

5.2.6.10 Modeling - Meshes - Editing - Subdividing

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Subdividing

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Mesh Subdividing Tools

Subdividing adds resolution by cutting existing faces and edges into smaller pieces. There are several tools that allow you to do this:

Subdivide

Divide a face or edge into smaller units, adding resolution.

Loop Subdivide

Insert a loop of edges between existing ones

Vertex Connect

Connects selected vertices with edges that split faces.

Knife Subdivide

Cut edges and faces interactively

Bevel

Subdivides edges or vertices, making them faceted or rounded

Subdivide

Reference

Mode: *Edit* mode

Panel: *Mesh Tools* (*Editing* context)

Menu: Mesh ▸ Edges ▸ Subdivide, Specials ▸ Subdivide/Subdivide Smooth

Hotkey: [W] ▸ [pad1]/[pad2]

Subdividing splits selected edges and faces by cutting them in half or more, adding necessary vertices, and subdividing accordingly the faces involved, following a few rules, depending on the settings:

- When only one edge of a face is selected (Tri mode), triangles are subdivided into two triangles, and quads, into three triangles.
- When two edges of a face are selected:
 - If the face is a triangle, a new edge is created between the two new vertices, subdividing the triangle in a triangle and a quad.
 - If the face is a quad, and the edges are neighbors, we have **three** possible behaviors, depending

on the setting of *Corner Cut Type* (the drop-down menu next to the *Subdivide* button, in *Mesh Tools* panel) See below for details.

- If the face is a quad, and the edges are opposite, the quad is just subdivided in two quads by the edge linking the two new vertices.
- When three edges of a face are selected:
 - If the face is a triangle, this means the whole face is selected - it is then sub-divided in four smaller triangles.
 - If the face is a quad, first the two opposite edges are subdivided as described above. Then, the “middle” edge is subdivided, affecting its new “sub-quad” as described above for only one edge.
- When four edges of a face (a quad) are selected, the face is subdivided into four smaller quads.

Options

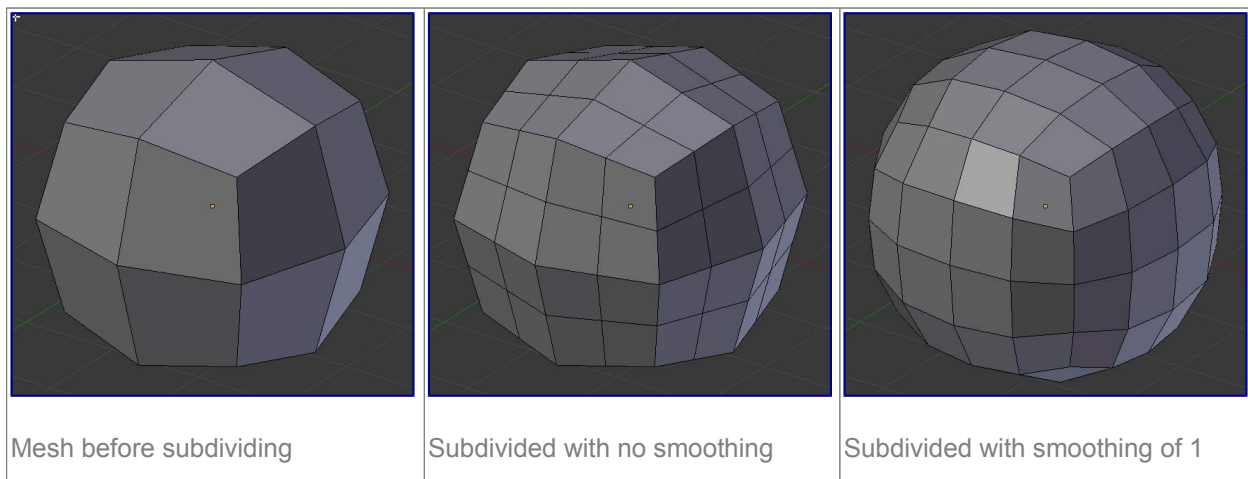
These options are available in the *Tool Panel* after running the tool;

Number of Cuts

Specifies the number of cuts per edge to make. By default this is 1, cutting edges in half. A value of 2 will cut it into thirds, and so on.

Smoothness

Displaces subdivisions to maintain approximate curvature, The effect is similar to the way the subdivision modifier might deform the mesh.



Quad/Tri Mode

Forces subdivide to create triangles instead of ngons, simulating old behavior (see examples below)

Corner Cut Type

This drop-down menu controls the way quads with only two adjacent selected edges are subdivided

Fan

the quad is sub-divided in a fan of four triangles, the common vertex being the one opposite to the selected edges.

Innervert

(i.e. “inner vertex”), The selected edges are sub-divided, then an edge is created between the two new vertices, creating a small triangle. This edge is also sub-divided, and the “inner vertex” thus created is linked by another edge to the one opposite to the original selected edges. All this results in a quad sub-divided in a triangle and two quad.

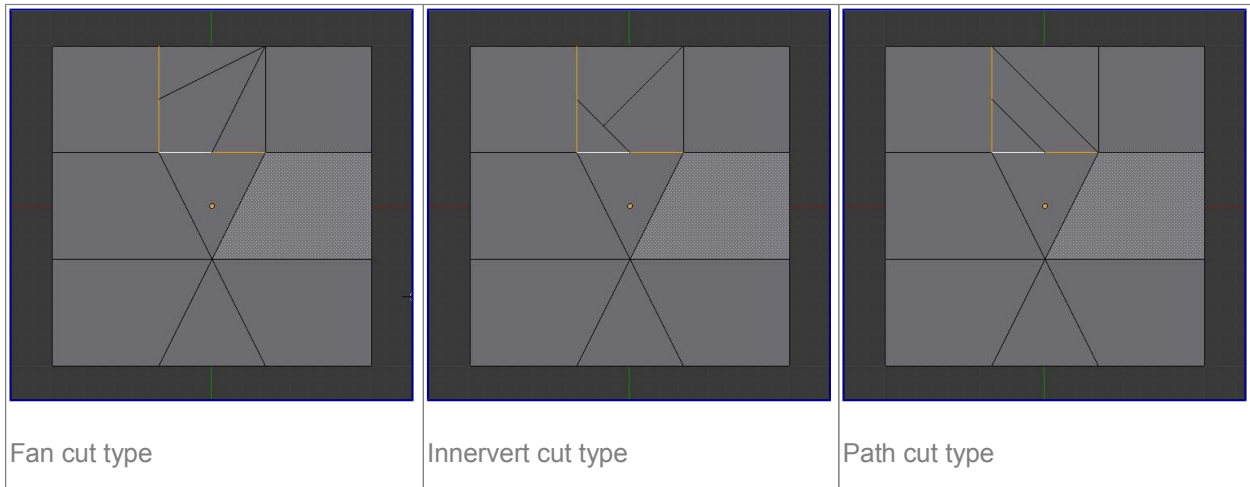
Path

First an edge is created between the two opposite ends of the selected edges, dividing the quad in

two triangles. Then, the same goes for the involved triangle as described above.

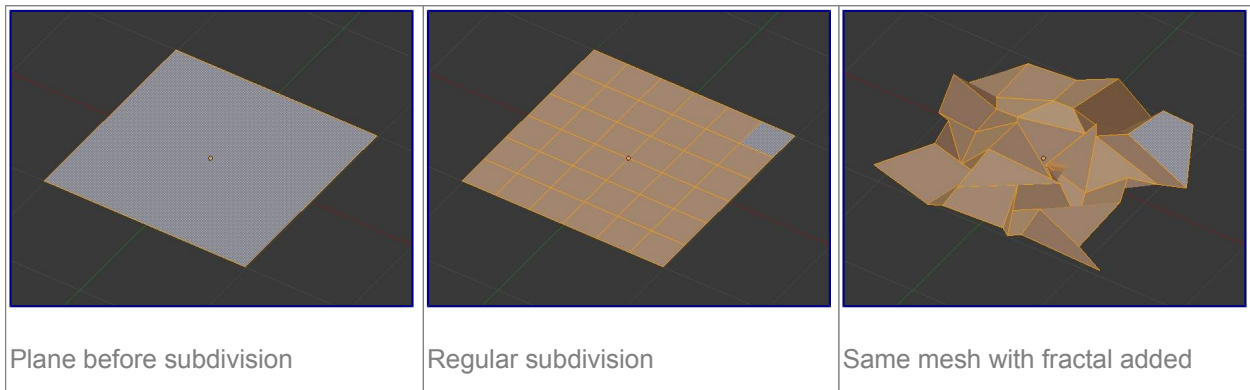
Straight Cut

Currently non functioning...



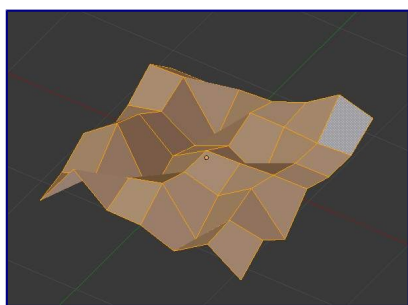
Fractal

Displaces the vertices in random directions after the mesh is subdivided



Along Normal

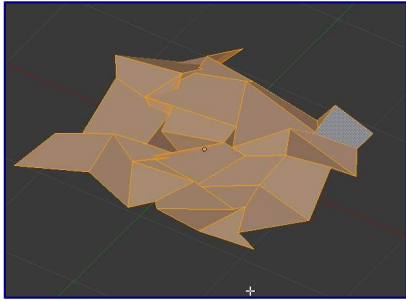
Causes the vertices to move along the their normals, instead of random directions



Along normal set to 1

Random Seed

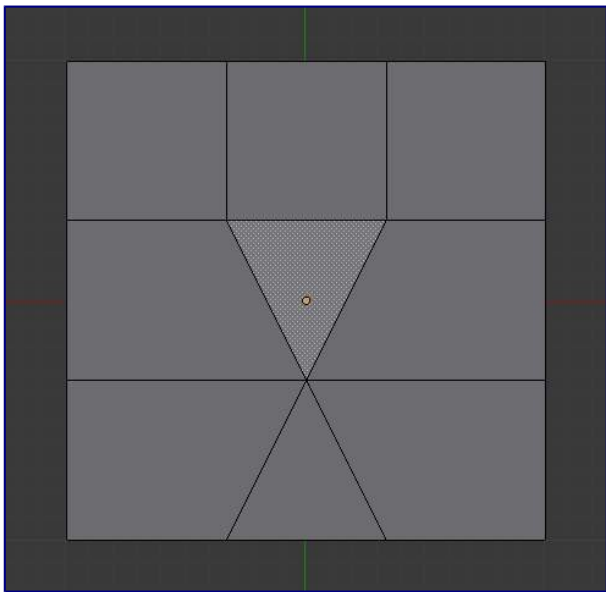
Changes the random seed of the noise function, producing a different result for each seed value.



Same mesh with a different seed value

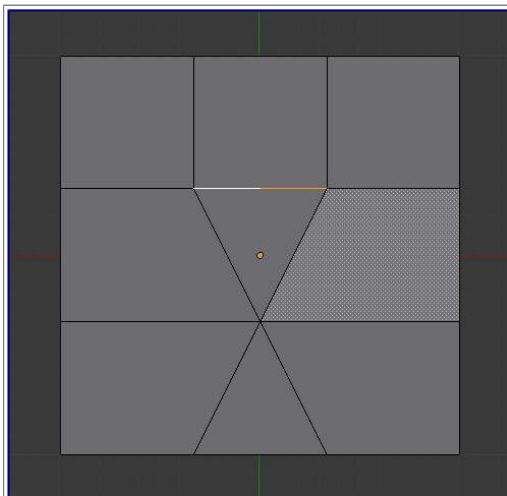
Examples

Below are several examples illustrating the various possibilities of the *Subdivide* and *Subdivide Multi* tools. Note the selection after subdivision.

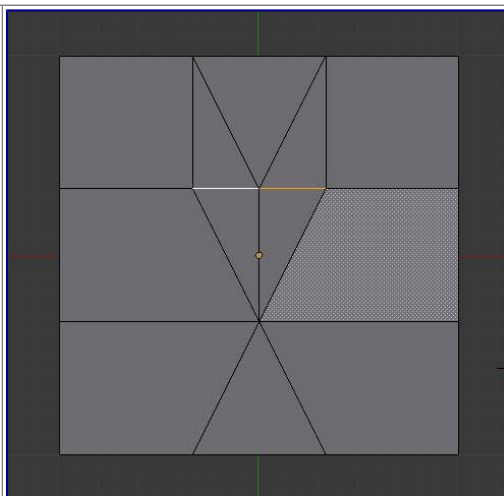


The sample mesh.

One Edge

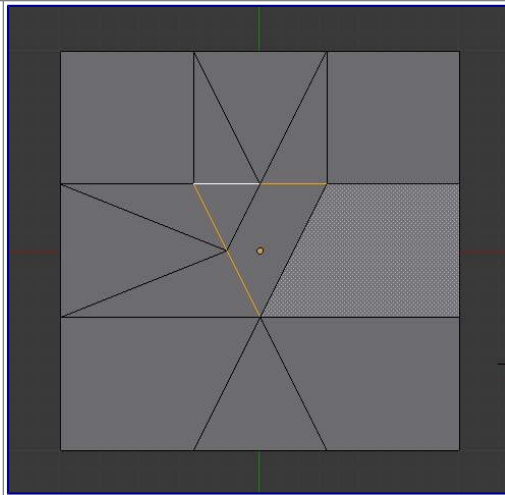
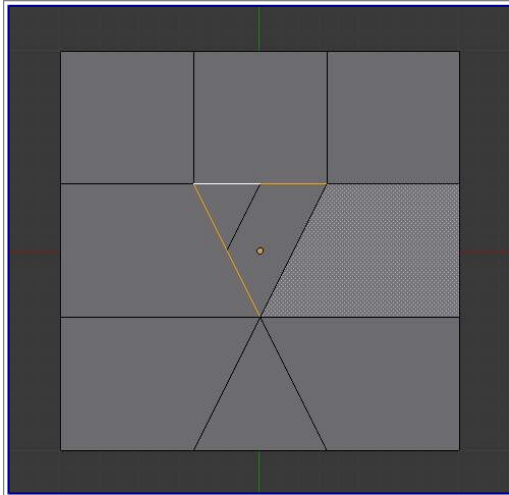


One Edges



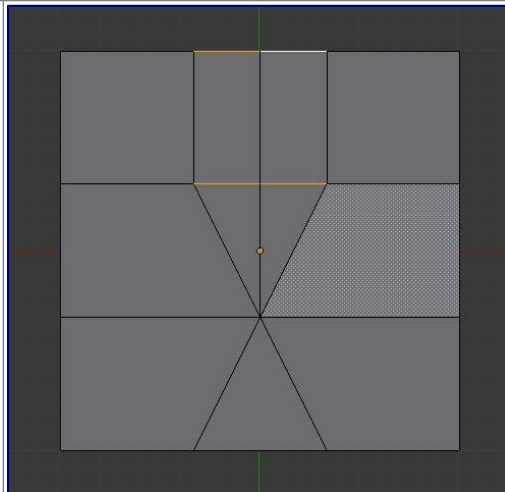
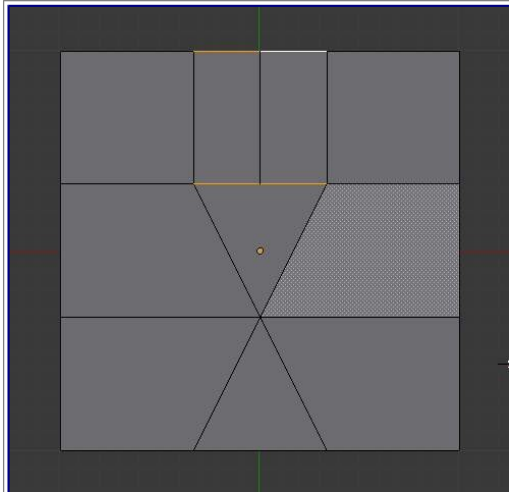
Quad/Tri Mode

Two Tri Edges



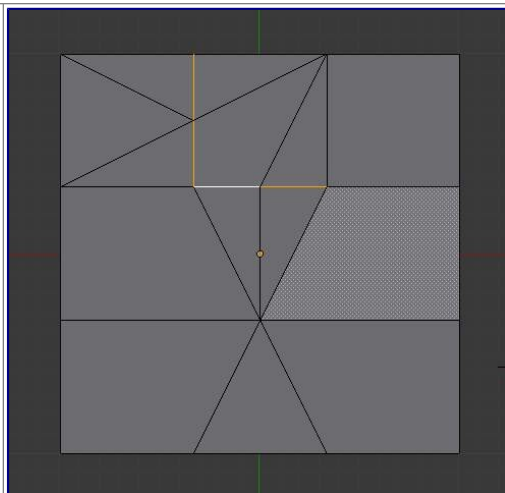
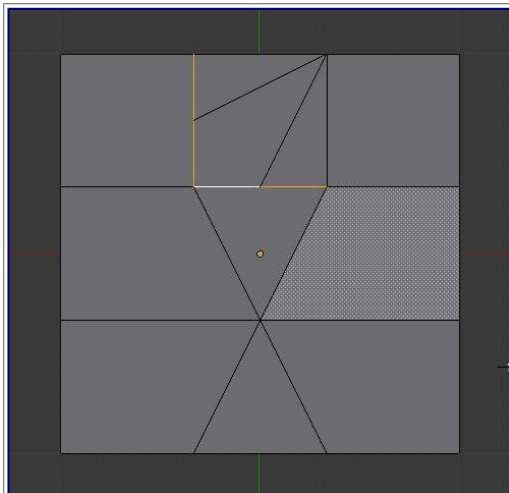
Quad/Tri Mode

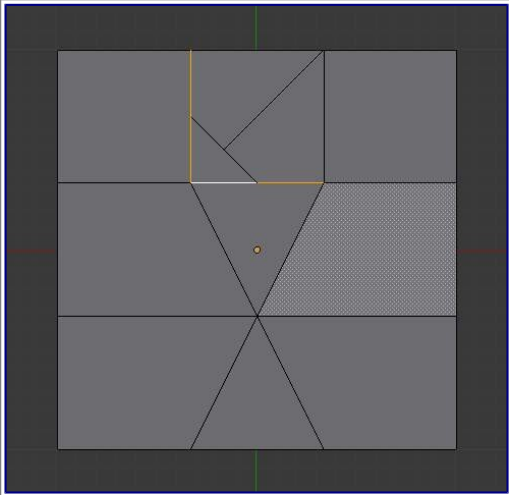
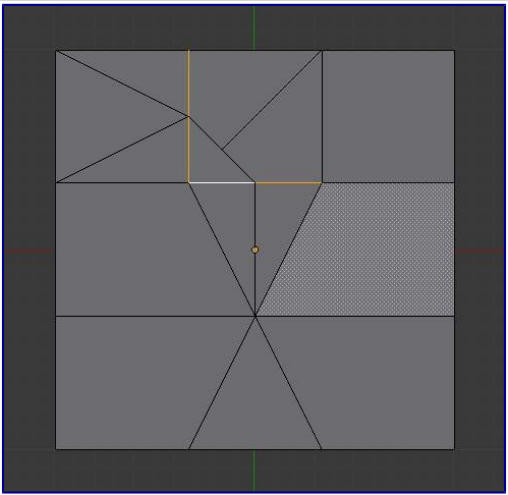
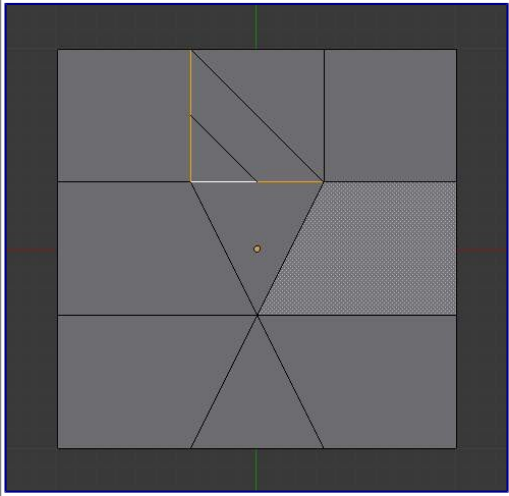
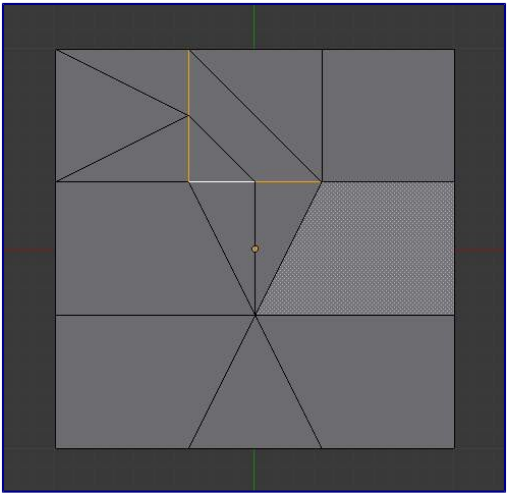
Two Opposite Quad Edges



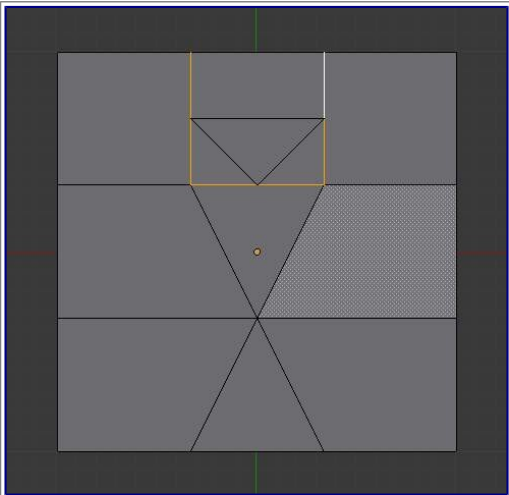
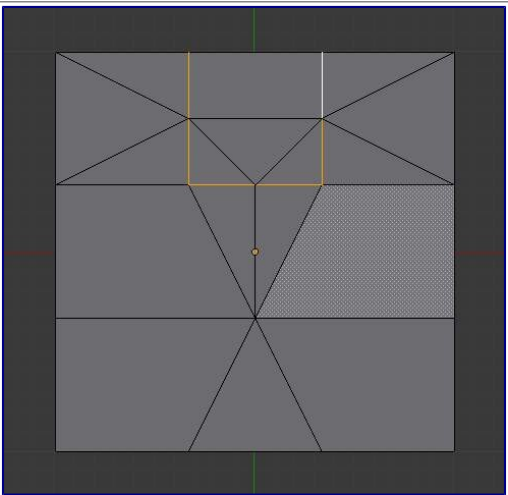
Quad/Tri Mode

Two Adjacent Quad Edges

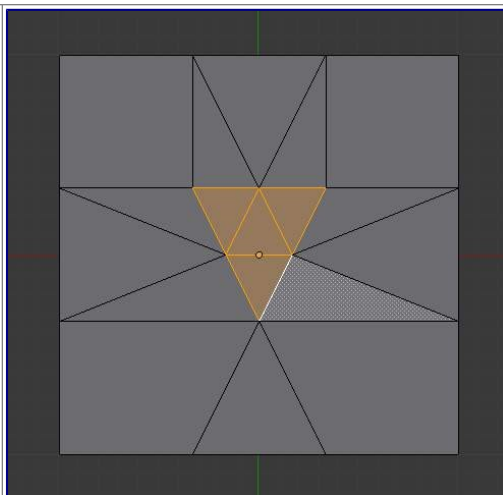
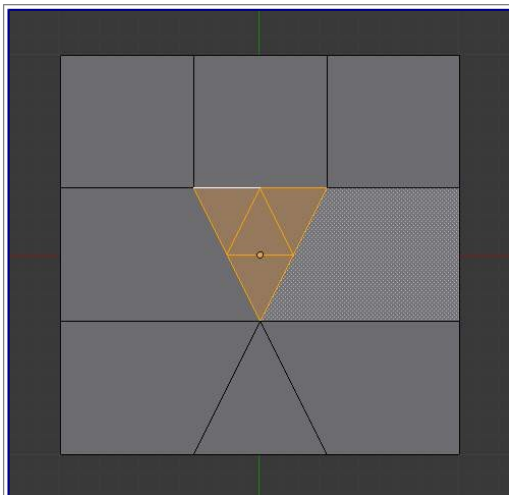


Fan cut type	Quad/Tri Mode
	
Innervert cut type	Quad/Tri Mode
	
Path cut type	Quad/Tri Mode

Three Edges

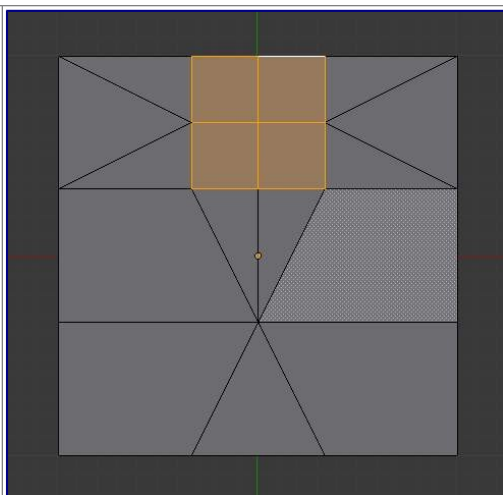
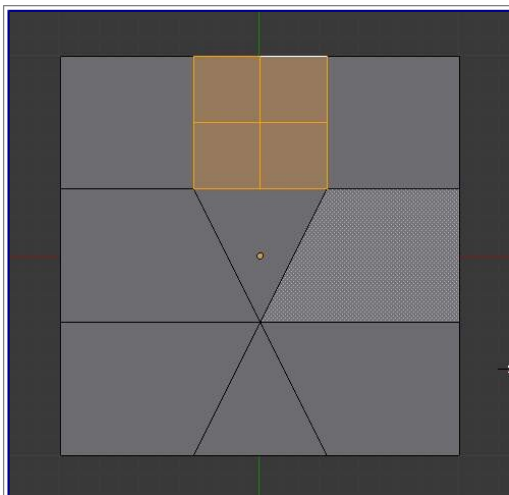
	
	Quad/Tri Mode

Tri



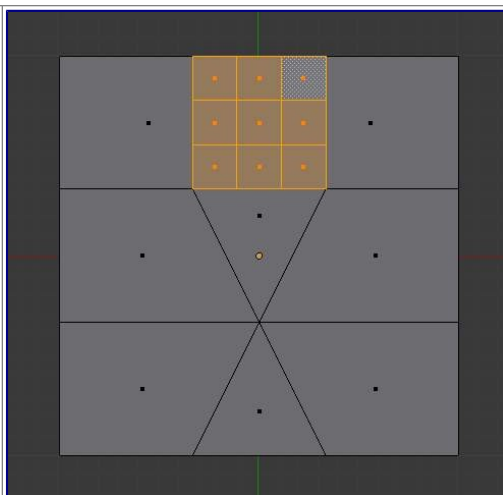
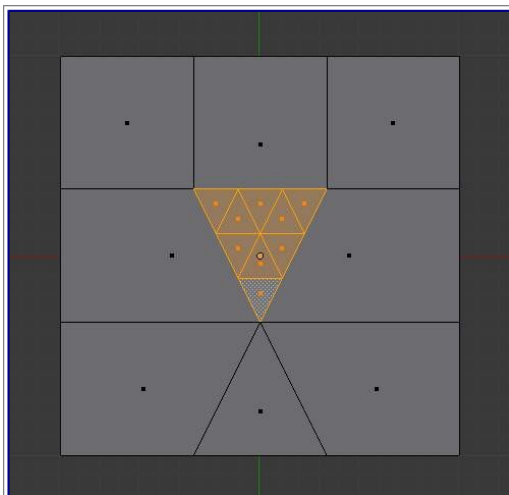
Quad/Tri Mode

Quad/Four Edges



Quad/Tri Mode

Multicut



Tri with two cuts

Quad with two cuts

Loop Subdivide

Reference

Mode: *Edit* mode

Panel: *Editing* context → *Mesh Tools*

Hotkey: **Ctrl-R**

Loop Cut splits a loop of faces by inserting a new edge loop intersecting the chosen edge. The tool is interactive and has two steps:

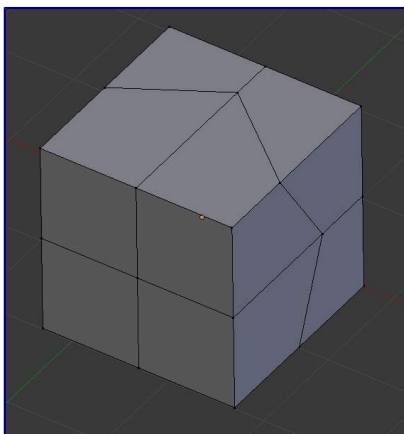
Usage

Pre-visualizing the cut

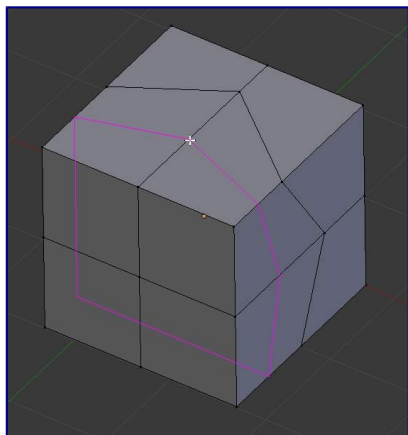
After the tool is activated, move the cursor over a desired edge. The cut to be made is marked with a magenta colored line as you move the mouse over the various edges. The to-be-created edge loop stops at the poles (tris and ngons) where the existing face loop terminates.

Sliding the new edge loop

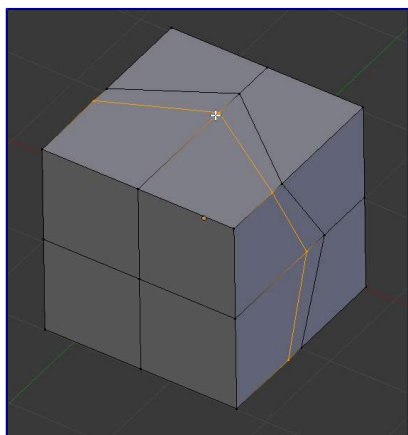
Once an edge is chosen via **LMB**, you can move the mouse along the edge to determine where the new edge loop will be placed. This is identical to the *Edge Slide* tool. Clicking **LMB** again confirms and makes the cut at the pre-visualized location, or clicking **RMB** forces the cut to exactly 50%. This step is skipped when using multiple edge loops (see below)



mesh before inserting edge loop



Preview of edge loop location



Interactive placement of edge loop between adjacent loops

Options

Options are only available while the tool is in use, and are displayed in the 3d view header

Even E

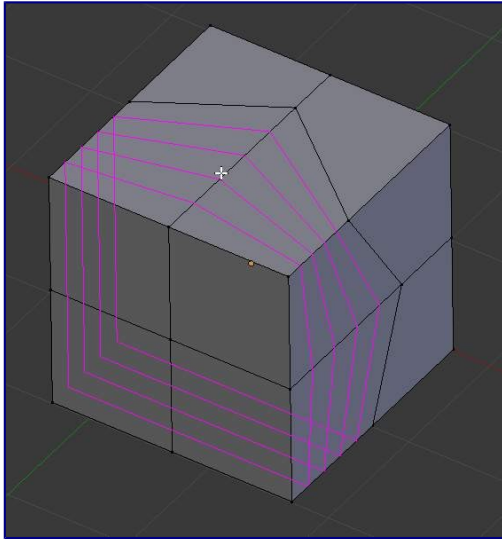
Only available for single edge loops. This matches the shape of the edge loop to one of the adjacent edge loops. (See Edge Slide tool for details)

Flip F

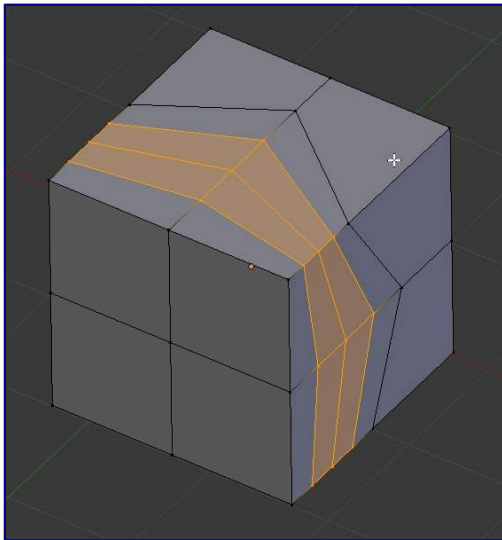
When Even is enabled, this flips the target edge loop to match. (See Edge Slide tool for details)

Number of Cuts **Wheel** or **NumpadPlus** / **NumpadMinus**

After activating the tool, but before confirming initial loop location, you can increase and decrease the number of cuts to create, by entering a number with the keyboard, scrolling **Wheel** or using **NumpadPlus** and **NumpadMinus**. Note that when creating multiple loops, these cuts are uniformly distributed in the original face loop, and *you will not be able to control their positions*.



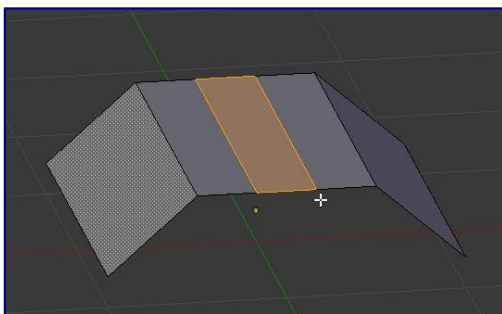
Preview of multiple edge loops



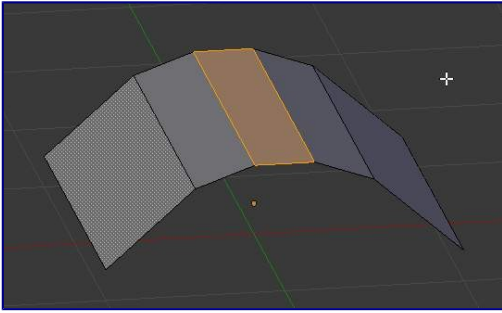
Result of using multiple cuts

Smoothing **Alt - Wheel**

Smoothing causes edge loops to be placed in an interpolated position, relative to the face it is added to, causing them to be shifted outwards or inwards by a given percentage, similar to the *Subdivide Smooth* command. When not using smoothing, new vertices for the new edge loop are placed exactly on the pre-existing edges. This keeps subdivided faces flat, but can distort geometry, particularly when using *Subdivision Surfaces*. Smoothing can help maintain the curvature of a surface once it is subdivided.



Added edge loops without smoothing



Same edge loops, but with smoothing value

Knife Tool

Reference

Mode: *Edit* mode

Panel: *Mesh Tools* (*Editing* context)

Hotkey: **K** or **Shift-K**

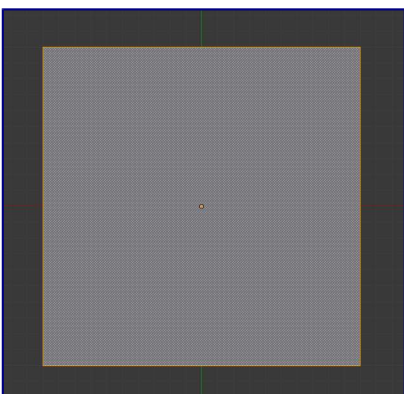
The knife tool can be used to interactively cut up geometry by drawing lines or closed loops to create holes.

Usage

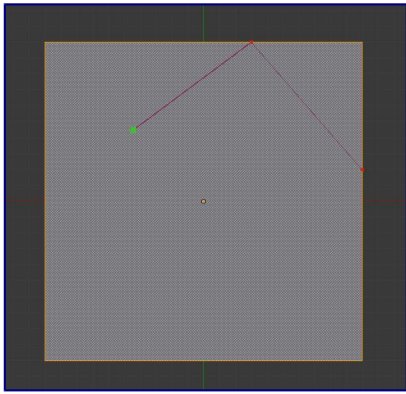
When you press **K** (or **Shift-K**), the Knife tool becomes active.

Drawing the cut line

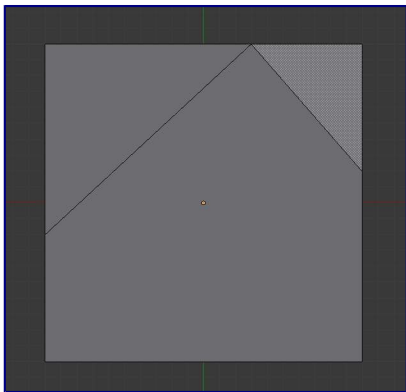
When using *Knife*, the cursor changes to an icon of a scalpel and the header changes to display options for the tool. You can draw connected straight lines by clicking **LMB**.



Mesh before knife cut



Knife cut active



After confirming knife cut

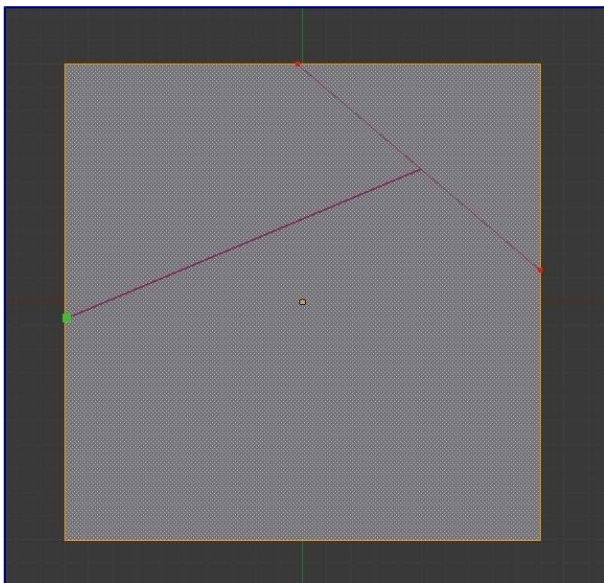
Options

Knife selection **Shift - K**

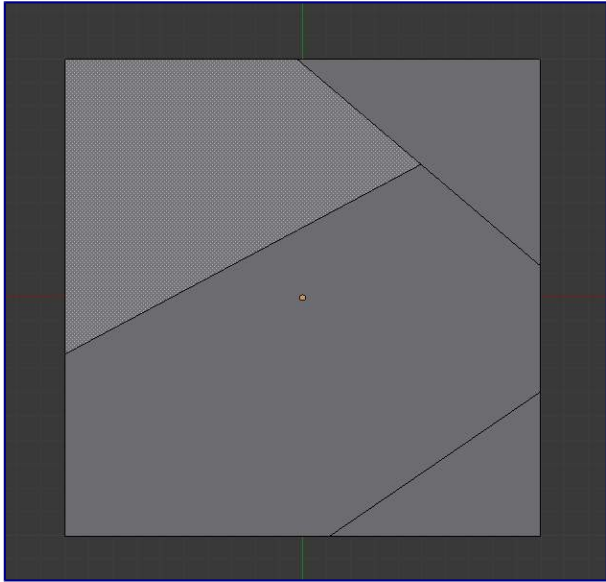
Activates the knife so only selected faces are cut.

New cut **E**

Begins a new cut. This allows you to define multiple distinct cut lines. If multiple cuts have been defined, they are recognized as new snapping points.



Creating multiple cuts



Result of starting new cuts while in the tool

Midpoint snap Ctrl

Hold to snap the cursor to the midpoint of edges

Ignore snap Shift

Hold to make the tool ignore snapping.

Cut through: Z

Allow the cut tool to cut through to obscured faces, instead of only the visible ones.

Angle constrain C

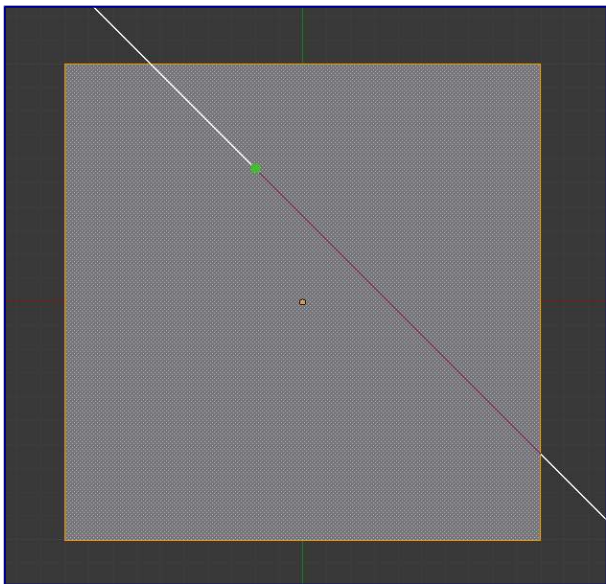
Constrains the cut to 45 degree increments.

Close loop: Double click LMB

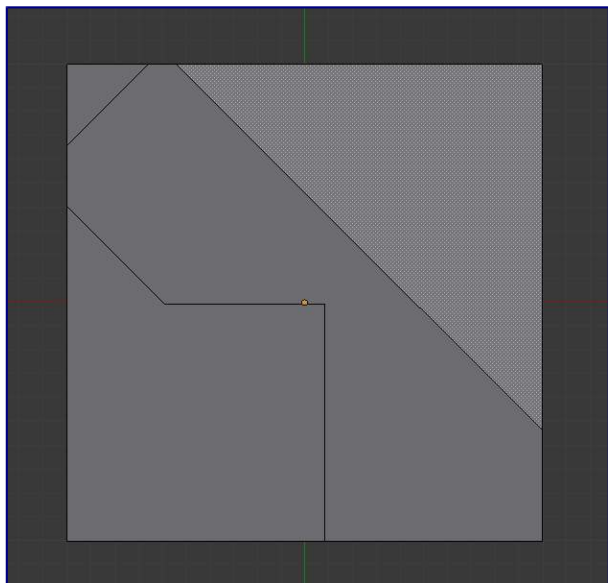
This is a quick way to close the loop you're currently cutting.

Draw a continuous line: LMB drag.

So you can draw a freehand line over a surface, points will be created at edge intersections.



Constraining cut angle



Result of constraining cut angle

Confirming and selection

Pressing `ESC` or `RMB` at any time cancels the tool, and pressing `LMB` or `Return` confirms the cut, with the following options:

`Return` will leave selected every edge except the new edges created from the cut.

Limitations

Cuts that begin or end in the middle of a face, will be ignored. This is a limitation of the current geometry that can be modeled in Blender.

Knife Project

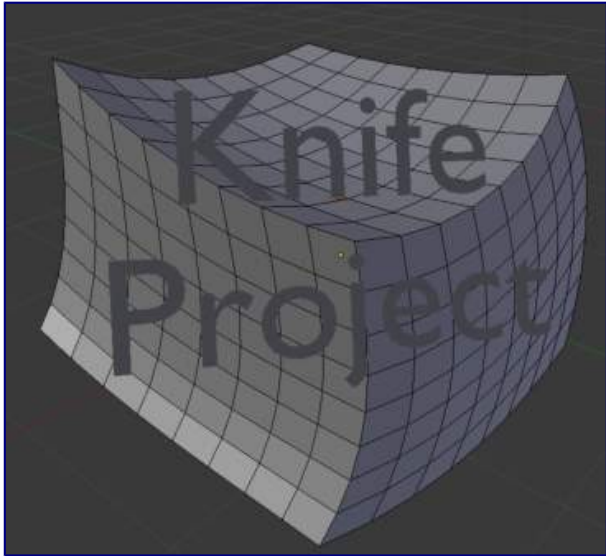
Knife projection is a non-interactive tool where you can use objects to cookie-cut into the mesh rather than hand drawing the line.

This works by using the outlines of other selected objects in edit-mode to cut into the mesh, resulting geometry inside the cutters outline will be selected.

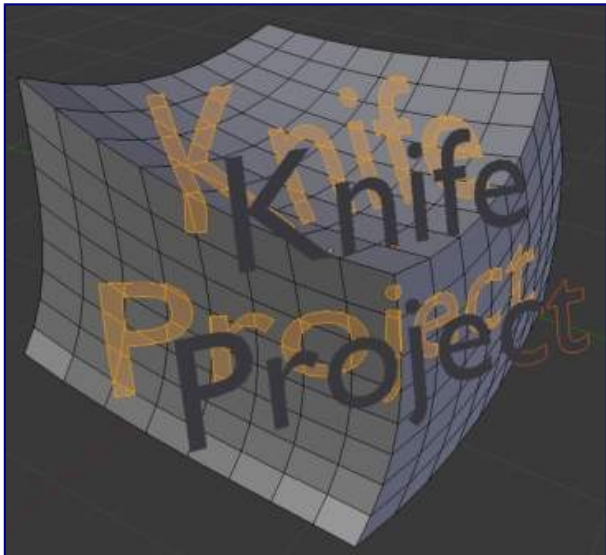
Outlines can be wire or boundary edges.

To use Knife Project, in ‘object’ mode select the “cutting object” first then shift select the “object to be cut”. Now tab into edit mode and press “knife project”.

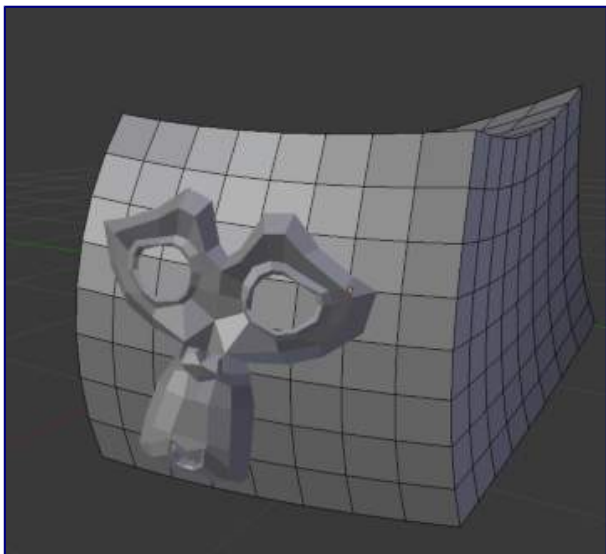
Examples



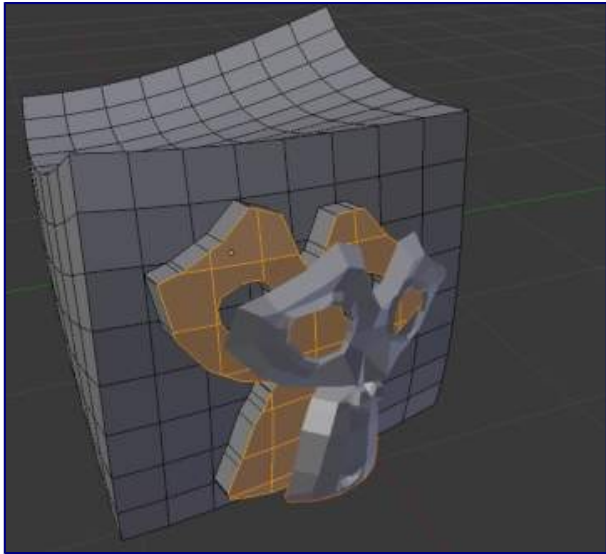
Before projecting from a text object



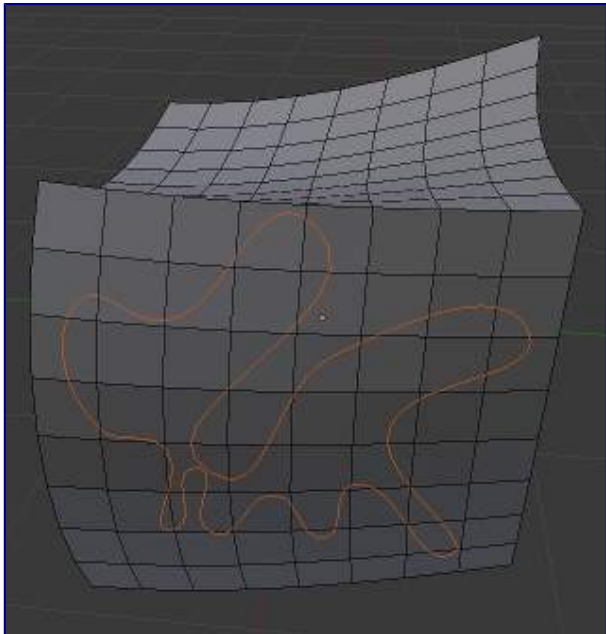
Resulting knife projection



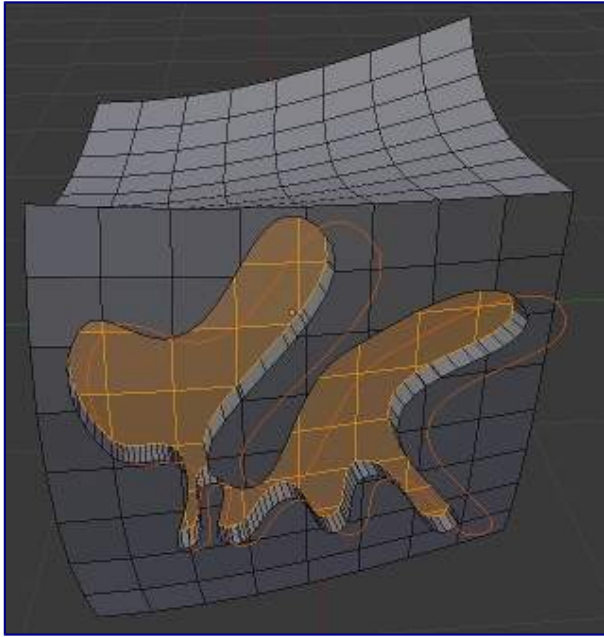
Before projecting from a mesh object



Resulting knife projection (extruded after)



Before projecting from a 3D curve object



Resulting knife projection (extruded after)

Known Issues

Cutting holes into single faces may fail, this is the same limitation as with the regular knife tool but more noticeable for text, this can be avoided by projecting onto more highly subdivided geometry.

Mesh Bisect

Reference

Mode: *Edit* mode

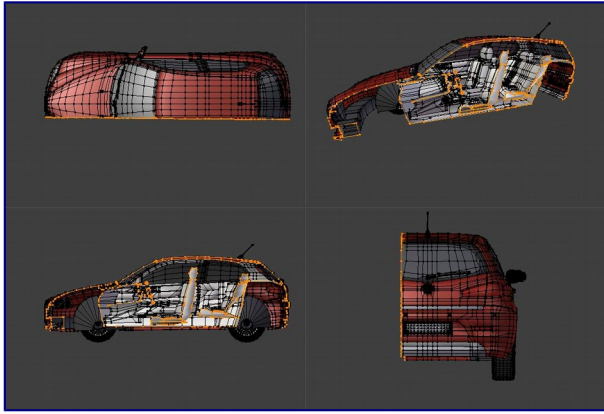
Menu: Mesh ▸ Bisect

The bisect tool is a quick way to cut a mesh in-two along a custom plane.

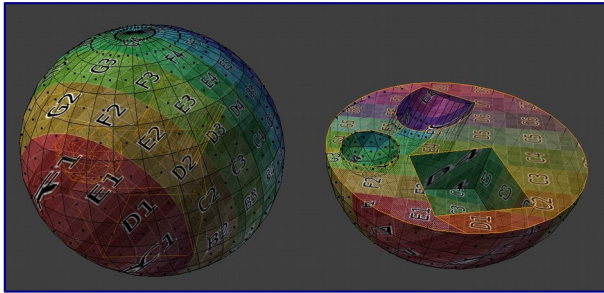
There are three important differences between this and the knife tool.

- The plane can be numerically adjusted in the operator panel for precise values.
- Cuts may remove geometry on one side.
- Cuts can optionally fill in the holes created, with materials and UV's & vertex-colors based on the surrounding geometry.

This means the bisect tool can cut off parts of a mesh without creating any holes.



Example of a common use of bisect



Example of bisect with fill option

Vertex Connect

Reference

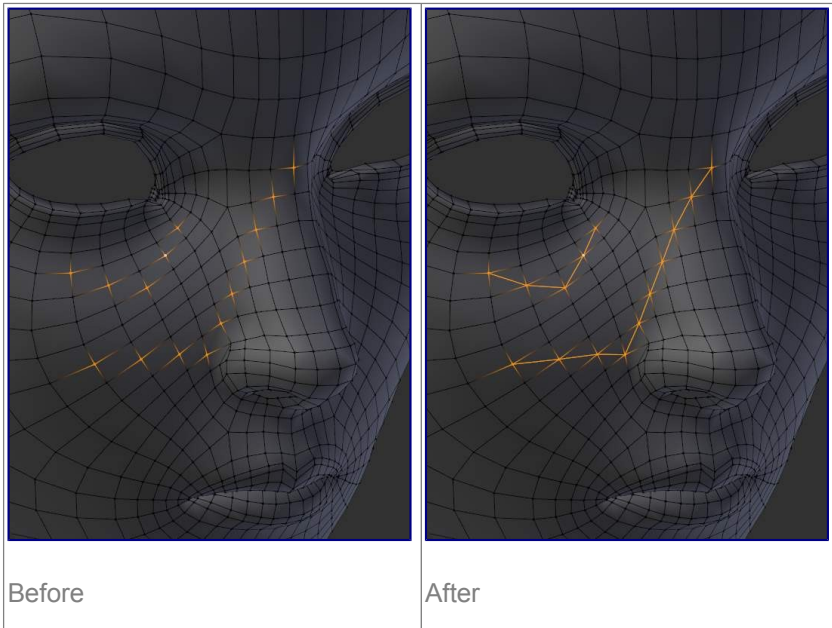
Mode: *Edit* mode

Menu: Mesh → Vertices → Connect

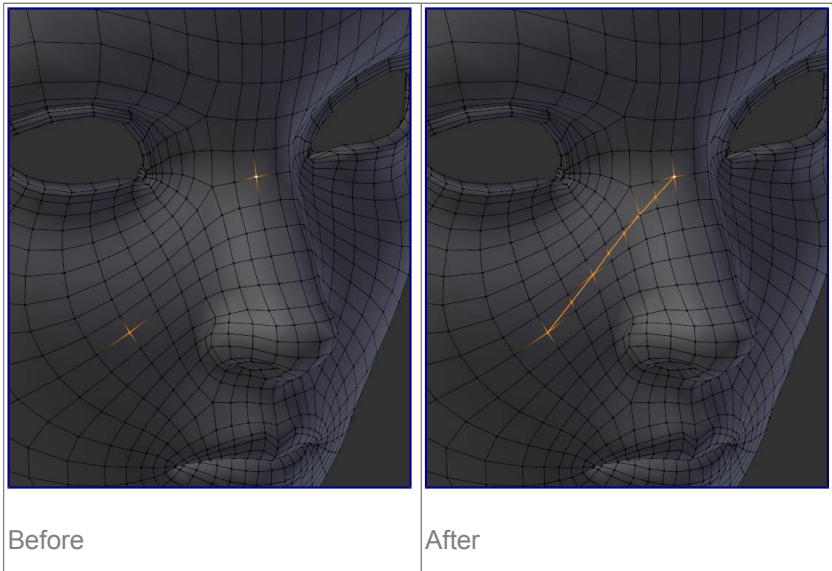
Hotkey: J

This tool joins selected vertices by edges, The main difference between this and creating edges is that faces are split by the newly joined vertices.

When many vertices are selected, faces will be split by their selected vertices.



When there are only 2 vertices selected, a cut will be made across unselected faces, a little like the knife tool; however this is limited to straight cuts across connected faces.



Bevel

Reference

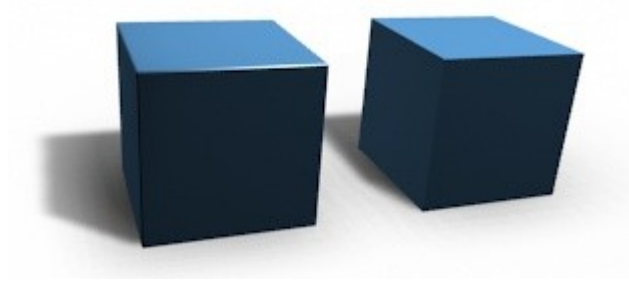
Mode: *Edit* mode

Menu: Mesh ▸ Edges ▸ Bevel or [Ctrl][E] ▸ Bevel

Hotkey: Ctrl-B or [W] ▸ Bevel

Menu (vertex-only): Mesh ▸ Vertices ▸ Bevel or [Ctrl][V] ▸ Bevel

Hotkey (vertex-only): Shift-Ctrl-B



With bevel and without bevel.

The bevel tool allows you to create chamfered or rounded corners to geometry. A bevel is an effect that smooths out edges and corners. True world edges are very seldom exactly sharp. Not even a knife blade edge can be considered perfectly sharp. Most edges are intentionally beveled for mechanical and practical reasons.

Bevels are also useful for giving realism to non-organic models. In the real world, the blunt edges on objects catch the light and change the shading around the edges. This gives a solid, realistic look, as opposed to un-beveled objects which can look too perfect.

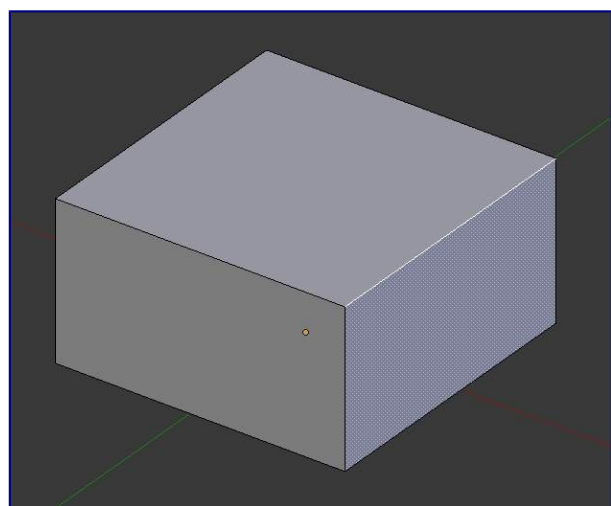
Bevel Modifier

The *Bevel Modifier* is a non destructive alternative to the bevel tool. It gives you the same options, with additional goodies, like the bevel width controlled by the vertices weight, and all the modifiers general enhancements (non-destructive operations, ...).

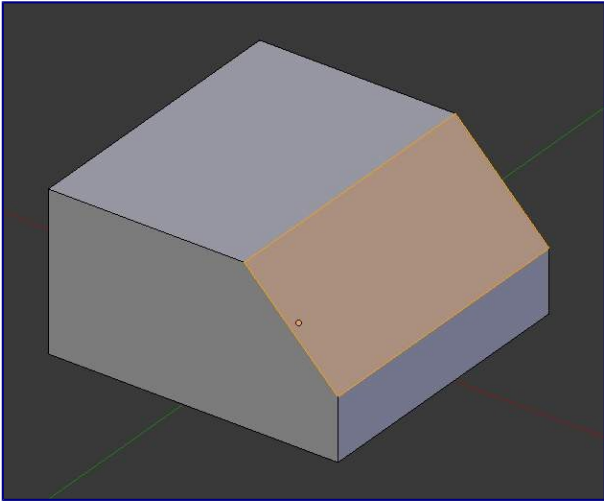
Usage

The *Bevel* tool works only on selected edges. It will recognize any edges included in a vertex or face selection as well, and perform the bevel the same as if those edges were explicitly selected. In “vertex only” mode, the *Bevel* tool works on selected vertices instead of edges. The *Bevel* tool smooths the edges and/or “corners” (vertices) by replacing them with faces making smooth profiles with a specified number of *segments* (see the options below for details about the bevel algorithm).

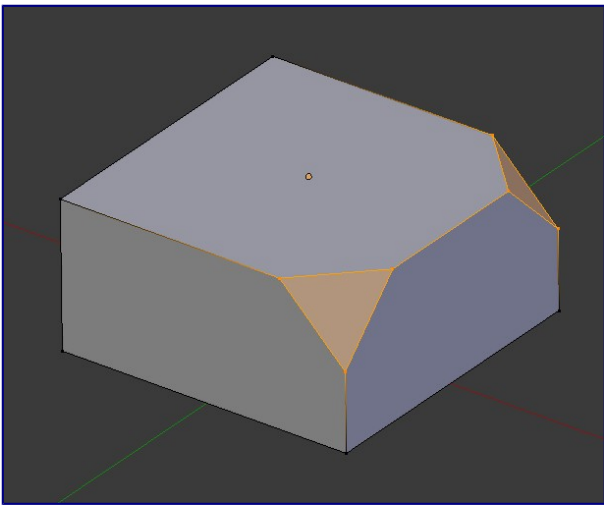
Use **Ctrl-B** or a method listed above to run the tool. Move the mouse to interactively specify the bevel offset, and scroll the **Wheel** to increase or decrease the number of segments. (see below)



Selected edge before beveling



Result of bevel (one segment)

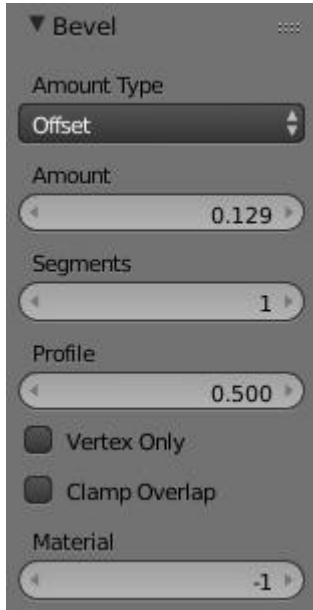


Result of bevel (vertex only)

Note

Normal (edge) beveling only works on edges that have exactly two faces attached to them. Vertex bevel has no such restriction.

Options



Amount

You can change the bevel amount by moving the mouse towards and away from the object, a bit like with transform tools. The exact meaning of the value depends on the *Amount Type* option (see below). As usual, the scaling can be controlled to a finer degree by holding **Shift** to scale in 0.001 steps. **LMB** finalizes the operation, **RMB** or **ESC** aborts the action.

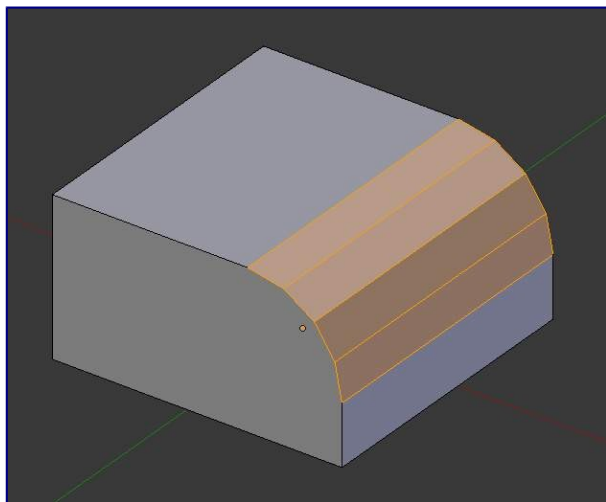
Amount Type

Selects how the *Amount* value controls the size of the bevel. According to the selection, the amount is: - **Offset** - the distance of a new edge from the original - **Width** - the width of the bevel face - **Depth** - the perpendicular distance from the original edge to the bevel face - **Percent** - the percentage of the length of adjacent edges that the new edges slide

Segments

The number of segments in the bevel can be defined by scrolling the mouse **Wheel** to increase or decrease this value. The greater the number of segments, the smoother the bevel.

Alternatively, you can manually enter a segment number value while using the tool, or in the Mesh Tool options panel after using the tool.



Bevel with 4 segments

Profile

This is a number between 0 and 1 that controls the shape of the profile (side view of a beveled edge). The default value, 0.5, gives a circular arc (if the faces meet at right angles). Values less than that give a flatter profile, with 0.25 being exactly flat, and values less than that giving a concave bevel. Values more than 0.5 give a more “bulged-out” profile.

Vertex Only

When selected, the tool is in “vertex only” mode, and only vertices will be beveled.

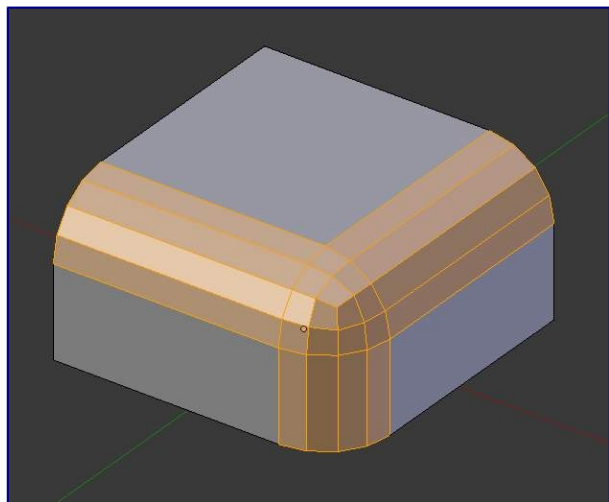
Clamp Overlap

When selected, the bevel amount is not allowed to go larger than an amount that causes overlapping collisions with other geometry.

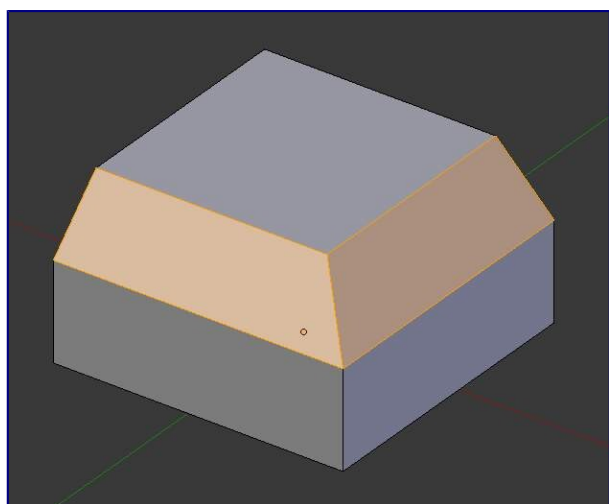
Material

The *Material* number specifies which material should be assigned to the new faces created by the *Bevel* tool. With the default, -1, the material is inherited from the closest existing face (“closest” can be a bit ambiguous). Otherwise, the number is the slot index of the material to use for all newly created faces.

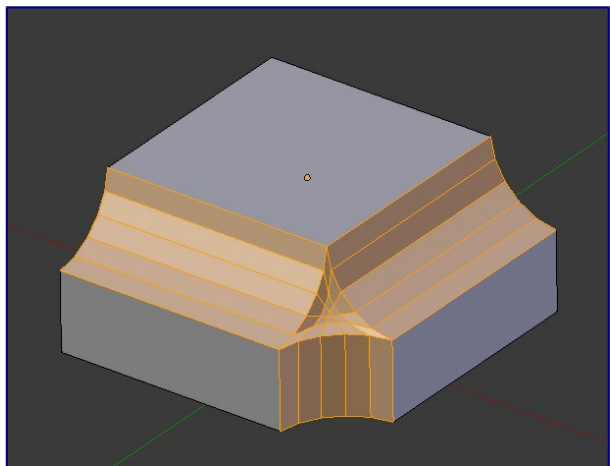
Examples



Result of beveling multiple edges



Another example of beveling multiple edges



An example using Profile=0.150