

Boolean Modeling in Maya

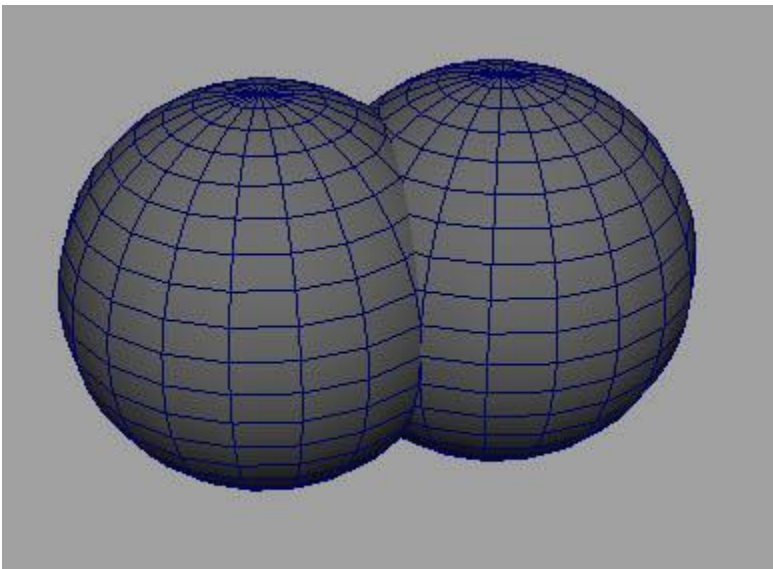
Booleans let you model with other objects. In this tutorial we'll cover in depth, basic boolean operations, anatomy of a boolean, where to use booleans, and common boolean errors (example: objects disappearing, inverted operations).

Set-up

To follow this tutorial it's best if you have a basic knowledge of Maya.

Set the menu set to polygons.

Create two spheres, and move them so they intersect like in the image below.



What Is A Boolean

Booleans in Maya let you take an object, subtract, add or intersect its geometry onto another object (merging). A boolean can only happen between two objects. The first selected object will be booleaned. The other piece will be added.

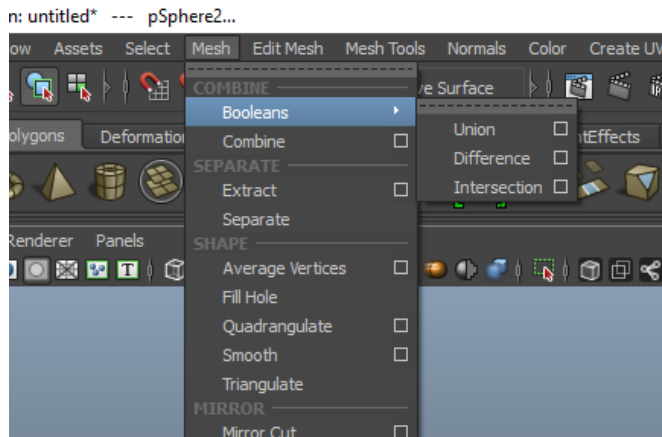
Booleans are great, but have some drawbacks.

1. The geometry is less than savory, but still usable, and can be re-worked with a little time. Edge loops will be hard to keep.
2. Prone to errors (we'll learn how to fix these later).
3. Due to the geometry that it produces, smoothing a booleaned object can become a pain.

Now let's get started.

Boolean Operations

Step one - Select both spheres and go to mesh>booleans...

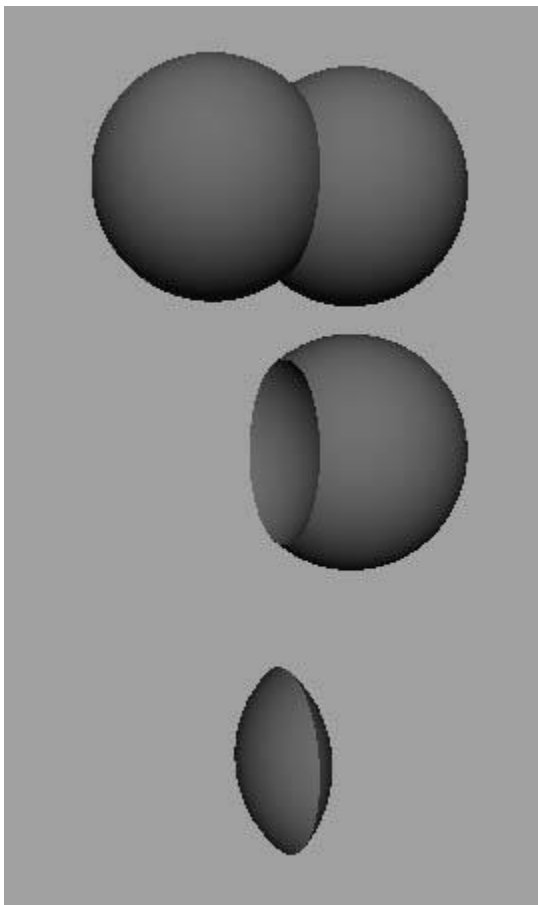


There are 3 different boolean operations:

Union - This will merge both objects together. It will get rid of geometry between the two pieces.

Difference - Subtracts the last selected geometry from the first selected geometry.

Intersection - The geometry between the two objects will be kept and the rest will be removed.



Anatomy of a Boolean

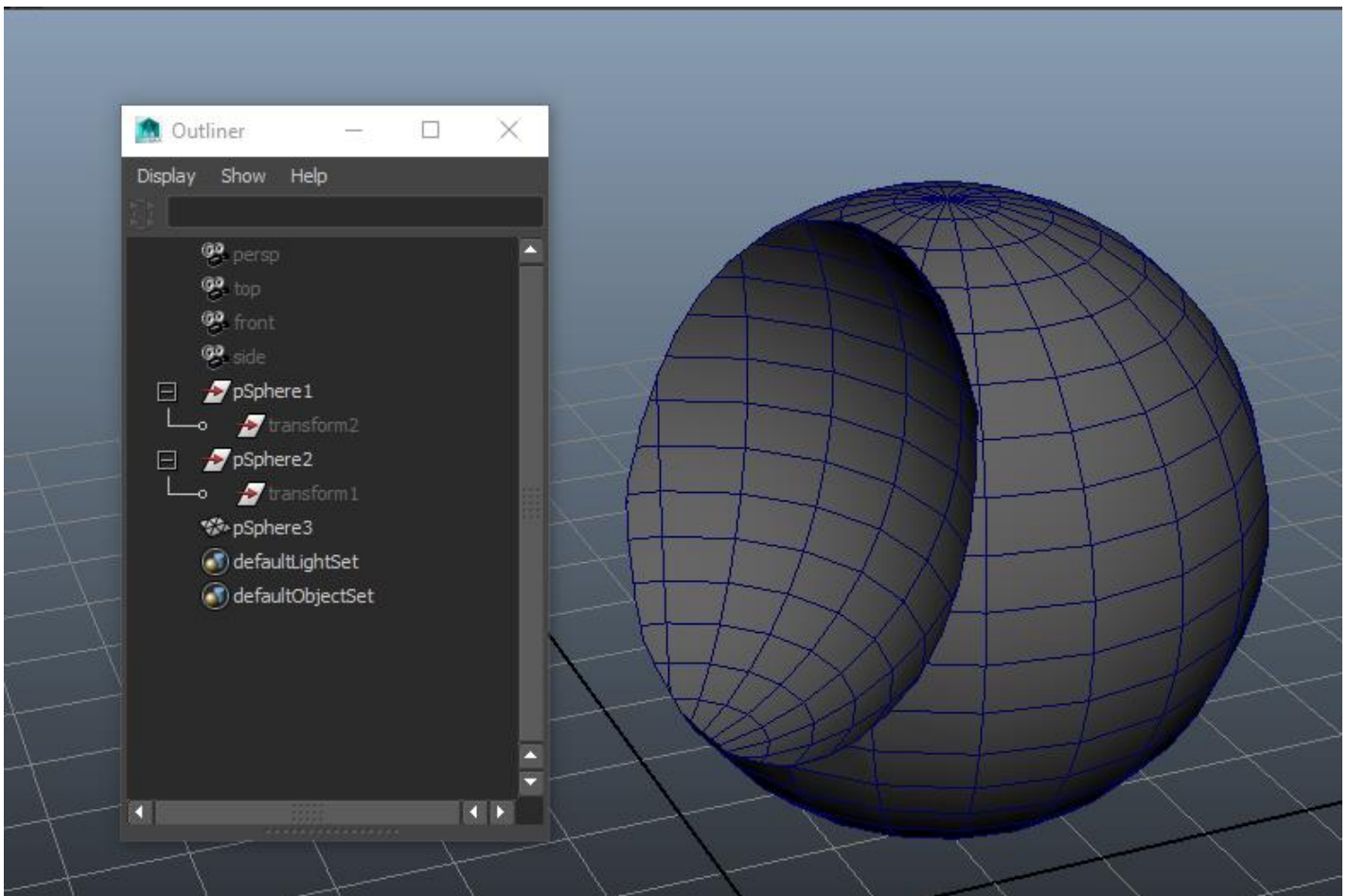
Step one - Go back to set-up and create the two spheres again.

Step two - Select them both and go to mesh>boolean>difference.

It appears that the other geometry has been removed and has only left the protruding surface in the boolean sphere. Actually, the geometry hasn't been deleted. Its vertices and transformation information is still there. To access it...

Step three - Go to window>outliner.

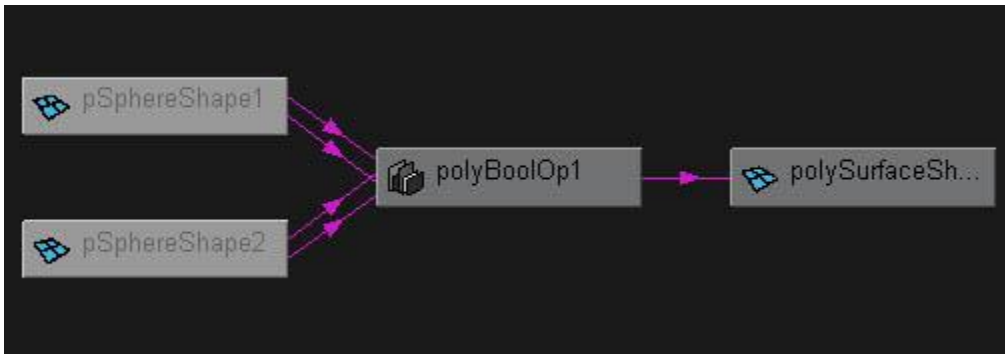
Step four - There will be two groups: pSphere1, pSphere2, and the outputted geometry. Maximize the groups so you can see inside of them. Each one has a transform node.



Step five - Select the group pshepre2 and you will find that, when using the move tool, you can move the sphere's geometry around, therefore watching the boolean in real time.

Here's how a boolean works: It takes both geometry's shape nodes, connects their outputs to a boolean node, then the boolean node, based on the outputted information from the geometry shape node, generates a new mesh.

To see this connection, select the visible boolean output geometry and go to window>hypergraph: connections. As you can see, the "**out mesh**" and the "**worldmatrix**" of both sphere's shape nodes have been connected to a **boolean node** and the boolean node outputs the new geometry.



Animating Booleans

Yes, this is possible. Simply set key frames on the boolean geometry groups.

Where to use booleans

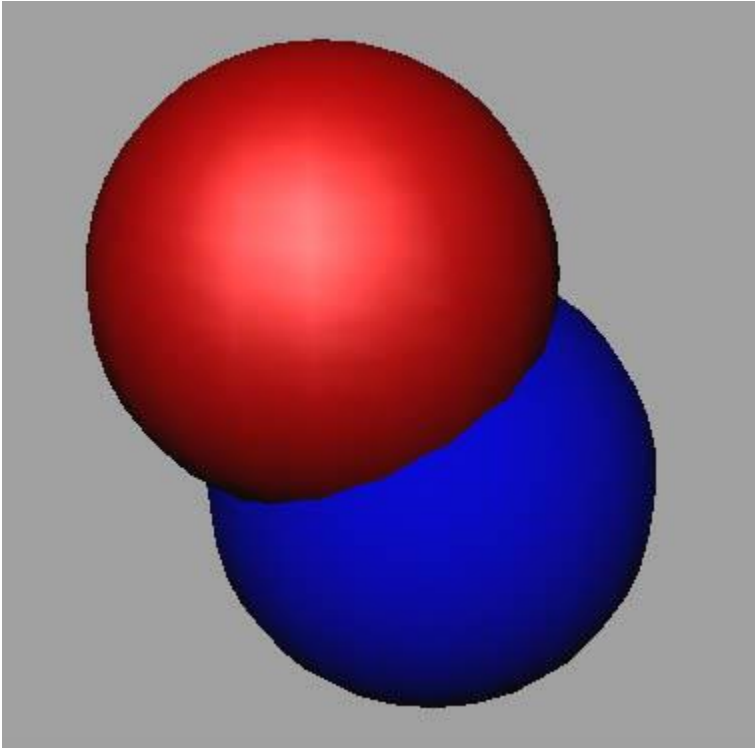
As mentioned before, booleans do have drawbacks. So the rule of thumb is if you need to smooth the surface later, example: organic modeling - people - animals, you probably don't want to use boolean. If it's a surface like a monitor, computer or keyboard, booleans are great.

Booleans and shaders

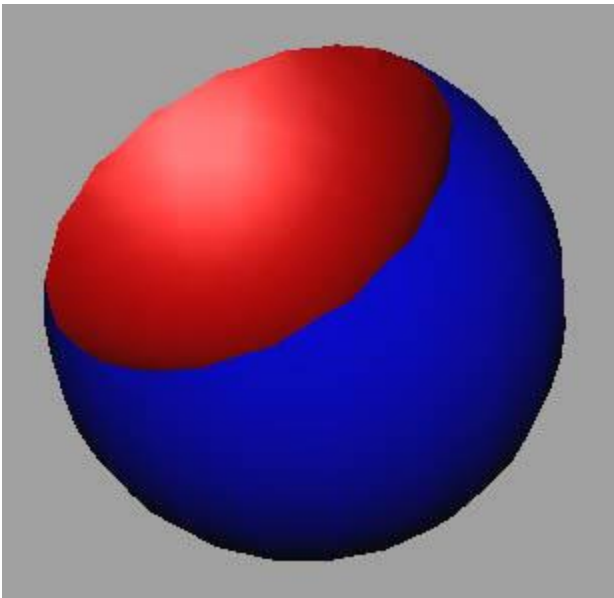
When you boolean an object, shader information is also booleaned.

Step one - Download example file [shaders.mb](#).

Step two - The red sphere has been assigned a blinn with its color set to red. The blue sphere has been assigned to a lambert with its color set to blue.



Select the blue and then the red sphere, and go to boolean>difference.



As you can see, the shaders are also boolean, so all the faces that the red sphere intersected are red, and the rest are blue.

Common Boolean Errors

Boolean is probably the fidgetiest function in Maya. This next section covers some common issues.

- Inverted boolean operations

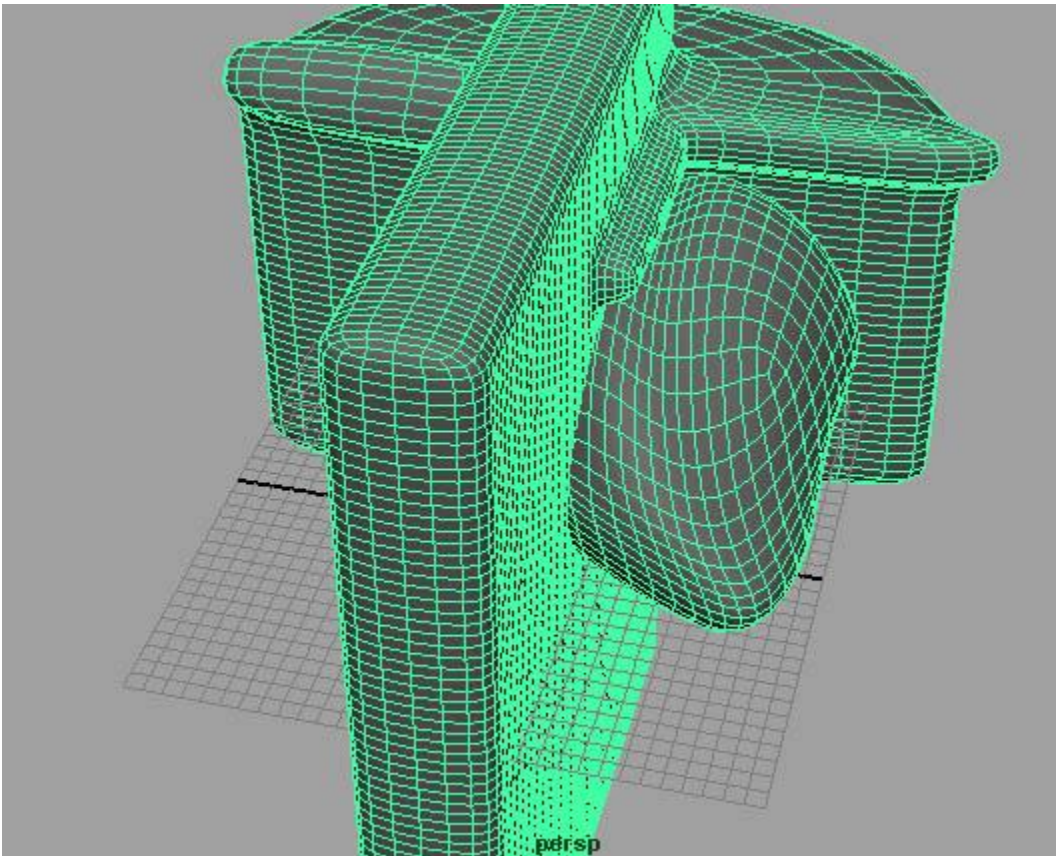
#1 Cause - Inverted normals. One of the surface's normals is probably facing backwards.

Fix - Select one of the objects and go to normals>vertex normal edit tool. This will show the normals as lines coming off the vertices. If you don't see any lines facing outwards, go to normals>reverse. If you don't see any reversed normals, select the other object and reverse its normals, and that should fix it.

- Objects disappearing

1 Cause - Scene tolerance.

Fix - Select both objects and group them. Scale the group until it's noticeably larger than the grid.



Then do the booleans and after that select the boolean geometry and then the group, and go to edit>parent. Now go to edit>delete all by type>history, and, last, select the group and, in the attributes editor, set the scale properties back to 1 and it will resize the geometry back to its original size.

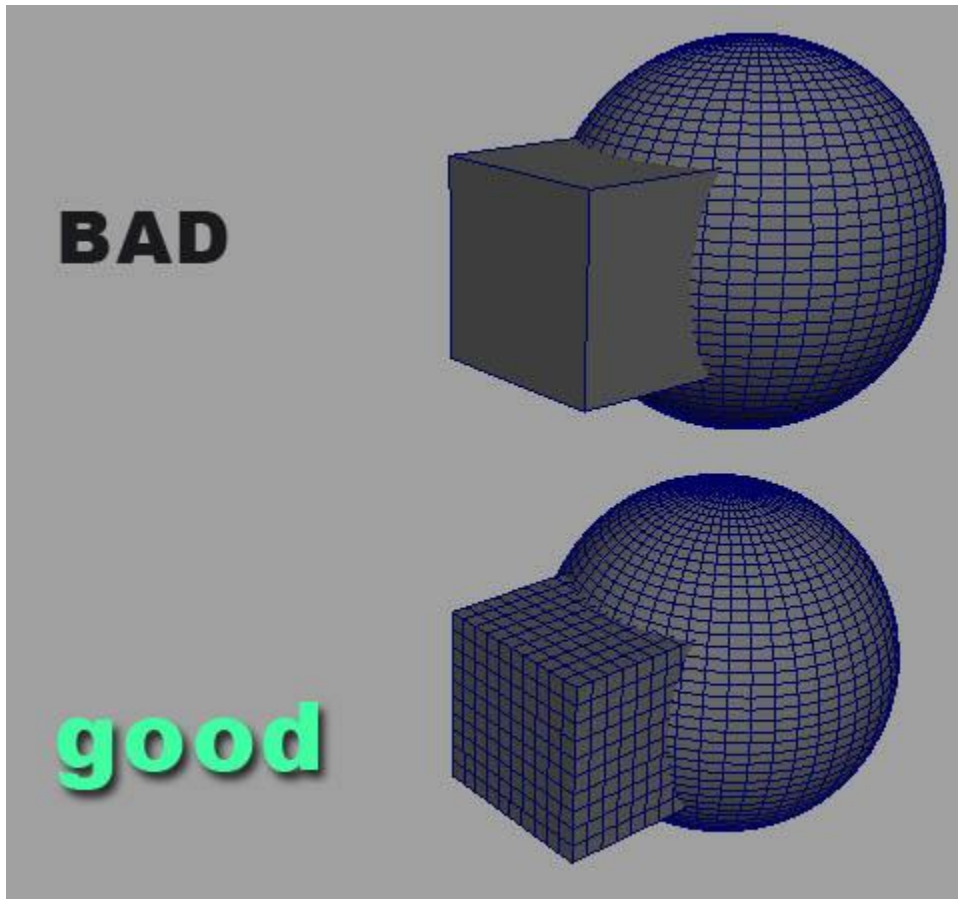
If you want to test this out for yourself, download badgeo.mb.

#2 Cause - Modeling history and history of previous booleans.

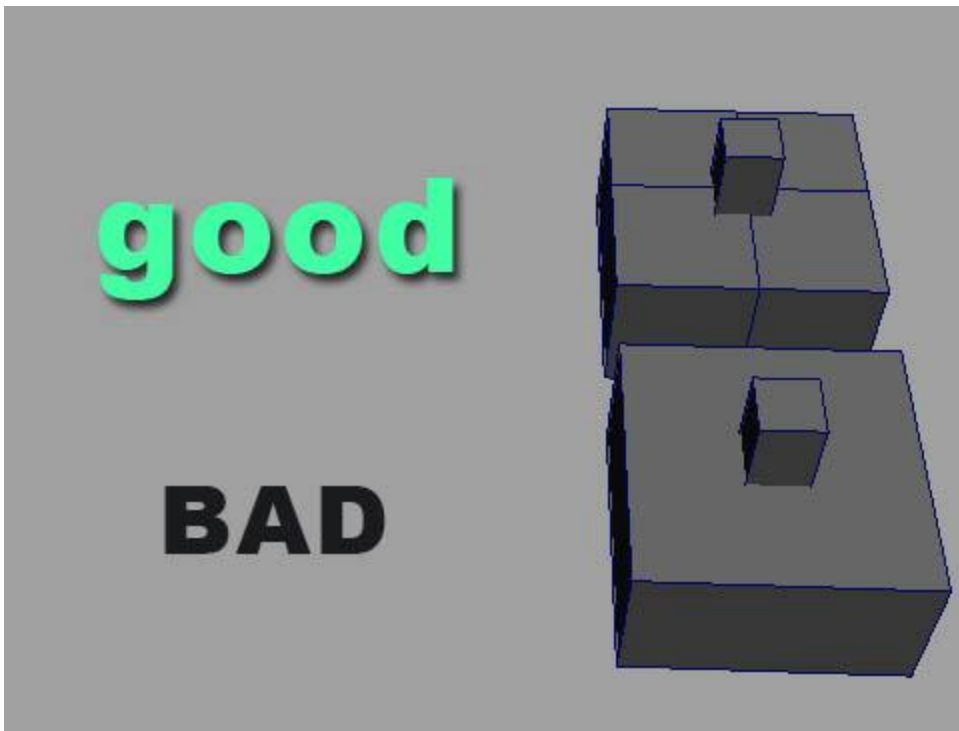
Fix - Go to edit>delete all by type>history.

Additional Information

- Make sure both pieces of geometry are of similar geometry density.



- Never boolean on only one face.



- You can't boolean more than two objects at once.
- You can't boolean different types of geometry. Example: you can't boolean a polygon with a NURB.
- It's a good practice to delete history after you finish with the boolean because this can cause problems.
- Don't accidentally delete history if you're animating a boolean.

Conclusion

This tutorial has covered a lot of the main features when booleaning.
Good luck.