit* menu contains commands like copy, paste, undo, and redo. The *View* menu enables customization of the screen layout. The second area is a menu bar located just below the menu bar and is populated with various icons. Some of the icons represent the commands previously mentioned in the drop down *File* menu. The other icons represent the tool and modeling functions. Some of the icons also contain drop down-menus with additional functions. The icons with drop-down menus are closely tied to the third area, which is a tool palette found on the right side of the screen. On this palette are four tabs; *Modeling*, *Objects*, *View*, and *Input*. Within each tab are functions specific to that topic. Again, many of these functions are tied to the icons at the top of the screen. The final component of the interface is the *Clay Area*. This is the large blue area where the grid is constrained by a black wire-frame box which encapsulates the modeling area. Models *cannot* be created outside this box.

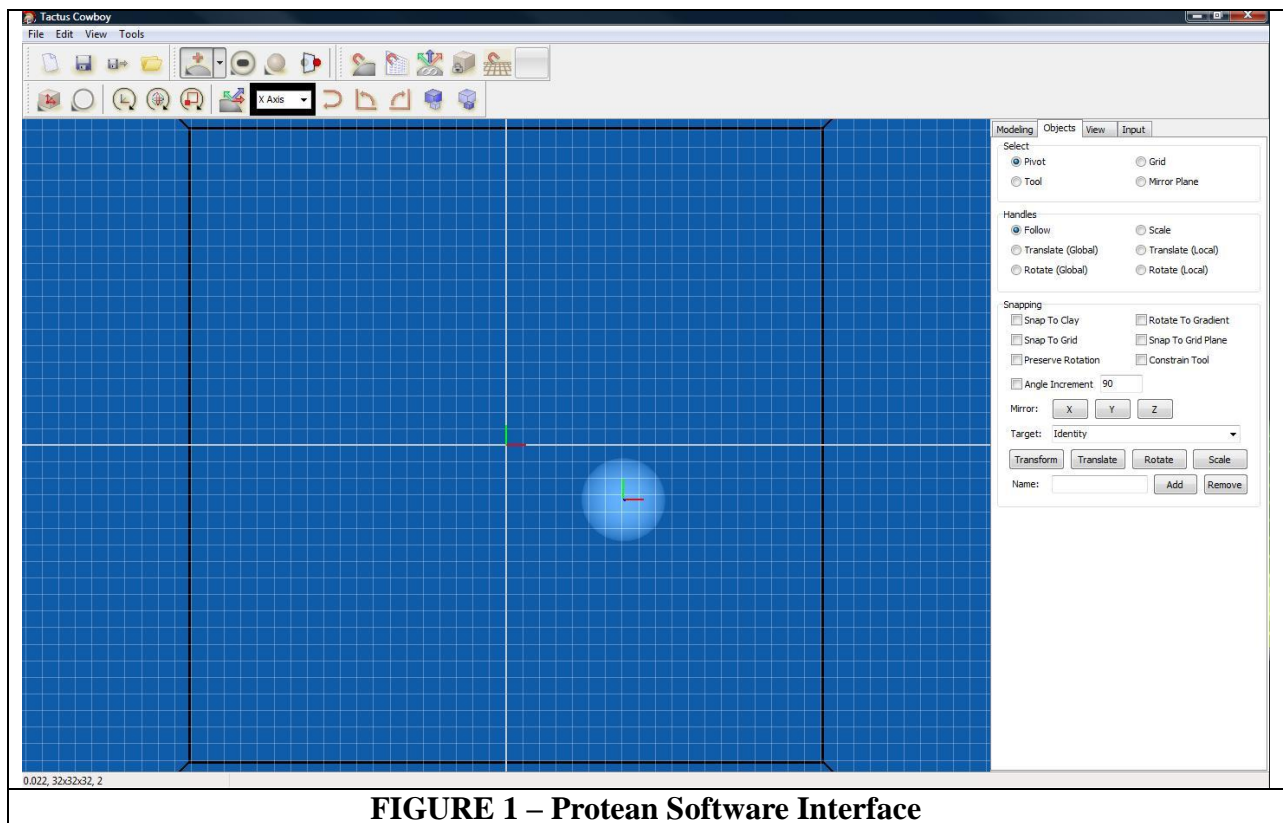


FIGURE 1 – Protean Software Interface

***Pixels and Voxels:***

Pixels occupy space in a two-dimensional space, like a television screen. Pixels vary in number and this determines the resolution of the 2-D image: the more pixels in a given space (e.g. an inch), the higher the resolution of the image.

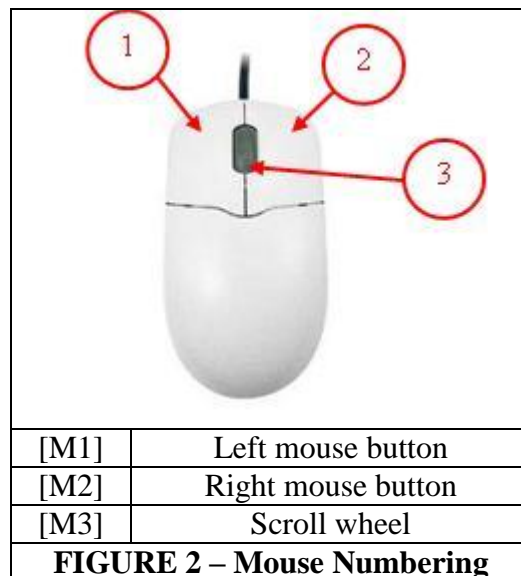
Voxels have the same properties as pixels in terms of number and resolution. Voxels differ from pixels because, in addition to horizontal and vertical dimensions, voxels have the third dimension which gives them depth.

***Getting Started:***

Go to the menu bar at the top left corner of the screen and select *File > New*. A dialog box will appear. Select the block size and resolution for your model or use one of the model presets. The default is a Block Size of 32 which will allow new users to get familiar with Protean Caly. Increasing the block size will increase the number of voxels, which will increase the resolution of the model. Increasing the number of blocks also increases the size of the Protean file you are creating. Protean stores the 3D bitmap as an array of blocks, so the allowed resolutions are limited to multiples of the block size. The 3D bitmap has a resolution, just like a regular 2D bitmap so modeling is analogous to painting in 2D paint programs (such as Photoshop). The resolution of the current file is always shown in the status bar in the lower left portion of the screen.

***Mouse Movements:***

The following number and name conventions will be used for specific mouse actions throughout this document. *Figure 2* shows the mouse button numbering scheme.



Keys on the keyboard are indicated by the name of the key and appear in brackets (Examples: [A], [Space], etc...) For the mouse, the brackets contain the letter M and a number. Viewing the clay object is done in the same way real-work objects can be viewed with a camera. So, for example, in order to pan, rotate, zoom and view the model from any angle, the following camera movement controls are used (see *Table 1*):

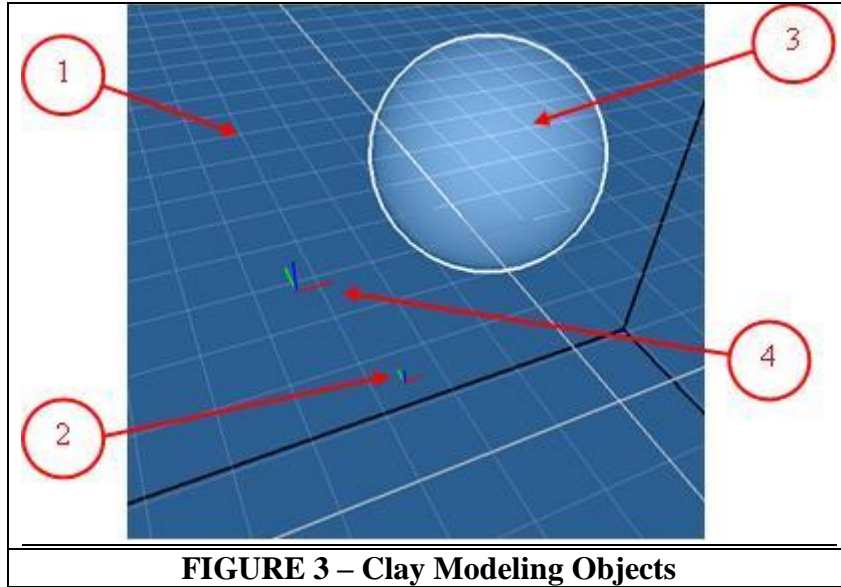
|   |                        |
|---|------------------------|
| [M3] (hold down and drag the mouse)           | Rotate                 |
| [M3] + [Shift] (hold down and drag the mouse) | Pan                    |
| [M3] + [Ctrl] (hold down and drag the mouse)  | Zoom                   |
| [M3] (scroll)                                 | Zoom                   |
| [Alt] (hold down with any of the above)       | Move the camera slowly |

**TABLE 1 – Camera Movement Controls**

Modeling in clay is done by moving to the desired position and then performing a clay operation. Every object has a translation, rotation and scale. *Table 2* lists all of the objects in clay and *Figure 3* show's what each object looks like in the application.

|            |  |
|------------|--|
| (1) Grid   | The grid is the default snap object for the cursor.  |
| (2) Cursor | The cursor shows the 3D position of the mouse in the clay area. It is represented by a smaller set of axes.  |
| (3) Tool   | The tool is a volumetric shape. Operations will only affect the region inside of this shape. The tool is represented by a translucent model of the tool shape. |
| (4) Pivot  | The pivot is the center of the tool. It is represented by a set of axes. Moving the pivot will always cause the tool to move as well.                          |

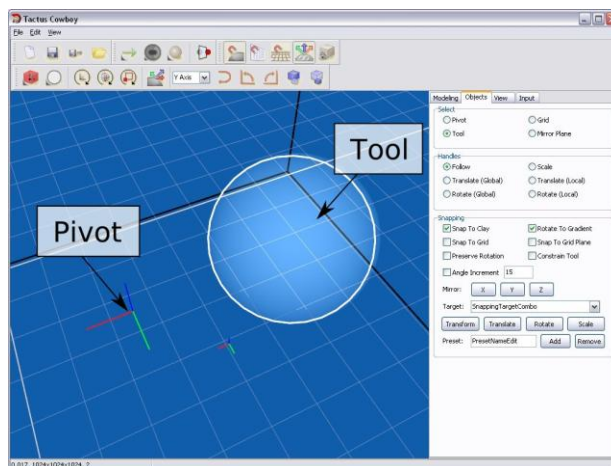
**TABLE 2 – Clay Objects**



Use the scroll wheel [M3] to zoom in on the center of the Grid (1). The Grid size represents the initial block size selected when a new file is created. The Cursor (2) shows the 3D position of the mouse in the clay area. It is represented by a small set of axes. The **Red**, **Green** and **Blue** axes represent the X, Y, and Z axes respectively. The white circle is the modeling Tool (3), which is a volumetric shape, in this case a circle. Other tool shapes are also available, for example a cone, cylinder, wedge, and cube and can be accessed by selecting the *tool shape* icon on the menu bar.

At the center of the tool is another set of axes called the Pivot<sub>[T1]</sub> (2). Moving the pivot will always cause the tool to move but moving the tool will only cause the pivot to move if it is located inside the tool. The pivot can be separated from the tool by selecting the *object to move* icon in the toolbar. From the drop down menu, select *Tool*. Now click inside the tool and drag it to another location on the grid and press [Space] to release it.

*Notice that the tool no longer has the pivot inside of it (Figure 4).*



Select the tool and move it around the grid.

*Notice the pivot does not move.*

Press the spacebar [Space] to *Park* the tool. Now, from the *object to move* drop down menu select the pivot.

*Notice the white circle now encompasses the pivot.*

Select the pivot and move it around the grid. Notice that the tool now follows the pivot. Press [Space] to *Park* the tool. In order to have the tool coincide with the pivot again, select *Tool* from the *object to move* drop down menu. Drag the tool over the pivot and press [Space]. The two should now move together around the grid.

*Notice as the mouse is moved around the grid, the tool remains in its current location.*

The tool is in *Parked* mode. Click anywhere inside or on the tool surface with the left mouse button [M1]. The tool has now been *Selected* and will, as a default, follow the cursor position.

*Notice that the dark white line on the outer surface of the tool disappears when the tool has been selected and reappears when it is parked.*

To park the tool at another location on the grid, press [Space]. When the tool is parked, the cursor is free to move around the grid. To move the tool to another part of the grid, either click on it as previously described and drag it to its new position or, while it is *Parked*, place the cursor in the position you want the tool and click the left mouse button [M1].

*Notice that when the cursor is used to place the tool on the grid, it remains in Selected mode until the spacebar [Space] is pressed to put it in Parked mode.*

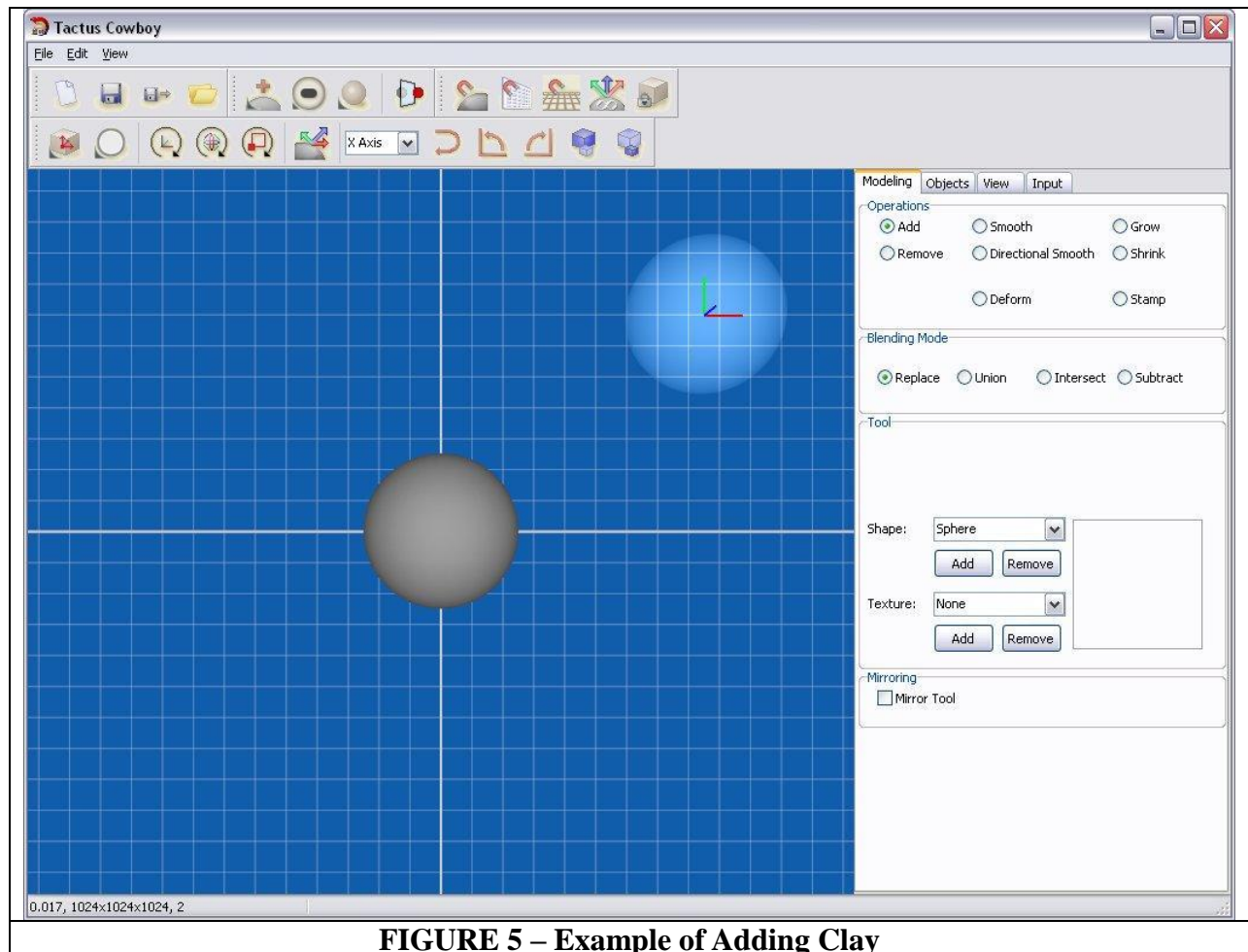
### ***Adding Clay:***

The default tool tip is a sphere and the default operation is *Add clay*. To add a sphere of clay simply move the cursor to any location on the grid, then press and release the left mouse button [M1]. A sphere of clay, the size of the tool will appear (*Figure 5*). To add more clay simply click on the screen again and another identical sphere of clay will appear. Continuous spheres of clay can also be added by holding down the left mouse button [M1] and dragging the mouse along the grid.

Select the *tool shape* icon from the menu in order to change the tool tip from a sphere to a cube. Now when you click the grid, a cube of clay will appear. This process can be repeated for different tool tips.

*Example:*

- Click the left mouse button [M1] once to pick up the *Pivot & Tool*.
- Move the mouse, the *Pivot* and *Tool* will follow the mouse cursor.
- Click the left mouse button [M1] once to add a sphere of clay or click and hold the left mouse button to continuously add spheres.
- Press [Space] when finished to release the *Pivot & Tool*.



**FIGURE 5 – Example of Adding Clay**

***Moving Objects:***

Objects are moved using *Handles*, the exception to this is the cursor which always follows the mouse cursor. The *Handle* system is comprised of four components, namely the X, Y, and Z axes and the circle outlining the tool. In other words, a handle is an axis that has turned white when selected. *Table 3* lists the different handles and how they cause the object to move.

|                    |   |
|--------------------|---|
| Follow             | Follows the cursor.                                     |
| Translate (Global) | Moves along straight lines parallel to the global axes. |
| Translate (Local)  | Moves along the local axes.                             |
| Rotate (Global)    | Rotate around the global axes.                          |
| Rotate (Local)     | Rotate around the local axes.                           |
| Scale              | Scale along the local axes and uniform scale.           |

**TABLE 3 – Handle Movements**

As previously discussed, objects are always in one of two modes: “Parked” or “Selected”. When an object is “Parked” its handles are displayed and can be selected by a single click of [M1]. Selecting a handle changes the mode to “Selected”. In this mode, the object will move according to the rules of the handle that was picked. The object will stay in “Selected” mode until it is released. To release an object, press [Space]. *Table 4* summarizes the modes.

|                      |   |
|----------------------|---|
| [M1] (single click)  | Select a handle. Enter “Selected” mode. |
| [Space] (press once) | Release a handle. Enter “Parked” mode.  |

**TABLE 4 – Object Modes**

***Removing Clay:***

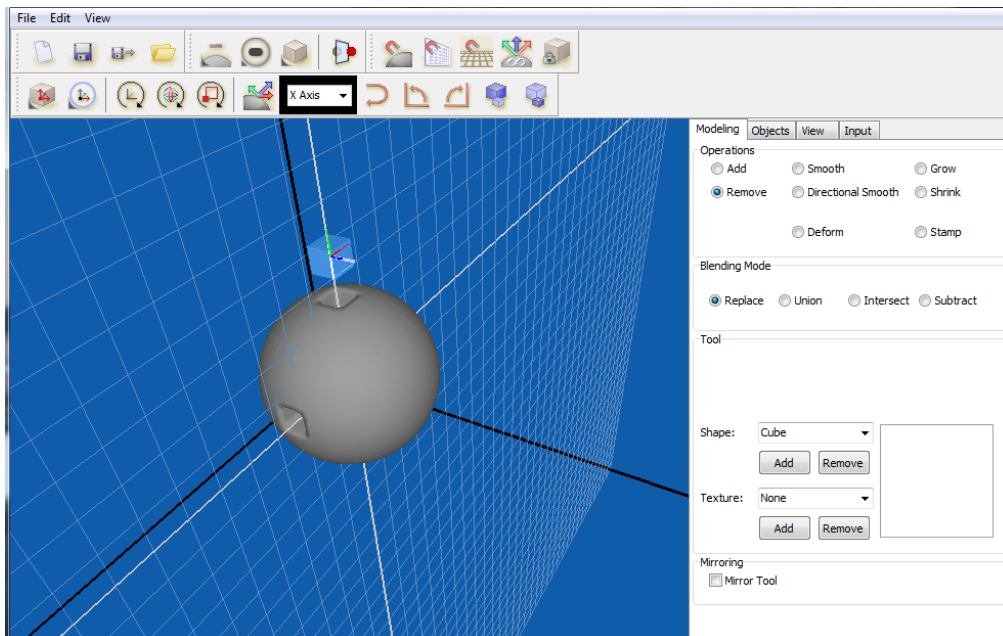
In this example we will put two square holes through a sphere of clay along the X and Y axes (*Figure 6*). Again, the default *Tool* and *Clay Operation* are a *Sphere* and *Add Clay* respectively.

- Place the *Tool* at the cursor position
- Press [M1] to add a sphere of clay
- Press [Space] to *Park* the *Tool*.
- Go to the *Select Operation* icon and select *Remove* from the menu
- Go to the *Select Tool Shape* icon and select *Cube* from the menu
- Reduce the size of the tool by pressing the *Scale Down* icon a number of times (Make the cube any size, as long as it is smaller than the sphere of clay)

- Zoom in on the clay to get a closer view using the mouse scroll button [M3]
- Press the *Select Movement Mode* icon and select *Translate (Global)* from the menu. The *Translate (Global)* operation will only allow the tool to move along the selected global axis.
- Move the cursor over the **Red Handle** (X axis) and press [M1]. The *Tool* is now locked along the X axis.
- Select the **Red Handle** (X axis) with the cursor (*Notice the handle turns white when selected*)
- Press and hold down [M1]
- Drag the *Tool* along the X axis from one side of the sphere to the other
- Press [Space] to *Park* the *Tool*
- Rotate the camera, using [M3], in order to see the square hole that was just created. Select the **Red Handle** again and move the *Tool* back to the origin
- Press [Space] to *Park* the *Tool*.

To make another square hole along the Y axis, this time:

- Select the **Green Handle**
- Press and hold [M1]
- Drag the tool all the way through the sphere
- Press [Space] to *Park* the tool
- Rotate the camera angle [M3] so that the square holes can be seen.









**FIGURE 6 – Remove Clay Operation**

**Clay Operations:**

Inside the tool volume is the only region affected by clay operations. To perform a clay operation, press and hold [M1] while in *Selected* mode (remember, operations cannot be done in *Parked* mode).

Some operations can take a long time to complete. Generally, the time required to perform an operation is proportional to the size of the tool. A larger tool covers more voxels, so it takes longer to calculate the result.

Most operations are affected by a parameter called *Feather*. If the *Feather* is set on the low side of the scale, the operation will have a large affect on the clay. If the *Feather* is set on the high side of the scale, the operation will have a reduced affect. *Table 5* summarizes the operations of Protean.

|  |   |
|--|---|
|  Add      | CSG Add operation. The volume of the tool is added to the clay.                               |
|  Remove   | CSG Remove operation. The volume of the tool is removed from the clay.                        |
|  Deform   | Features of the clay are moved along the path of the tool. (Uses <i>Feather</i> ).            |
|  Smooth  | This operation filters out sharp features on the surface of the clay. (Uses <i>Feather</i> ). |
|  Grow   | The volume of the clay is expanded along its normal's. (Uses <i>Feather</i> ).                |
|  Shrink | The volume of the clay is reduced along its normal's. (Uses <i>Feather</i> ).                 |

**TABLE 5 – Clay Operations**

**Snapping:**

*Snapping* affects the position and rotation of the selected object. *Table 6* lists the snapping modes and their effects.

|                    |  |
|--------------------|--|
| Snap to clay       | Moves to the surface of the clay model.  |
| Orient to gradient | Rotates so that one axis of the cursor (the Z axis) is aligned to the gradient of the clay at the cursor's position. |
| Snap to grid       | Moves to the nearest grid intersection.  |

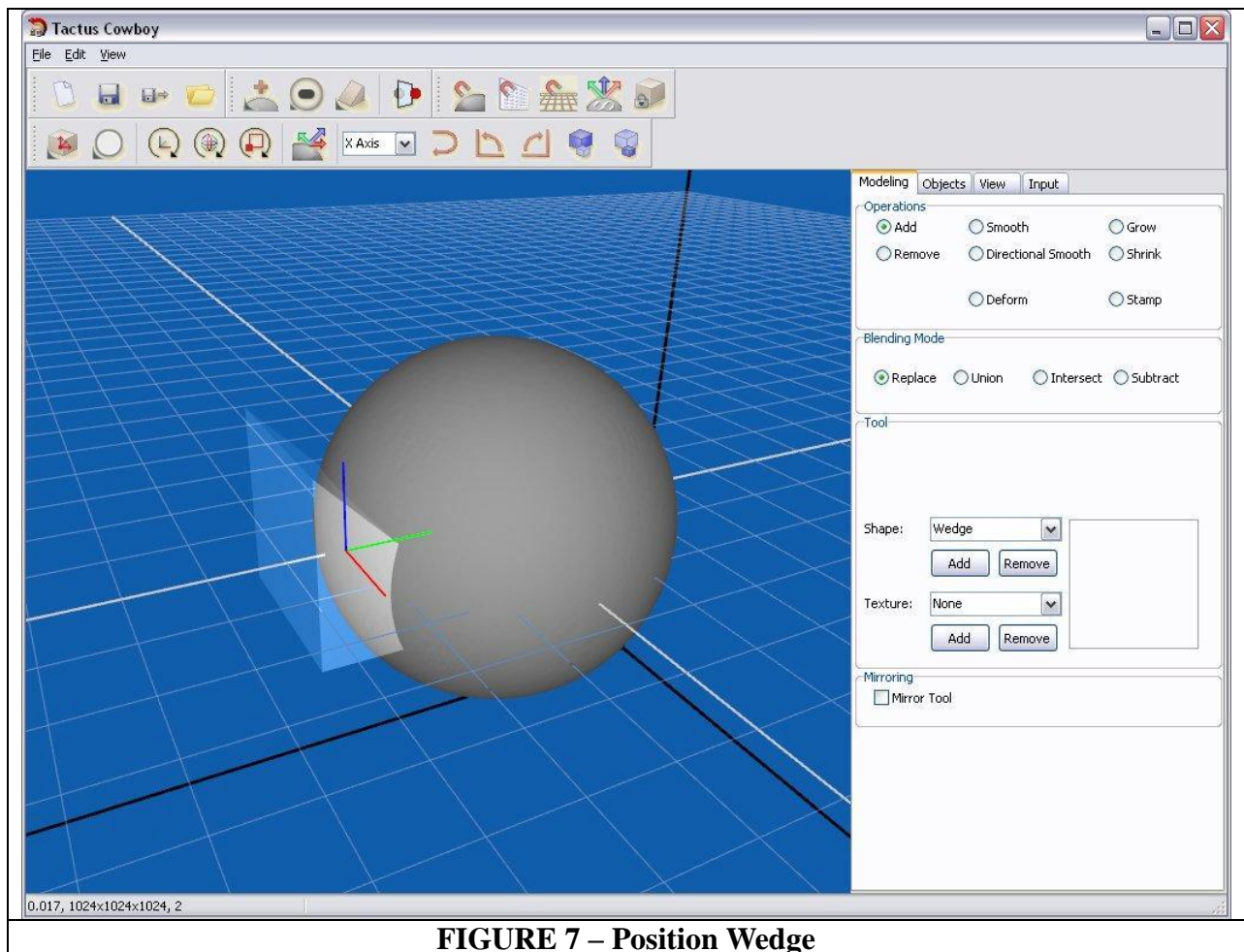
**TABLE 6 – Snapping Modes**

## ***MODELING EXAMPLES:***

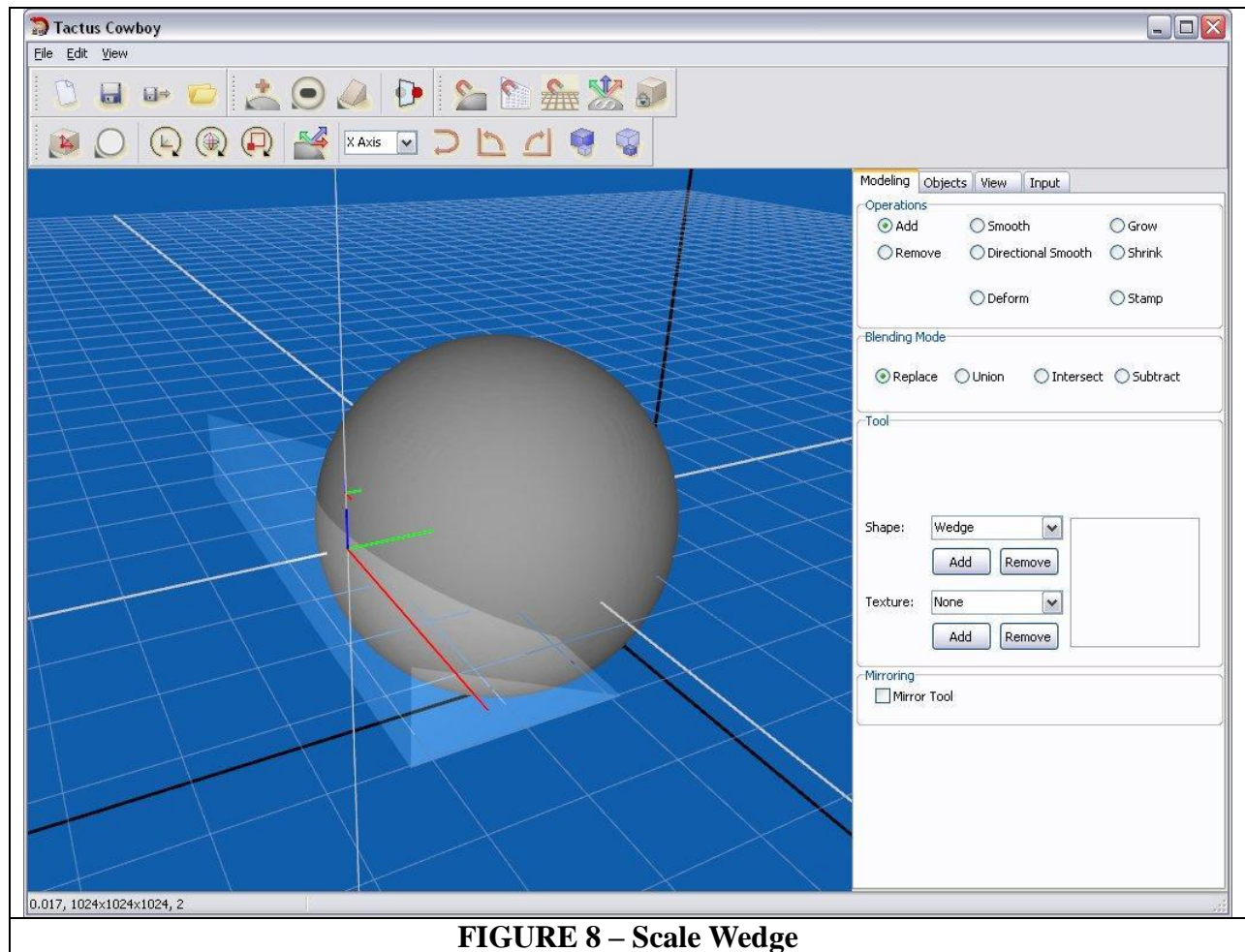
### ***Carve a PacMan Mouth***

*Demonstrates:* Remove operation, Scale handles, Rotate handles

- Add a sphere of clay at the intersection of the modeling space axes
- Select “Wedge” as the current shape
- Select “Remove” as the current operation
- Move the wedge so one corner is in the sphere. The wedge shape will define the mouth.

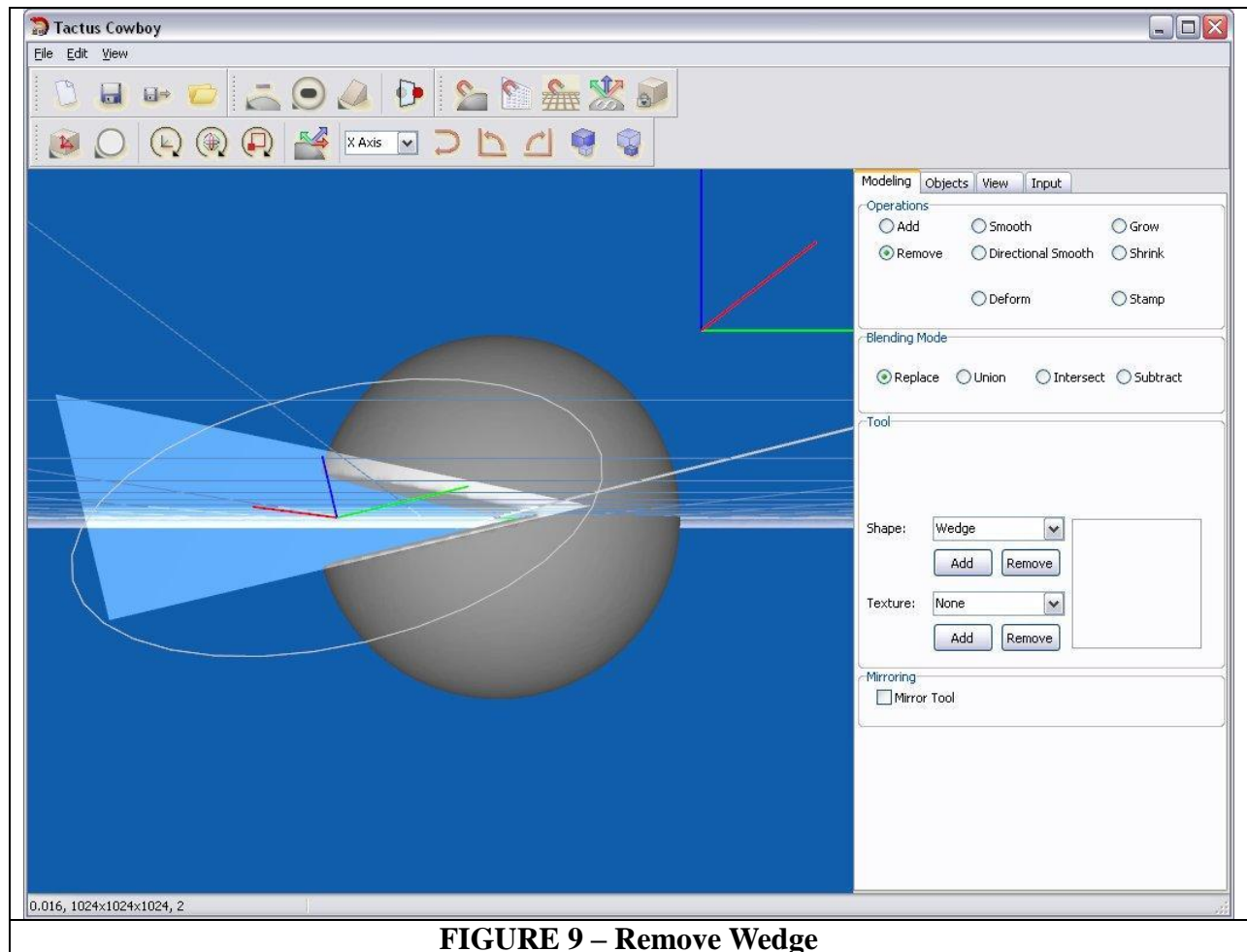


- Scale the wedge along the X axis so it is wider than the sphere.



**FIGURE 8 – Scale Wedge**

- Scale the wedge along the Z axis to change the angle of the mouth.
- Rotate the wedge around the X axis so the corner is on the grid plane.
- Scale the wedge uniformly until it looks like a good mouth size.
- Click the left mouse button to remove the wedge from the sphere.

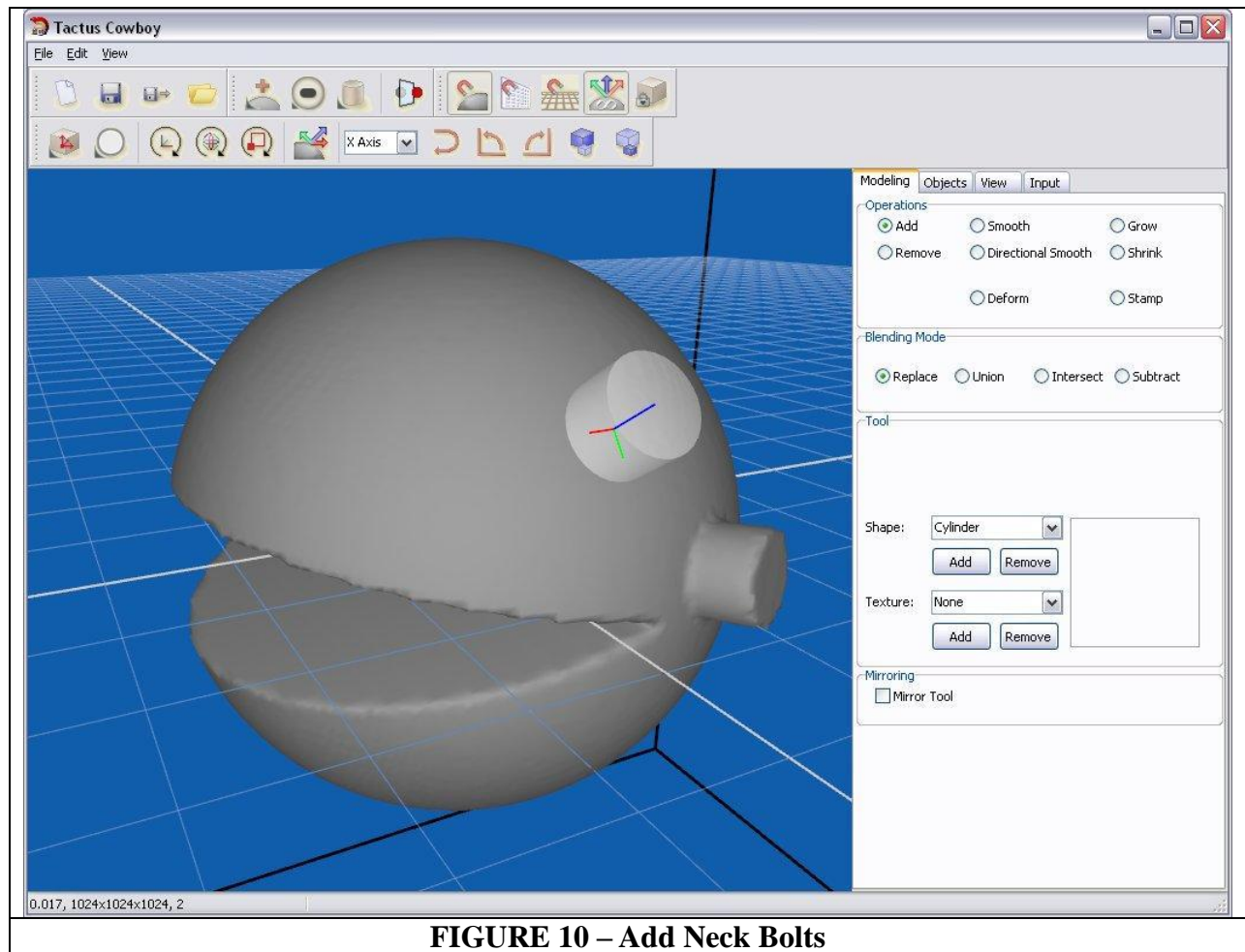


**FIGURE 9 – Remove Wedge**

### *Add Neck Bolts*

*Demonstrates:* Snap to clay, Rotate to gradient

- Select “Cylinder” as the current shape.
- Select “Add” as the current operation.
- Enable “Rotate to gradient”.
- Enable “Snap to clay”.
- Select “Follow” as the current movement mode.
- Move the cylinder just behind the mouth where you think the first bolt should be.
- Scale the cylinder to a good bolt size.
- Click the left mouse button to add the bolt. Add another bolt to the other side.

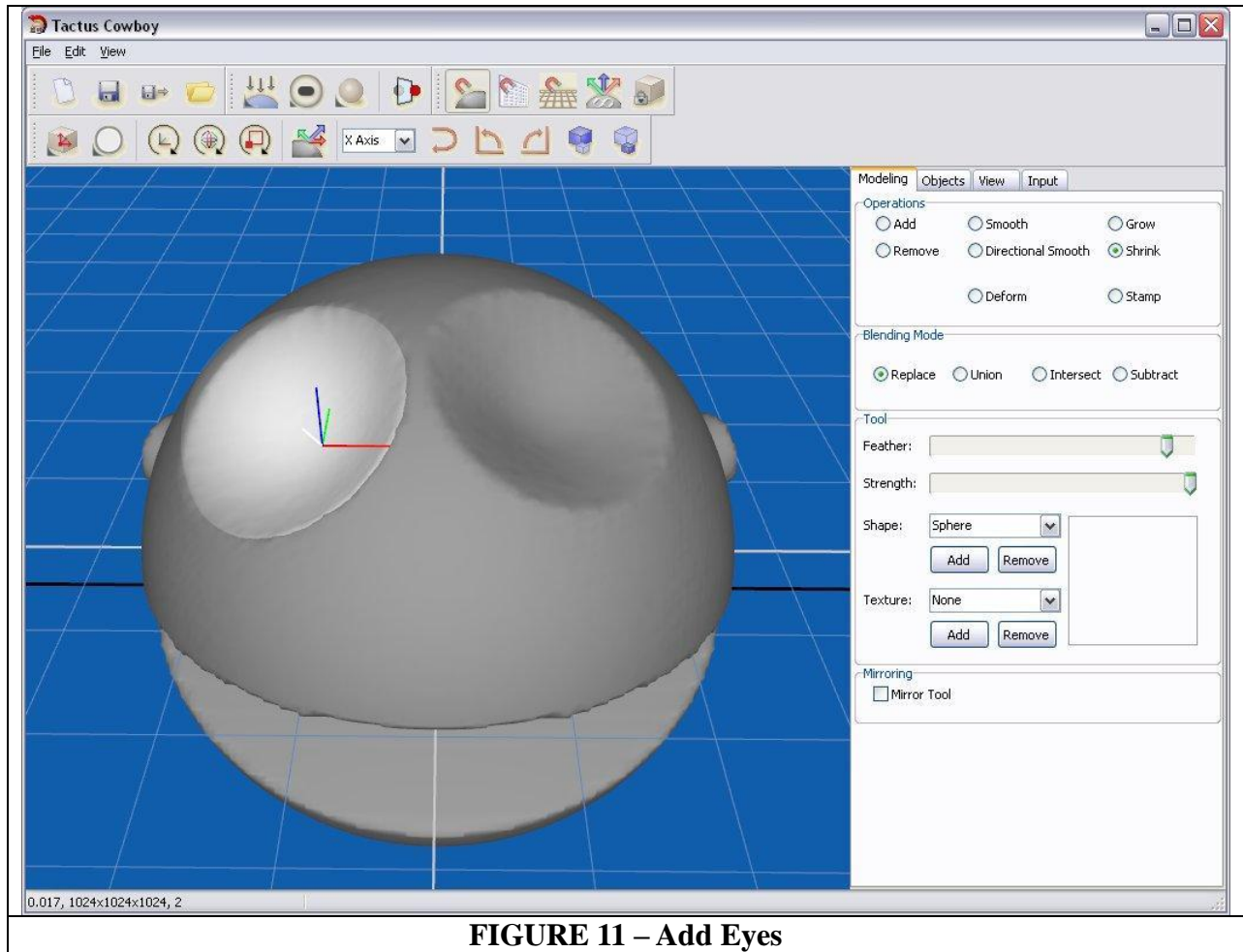


**FIGURE 10 – Add Neck Bolts**

### *Shrink Eye Sockets*

*Demonstrates:* Shrink operation

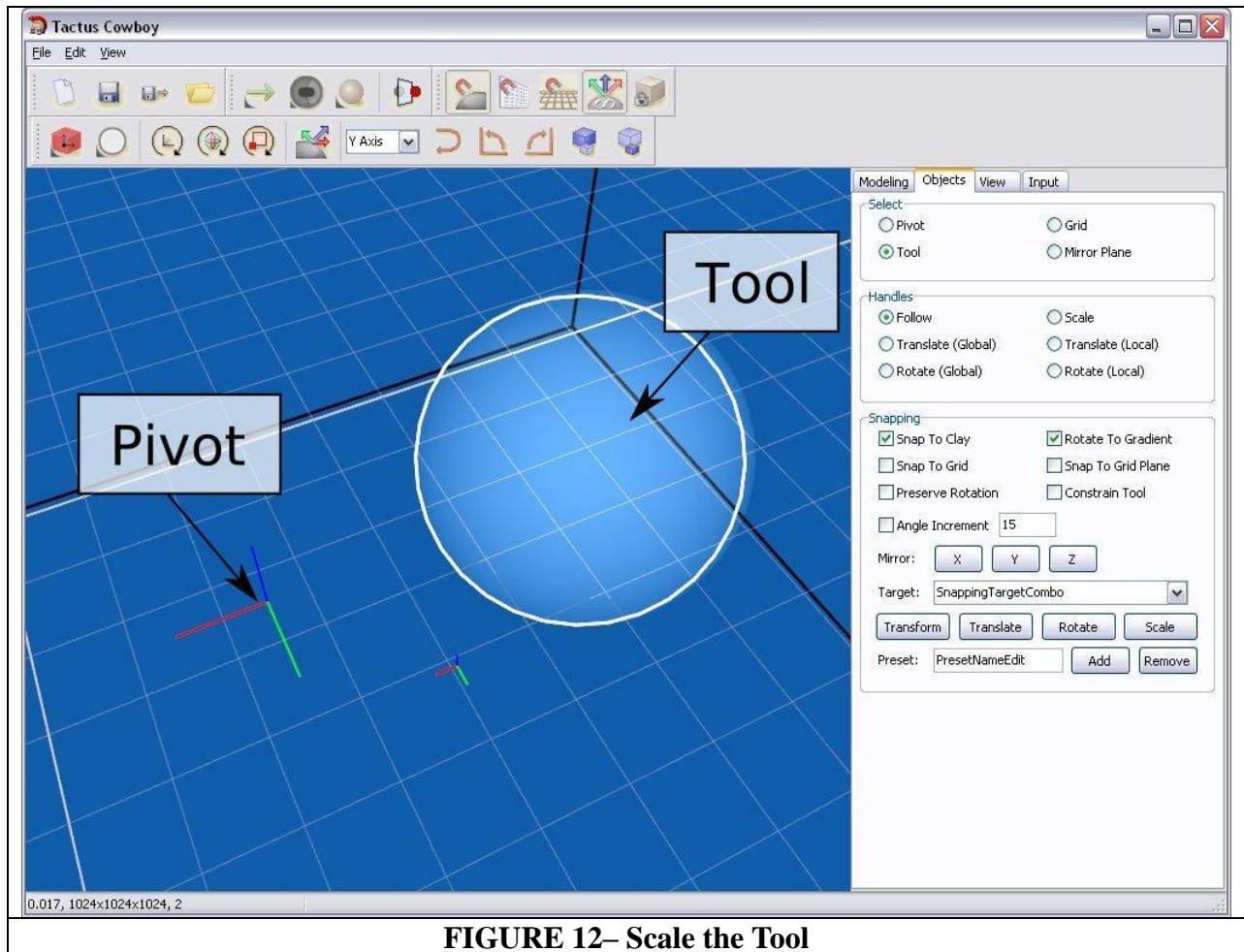
- Select “Sphere” as the shape and “Shrink” as the operation.
- Enable “Snap to Clay”.
- Slide the “Feather” almost all the way up (to the right).
- Scale the sphere to about eye socket size.
- Hold down the left mouse button where you want to eyes to be to sink in the eye sockets.



## ***Make a doughnut***

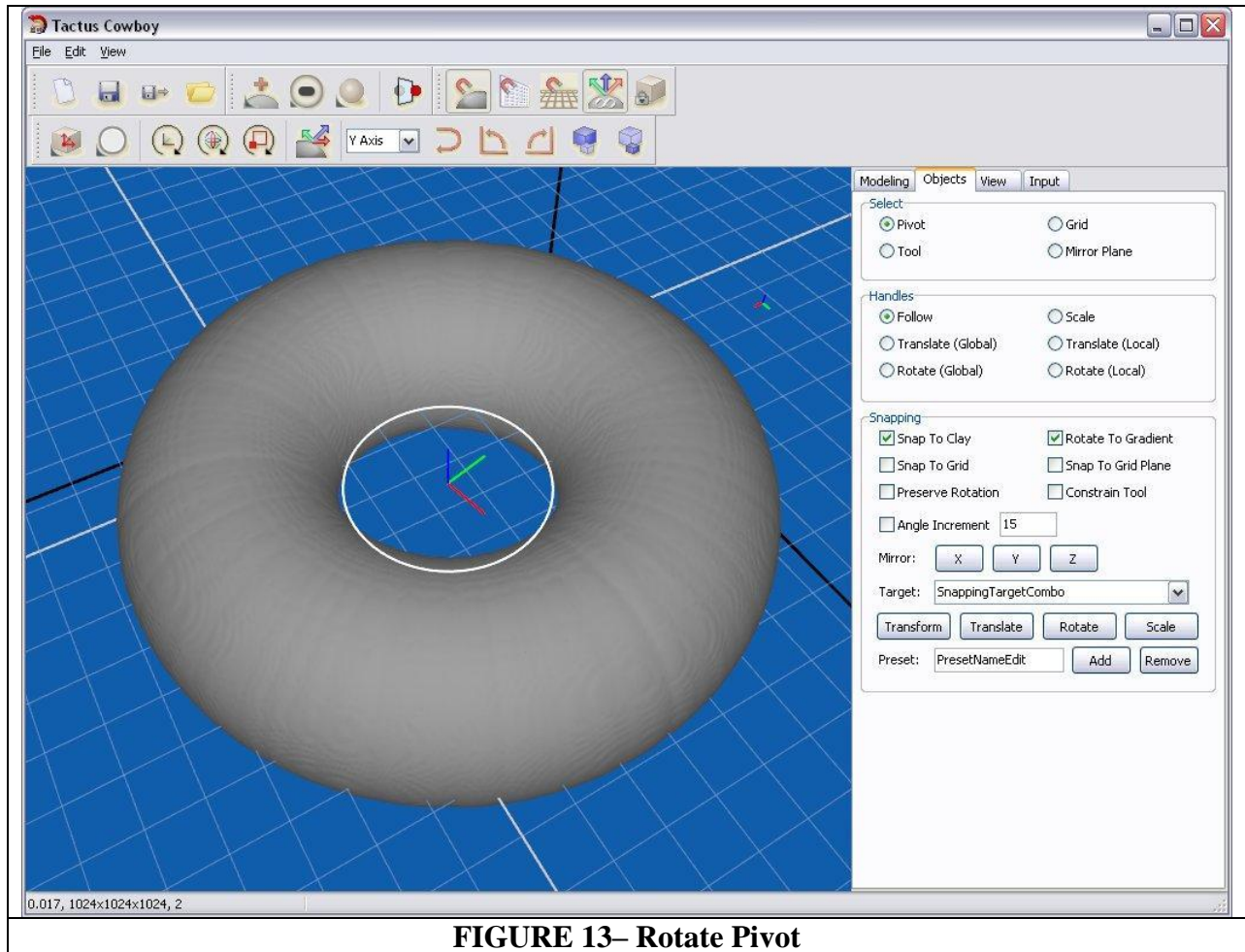
*Demonstrates:* Tool and pivot

- Select “Sphere” as the shape and “Add” as the operation.
- Scale the sphere to about doughnut hold size.
- Select “Tool” as the current object.



**FIGURE 12– Scale the Tool**

- Move the tool away from the pivot about half the width of a doughnut hole.
- Select “Pivot” as the current object.
- Select “Rotate” as the current movement mode.
- Select the blue handle to rotate around the Z axis.
- Hold down the left mouse button while slowly rotating the pivot. This will create a doughnut shape.

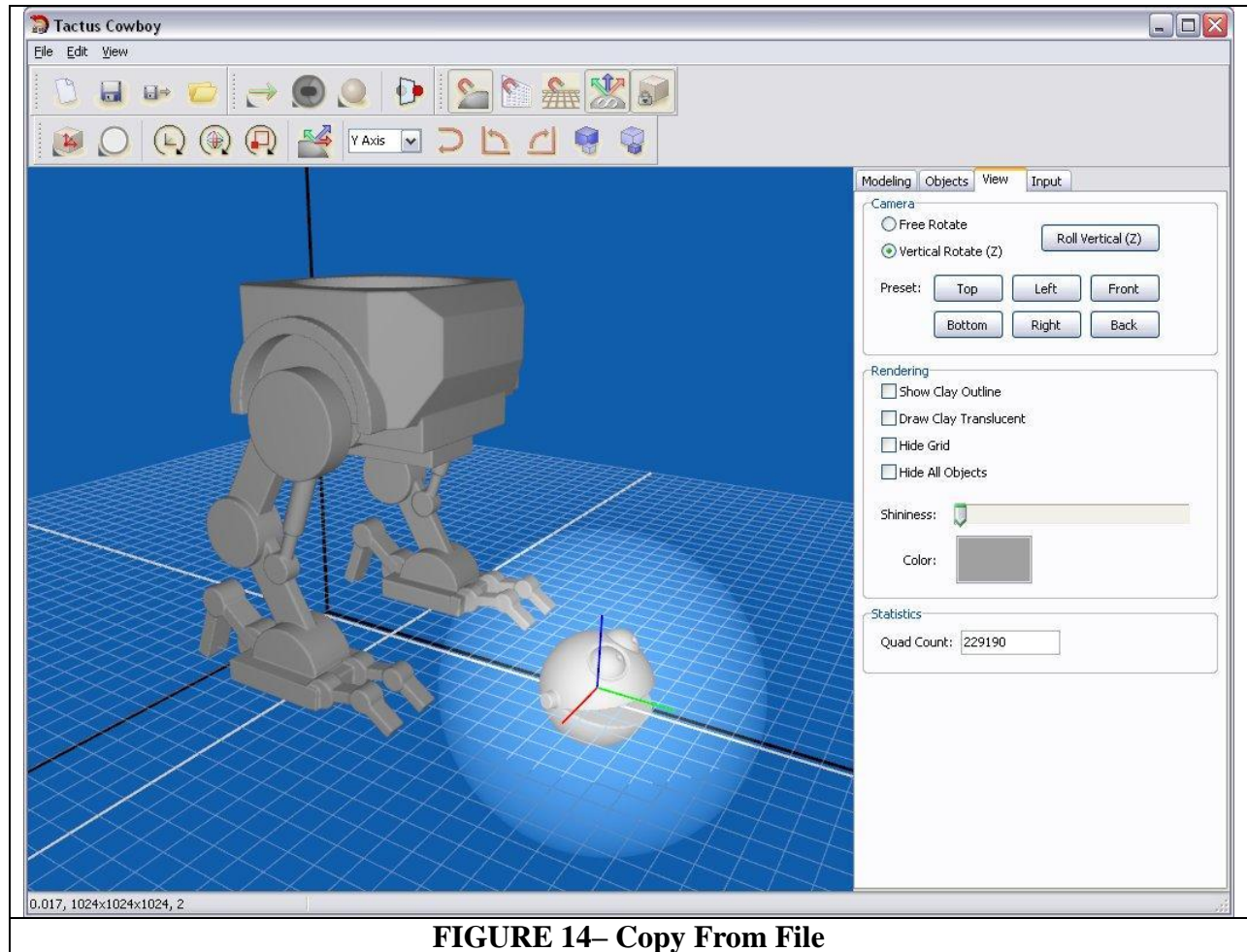


**FIGURE 13– Rotate Pivot**

***Merge two models:***

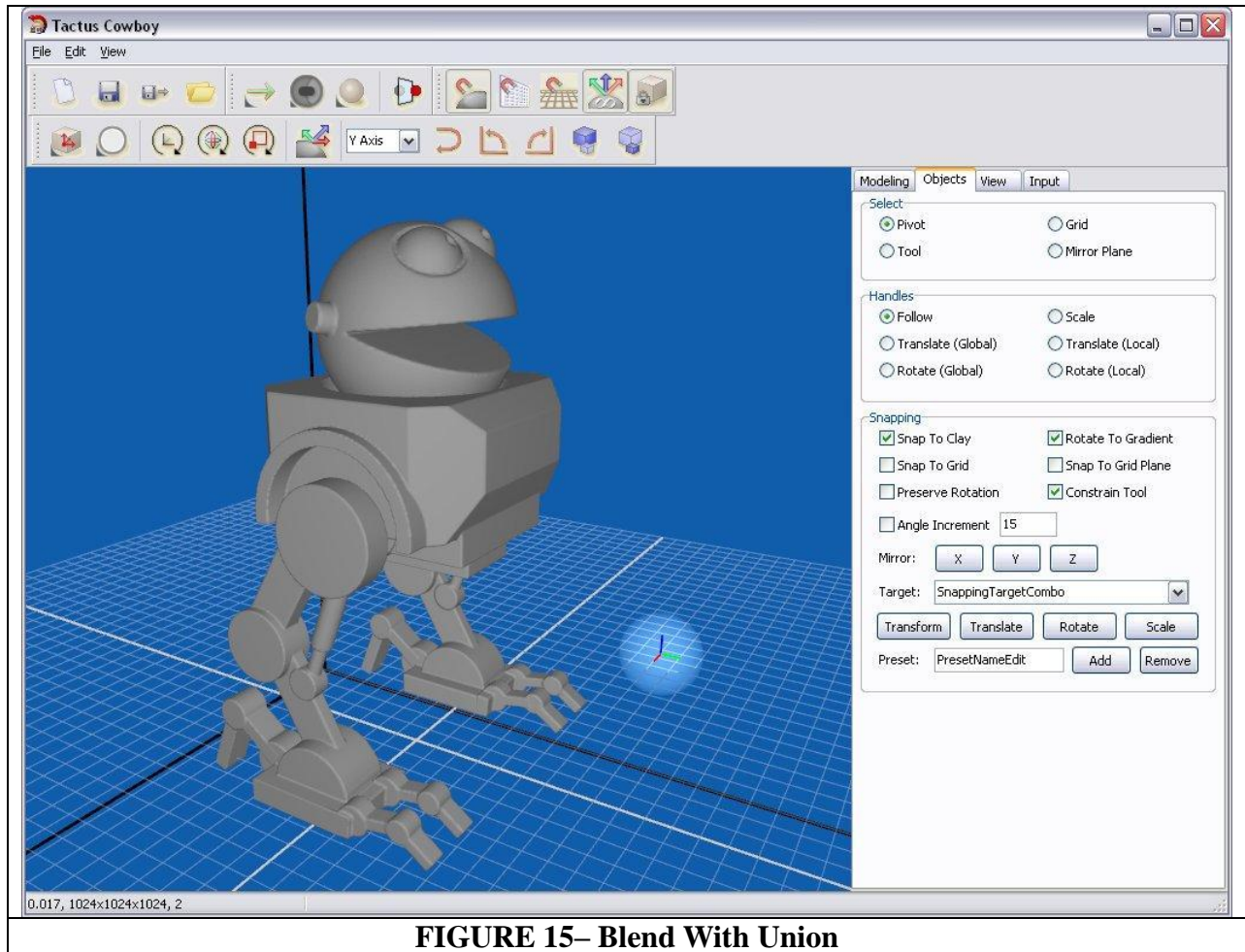
*Demonstrates:* Copy from file, Union blending mode

- Select “Edit->Copy From File” and choose the file to copy. The contents of the file appear in the tool as if it was copied.



**FIGURE 14– Copy From File**

- Transform the tool until it is in the right place.
- Set the current blending mode to “Union”
- Press “Ctrl + V” or select Edit->Paste to paste the tool into clay.



## ***QUICK REFERENCE:***

### Keyboard Shortcuts:

#### Camera:

|   |                      |
|---|----------------------|
| [M3] (hold down and drag the mouse)           | Rotate               |
| [M3] + [Shift] (hold down and drag the mouse) | Slide                |
| [M3] + [Ctrl] (hold down and drag the mouse)  | Zoom                 |
| [M3] (scroll)                                 | Zoom                 |
| [Alt] (hold down with any of the above)       | Move the camera slow |

#### Handles:

|              |                    |
|--------------|--------------------|
| [F]          | Follow             |
| [T]          | Translate (Global) |
| [T] + [Ctrl] | Translate (Local)  |
| [R]          | Rotate (Global)    |
| [R] + [Ctrl] | Rotate (Local)     |
| [S]          | Scale              |

#### Operations:

|     |               |
|-----|---------------|
| [1] | Add           |
| [2] | Remove        |
| [3] | Deform        |
| [4] | Smooth        |
| [5] | Grow          |
| [6] | Shrink        |
| [7] | Texture Stamp |

## ***TOOL BAR COMMANDS:***



**Select Operation:** Dropdown menu for operation selection



**Select Tool Shape:** Dropdown menu for tool shape



**Mirror Clay Continuously:** Mirror the result of any operation in the reflection of the tool determined by the mirror plane



**Snap to Clay:** Constrain cursor to move along clay surface when near it



**Snap to Grid:** Constrain cursor to appear only at grid lattice points



**Snap to Grid Plane:** Constrain cursor to move only along the plane



**Rotate to Gradient:** Rotate cursor to surface normal's of clay and grid plane. Local Z of the cursor is aligned with the normal and the local X is aligned with the grid plane



**Preserve Rotation During Follow:** Don't allow follow mode to affect rotation



**Constrain Tool to Pivot:** When using “Follow” or “Translate”, don't allow tool to move past the pivot



**Select Object to Move:** Dropdown menu to select objects to move with handles (Pivot, Tool, Grid, Mirror Plane)



**Select Movement Mode:** Dropdown menu to select movement mode handles (Follow, Translate, Rotate, and Scale)



**Reset Translation (Ctrl+Alt+T):** Set translation of current object to local origin



**Reset Rotation (Ctrl+Alt+R):** Set rotation of current object to local rotation identity



**Reset Scale (Ctrl+Alt+S):** Set scale of current object locally to uniform scale of 1



**Rotate Once to Gradient (Ctrl+H):** Change rotation of current object to align to the surface normal's of clay and grid plane



**Mirror Axis:** Flip current object locally along axis specified by axis combo box



**Rotate CCW Around Axis:** Rotate current object around local axis specified by axis combo box counter clockwise by the angle increment specified by single increment combo box



**Rotate CW Around Axis:** Rotate current object around local axis specified by axis combo box clockwise by the angle increment specified by single increment combo box



**Scale Down:** Decreases the size of the model



**Scale Up:** Increases the size of the model

## MODELING PANEL OPERATIONS



**Add:** Adds additional clay to the selected location on the model



**Deform:** Changes the shape of the selected area of the clay model



**Remove:** Removes clay from the selected area on the model



**Grow:** Grows the selected part of the model outward



**Smooth:** Smooths the surface of the selected part of the model



**Shrink:** Shrinks the selected part of the model inward

## CAMERA

**Look at Cursor Position:** Set view center to cursor position

**Look at Object Position:** Set view center to current object position

**View Object Position:** Set view center to cursor position and rotate camera so that it is in center of screen

**View Cursor Position:** Set view center to cursor position and rotate camera so that it is in center of screen

**Roll Vertical (Z):** Rotate camera so that Z axis of workspace is upright

For more information visit: <http://www.proteanclay.com>

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