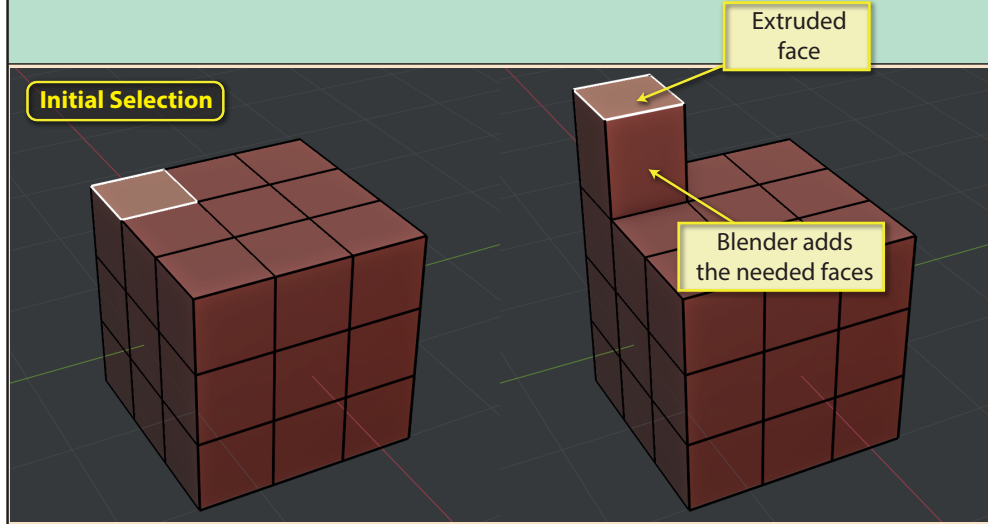


The Extrude Tool

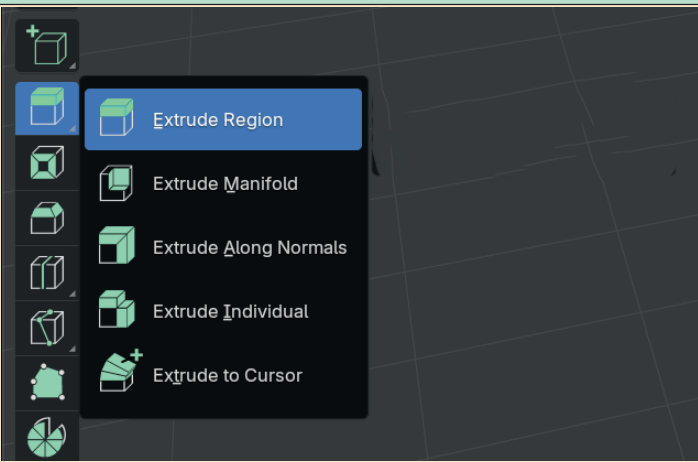


The Extrude tool performs a bit of magic. It allows us to select faces, edges, or vertices and “pull out” an exact copy of that selection that stays attached to the original mesh. Blender automatically adds the necessary edges or faces required to ensure the new copies remain attached to the original geometry.

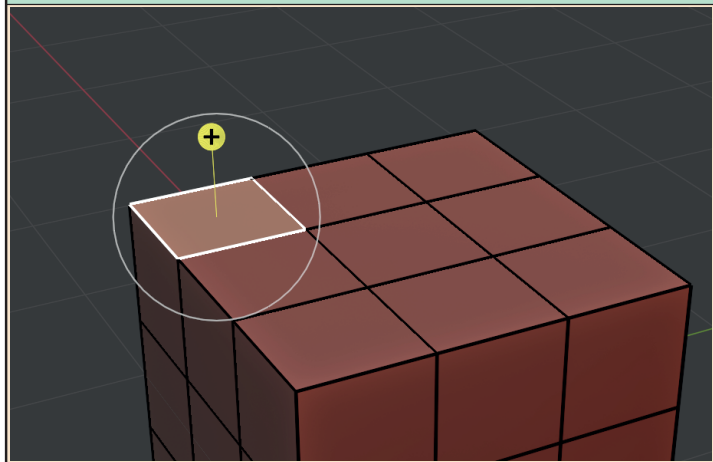
Below we can see the effect produced when we select a single face in a subdivided Cube and extrude it upwards.



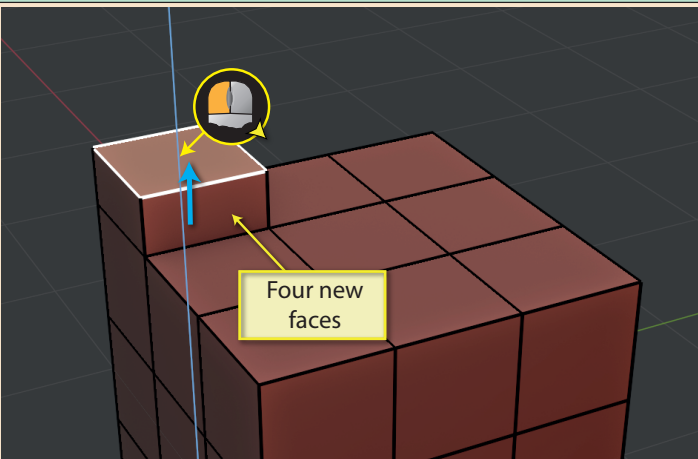
The **Extrude tool** icon is the first in the Toolbar that is unique to Edit mode. There are five different version of the Extrude tool as we can see from below.



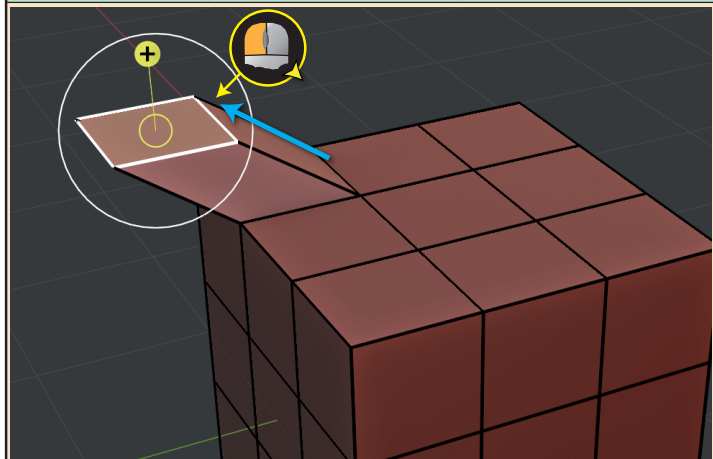
With the default **Extrude Region** activated, the selected area of our mesh will display a yellow-headed “pin” and a white circle.



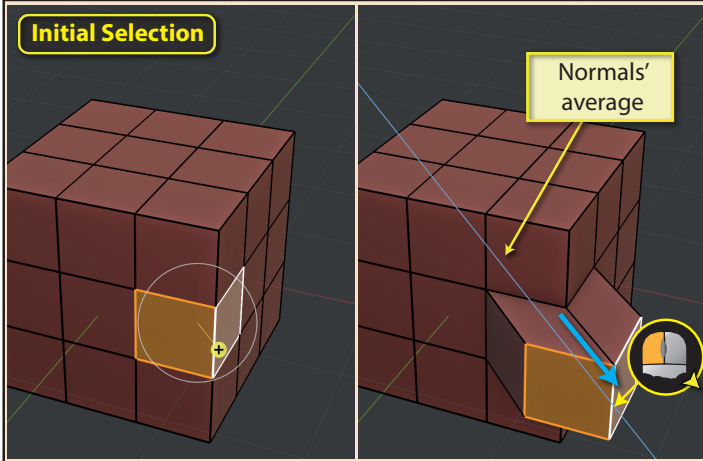
Dragging on the “pin” will execute the extrusion, dragging the selected face away from its original position along the face’s normal with Blender adding the necessary new faces.



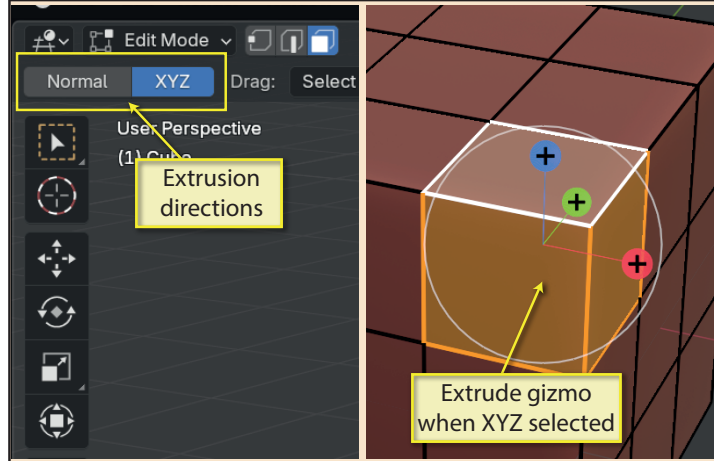
If we drag elsewhere within the white circle, then the extruded face can be moved in any direction.



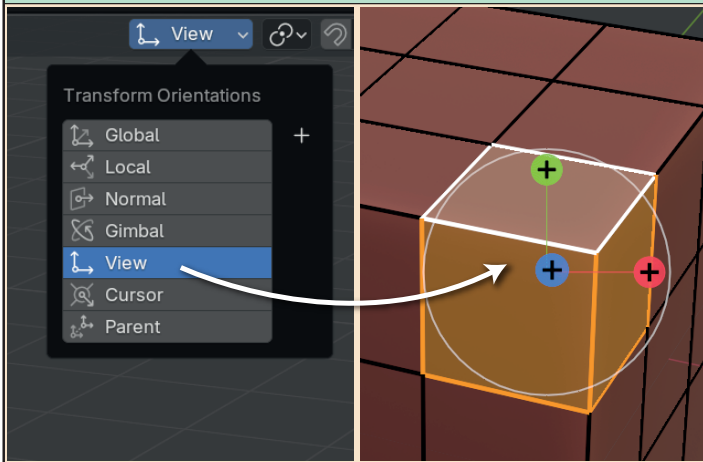
If more than one face is selected, the direction in which they move when dragging on the yellow pin is the average of their normals.



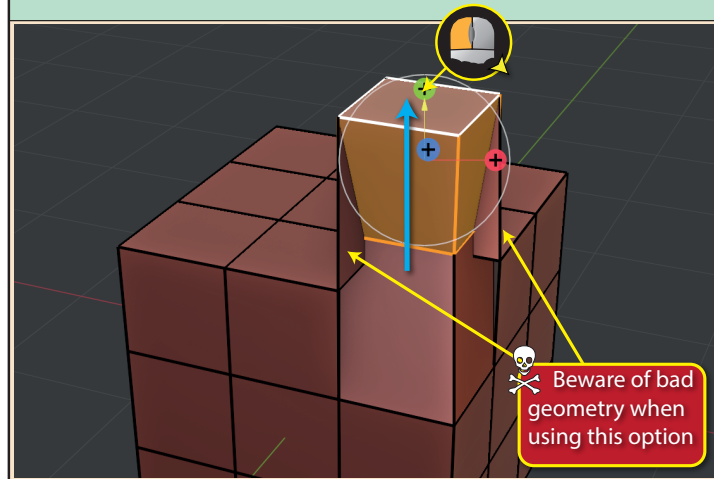
At the top-left of the **3D Viewport** is a control that allows us to select the path of future extrusions. By default it is set to **Normal**, but if we select **XYZ** then the extrude gizmo changes to show the new directions available.



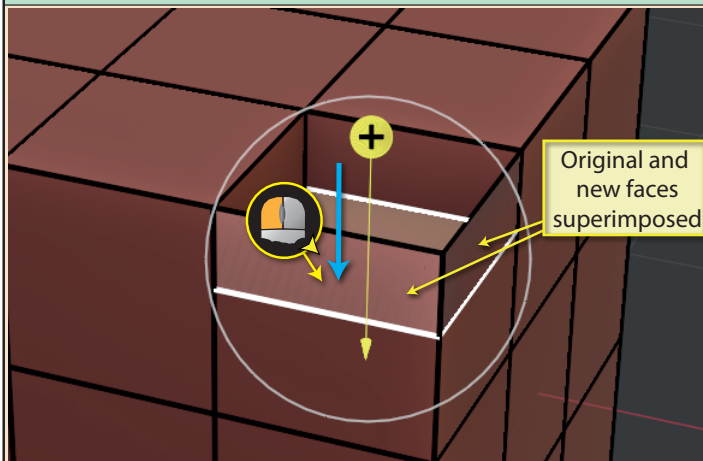
The X, Y and Z directions shown in the gizmo are controlled by the **Transform Orientation** setting.



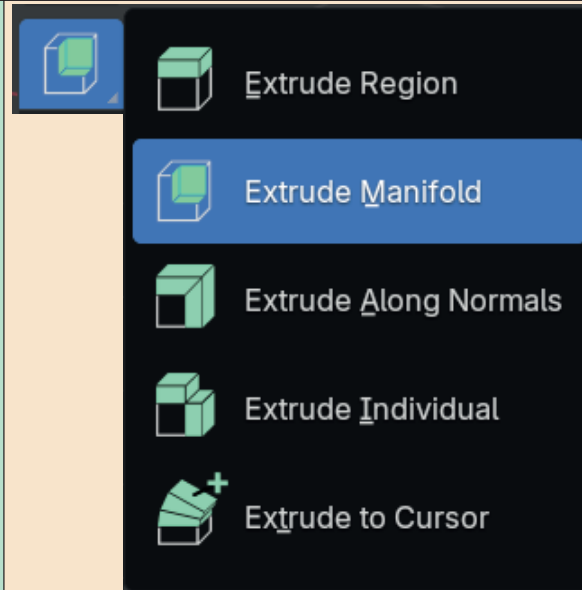
Dragging on a labelled circle will extrude the selection in that direction while dragging elsewhere within the white circle enables free movement as before.



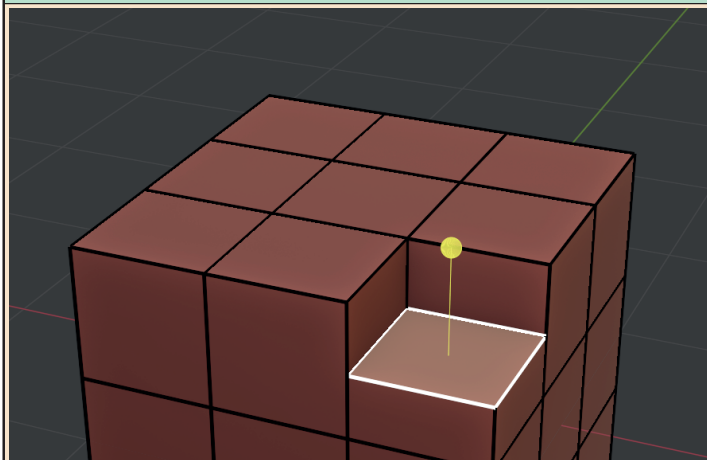
A limitation to **Extrude Region** appears when we extrude inwards. This leaves the original surrounding faces intact while also creating new ones.



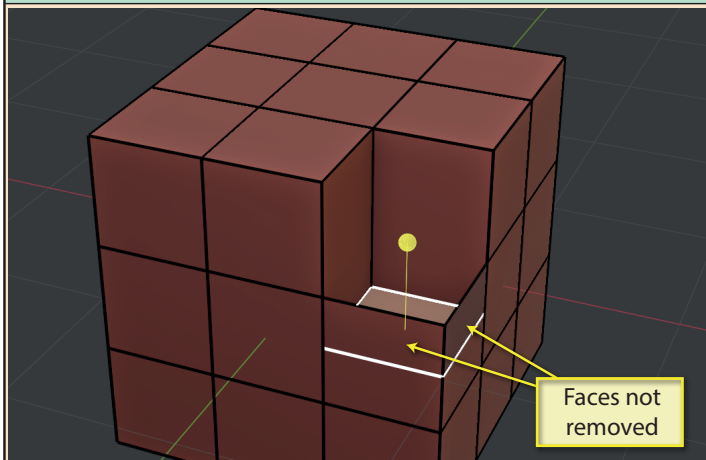
To solve this problem, we'll move on to the next Extrude option - **Extrude Manifold**.



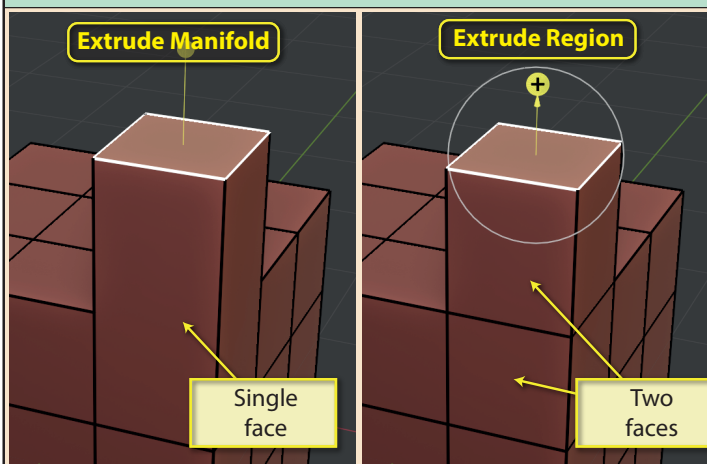
Using this option, extruding inward is handled correctly. Notice that the gizmo no longer has a white circle.



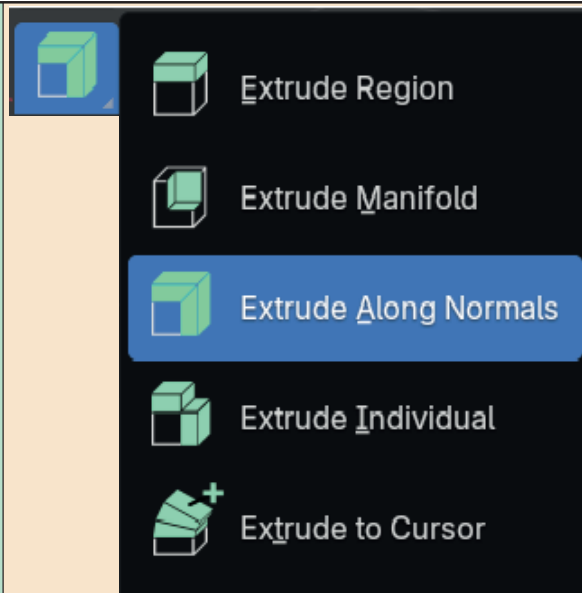
However, this option isn't perfect, as we can see if we extrude further down.



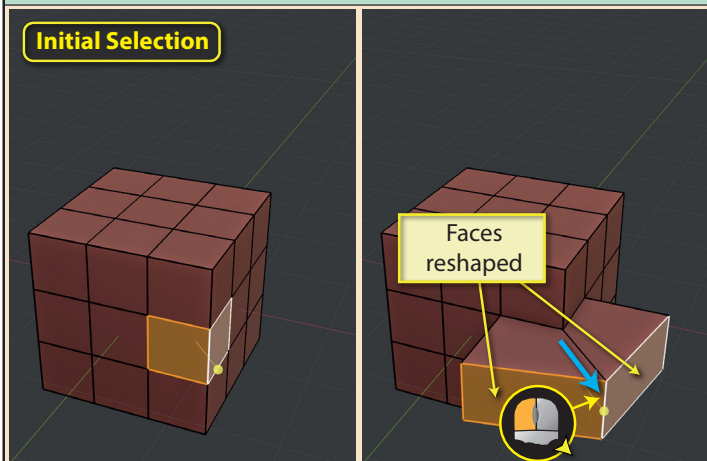
When we use *Extrude Manifold* to extrude upwards, Blender extends the existing faces rather than creating new ones.



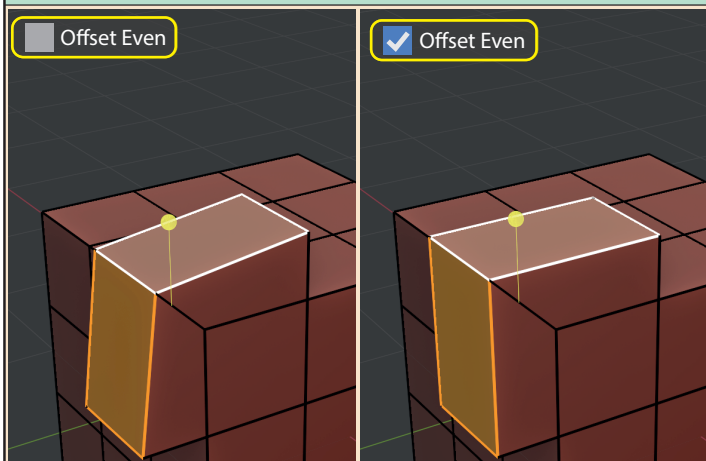
Extrude Along Normals allows each selected face to extrude along its own normal.



Although each face extrudes along its own normal, faces that were originally attached to each other remain attached and this can distort their shape.



In the top-left of the *3D Viewport* is a checkbox labelled **Offset Even**. If this is selected any future extrusion keeps the moved faces parallel to their original position.



Extrude Individual is another option when extruding multiple faces.

	Extrude Region
	Extrude Manifold
	Extrude Along Normals
	Extrude Individual
	Extrude to Cursor

With this option, the faces extrude along their own normals but this time they retain their original shape. This means that adjoining faces may no longer be joined after extrusion.

Extrude to Cursor is the final option. This is best used when only one face is selected. It extrudes the selection to the position of the mouse pointer.

	Extrude Region
	Extrude Manifold
	Extrude Along Normals
	Extrude Individual
	Extrude to Cursor

After selecting the face to be extruded, the mouse pointer is moved to the end point of the extrusion. Left-clicking initiates the extrusion. Note that the original surrounding faces may be distorted.

Before Extrusion

After Extrusion

Faces distorted

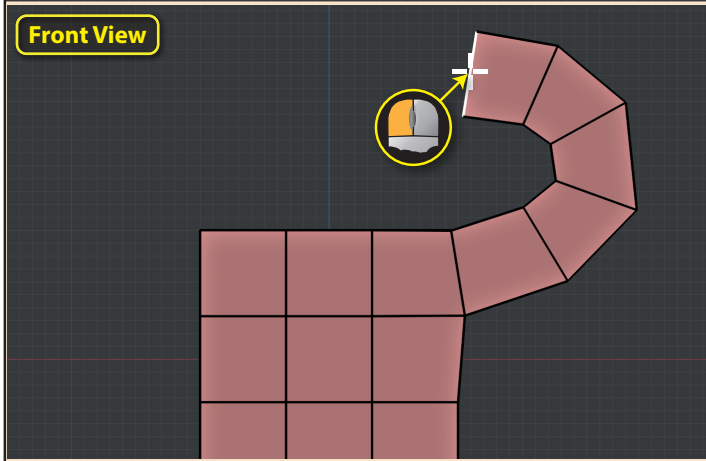
If, rather than clicking, we drag the mouse pointer, the new extrusion will follow along.

In the top-left corner of the **3D Viewport** there is a checkbox labelled **Rotate Source**. This causes the initial selection to rotate if necessary to allow the extrusion to follow the path of the normal. Below we can see the result if this box is unchecked.

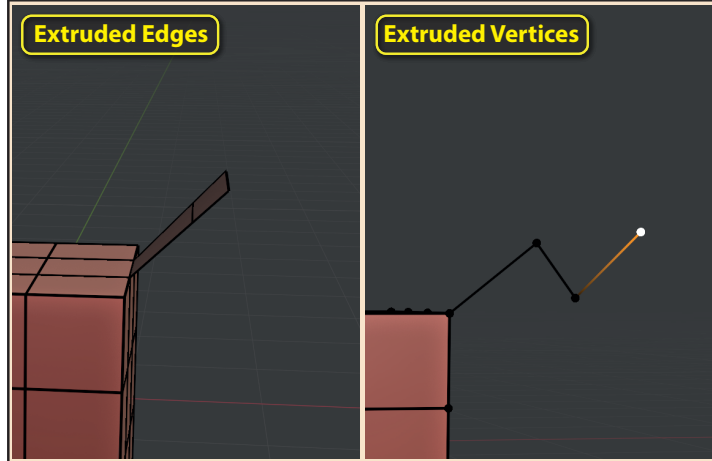
Rotate Source

Rotate Source, when active, only adjusts the orientation once. If the extrusion is dragged to a new location, the orientation does not change.

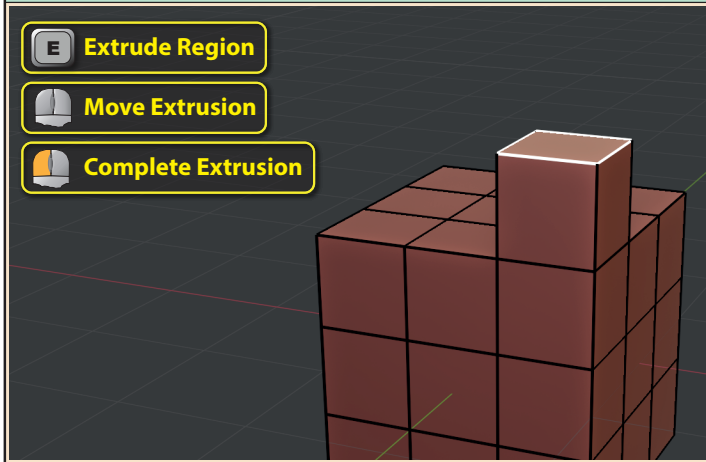
When using this option, it is usually best to work from a named viewpoint such as Front, since this usually results in less distortion of the new elements.



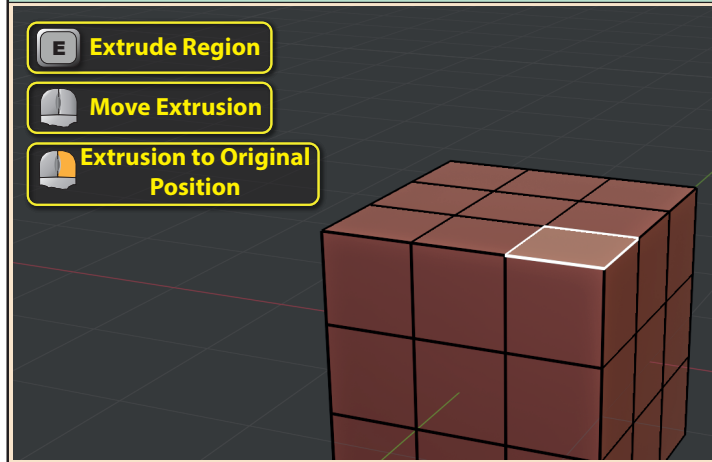
All of the extrude options allow us to extrude not only faces, but also edges and vertices.



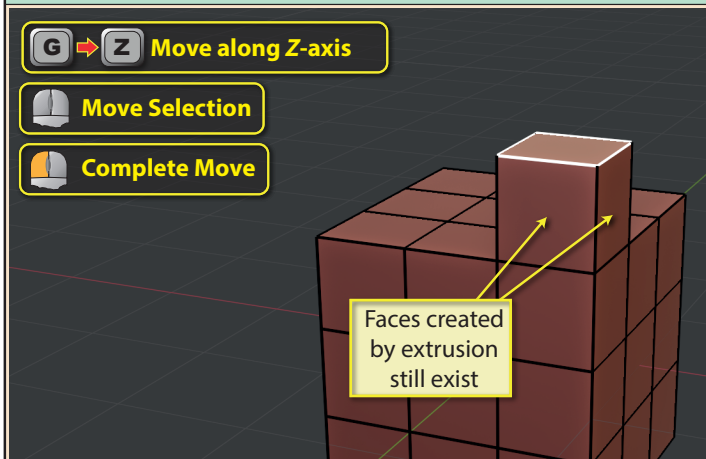
The **Extrude Region** operation can be accessed using the keyboard shortcut, **E**. Using this option, there's no gizmo. Moving the mouse pointer moves the extrusion, left-clicking completes the extrusion.



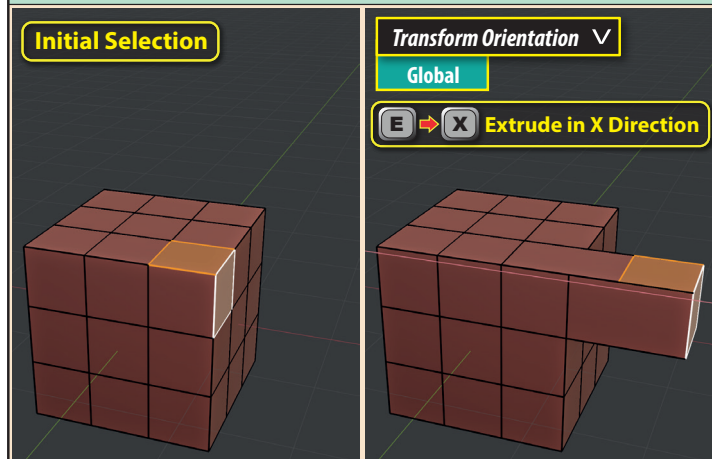
If we right-click, the face jumps back to its original position, but the extrusion has still taken place.



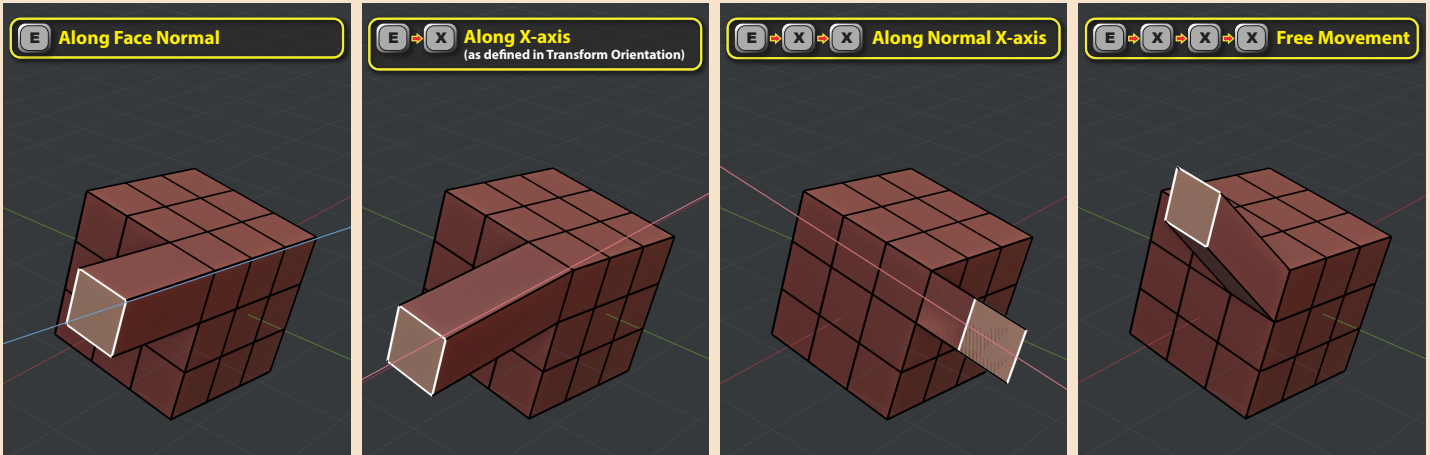
Moving the face will show that the additional new faces caused by the extrusion still exist.



When using the **E** shortcut, we can follow this up with a direction letter, **X**, **Y**, or **Z**. The axis that this causes the extrude to follow depends on the setting in the **Transform Orientation** setting in the top-middle of the **3D Viewport**.

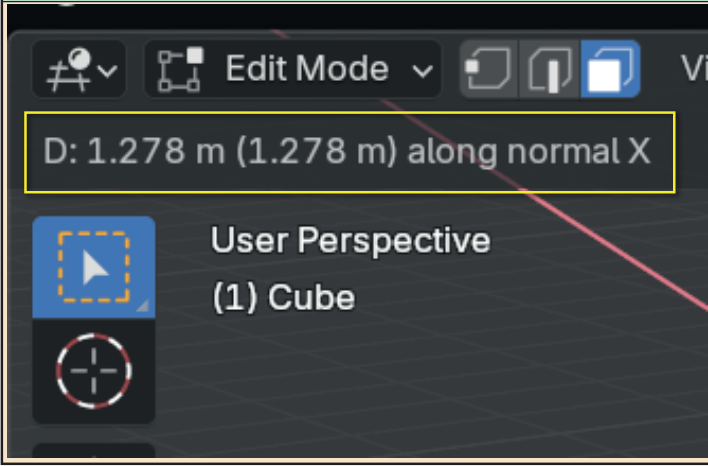


Two presses of the direction key will change the extrusion direction to use the Normal axes set irrespective of the *Transform Orientation* setting. A third press of the direction letter, allows free movement.



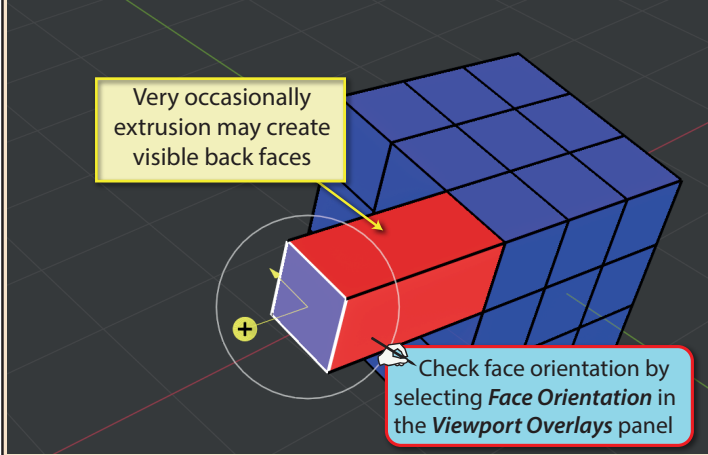
There is an exception to this rule. When we chose the z-axis, the effect of the key presses are summarised below.

The extrusion length and the axis being used is displayed in the top-left of the *3D Viewport*.



The Extrude options also create a *Last Op* panel which differs slightly for each extrude option. Below we can see the *Last Op* panel for **Extrude Region**.

Flip Normals reverse which side of a face is the front face and which the back face. This is sometimes necessary since the extrusion operation can, on occasion, create visible back faces that we need to reverse.

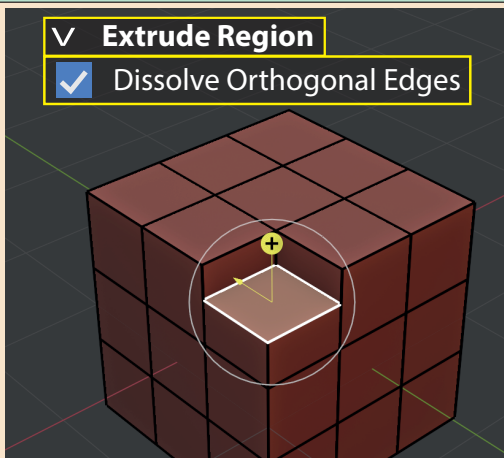
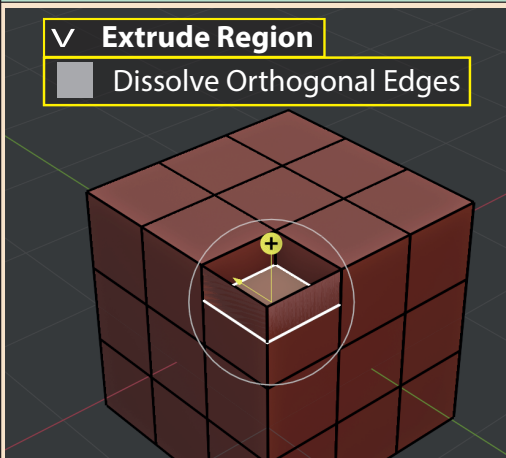


Dissolve Orthogonal Edges removes edges (and hence faces) that are not required when we extrude inward (in other words, it performs the same function as *Extrude Manifold*).

Move X, Y and Z define the movement of the extruded elements in each direction.

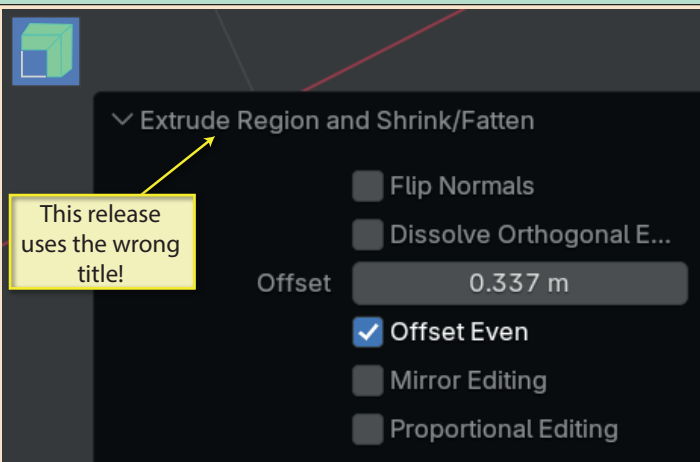
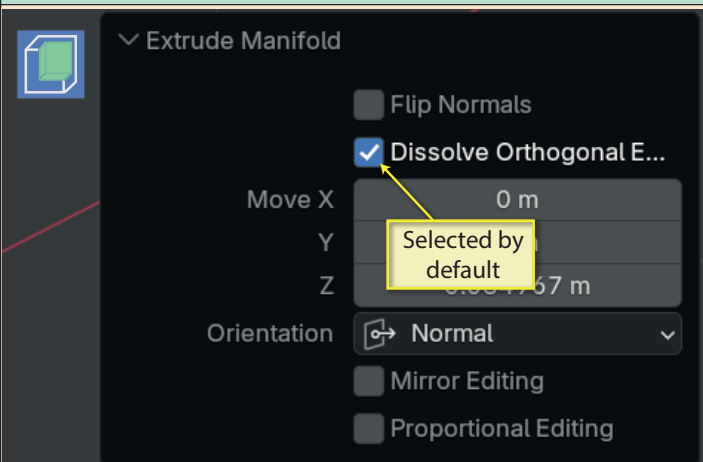
Orientation determines which set of axes those movements refer to.

Mirror Editing and **Proportional Editing** may be ignored for now.



When we select **Extrude Manifold** in the Toolbar, the *Last Op* panel created has identical fields to that for *Extrude Region*. The only difference being that the checkbox, **Dissolve Orthogonal Edges** is selected by default.

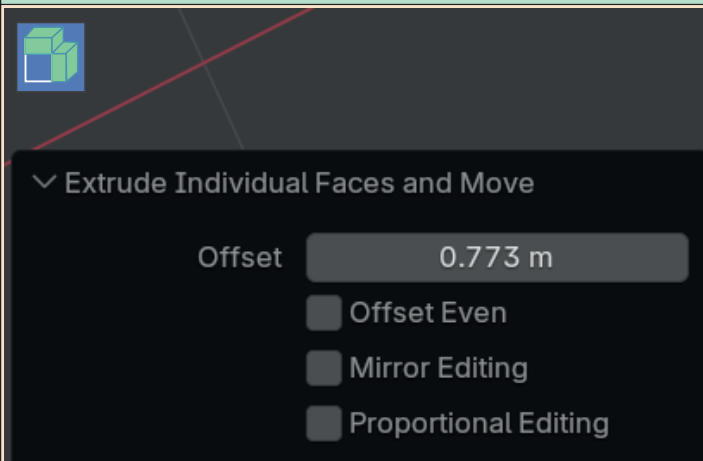
Extrude along Normals has a *Last Op* panel that omits *Move* and *Orientation* adding **Offset** and **Offset Even**. **Offset** specifies the distance moved and **Offset Even**, when checked, ensures the extruded faces remain parallel to their original position.



Extrude Individual has a reduced *Last Op* panel, but with no new fields.

Pressing **Alt E** produces a popup menu displaying most (but not **Extrude to Cursor**) of the extrude options available in the Toolbar as well as two new options: **Extrude Repeat** and **Spin**.

And **Extrude to Cursor** has no *Last Op* panel.

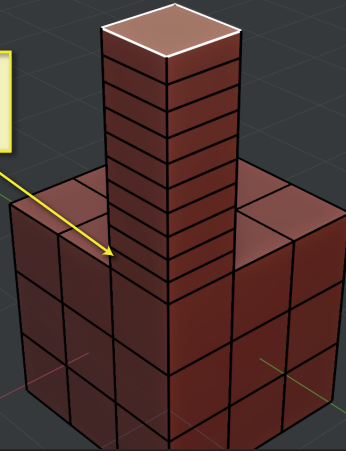


Selecting **Extrude Repeat** automatically performs an identical extrusion a specified number of times.

Alt E

Extrude Repeat

This extrusion has been performed 10 times



The nature of the extrusion is determined by the values specified in the *Last Op* panel.

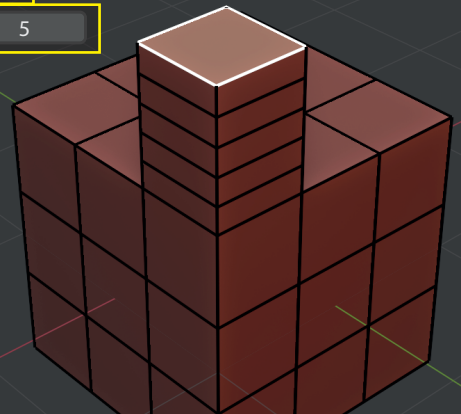
▼ Extrude Repeat

Steps	10
Offset X	0 m
Y	0 m
Z	0.1 m
Scale Offset	1.930

Steps determines how often the extrusion is repeated.

▼ Extrude Repeat

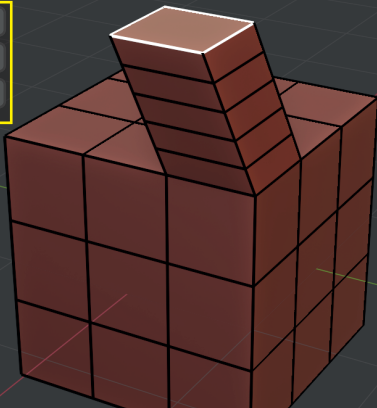
Steps 5



Offset X, Y and Z control the first extrude's direction and distance.

▼ Extrude Repeat

Offset X -0.05
Y 0.05
Z 0.2



Scale Offset is a multiplying factor that is applied to the **Offset X, Y and Z** values. Its default value is 1.0.

▼ Extrude Repeat

Offset X -0.05
Y 0.05
Z 0.2
Scale Offset 2.0

