

BLENDER STARTER KIT PART 1 – PART 2

Corso Realtà Virtuale 2020/2021

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MODELING

<https://docs.blender.org/manual/en/latest/modeling/#>



ADD – DUPLICATE – DELETE

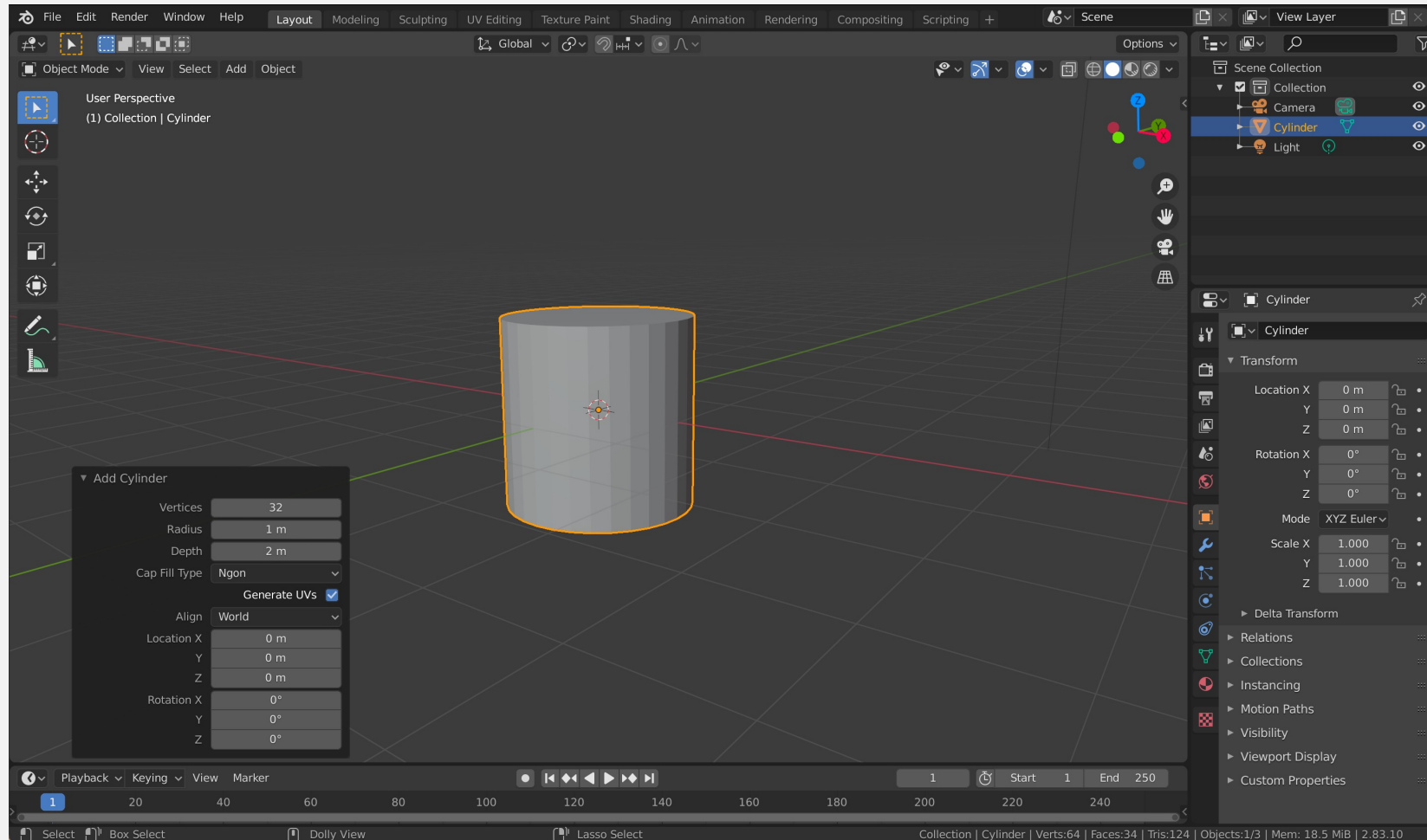
- You can delete an object with:
 - **[X]** and then confirm
 - **[canc]**
 - Click on **Object > Delete**
- You can add an object with
 - **[Shift][A]**
 - Click on **Add** (in the top left)
- You can duplicate objects with
 - **[Shift][D]**
 - Click on **Object > Duplicate Objects**



SOME TIPS - ADD

Every time you create an object it appears “Add (Object name)” button in the bottom left. If you click on it you can change the Object’s attributes: n° vertices, location...

Pay attention! If you click in another area the button disappears.



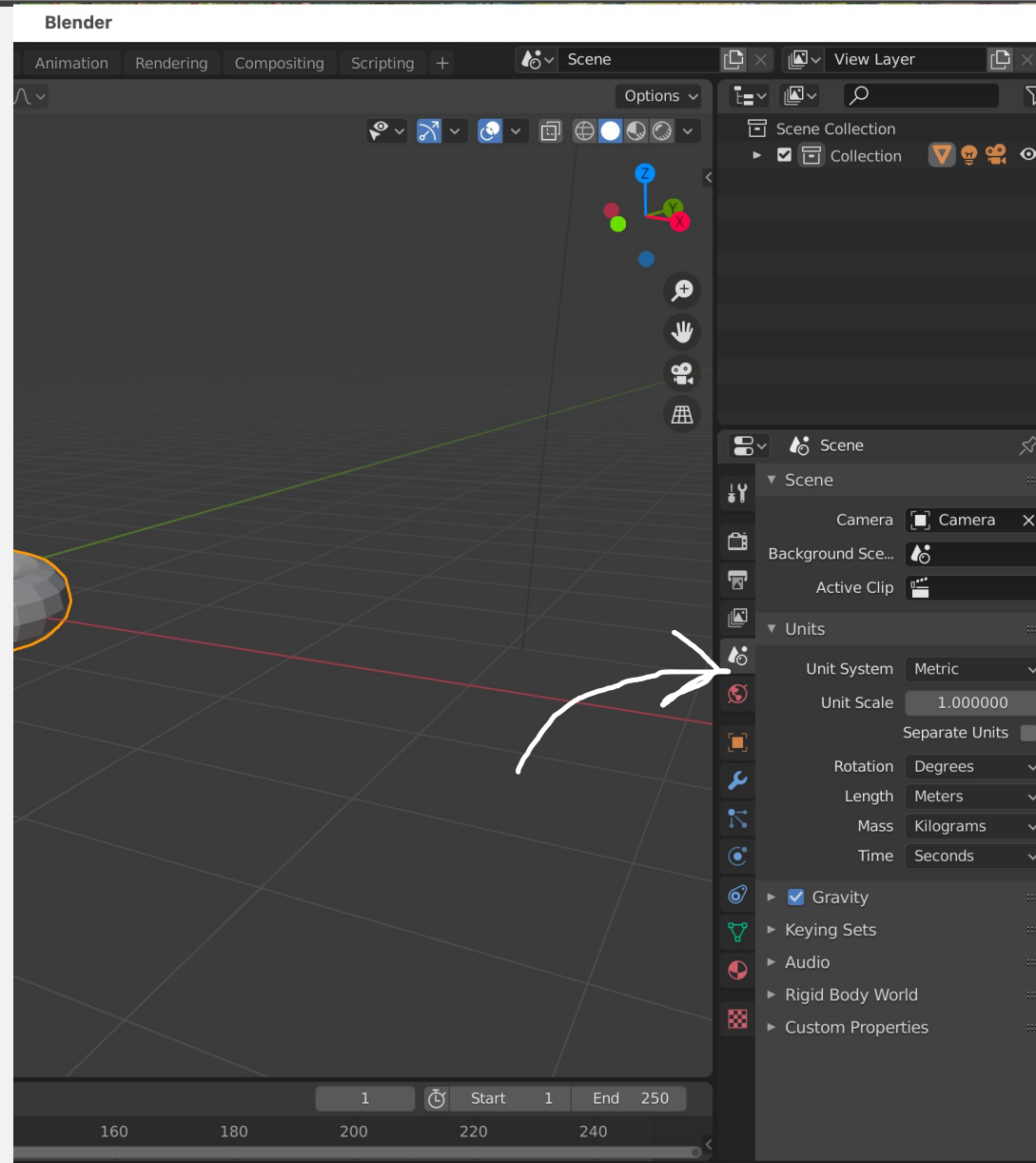
UNIT SYSTEM

You can change the Unit System in the section:

Scene Properties

under the voice:

Units



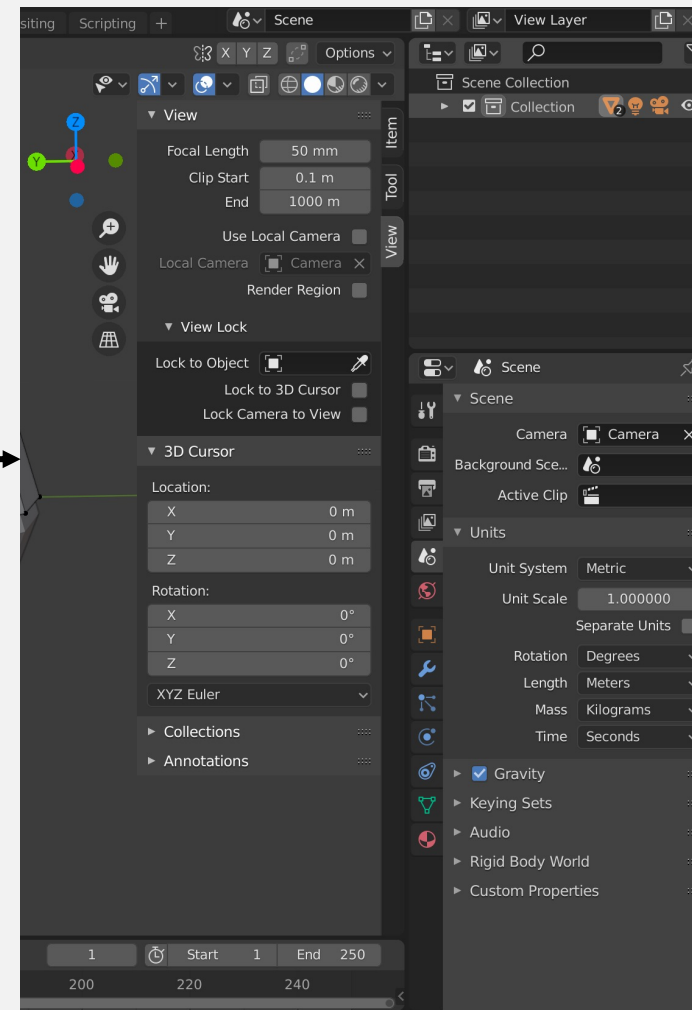
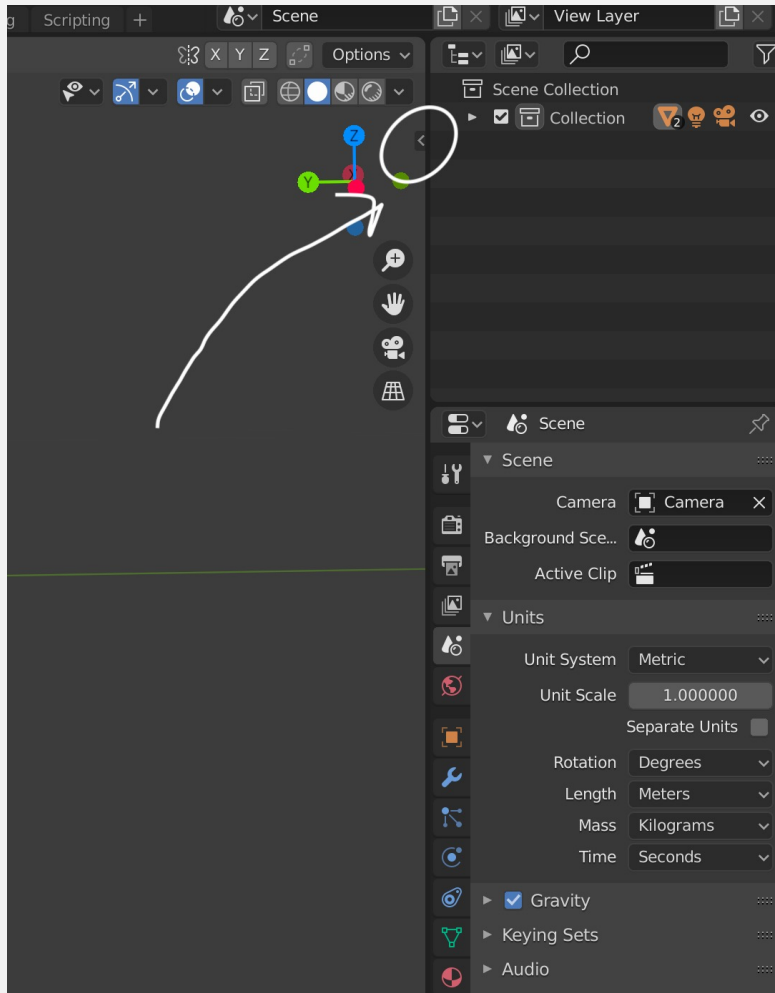
VIEWPORT NAVIGATION

- Zoom in/out with mouse **Scroll**
- Orbit view when **holding middle mouse button**
- Move to an area in the scene with:
[Shift] + hold middle mouse
- Focus on current object with:
 - Press numpad **Period .**
 - Click on
View > Frame Selected
- Align view with an axis with
 - **[alt] + middle mouse click**
 - Front (y aligned) numpad **1**, Side (x aligned) numpad **3**, Top down (z aligned) numpad **7**



CHANGE VIEW SETTINGS

You can change view settings clicking on the little arrow in the top near the **Collection** or with the hotkey [N]



GRAB – SCALE – ROTATE

Press Esc or Right click to cancel the action, Left click to confirm

Move [G] (Grab)
Rotate [R]
Scale [S]
along axes: [X] [Y] [Z] or middle click

Hold middle mouse button to orbit and change the view
[Shift] + middle mouse to drag to a new section in the view

Collection | Cube | Verts:8 | Faces:6 | Tris:12 | Objects:1/3 | Mem: 16.4 MiB | 2.83.10

The image shows the Blender 2.80.0 interface. The 3D viewport displays a grey cube with a yellow bounding box. A red line indicates the X-axis, a green line the Y-axis, and a blue line the Z-axis. The left sidebar shows the 'Tools' shelf with icons for Move, Rotate, and Scale. The right sidebar shows the 'Properties' panel for the selected 'Cube' object, with the 'Transform' section expanded. The top status bar shows the current object and scene information.

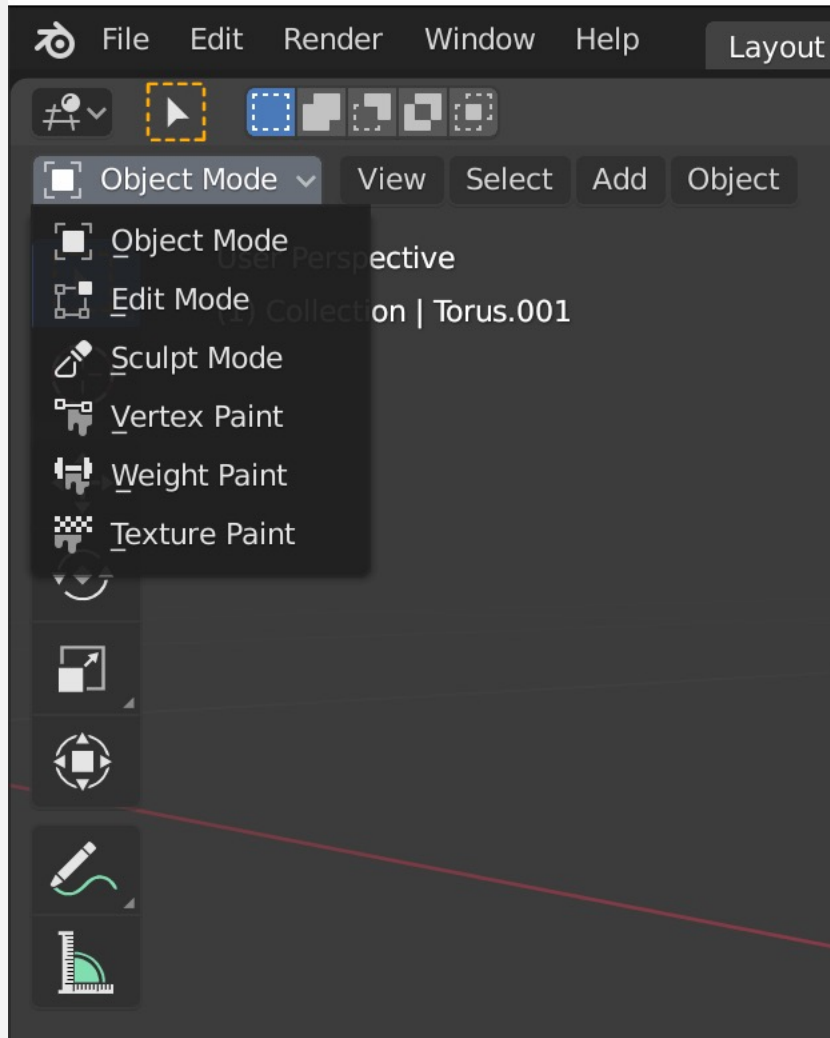


GRAB – SCALE – ROTATE

- Move (Grab) object with: **[G]**
- Rotate object with: **[R]**
- Scale object with: **[S]**
- You can move/rotate/scale an object along an axis with: **[X] [Y] [Z]**
- When executing an action press **left click** to confirm, **right click** or **esc** to cancel



SWITCH BETWEEN OBJECT MODES



In Blender you can switch between Object Modes.

In the top left corner you can see the **Object Modes dropdown menu** that you can use to switch between Modes.

Otherwise you can choose a mode in the Pie menu appearing with hotkey **[ctrl] [tab]**

List of Object Modes:

<https://docs.blender.org/manual/en/latest/editors/3dview/modes.html>



OBJECT & EDIT MODE

Two of the Object Modes are the **Object Mode** and the **Edit Mode**, from Blender docs:

- The **Object Mode** is dedicated to Object data-block editing (e.g. position, rotation, size)

https://docs.blender.org/manual/en/latest/scene_layout/object/index.html

- The **Edit Mode** is dedicated to object's “shape” *Object Data* data-block editing (e.g. vertices/edges/faces for meshes [...])
Since Edit mode is dedicated to shapes, the light, the camera, ... cannot be selected in this mode.

<https://docs.blender.org/manual/en/latest/modeling/index.html>

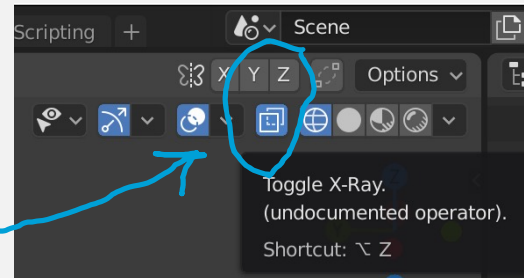


EDIT MODE

- You can switch between the *Current Mode* (Object, Sculpt ...) and the **Edit Mode** with **[tab]**
- Inside Edit Mode:
 - You can use **X-Ray Mode** to see the vertices through the object with

- **[alt] [Z]**

- X-Ray button in the top right area 



- You can select all the vertices of an object with **[A]**
 - You can deselect all with **[alt] [A]**



EDIT MODE

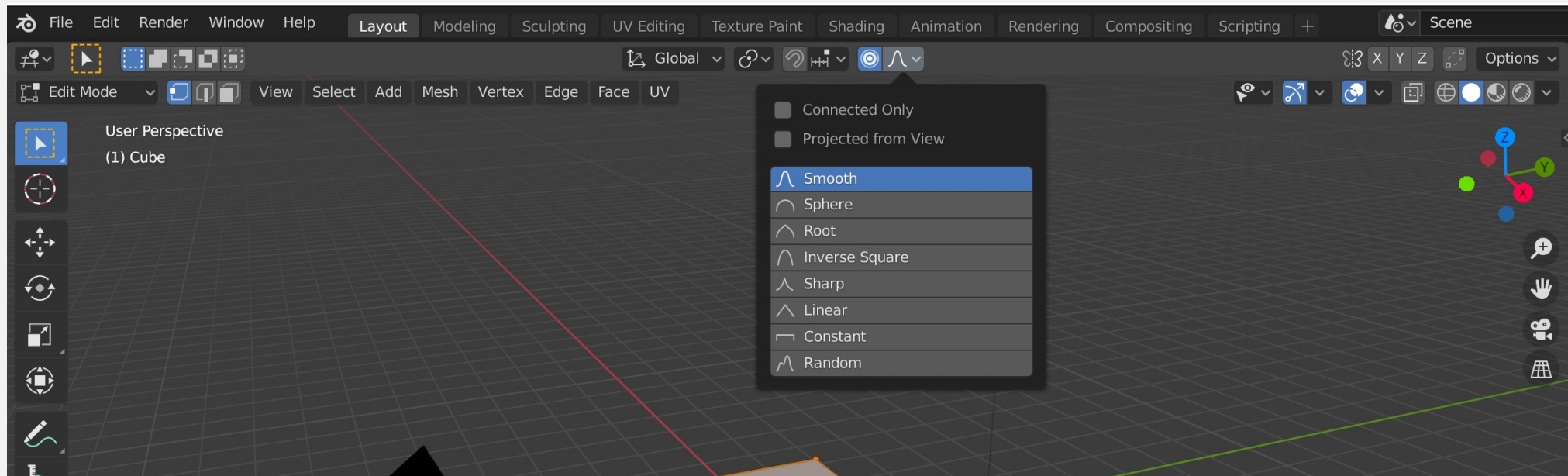
- Inside **Edit Mode** (Continue):
 - When you click on a vertex, you can use **[ctrl] [L]** to select all vertices connected with that
 - You can select all vertices connected in a loop with **[alt] + left click** on a vertex
 - You can select multiple vertices and create a new face (Extrude) with **[E]**
 - You can *invert the selection* with
 - **[ctrl] [I]**
 - Click on **Select > Invert**



PROPORTIONAL EDITING

- It is the way to transform selected elements (such as vertices) while having that transformation affect other nearby elements, hotkey: **[O]**

https://docs.blender.org/manual/en/latest/editors/3dview/controls/proportional_editing.html

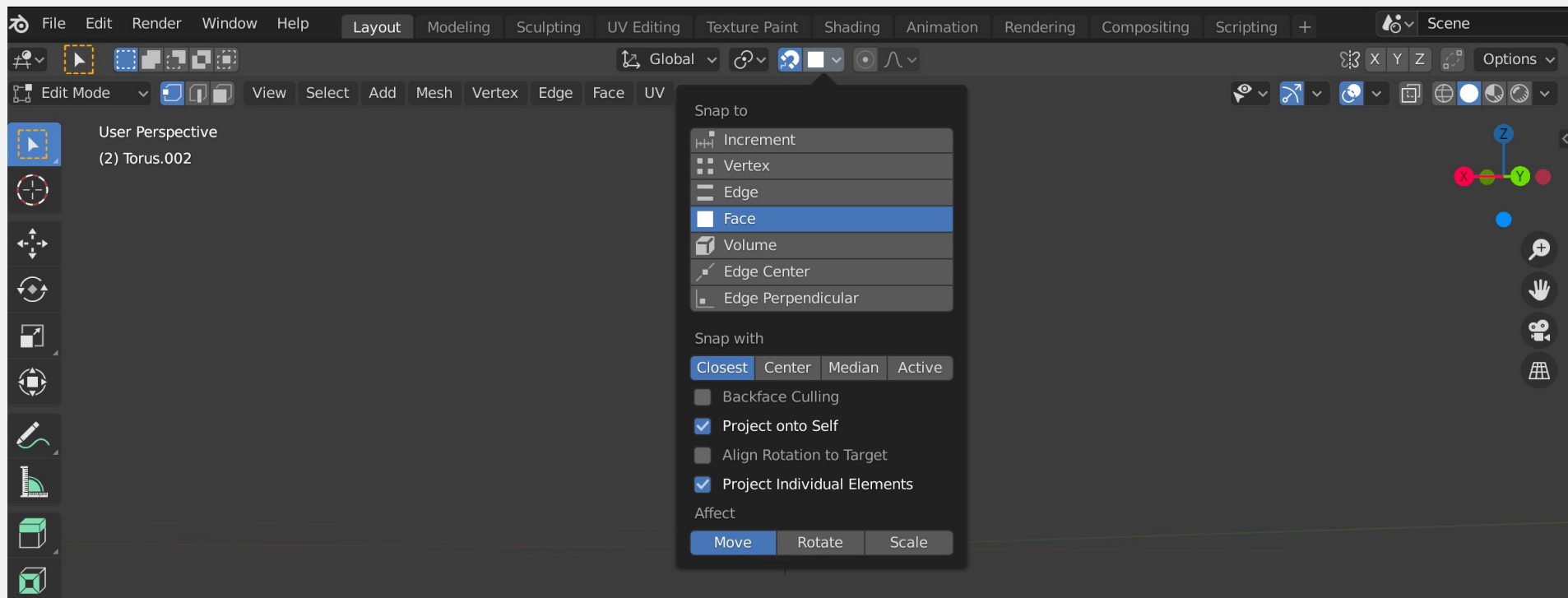


- Use **scroll** to increase / decrease the area affected by the transformation.
Example: **[G]** to grab a vertex and then scroll to choose the affected area

TRANSFORM SNAPPING

- It is the ability to snap objects and mesh to different types of elements during a transformation, hotkey: **[shift][tab]**

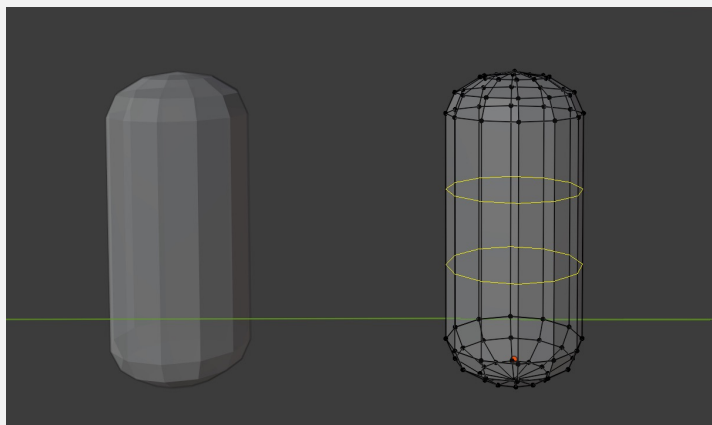
<https://docs.blender.org/manual/en/latest/editors/3dview/controls/snapping.html>



LOOP CUT

- You can perform a Loop Cut with the hotkey **[ctrl] [R]**

The Loop cut splits the surface inserting a new edge loop intersecting the chosen edge



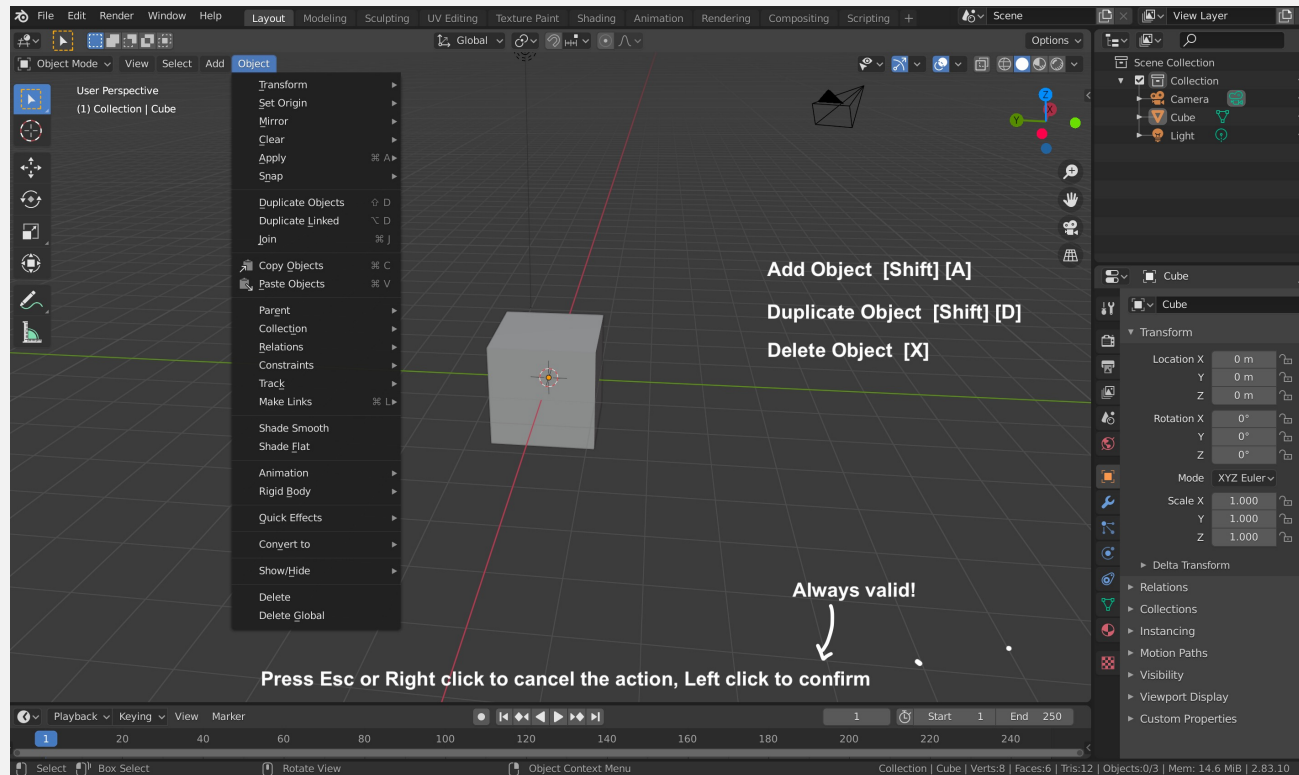
- You can perform multiple cuts intersecting the same edge,
 1. Press the loop cut hokey
 2. Roll the middle mouse to add new cuts

<https://docs.blender.org/manual/en/latest/modeling/meshes/tools/loop.html>

https://docs.blender.org/manual/en/latest/modeling/meshes/editing/edge/loopcut_slide.html#loop-cut-and-slide



COLLECTIONS

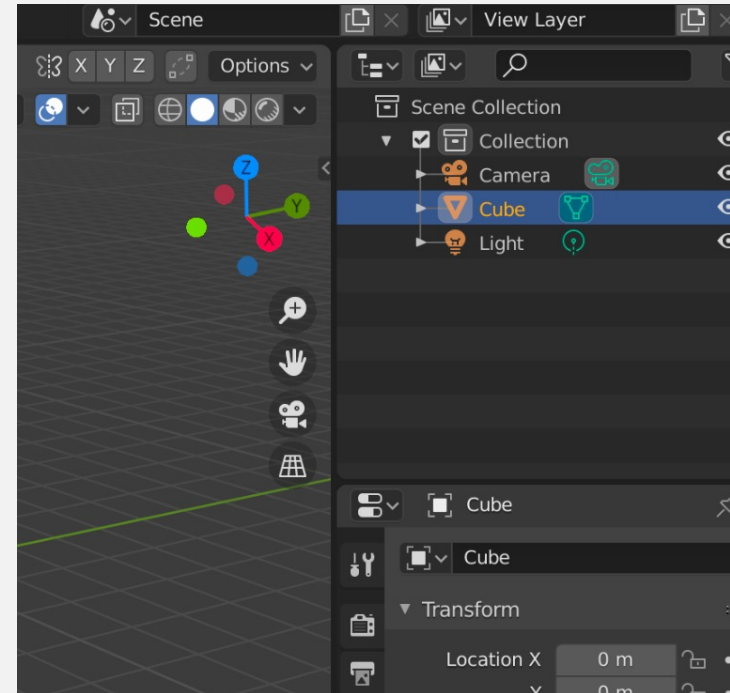


- You can Move an object to an Existing / New Collection with hotkey **[M]**
- You can select a geometry and separate it into a New Object with hotkey **[P]**
- You can Parent an Object (that becomes the “Child”) with another Object : First select the object to be the child, hold **[shift]** and then select the object to be the parent, now press **[ctrl] [P]** then selecting “Object (Keep Transform)”



HIDE OBJECT

- You can hide an object temporarily from the view with
 - Hotkey **[H]**
- You can restore and unhide with
 - Hotkey **[alt] [H]**
- You can also hide/unhide manually in the **Scene Collection** panel



JOIN AND DELETE OVERLAPPING GEOMETRY

- Join two objects [ctrl] [J]
- Open Face Menu [ctrl] [F]
 - **Intersect (Knife)** to cut the geometry, and choose the options:
 - “Self Intersect” to operate on overlapping geometry of the meshes
 - ”Cut”
- After selecting the loop already created by the intersect (knife) open Edges Menu [ctrl] [E] then choose the option
 - “Mark as Seam”, to select the *limit* edges loop
 - Click on a vertex of the overlapping mesh
 - Press [L] , now the overlapping mesh until the seam loop is selected
 - [canc] to delete, select vertices



HOTKEY FULL LIST



HOTKEYS

You can find the full hotkeys list here:

<https://docs.blender.org/manual/en/latest/interface/index.html>

Version 2.83 :

<https://docs.blender.org/manual/en/2.83/interface/index.html>

Otherwise, it is available online the PDF Blender Hotkey Reference
(version 2.36 ... quite old!)

<https://download.blender.org/documentation/BlenderHotkeyReference.pdf>



IMPORT / EXPORT

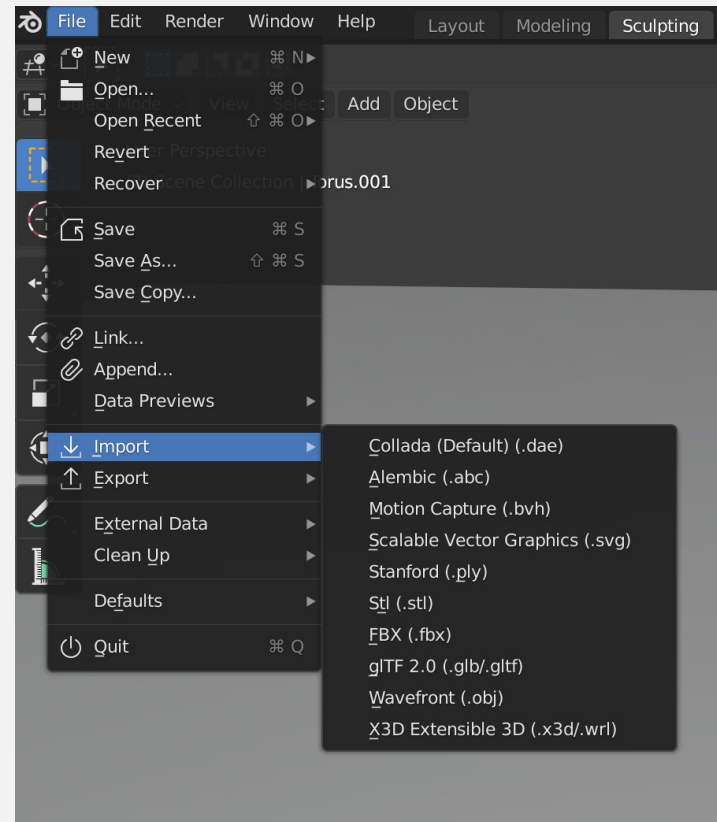


IMPORT / EXPORT

- You can import in Blender or export your work with a different 3D file extension, the supported extensions include:

- DAE
- FBX
- OBJ
- STL
- ...

- The import / export option is in
 - File > Import > (extension name)
 - File > Export > (extension name)



MODIFIERS

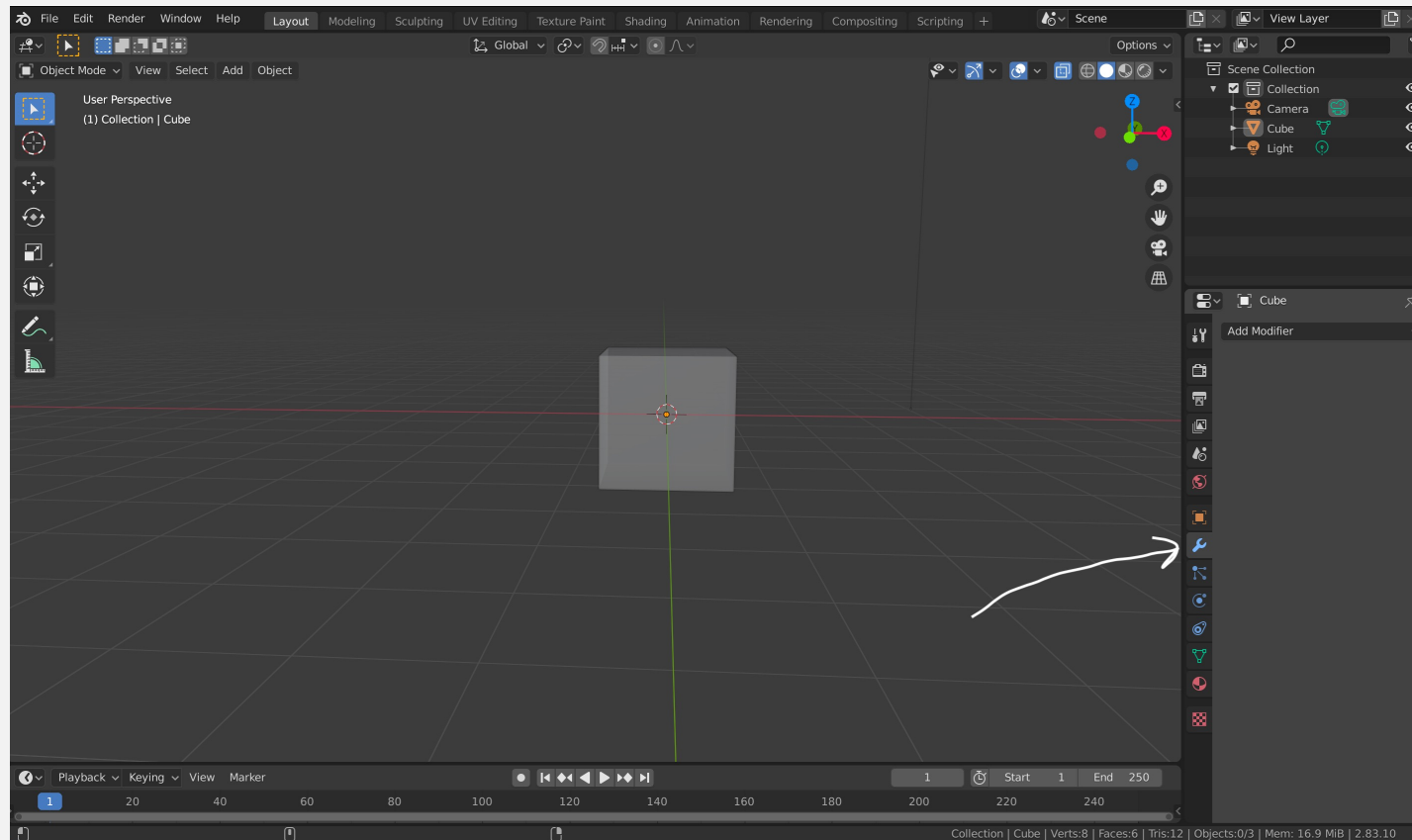
<https://docs.blender.org/manual/en/latest/modeling/modifiers/index.html>



MODIFIERS

Modifiers affect the shape of the object in a non-destructive way, i.e. leaving the original shape untouched but changing how the object is displayed and rendered.

You can add modifiers to an object in the **Modifiers Panel**.



MODIFIERS

List of all modifiers on Blender docs:

<https://docs.blender.org/manual/en/latest/modeling/modifiers/index.html#generate>

Some useful modifiers are:

- Subdivide-surface (Sub-div)
Splits faces into smaller faces giving a smooth appearance
- Solidify
Adds depth / thickness to object's surface
- Mirror
Applies changes in a mirrored way on the mesh, along object's local x, y, and/or z



MODIFIER STACK

Modifiers are ordered in the **Modifier Stack** (inside the **Modifiers Panel**).

The modifiers are applied to an object in order from top to bottom (different order, different result).

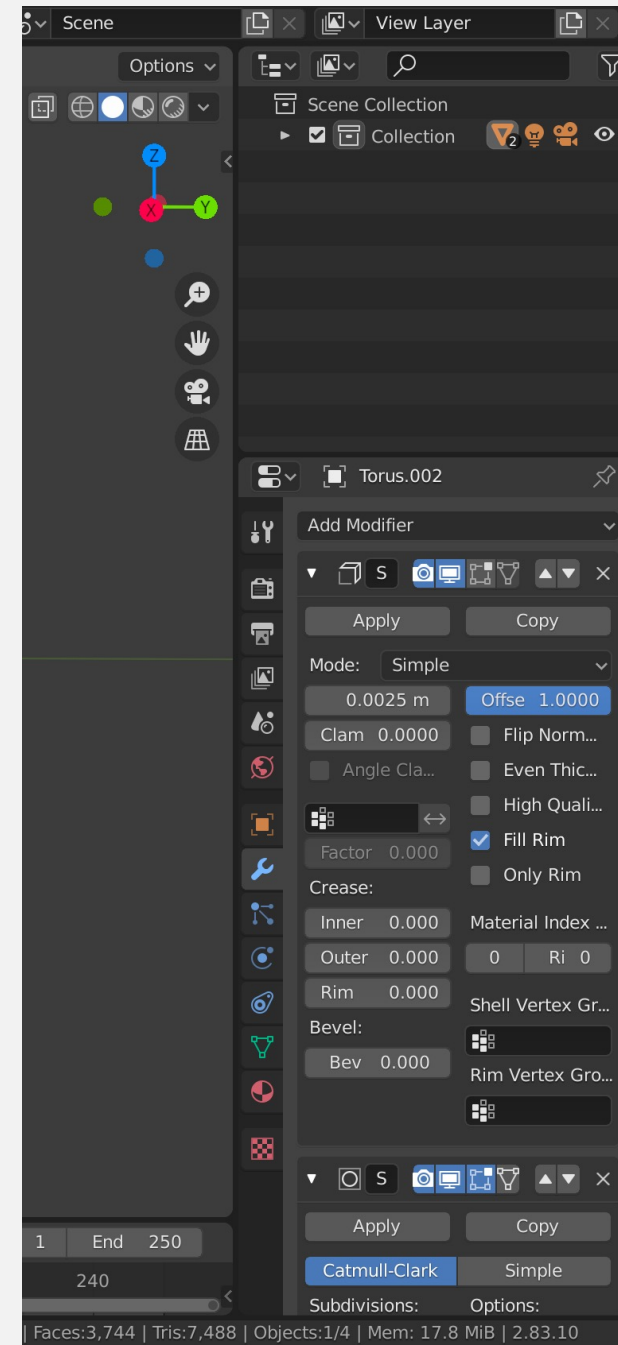
You can always change modifiers' order in the panel.

<https://docs.blender.org/manual/en/latest/modeling/modifiers/introduction.html>

APPLY

When you push the button **Apply** the modifier becomes “real” affecting the real geometry of the object. The **Apply** is a not reversible action.

You can **Apply** each modifier manually in a different order from the one in the **Modifier Stack**, the order in which you apply the modifiers becomes the final order.



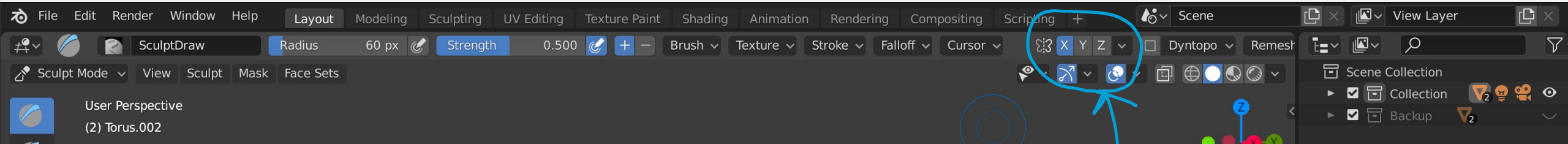
SCULPTING

https://docs.blender.org/manual/en/latest/sculpt_paint/sculpting/index.html



SCULPT

- You can increase / decrease brush dimension with :
 - **[F]** and then confirm with **left click** (cancel with **esc** or **right click**)
 - Changing the **Radius** ' value in the Tool Settings
- In the Tool Settings you can change also the **Strength** of the effect of the brush



In the Tool Settings you can enable the **Mirroring of brush effect** across an axis by clicking on **X ,Y or Z**



https://docs.blender.org/manual/en/latest/sculpt_paint/sculpting/introduction.html

SCULPTING TOOLS

List of all Tools:

https://docs.blender.org/manual/en/latest/sculpt_paint/sculpting/toolbar.html

🏠 » Sculpting & Painting » Sculpting » Toolbar

Toolbar

Draw
Moves vertices inward or outward based on the average normal.

Draw Sharp
Move vertices inward or outward based the original coordinates and uses the *Sharper Falloff*.

Clay
Similar to the *Draw* brush, but includes settings to adjust the plane on which the brush acts.

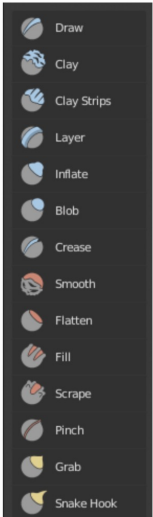
Clay Strips
The same as the *Clay* brush, but it uses a cube to define the brush area of influence rather than a sphere.

Layer
Moves all vertices to an exact height creating a flat layer.

Inflate
Displaces the mesh in the direction of the vertex normals.

Blob
Pushes mesh outward or inward into a spherical shape.

Crease
Creates sharp indents or ridees by pushing or pulling the mesh. while



SCULPTING TOOLS

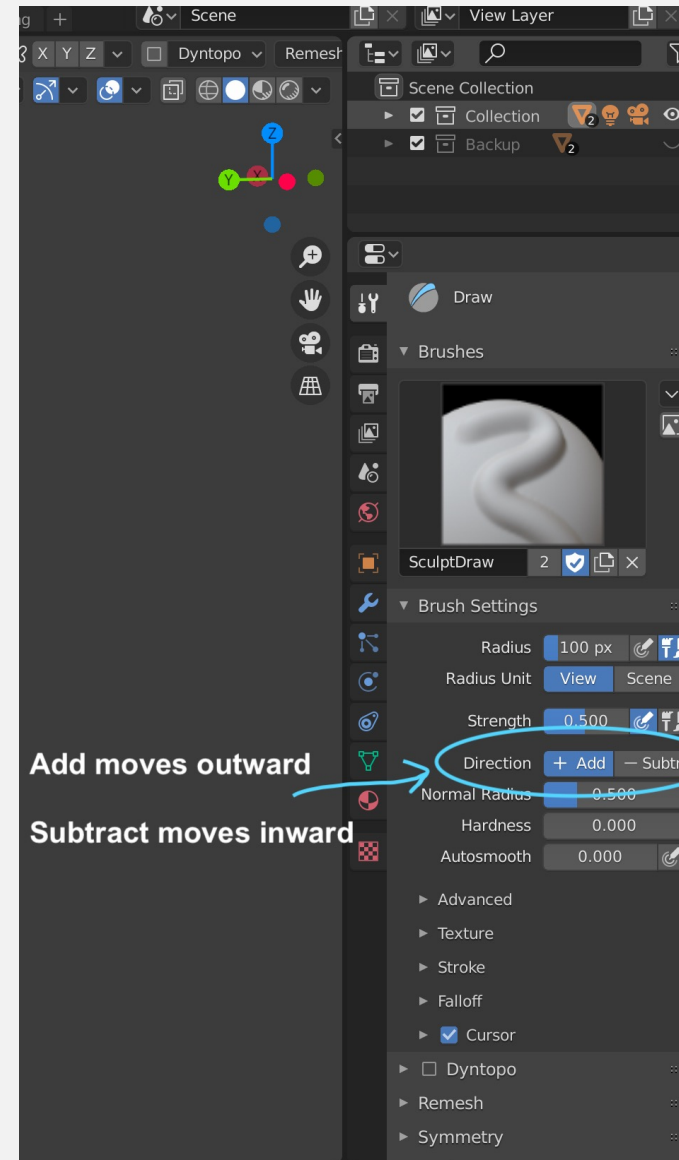
Tools have two modes:

for example, the **Draw Tool** moves the vertices outward or inward.

One mode is the default mode, and you can just select the tool and work with the brush on the object.

You can enable the other mode keeping pushed **[ctrl]** while using the brush.

You can also change the mode in the Brush Settings.



MATERIALS

<https://docs.blender.org/manual/en/latest/render/materials/index.html>

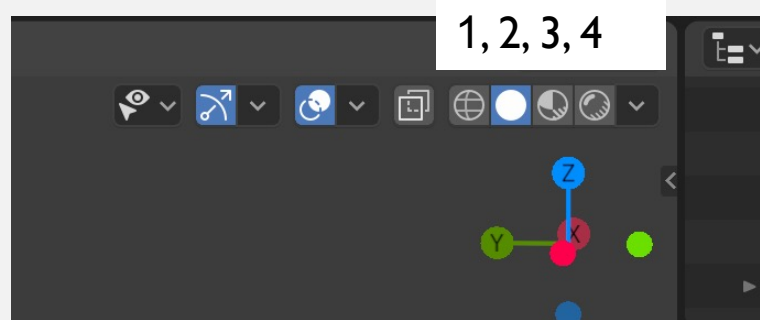


VIEWPORT

You can choose different shading modes to render the objects in the viewport.

You can choose the render mode in the top right area (or with hotkeys) or with the hotkey **[Z]** leading to a Pie Menu

1. Wireframe – it displays object only with edges (similar to x-ray)
2. Solid – default
3. Material - This mode is particularly suited for previewing materials and texture painting.
4. Rendered – full render



<https://docs.blender.org/manual/en/latest/editors/3dview/display/shading.html#view3d-viewport-shading>

https://docs.blender.org/manual/en/latest/editors/3dview/viewport_render.html

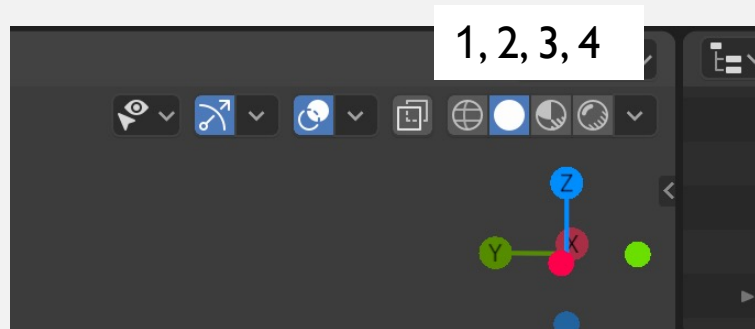



MATERIAL

- The Material represents the substance of the object.
It usually indicates surface qualities as color, shininess, transparency.

<https://docs.blender.org/manual/en/latest/render/materials/introduction.html>

- You can see the Material's effect on the object in the Material (3) or Rendered (4) mode



- You can add a Material in the Material Panel 
- In the Material Panel you can change the Material Properties as the *Base Color* of the object's surface

<https://docs.blender.org/manual/en/latest/render/materials/settings.html>



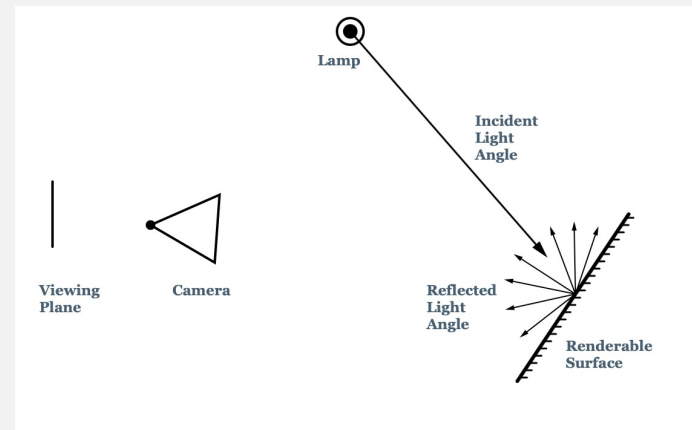
MATERIAL PROPERTIES – LIGHT REFLECTION

Other material properties are *Roughness* and *Specular* values for light reflection on the obj surface. Diffuse and specular reflection are not the same, even if they are generated in the same process of light scattering:

- *Roughness*, this value sets the amount of diffuse light rays' scattering, it ranges from 0 (it mirrors the light) to 1 (it absorbs the light)

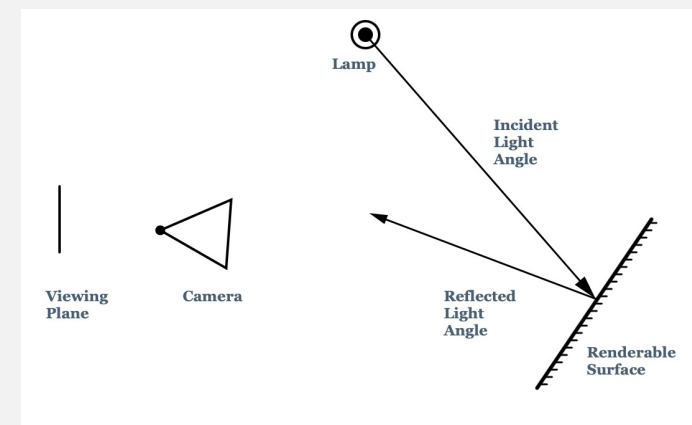
<https://docs.blender.org/manual/en/latest/render/materials/components/surface.html>

The reflected light is scattered, i.e. re-irradiated in all the directions in the diffusion phenomenon (no matter what the incident light angle is)



- *Specular*, this value sets the light reflected by the surface (it mimics the reflection of light surfaces). If you change this value to 0, you may affect the real physics of the object to render since all the objects in nature reflect at least some light's rays.

Specular reflection, it depends on the material composition (Renderable surface in the image), that is made by microfacets used to determine the sharpness of the reflected light



MATERIAL PROPERTIES

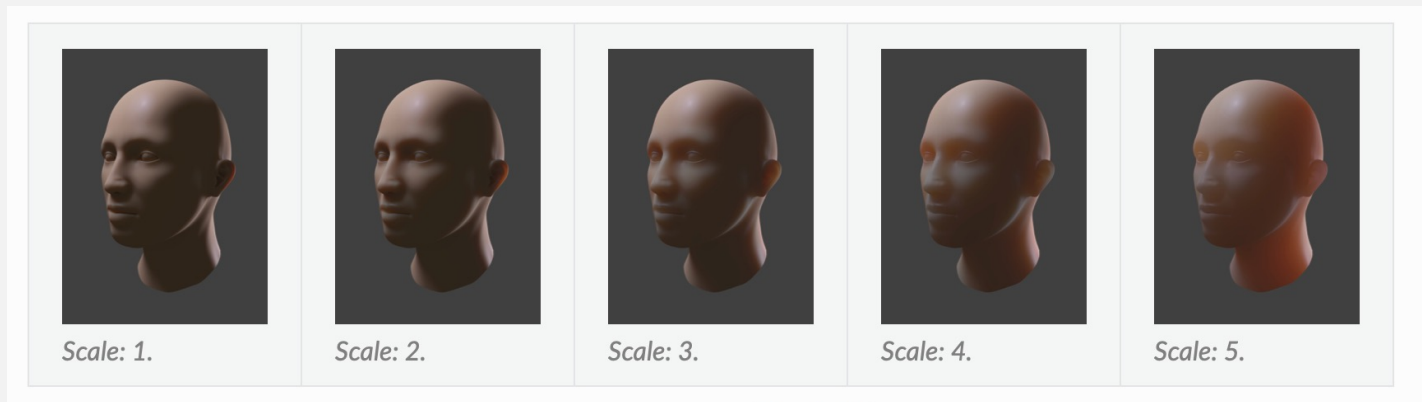
Other material properties are enabled by default by the *Principled BSDF Shader Node* (for further details see *Shader Nodes* section in this ppt):

https://docs.blender.org/manual/en/latest/render/shader_nodes/shader/principled.html

- *Subsurface Scattering*
 - *Subsurface* (*Subsurface Scattering*), this value is used to set how light rays enter in the object and bounce in it and then exit. Increase this value to increase translucent effect.
 - *Subsurface Color*, is the Albedo, the darker the color the more light is scattered.
 - *Subsurface Radius*, sets how far the rays bounce in the object, it is defined in RGB values

Here you can find also the doc of the specific *Subsurface Scattering Shader Node* :

https://docs.blender.org/manual/en/latest/render/shader_nodes/shader/sss.html





Example images for increasing *Subsurface* (*Subsurface Scattering*) values



MULTIPLE MATERIALS

You can add more materials, each one on a different part of a mesh.

1. Switch to Edit Mode
2. Select the part of a mesh (of the Object) that you want the Material to assign to
3. Click on Material Panel  and then
 - click on + to create a new Material or to add an existing one
(after clicking on + click on the arrow  to add an existing Material)
4. Click on Assign
5. Repeat for each material you want to assign to a part of mesh

ELDER DOCUMENTATION

There are interesting materials on how light works and on materials properties on the elder documentation, you can read also this (images in the previous two slides are coming from these docs)

- *Roughness*
https://docs.blender.org/manual/en/2.79/render/blender_render/materials/properties/diffuse_shaders.html
- *Specular*
https://docs.blender.org/manual/en/2.79/render/blender_render/materials/properties/specular_shaders.html
- *Subsurface scattering*
https://docs.blender.org/manual/en/2.79/render/blender_render/materials/properties/subsurface_scattering.html

“Before you can understand how to design effectively with materials, you must understand how simulated light and surfaces interact”.

https://docs.blender.org/manual/en/2.79/render/blender_render/materials/introduction.html#how-materials-work




PARTICLES

<https://docs.blender.org/manual/en/latest/physics/particles/index.html>



PARTICLES

Particles are items generated or emitted from mesh objects, and they are typically very numerous. Each particle can be a point of light or a mesh and it can be joined/static or dynamic.

1. Select the object on which you want to generate particles.
2. Go to Particle System Panel 
3. Click on + to add a Particle Setting
4. In the Particle Setting you can choose
 - *Emitter*: animated particle system, generating particles, as confetti or bubbles animation, you can also see the preview clicking on spacebar (click again to stop)
 - *Hair*: joined particle system, as hairs or no animated objects

https://docs.blender.org/manual/en/latest/physics/particles/particle_system_panel.html



EMISSION OPTION

In the Emission you can set Particle's system options as

- The *Number*: num of particles
- The *Seed*: the seed of random distribution of particles generation position
- Properties for Hair particles
 - *Hair Length*
 - *Segments*: the num of hair segments

<https://docs.blender.org/manual/en/latest/physics/particles/hair/emission.html>

- Properties for Emitter particles
 - *Frame Start*
 - *(Frame) End*
 - *(Particle's) Lifetime*, the particles' lifespan in frames
 - *Lifetime Random Variation*, gives to the particle's life a random variation

<https://docs.blender.org/manual/en/latest/physics/particles/emitter/emission.html>



(PARTICLES SYSTEM'S) RENDER OPTION

In the Render section you can change how particles appear when rendered.

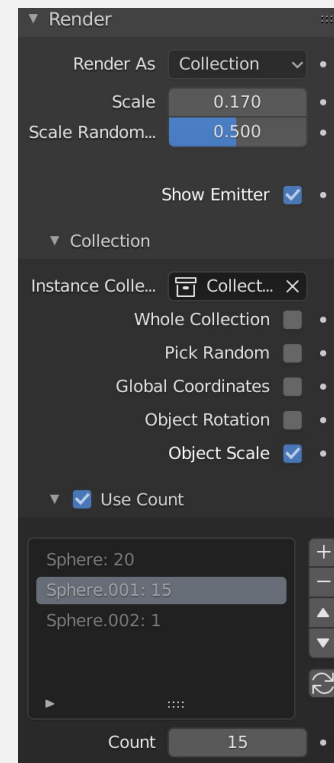
In this section you can decide to *Render as Object*, with this option you can select another object in the scene that will be the particle.

Instead of a single Object you can choose to *Render as Collection*, in this case the objects that belong to a collection are rendered sequentially in the position of the particles.

In case of *Render as Collection*, you can enable the *Use Count* in the Render Option to give weights to each element of the collection (higher the weight more often is instantiated in a particle position)

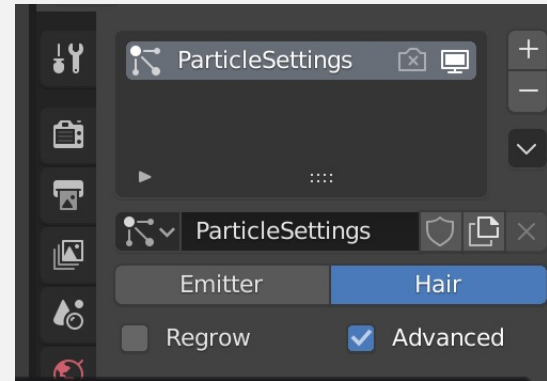
All the *Render as* options:

<https://docs.blender.org/manual/en/latest/physics/particles/emitter/render.html>



ADVANCED OPTION - ROTATION

You can enable Advanced Options under the Particle's Name, in this way, advanced sections as Rotation are shown in the menu



In Rotation section you can define how particles are rotated with:

- Orientation axis: aligns the particles x axis with global x axis, global y, ...
- Randomize: randomizes particle's orientation
- Phase: Initial rotation phase
- Randomize Phase: adds a random rotation to the phase

<https://docs.blender.org/manual/en/latest/physics/particles/emitter/rotation.html>



VERTEX GROUPS

Vertex Groups:

https://docs.blender.org/manual/en/latest/modeling/meshes/properties/vertex_groups/index.html

Weight Paint:

https://docs.blender.org/manual/en/latest/sculpt_paint/weight_paint/index.html



VERTEX GROUPS

Vertex Groups are used to define a subset of vertices belonging to a mesh.

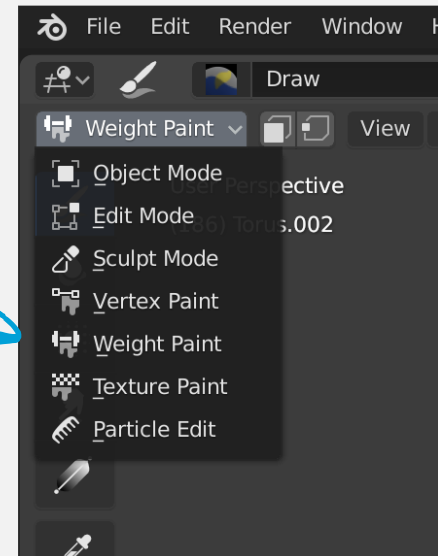
Vertex Groups can be used for Bones Rigging or for Particle Systems.

A Vertex Group with the Particle System is used to define a part of the object's surface from which particles are generated (as hairs on the head).

- https://docs.blender.org/manual/en/latest/modeling/meshes/properties/vertex_groups/introduction.html
- https://docs.blender.org/manual/en/latest/sculpt_paint/weight_paint/usage.html

A vertex Group can have a huge number of vertices in it, and each vertex has an assigned weight.

Vertex Groups can be easily generated in the Weight Paint Mode.



However, they are also accessible in the Vertex Group Panel 

https://docs.blender.org/manual/en/latest/modeling/meshes/properties/vertex_groups/vertex_groups.html#editing-vertex-groups



WEIGHT PAINT MODE

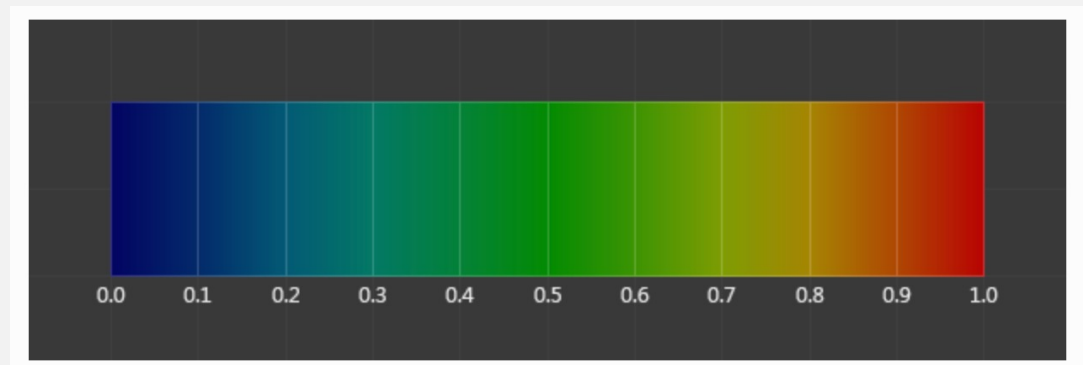
Weight paint mode can be used to define a weighted subset of vertices from a mesh in an intuitive way.

The Vertex Group can be generated simply painting the mesh, use Draw to paint, use Blur to reduce, you can change brush size with **[F]**.

https://docs.blender.org/manual/en/latest/sculpt_paint/weight_paint/tool_settings/index.html

The weights of each vertex are expressed with a Weighting Color Code using a gradient cold-hot color system: high value vertexes (near to 1) are **Red**, low value vertexes (near to 0) are **Blue**.


https://docs.blender.org/manual/en/latest/sculpt_paint/weight_paint/introduction.html

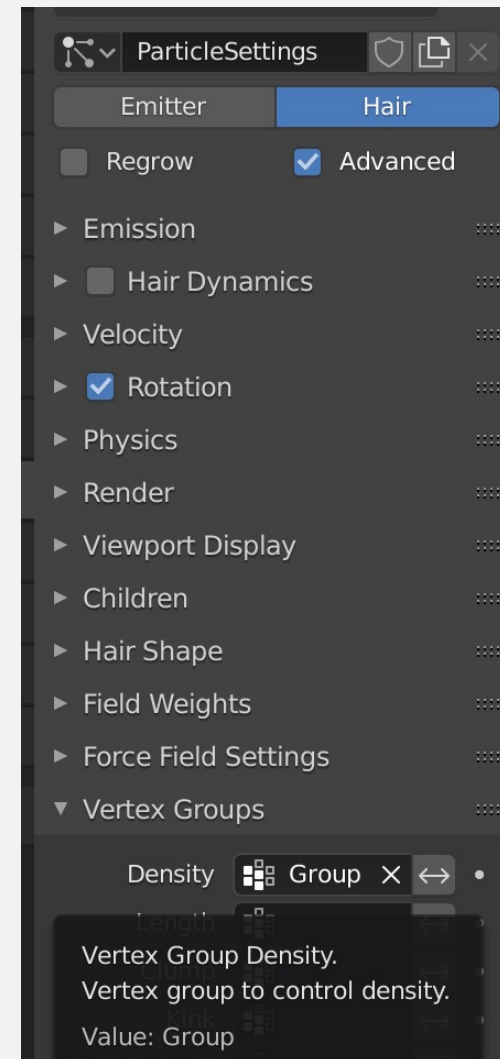


PARTICLE SYSTEM DENSITY WITH VERTEX GROUP

You can use Vertex Groups to define the Density of the Particles distribution on the mesh.

You can do it:

1. Generate a Vertex Group
2. Open Particle System Panel 
3. Open Vertex Group menu in the Particle System Panel
4. A Density voice select your Vertex Group



SHADER NODES

https://docs.blender.org/manual/en/latest/render/shader_nodes/index.html



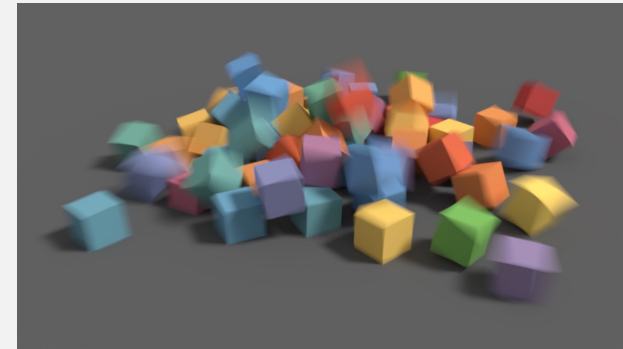
SHADERS

- Shaders are computer programs used for shading a 3D scene, rendering appropriated light/darkness, materials and background.
 - Shaders are used to define the surface or the volume of an object, in Blender the final output of all surface and volume shaders is a Shade

Shaders in Blender:

- *Bidirectional Scattering Distribution Function* (BSDF) shaders describe light reflection, refraction and absorption at an object surface.
- *Emission* shaders describe light emission at an object surface or in a volume.
- *Volume* shaders describe light scattering inside a volume.
- *Background* shaders describe light emission from the environment.

https://docs.blender.org/manual/en/latest/render/shader_nodes/introduction.html#shaders



Blender's Example image for Object Info Node
https://docs.blender.org/manual/en/latest/render/shader_nodes/input/object_info.html



SHADERS

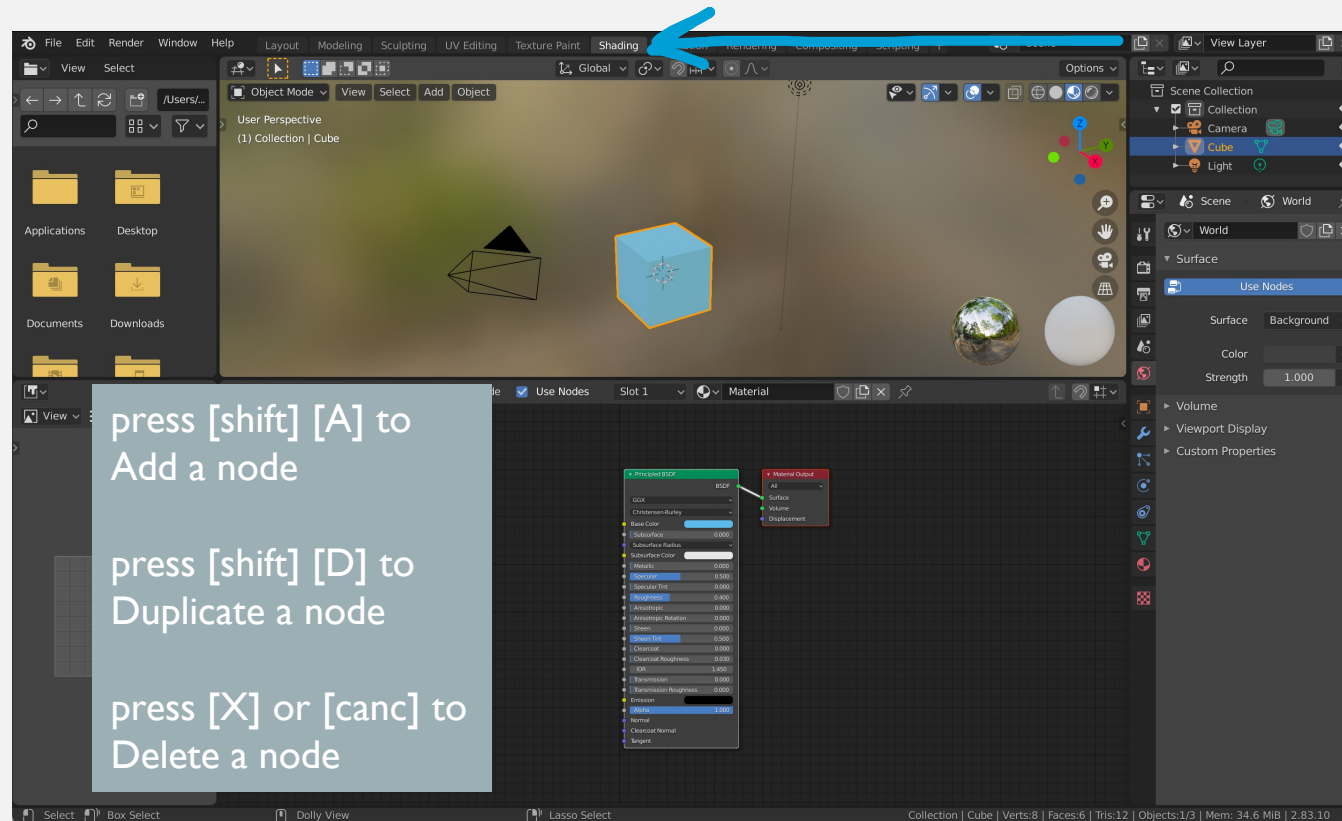
You can manage Shaders in the Shader Node view.

You can access clicking on top in the *Shading* window.

In this view you can add node components to your object's while observing the object's rendering result

Here a list of all shaders available:

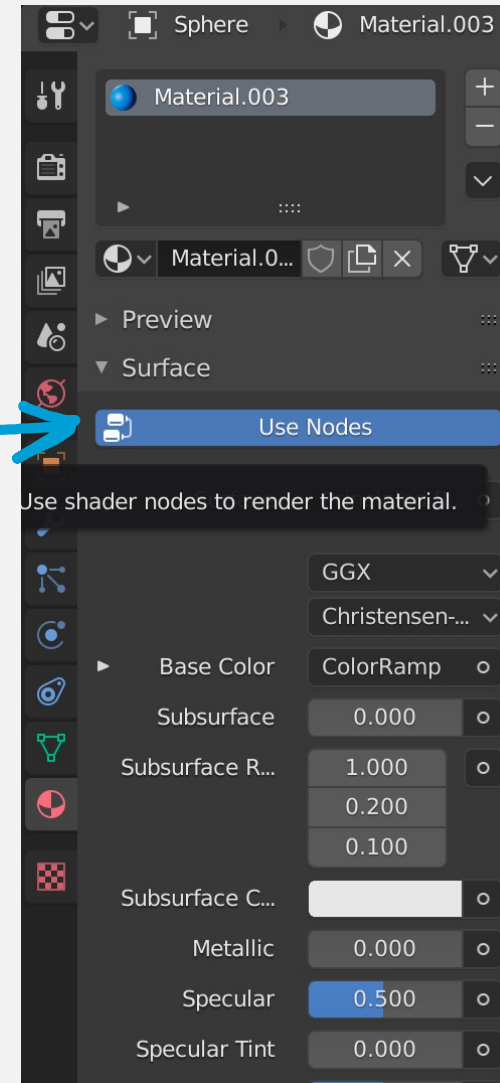
https://docs.blender.org/manual/en/latest/render/shader_nodes/index.html



MATERIALS PANEL

In the Material Panel you can see both standard material's properties, as the base color, and the properties available in the Shader Nodes.

The option of using Shader Nodes is currently enabled by default.



TEXTURES

https://docs.blender.org/manual/en/latest/sculpt_paint/texture_paint/index.html



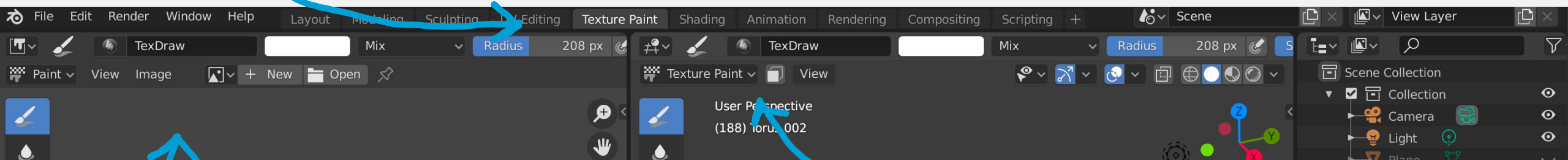
UV TEXTURE

The UV texture is a flat picture (as png) that is used to color the surface's mesh of an object; therefore, the final effect can be rendered as the flat image “wraps” the object's surface.

You are actually painting a 2D image wrapped on a 3D mesh.

In Blender you can directly perform *texture paint*, painting a 2D image in the *Texture Paint* window (1), that shows you the 2D image window on the left (2) and the *Texture Paint Mode* window on the right (3).

You can also import here external images (from Photoshop, GIMP, ...)



The UV texture painted in Blender should be saved as a separate file, and it is not automatically saved when saving the whole blend project.

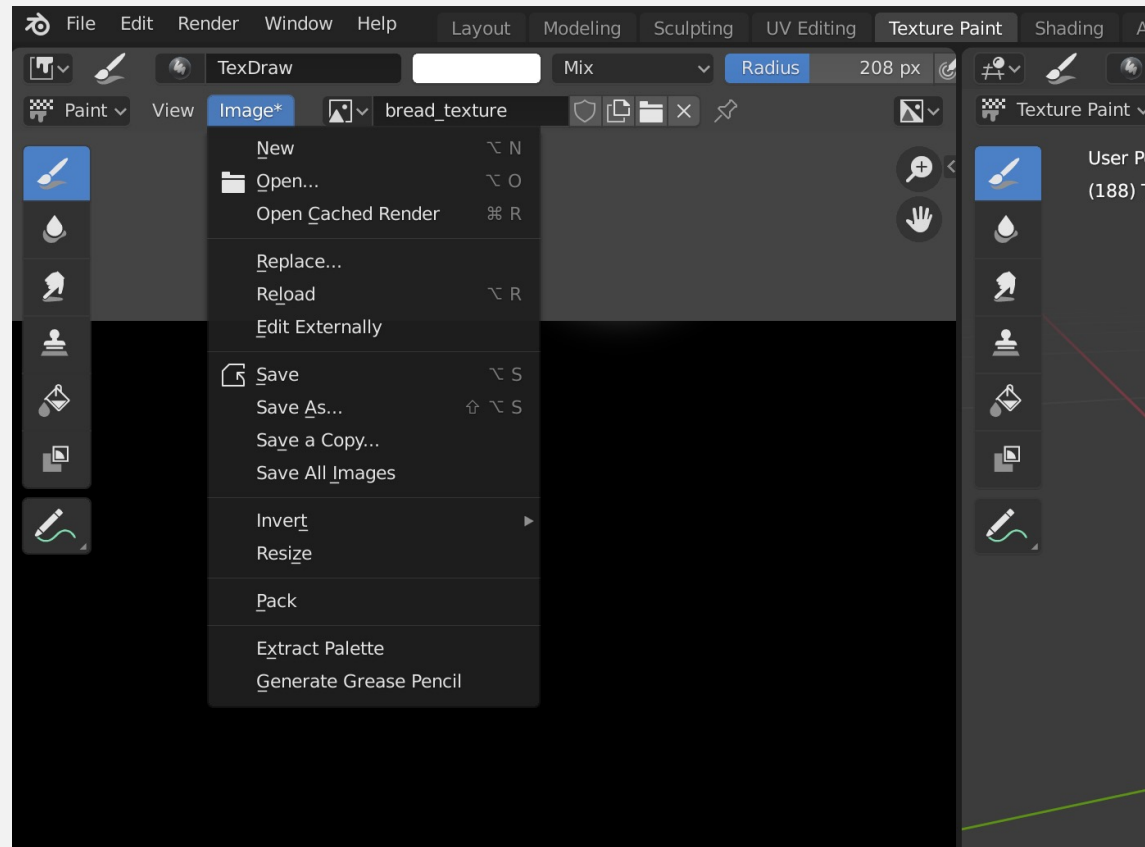
https://docs.blender.org/manual/en/latest/sculpt_paint/texture_paint/introduction.html#getting-started



SAVE TEXTURE

Textures are not saved automatically, you can save the Texture with:

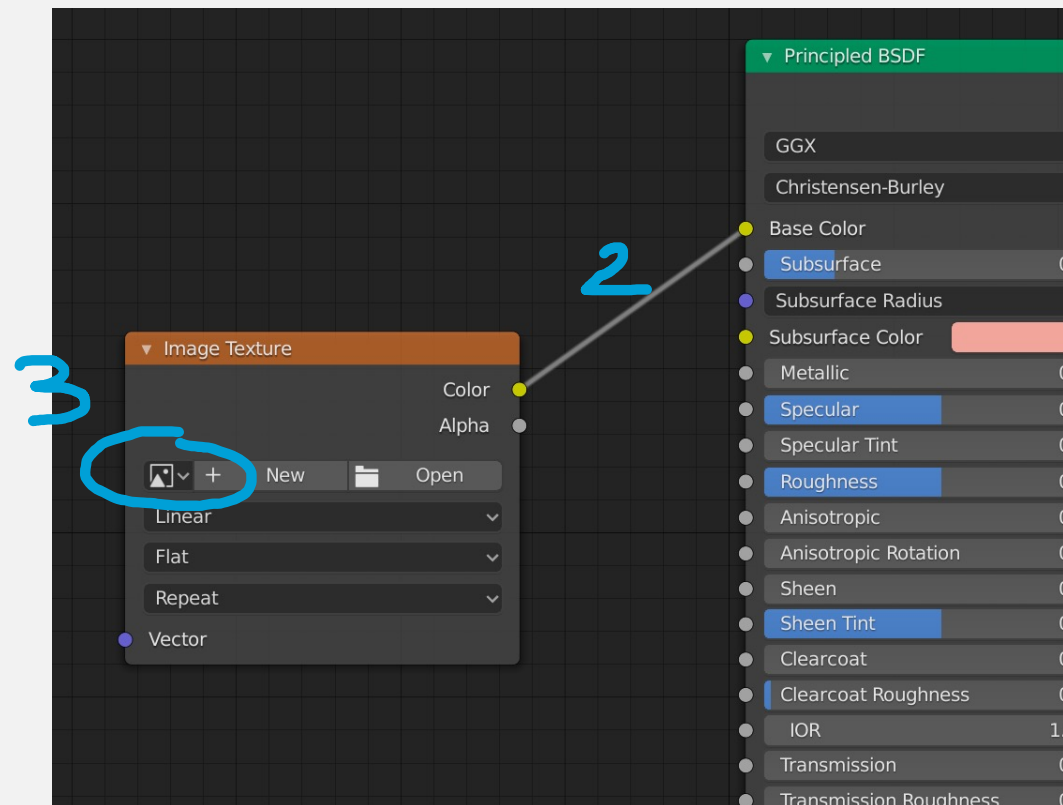
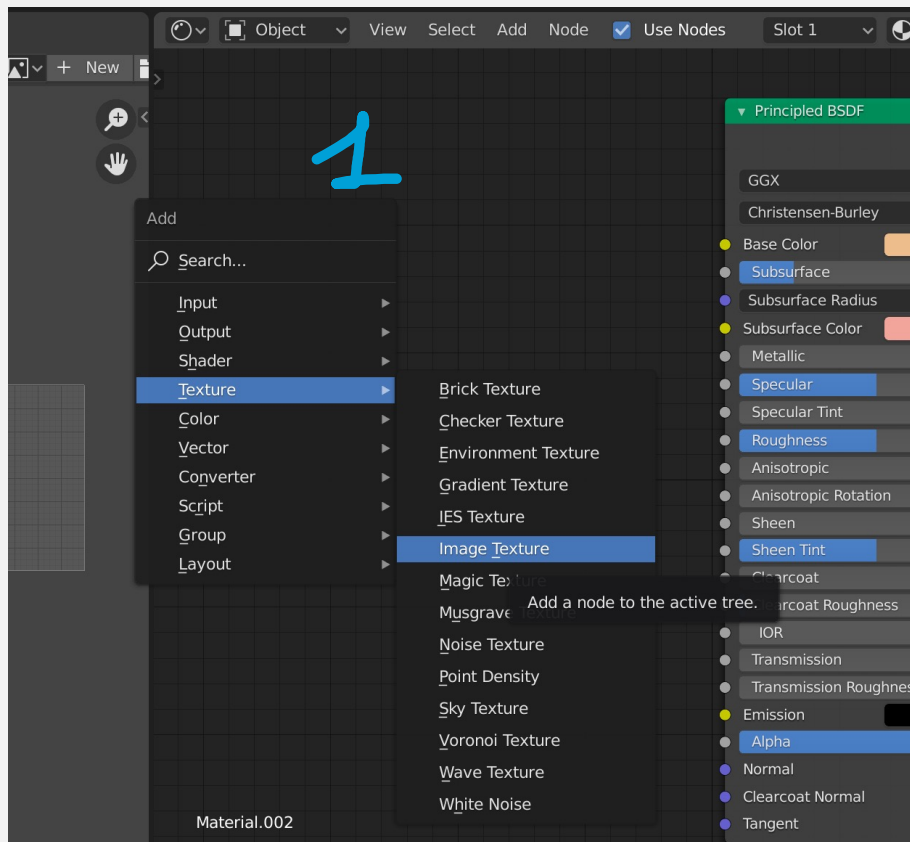
- Click on **Image*** > Save
- **[alt][S]** when you are with the mouse on the 2D texture window



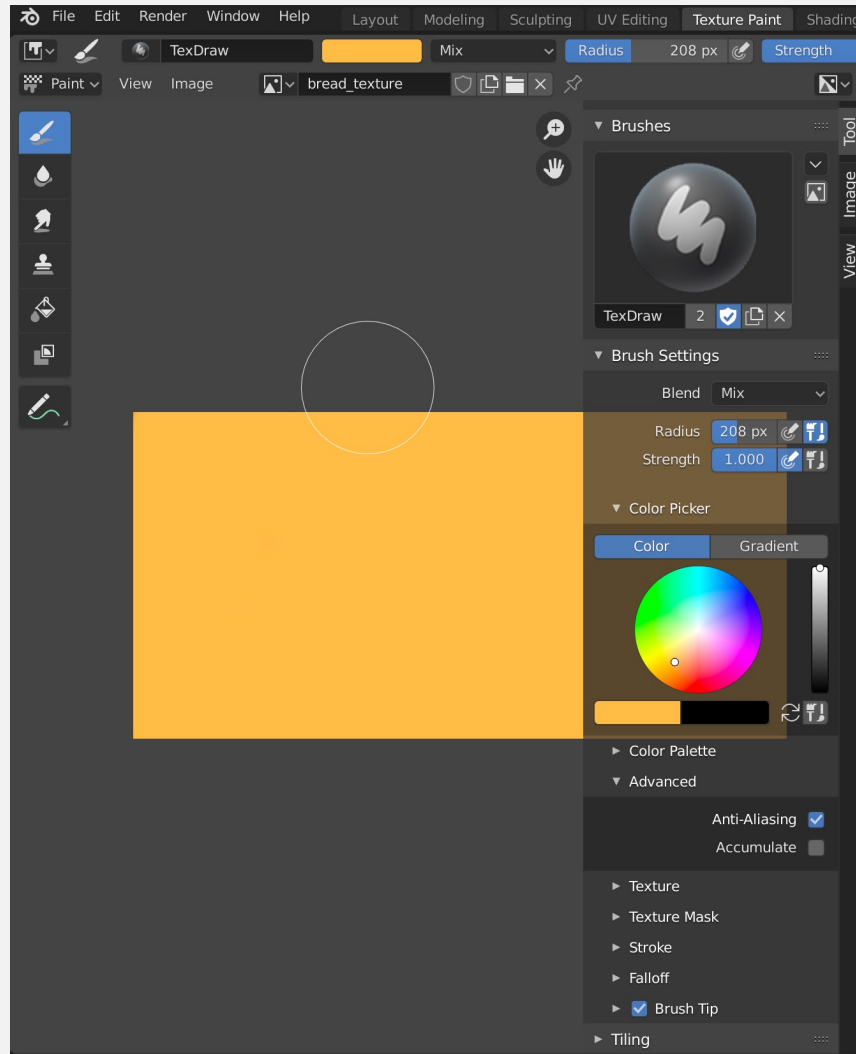
ADD TEXTURE TO MATERIAL'S NODE

You can add a texture to an Object with Texture Nodes in the Shading window.

1. Add an Image Texture Node
2. Bind the Color of Image Texture Node with Color of Material's Principled BSDF Node
3. Select the texture in the Texture Node (you can also create a new texture here clicking on +)



PAINT TEXTURE TOOL PANEL

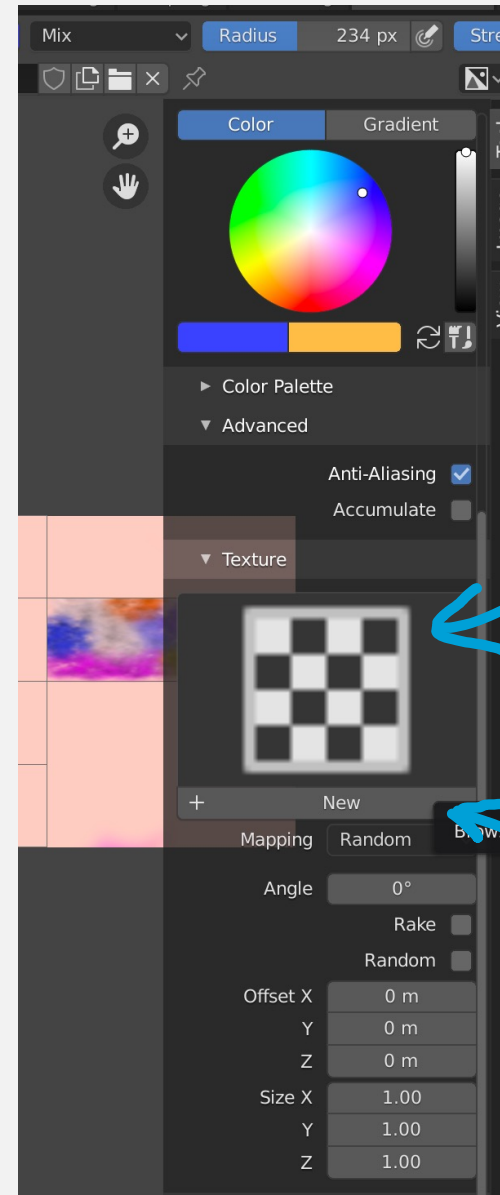


Press [N] to make Tool left panel appear, in this panel:

- You can select the Brush color you can also switch the color with [X]
- You can set Brush radius in the Radius property or with [F]
- You can select a Procedural Generated Texture in the *Texture section*

PROCEDURAL GENERATED TEXTURE

1. Press *Texture* in the Tool left panel
2. Click on + New to generate a new texture or on the Squared Image to pick up an existing texture you have made before



Select existing texture

1

Create new texture

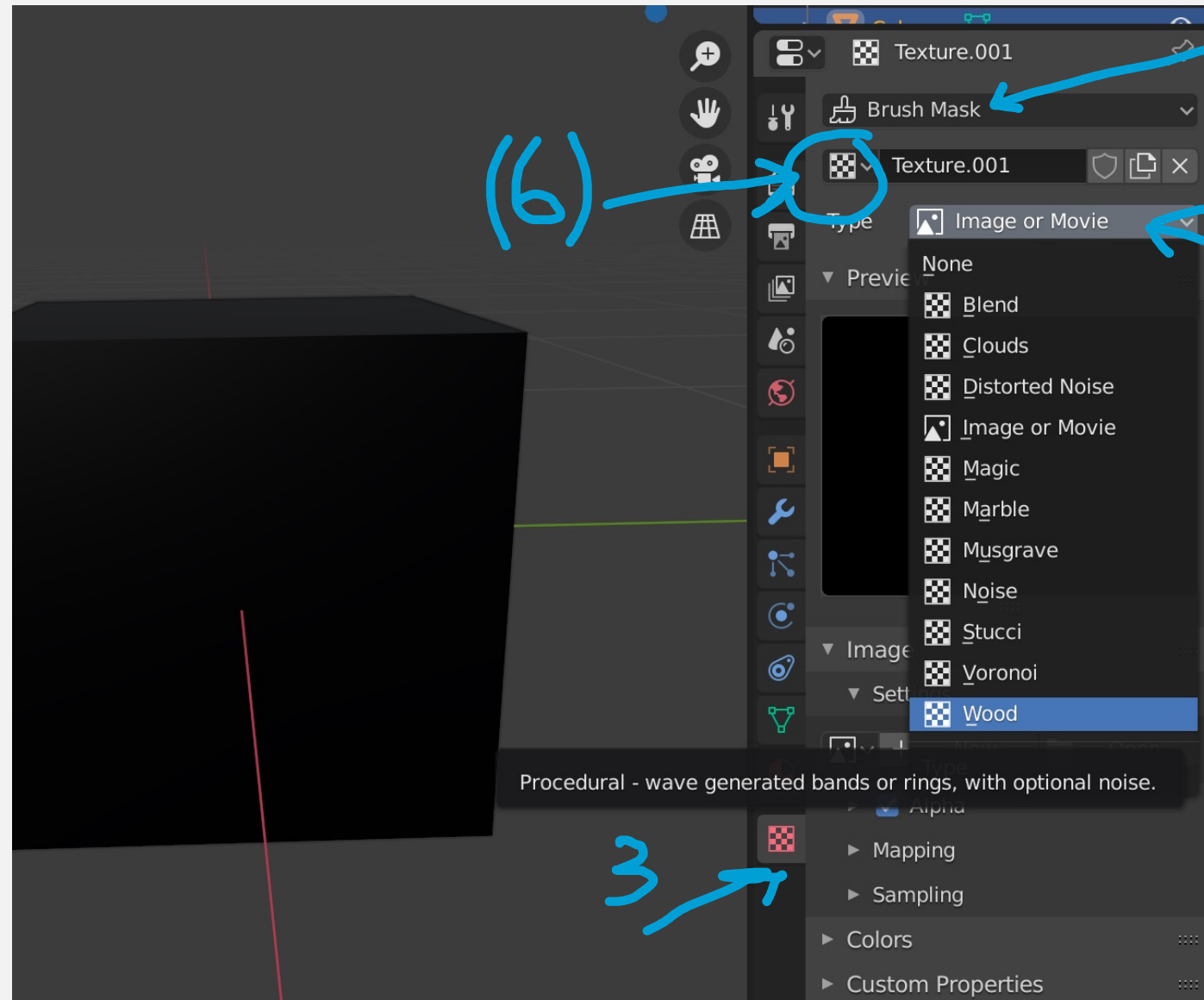
2



PROCEDURAL GENERATED TEXTURE (2)

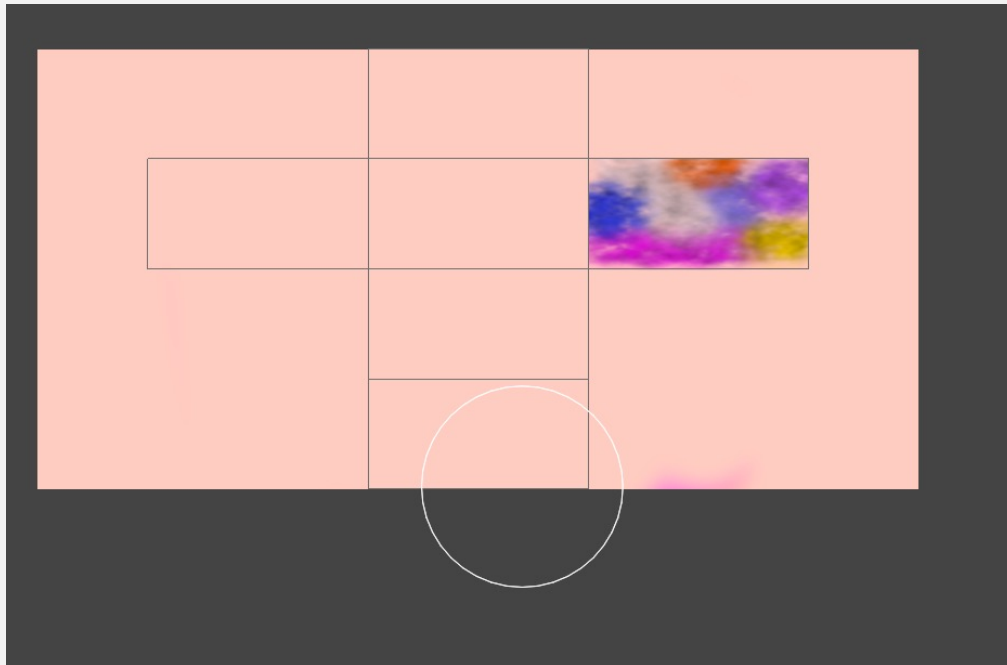
3. On the right window (Texture Paint) click on *Texture Properties*
4. Select Brush Mask from the Menu
5. Select one of the Procedural textures built in Blender

If you “lose” the texture, for example generating a new one, you can select the texture in the squared symbol (6)

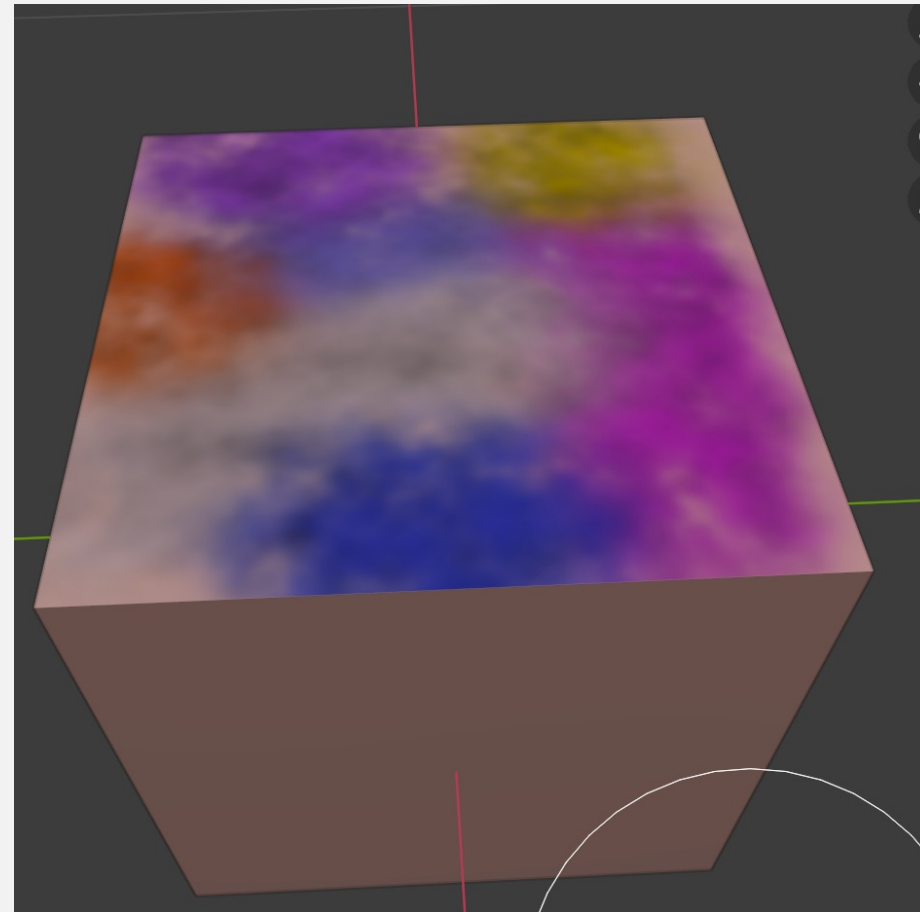


PROCEDURAL GENERATED TEXTURE (3)

Now you can paint your object with the procedural “effect”, here an example with Clouds proc. Gen. texture on a square’s face



2D view



3D view

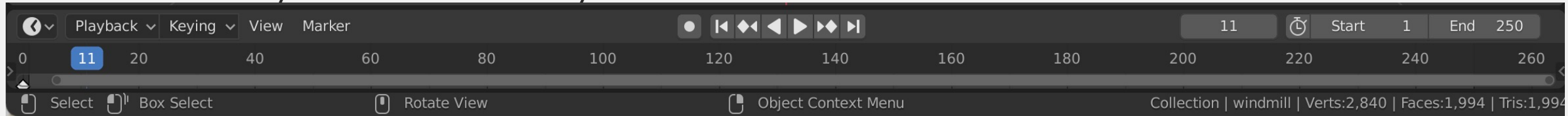
ANIMATION

<https://docs.blender.org/manual/en/latest/animation/keyframes/index.html>

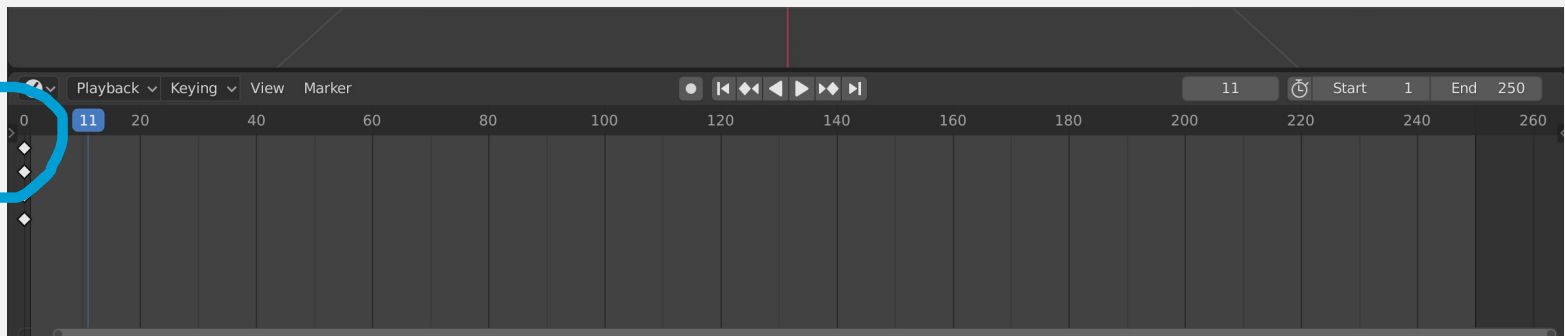


TIMELINE PANEL

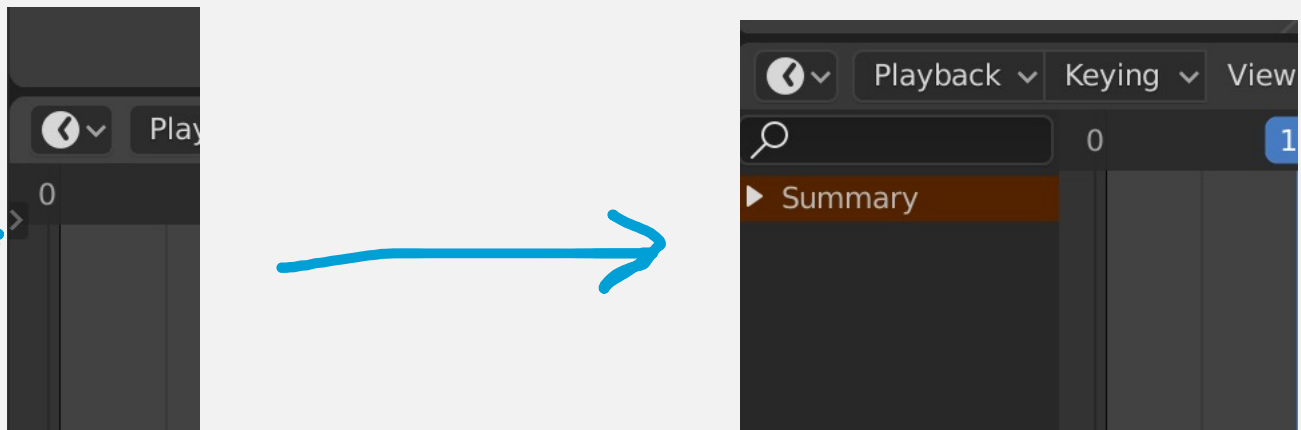
1. At the bottom of Blender's window you can find the Timeline panel, that shows the timeline in which you can set animation keyframes



2. You can drag and move up to enlarge the window

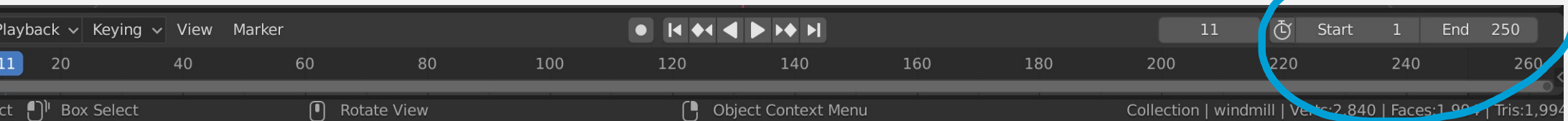


You can also open the Summary by *clicking* or *click and dragging* on the little arrow > on the left side



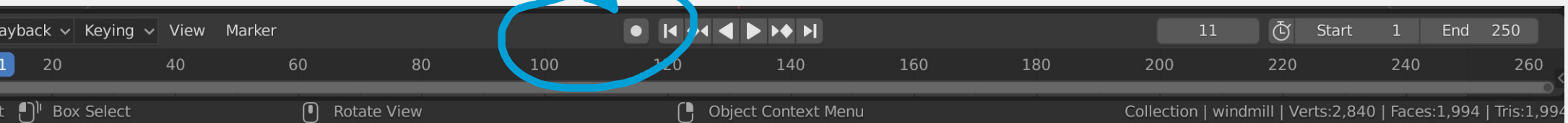
KEYFRAMES

- You can add a Keyframe with [I]
- To add a keyframe in a specific moment, you can select the frame in the timeline, then [I]
- There are different type of Keyframes:
 - Location
 - Scale
 - Rotation
 - LocRot for location and rotation keyframes
 - ...
- You can setup the Start frame and End frame of your animation



KEYFRAMES

- You can start the animation play with **[spacebar]**
- Instead of adding the keyframes manually, you can automatically record: enable recording then changing the mesh position / rotation / scale / ...

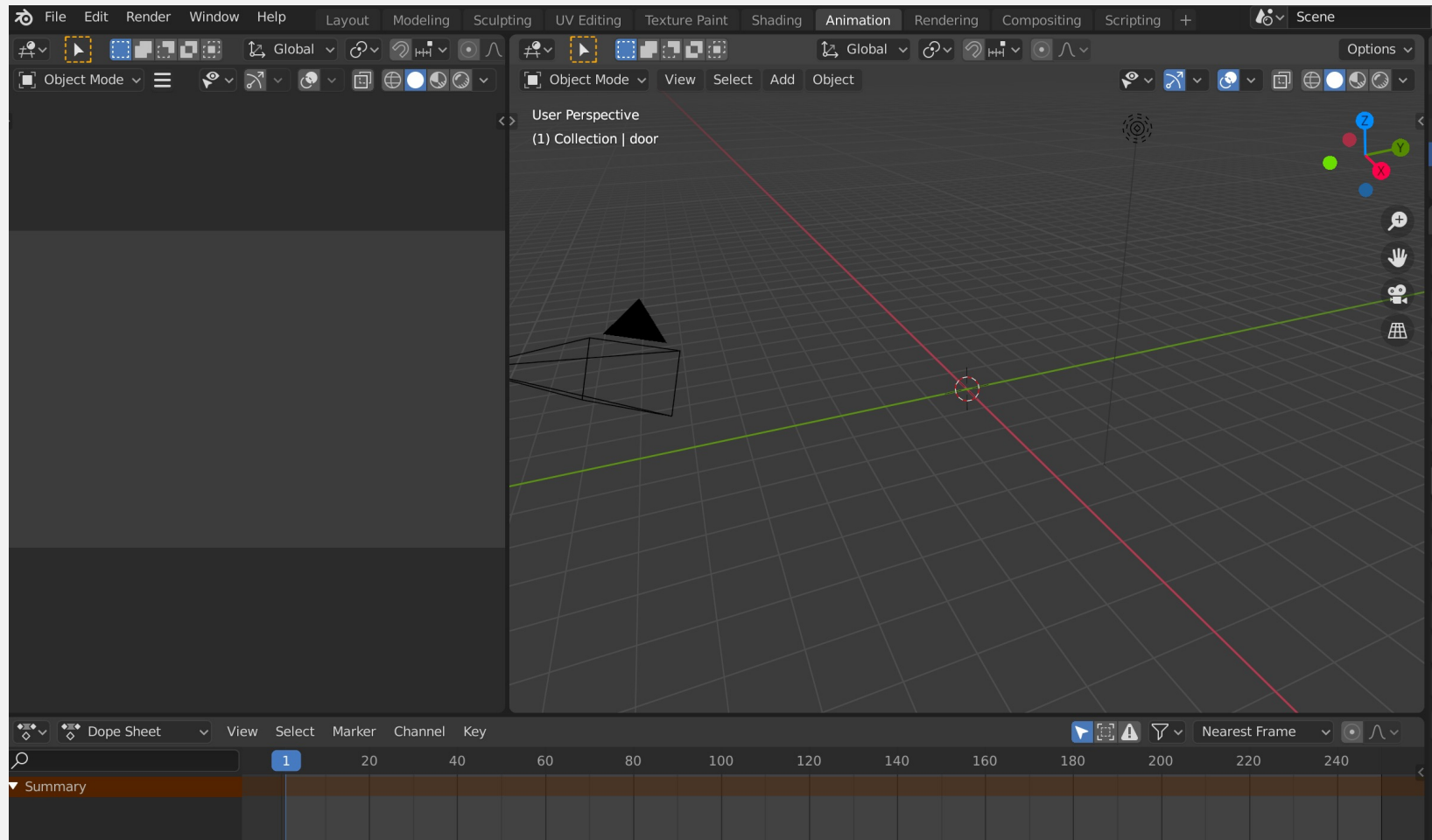


<https://docs.blender.org/manual/en/latest/editors/timeline.html>



ANIMATIONS

You can manage Animations in the Animation view, by default the Dope Sheet is displayed



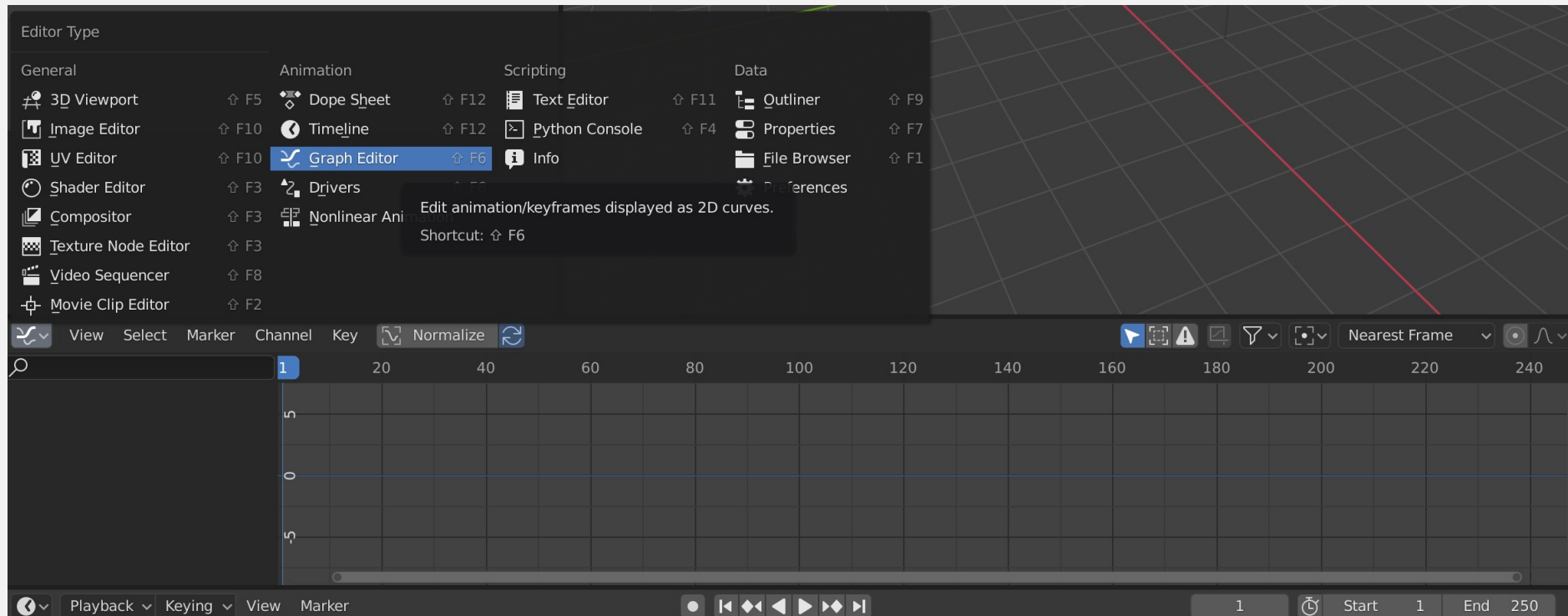
https://docs.blender.org/manual/en/latest/editors/dope_sheet/introduction.html



KEYFRAMES EDIT

- The Dope Sheet can be used to edit Keyframes [shift] [F12]
- The Timeline can be used to playback and manage Keyframes [shift] [F12]
- The Graph Editor can be used to display the animation as 2D curves, and to manage them

The first two have the same hotkey, once you press one appears, the second time you press the other one appears.



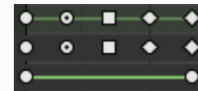
GRAPH EDITOR

- Click “Normalized” to observe the curved normalized between -1 and +1
- Once you click on a keyframe symbol (the little diamond symbol) you can change a Handle Type (Bezier-Handle) with
 - hotkey [V]
 - Click on Key > Handle Type

from Blender doc: When using Bézier-interpolated curves it is possible to control the slope of the curve at the control points. This is done via the curve point handles; [...] Each curve point can have a different handle type, even within the same curve.”

Symbol	Handle Type
--------	-------------

Circle	Auto Clamped (default)
Circle With Dot	Automatic
Square	Vector
Clipped Diamond	Aligned
Diamond	Free



From top: summary, Bézier, linear.

- Image from: <https://docs.blender.org/manual/en/latest/animation/keyframes/introduction.html#handles-interpolation-mode-display>
- Bezier-Handles: https://docs.blender.org/manual/en/latest/editors/graph_editor/fcurves/introduction.html#editors-graph-fcurves-settings-handles




RENDERING

<https://docs.blender.org/manual/en/latest/render/index.html>

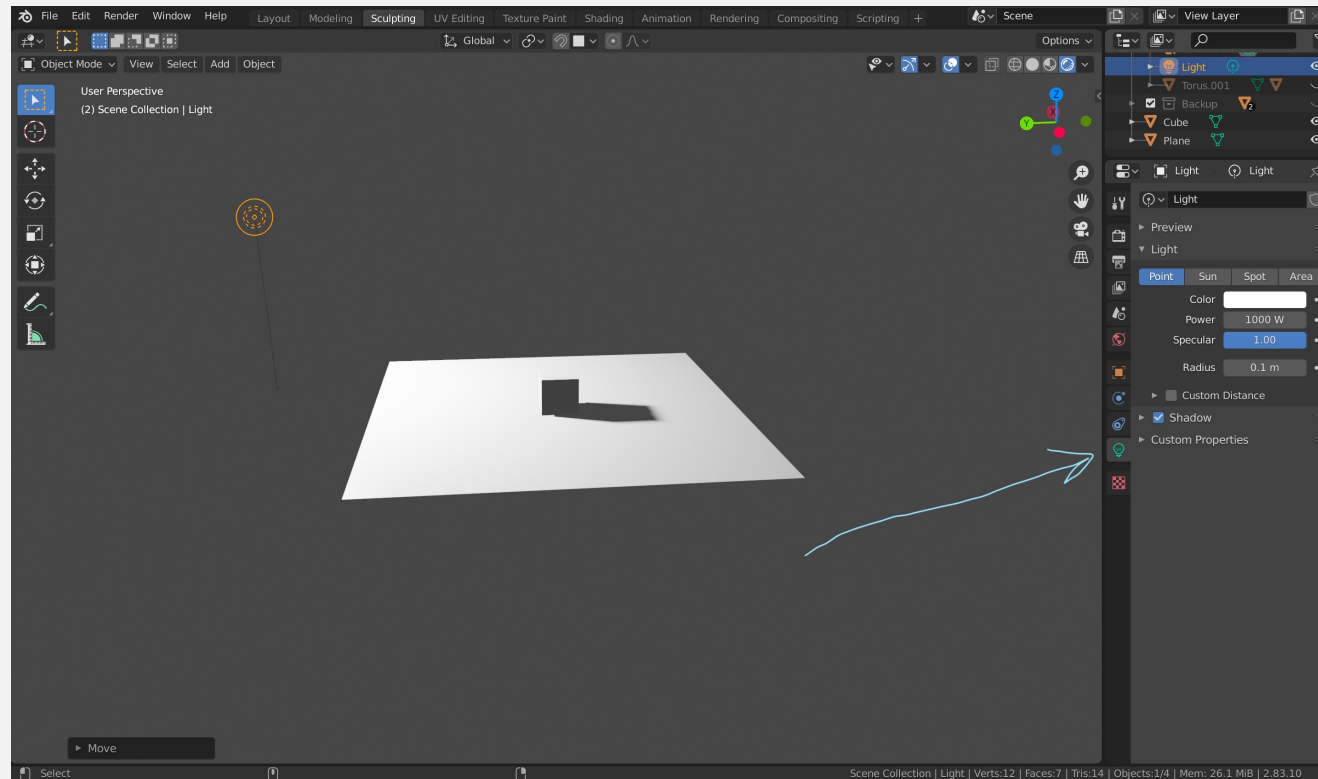


RENDER - LIGHT

When you are in rendering mode, you see how light affects the scene.

Once you have selected the **Light** in the **Scene Collection** panel a green lightbulb,  indicating the *Object data properties*, appears in the menu.

There you can change the **Color** of light, the **Power**, choose to **Cast Shadows**, choose the **Light Type** (Point, Sun, Spot, Area) , ...

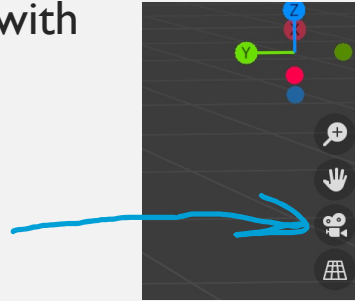


https://docs.blender.org/manual/en/latest/render/lights/light_object.html

RENDER - CAMERA

You can enable camera view with

- hotkey: numpad **0**
- Camera button

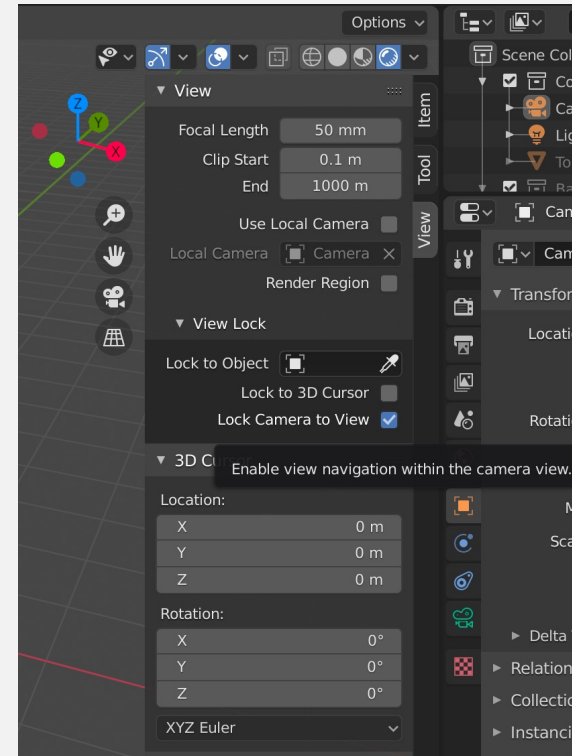


Now you can zoom in / out with the middle mouse.

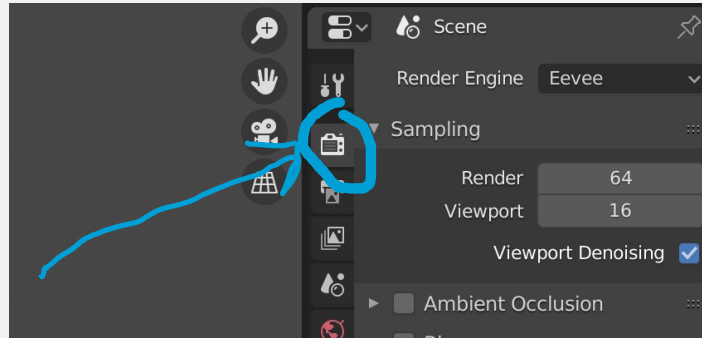
... However if you use the mouse to change the camera's angle you lose the camera view...

When you are in the camera view you can select the Camera in the Scene Collection and then press **[G]** (Grab), now if you use the mouse the camera follows your action (but no zoom!).

You can change these settings in the **View** menu enabling **Lock Camera View** to make both the camera follow the mouse and the zoom with middle mouse btn,



RENDER PROPERTIES



In the menu *Render Properties* you can


- change the value in **Sampling** → **Render** to set the number of samples per pixels.
- choose the **Render Engine**

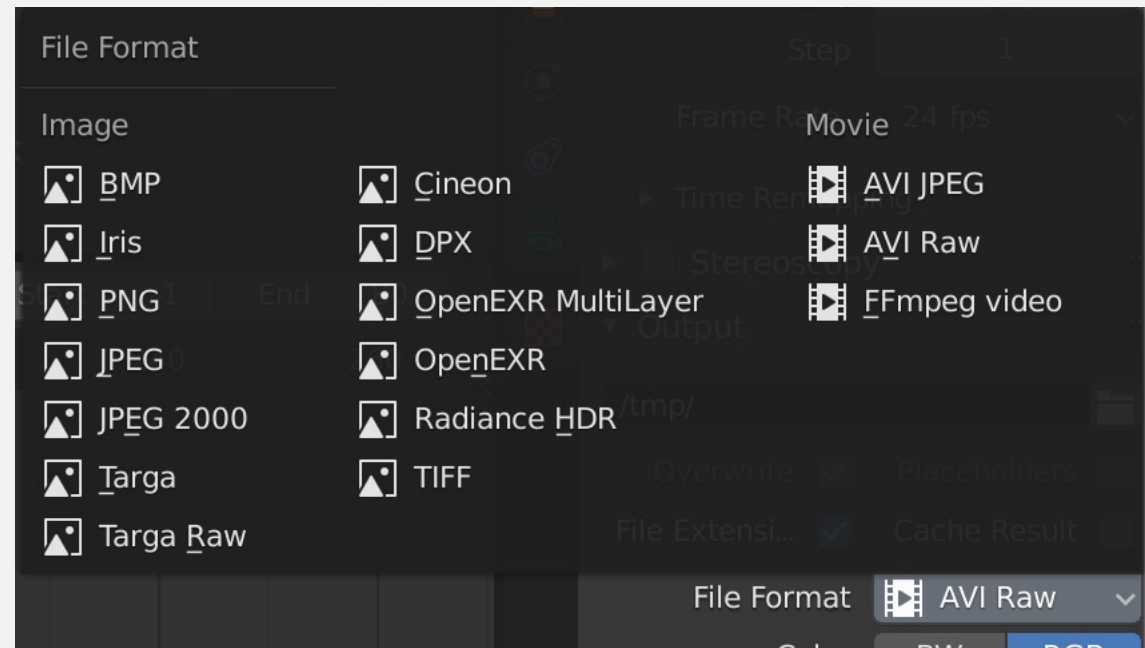
Blender offers three different **Render Engine** :

- **Eevee** (based on OpenGL) produces projects with high quality, the realism is lower than Cycles but the rendering is faster. It can be used also in 3D viewport preview for who works with Cycles.
Introduction, <https://docs.blender.org/manual/en/latest/render/eevee/introduction.html>
Full, <https://docs.blender.org/manual/en/latest/render/eevee/index.html>
- **Workbench** is optimized for 3D viewport previews, not for production projects
Introduction, <https://docs.blender.org/manual/en/latest/render/workbench/introduction.html>
Full, <https://docs.blender.org/manual/en/latest/render/workbench/index.html>
- **Cycles** produces projects with high quality, but rendering process is longer than Eevee. It is useful for physically based results for production,
Introduction, <https://docs.blender.org/manual/en/latest/render/cycles/introduction.html>
Full, <https://docs.blender.org/manual/en/latest/render/cycles/index.html>



OUTPUT PROPERTIES

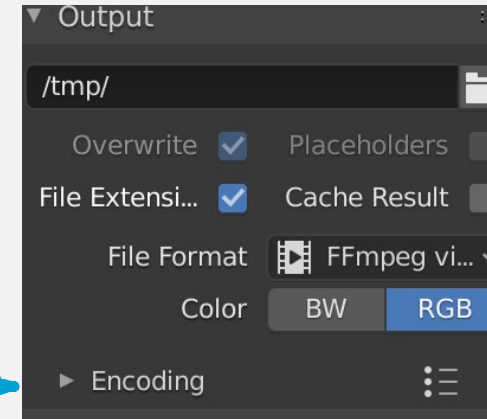
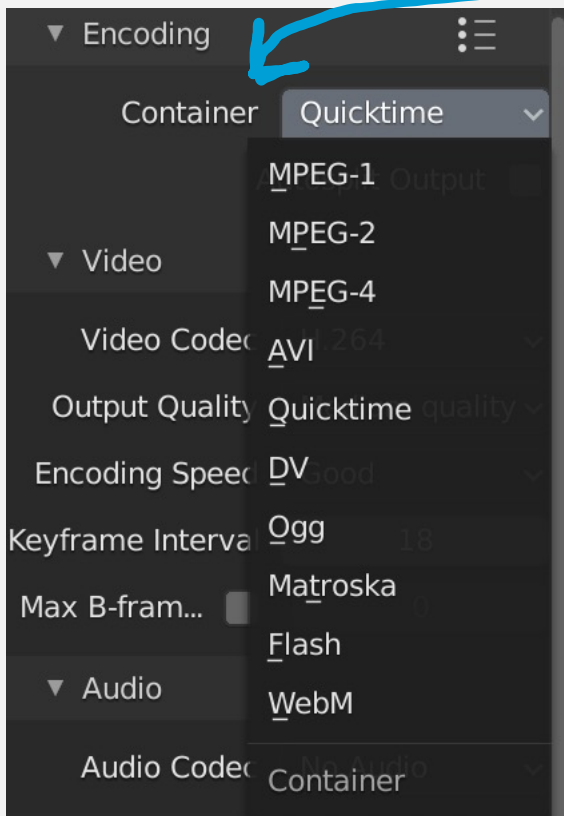
- In the Output Properties  you can find the following features
 - Dimensions:
 - Frame Rate
 - Resolution
 - Output > File Format (PNG, TIFF, ...)



VIDEO FORMAT AND CONTAINER

The Ffmpeg video format is usually chosen for the animation.

You can choose the Container in the Output > Encoding



Therefore, at Output > Encoding > Container you can choose the preferred extension, here the list of Containers:

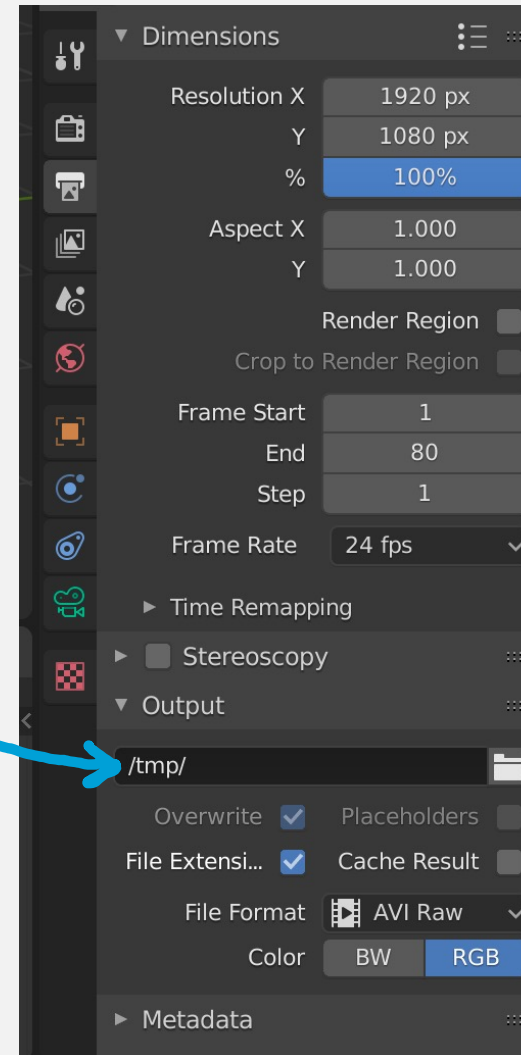
https://docs.blender.org/manual/en/latest/files/media/video_formats.html#ffmpeg-containers

https://docs.blender.org/manual/en/latest/files/media/video_formats.html#



SAVE FOLDER (OUTPUT PROPERTIES)

In the Output section (in the Output Properties menu) you can also choose the *output folder* in which the rendered image/video is saved automatically



RENDER VS VIEW

<p>Render</p> <p>Use this to create and save a new image / animation</p>	<p>View</p> <p>Use this to render the image of the scene / play back rendered animations</p>
<ul style="list-style-type: none">• You can render the active scene in an image with<ul style="list-style-type: none">• F12• Render > Render Image• You can render the active scene in an animation with<ul style="list-style-type: none">• [ctrl] [F12]• Render > Render Animation	<ul style="list-style-type: none">• You can open render view with<ul style="list-style-type: none">• F11• Render > View Render• You can open view animation with<ul style="list-style-type: none">• [ctrl] [F11]• Render > View Animation

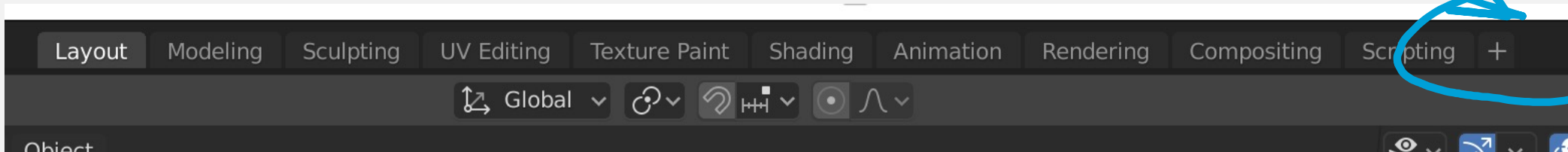
ANIMATIONS – VIDEO EDITING

To save an animation you can:

- (Short video) select a video format and a container offered by Blender
- (Long video) render the animation images one by one and save them separately, then make a video with a video editor or use Blender's Video Editing.

To save separate images, instead of a video format choose an image file format. The images frame by frame will be saved in the *output folder*, you can name a folder for example "frames", then you can select it from the menu (see previous slide).

Then you can find Blender's Video Editing by clicking on + then Video Editing > Video Editing



Finally in the Sequencer Editor click on Add > Image/Sequence

https://docs.blender.org/manual/en/latest/video_editing/index.html



Blender documentation

- Latest version (the latest version at today is 2.91)
<https://docs.blender.org/manual/en/latest/index.html#>
- 2.83
<https://docs.blender.org/manual/en/2.83/index.html#>

Resources wiki

- <https://blender.stackexchange.com/questions/15355/resources-for-blender>