5.2.6.9 Modeling - Meshes - Editing - Duplicating

Duplicating

- Mesh Duplicating Tools
- Duplicate
- Extrude
    - Extrude Region
    - Extrude Individual
    - Extrude Edges and Vertices Only
- Inset
    - Options
- Mirror
    - Description
- Spin
    - Example

- Screw Tool
  - Introduction
  - Description
  - Usage
  - Limitations
  - Options
  - Examples

Mesh Duplicating Tools

This section covers mesh editing tools that add additional geometry by duplicating existing geometry in some way.

- *Duplicate Geometry.*
- *Extrusion*.
- *Spin*.
- *Screw.*

Note

Multiple Viewports

When you use one of the duplication tools in the *Mesh Tools* panel, Blender cannot guess which view you want to work in - if you have more than one opened, of course... As the view is often important for these tools, once you have activated one, your cursor turns into a sort of question mark - click with it inside the window you want to use.

Duplicate

Reference

Mode: *Edit* mode
Menu: Mesh ‣ Duplicate
Hotkey: `Shift-D`

This tool simply duplicates the selected elements, without creating any links with the rest of the mesh (unlike extrude, for example), and places the duplicate at the location of the original. Once the duplication is done, *only the new duplicated elements are selected*, and you are automatically placed in grab/move mode, so you can translate your copy elsewhere...

In the *Tool Shelf* are settings for *Vector* offset, *Proportional Editing*, *Duplication Mode* (non-functional?), and *Axis Constraints*.

Note that duplicated elements belong to the same *vertex groups* as the “original” ones. The same goes for the

material indices, the edge's *Sharp* and *Seam* flags, and probably for the other vertex/edge/face properties...

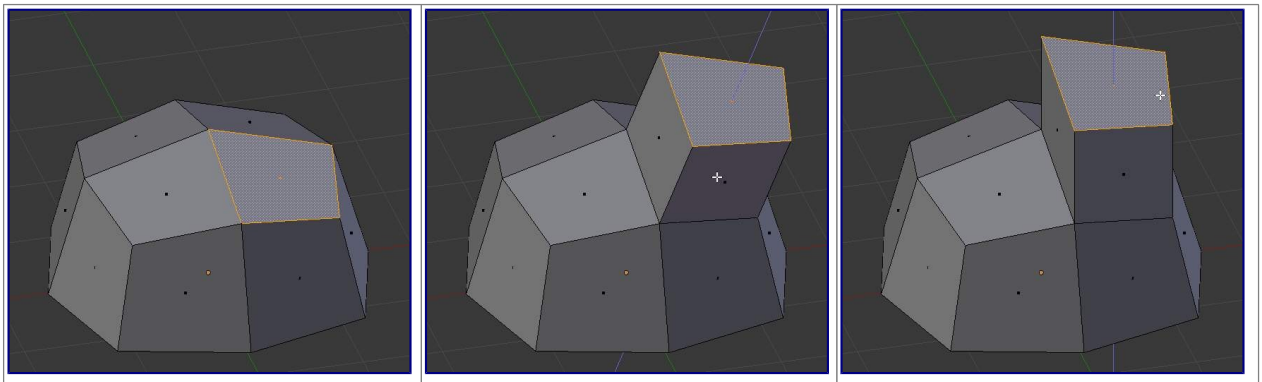
Extrude

Extrude Region

Reference
Mode: *Edit* mode Panel: Mesh Tools ‣ Extrude Menu: Mesh ‣ Extrude Region Hotkey: `E` or `Alt-E`

One tool of paramount importance for working with meshes is the *Extrude* tool. It allows you to create parallelepipeds from rectangles and cylinders from circles, as well as easily create such things as tree limbs. *Extrude* is one of the most frequently used modeling tools in Blender. It's simple, straightforward, and easy to use, yet very powerful.

The selection is extruded along the common normal of selected faces. In every other case the extrusion can be limited to a single axis by specifying an axis (e.g. `X` to limit to the X axis or `Shift-X` to the YZ plane. When extruding along the face normal, limiting movement to the global Z axis requires pressing `Z` twice, once to disable the face normal Z axis limit, and once to enable the global Z axis limit.



Selected face | During extrude | Set to Z axis

Although the process is quite intuitive, the principles behind *Extrude* are fairly elaborate as discussed below:

- First, the algorithm determines the outside edge-loop of the extrude; that is, which among the selected edges will be changed into faces. By default (see below), the algorithm considers edges belonging to two or more selected faces as internal, and hence not part of the loop.
- The edges in the edge-loop are then changed into faces.
- If the edges in the edge-loop belong to only one face in the complete mesh, then all of the selected faces are duplicated and linked to the newly created faces. For example, rectangles will result in parallelepipeds during this stage.
- In other cases, the selected faces are linked to the newly created faces but not duplicated. This prevents

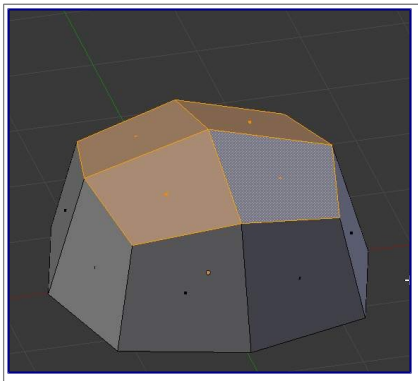
undesired faces from being retained “inside” the resulting mesh. This distinction is extremely important since it ensures the construction of consistently coherent, closed volumes at all times when using *Extrude*.

- When extruding completely closed volumes (like e.g. a cube with all its six faces), extrusion results merely in a duplication, as the volume is duplicated, without any link to the original one.
- Edges not belonging to selected faces, which form an “open” edge-loop, are duplicated and a new face is created between the new edge and the original one.
- Single selected vertices which do not belong to selected edges are duplicated and a new edge is created between the two.

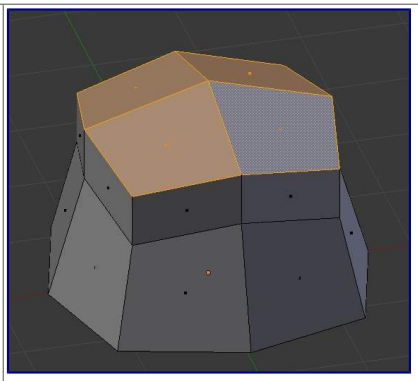
Extrude Individual

Reference
Mode: *Edit* mode Panel: Mesh Tools ‣ Extrude Individual Menu: Mesh ‣ Extrude Individual Hotkey: `Alt-E`

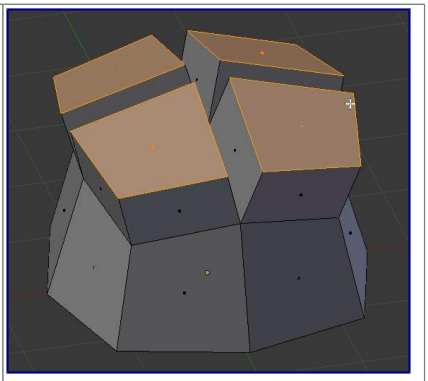
Extrude Individual allows you to extrude a selection of multiple faces as individuals, instead of as a region. The faces are extruded along their own normals, rather than their average. This has several consequences: first, “internal” edges (i.e. edges between two selected faces) are no longer deleted (the original faces are).



Selection of multiple faces



Extruded using extrude region

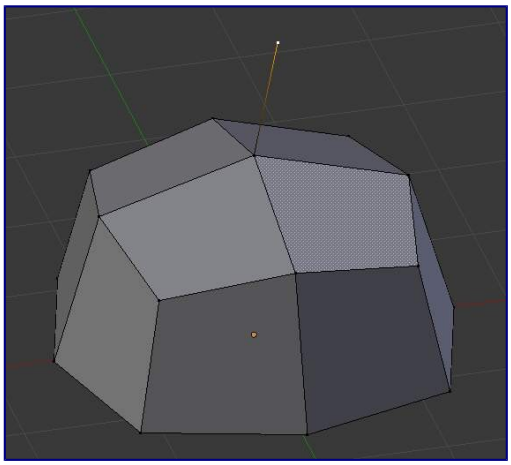


Extruded using Extrude Individual

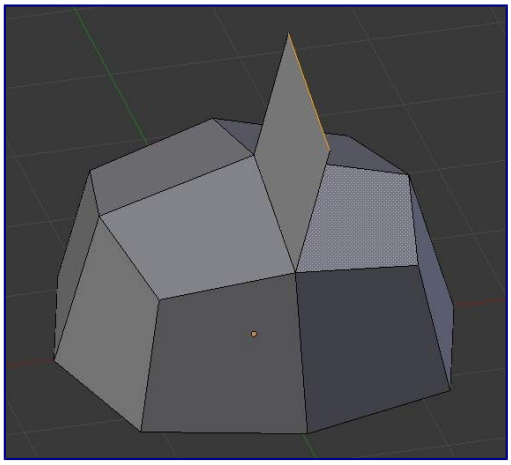
Extrude Edges and Vertices Only

Reference
Mode: *Edit* mode, Vertex and Edge Hotkey: `Alt-E`

If vertices are selected while doing an extrude, but they do not form an edge or face, they will extrude as expected, forming a non-manifold edge. Similarly, if edges are selected that do not form a face, they will extrude to form a face.



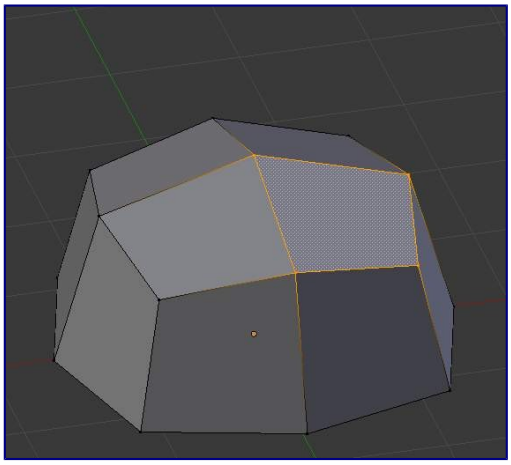
Single vertex extruded



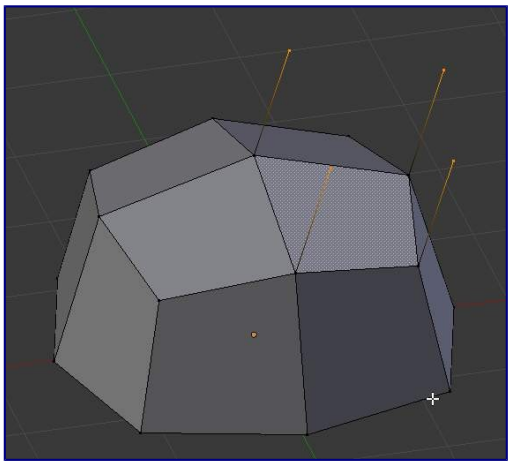
Single edge extruded

When a selection of vertices forms an edge or face, it will extrude as if the edge was selected. Likewise for edges that form a face.

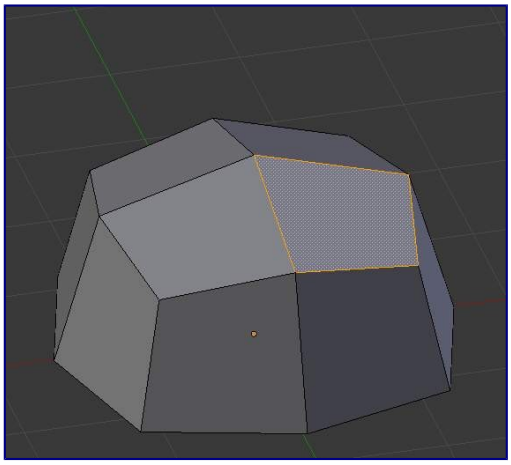
To force a vertex or edge selection to extrude as a vertex or edge, respectively, use `Alt-E` to access the Extrude *Edges Only* and *Vertices Only*.



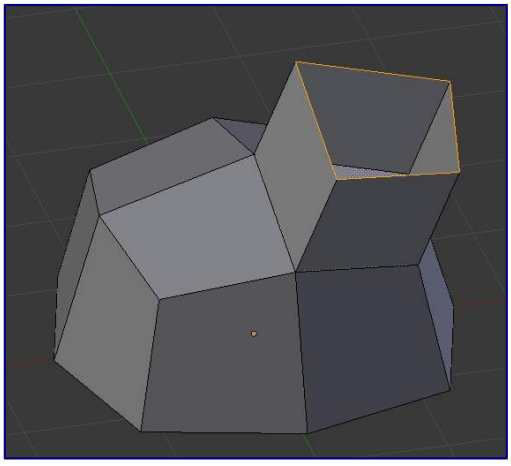
Vertex selected



Vertices Only extrude



Edge selected



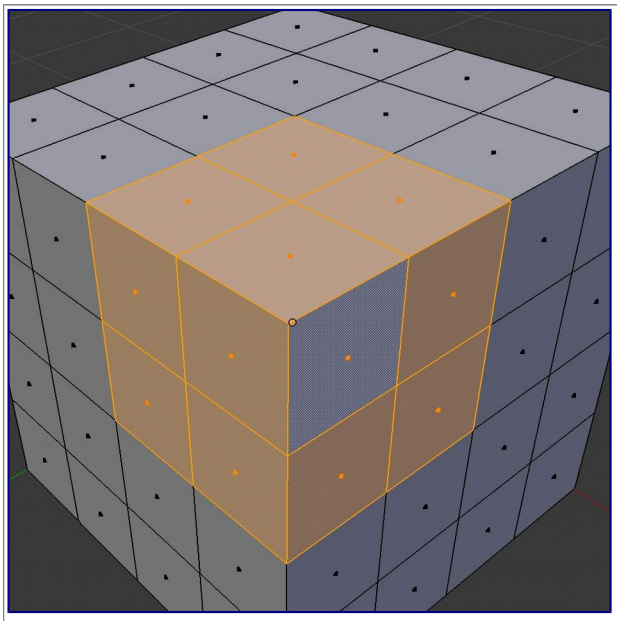
Edge Only extrude

Inset

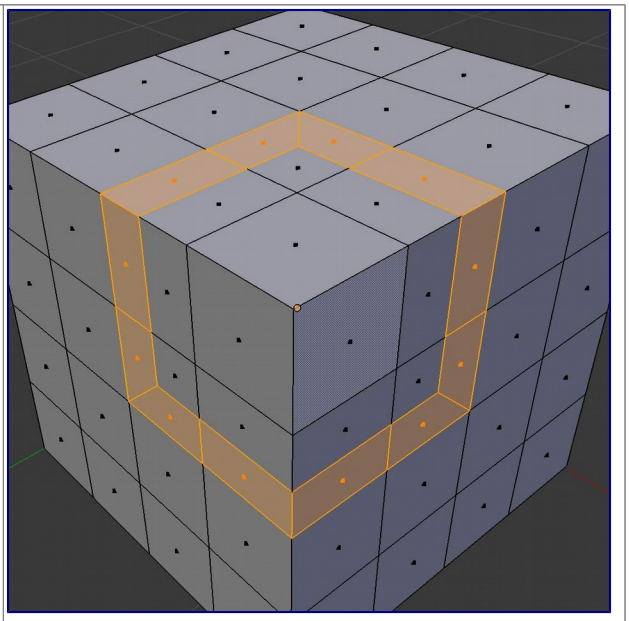
Reference
Mode: *Edit* mode Menu: Mesh ‣ Faces ‣ Inset or [ctrl][F] ‣ Inset

Hotkey: `I`

This tool takes the currently selected faces and creates an inset of them, with adjustable thickness and depth. The tool is modal, such that when you activate it, you may adjust the thickness with your mouse position. You may also adjust the depth of the inset during the modal operation by holding `Ctrl`.

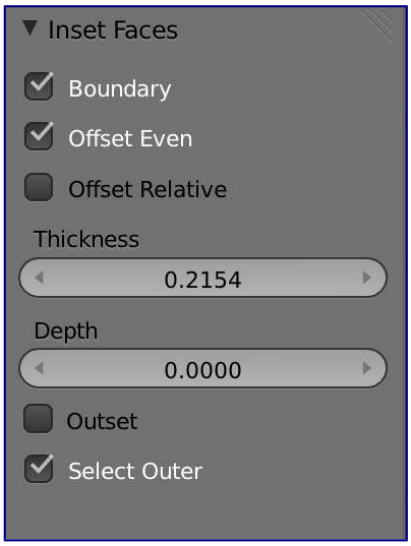


Selection to inset



Selection with inset

Options



Inset Operator Settings

Boundary
: Determines whether open edges will be inset or not.

Offset Even
: Scale the offset to give more even thickness.

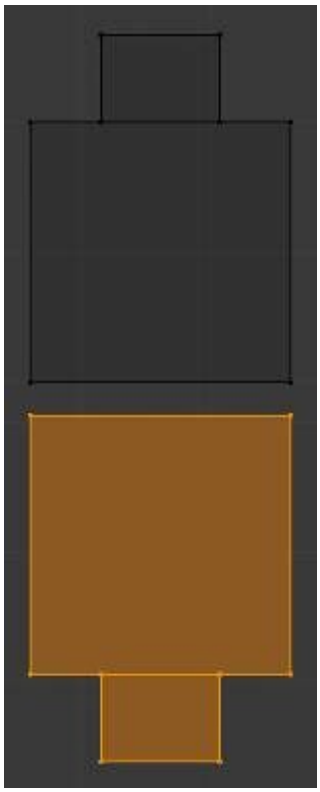
Offset Relative
: Scale the offset by surrounding geometry.

Thickness
Set the size of the inset.
Depth
Raise or lower the newly inset faces to add depth.
Outset
Create an outset rather than an inset.
Select Outer
Toggle which side of the inset is selected after operation.

Mirror

Reference
Mode: *Object* and *Edit* modes
Menu: Object/Mesh ‣ Mirror
Hotkey: `Ctrl-M`

Description



Mirroring a selection.

Mirroring an Object or Mesh selection will create a reversed version of the selection. The position of the mirrored version of the selection is determined by the *Pivot Point.* A common use of mirroring is to model half an object, duplicate it and then use the mirror transform to create a reversed version to complete the model. Note that mirrored duplicates can also be created with a *Mirror modifier.*

Read more about the Pivot Point

Read more about the Mirror Modifier

Usage

To mirror a selection along a particular global axis press:

`Ctrl-M`, followed by `X`, `Y` or `Z`.

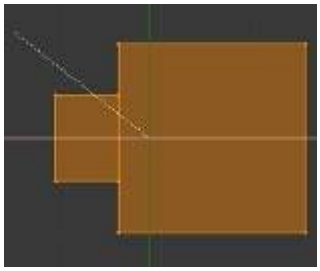
The image *Mirroring a selection* shows the results of this action after a mesh element has been duplicated.

In Mesh mode, you can mirror the selection on the currently selected Transform Orientation by pressing the appropriate axis key a second time. For example, if the Transform Orientation is set to *Normal*, pressing:

`Ctrl-M`, followed by `X` and then `X` again

will mirror the selection along the X-axis of the *Normal Orientation.*

Read more about Transform Orientations



Interactive mirror.

You can alternatively hold the `MMB` to interactively mirror the object by moving the mouse in the direction of the mirror axis.

Spin

Reference
Mode: *Edit* mode Panel: *Mesh Tools* (*Editing* context)

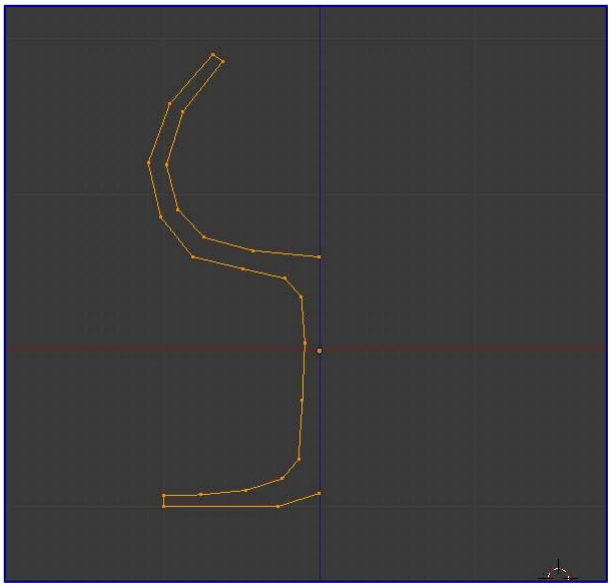
Use the *Spin* tool to create the sort of objects that you would produce on a lathe (this tool is often called a “lathe”-tool or a “sweep”-tool in the literature, for this reason). In fact, it does a sort of circular extrusion of your selected elements, centered on the 3D cursor, and around the axis perpendicular to the working view...

- The point of view will determine around which axis the extrusion spins...
- The position of the 3D cursor will be the center of the rotation.

Here are its settings:

Steps
Specifies how many copies will be extruded along the “sweep”.
Dupli
When enabled, will keep the original selected elements as separated islands in the mesh (i.e. unlinked to the result of the spin extrusion).
Angle
specifies the angle “swept” by this tool, in degrees (e.g. set it to `180` for half a turn).
Center
Specifies the center of the spin. By default it uses the cursor position.
Axis
Specify the spin axis as a vector. By default it uses the view axis.

Example

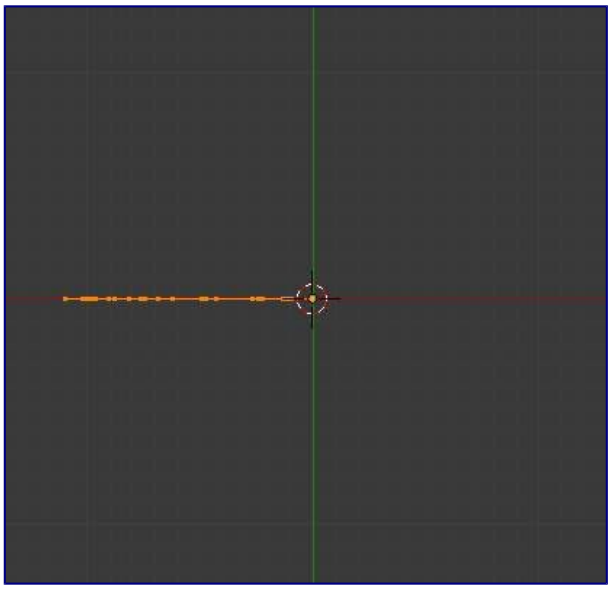


Glass profile.

First, create a mesh representing the profile of your object. If you are modeling a hollow object, it is a good idea to thicken the outline. (*Glass profile*) shows the profile for a wine glass we will model as a demonstration.

Go to the *Edit* mode and select all the vertices of the Profile with A.

We will be rotating the object around the cursor in the top view, so switch to the top view with `Numpad7`.

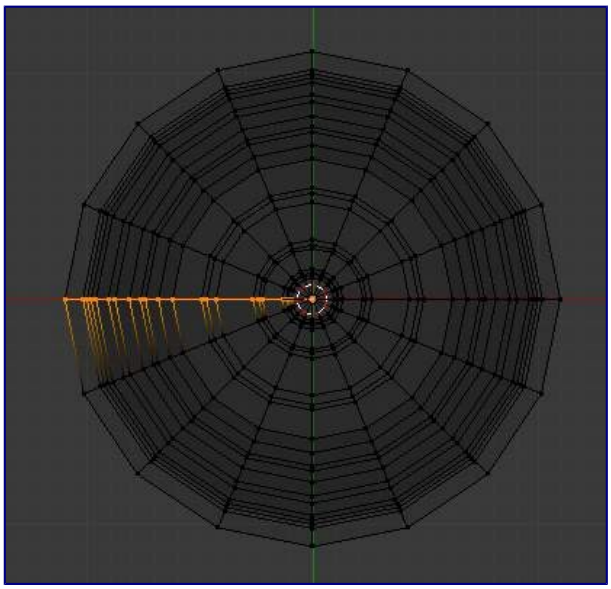


Glass profile, top view in Edit mode, just before spinning.

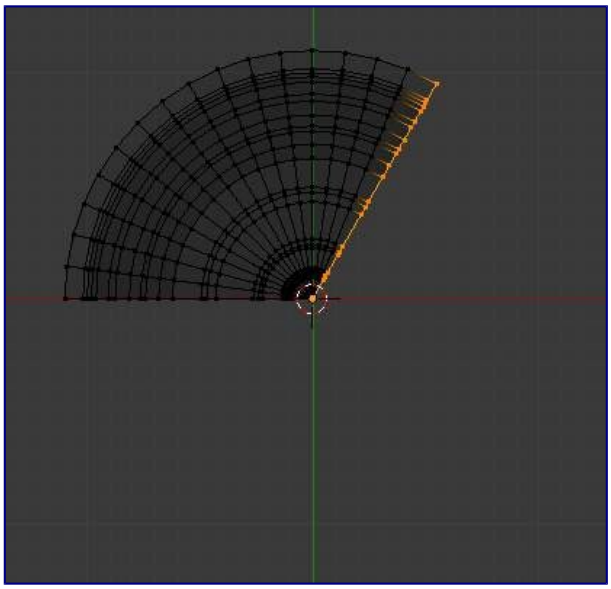
Place the cursor along the center of the profile by selecting one of the vertices along the center, and snapping the 3D cursor to that location with Mesh ‣ Cursor ‣ Selection. (*Glass profile, top view in Edit mode, just before spinning*) shows the wine glass profile from top view, with the cursor correctly positioned.

Click the *Spin* button. If you have more than one 3D view open, the cursor will change to an arrow with a question mark and you will have to click in the window containing the top view before continuing. If you have only one 3D view open, the spin will happen immediately. (*Spun profile*) shows the result of a successful spin.

Angle

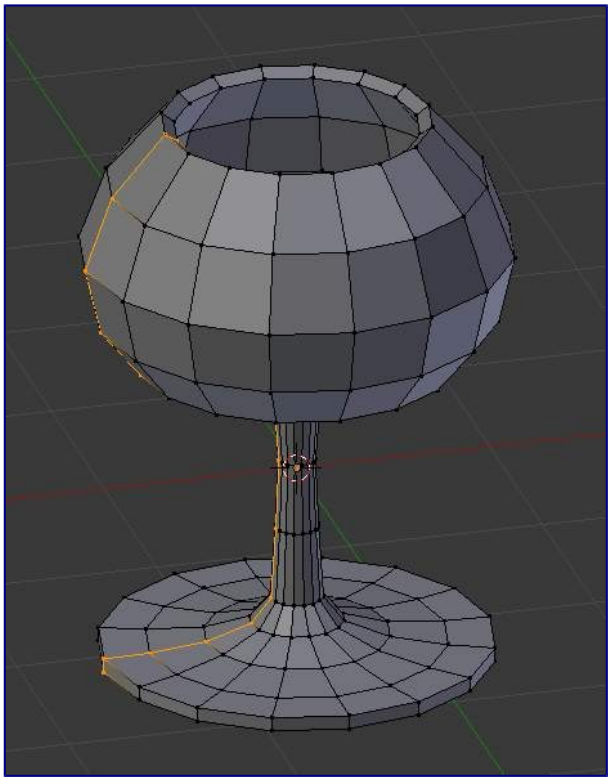


Spun profile using an angle of 360

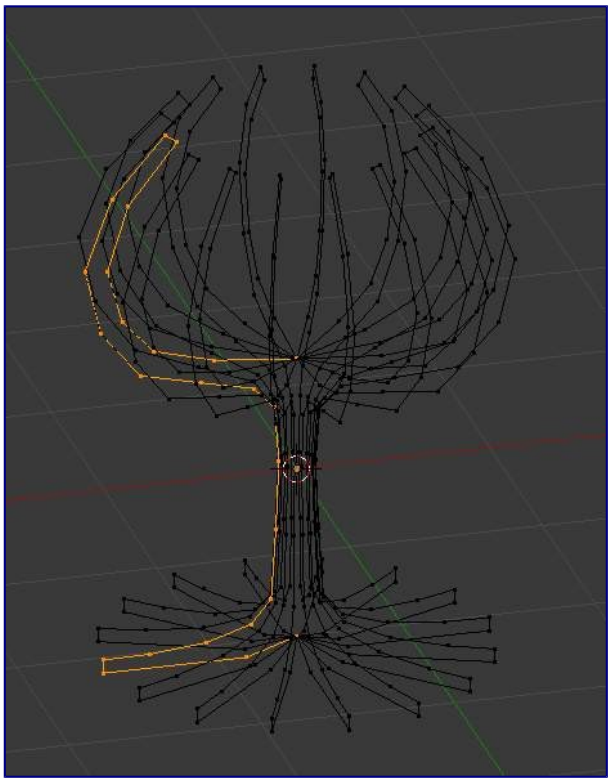


Spun profile using an angle of 120

Dupli

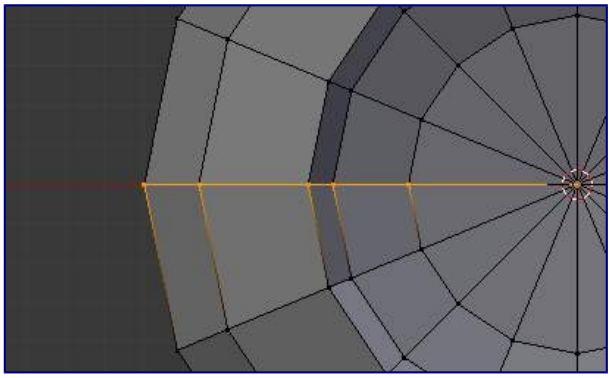


Result of spin operation



Result of Dupli enabled

Merge Duplicates



Duplicate vertices

The spin operation leaves duplicate vertices along the profile. You can select all vertices at the seam with Box select (`B`) shown in (*Seam vertex selection*) and perform a *Remove Doubles* operation.

Notice the selected vertex count before and after the *Remove Doubles* operation (*Vertex count after removing doubles*). If all goes well, the final vertex count (38 in this example) should match the number of the original profile noted in (*Mesh data - Vertex and face numbers*). If not, some vertices were missed and you will need to weld them manually. Or, worse, too many vertices will have been merged.

Note

Merging two vertices in one

To merge (weld) two vertices together, select both of them by `Shift-RMB` clicking on them. Press `S` to start scaling and hold down `Ctrl` while scaling to scale the points down to 0 units in the X, Y and Z axis. `LMB` to

complete the scaling operation and click the *Remove Doubles* button in the *Buttons* window, *Editing* context (also available with [W] ‣ Remove Doubles).

Alternatively, you can use [W] ‣ Merge from the same *Specials* menu (or `Alt-M`). Then, in the new pop-up menu, choose whether the merged vertex will be at the center of the selected vertices or at the 3D cursor. The first choice is better in our case!

Recalculate Normals

All that remains now is to recalculate the normals to the outside by selecting all vertices, pressing `Ctrl-N` and validating *Recalc Normals Outside* in the pop-up menu.

Screw Tool

Reference
Mode: *Edit Mode* Panel: *Edit Mode* –> *Mesh Tools* (shortcut `T`) –> Add –> Screw Button

Introduction

The *Screw* Tool is an effective way to revolve a profile, giving similar results to what you would expect from a lathe, with the option to offset the operation to give a screw effect.

You can see some examples of Meshes generated with the *Screw* tool in Fig. 1 - Wood Screw tip done with the screw tool and Fig. 2 - Spring done with the screw tool.

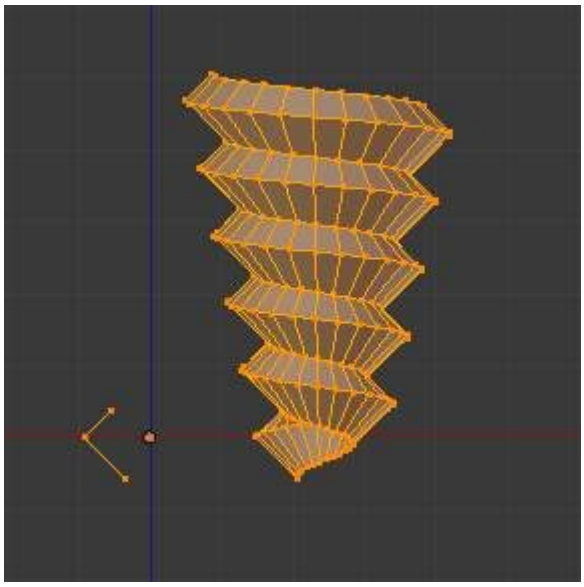


Fig. 1 - Wood Screw tip done with the screw tool

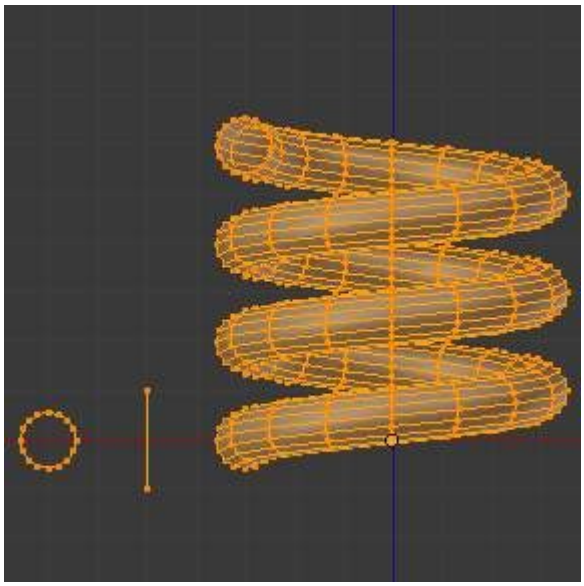


Fig. 2- Spring done with the screw tool

Description

The *Screw* tool combines a repetitive *Spin* with a translation, to generate a screw-like, or spiral-shaped, object. Use this tool to create screws, springs, or shell-shaped structures (Sea shells, Wood Screw Tips, Special profiles, etc).

The main difference between the Screw Tool and the *Screw Modifier* is that the Screw Tool can calculate the angular progressions using the basic profile angle automatically. Or it can adjusting the Axis angular vector without using a second modifier (for example, using the Screw Modifier with a Bevel Modifier, Curve Modifier, etc...), resulting in a much cleaner approach for vertex distribution and usage.

This tool works using open or closed profiles, as well as profiles closed with faces. You can use profiles like an open-edge part that is a part of a complete piece, as well as a closed circle or a half-cut sphere, which will also close the profile end.

Usage

- This tool works only with Meshes.
- In *Edit Mode*, the button for the *Screw* tool operation is located in the *Mesh Tools* Panel, (shortcut T) –> Add –> Screw Button.
- To use this tool, you need to create at least one open profile or line to be used as a vector for the height, angular vector and to give Blender a direction.
- The *Screw* function uses two points given by the open line to create an initial vector to calculate the height and basic angle of the translation vector that is added to the “Spin” for each full rotation (see examples below). If the vector is created with only two vertices at the same **X**, **Y** and **Z** location (which won’t give Blender a vector value for height), this will create a normal “Spin”.
- Having at least one vector line, you can add other closed support profiles that will follow this vector during the extrusions (See limitations).
- The direction of the extrusions is calculated by two determinant factors, your point of view in Global Space and the position of your cursor in the 3DView Space using Global coordinates.

- The profile and the vector must be fully selected in *Edit Mode* before you click the *Screw Button* (See Limitations.)
- When you have the vector for the open profile and the other closed profiles selected, click the *Screw* Button.

Limitations

There are strict conditions about your profile selection when you want to use this tool. You must have at least one open line or open profile, giving Blender the starting Vector for extrusion, angular vector and height. (e.g. a simple edge, a half circle, etc...). You need only to ensure that at least one reference line has two “free” ends. If two open Lines are given, Blender won’t determine which of them is the vector, and will then show you an error message, *“You have to select a string of connected vertices too”*. You need to select all of the profile vertices that will participate in the *Screw* Tool operation; if they are not properly selected, Blender will also show you the same message.

Note that the open line is always extruded, so if you only use it to “guide” the screw, you will have to delete it after the tool completion (use linked-selection, `Ctrl-L`, to select the whole extrusion of the open line).

If there is any problem with the selection or profiles, the tool will warn you with the error message: *“You have to select a string of connected vertices too”* as seen in Fig. 3 and 4, both in the info Window and at the place where you clicked to start performing the operation (when you click the Screw Button).

Fig. 3 - Screw Error message in the Header of the Info Window

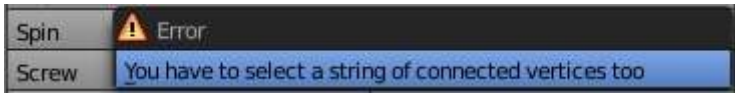


Fig. 4 - Error message when clicking in the Screw Tool with an incorrect or bad selection

You may have as many profiles as you like (like circles, squares, and so on) - Note that not all vertices in a profile need to be in the same plane, even if this is the most common case. You may also have other, more complex, selected closed islands, but they have to be closed profiles because Blender will seek for only one open profile for the translation, height and angular vector. Some closed meshes that overlap themselves may not screw correctly (for example: Half UVsphere = OK, more than half = could cause the Screw Tool to have wrong behavior or errors), and profiles that are closed with faces (like a cone or half sphere) will be closed automatically at their ends, like if you were extruding a region.

Tip

Simple way to not result in error

Only one open Profile, all of the others can be closed, avoid volumes and some profiles closed with faces...

Options

This tool is an interactive and modal tool, and only works in the *Edit Mode*.

Once you click in the *Screw* tool in the Mesh Tools Panel, Blender will enter in the *Screw* interactive mode, and

the Operator Panel at the end of the Mesh Tools Panel will be replaced so you can adjust the values explained below. To show the Mesh Tools Panel, use the shortcut T in the Edit Mode of the 3D View Window.

Once you perform any other operation, Blender leaves the interactive mode and accepts all of the values. Because it's modal, you can't return to the interactive mode after completing/leaving the operation or changing from *Edit Mode* to *Object Mode*. If you want to restart the operation from its beginning, you can press Ctrl-Z at any time in *Edit Mode*.

- The basic location of the cursor at the point of view (using Global coordinates) will determine around which axis the selection is extruded and spun at first (See Fig. 6 - Cursor Basic Location - Transform Panel). Blender will copy your cursor location coordinates to the values present in the *Center* values of the *Screw* interactive Panel. Depending on the Global View position, Blender will automatically add a value of **1** to one of the Axis Vectors, giving the profiles a starting direction for the Screw Operation and also giving a direction for the extrusions. (See examples below.)
- The position of the 3D cursor will be the starting center of the rotation. Subsequent operations (e.g. pressing the Screw button again), will start from the last selected element. Continuous operations without changing the selection will repeat the operation continuously from the last point.

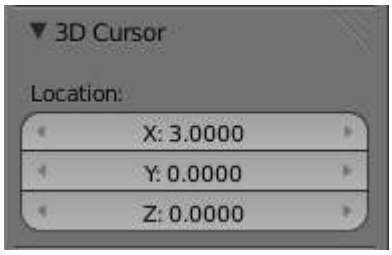


Fig. 6 - Cursor Basic Location - Transform Panel

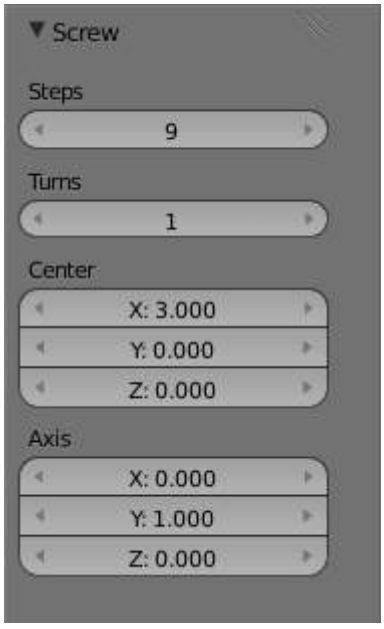


Fig. 7 - Screw Interactive Panel - Mesh Tools Panel (Edit Mode)

Center

These numeric fields specify the center of the spin. When the tool is called for the first time, it will copy the X, Y and Z location (Global Coordinates) of the cursor presently in the 3D View to start the operation. You can specify the cursor coordinates using the Transform Panel in 3D View, using shortcut T to toggle

the Panel, and typing in the 3D Cursor Location coordinates. You can adjust these coordinates interactively and specify another place for the spin center during the interactive session. (See Fig. 7 - Screw Interactive Panel - Mesh Tools Panel (Edit Mode))

Steps
: This numeric field specifies how many extrusion(s) will be done for each `360` turn. The steps are evenly distributed by dividing `360` by the number of steps given. The minimum value is `3`; the maximum is `256` (See Fig. 7)

Turns:
: This numeric field specifies how many turns will be executed. Blender will add a new full `360` turn for each incremental number specified here. The minimum value is `1`; the maximum is `256`. (See Fig. 7)

Axis
: These `3` numeric fields vary from `-1.0` to `1.0` and are clamped above those limits. These values correspond to angular vectors from `-90` to `90` degrees. Depending on the position where you started your cursor location and Object operation in the viewport and its axis positions in Global View space and coordinates, Blender will give the proper Axis vector a value of `1`, giving the angular vector of the profile a starting direction and giving the extrusions a starting direction based on your view. Blender will let you adjust your axis angular vectors and you can tweak your object such that you can revert the direction of the screw operation (by reverting the angular vector of the height), meaning you can revert the clockwise and counterclockwise direction of some operations, and also adjust the angular vectors of your profile, bending it accordingly. (See Fig. 7)

Examples

The Spring example

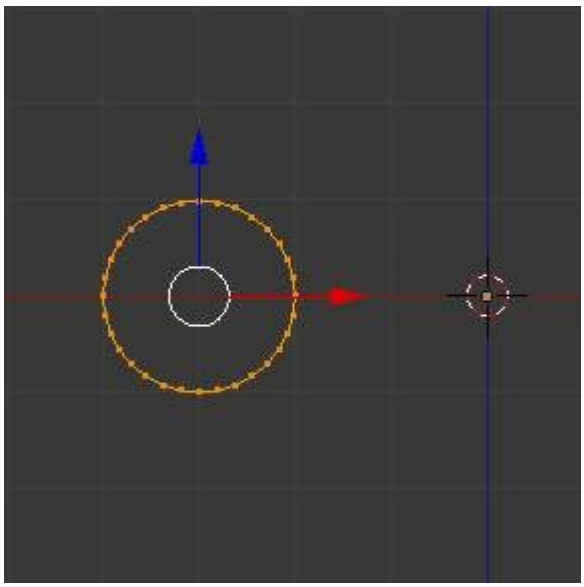


Fig. 8 - Circle placed at X -3,0,0

- Open Blender and delete the default Cube.
- Change from perspective to orthographic view using shortcut `Numpad5`.
- Change your view from *User Ortho* to *Front Ortho*, using the shortcut `Numpad1`. You will see the X (red) and Z (blue) coordinate lines.
- In case you have moved your cursor by clicking anywhere in the screen, again place your cursor at the Center, using the shortcut `Shift-S` choosing *Cursor to Center* or the Transform Panel, placing your cursor at `(0, 0, 0)` typing directly into the Cursor 3D Location.

- Add a circle using shortcut `Shift-A` and choosing –> Mesh –> Circle.
- Rotate this circle using the shortcut `R-X` and typing `90` and `Return`.
- Apply the Rotation using `Ctrl-A` and choosing *Rotation*
- Grab and move this circle to the left `3` Blender Units on the `X` Axis; you can use the shortcut `Ctrl` while grabbing with the mouse using the standard transform widgets (clicking on the red arrow shown with the object and grabbing while using shortcut `Ctrl` until the down left info in the 3D View marks `D. -3.0000 (3.0000) Global`), or press the shortcut `G-X` and typing `-3` and `Return`. You can use the Transform Panel (toggled with the shortcut `T` , and type `-3` and `Return` in the Location too. (See the Fig. 8 - Circle placed at X -3,0,0).
- You will have to scale your circle using the shortcut `S` and typing **.5**, then `Return`.
- Now enter *Edit Mode* using shortcut `Tab`.
- De-select all vertices using the shortcut `A`.

Now we will create a height vector for Blender:

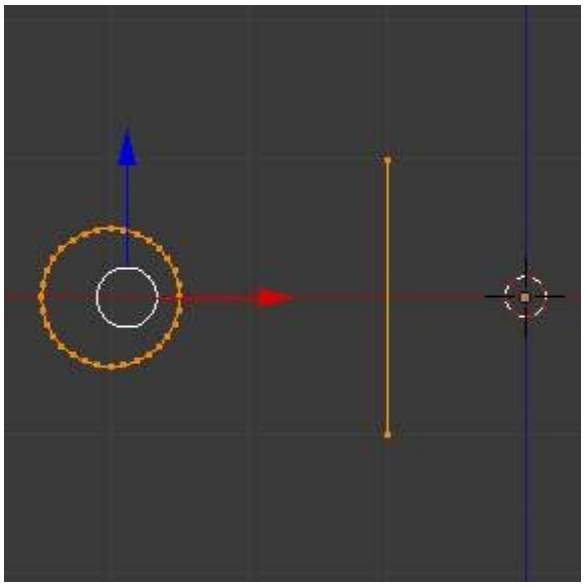


Fig. 9 - Profile and vector created

- Press `Ctrl` and Left click `LMB` near the circle, in more or less at the light grey line of the square above the circle, and, while still pressing `Ctrl`, Left Click `LMB` again in the grey line below the circle. You have created two vertices and an Edge, which Blender will use as the first height and angle vector.
- Now, in the Transform Panel, in the median, clicking in the Global coordinates, for the **X**, **Y**, and **Z** coordinates, put **(-2, 0, -1)**.
- Right Click `RMB` in the other vertex, and again, type its coordinates for **X**, **Y** and **Z** to **(-2, 0, 1)**. This will create a straight vertical line with 2 Blender units of Height.
- De-select and select everything again with the shortcut `A`. (See Fig. 9 - Profile and vector created)
- Place again your cursor at the center. (Repeat step 2)
- At this point, we will save this Blender file to recycle the Spring for another exercise; click with `LMB` in *File*, it is placed at the header of the Info Window, (At the top left side), and choose *Save as*. Our suggestion is to name it *Screw Spring Example.blend* and click in *Save as Blender file*. You can also use the shortcut `Shift-Ctrl-S` to open the File Browser Window in order to save your Blender file.
- Click Screw and adjust the Steps and Turns as you like and we have a nice spring, but now here comes

the interesting part!

Clockwise and Counterclockwise using the Spring Example

Still in the interactive session of the *Screw Tool*, you will see that the **Z** Axis Value of the *Screw* Panel is set to **1.000**. Left click LMB in the middle of the Value and set this value to **-1.000**. At first, the Spring was being constructed in a Counterclockwise direction, and you reverted the operation **180** degrees in the **Z** Axis. This is because you have changed the angular vector of the height you have given to Blender to the opposite direction (remember, **-90** to **90** = **180** degrees ?). See Fig. 10 - Counterclockwise direction and Fig. 11 - Flipped to Clockwise direction.

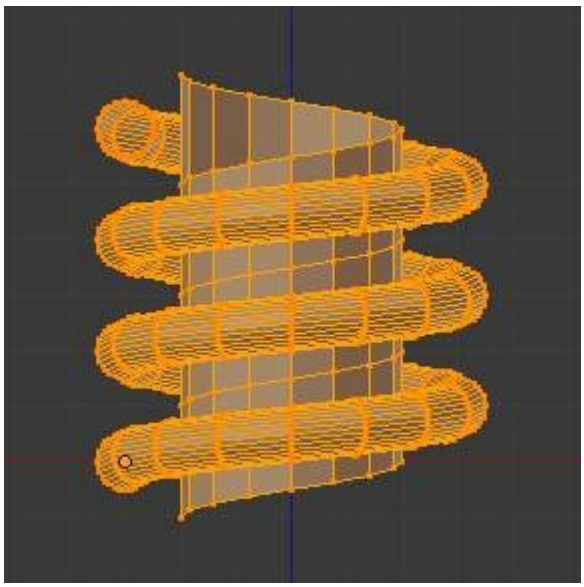


Fig. 10 - Counterclockwise direction

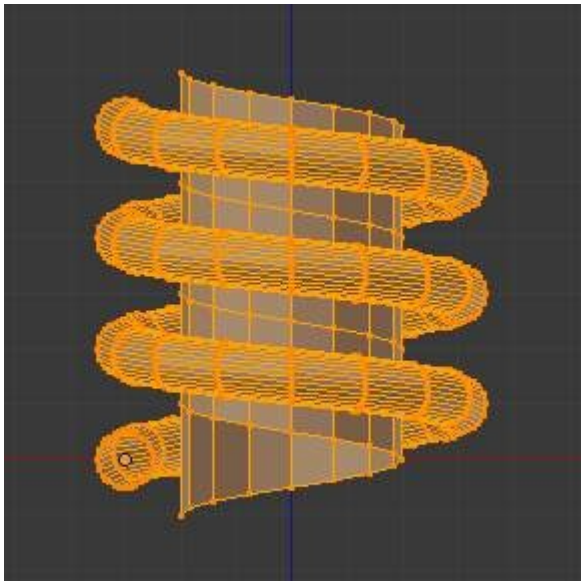


Fig. 11 - Flipped to Clockwise direction.

It’s also important to note that this vector is related to the same height vector axis used for the extrusion and we have created a parallel line with the **Z** Axis, so, the sensibility of this vector is in practical sense reactive only to negative and positive values because it’s aligned with the extrusion axis. Blender will clamp the positive and negative to its maximum values to make the extrusion follow a direction, even if the profile starts reverted. The

same rule applies to other Global axes when creating the Object for the *Screw* Tool; this means if you create your Object using the Top View (Shortcut `Numpad7` with a straight parallel line following another axis (for the Top View, the **Y Axis**), the vector that gives the height for extrusion will also change abruptly from negative to positive and vice versa to give the extrusion a direction, and you will have to tweak the corresponding Axis accordingly to achieve the Clockwise and Counterclockwise effect.

Note

Vectors that aren't parallel with Blender Axis

The high sensibility for the vector doesn't apply to vectors that give the Screw Tool a starting angle (Ex: any non-parallel vector), meaning Blender won't need to clamp the values to stabilize a direction for the extrusion, as the inclination of the vector will be clear for Blender and you will have the full degree of freedom to change the vectors. Our example is important because it only changes the direction of the profile without the tilt and/or bending effect, as there is only one direction for the extrusion, parallel to one of the Blender Axes

Bending the Profiles using the Spring Example

Still using the Spring Example, we can change the remaining vector for the angles that aren't related to the extrusion Axis of our Spring, thus bending our spring with the remaining vectors and creating a profile that will also open and/or close because of the change in starting angular vector values. What we are really doing is changing the starting angle of the profile prior to the extrusions. It means that Blender will connect each of the circles inclined with the vector you have given. Below we show two bent Meshes using the Axis vectors and the Spring example. See Fig. 12 and Fig. 13. These two Meshes generated with the *Screw* tool were created using the Top Ortho View.

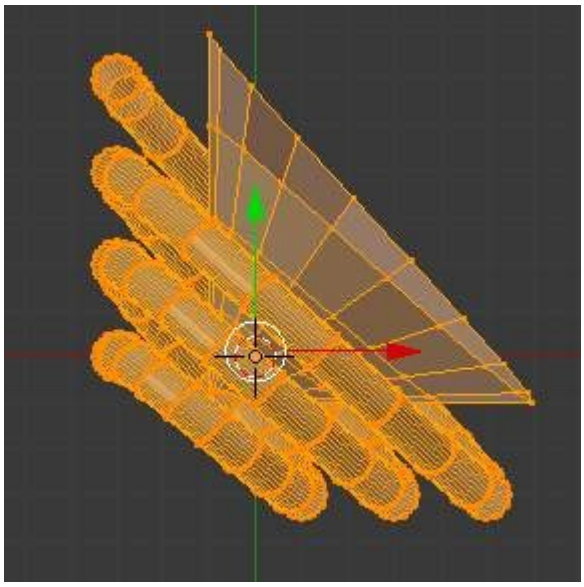


Fig. 12 - Bended Mesh, Example 1 - The Axis will give the profile a starting vector angle

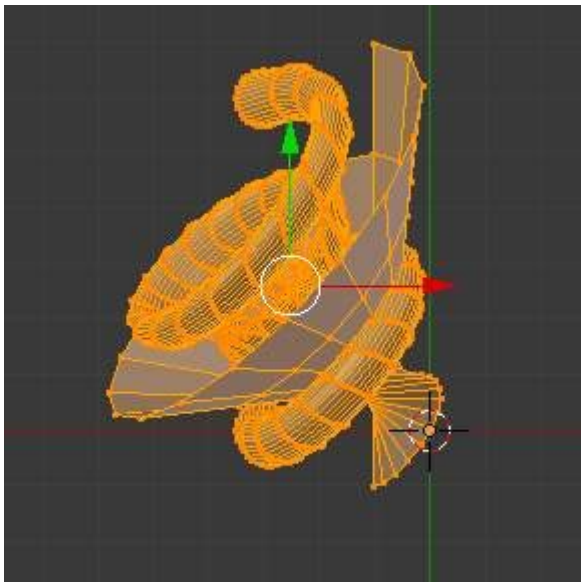


Fig. 13 - Bended Mesh Example 2 - The vector angle is maintained along the extrusions

Creating perfect Screw Spindles

Using the Spring Example, it's easy to create perfect Screw Spindles (like the ones present in normal screws that we can buy in hardware stores). Perfect Screw Spindles use a profile with the same height as its vector, and the beginning and ending vertex of the profile are placed at a straight parallel line with the axis of extrusion. The easiest way of achieving this effect is to create a simple profile where the beginning and ending vertices create a straight parallel line. Blender won't take into account any of the vertices present in the middle but those two to take its angular vector, so the spindles of the screw (which are defined by the turns value) will assembly perfectly with each other.

- Open Blender and click in *File* located at the header of the Info Window again, choose *Open Recent* and the file we saved for this exercise. All of the things will be placed exactly the way you saved before. Choose the last saved Blender file; in the last exercise, we gave it the name *Screw Spring Example.blend*.
- Press the shortcut `A` to de-select all vertices.
- Press the shortcut `B`, and Blender will change the cursor; you're now in border selection mode.
- Open a box that selects all of the circle vertices except the two vertices we used to create the height of the extrusions in the last example.
- Use the shortcut `X` to delete them.
- Press the shortcut `A` to select the remaining vertices.
- Press the shortcut `W` for the *Specials Menu*, and select *Subdivide*
- Now, click with the Right Mouse button at the middle vertex.
- Grab this vertex using the shortcut `G-X`, type **-1** and `Return`. See Fig. 14 - Profile for a perfect screw spindle.
- At this point, we will save this Blender file to recycle the generated Screw for another exercise; click with `LMB` in *File* – it is in the header of the Info Window (at the top left side), and choose *Save as*. Our suggestion is to name it *Screw Hardware Example.blend* and click in *Save as Blender file*. You can also use the shortcut `Shift-Ctrl-S` to open the File Browser Window in order to save your Blender file.
- Press shortcut `A` twice to de-select and select all vertices again.

- Now press Screw.
- Change Steps and Turns as you like. Fig. 15 - Generated Mesh - Shows you an example of the results.

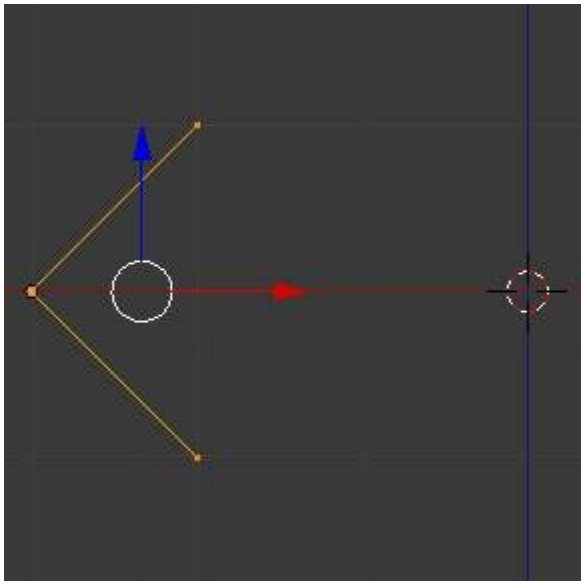


Fig. 14 - Profile for a perfect screw spindle. The starting and ending vertices are forming a parallel line with the Blender Axis

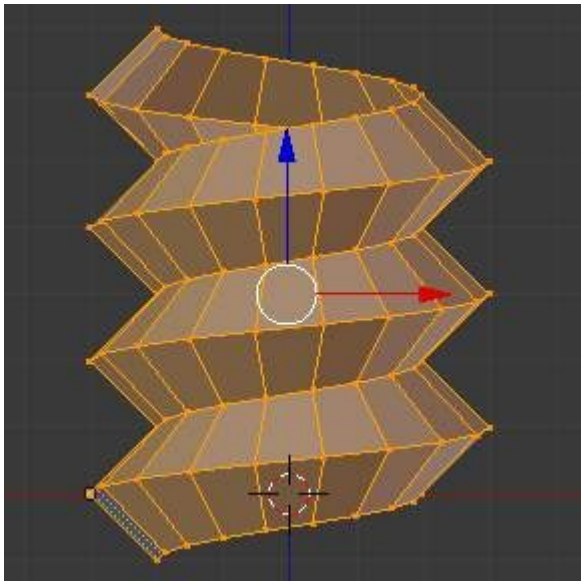


Fig. 15 - Generated Mesh. You can use this technique to perform normal screw modeling.

Here, in Fig. 16 and Fig. 17, we show you an example using a different profile, but maintaining the beginning and ending vertices at the same position. The generated mesh looks like a medieval ramp!

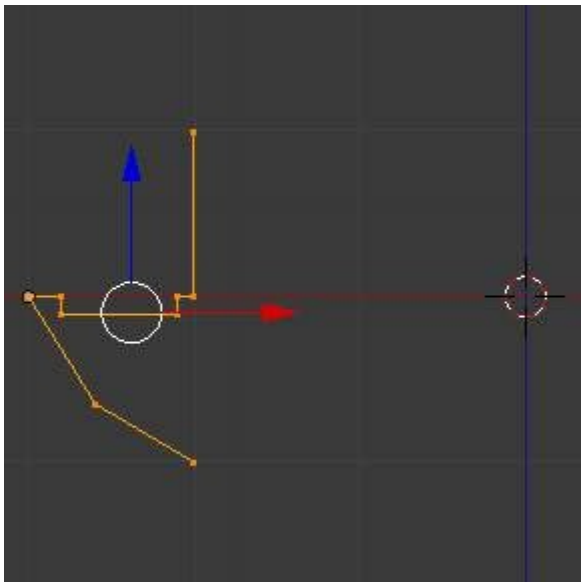


Fig. 16 - Profile with starting and ending vertices forming a parallel line with the Blender Axis

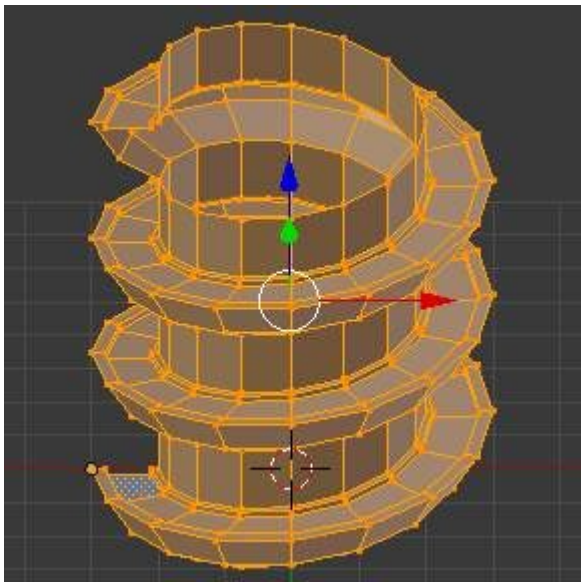


Fig. 17 - Generated Mesh with the profile at the left. We have inclined the visualization a bit.

As you can see, the Screw spindles are perfectly assembled with each other, and they follow a straight line from top to bottom. You can also change the Clockwise and Counterclockwise direction using this example, to create right and left screw spindles. At this point, you can give the screw another dimension, changing the Center of the Spin Extrusion, making it more suitable to your needs or calculating a perfect screw and merging its vertices with a cylinder, modeling its head, etc.

A Screw Tip

As we have explained before, the *Screw* tool generates clean and simple meshes to deal with; they are light, well-connected and are created with very predictable results. This is due to the Blender calculations taking into account not only the height of the vector, but also its starting angle. It means that Blender will connect the vertices with each other in a way that they follow a continuous cycle along the extruded generated profile.

In this example, you will learn how to create a simple Screw Tip (like the ones we use for wood; we have shown an example at the beginning of this page). To make this new example as short as possible, we will

recycle our last example (again).

- Open Blender and click in *File* located in the header of the Info Window again; choose *Open Recent* and the file we saved for this exercise. All of the things will be placed exactly the way you saved before. Choose the last saved Blender file; in the last exercise, we gave it the name *Screw Hardware Example.blend*.
- Grab the upper vertex and move a bit to the left, but no more than you have moved your last vertex. (See Fig. 18 - Profile With Starting Vector Angle)
- Press the shortcut `A` twice to de-select and select all.
- Press the shortcut `Shift-S` and select *Cursor to Center*
- Press Screw.

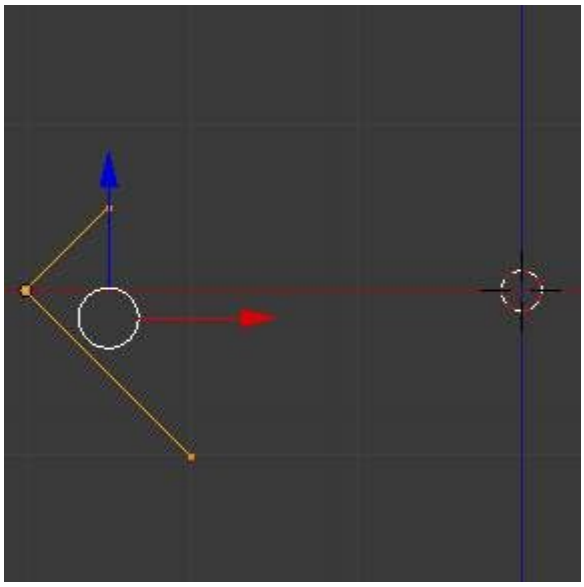


Fig. 18 - Profile With Starting Vector Angle

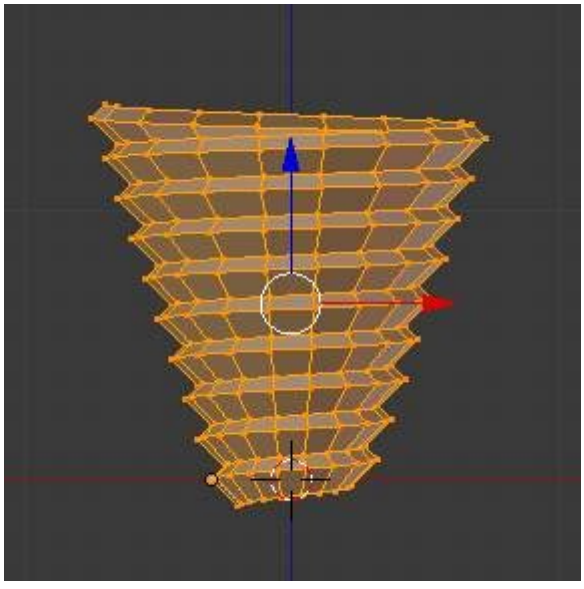


Fig. 19 - Generated Mesh with the Profile

As you can see in Fig. 19, Blender follows the basic angular vector of the profile, and the profile basic angle determines whether the extruded subsequent configured turns will open or close the resulting mesh following this angle. The vector of the extrusion angle is determined by the starting and ending Vertex of the profile.