

ShapeShop Manual

Version 0.0.1

ShapeShop Quick Reference

Shape Creation



Bloppy Shape



Linear Sweep



Surface of Revolution



Surface Drawing

Shape Editing



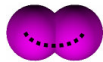
Blend Bloppy Sweep



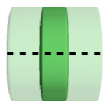
Cut From Surface



Blend Shapes



Join Shapes



Resize Sweep

Parameters



Blending Smoothness



Radius



Sweep Length

Introduction

ShapeShop is a tool for sketch-based creation of 3D models. The goal of ShapeShop is to allow artists and designers to quickly generate 3D models that represent their ideas. One way to think of ShapeShop is as a rapid prototyping tool for 3D modeling. ShapeShop will never provide the level of control found in Maya, but it does allow you to create 3D models very quickly.

ShapeShop does not use triangle meshes, NURBS, or subdivision surfaces to represent 3D models. Instead, ShapeShop uses a surface representation called the **BlobTree**. The BlobTree is a realization of a larger class of shape representation called an *implicit surface*. If you have ever used metaballs, you have used implicit surfaces. However, ShapeShop uses much more complex types of implicit surfaces than metaballs.

BlobTrees have some significant benefits over meshes and NURBS. It is very easy to do things like Computational Solid Geometry (CSG) operations (such as cutting a hole in an object). BlobTrees also make it easy to smoothly blend two shapes together to get another shape.

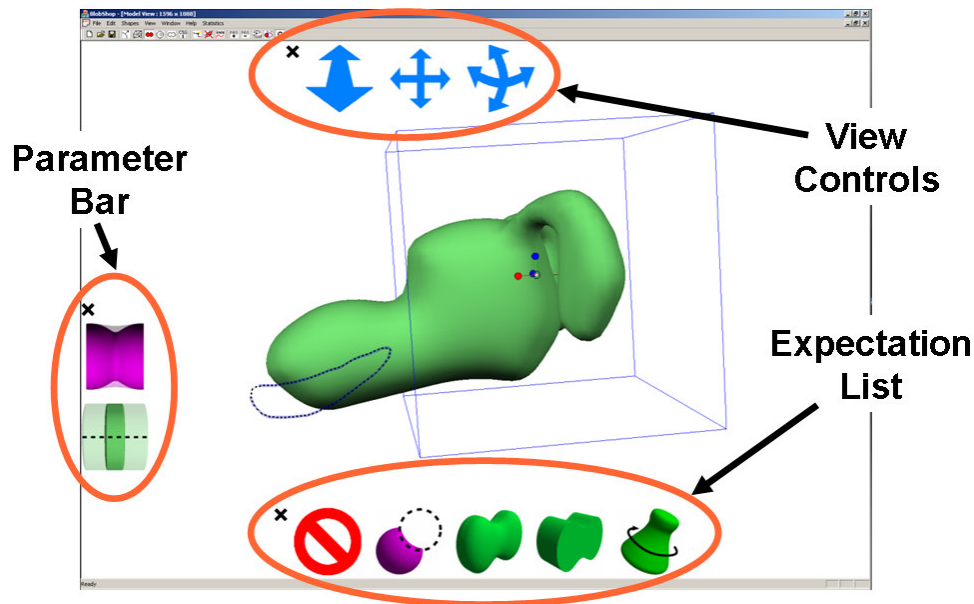
However, modeling with BlobTrees is quite different from modeling with the surfaces you are familiar with from existing commercial tools. Here are some things you will have to get used to:

1. BlobTrees are a *volume representation*. That means you are always creating a closed 3D shape. Very thin sheets, like cloth, are difficult to represent with BlobTrees.
2. As we stated above, BlobTrees are an *implicit representation*. That means that ShapeShop doesn't actually know where the surface is. ShapeShop has to *search through space* to find the surface, so that it can show it to you. It is difficult for ShapeShop to find the exact edges of sharp and thin parts of a model.
3. BlobTrees do not support some of the things you can do with a triangle mesh or NURBS surface. For example, BlobTrees don't have control points, so you cannot deform the surface as easily as with a NURBS surface. However, you can often get the same kinds of results using blending operations.

(TODO: there are other things...)

ShapeShop Interface

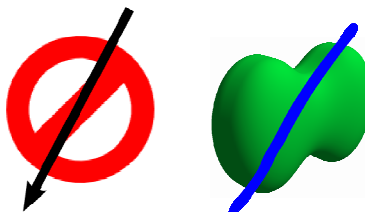
The image below shows essentially what the ShapeShop user interface looks like. In the rest of this section we will describe the three main toolbars – the **Expectation List**, the **View Controls**, and the **Parameter Bar**.



Expectation List

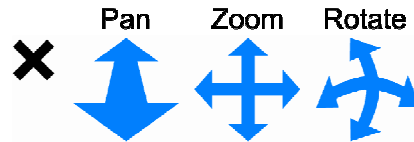
The expectation list is a dynamic, context-dependent toolbar that allows you to select different sketch-based actions. Each time you draw a stroke, ShapeShop examines everything in the scene, as well as the strokes you have drawn, and comes up with a list of possible actions. Each icon in the expectation list represents a possible action.

The buttons in the expectation list are not like regular buttons. In fact they aren't really "buttons" at all. To select an action in the expectation list, you do not click on it. Instead, you draw a "crossing" stroke over the button. A "crossing" stroke is essentially a straight-ish line across the button. It doesn't have to be perfectly straight, just mostly straight (see below). The actions you can take are described throughout this document.



View Control Toolbar

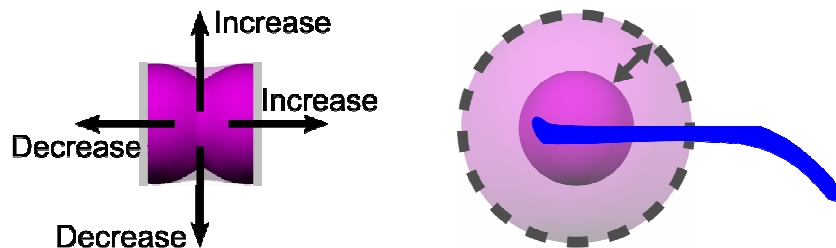
The view control toolbar, shown below, is essentially a camera control.



You can pan, zoom, and rotate the view by dragging outwards from any of the buttons. For the zoom button, dragging “right” or “up” will zoom in, and dragging “left” or “down” will zoom-out. You can move the toolbar by dragging on the **x** button, or hide the toolbar by crossing the **x** button, or hide the toolbar by crossing the **x** button. To re-summon the toolbar, make a V-shaped stroke.

Parameter Bar

The icons in the parameter bar allow you to modify the selected BlobTree node. To modify the parameter value, drag outward from the center of the parameter icon. Dragging up or to the right will increase the value, dragging left or down will decrease it.



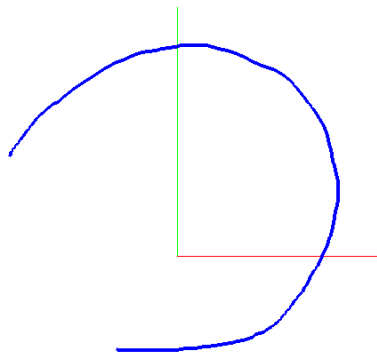
Dialog Bar

Sketching in 2D

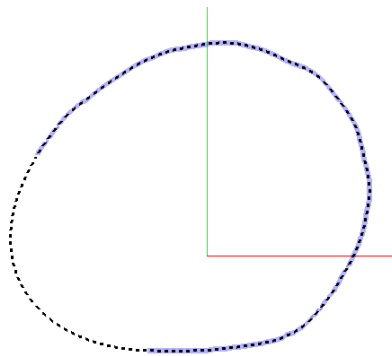
ShapeShop has a “smart” 2D drawing system that will attempt to help you draw the shapes you want to draw.

2D Curve Drawing

To draw in ShapeShop, simply hold down your left mouse button (or equivalent) and draw your 2D curve. ShapeShop will attempt to automatically close your curve.



Open curve that you draw

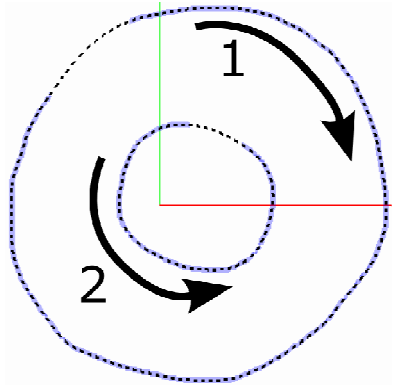


Closed curve that ShapeShop creates

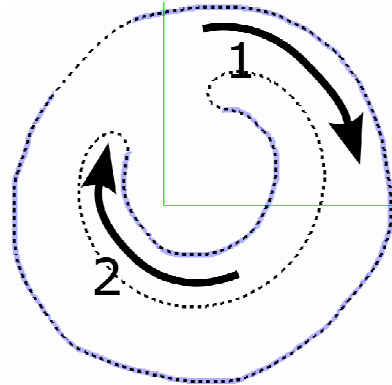
You might notice in the image on the right that there are actually two lines – a dashed black line, and a semitransparent blue line. The blue line represents the strokes you actually drew. The black line shows you how ShapeShop has interpreted your strokes. This is the line that ShapeShop will use to create shapes.

Drawing “Holes”

ShapeShop allows you to create a 3D shapes with holes. You create these holes by sketching two curves – an outer curve and an inner curve. However, to tell ShapeShop that you want to draw holes, you have to switch the direction you draw your curve. For example, if you draw your outer curve in a counter-clockwise orientation, then you have to draw your inner curve in a clockwise orientation. The images below might help make this clear.



Drawing the outer and inner sketches with opposite orientation produces the expected curve.



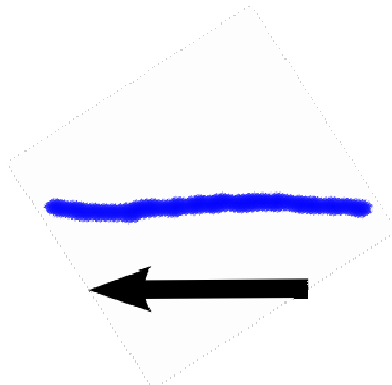
Drawing the outer and inner sketches with the same orientation produces a different shape.

Editing

If you are done with a sketch, or you don't like what you have drawn, there are two ways to get rid of it. You can either use the clear button (below left) or use the **pop** gesture (below right). The **pop** gesture only discards the last stroke you drew, not the entire sketch.

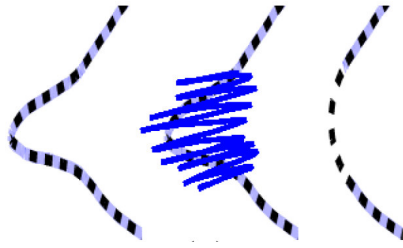


Drawing a stroke across the Cancel button will erase all the strokes currently on the screen.

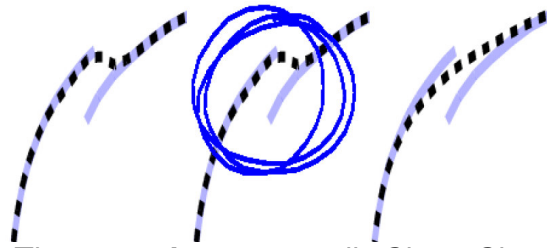


*The **pop** gesture, made by drawing a sharp stroke to the left, discards the last stroke you made.*

ShapeShop also supports two sketch-editing gestures that can help you create the 2D curves you desire. The **erase** gesture is made by “scribbling” over part of the strokes you have drawn (the blue strokes). This gesture removes part of the blue strokes, and lets ShapeShop re-interpret the remaining strokes. The **smooth** gesture, made by circling part of the curve several times, tells ShapeShop to smooth out the curve. Again, this gesture only affects the part of the curve that lies over top of the strokes you drew.



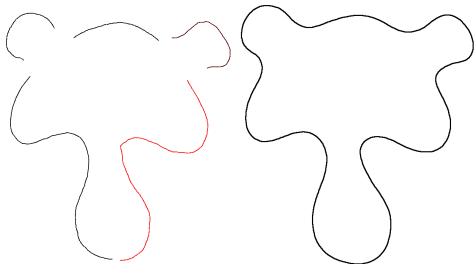
The **erase** gesture removes parts of the strokes you made (blue). ShapeShop then re-interprets your remaining strokes. You cannot erase parts of the curve ShapeShop generates (black).



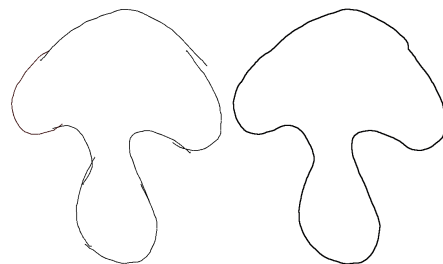
The **smooth** gesture tells ShapeShop to smooth out the curve it generates from your strokes. Only the region inside the circle is smoothed. Smoothing can be applied multiple times to the same region.

Advanced Sketching

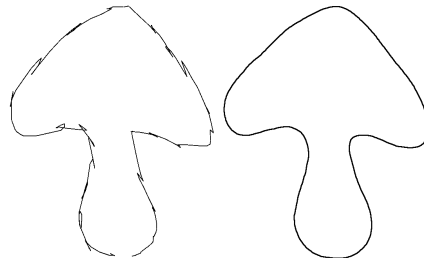
ShapeShop is capable of filling the gaps between your strokes, as well as smoothing what you have drawn. You can take advantage of these features in various ways. For example, you can draw only parts of the curve and ShapeShop will fill in the rest.



ShapeShop can fill the gaps between your strokes.



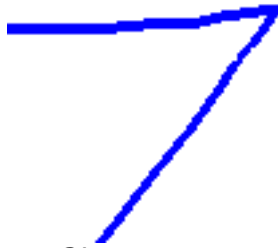
ShapeShop can join multiple overlapping strokes.



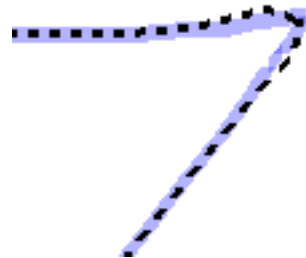
ShapeShop can smooth out a rough sketch.

Limitations

ShapeShop attempts to dynamically interpret the strokes you draw as closed 2D curves. To do this, ShapeShop has to make some assumptions. One key assumption is that the curve is smooth. As shown in the image below, ShapeShop will smooth out any sharp creases in your strokes.



Sharp curve you draw.



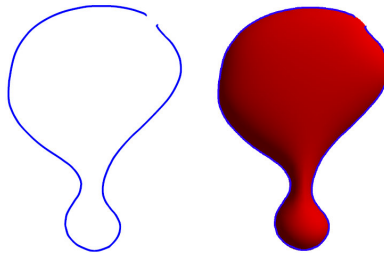
ShapeShop's generated curve (black line) smooths out your sharp curve.

NOTE: This is a technical restriction. We are working on ways to deal with it.

Creating 3D Shapes

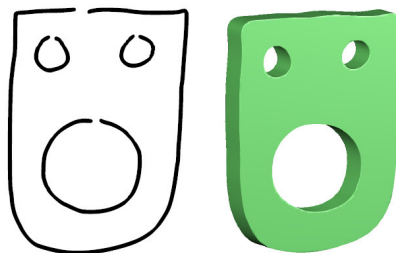
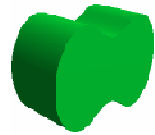
Blobby Shapes

To create a “blobby” shape, draw the 2D curve that represents the outline of the shape you want. Then, create the shape by drawing a stroke across the *Blobby Shape* button (shown to the right). The initial width of the blobby shape is proportional to the screen-space area of your sketch. However, you can resize it using the resize gesture (Section XX) or by changing the length parameter (Section YY). An example is shown below.



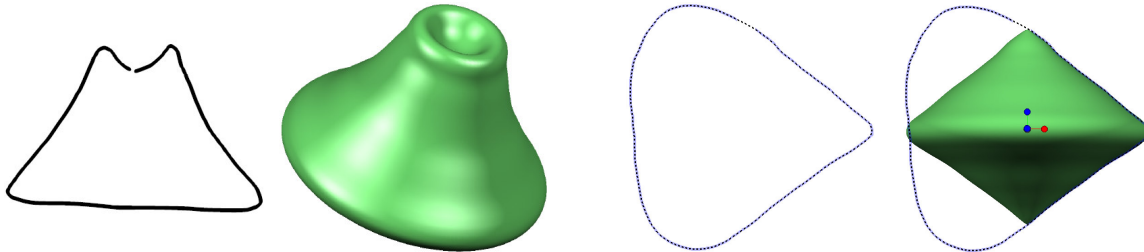
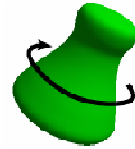
Linear Sweeps

Create a linear sweep by drawing the 2D sweep profile and then selecting the *Linear Sweep* button (shown to the right). The length of the linear sweep will initially be proportional to the screen-space area of your sketch. However, you can resize it using the resize gesture (Section XX) or by changing the length parameter (Section YY). An example is shown below.



Surfaces of Revolution

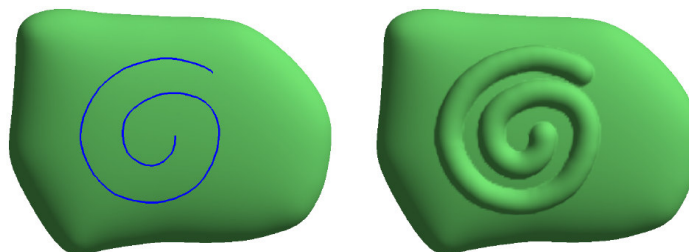
Create a surface of revolution by drawing the 2D revolution profile and then selecting the *Surface of Revolution* button (shown to the right). Some examples are shown below.



NOTE: Currently, the revolution axis (the 3D line that the curve is rotated around) is always the line through the middle of your sketch. So, in the curve above left, only the right half of the curve is revolved. This is a current limitation of the system which will be improved in the future. The example shown above on the right might help you get a feel for how this currently works.

Surface Drawing

ShapeShop allows you to “draw” on the surface with a sort of 3D brush. Currently the only shape supported is tube-like, somewhat like drawing with toothpaste. Draw your strokes over top of the surface and then select the *Surface Drawing* button, shown to the right. You can change the radius and tapering of the new shape (Section YY). An example is shown below.



NOTE: The surface drawing geometry is currently created by blending a bunch of spheres. You may have to draw slowly to get a smooth tube. This will be improved in future versions.

Editing 3D Shapes

TODO: this section...

Blending

Cutting

Joining Shapes

Resizing Sweeps

Exporting Meshes

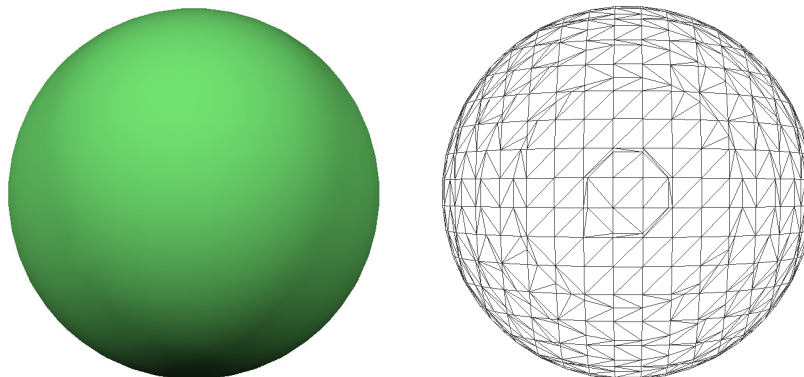
ShapeShop allows you to export triangle meshes in .obj format that can be imported into other tools such as Maya. You can see what the mesh looks like by enabling wireframe mode. Make sure the two toggle-buttons highlighted with arrows below are both pressed down.



Enable wireframe mode by selecting **both** the Show Mesh and Show Surface buttons.

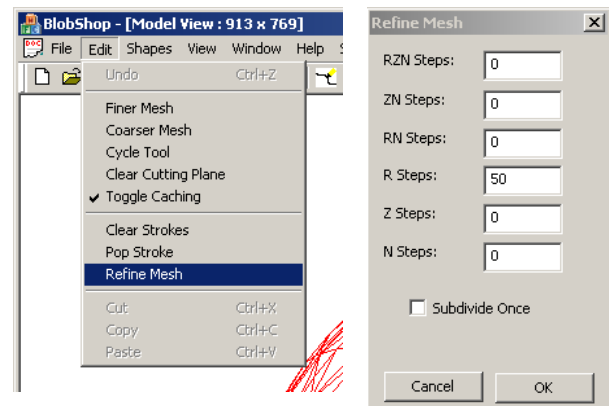
Triangle Quality

Below is an example of the kind of wireframe you will see if you turn on wireframe rendering mode.

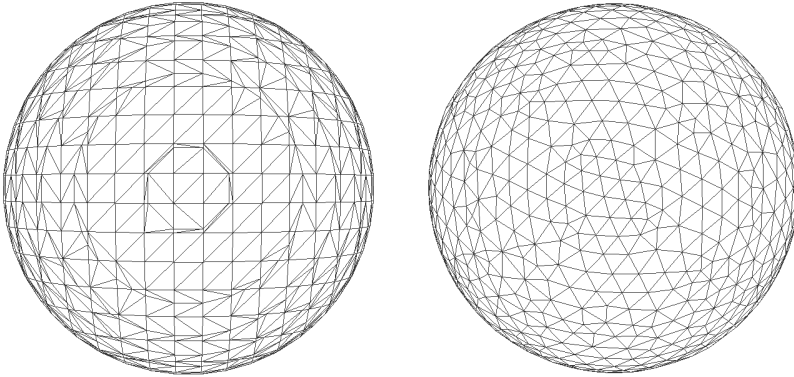


If you closely examine the mesh shown above (on the right), you may notice that the triangle quality is very bad. By default, the algorithms used to visualize the changing BlobTree surface produces many skinny triangles, called *sliver triangles*. This is usually undesirable. To get rid of the sliver triangles, you can optimize the mesh.

First, select the *Refine Mesh* option under the *Edit* menu (right). Then enter a number of steps in the 'R Steps' dialog (further right). Numbers in the range 1-100 are good, larger numbers mean a better mesh but also a longer wait. Click the *OK* button. ShapeShop will then refine the mesh (this might take a while). Doing



multiple refinement steps has the same effect as one long refinement step. Refinement will produce a mesh with more uniform triangles (below right).



Sharp Features

TODO: explain how to get better meshes with sharp features....

Tips

ShapeShop produces a large number of triangles. Unfortunately there is a limit to the number of triangles that software like Maya can handle. Hence, you should make sure your meshes do not have too many triangles.

TODO: expand on this...