

CIS367 - Computer Graphics Blender Overview

Erik Fredericks - frederer@gvsu.edu





3D modeling software

Open source!

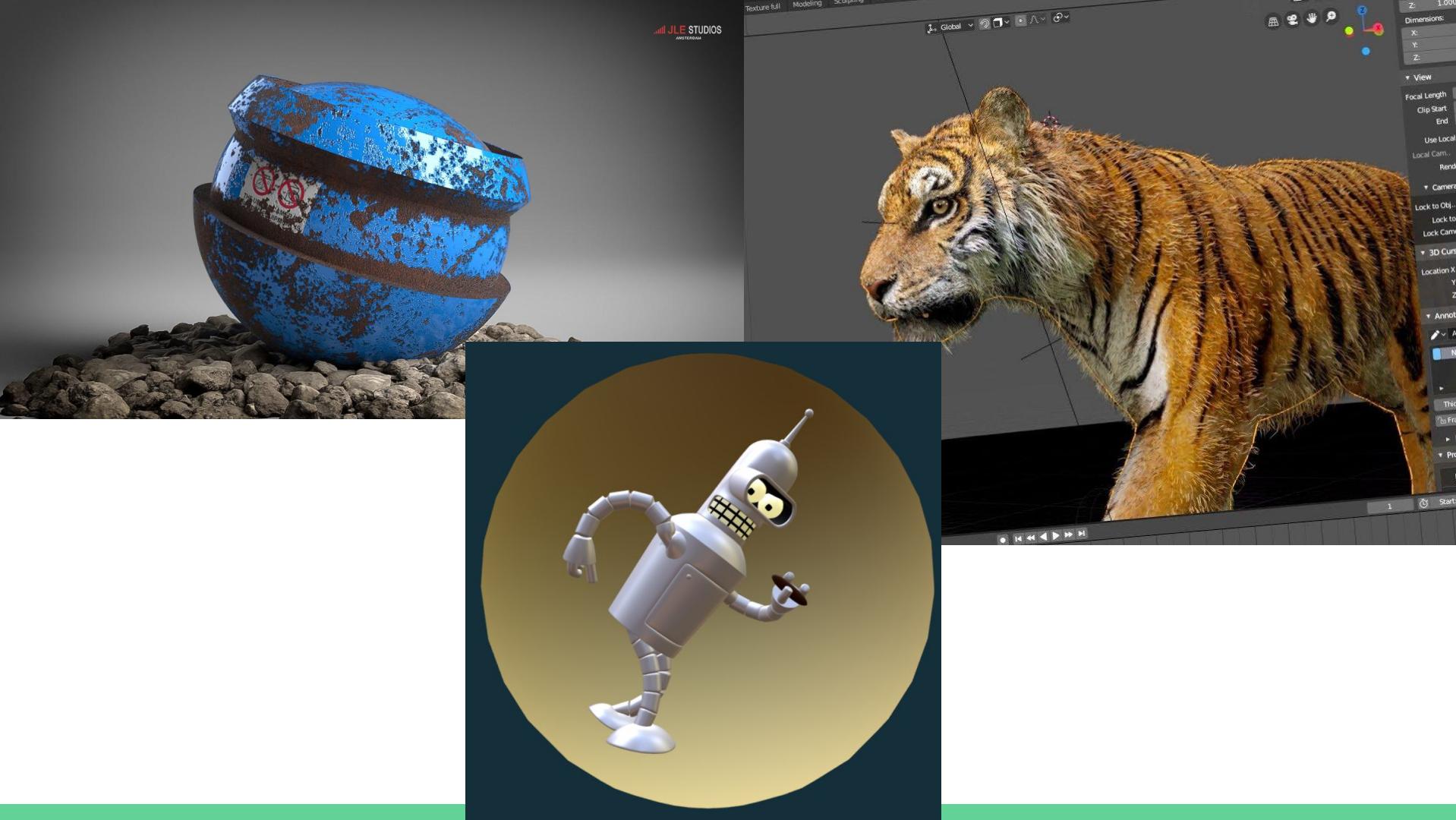
<http://www.blender.org>

We'll cover the interface, some of the basics, etc.

Software is very useful if you need to model complex shapes for animations, games, etc.

https://www.youtube.com/playlist?list=PLa1F2ddGya_-UvuAqHAksYnB0qL9yWDO6 → Blender tutorial basics

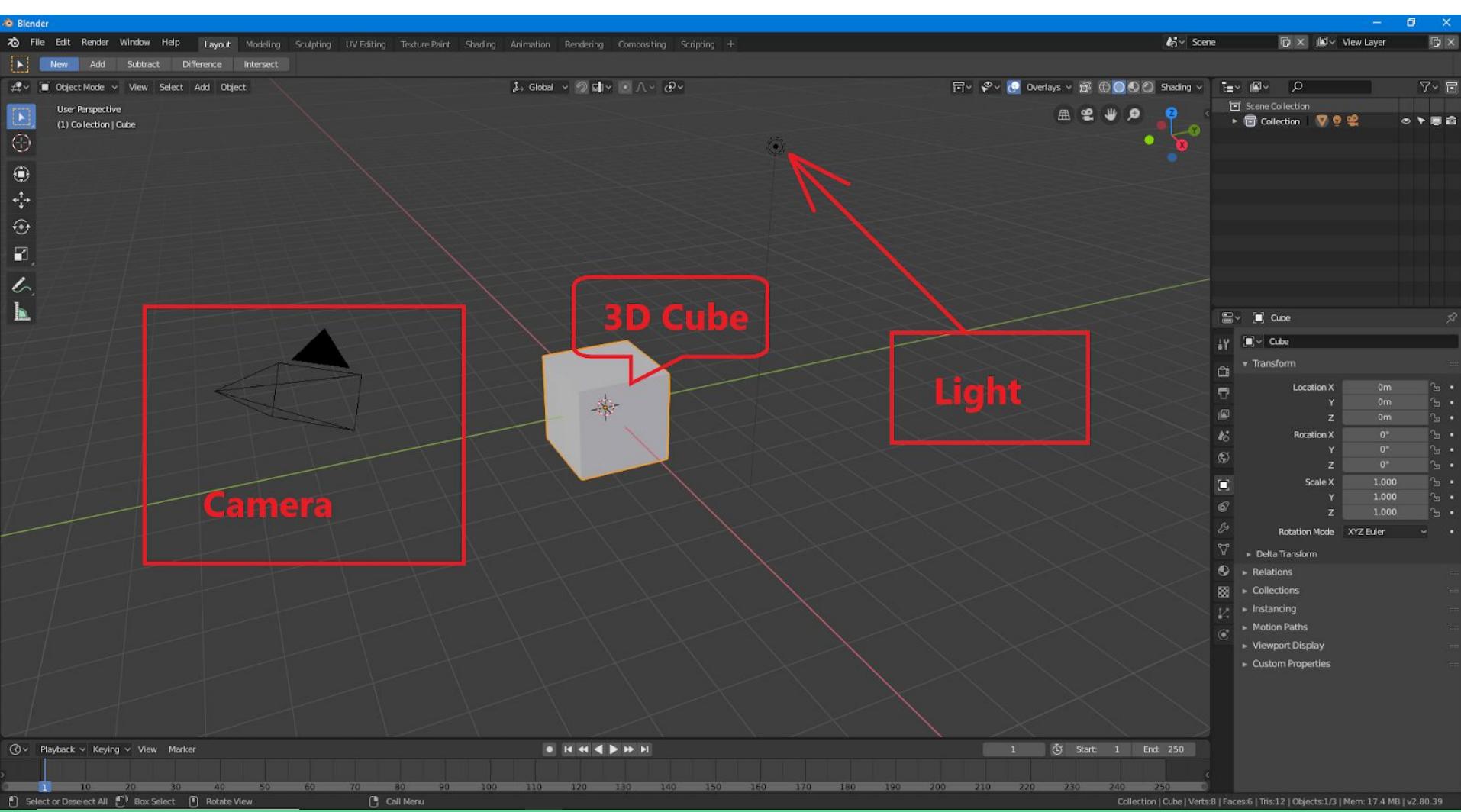
<https://www.ablenderuser.in/2019/01/blender-28-introduction.html> → Borrowed several nice screenshots (now dead ._.)

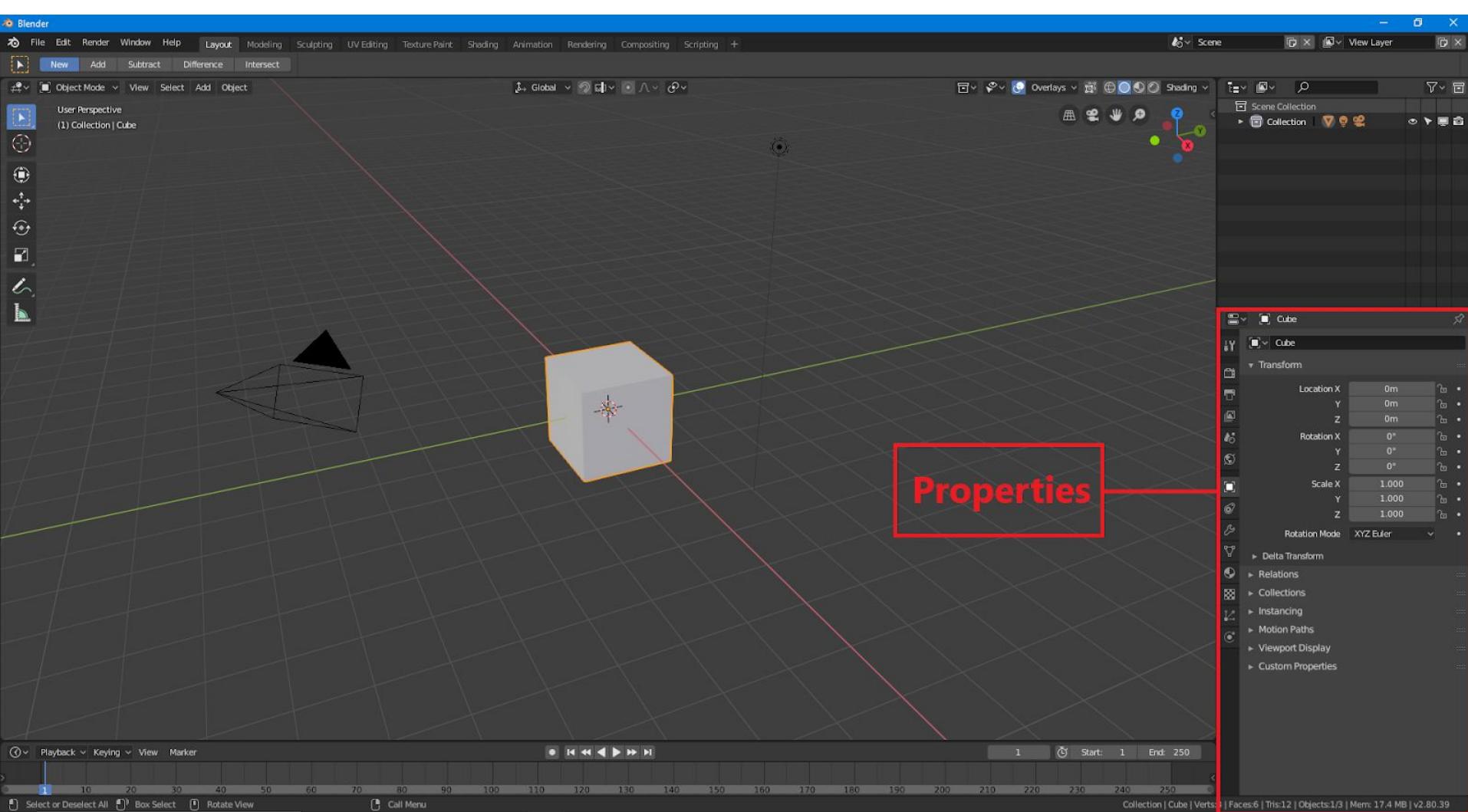


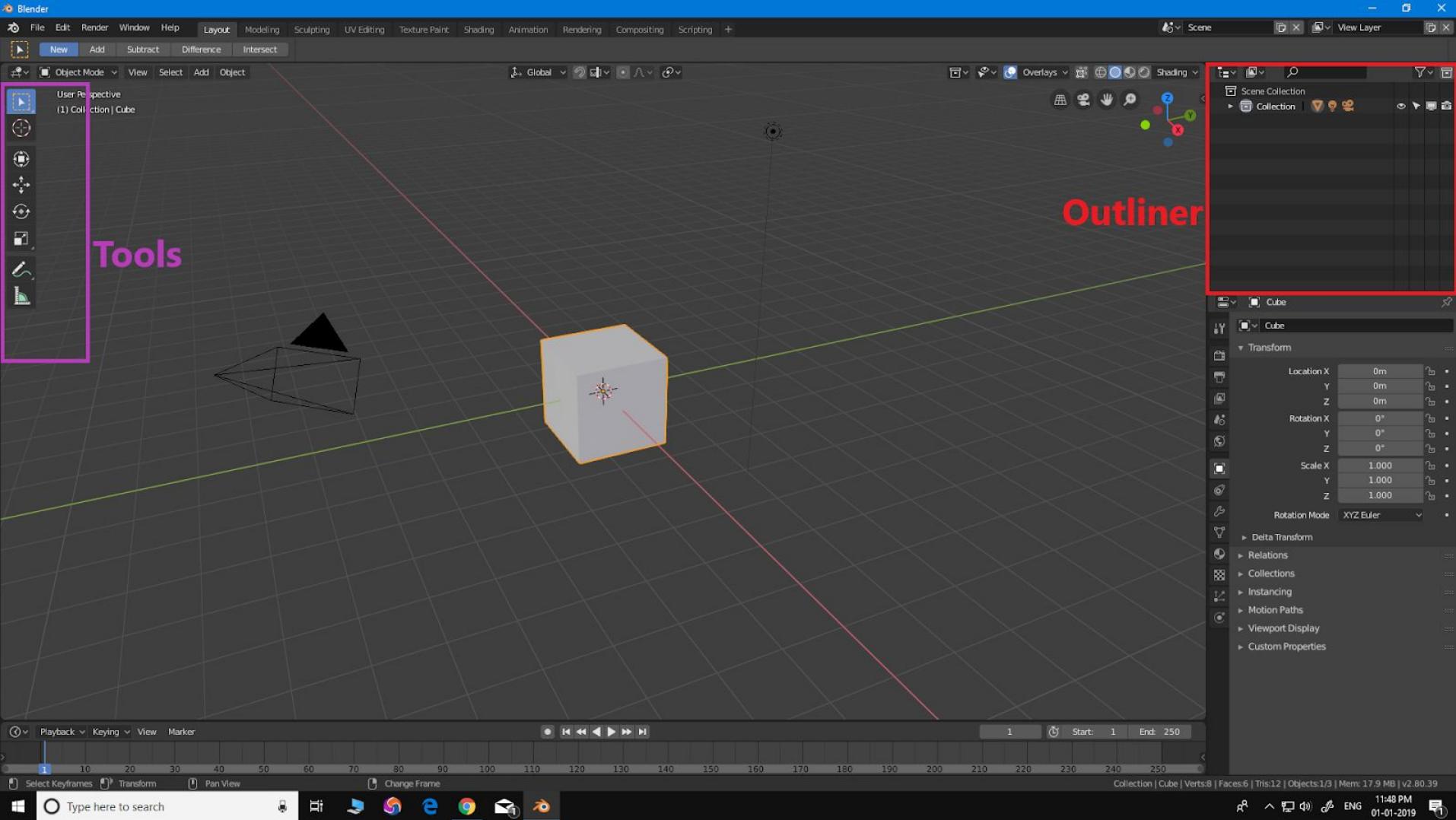
The interface

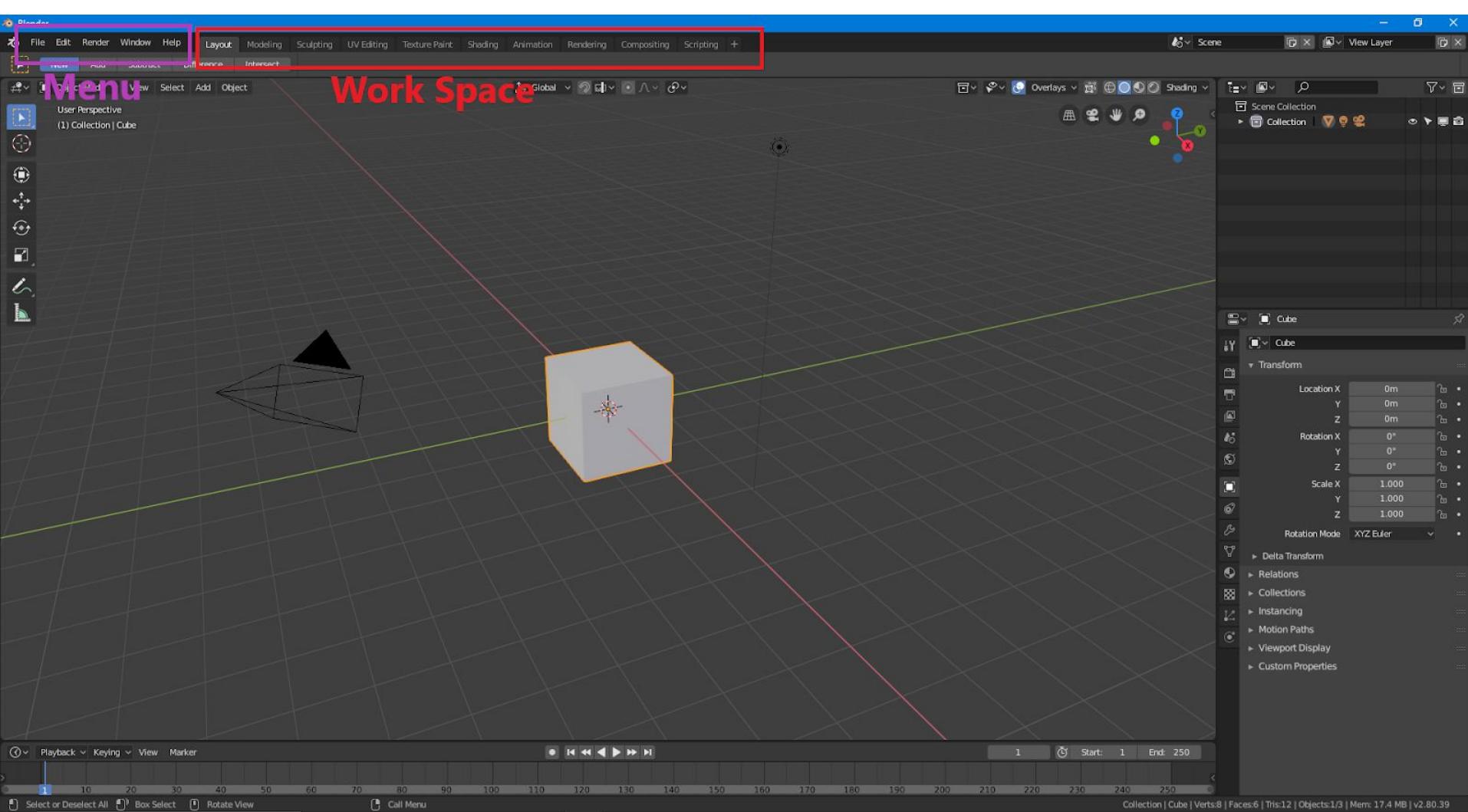
Used to be *super* clunky

Still a bit difficult to get into unfortunately





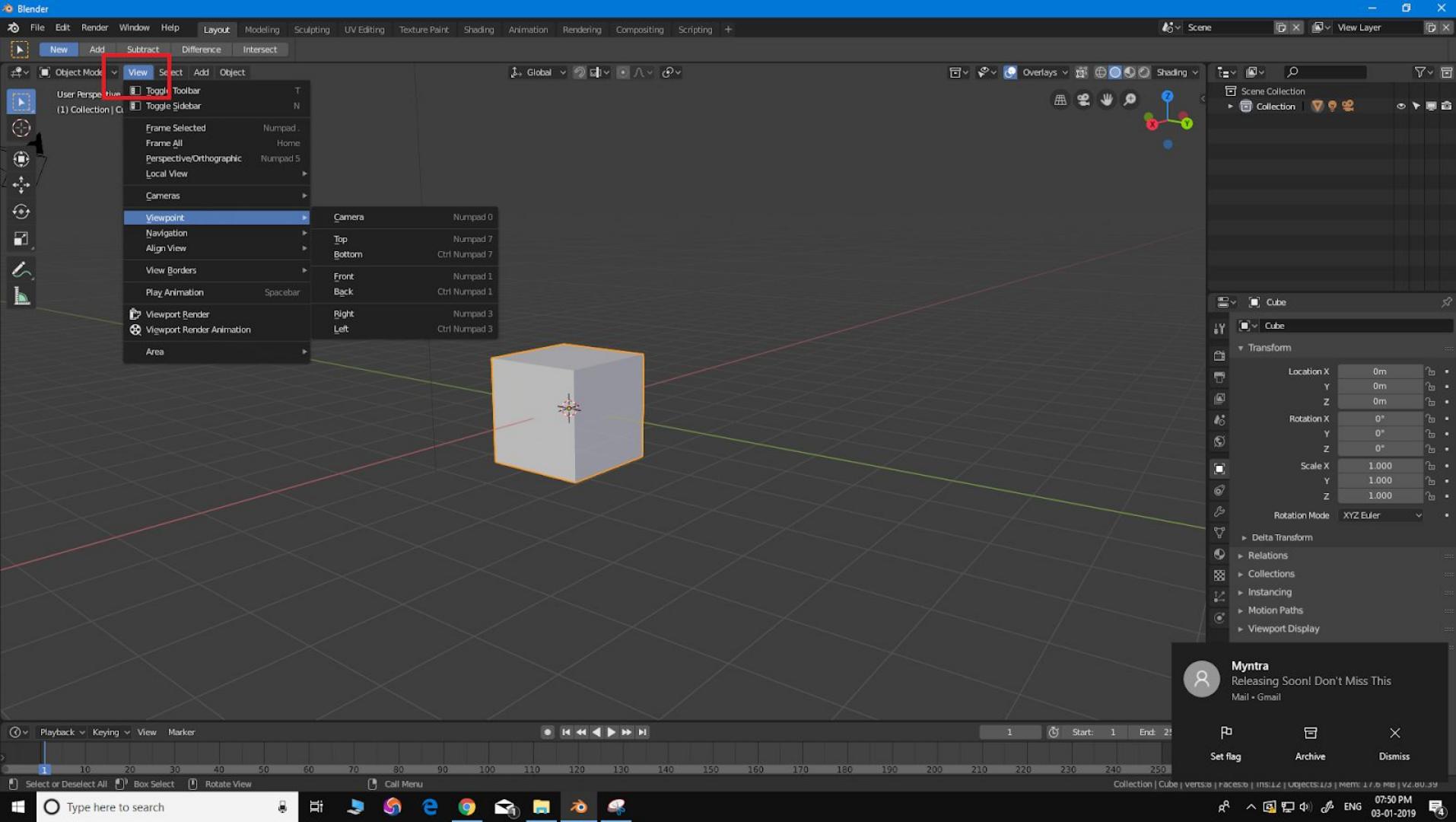


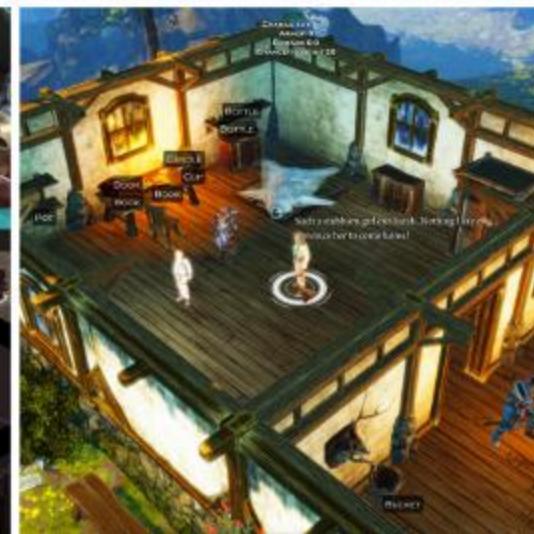
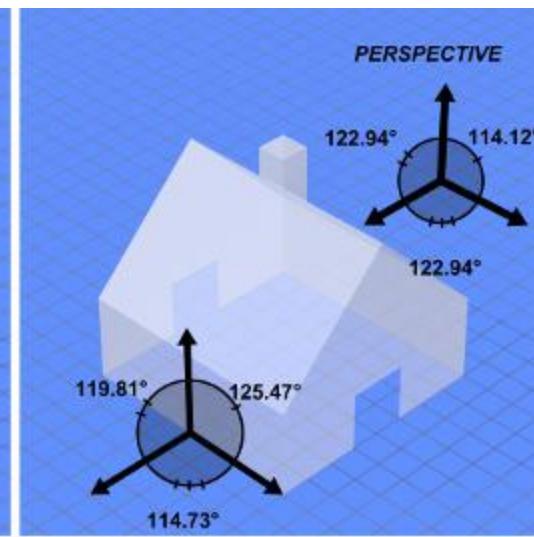
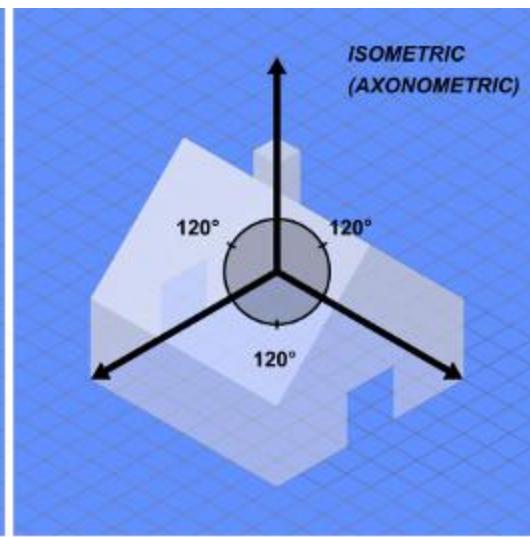
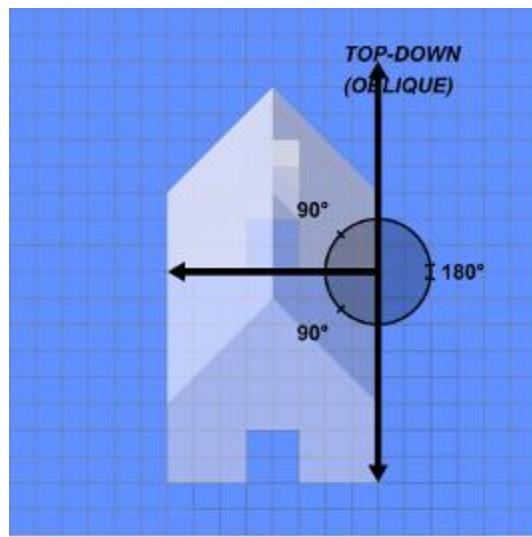


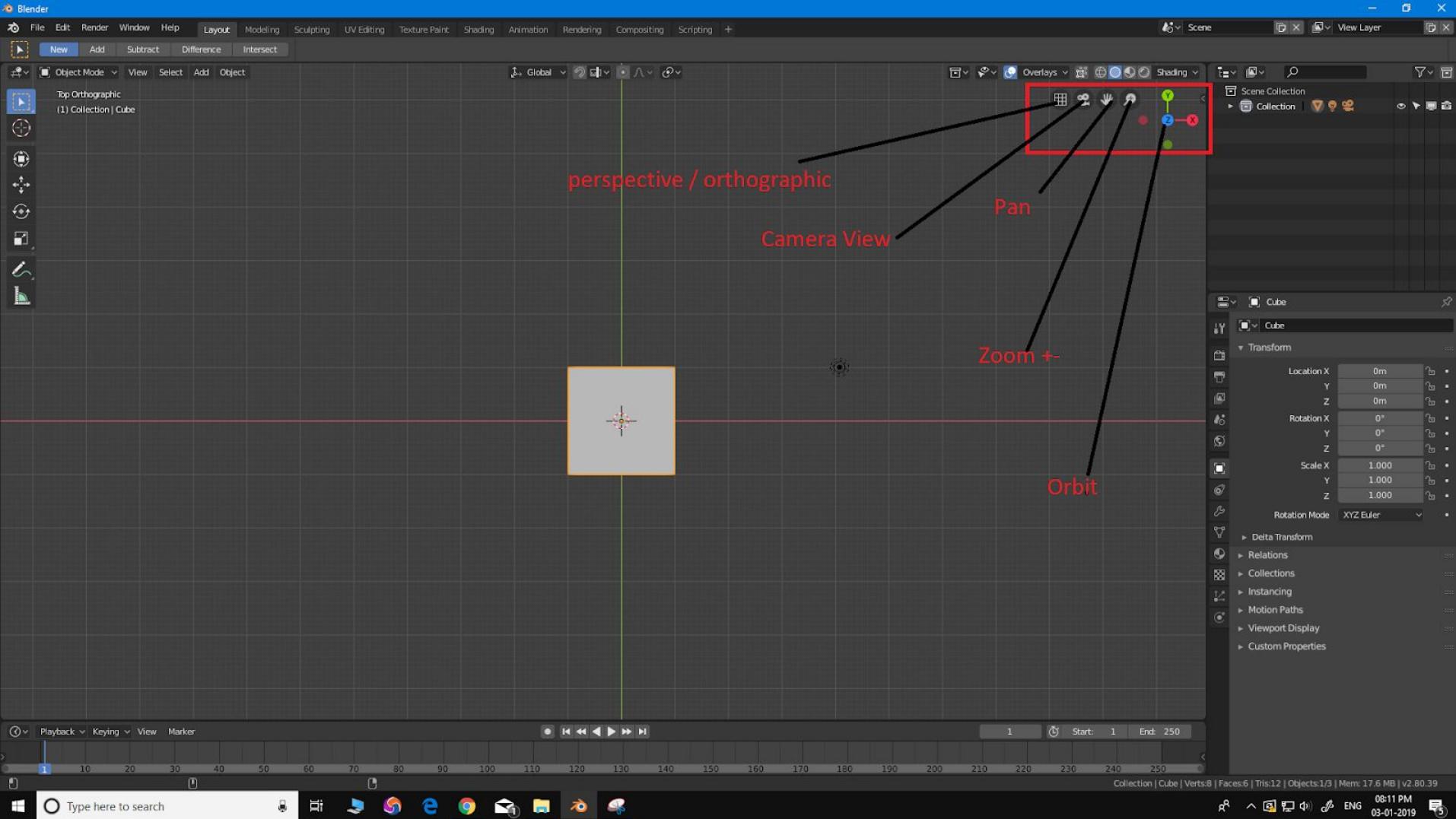
Viewpoints

Various ways to look at an object

- Front, top, left, etc.
- Perspective/Orthographic (close to isometric)
- Hotkeys assigned to change views easy (just check the menu (Viewpoint))







Object modes

Object mode

Edit mode

Sculpt mode

Vertex paint

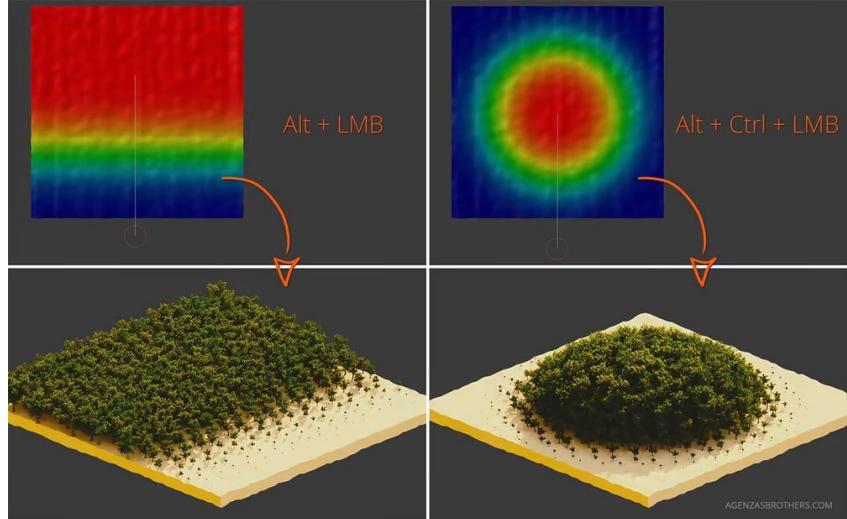
- Color vertices

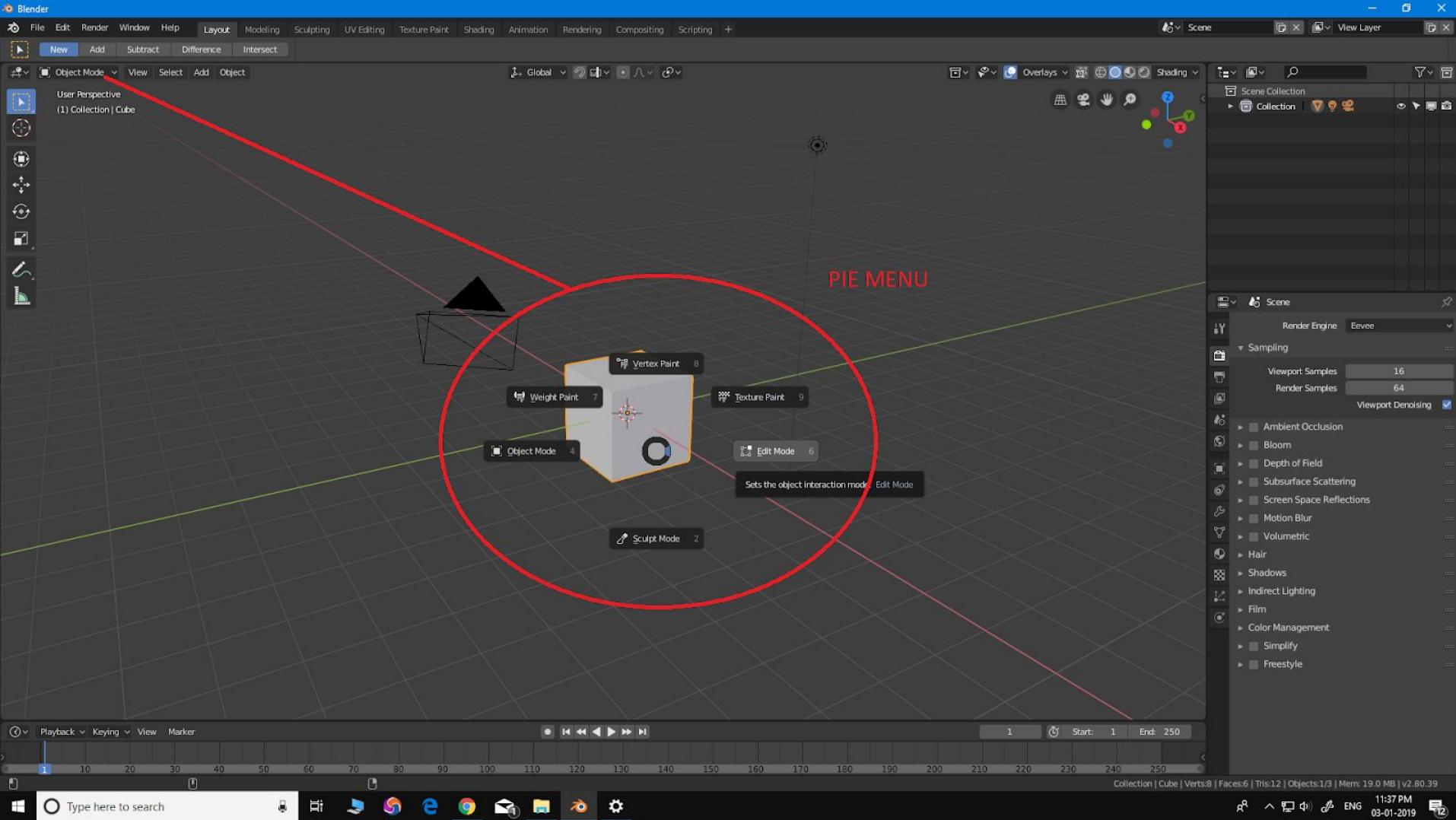
Weight paint

- Rigging, particle density (e.g., hair)
- <https://all3dp.com/2/blender-weight-paint-simply-explained/>

Texture paint

- UV mapping





Type here to search

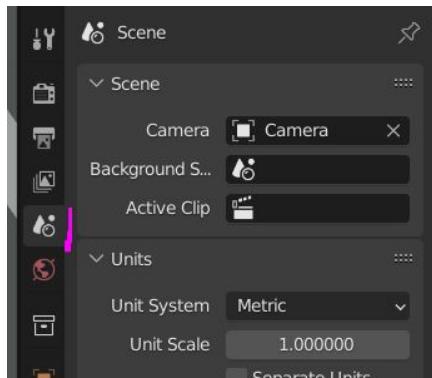


11:37 PM
ENG
03-01-2019

So what do we have?

A very handy tool for **modeling** various objects at varying levels of precision!

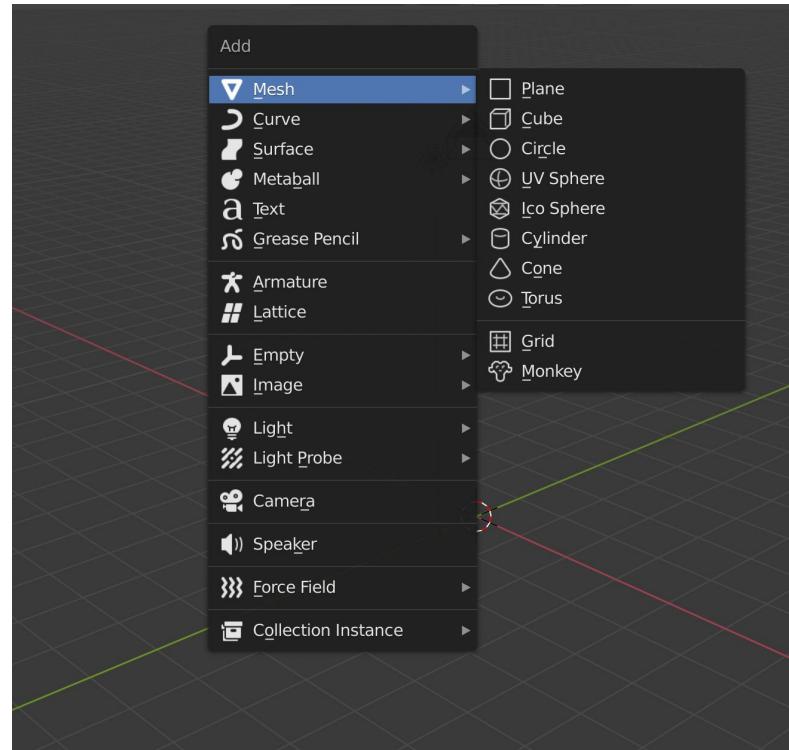
- Can **drag and drop** by hand
- Can also specify **precise measurements** via properties



Adding objects

Either via the Add menu or **Shift+a**

Select your favorite primitive and have fun



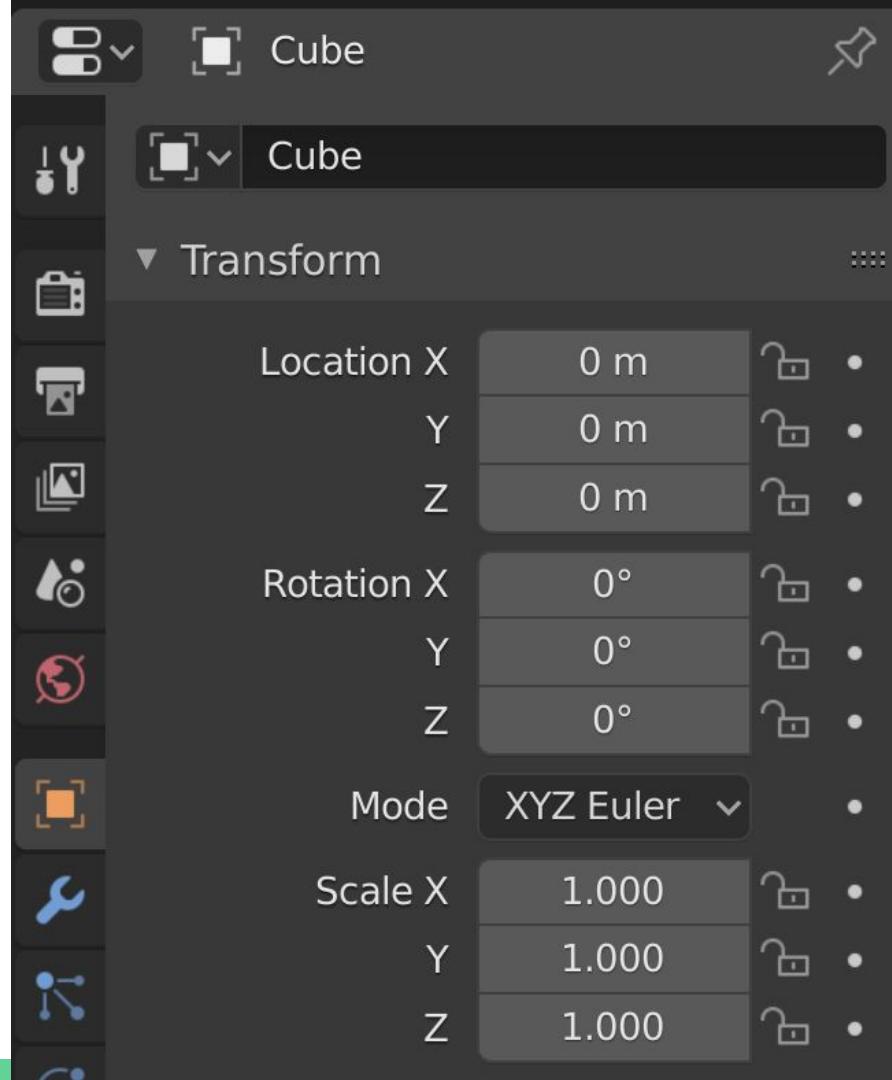
Transformations

Types:

- Translate
- Rotate
- Scale

Precision:

- Coordinate
- Axis



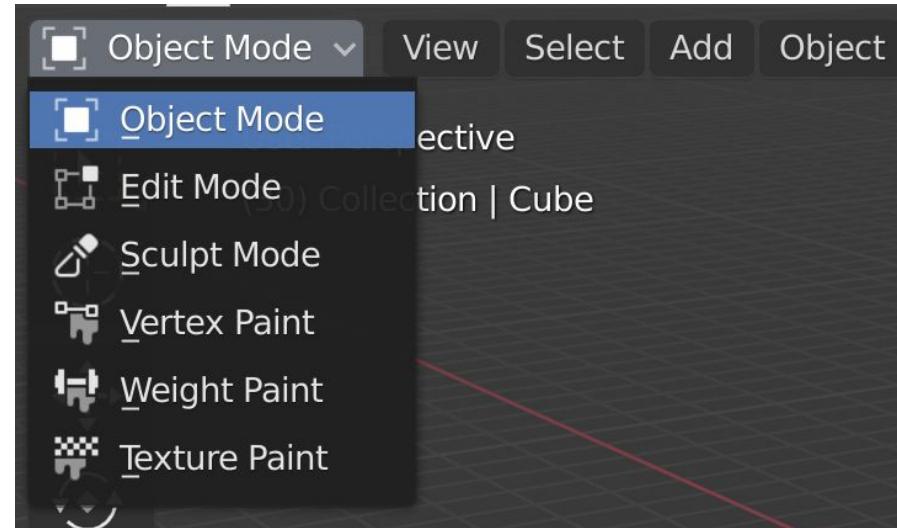
Modes

Object mode

- Objects treated as a **single entity**
- Basic transformations applied

Edit mode

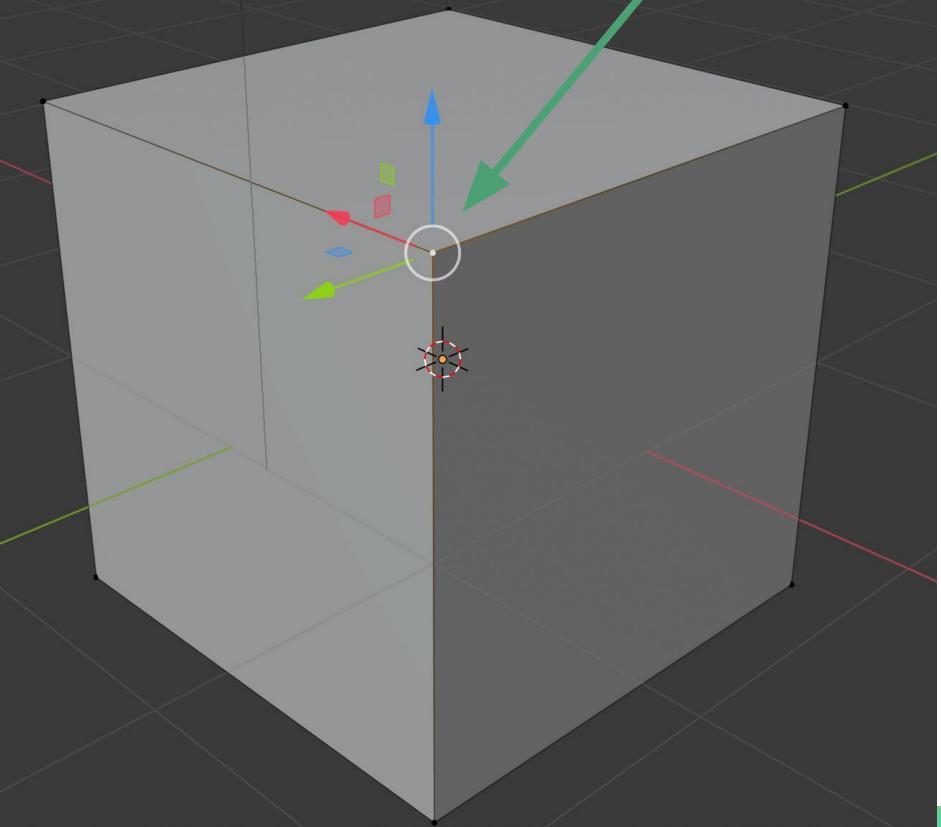
- Individual vertex/face/edge selection
- Any other changes to geometry



Edit Mode View Select Add Mesh Vertex Edge Face UV



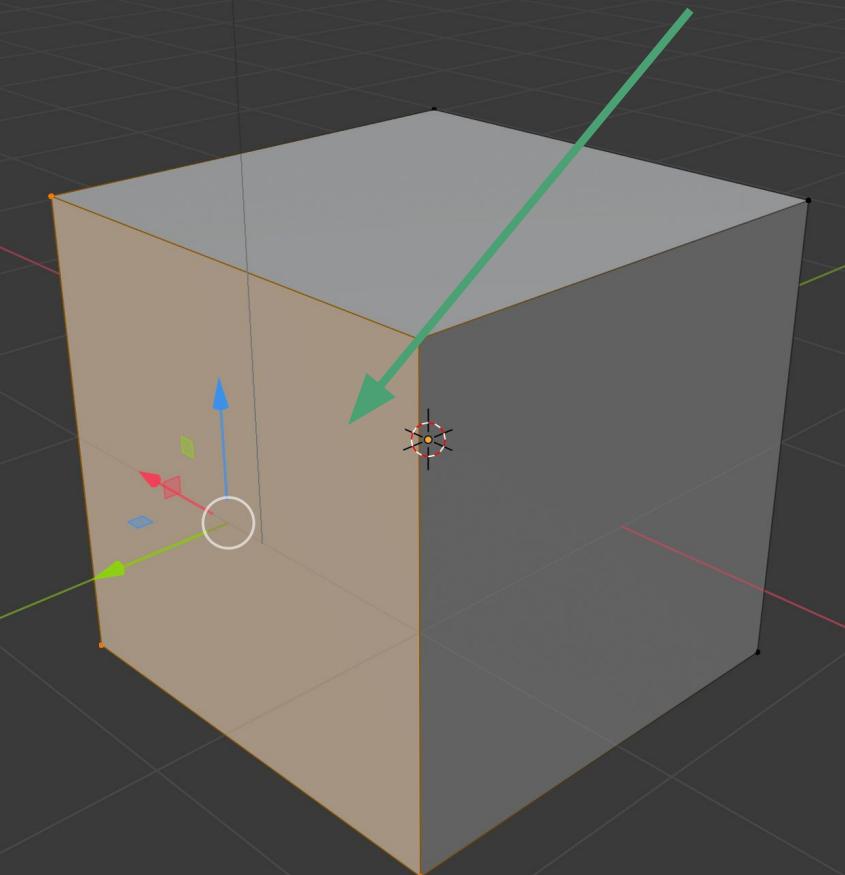
User Perspective
(30) Cube



Orientation: Default Global

Edit Mode View Select Add Mesh Vertex Edge Face UV

User Perspective
(30) Cube



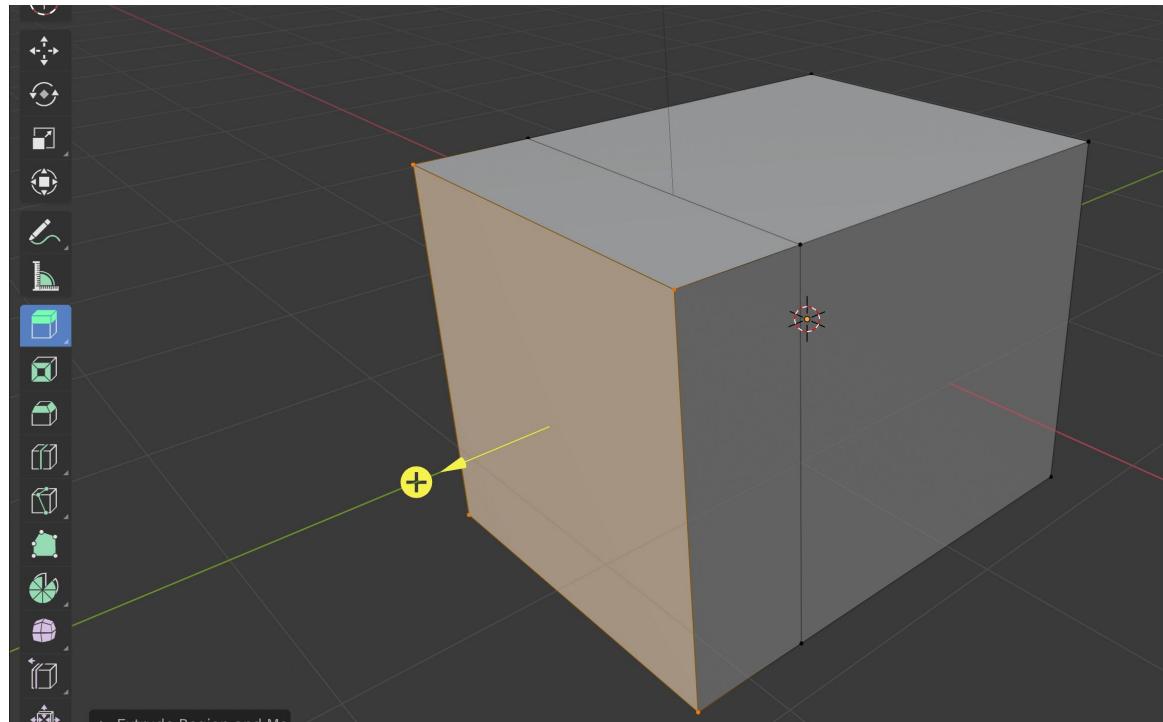
Extrude

Region:

- Selection treated as a whole

Individual:

- Each face independent



Fill

Create new faces by selecting:

- Two opposing edges
- Closed edges
- Contiguous vertices

Press 'F' to fill

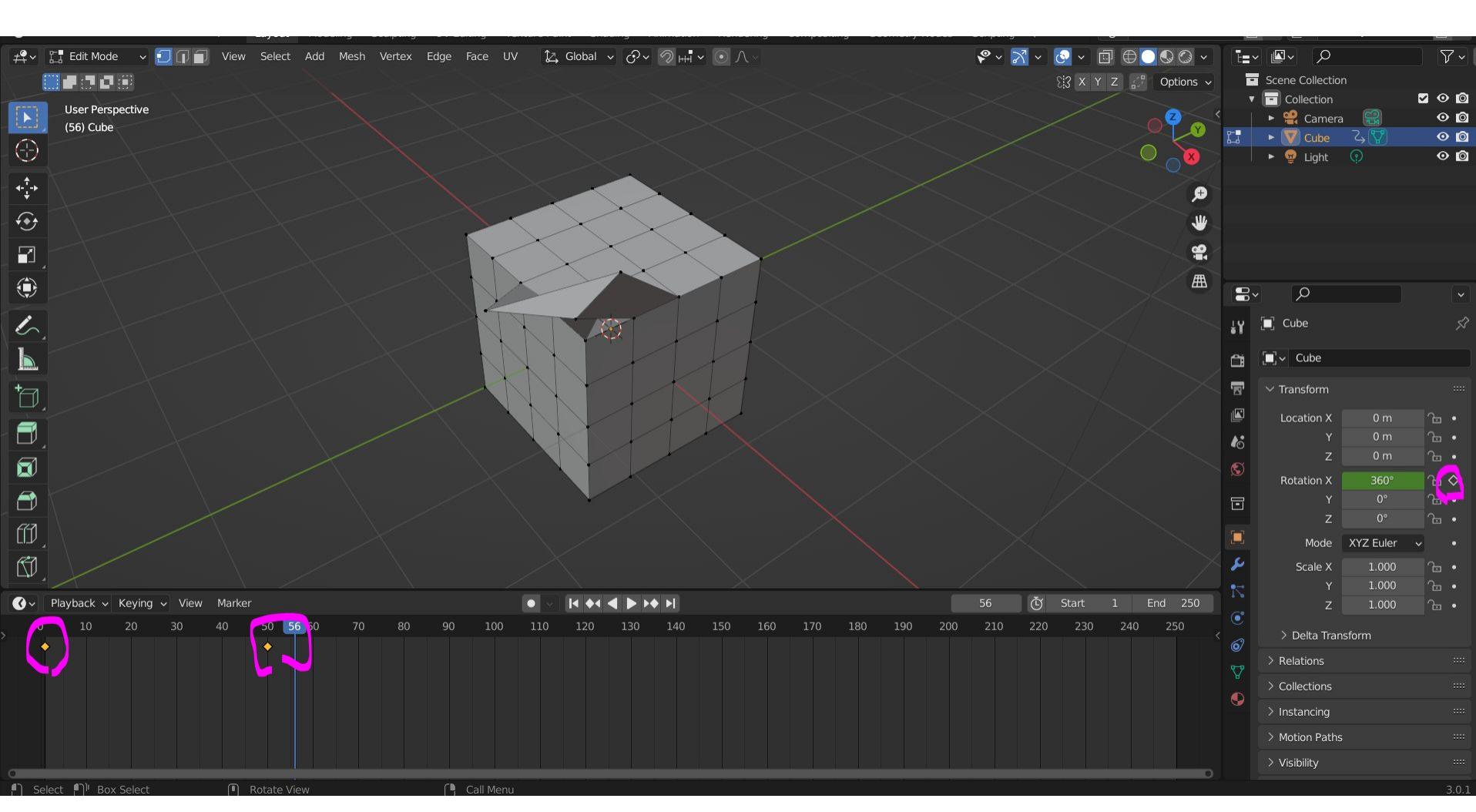
Animation

Drag up the timeline and you can keyframe pretty much anything.

Keyframe: a "stopping point"

Interpolation: what happens in between

- AKA tweening



Rendering an animation?

I'm sure those of you that are Blender experts have a better workflow but what I do:

- 1) Render to PNG sequence
- 2) Use gifski (or ffmpeg) to stitch together
 - a) gifski I know the commands, ffmpeg I have to lookup every time
- 3) ...
- 4) Profit!

Texturing/UV

Let's paint our monkey a little bit



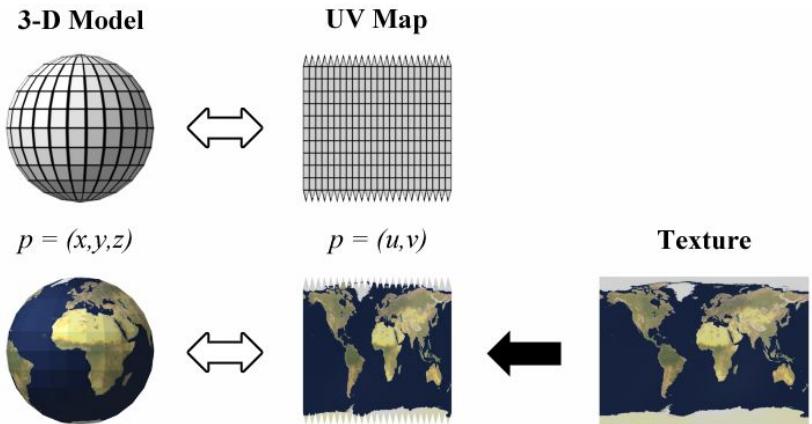
UVs

Textures are **two dimensional**

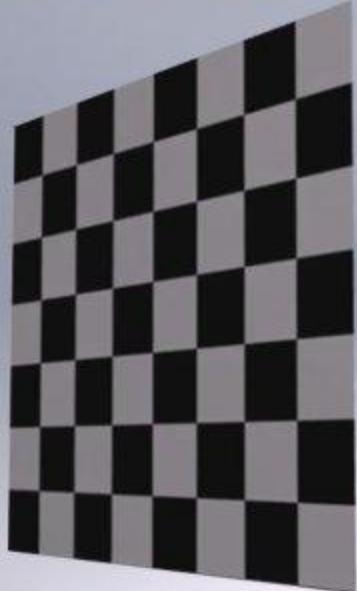
Models are **three dimensional**

Need a way to wrap images around models!

→ Do this in UV space (two dimensions when texturing)

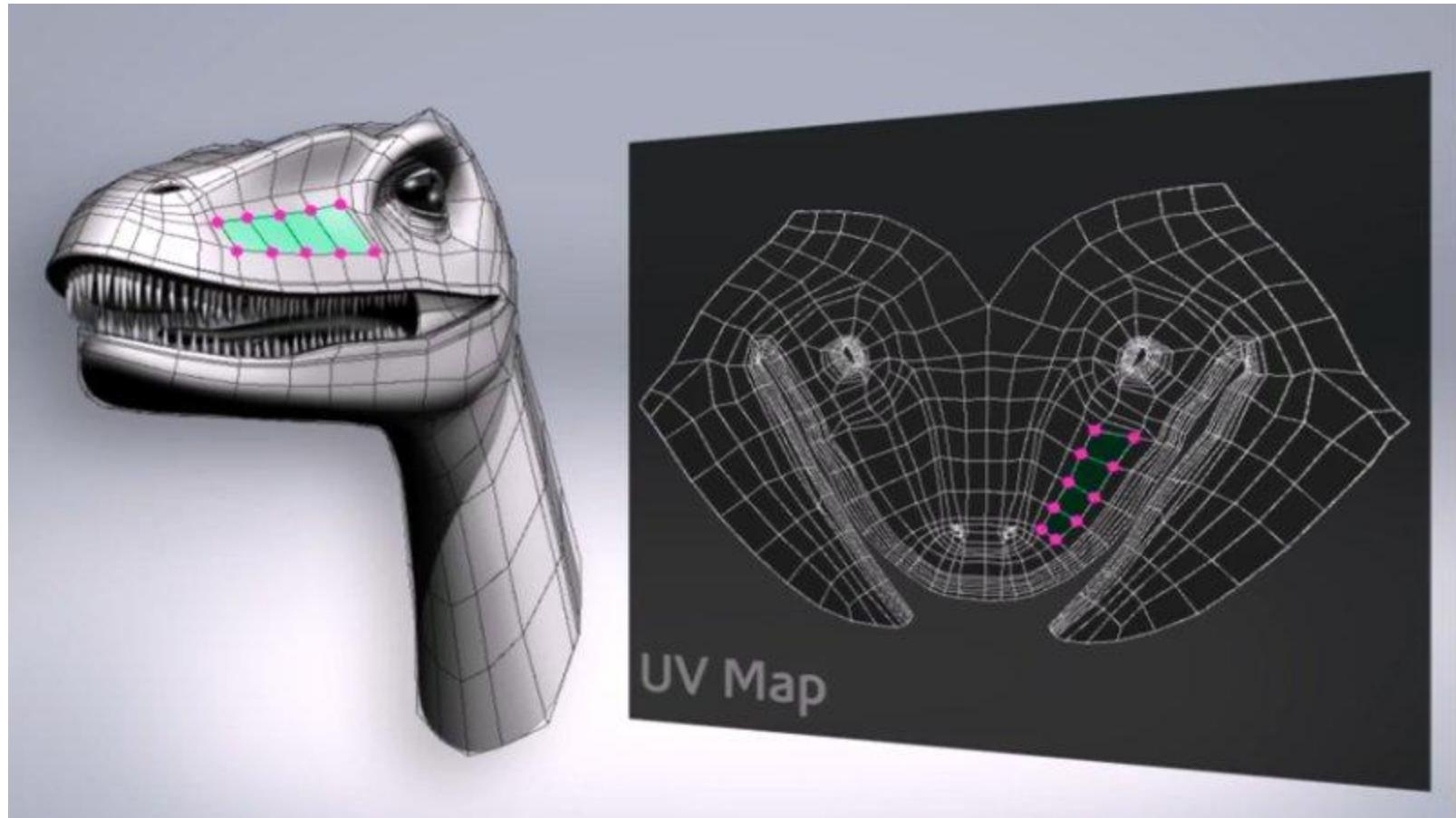


2D Texture



3D Model





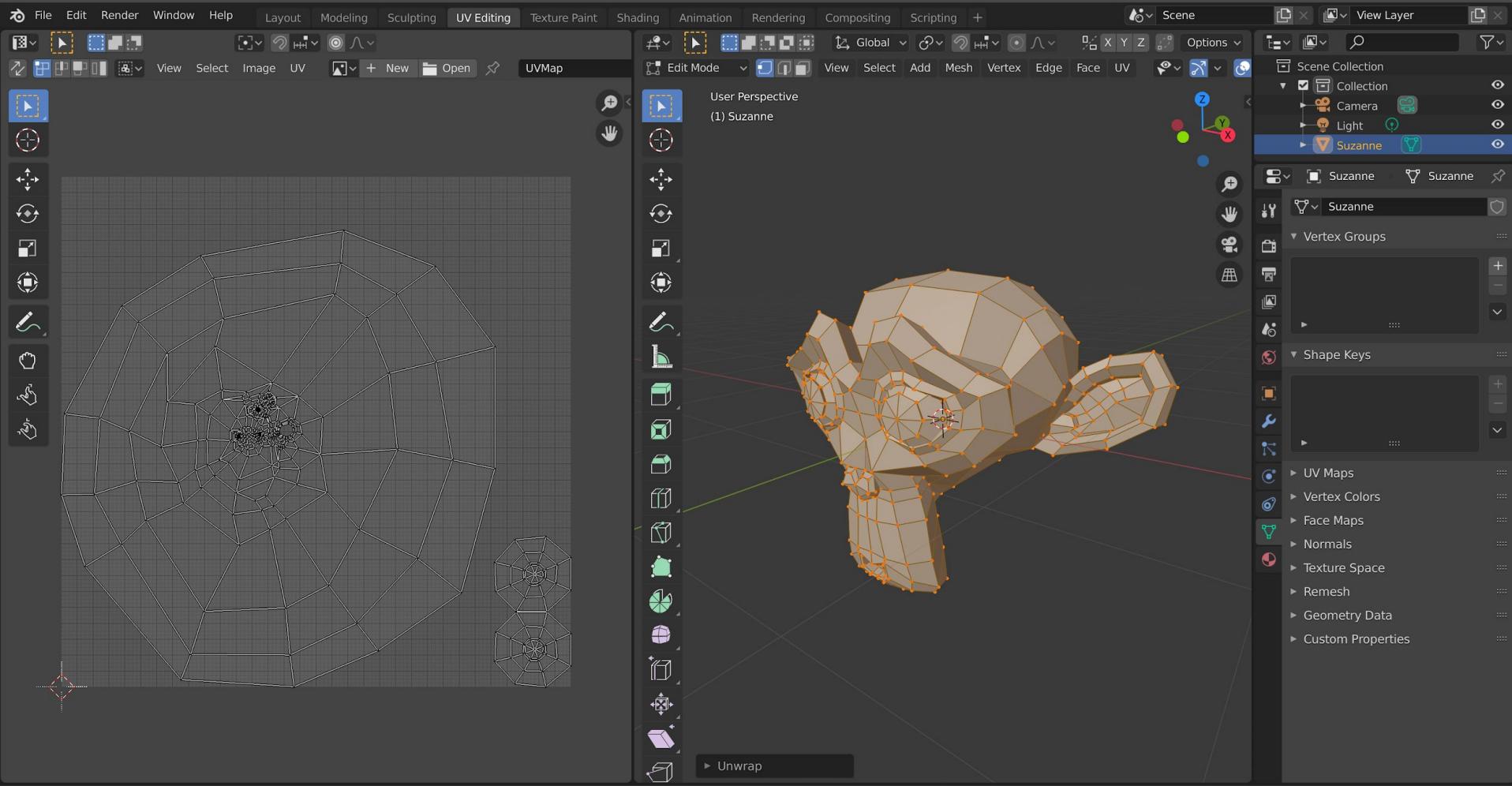
UVs

UV Editing view

Edit mode → UV → Unwrap

- Blender primitives come pre-unwrapped *properly*

Blender

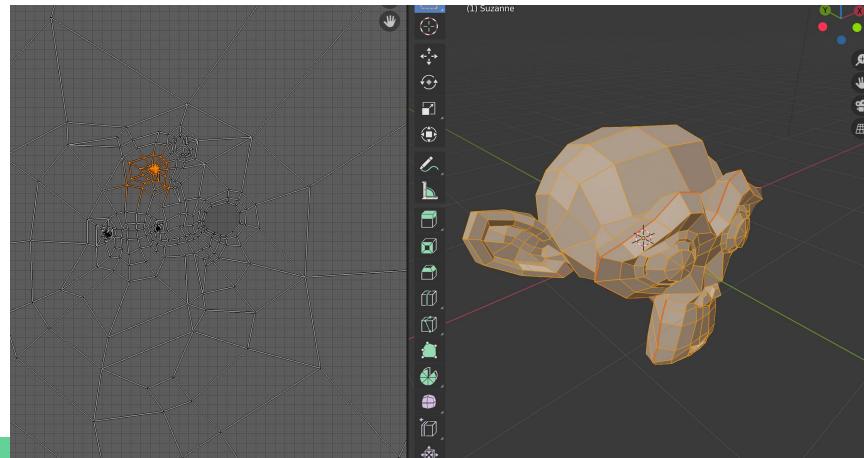
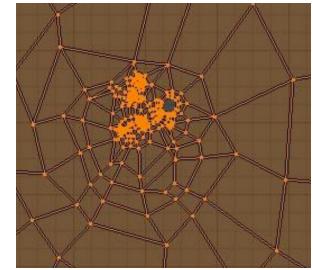


Seams

Seams lay out UVs for model

Select edges and click 'Mark Seams'
→ Lays out how the texture will wrap!

(Select edges on right and Unwrap again to see result)



A reasonable UV mapping tutorial

<https://renderguide.com/blender-uv-mapping-tutorial/>

<https://download.blender.org/documentation/html/ch11s06.html>

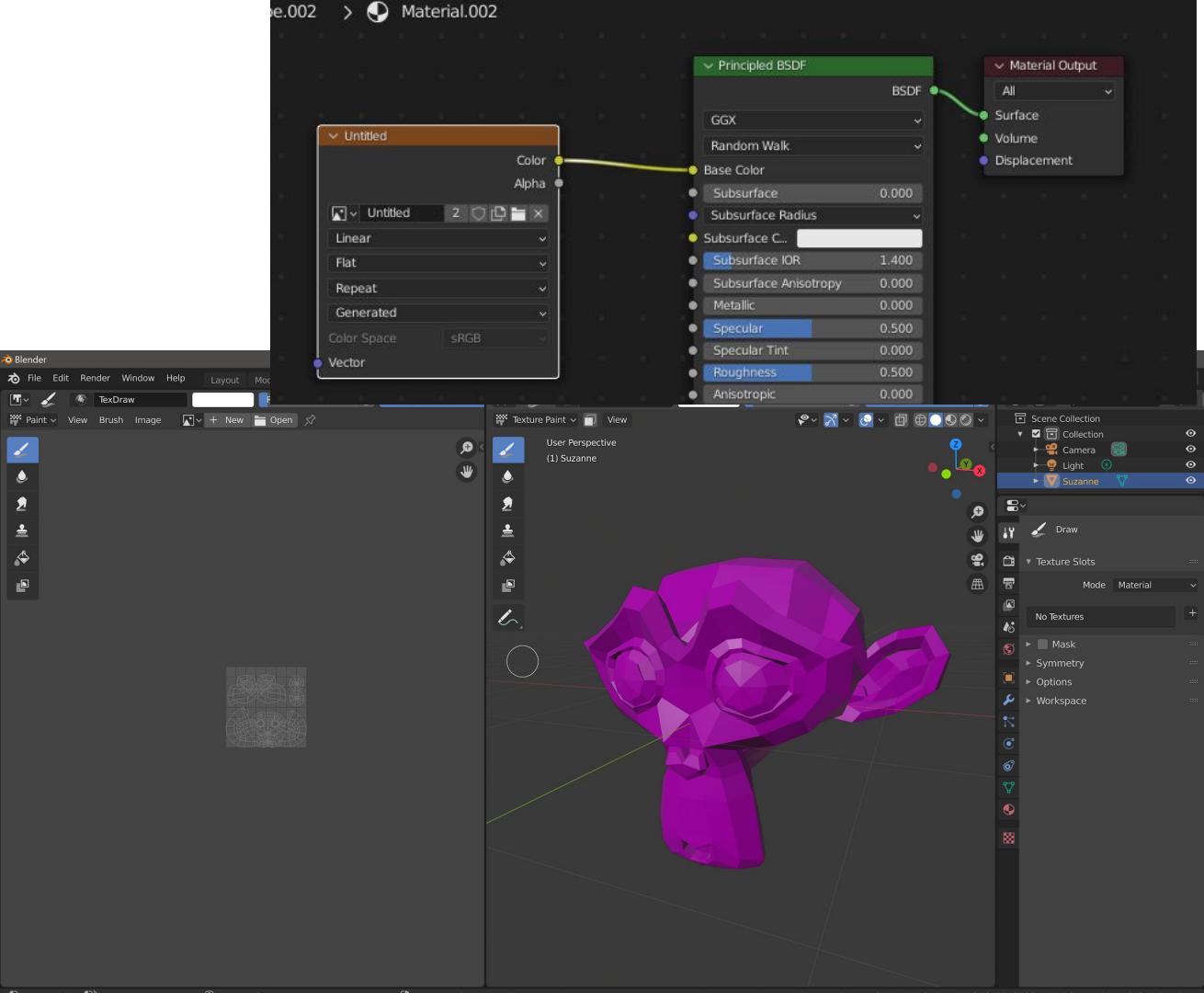
Texture painting

No texture!

Create Image → Save

Add Image Texture to
Shading Node Editor
→ Select created image

Then you can draw!

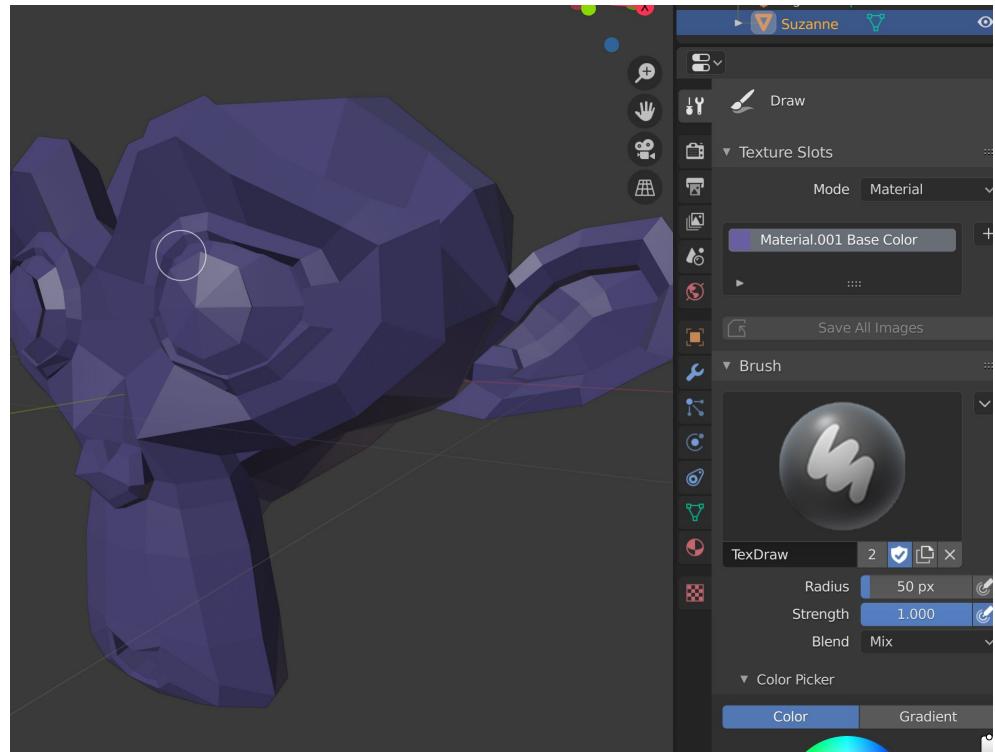


Texture painting

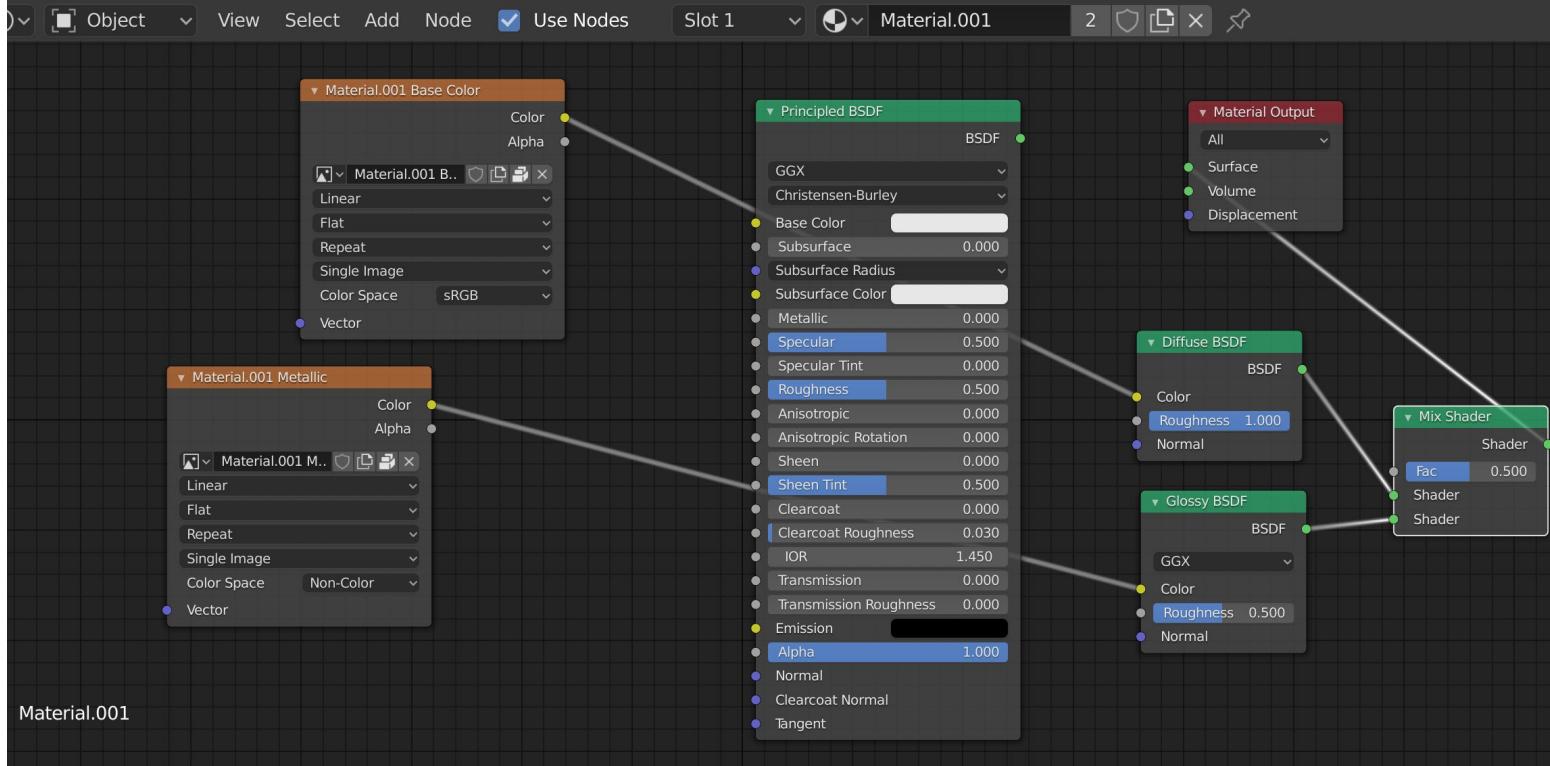
With texture!

To save as image (needed later):
UV Editing → Image → Save as Image

To store in .blend file:
UV Editing → Image → Pack



Shadi

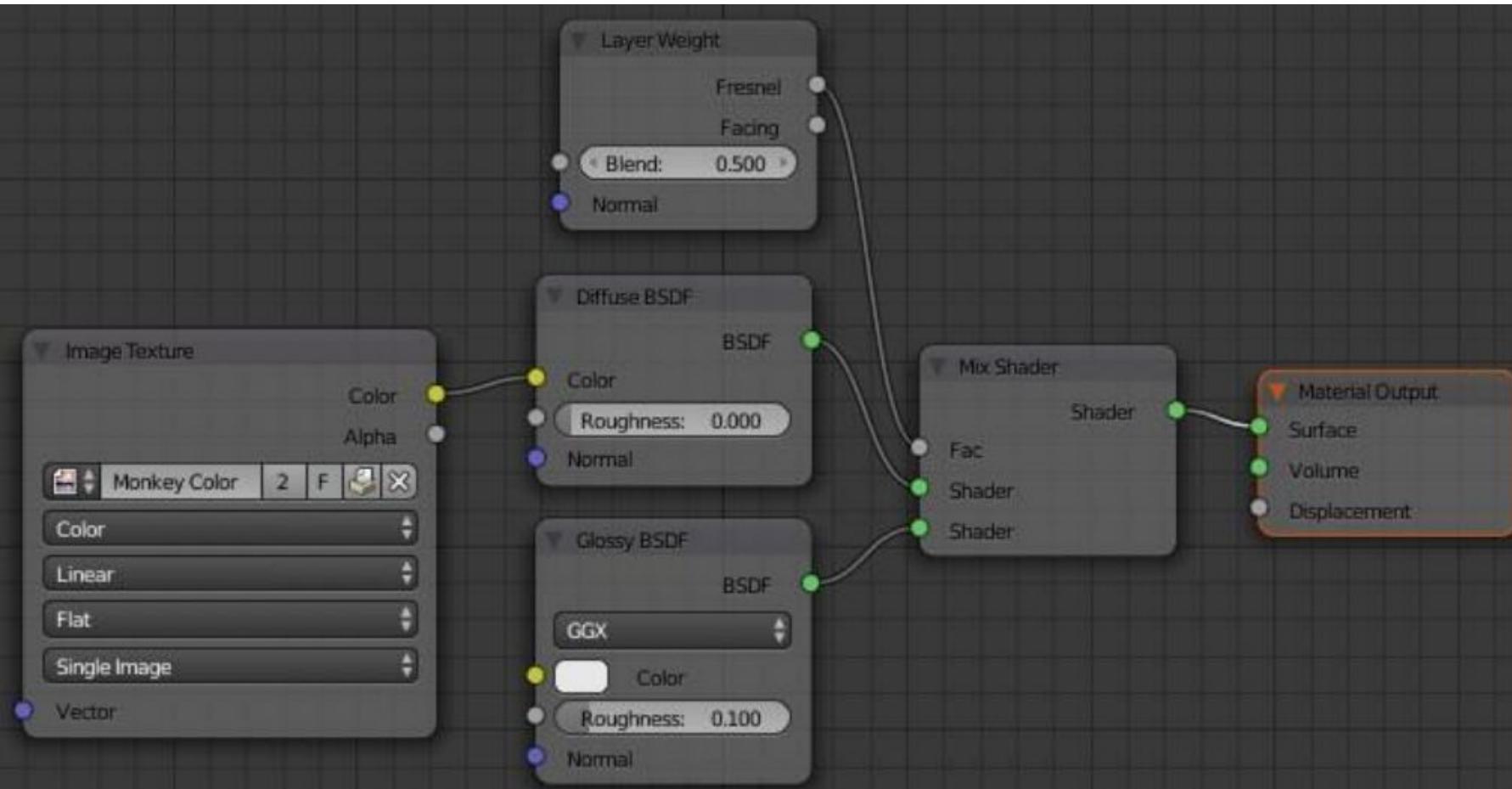


Scene

- 1) Add a plane
- 2) Orient monkey head to sit on top
- 3) Add a point light (strength ~500)
- 4) Add some nodes and play around!

<https://www.blenderhd.com/wp-content/uploads/2015/08/BeginnersGuideToBlender.pdf>

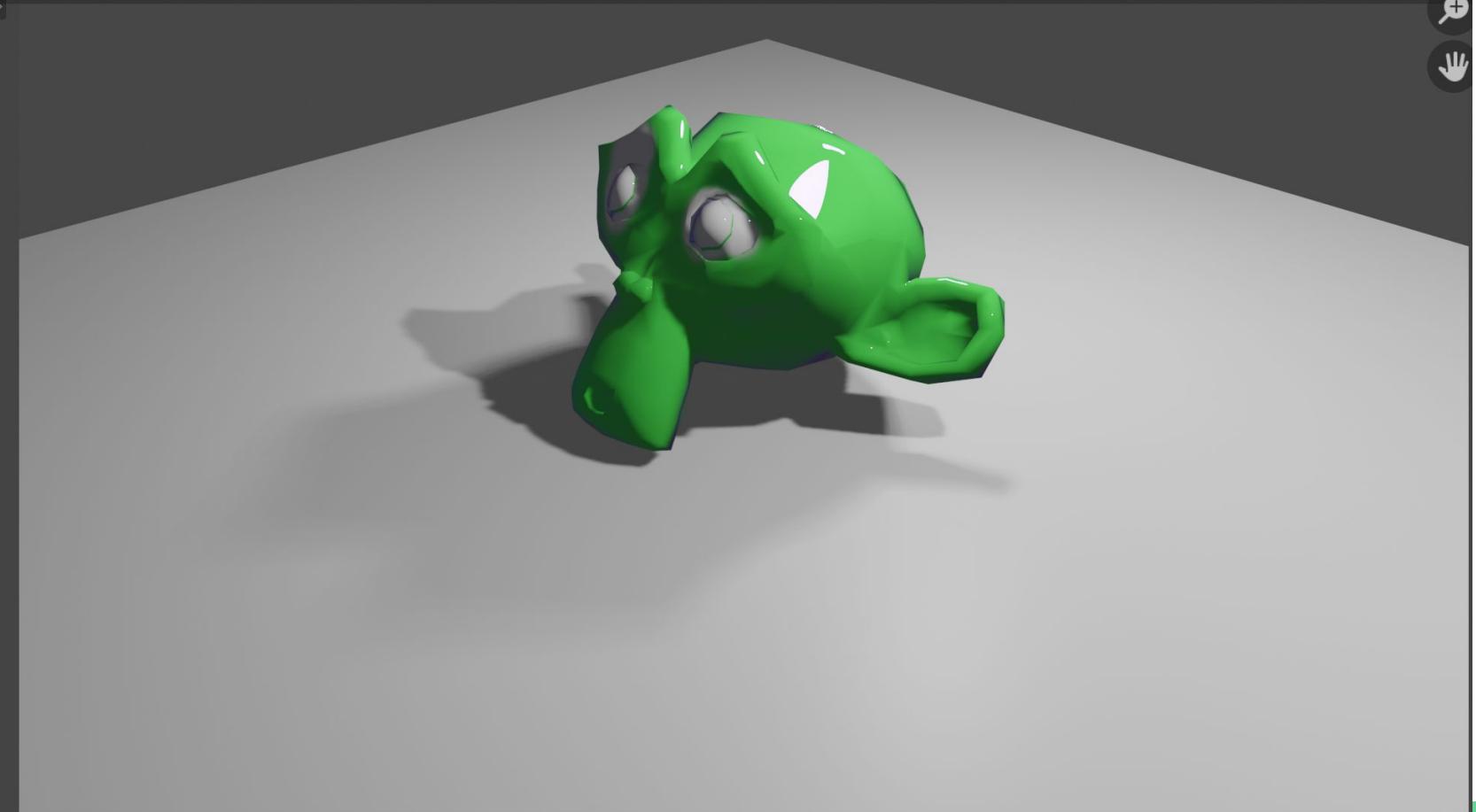
"Plastic look"



Blender Render

[T] View View Image [R] Render Result [S] Slot 1 View Layer Combined [X]

Frame:1 | Time:00:00.72 | Mem:128.84M (0.00M, Peak 169.34M)



!!

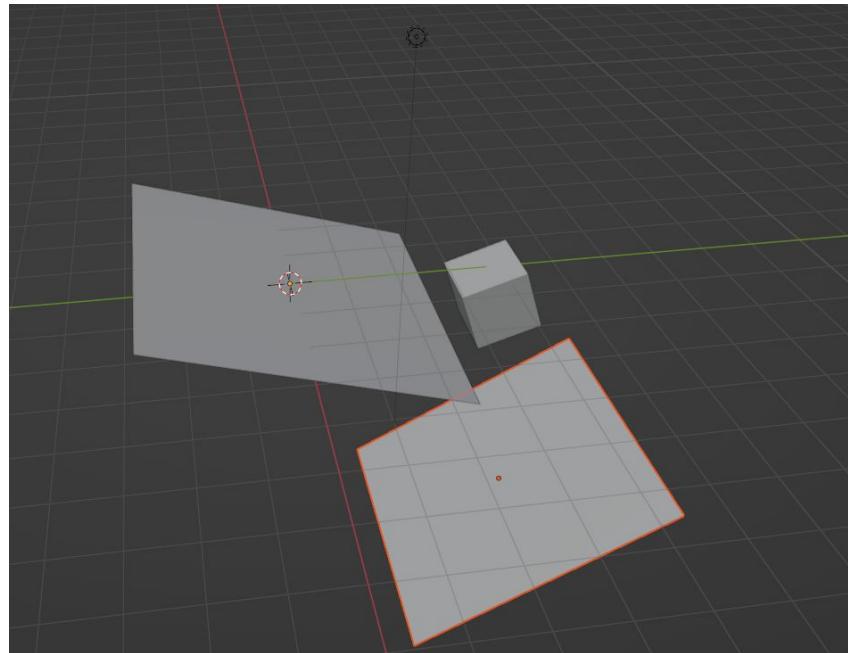
Add monkey (poor Suzanne)

F3 (search) → Smoke

Physics

Physics properties

- Rigid body (active on moving, passive on receiving)

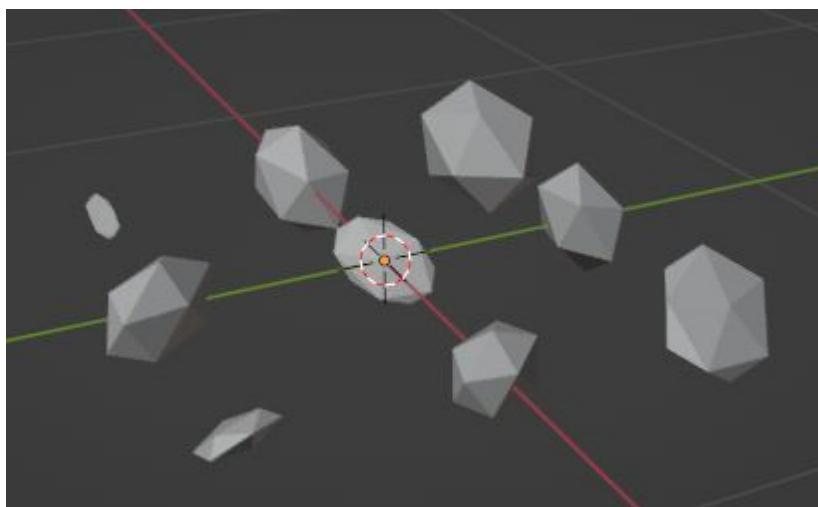


Geometry nodes

Oh my what a rabbit hole these are...

Fun to be had:

Grid -> Mesh to Points -> Instance on Points



Rendering engine + HDRIs

Eevee or Cycles?

Eevee: real-time rendering

Cycles: physics-based rendering

Which do you pick?

Eevee: speed

Cycles: fidelity



(The settings you pick will probably determine how 'well' they look)

Fluid sim

% <https://www.versluis.com/2022/06/creating-fluid-simulations-in-blender/>

1. Use default cube
 - a. Go to wireframe mode to be able to see what's going on
 - b. Align with default plane (move up by 1 or hotkey: gz1)
2. Add Fluid
 - a. Domain: Liquid
 - b. Resolution divisions = voxel size
 - c. Under Cache: Type: All
 - i. Bake All will calculate the physics and write out to cache directory

Fluid sim

3. Add emitter (icosphere), size, and place inside near top of cube
4. Add Fluid: Flow
 - a. Flow type: Liquid
 - b. Flow behavior: Inflow

(% the link)

Geometry: *object turns to liquid and falls*

Inflow: *flow object pours liquid (e.g., a tap)*

Outflow: *flow object drains liquid (e.g., drain hole)*

5. Select the Cube domain and Bake All

Fluid sim

Rest of the guide adds a cup to catch the liquid

Let's animate the emitter instead

Need to 'Free All' in the Cube domain

Keyframe the position of the icosphere and then rebake

WiP



Point of note:

We have ~4 weeks left and you have an ongoing assignment.

You'll have two more short assignments (Blender + Unity) + an extra credit opportunity (Blender geometry nodes)

You also have to present your term project (lite) the last week of class.

Plan wisely!

The following slides are basically notes from several of the Blender Guru donut videos

Donut (notes from blender guru)



Add torus

Size appropriately (~.05m / .03m)

Lowest res possible (less vertices for mesh → major segments)

Edit mode, proportional mode (O), G, scroll, distort bounds

Object mode, shade smooth

→ sharp edges

Higher res → subsurface modifier

→ properties, wrench, add modifier, subdivision surface

→ not destroying/changing vertices!

→ viewport smooths

DON'T HIT APPLY JUST YET ON MODIFIERS!

Donut

Side view to select top half (going to cut it) (tilde/side or click X)

show xray 

shift+d to duplicate, escape to snap back to loc

p to separate, selection

(if stuck, ctrl+L will select all vertices for selected object)

object mode shows objects

rename (dbl click) object in scene collection

zoom in and you can see clipping

select icing, n, (view) clip → 0.001

give thickness to mesh. add modifier, solidify

→ offset 1.0

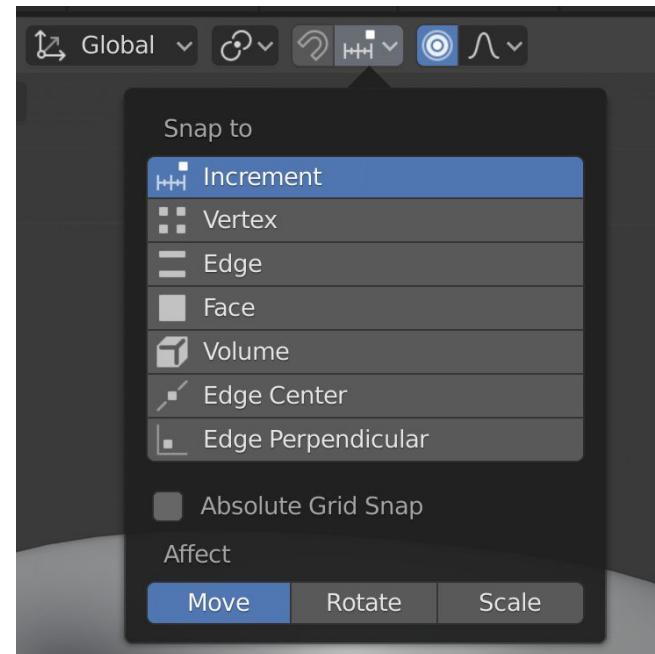
→ thickness, .0025

hard angle on icing → swap order of subsurface w/ solidify

Dribble

Edit on icing

- uncheck last box in solidify modifier (see vertices)
- need vertices to add dribbles
- select with A (alt+A deselects)
- right click and subdivide, smoothness to 1.0
- alt + left click to select edge
- invert selection (select)
- h to hide (alt h to bring back)
- snap to keep vertices snapped to underlying mesh
 - snap to face, and individual elements
- pick random proportional modes



Select ~2 vertices, e for extrude
→ Make some dribbles

Solidify, Crease, inner → 1.0 to round off and make it look 'stuck' to donut

6 Key Principles

<https://www.youtube.com/watch?v=OVbIOHAI3iY>

If time

- Work on term projects
- Verbal status of where you're at before leaving

Loading

<https://sandbox.babylonjs.com/>