

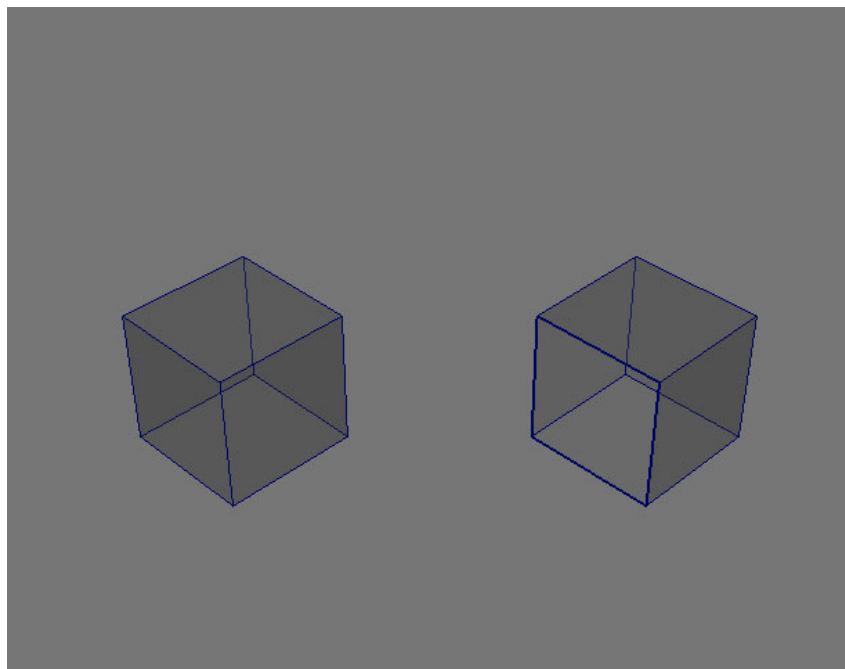
A tutorial on

# Border Edges

in  
Maya

Edges that form a loop around the openings of a mesh are known as **border edges**, and serve to represent where the continuity of polygons ends.

To better illustrate this, check out the image below.



The cube on the left has no border edges because each of its edges form an enclosure of polygons; what's called a "closed mesh". When a polygon is removed, as seen on the right, however, a loop of four border edges is produced because an opening into space is made; what's called an "open mesh".

Border edges like the ones above don't often cause problems. When they form around polygons, or where an opening shouldn't be, however, they tend to cause problems with shading and deformation.

## Getting started

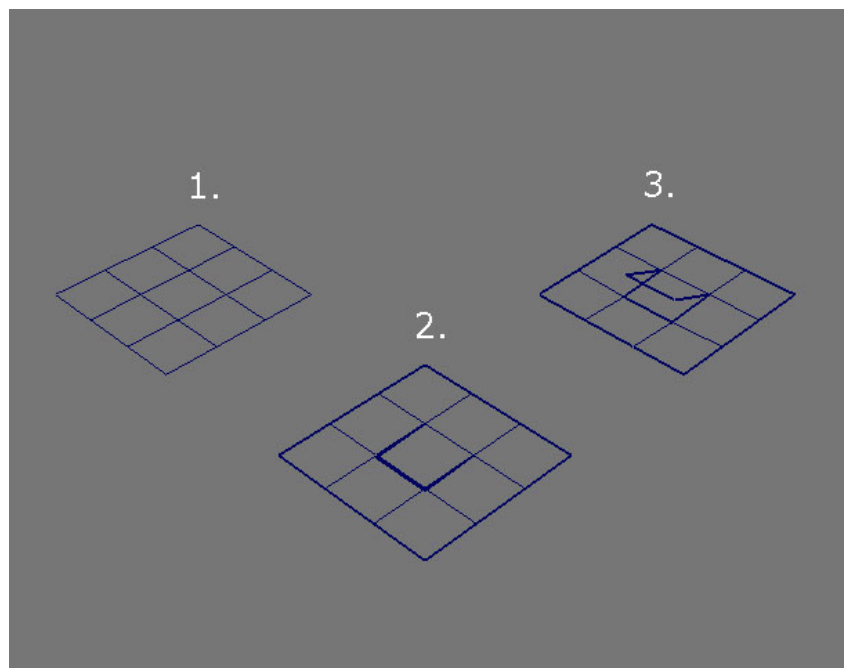
By default, border edges are turned off from view in Maya. To turn them on, **select your model** and then navigate to **Display – Polygons – Border Edges** from the **Main Menu Bar**. Border edges will appear as bolded edges.

## Removing border edges

There are a few different methods for correcting erroneous border edges, all dependent on how they're created.

### Merging vertices

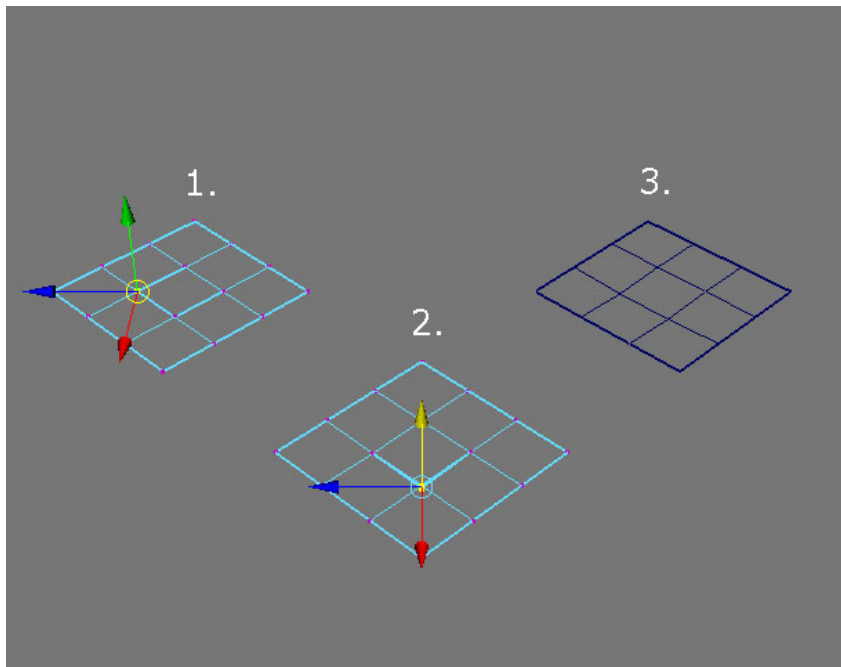
In some cases, border edges are the result of one or more edges overlapping each other instead of sharing common vertices.



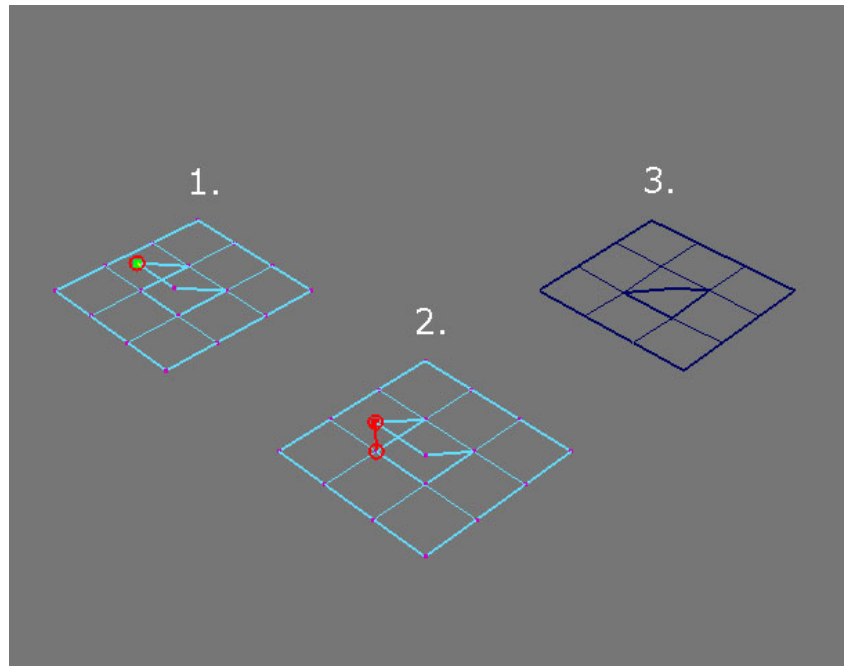
At first glance, the plane on the left appears normal with all of its edges sharing one vertex. With border edges turned on however, we can see that three edges are in fact not, and that the middle polygon is thus not connected to the ones surrounding it.

To fix the border edges in the example above, we are going to **Merge** each pair of separated vertices into one.

1. Change the Main Menu Bar to **Polygons** if it isn't already. This can be done by selecting the drop-down menu in the top-left corner of the program or pressing F3 on your keyboard.
2. Select your object and press F9 on your keyboard to enter vertex editing of **Component Mode**. Click-and-drag a marquee around two overlapping vertices and then navigate to **Edit Mesh – Merge** to conjoin them.



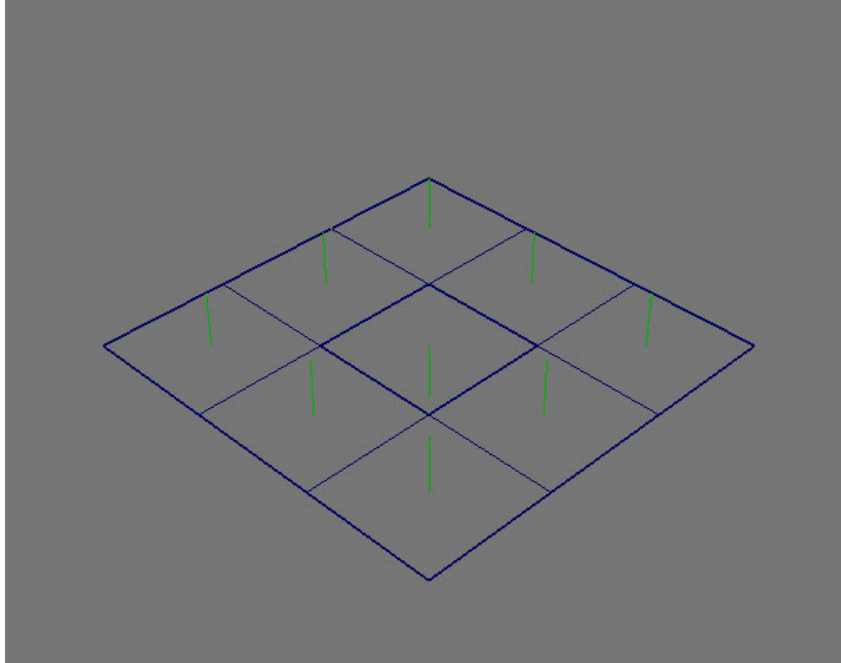
Likewise, if the vertices on your model are not overlapping, use the **Merge Vertex Tool** instead. Hover over the outermost vertex you wish to merge in and left-click-hold to select it. Drag your cursor over top of the vertex you wish to merge to and release left-click.



## Flip normals

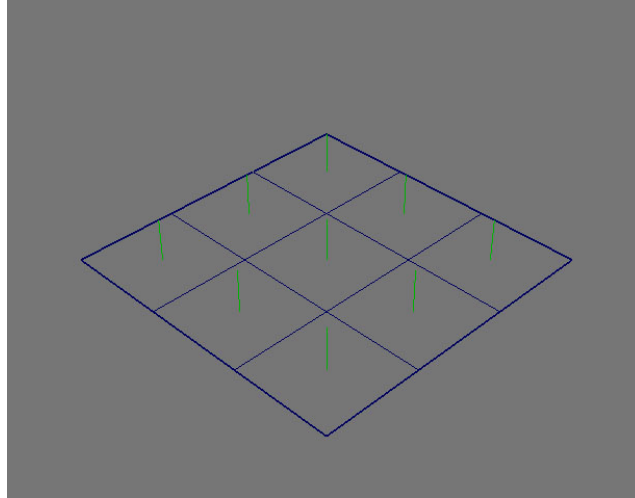
Polygons whose normals are inverted produce gaps in the flow of a mesh, creating border edges. Flipping the normal upright again will correct this. Doing this however to normals that are not inverted to can generate more border edges and also cause additional smoothing and textural issues.

1. To make certain that the normal in question is inverted, select your mesh and navigate to **Display – Polygons – Face Normals**. Green lines will project from the polygons of the mesh indicating which direction their normals are facing.



As can be seen in my example above, with the normals display turned on, the center polygon has an inverted normal with a resultant 4 border edges.

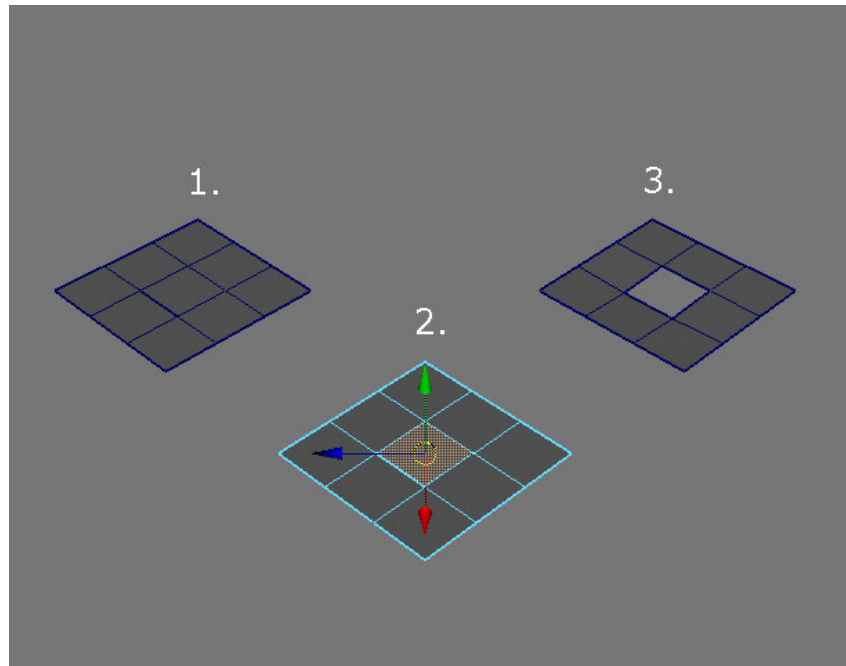
2. Change the Main Menu Bar to **Polygons** if it isn't already. This can be done by selecting the drop-down menu in the top-left corner of the program or pressing F3 on your keyboard.
3. Select your model and press F11 on your keyboard to enter face editing of **Component Mode**. Select the polygon contained within the loop of border edges and then navigate to **Normals – Reverse**, to flip it. If you find that there are multiple normals inverted on your mesh, navigate to **Normals – Conform** to flip all of them at once.



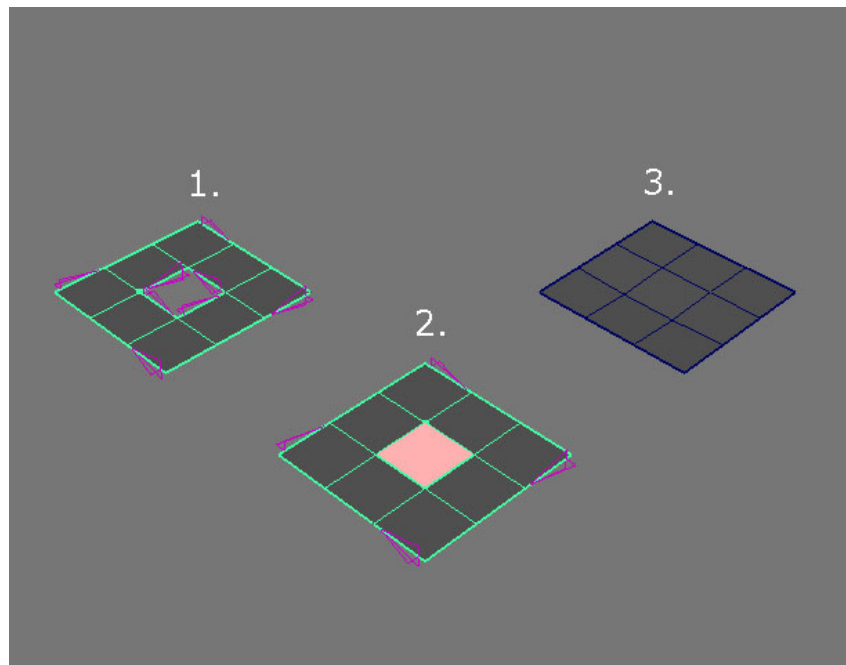
## Appending

While unmerged, overlapping edges are the most common reason for border edges, there are times when they are in fact composed of a single edge between two vertices. For situations like this, a second method of approach is to delete the adjoined polygon(s) and append the gap closed. This method is more practical than bridging, as Maya produces the most geometrically correct polygon and normal relevant to your mesh.

1. Change the Main Menu Bar to **Polygons** if it isn't already. This can be done by selecting the drop-down menu in the top-left corner of the program or pressing F3 on your keyboard.
2. Select your model and press F11 on your keyboard to enter face editing of **Component Mode**. Select a polygon adjoined to the border edge and press Backspace or Delete to remove it.



3. Navigate to **Edit Mesh – Append to Polygon Tool**. Select an edge that borders the opening; purple triangles will appear, indicating where you can append a face or polygon to. Select the triangle directly across from your initial selection; a pink fill will appear inside the opening. Press **Enter** to confirm.



## Conclusion

Because border edges are typically turned off by default in Maya, users may be unaware that a mesh has them. Finding and correcting offending border edges is a good modeling practice that serves to fix broken geometry, shading, deformations, normals, and, by extension, provide for a more robust mesh.

I hope that this guide has been of some use to you, both in helping to improve the quality of your work and modeling.

Thanks for reading!

Matt