Blender as a creative tool

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Blender 4.5

Preview

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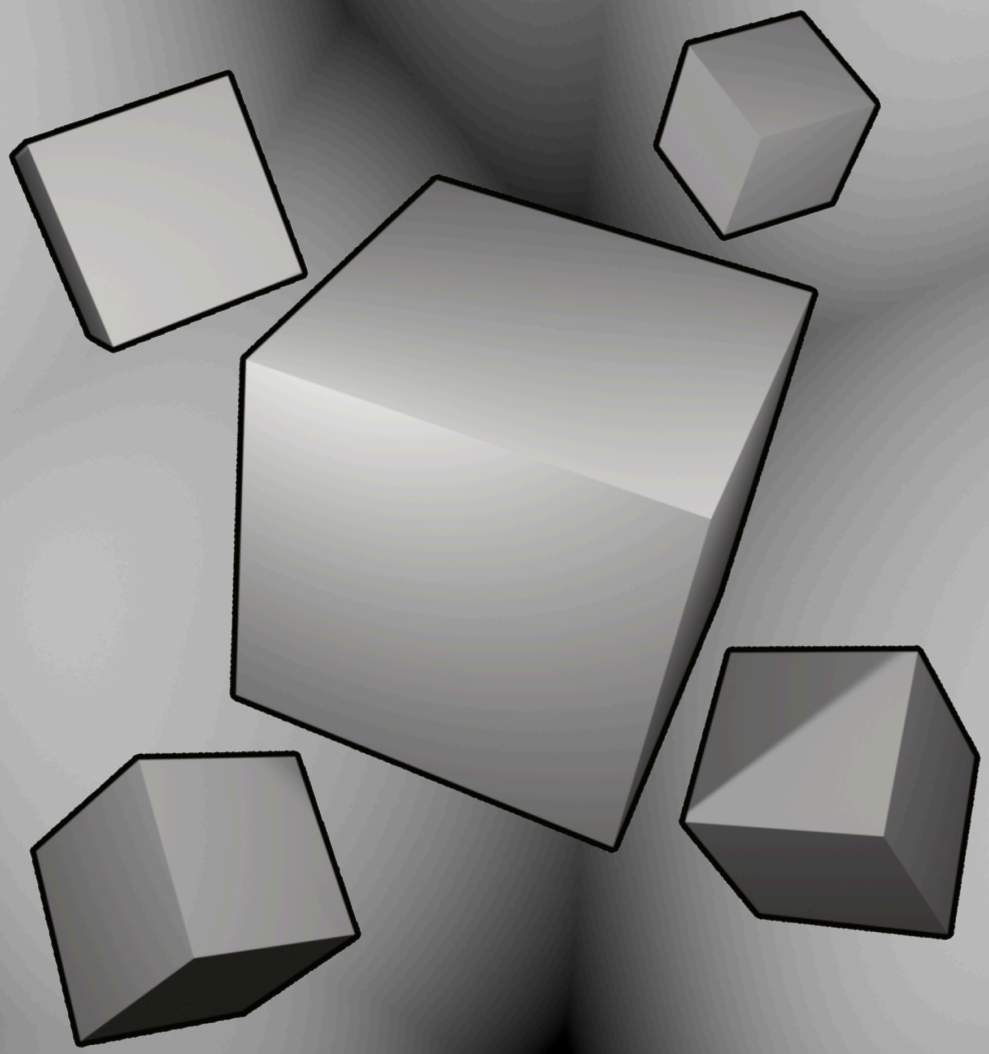
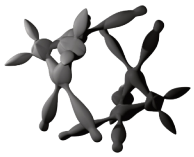
- Fundemental concepts
- User Interface
- Navegation
- Adding Objects
- Object Modes
- Edit mode tools
- Orientations
- Outliner editor
- Properties editor
- What is a render?
- Camera
- Perspective modes
- Exporting
- EEVEE & Cycles (intro to rendering)
- Extra tips



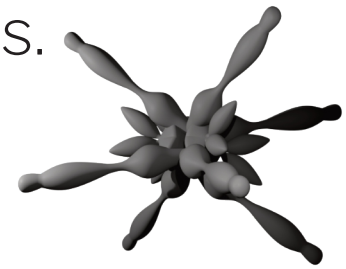
What is 3D modeling?

3D modeling is the process of creating a digital representation of an object in three dimensions using computer software. This can involve a wide range of techniques and approaches, much like any other artistic medium. While there's no single "right" way to model, it's essential to consider factors such as your computer's processing power and efficient modeling practices to ensure a quicker and smoother workflow.

3D modeling software allows us to create 3D digital objects that are represented on a 2D screen in a way that allows us to perceive them as 3D through the principles of perspective.



The applications of 3D models are diverse and extensive, spanning animation, video game development, 3D printing, architecture, digital preservation and restoration of historical landmarks and artifacts, and even for medical research such as the development and design of prosthetics.



Before exploring the various modeling techniques, let's delve into the fundamental building blocks of 3D graphics.

Fundemental concepts

Everything we create in Blender is data represented within a digitally constructed three-dimensional space that utilizes a **Cartesian coordinate system**.

This means that everything we create exists somewhere on a three-dimensional grid composed of **three distinct axes or directions**.

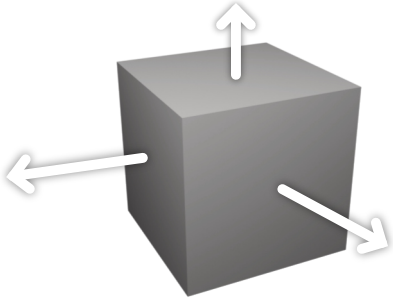
X is left and right

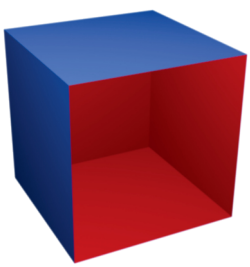
Y is forward and back

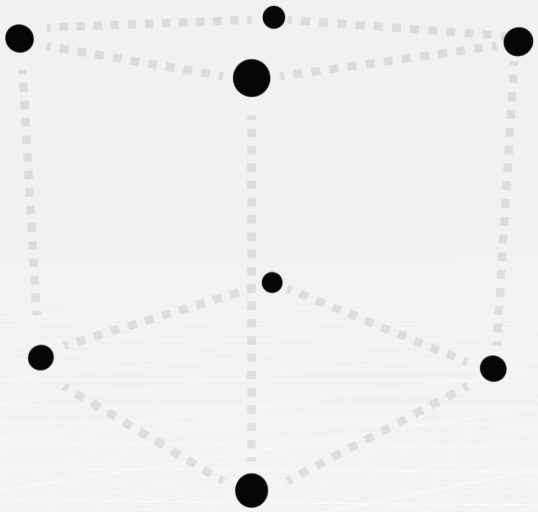
Z is up and down

The objects that we create and modify In 3D modeling programs are called **meshes** and are made up of **vertices, edges, and faces**; each of which have **XYZ** coordinates in virtual space.

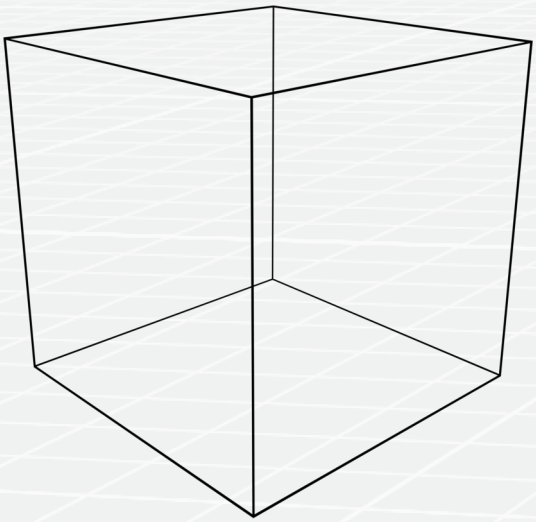
Vertices, **edges**, and **faces** all have imaginary, perpendicular lines called **Normals** that define the direction in which they are facing. **Normals** are most often used to determine the direction of our faces.



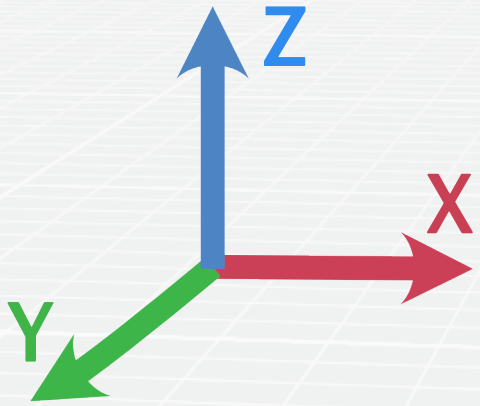


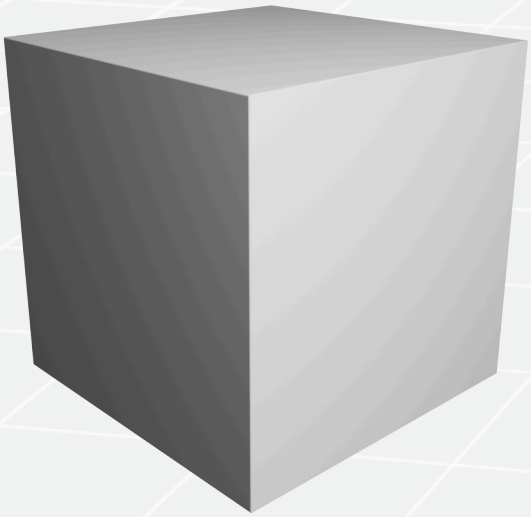


Vertex (points in space)



Edges





Faces

User Interface

Blender is a modular program which is divided into different **Editors** which can be modified and layed out in any way which suits your workflow.

At the top of the screen are **workspace** presets that are designed specifically for the different aspects of 3D modeling.

Different editors have different **modes**.

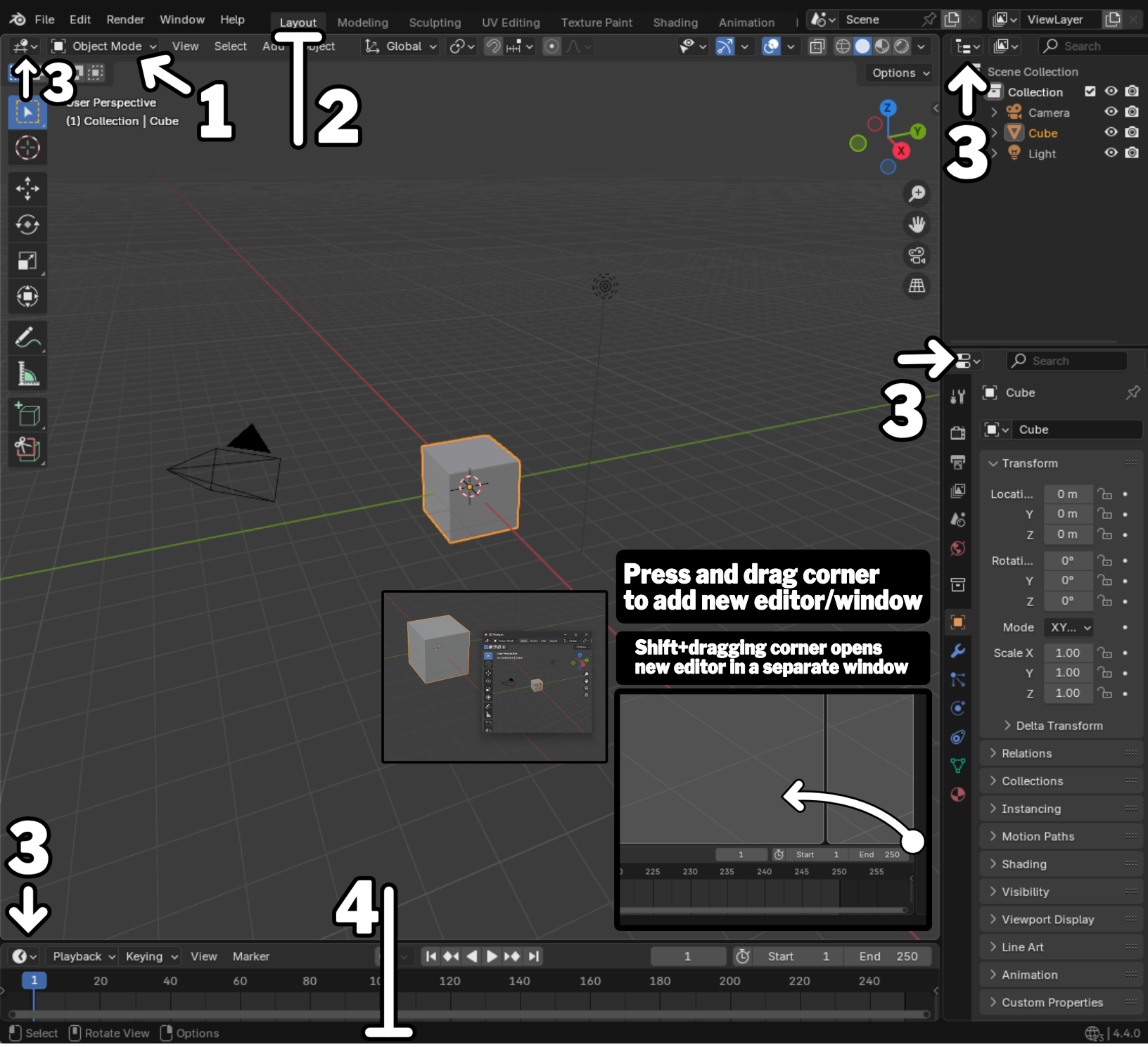
It is important to note that

Blender is context sensitive as to where the mouse is hovering.

Keyboard shortcuts are also dependent on mouse position.

To preview the actions we can take, keyboard shortcuts, messages, and statistical information, reference the **status bar** at the bottom of blender's window.

See next page



Modes **1** Workspaces **2**

Editors **3** Status bar **4**

Navigation

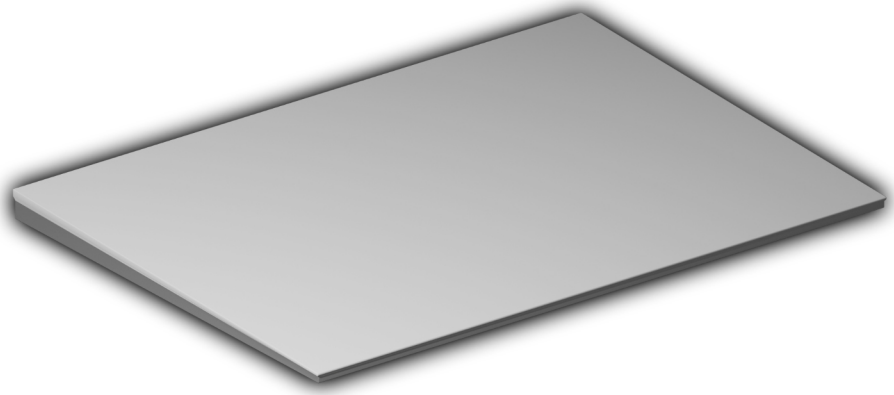
Mouse

Middle mouse button + drag
Rotate

Ctrl + Middle mouse button + drag
Zoom

Shift + Middle mouse button + drag
Pan

Trackpad



Two finger drag
Rotate

Ctrl + Two finger drag
Zoom

Shift + Two finger drag
Pan

In Blender's preferences you can activate "**emulate three-button mouse**" to use the trackpad as if it were a three button mouse.

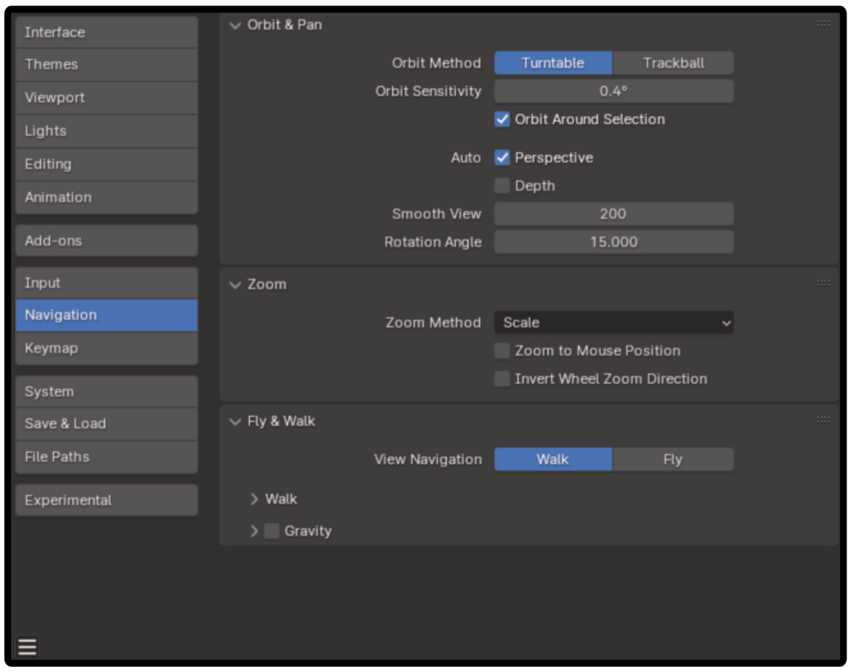
With "three button mouse" active, **Alt + LMB** becomes the Center Button.
It is important to note that **certain functions are lost** as **Alt+LMB** is used for some operations.

You can also navigate Blender Using the gizmos on the right Side of the viewport.

The **tilde ~** key opens the navigation pie-menu.

In the navigation tab of Blender's preferences (**Ctrl + Comma**) you can modify the feel of Blender's navigation to your liking.

I reccomend activating "**orbit around selection**".



Shift + Tilde~ Flight Navigation

(**video game like movement**)

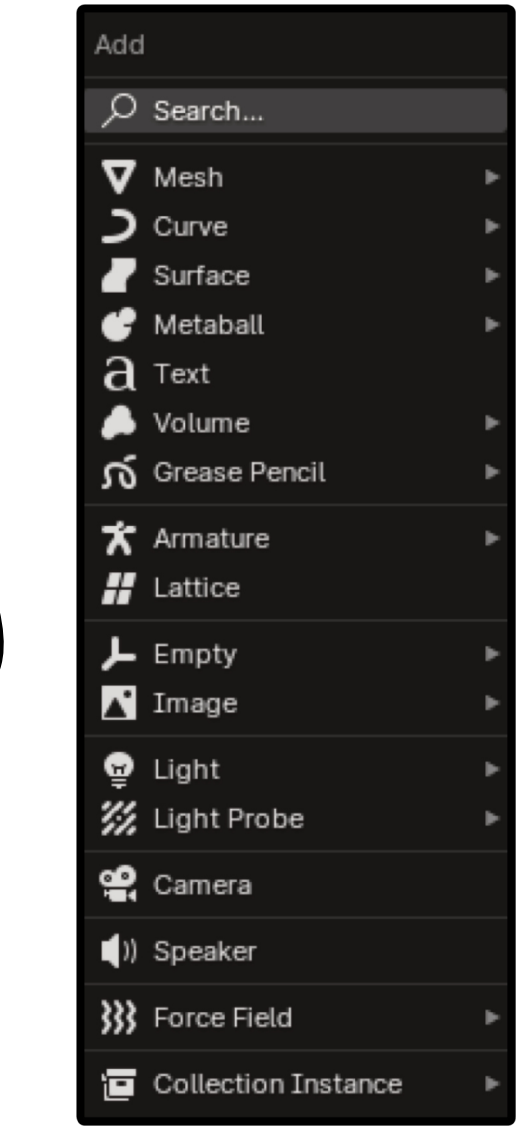
Use with the camera view to reposition camera

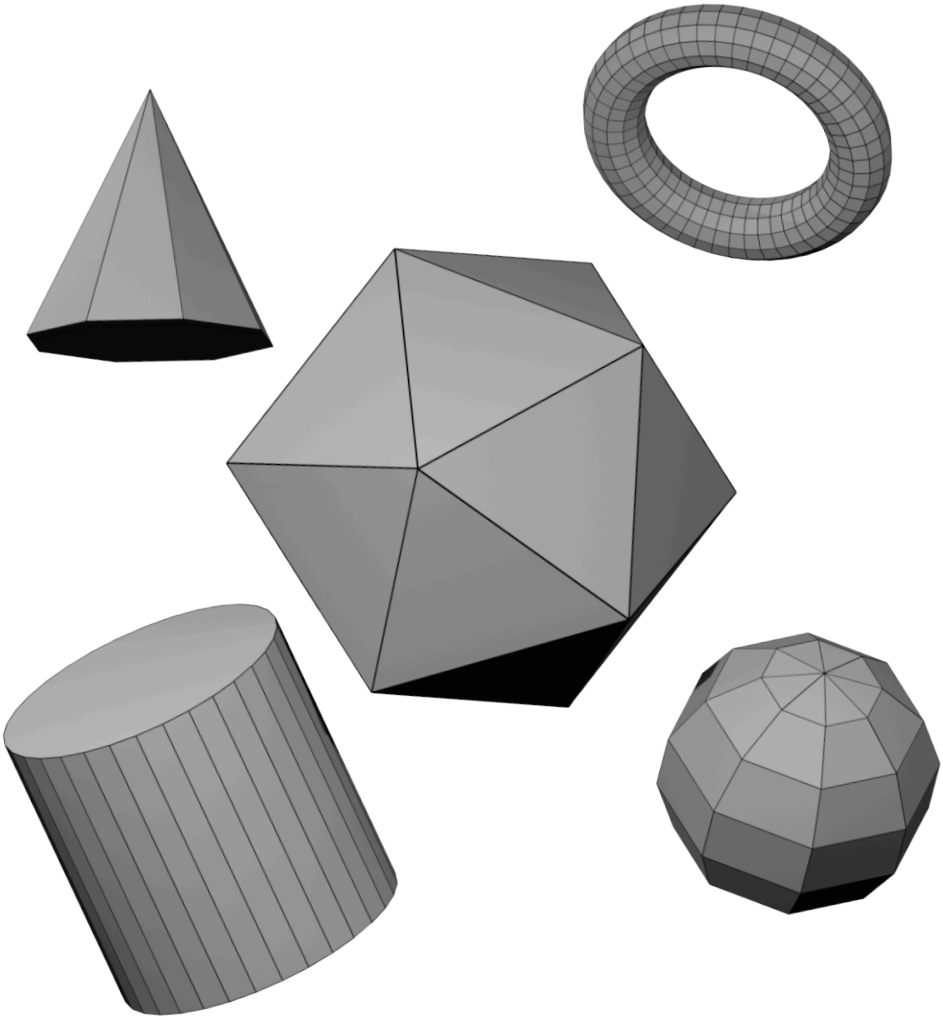
Adding Objects

Shift + A

Objects are added to the 3D cursor

Shift + RMB
Moves the 3D cursor





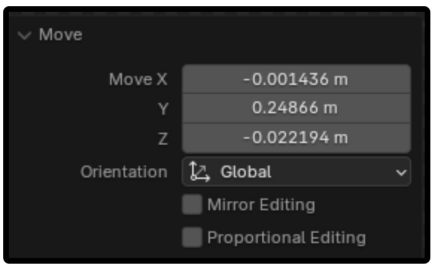
Context menu

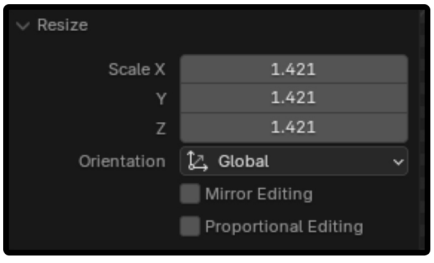
Each time we add a new object or make changes to our mesh,
a **context menu tab will be created**. This tab allows us to manage and manipulate the parameters of the manipulation or the newly added object with precision.

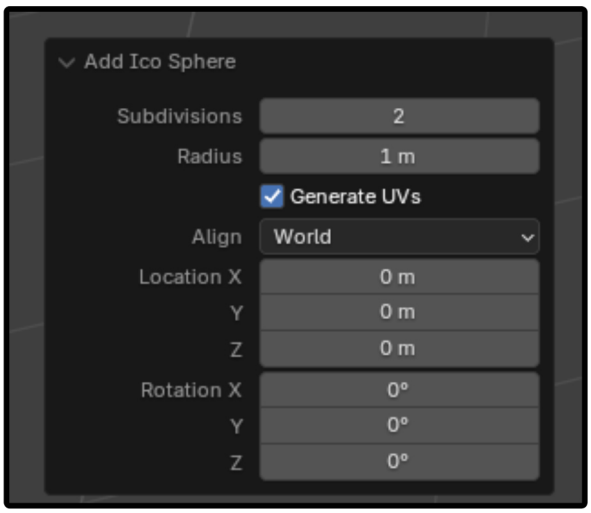
If you click outside the context menu and change anything,
it will disappear permanently.
To restore the context menu (if you click away only) press **F9**.

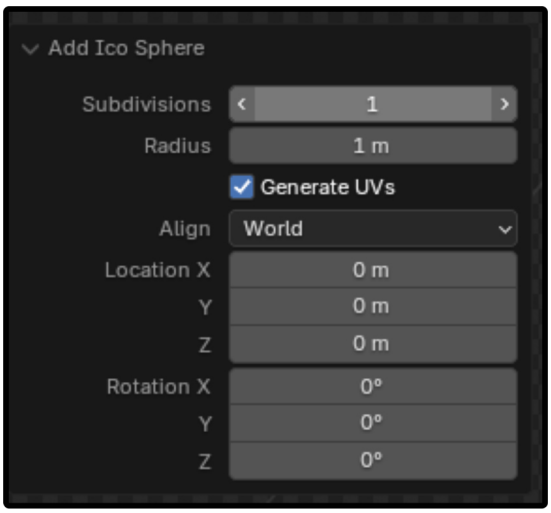
This menu allows us to define the geometry of our added objects, such as the number of faces on our cylinders or spheres, along with their size and dimensions.

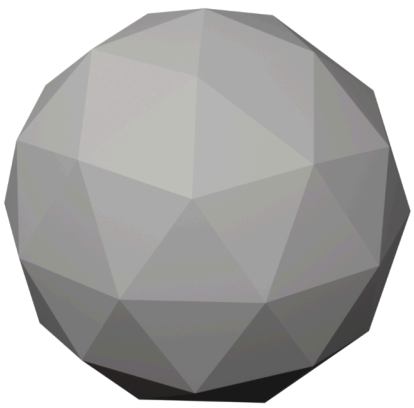
You can find the context menu in the lower left corner of the viewport.

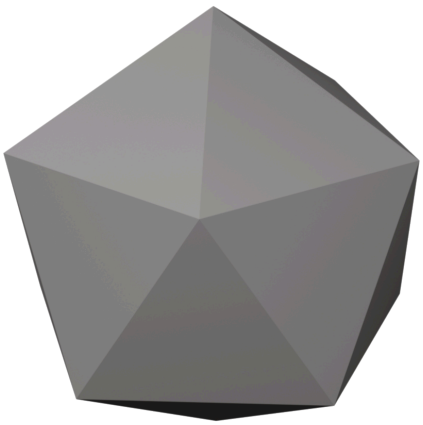






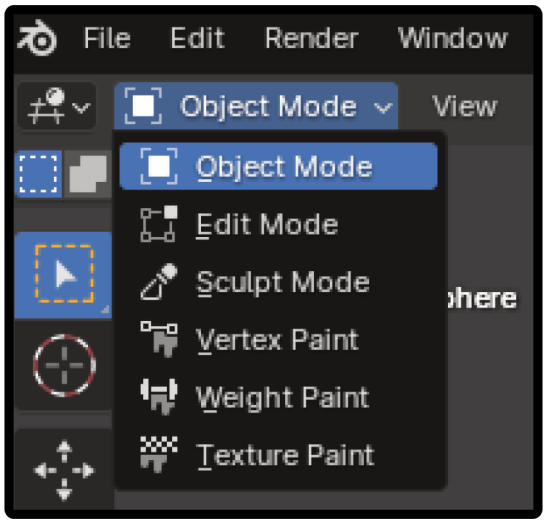






Object Modes

Objects in Blender occupy different modes for manipulation, editing, sculpting and painting.



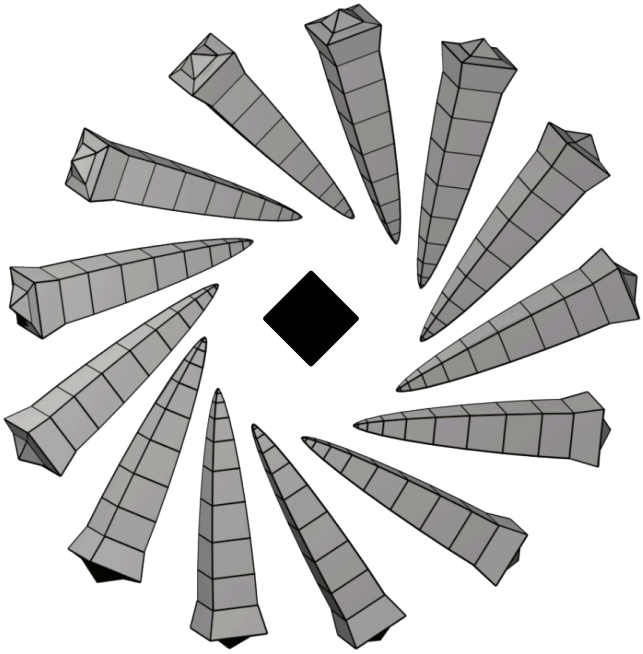
Object mode
is used to position/rotate/scale objects

Edit mode
allows editing the mesh directly

Sculpt mode
allows the use of sculpting tools to work your meshes like clay. (Using a brush)

TAB

Switches between the last two modes used



Ctrl+TAB

Opens the object mode pie menu.

Different object types have have different object modes.

It is important to remember that any modifications to the **scale** of a mesh that are made in **Object mode** will **have to be applied** with **Ctrl + A** to prevent any modifiers from being distorted.

As of version 4.4.0, you will be notified in the lower context bar if the scale needs to be applied.

Edit mode tools

Familiarizing yourself with the mesh editing tools in Blender's Edit mode is essential for 3D modeling in Blender.

These fundamental tools let us transform and manipulate our geometry (edges, faces, and vertices).

Aside from sculpting, (and geometry nodes) the majority of 3D modeling in Blender relies on these tools.

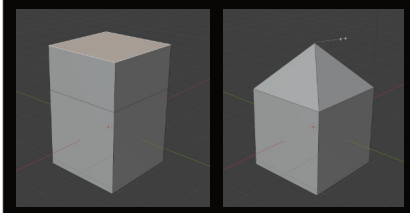
Try to memorize the shortcuts associated with each tool.

When using a tool or operation like **Grab**, **Rotate**, and **Scale**
You can type out a number in order to more precicely manipulate your mesh.

Grab moves by **Meters**

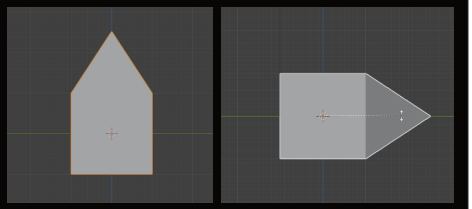
Rotate moves by **Degrees**

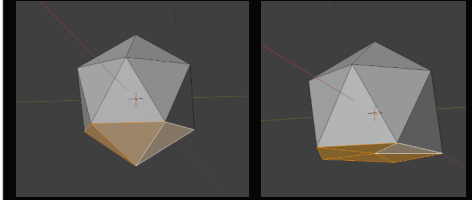
Scale grows by a **Multiplicative factor**



Scale **S + 0**

Rotate **R + 90**

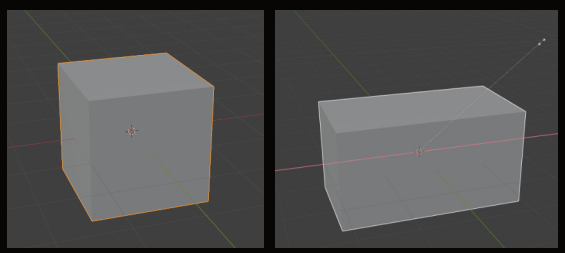




To flatten multiple faces
Scale **S + Z + 0**

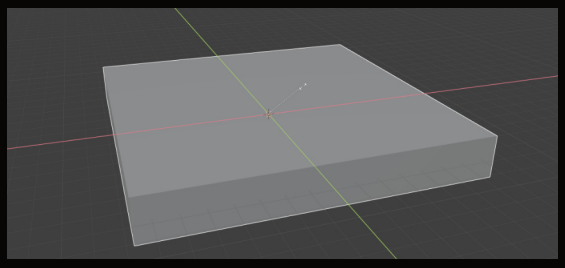
When **X** **Y** or **Z** is pressed while using an operator or a tool such as **grab**, **rotate**, and **scale**,
the object will be modified on the specified axis.

Scale **S + X**



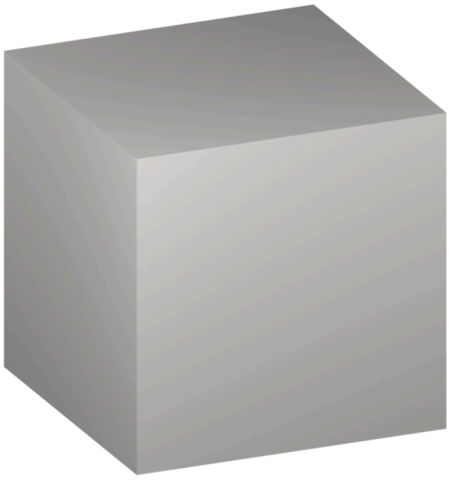
If **Shift** is pressed **before** the Axis is defined, the mesh will be modified on all axes which are not the specified axis.

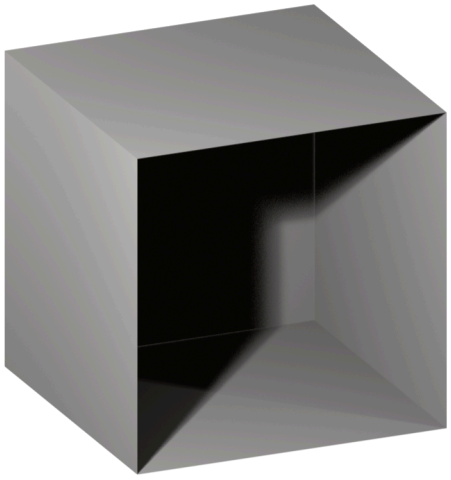
Scale **S + Shift + Z**



Delete **X**

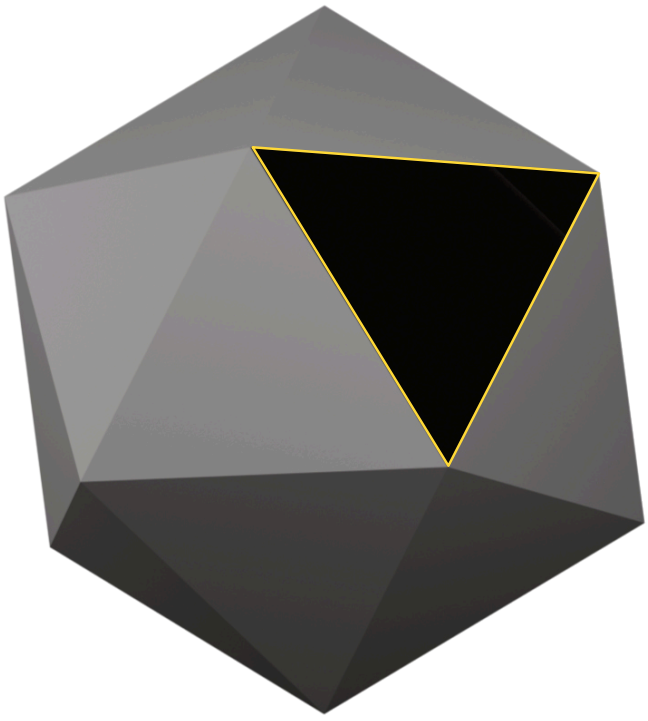
X is the universal delete button.
Use **X** to delete nodes, geometry, timeline sequences, etc.

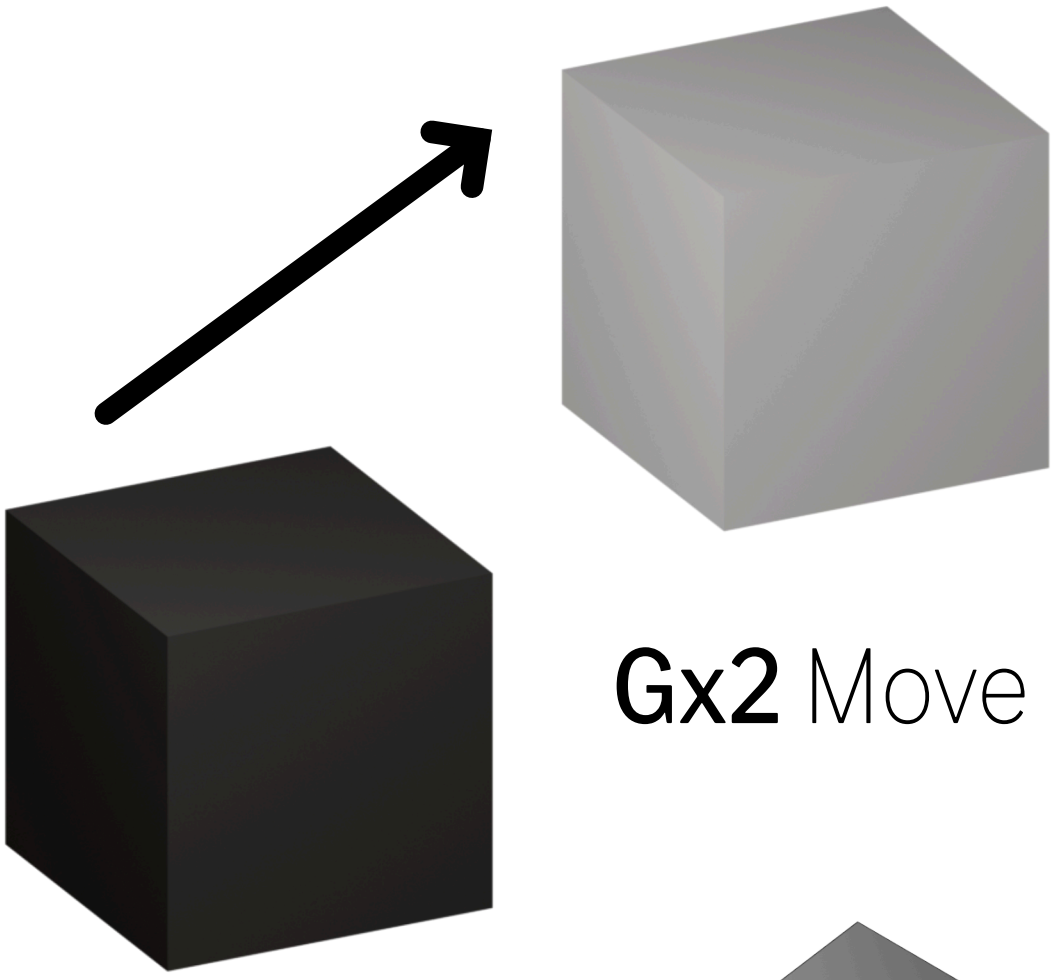




Fill faces **F**

(With edges selected)

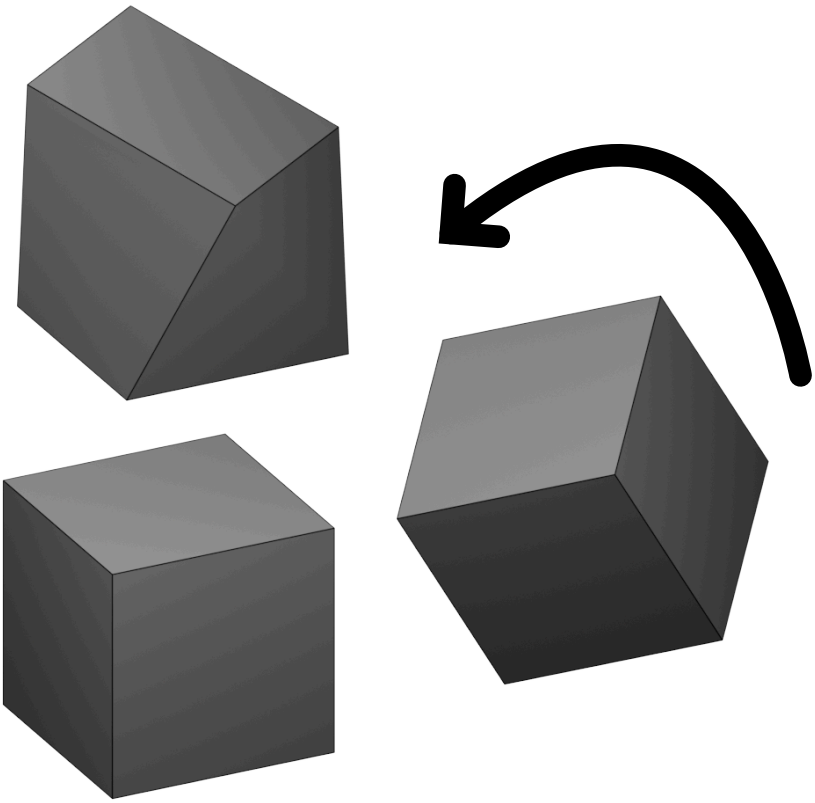




Grab

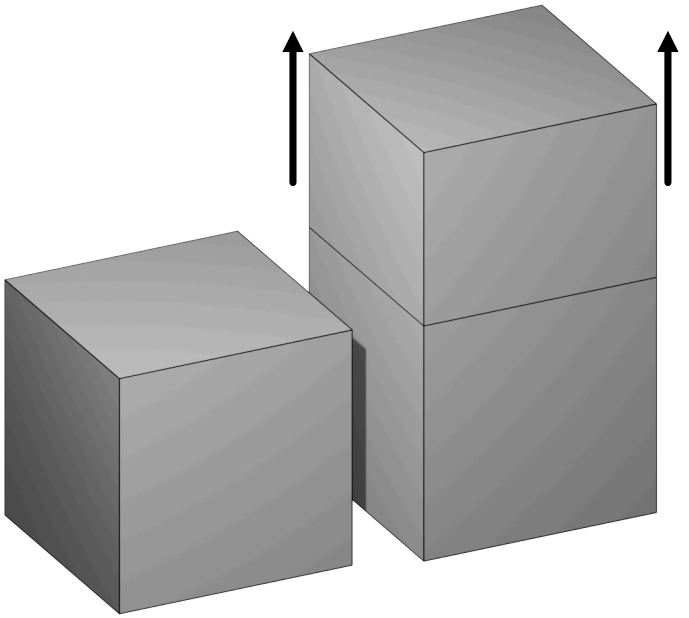
G

Gx2 Move on edges



R Rotate

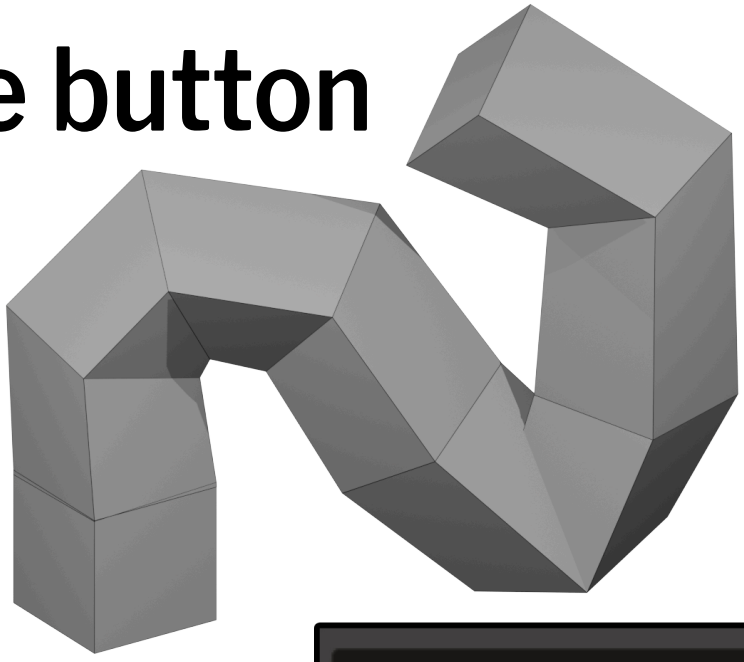
Rx2 Trackball rotation



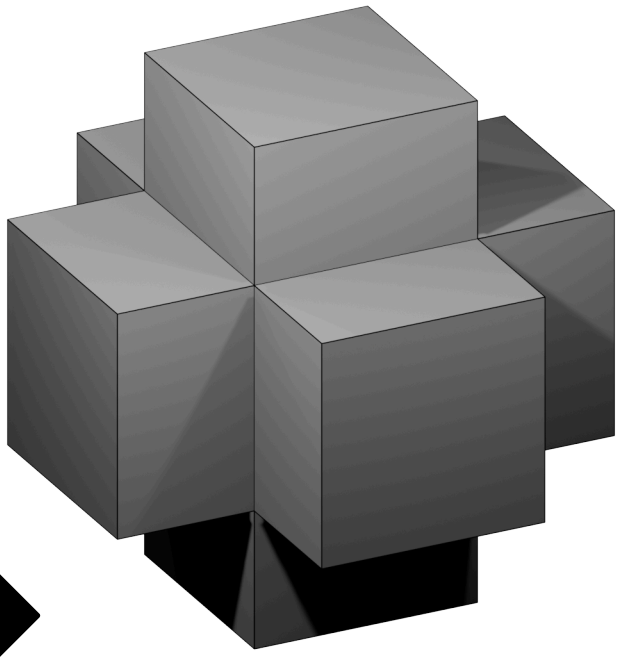
Extrude

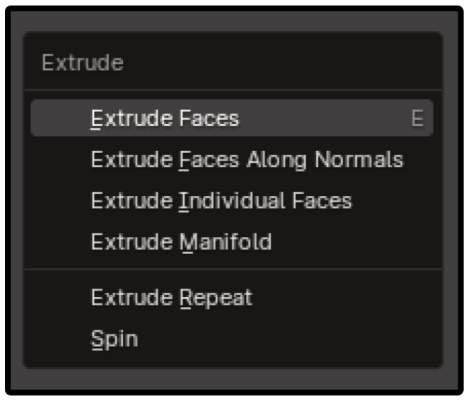
E

Ctrl+right mouse button
with selection.



Extrude to mouse





Alt+E

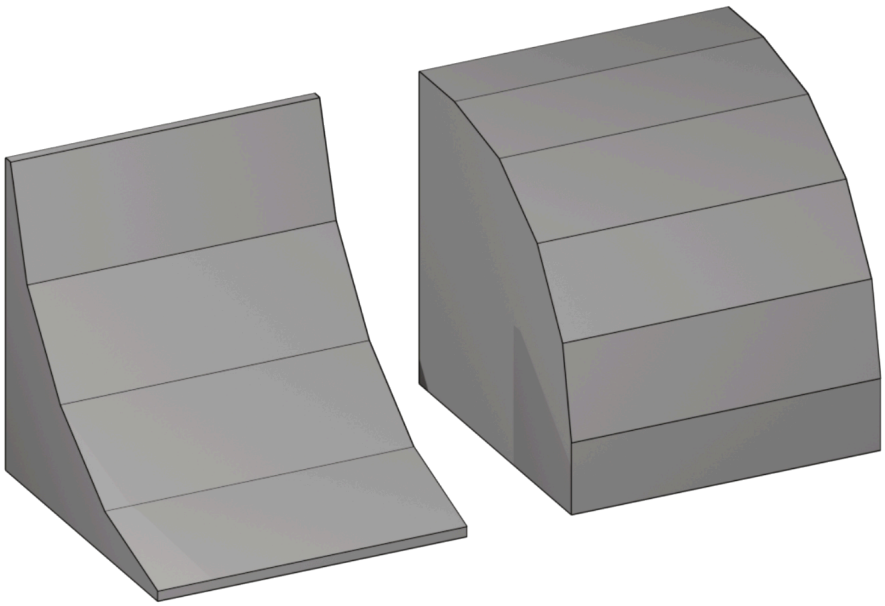
Extrude menu

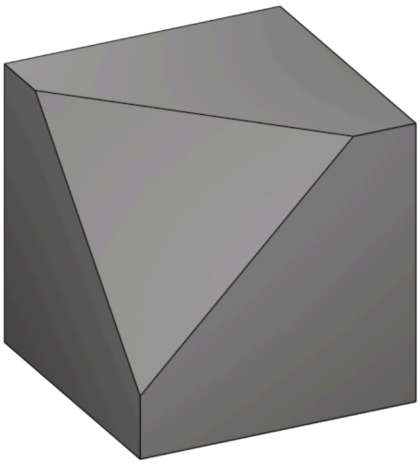
Bevel

Ctrl+B

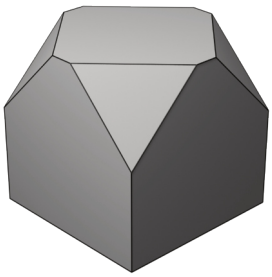
MMB scroll add edges

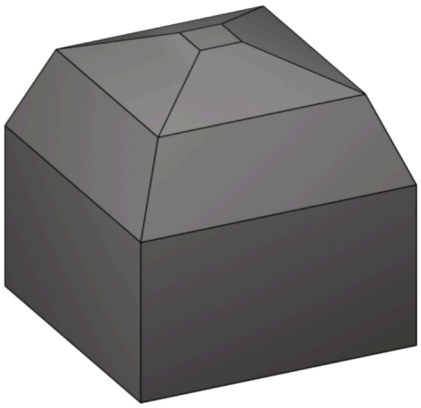
Ctrl+B +P
Convex/concave



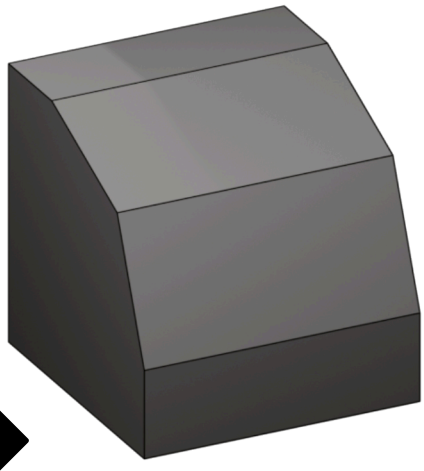


Vertex **+V**

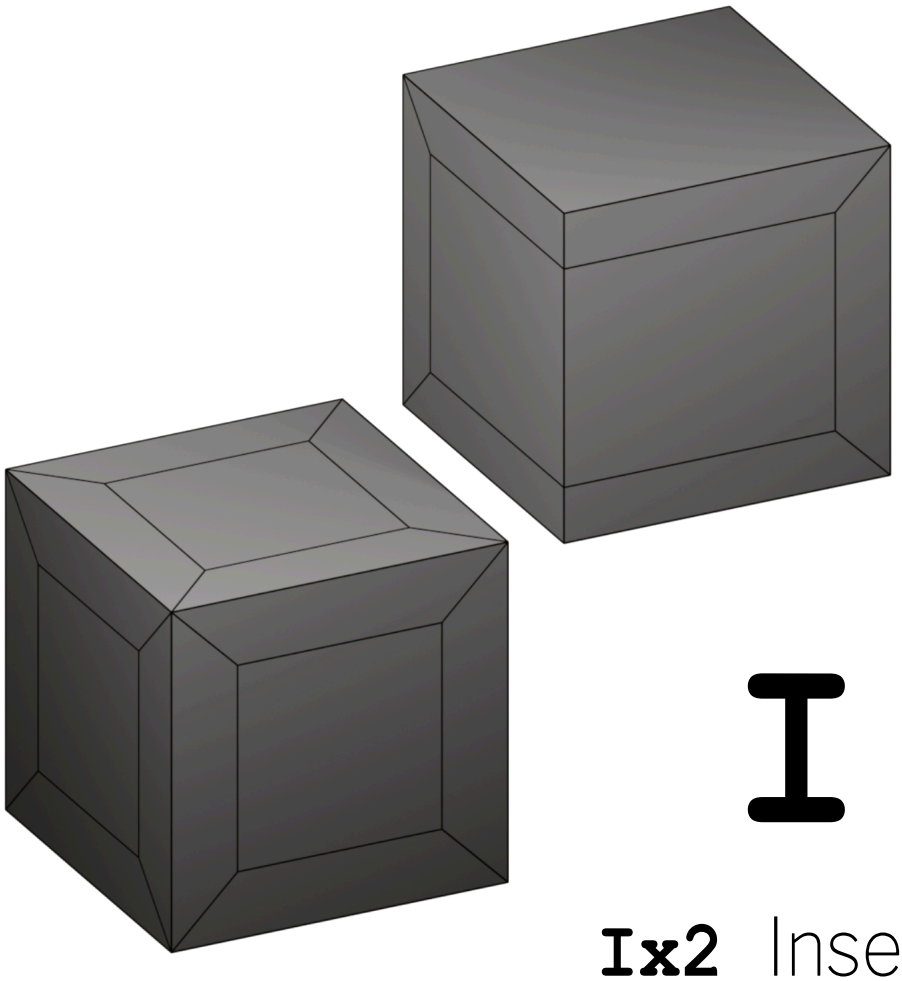




Face



Edge



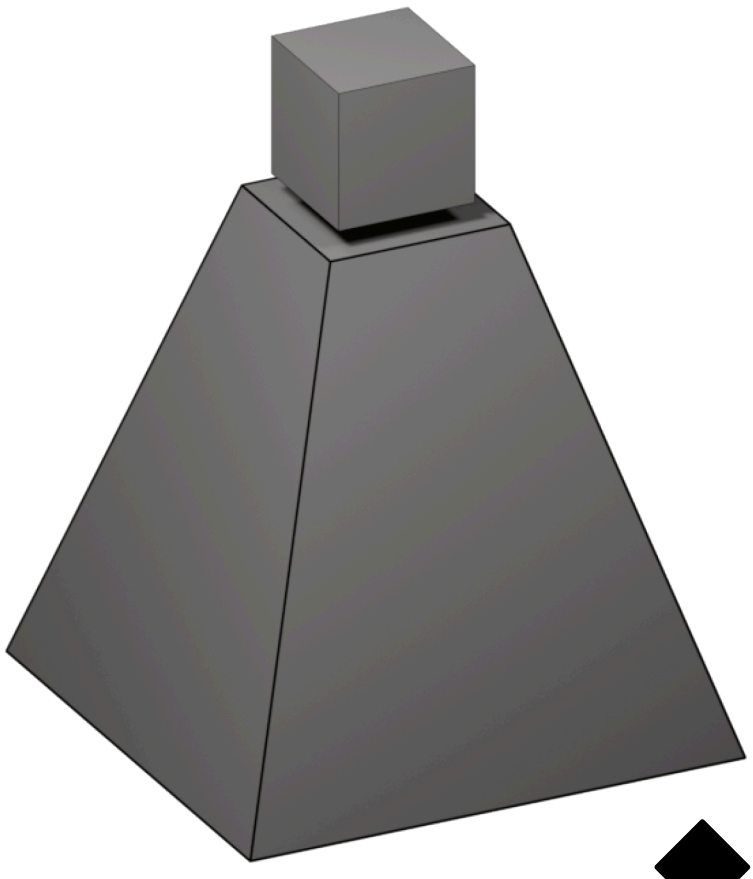
Inset

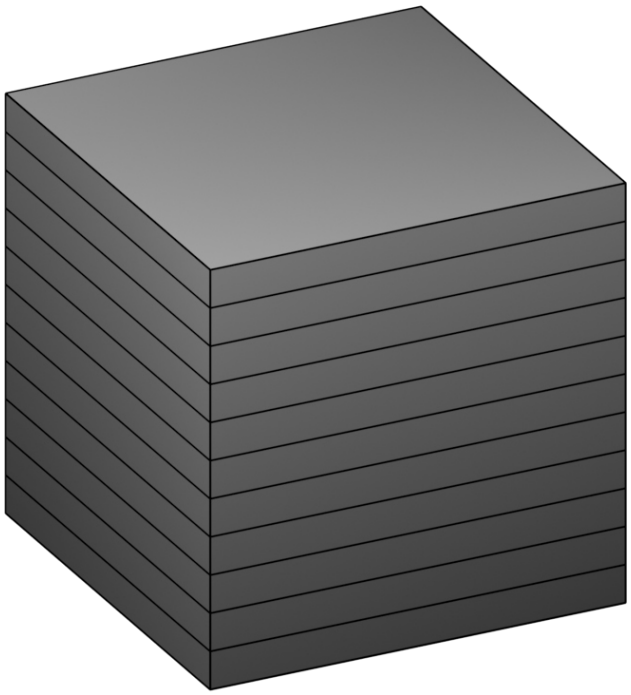
I

Ix2 Inset parallel faces

Scale

S





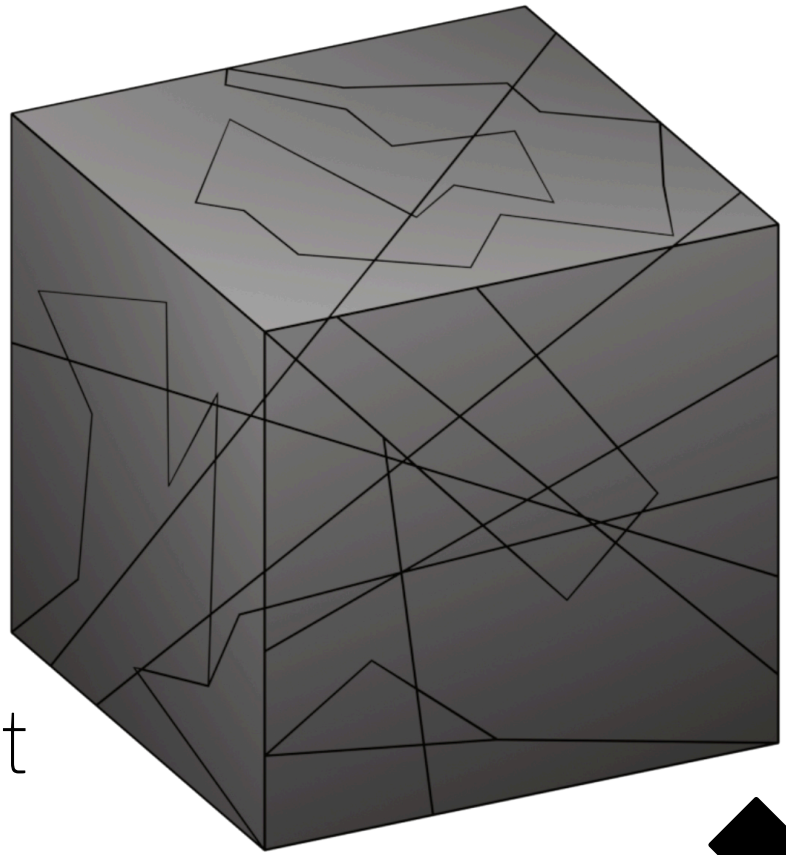
Loop cut

Ctrl+R

MMB scroll add cuts

Knife Cut

K

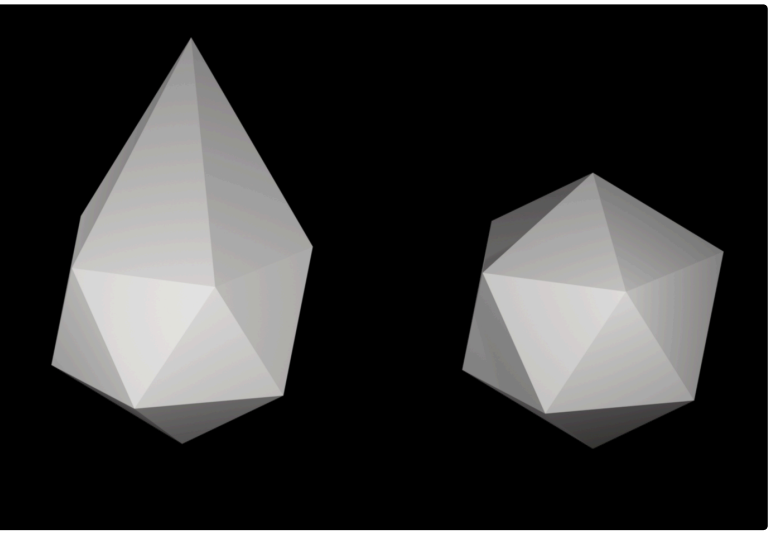


+C Cut through object
+A Angle constraint

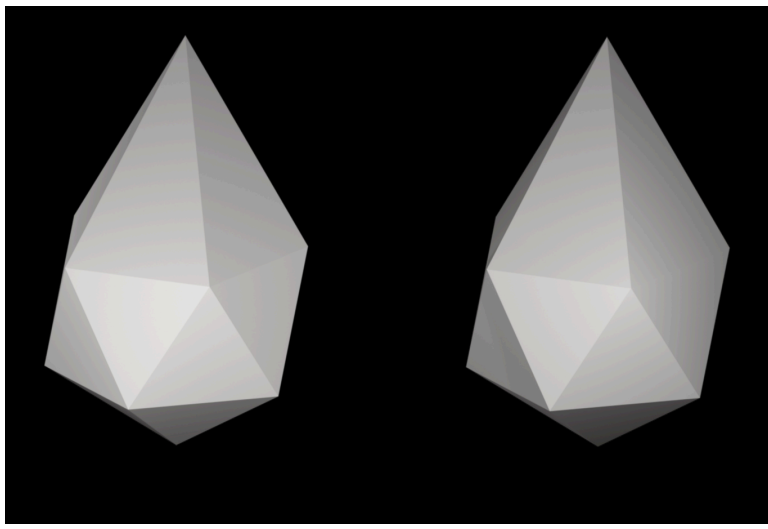
Duplicate **Shift + D**

Create instance **Alt + D**

like duplication, but the new object is a mirror of the original.



Duplication (new object)



Instance

Since an instanced object doesn't add new geometry to your scene,
you can add multiple copies of your object without slowing down the render.

Add cube

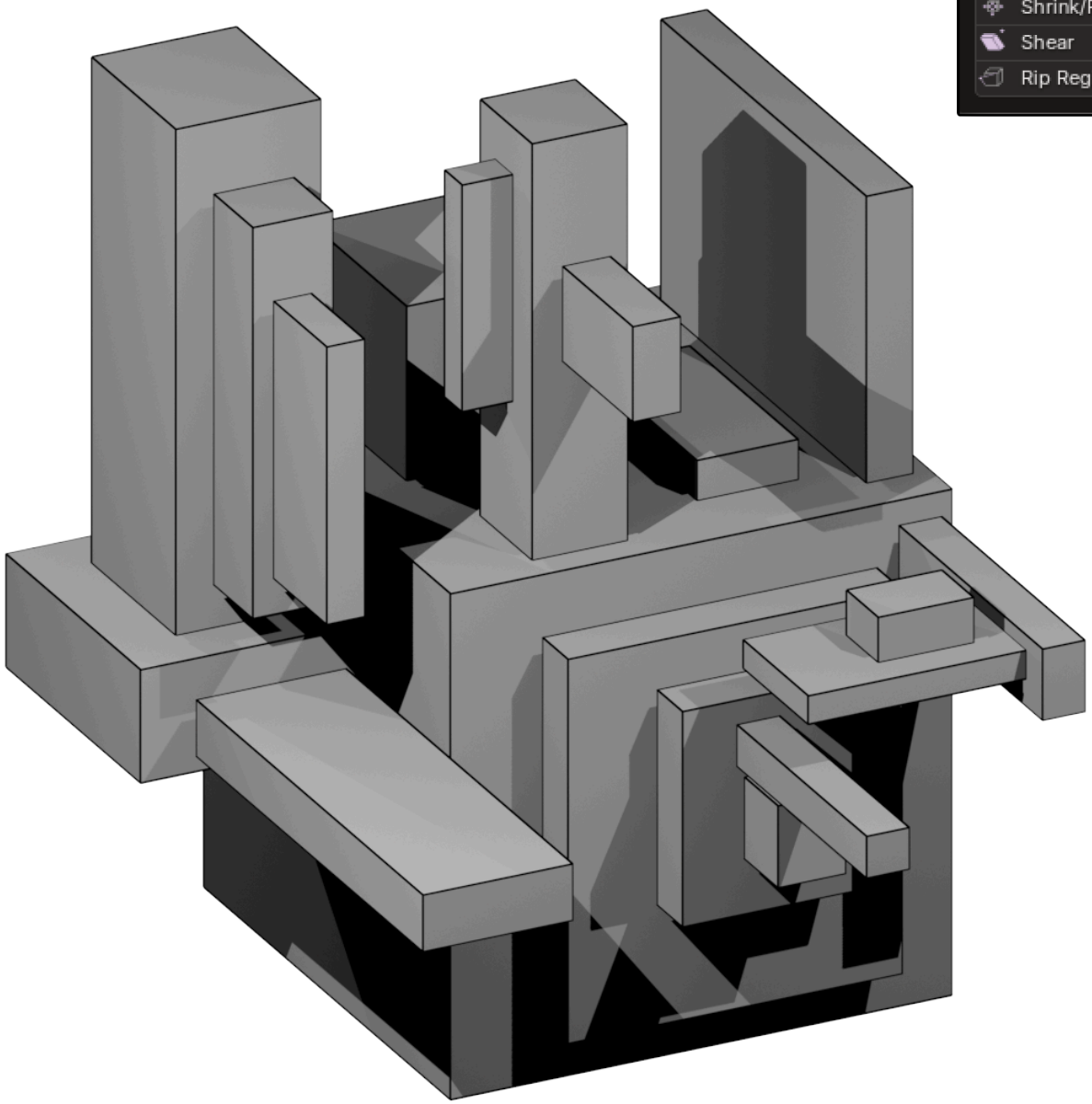
Shift + space + 9

Shift + space tool menu

Ctrl Toggles snap while dragging

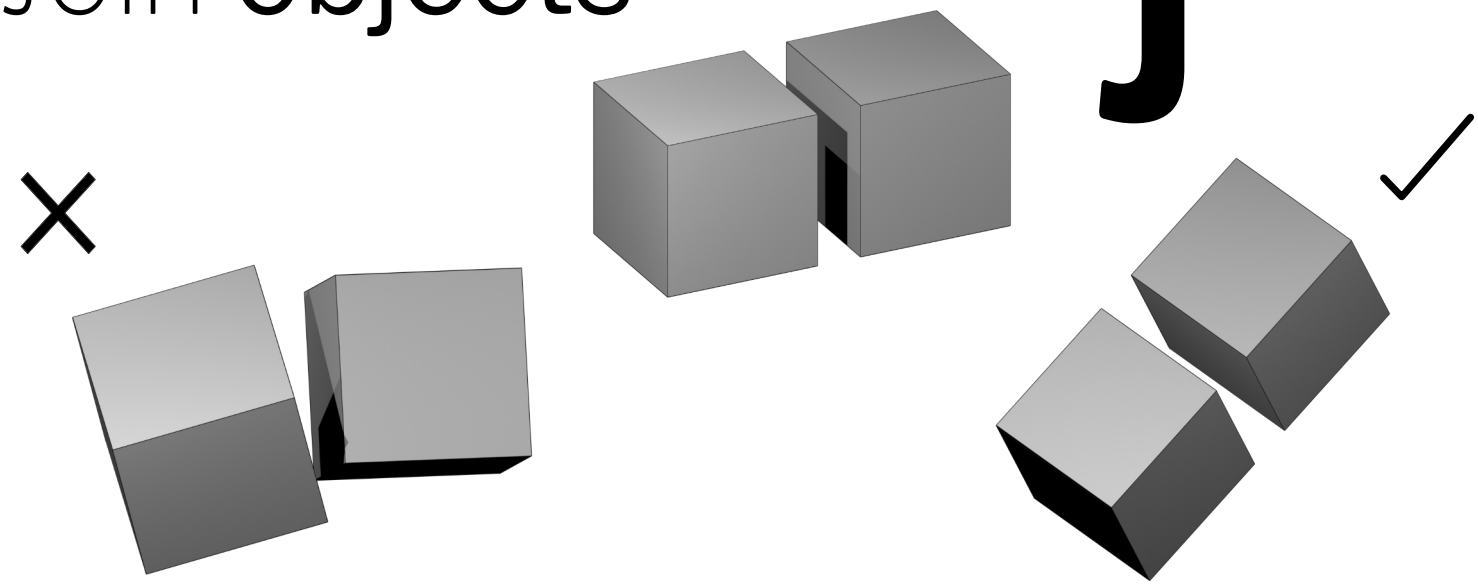
Shift Fixed aspect

Alt Toggles dragging from center



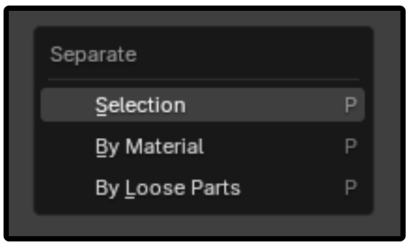
Join **objects**

J



J joins two objects while in **Object mode**. If you add new geometry in **Edit mode**, the new geometry will be added **inside of your selected object.**

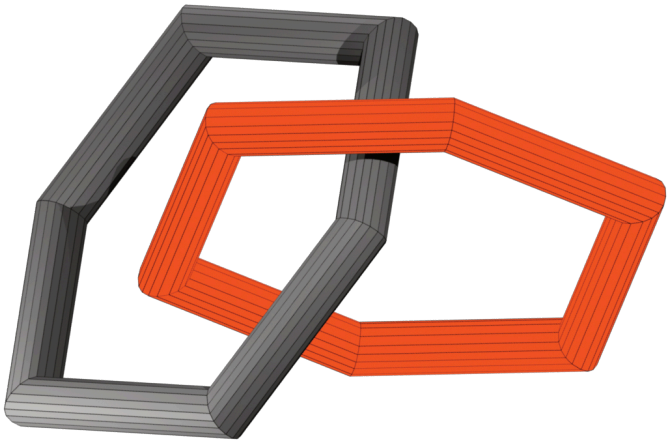
Think of an object like a **container** for geometry, where we can have multiple separate primitives and meshes inside of one object. All geometry in an object will transform around its **origin point.** **(Unless a different pivot point is defined)**



P Separates geometry inside of an object creating a new object from the separated geometry

Select linked **L**

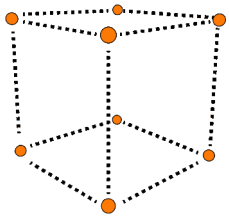
If you have two mesh bodies which are not attatched to eachother inside of an object, and want to quickly select one of the meshes, use the "Select linked" **L** shortcut.



Selecting geometry

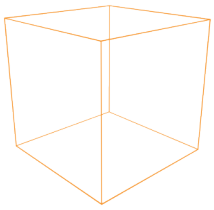
Vertex select (points)

1



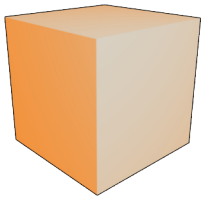
Edge select

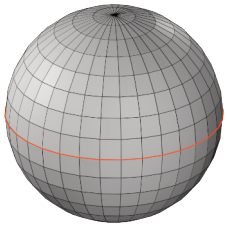
2



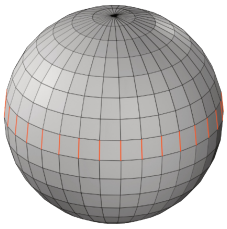
Face select

3

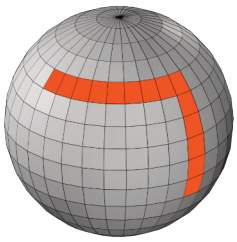




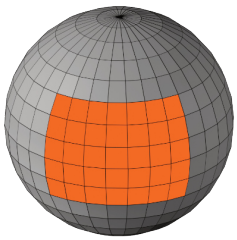
Alt + LMB
Loop selection



Ctrl + Alt + LMB
Ring selection



Ctrl + LMB
Select shortest route



Ctrl + Shift +LMB
Select group shortest route

Ctrl + Numpad **+** Expand selection

Ctrl + Numpad **-** Contract selection

Select all **A**

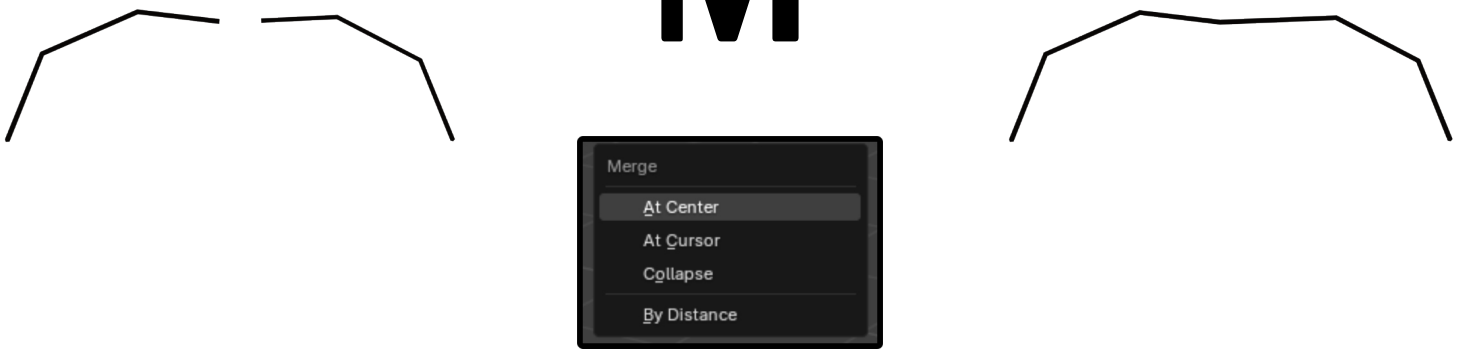
A selects all in every context
Nodes, geometry, keyframes etc

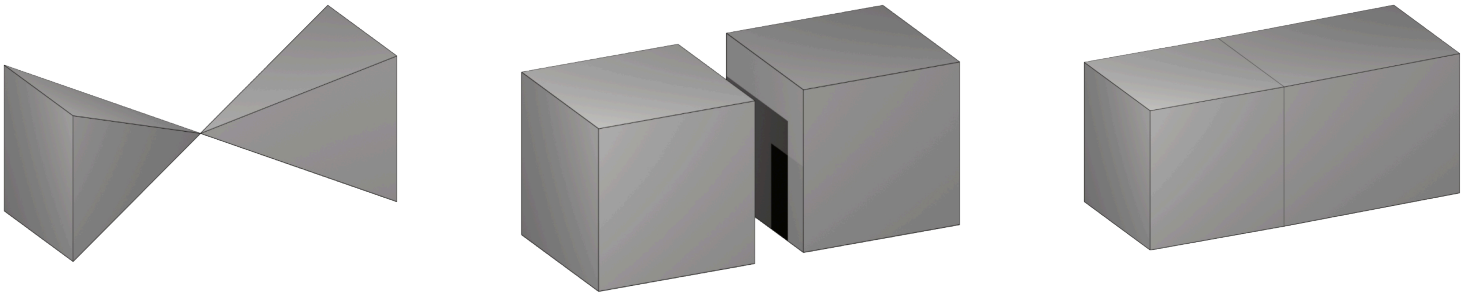
Selection menu **Shift + G**

◆

Merge Vertices,Edges,or Faces

M

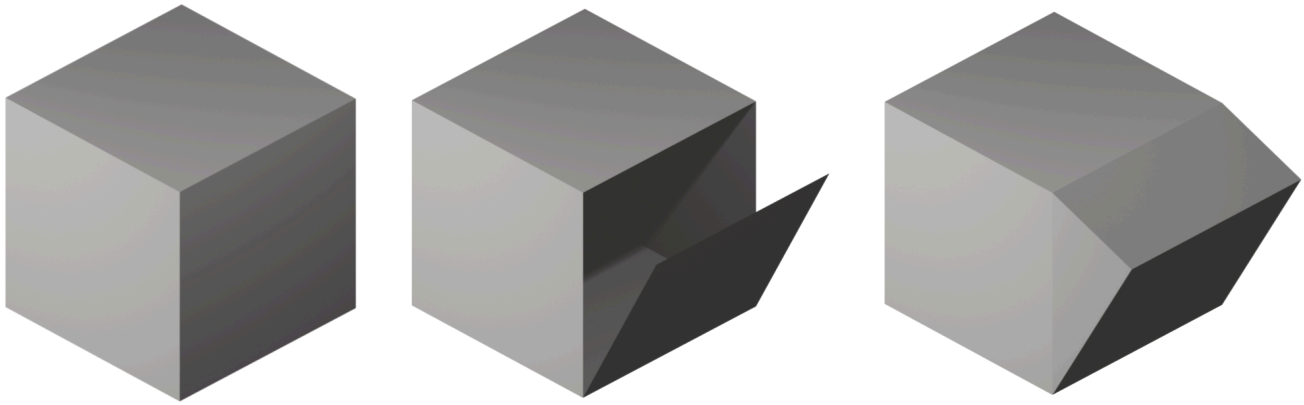




Rip Vertices

V

Rip creates a hole in your geometry by making a copy of selected vertices and edges which are still linked to the neighboring non-selected vertices, making it appear as though we ripped open the mesh object.



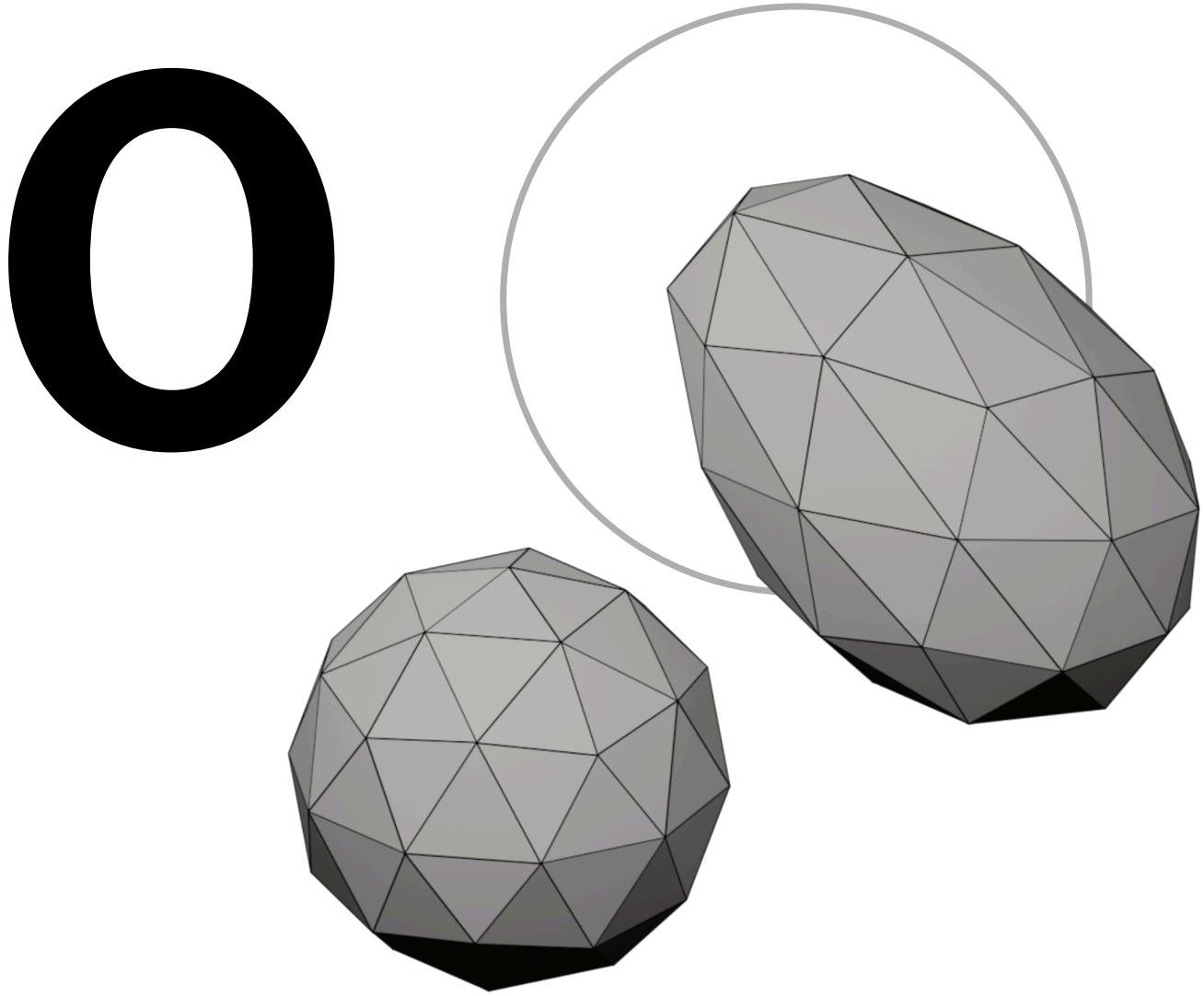
Alt+V

Creates new geometry around the rip.

Proportional editing

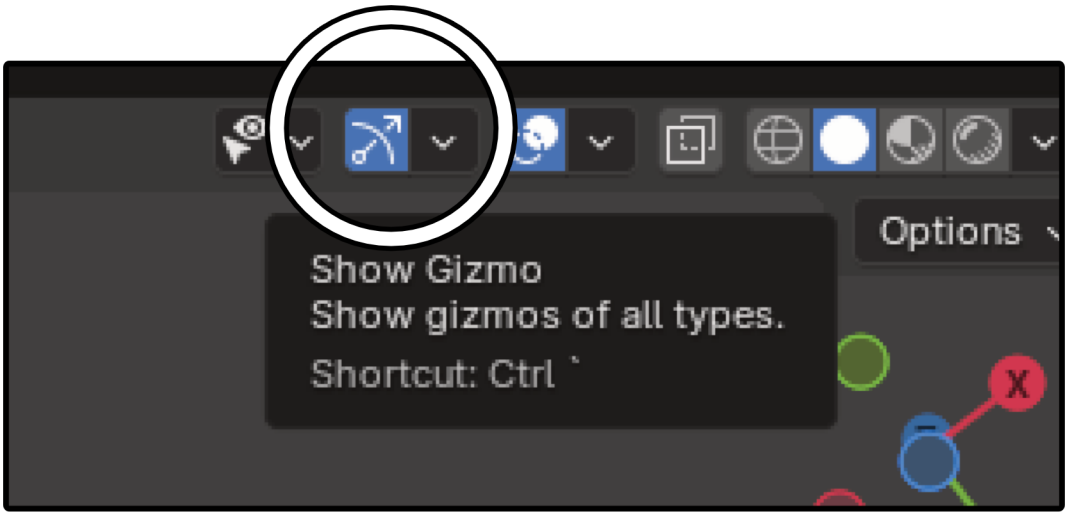
To manipulate multiple verteces/edges/ faces at once we use proportional editing.

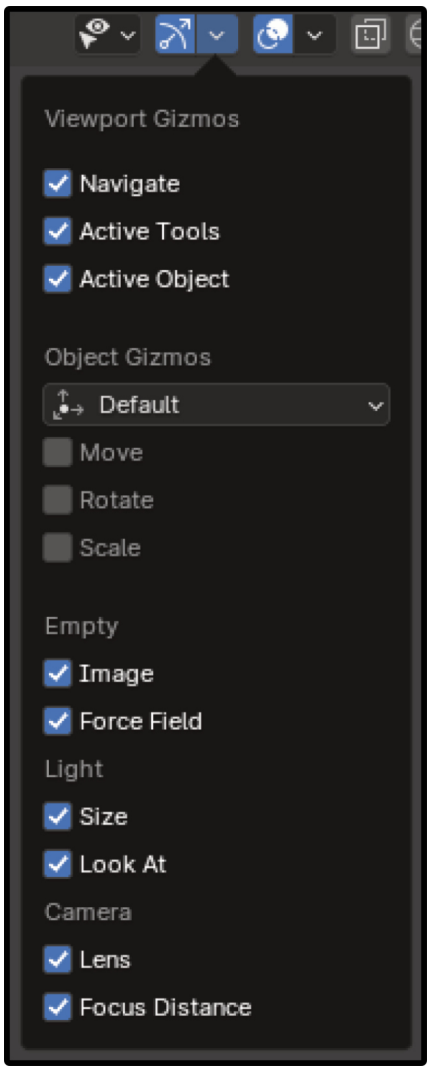
The mouse wheel expands and contracts the circle of influence

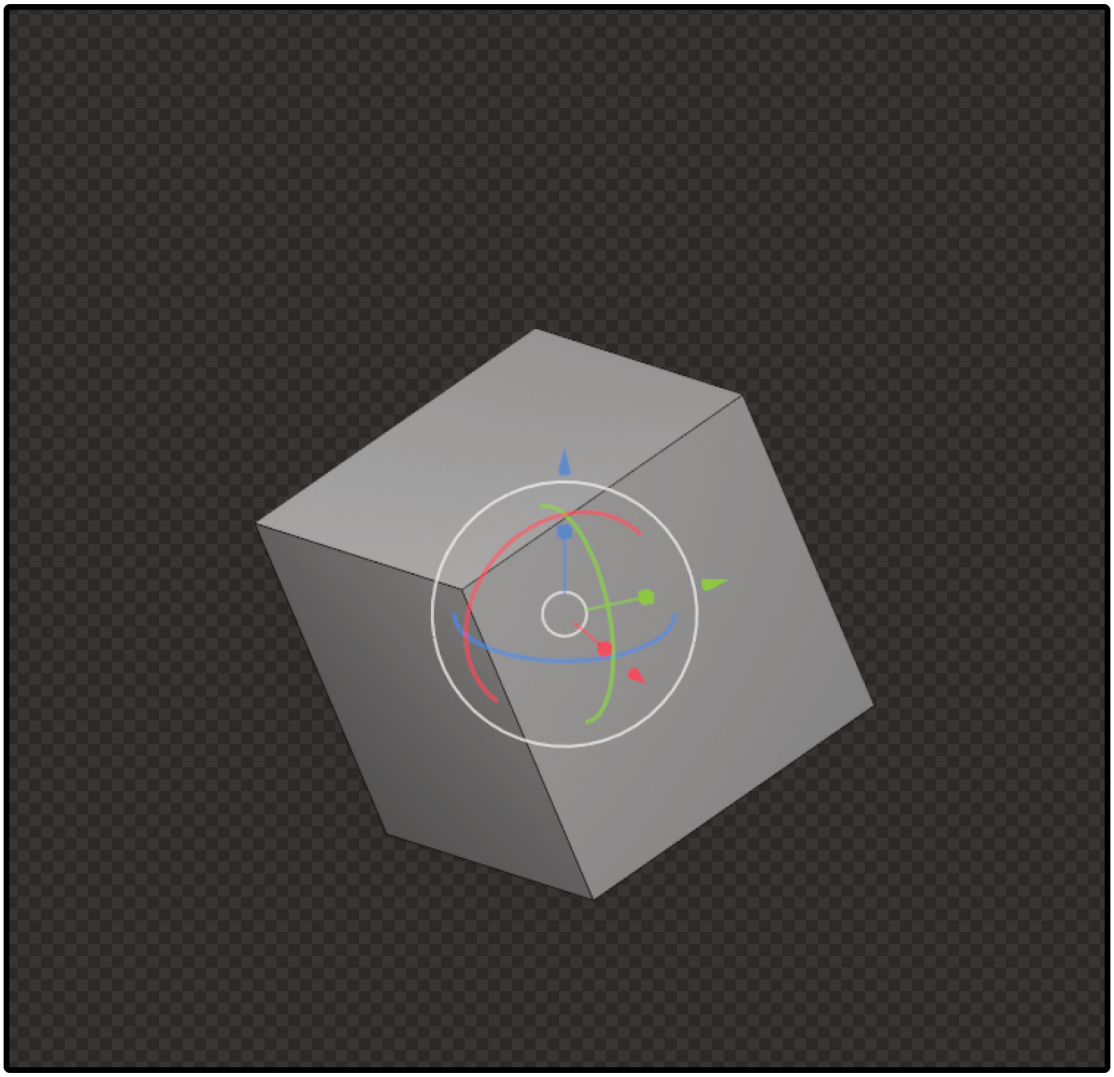


Manipulating objects using gizmos

In the show gizmo tab,
you can activate transformation controls for your objects.







Snapping

Snapping allows you to align objects and mesh elements to a selected target, as if the target were a magnet.

There are eight snapping target modes, and four “Snap base” paramiters which determine the point in the geometry which will snap to the target.

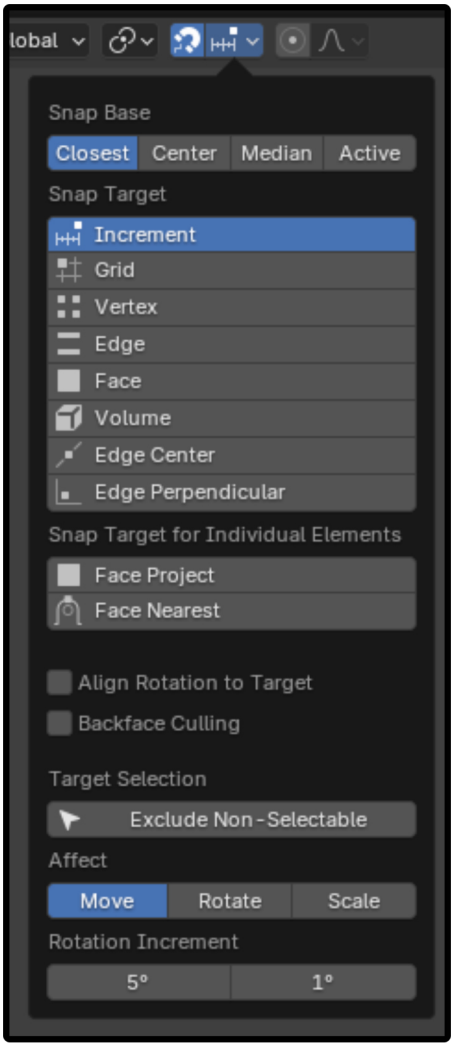
Snap Base

Closest
Snaps using the vertex that’s closest to the target.

Center
Snaps using the current pivot point of selection

Median
Snaps using the median (middle point) of the selection.

Active
Snaps using the origin if in object mode and the center of selection in edit mode



Snap Target

In order to accurately **snap to the faces** of another mesh, make sure your object’s origin point is at the bottom of the mesh, then toggle “**Face Project**” and “**Align Rotation to Target**”

Increment
Snaps to grid points. When in Orthographic view, the snapping increment changes depending on the zoom level.

Grid
Snaps to the grid that’s displayed in the viewport.

Vertex
Snaps to the vertex that’s closest to the mouse cursor.

Edge
Snaps to the edge that’s closest to the mouse cursor.

Face
Snaps to the face that’s closest to the mouse cursor

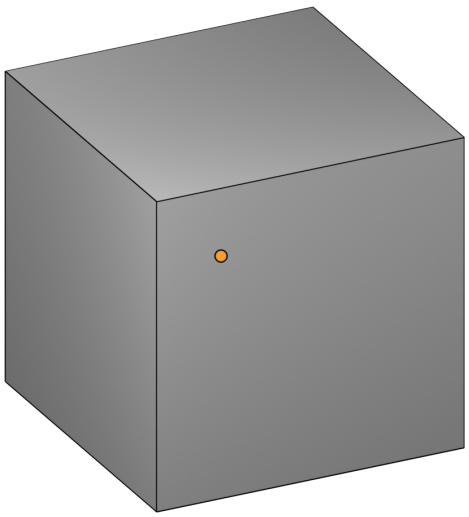
Volume
Snaps the selection to a depth that’s centered inside the object under the cursor. (good for armature)

Edge Center
Snaps to the centerpoint of the edge that’s closest to the mouse cursor.

Edge perpendicular
Snaps to a specific point on the edge so that the line from the selection’s original location (indicated by a white cross) to its new location is perpendicular to that edge.

Play around with the snap targets and base options to get a feel for what this tool can do.

Shift + Tab Toggles snapping

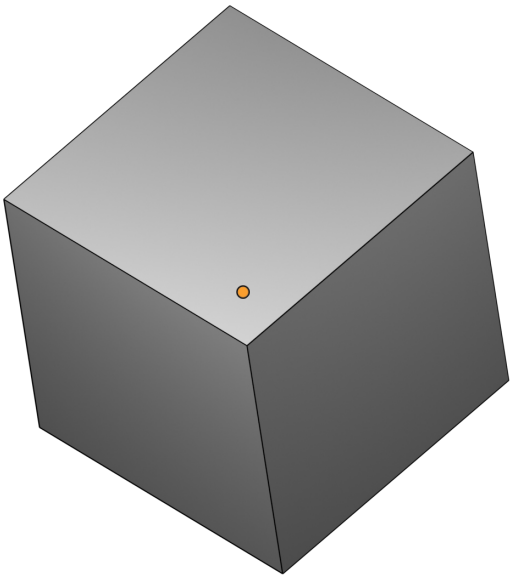


Origin point

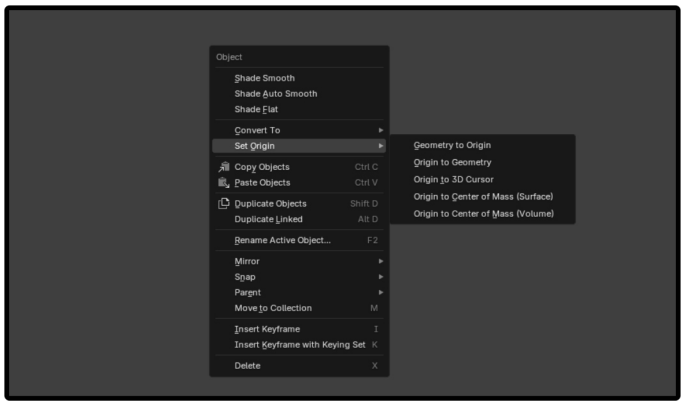
Each object has an origin that functions as a pivot point for transformations.

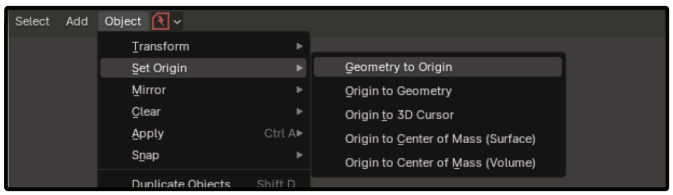
It appears in an object as an orange dot.

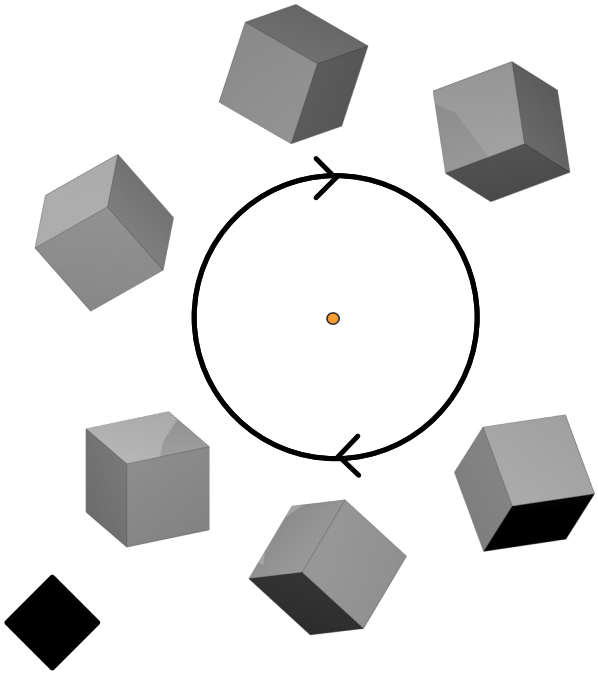
To move the origin, find the “set origin” section in the **RMB** menu when in object mode.



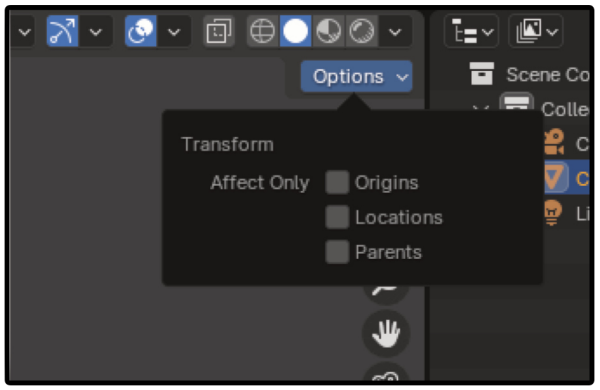
Or navigate to the object tab and search for “set origin”







In object mode, inside the options menu select **affect origins only** to manually move the origin point.

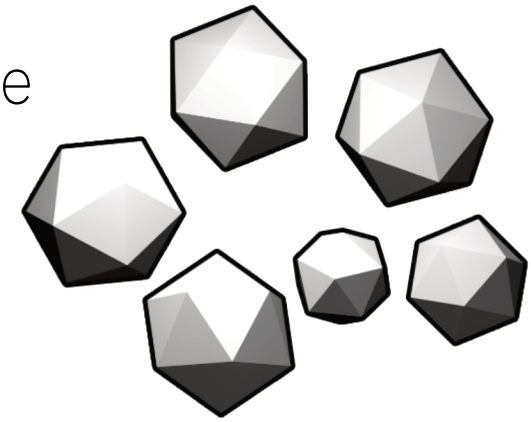


Transformation orientation and pivot point

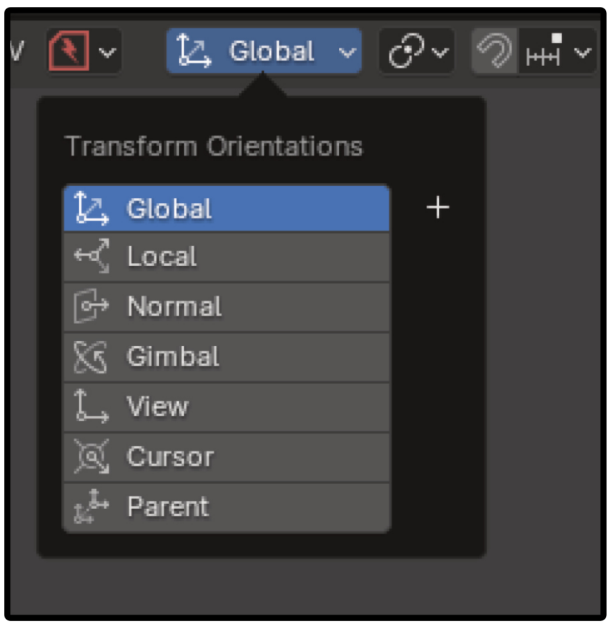
Blender has two transformation menus in the upper viewport.

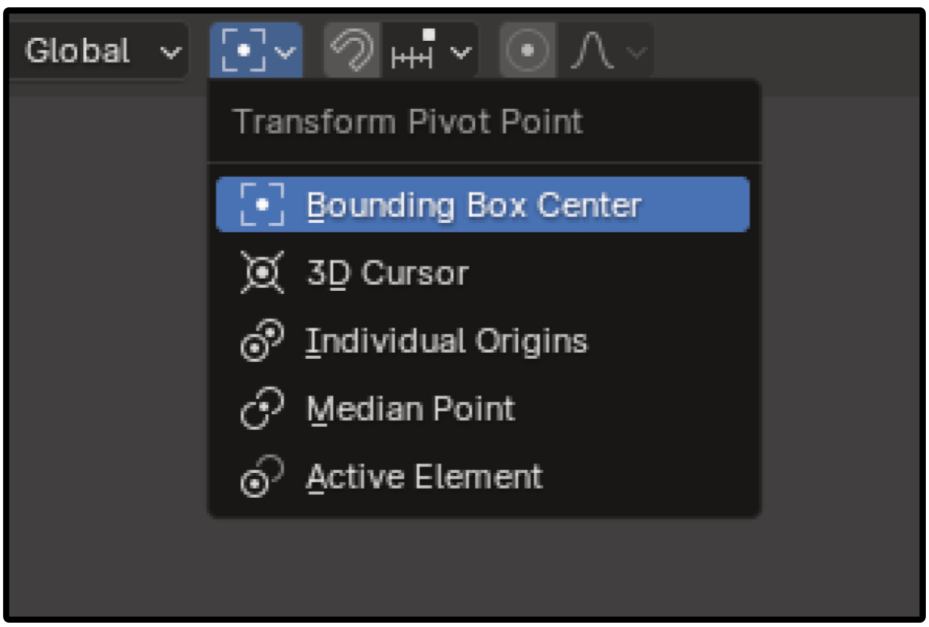
Transform orientation and **pivot points**.

The pivot points menu determines the **location of the origin points**, and the global orientation determines the **orientation of an object's axes.**



The pivot point serves as a distinct point from which an object can transform (like a hinge) and the global transformation defines the directionality inherent to an object (or relative to other objects).

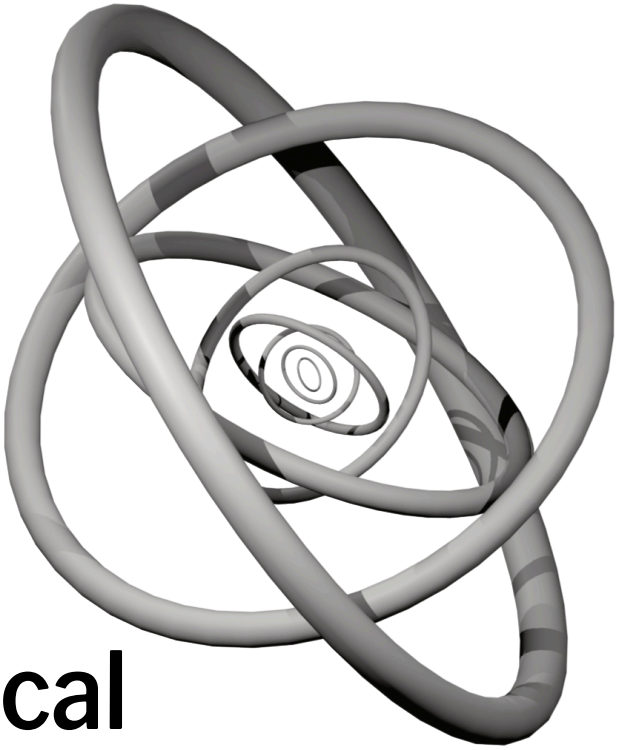




Transformation orientation

Comma ,

To open pie menu



Global

The object's transformations follow the global XYZ axes

Local

The object's transformations follow its individual/local axes

Normal

(in edit mode)
The object's transformations follow a selected face.
(In object mode)
Same as Local orientation

Gimbal

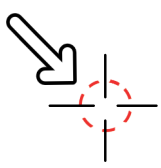
In the gimbal transformation orientation, each of the object's axes follow a hierarchy
Z follows Y which follows X
(We can modify this hierarchy)

View

The object's transformations Follow the screen's X Y Z axes

Cursor

The object's transformations Follow the 3D cursor

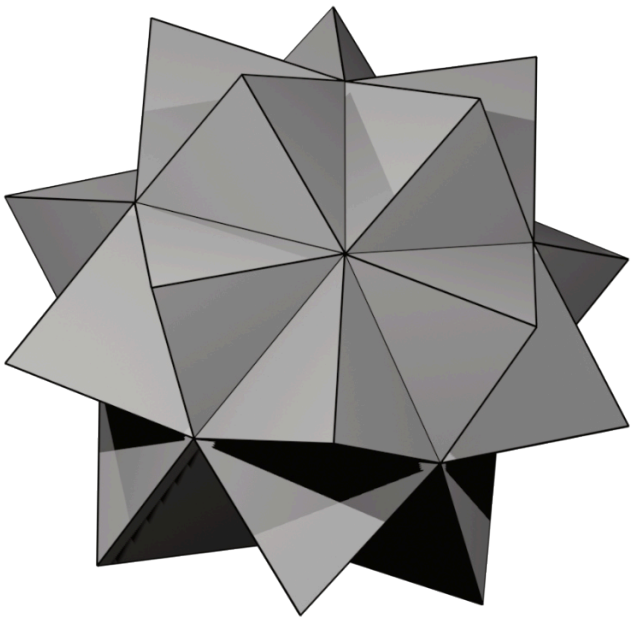


Superior (parent)

The object's transformations follow a second "parented" Object.

Transformation pivot point

Period .



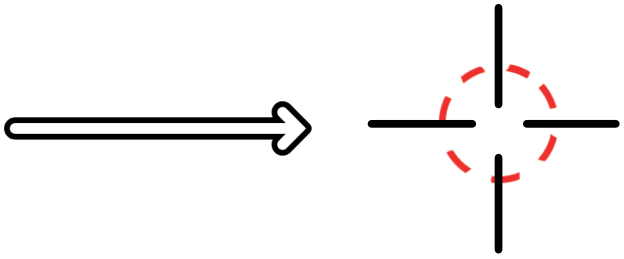
To open pie menu

Bounding box center

The pivot follows a point at the center of the volume of a box which fits as closely as possible around the selection while remaining aligned with the global axes.

Cursor 3D

The pivot point follows the 3D cursor



Individual origins

In object mode, the object transforms around its point of origin.
In edit mode, each element is transformed based on its own center.
(Example =The center of each individual face)

Median point

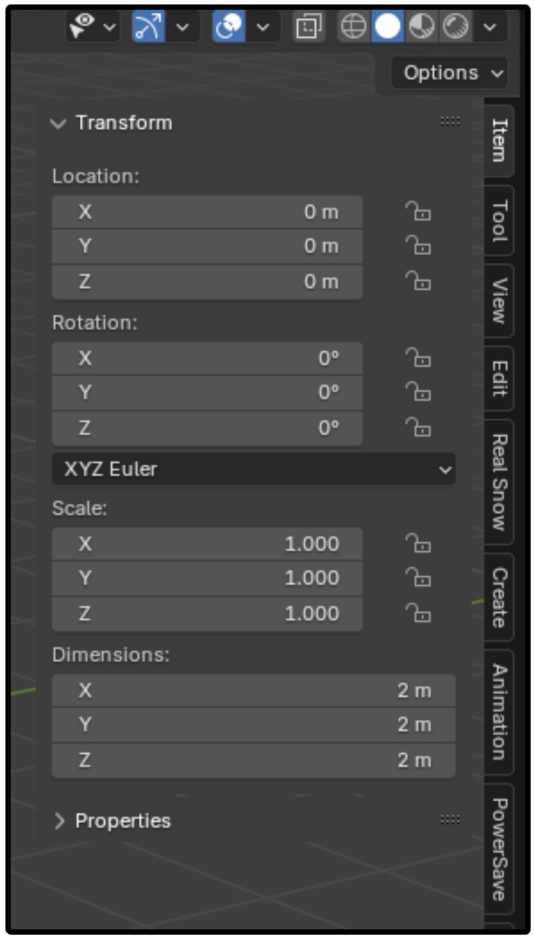
In object mode, the object's pivot is defined by the average of the selected objects' origins.
In edit mode the elements are transformed based on the average position of the selected vertices.
(This means that the pivot point will shift to the area with the densest geometry)

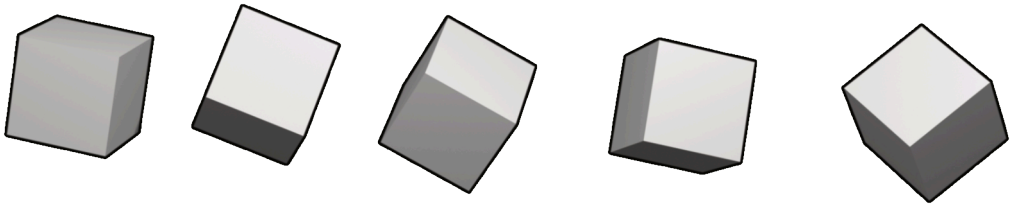
Active Element

The object or element is transformed according to the active object/element.
That is, the last selected object or element.
(The object/element with the lighter colored outline)

Side Bar **N**

Blender's sidebar enables us to view and adjust the parameters of our objects. It usually includes settings for any plugins we have added to Blender.

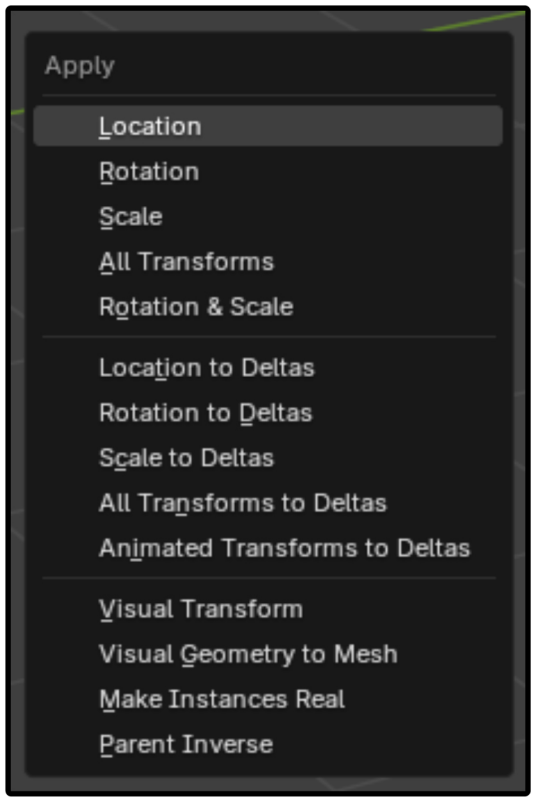




We can use the side bar to check wether or not the transformations we make in object mode need to be applied in order to avoid warping with the use of modifiers.

In the “Transform” tab most paramiters should be set to 0, or 1.000 for the “scale” inputs.

To apply any transformations made in object mode, press **Ctrl+A**.



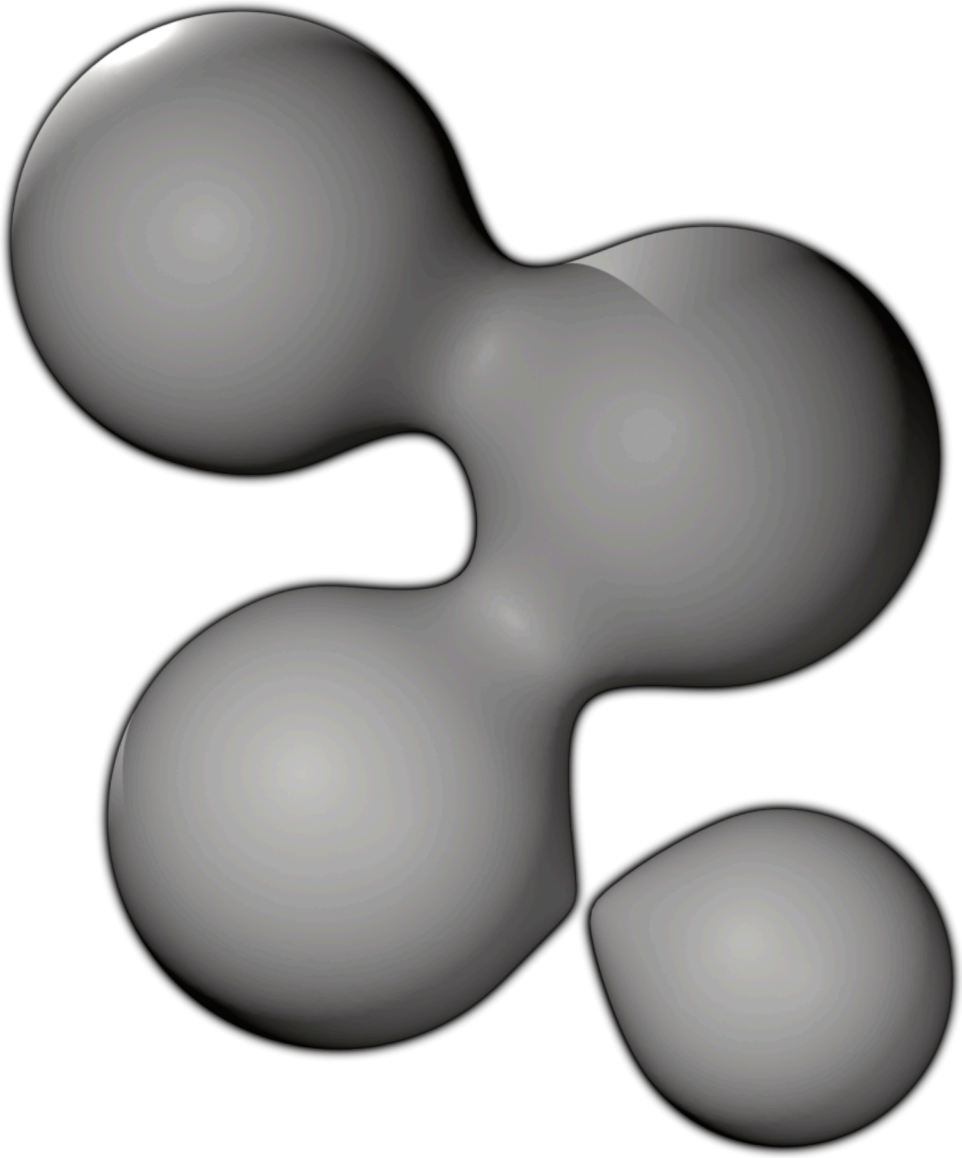
As of version 4.4.0, you will be notified in the lower context bar if the scale needs to be applied.

Meta objects

Meta objects are objects that act like mercury through mathematical algorithms.

They are implicit surfaces, meaning they are not explicitly defined by vertices (like normal meshes).

They can be converted to mesh objects and are a good way to define the general shape of an object before you start sculpting it.



Outliner editor

The Outliner is used to organize all of the objects in our scene. You can make new collections with **M**.

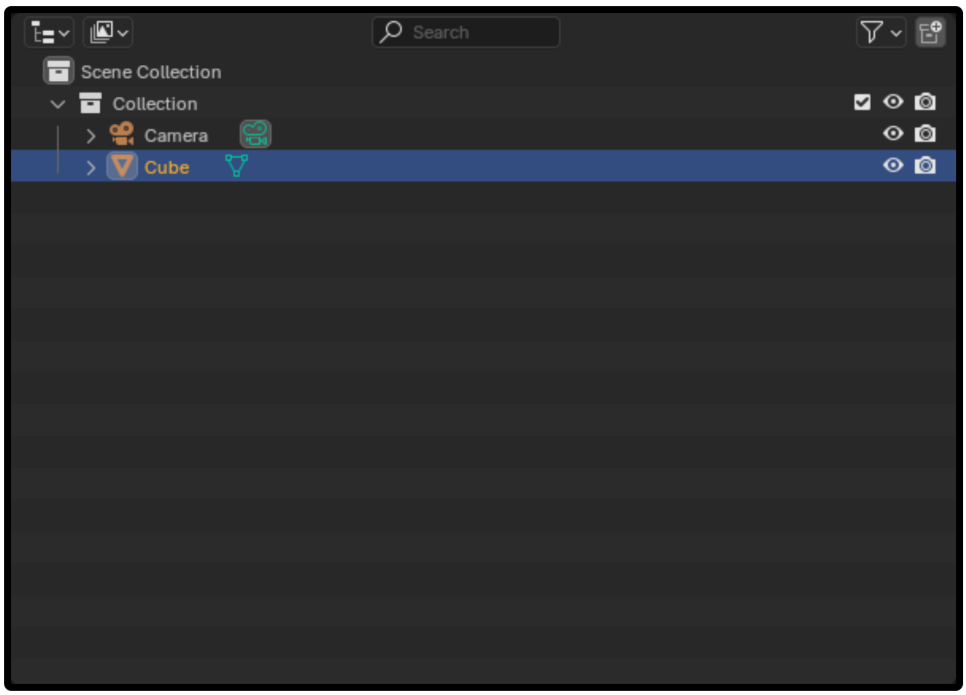
All objects selected will be added to the new collection when using the **M** shortcut.

We can also hide and remove the objects from our render using the camera and eye icons on the right of our objects.

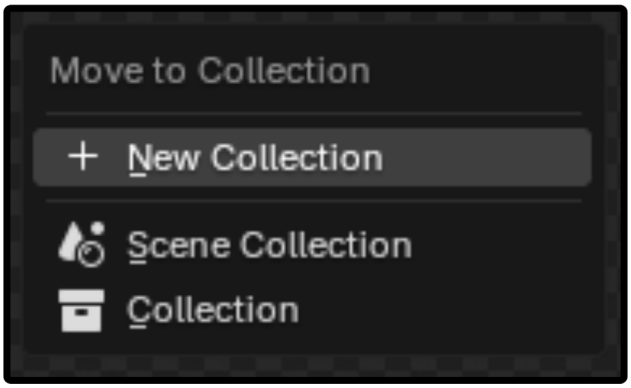
If the camera icon is turned off, the object will be absent from the final render.

If the eye icon is turned off, the object will be hidden in the viewport.

We can also hide our objects with **H** and bring them all back with **Alt+H**.



A collection is used to group objects together for organizational purposes. Think of them as folders which cintain your objects



Properties editor

The **Properties editor** is where we will work with most of the data for our objects and our render.

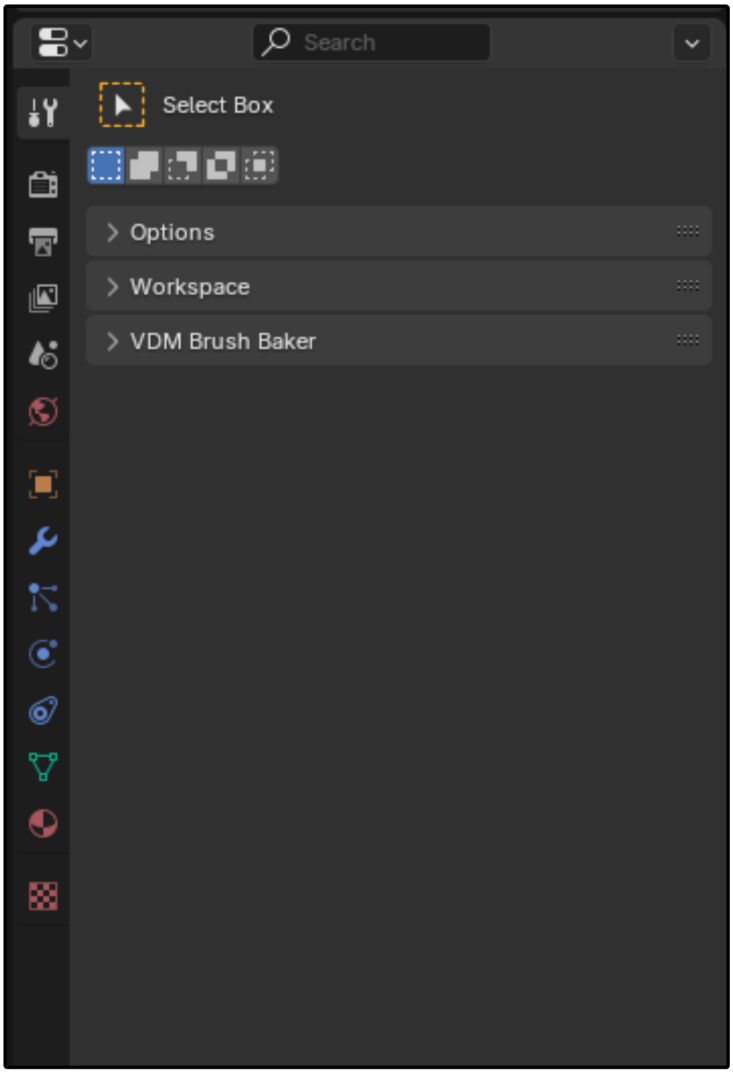
This is where we add modifiers, add physics and particle systems, manage our object's materials, as well as its constraint relationships and geometric data.

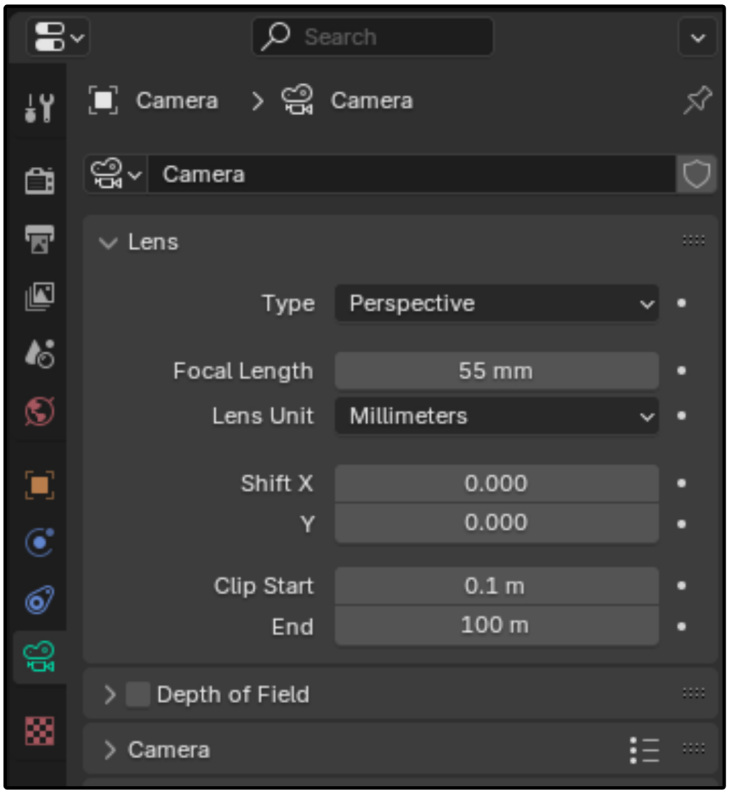
We also use the properties editor to change the paramiters of our render and image output, as well as the enviromnent material and post-processing layer information.

You'll notice that **the tabs change depending on what object is selected, and what object mode you find yourself in**.

For example, when a camera is selected, you can change the camera's paramiters inside of the "Data" tab.

This includes focal length, camera perspective mode, depth of field, and object clipping (how far away objects need to be in order to appear in the shot).





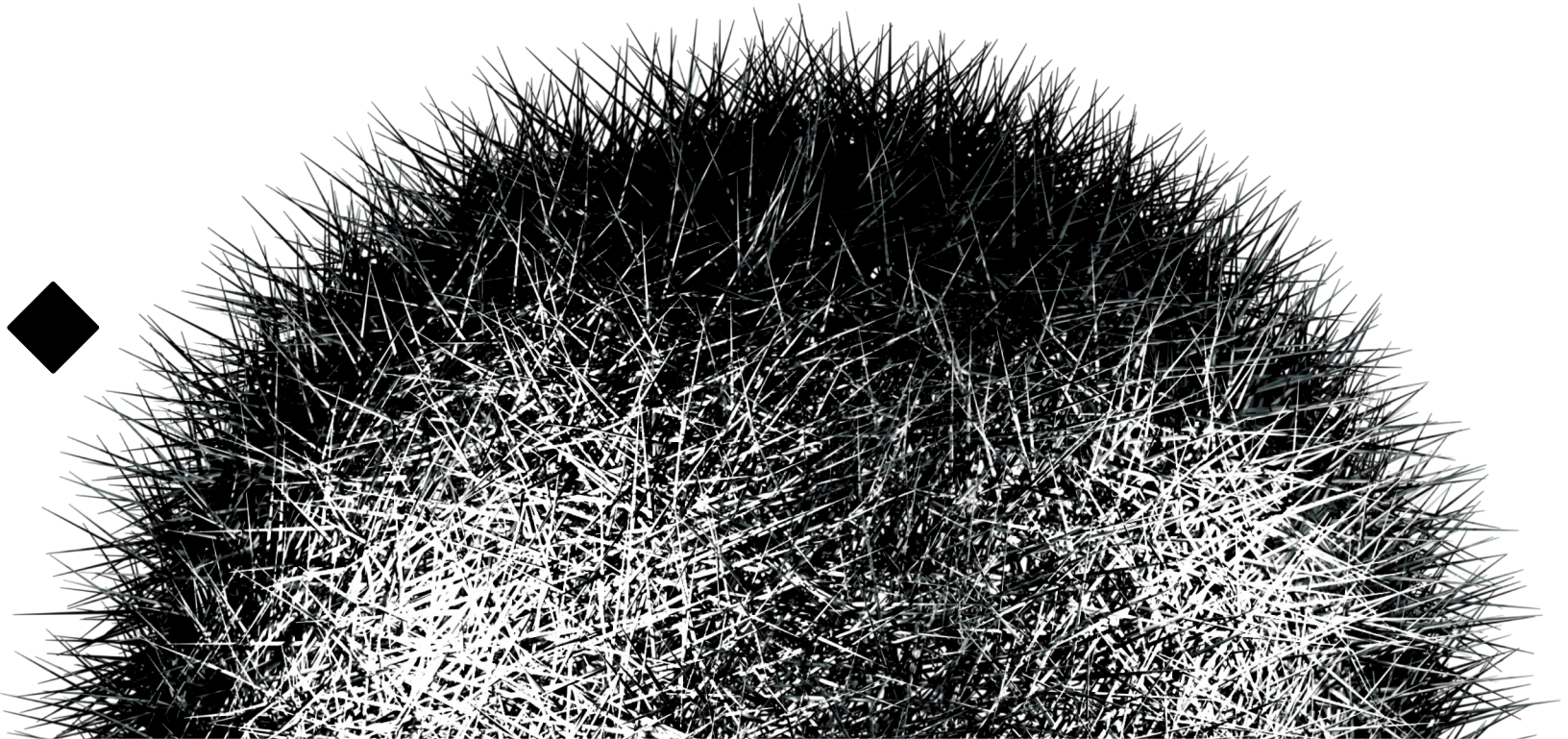
What is a render?

The final 2D image or video produced by one of the two lighting engines is known as a **render**. Blender captures the scene from the selected camera and processes the lighting information using either the EEVEE or Cycles render engine, ultimately creating a 2D representation of your 3D scene that can be used to produce an animation or image. While we typically use software like DaVinci Resolve to compile and composite the rendered shots, Blender also allows for compositing and sequencing videos directly within the software.

F12 renders an image.

Ctrl+F12 renders a video.

Read “Exporting”



Camera

A camera is an object that processes and defines what portion of the scene will be visible in the final render.

Multiple cameras can be used in the scene.

To see through your selected camera, press **tilde + 1**
or move the mouse diagonally south west in the view pie menu.

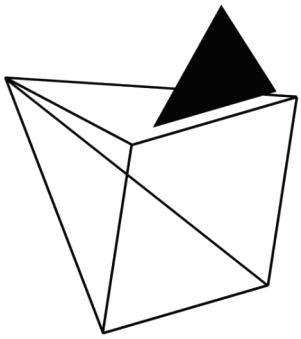
To better pisition and naviagte the camera in your scene, you can use flight mode (**Shift+Tilde**) or toggle **camera to view** in the sidebar (**N**) so that the camera follows your viewport.

Ctrl+**Alt**+Numpad **0** will align your camera to the viewport automatically

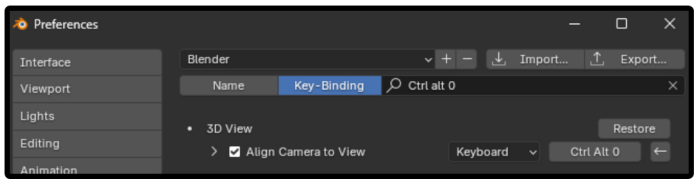
You can add Camera to view to the quick favorites menu

(**Right click + add to quick favorites**)

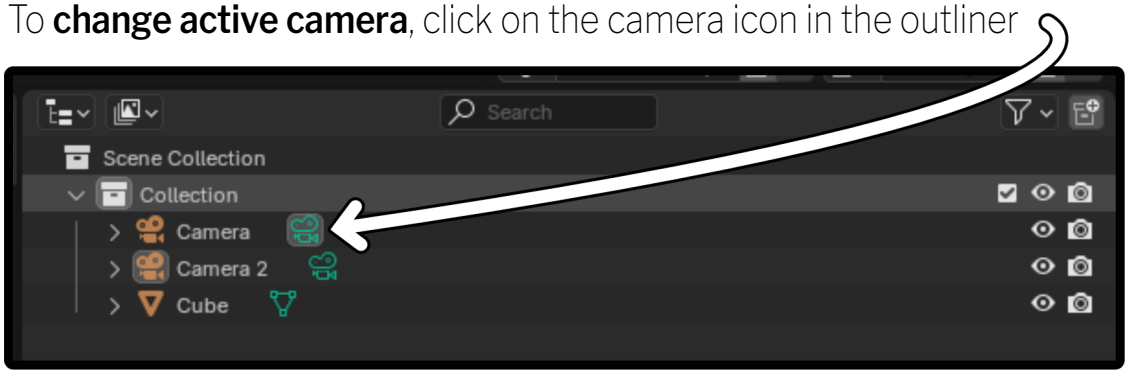
Quick Favorites = **Q**

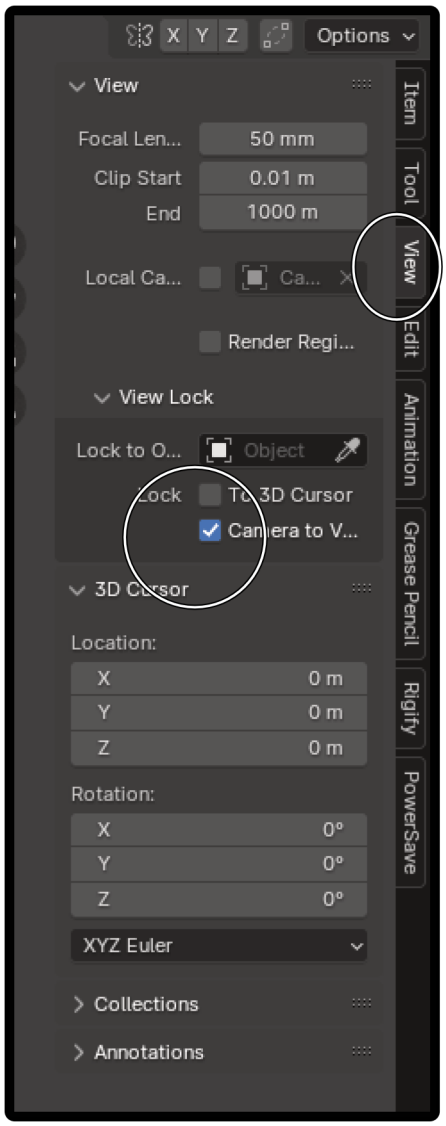


I recommend changing the
Ctrl+**Alt**+**Numpad 0** binding
(if you don't have a keyboard with a numpad)
in Blender's keymap settings to **Ctrl**+**alt**+**0**



To **change active camera**, click on the camera icon in the outliner



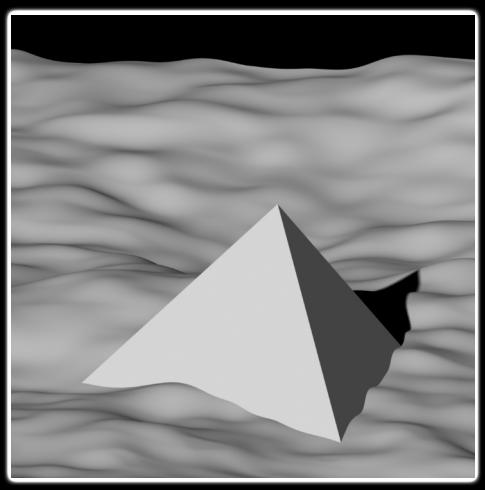


Orthographic and Perspective view

There are two visual perspective modes which we use in Blender for work and rendering.

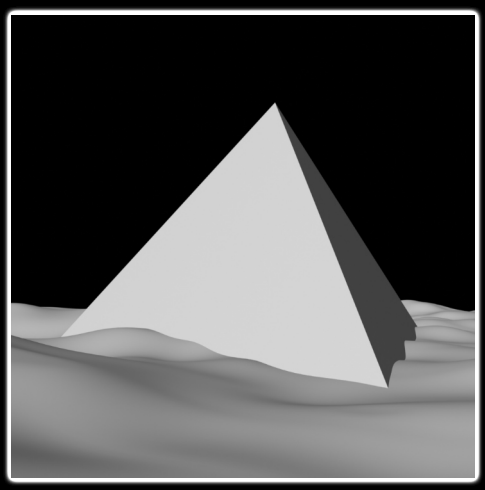
Orthographic

In orthographic view, objects are displayed without perspective distortion. This means that lines remain parallel, and shapes maintain their proportions regardless of depth.



Perspective

Perspective view simulates how the human eye perceives the world, where objects further away appear smaller, and parallel lines converge at a vanishing point.

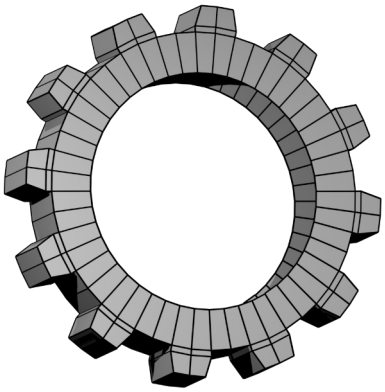


The viewport is typically displayed in perspective mode and switches to orthographic mode when selecting a view direction, or by pressing the perspective mode change button.

We can also change the perspective mode of any individual camera by navigating to the “Data” section in the properties editor with the desired camera selected, and changing the “Type” paramiter in the “Lens” tab.

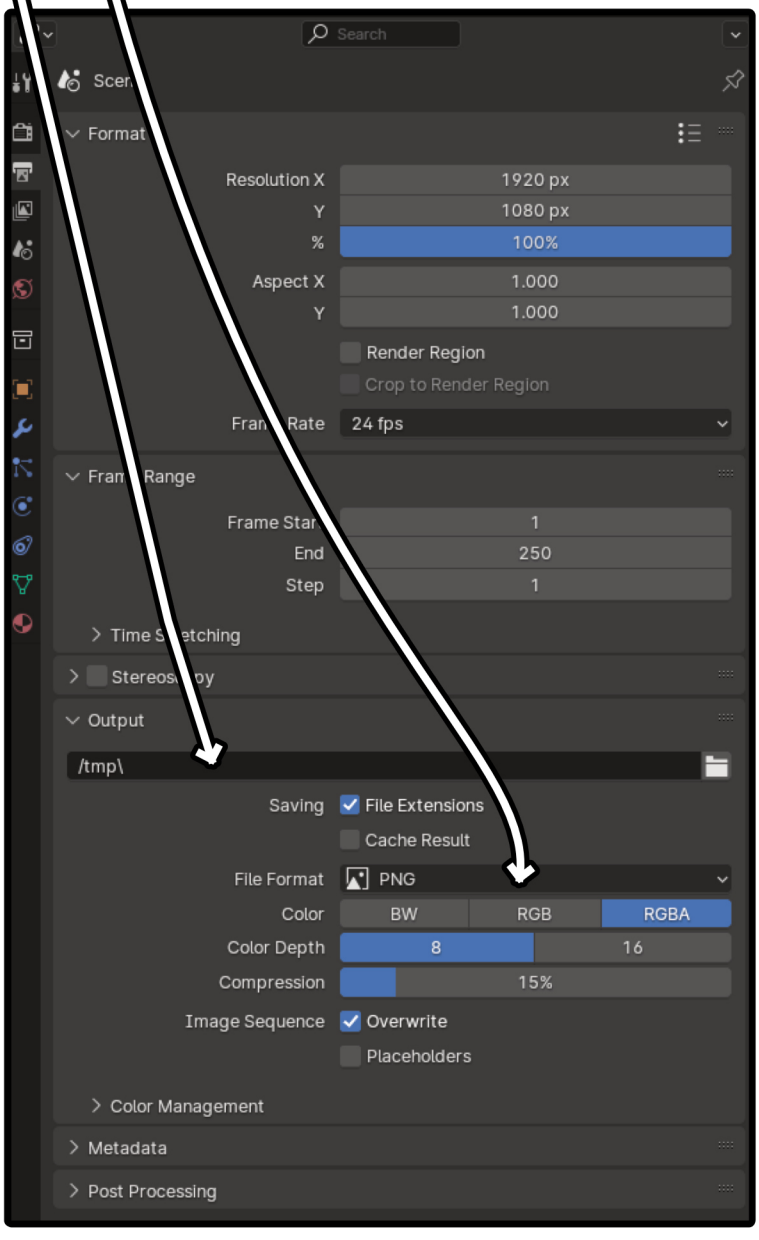
Exporting

In the properties editor, navigate to the printer icon to define the format of your final render. This is where you export a video or an image, define the dimensions of your render, and pick the frame-rate of your animation.



This is where you declare your render's save location

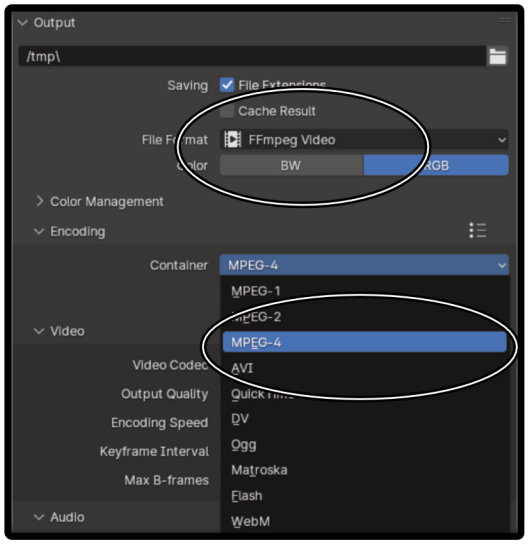
This is where you chose the format of your render

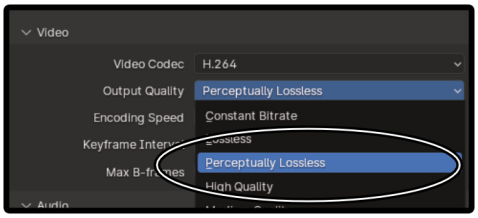


To save a video, change the file format to **Ffmpeg Video** and the container to **MPEG-4**

In "**output quality**" choose **perceptually lossless** for a **higher image quality**

If you click "render animation **Ctrl+f12**" with PNG (or any image format) active, you will export the frames of your animation as a series of images.





EEVEE & Cycles

Blender uses two engines to render images. One called **EEVEE** and another called **Cycles**.

EEVEE uses a process called rasterization. A system that estimates the way light interacts with objects and materials using numerous algorithms in real time. EEVEE is the lightest and fastest engine that Blender uses, but it is more difficult to achieve photorealism.

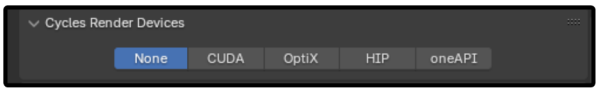
(With Blender's 4.1 update, EEVEE is now capable of using ray-tracing)

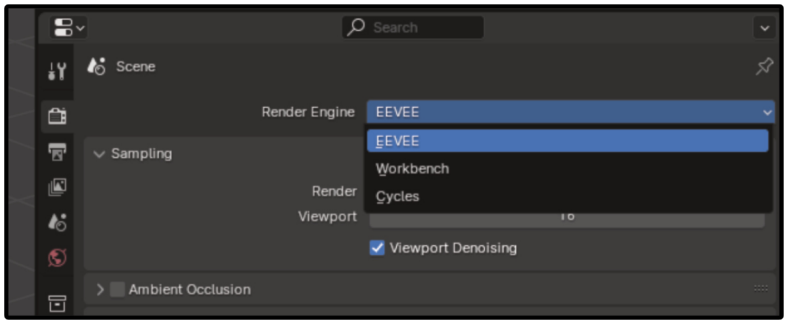
Cycles uses **physically-based path tracing** or "**Raytracing**"

It simulates light paths to approximate a photorealistic image. The Cycles rendering engine consumes a lot of your computer's GPU and it is recommended that you use a higher end GPU in order to avoid slowing down your computer and renders.
(you can always modify the render settings to make it a little easier on your graphics card)

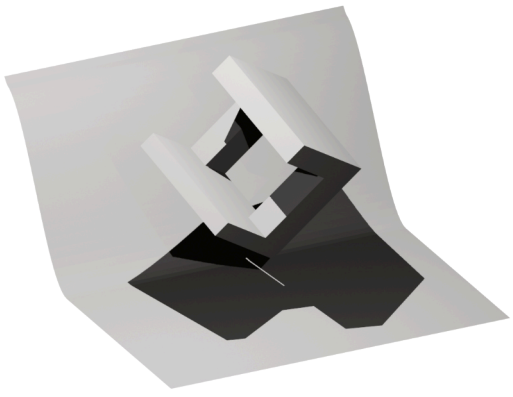
You can pick the engine in the render tab in the properties editor.

Note: if you use Cycles, make sure to activate GPU rendering in the Preferences, under the "System" tab.

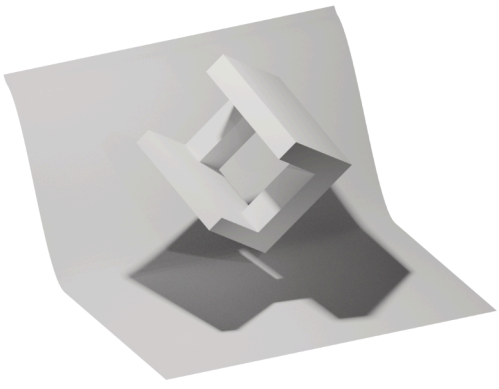




EEVEE



Cycles



Extra Tips

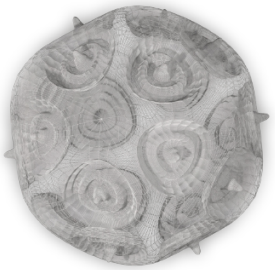
When you modify a mesh, the **right click** cancels the modification and the **left click** accepts it.

Alt + manipulation shortcut (**G, S, R,** etc) resets the manipulation. For example, **Alt+R** resets all rotation parameters to zero. (in Object mode)
(**Alt** generally works as a shortcut to reset a parameter)

Ctrl + Space isolates a screen.

Alt + Q with the mouse over a second object in a mode other than object mode, changes objects quickly.

Ctrl-f Ctrl-e Ctrl-v
Faces, edges, and points menu.



Ctrl I Invert selection.

Ctrl M + XYZ (**or middle mouse click + drag**) Quick Mirror.

/ Isolates an object. (press again to exit)

Shift + R Repeats the last operation

You can convert different object types in the RMB menu in object mode.

Curve, **Meta-ball**, **Text**, and **Greace pencil** objects can convert to **Mesh** objects.

Mesh objects can be converted into **Grease pencil** objects and **Curve** objects (only edges).