

Shading, texturing e rendering in Blender 3.5

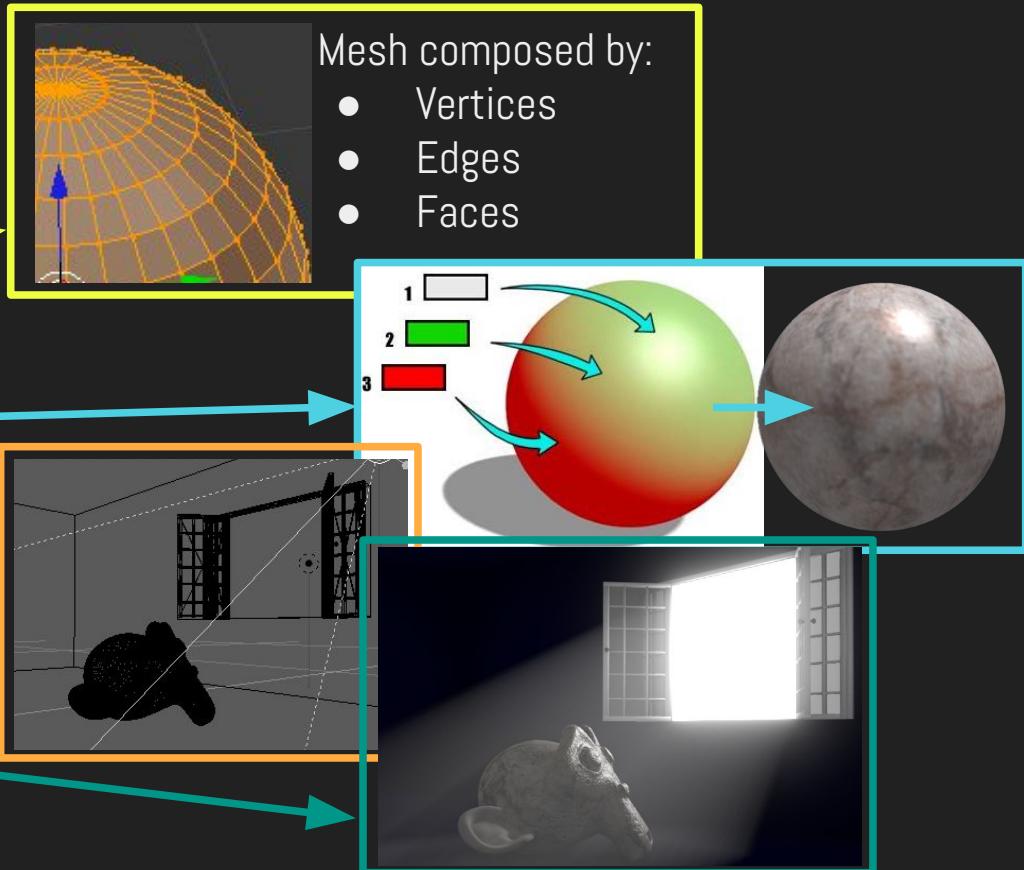
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Scene

The scene includes points, lines and polygons that exist inside a three dimensions space defined by X, Y, Z axis.

In order to **compose a scene** is necessary:

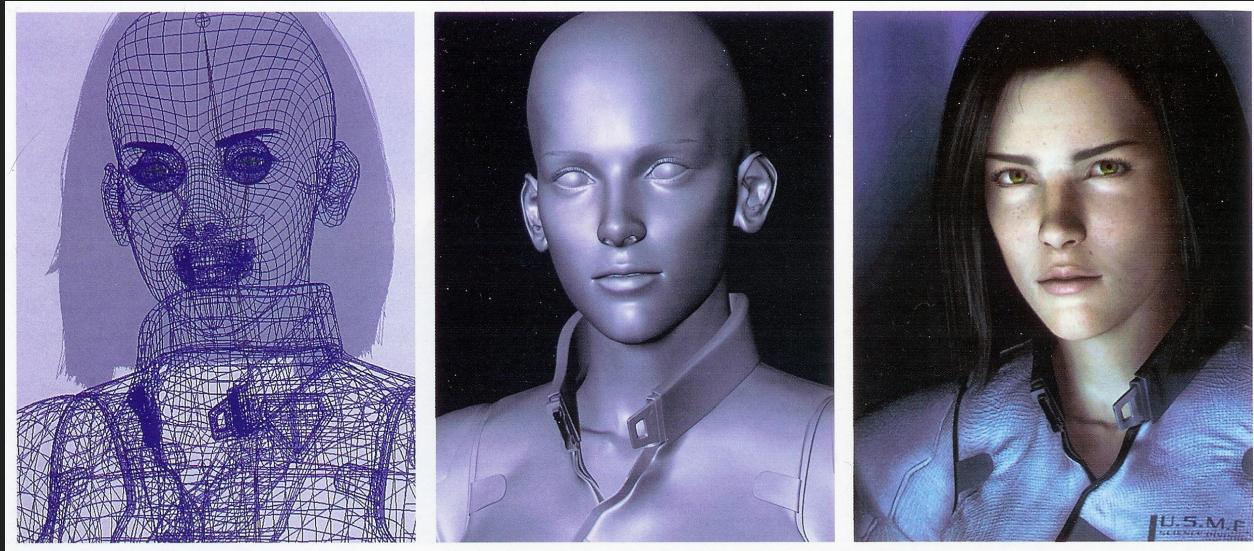
- define 3D object geometry
OBJECT MODELING
- define texture and material of all objects
SHADING AND TEXTURING
- define scene light for realistic final render
LIGHTING
- realize frame (**RENDERING**) or export created models in format file for real-time visualization



Materials

Materials controls the appearance of the meshes, curves, volumes and other objects. They define the substance that the object is made of, its color and texture, and how light interacts with it.

They can be considered as container of such properties.



Final Fantasy by Hironobu Sakaguchi, 2001

Materials

Shaders and textures jointly define materials to bring objects to life:

- **shaders** describe physical properties of an object, determining the **physical appearance or substance** the object is made of
- **textures** are helpers to the shaders and allows to define the colors and the composition of more complex materials



Materiali e texturing in Blender 3.5: its rendering engines

Cycles Eevee



- belongs to the ray-tracing rendering engine family
- physically-based path tracer
- physically based results out-of-the-box
- belongs to the pipeline based rendering (rasterization) engine family
- rendering engine using OpenGL
- focused on real-time, speed, interactivity (used for the Blender Viewport rendering and Material preview mode) and mimic physically based results

Blender

File Edit Render Window Help Layout Modeling Sculpting UV Editing Texture Paint Shading Animation Rendering Compositing Geometry Nodes Scripting + Scene ViewLayer

User Perspective
(1) Collection | Suzanne.001

Suzanne.001 > Suzanne.001 > suzanne2

Shading Options Object View Select Add Node Use Nodes Slot 1

Scene Collection Collection Camera Light Suzanne Suzanne.001

Suzanne.001 > suzanne2

suzanne2

Preview Surface

Use Nodes

Surface Principled BSDF

GGX Random Walk

Base Color (Blue)

Subsurface Radius (0.000)

Subsurface IOR (1.400)

Subsurface Anisotropy (0.000)

Metallic (0.000)

Specular (0.107)

Specular Tint (0.000)

Roughness (0.925)

Anisotropic (0.000)

Anisotropic Rotation (0.000)

Sheen (0.000)

Sheen Tint (0.500)

Clearcoat (0.000)

Clearcoat Roughness (0.030)

IOR (1.450)

Transmission (0.000)

Transmission Roughness (0.000)

Emission (Black)

Emission Strength (1.000)

Alpha (1.000)

Normal

Clearcoat Normal

Tangent

Material Output All Surface Volume Displacement

Surface Principled BSDF

GGX Random Walk

Base Color (Blue)

Subsurface (0.000)

Subsurface Radius (1.000)

Subsurface Radius (0.200)

Subsurface Radius (0.100)

Subsurface Color (White)

Subsurface IOR (1.400)

Subsurface Anisotropy (0.000)

Metallic (0.000)

Collection | Suzanne.001 | Verts:1,014 | Faces:1,000 | Tris:1,936 | Objects:1/4 | Memory: 40.5 MiB | VRAM: 1.5/8.0 GiB | 3.50

Materials

The image shows the Blender 2.8 interface with the Material Editor open. A large watermark 'Materials' is overlaid on the scene. The Material Editor panel displays a Principled BSDF node setup with various parameters. A yellow box highlights the 'Shading' tab in the header. Another yellow box highlights the 'Material Output' dropdown menu. A third yellow box highlights the 'Use Nodes' button in the Surface properties. The Outliner panel on the right lists objects and materials, and the Properties panel shows the detailed settings for the selected material.

Materials

Diffuse

PBR properties

Blender

File Edit Render Window Help Layout Modeling Sculpting UV Editing Texture Paint Shading Animation Rendering Compositing Geometry Nodes Scripting + Scene ViewLayer

Select Add Object Global View Select Add Node Use Nodes Slot 1 Material.001

User Perspective (1) Collection | Cube

3D Viewport

Material Properties

Principled BSDF

- Base Color (highlighted)
- Subsurface
- Subsurface Radius
- Subsurface C...
- Subsurface IOR
- Subsurface Anisotropy
- Metallic
- Specular (highlighted)
- Specular Tint
- Roughness (highlighted)
- Anisotropic
- Anisotropic Rotation
- Sheen
- Sheen Tint
- Clearcoat
- Clearcoat Roughness
- IOR
- Transmission
- Transmission Roughness
- Emission
- Emission Strength
- Alpha (highlighted)
- Normal
- Clearcoat Normal
- Tangent

Material Output

- All
- Surface
- Volume
- Displacement

Scene Collection

- Collection
- Camera
- Cube
- Cube.001
- Cube.002
- Light

Scene

Render Engine Eevee

Sampling

- Render 64
- Viewport 16
- Viewport Denoising

Ambient Occlusion

Bloom

Depth of Field

Subsurface Scattering

Screen Space Reflections

Motion Blur

Volumetrics

Performance

Curves

Shadows

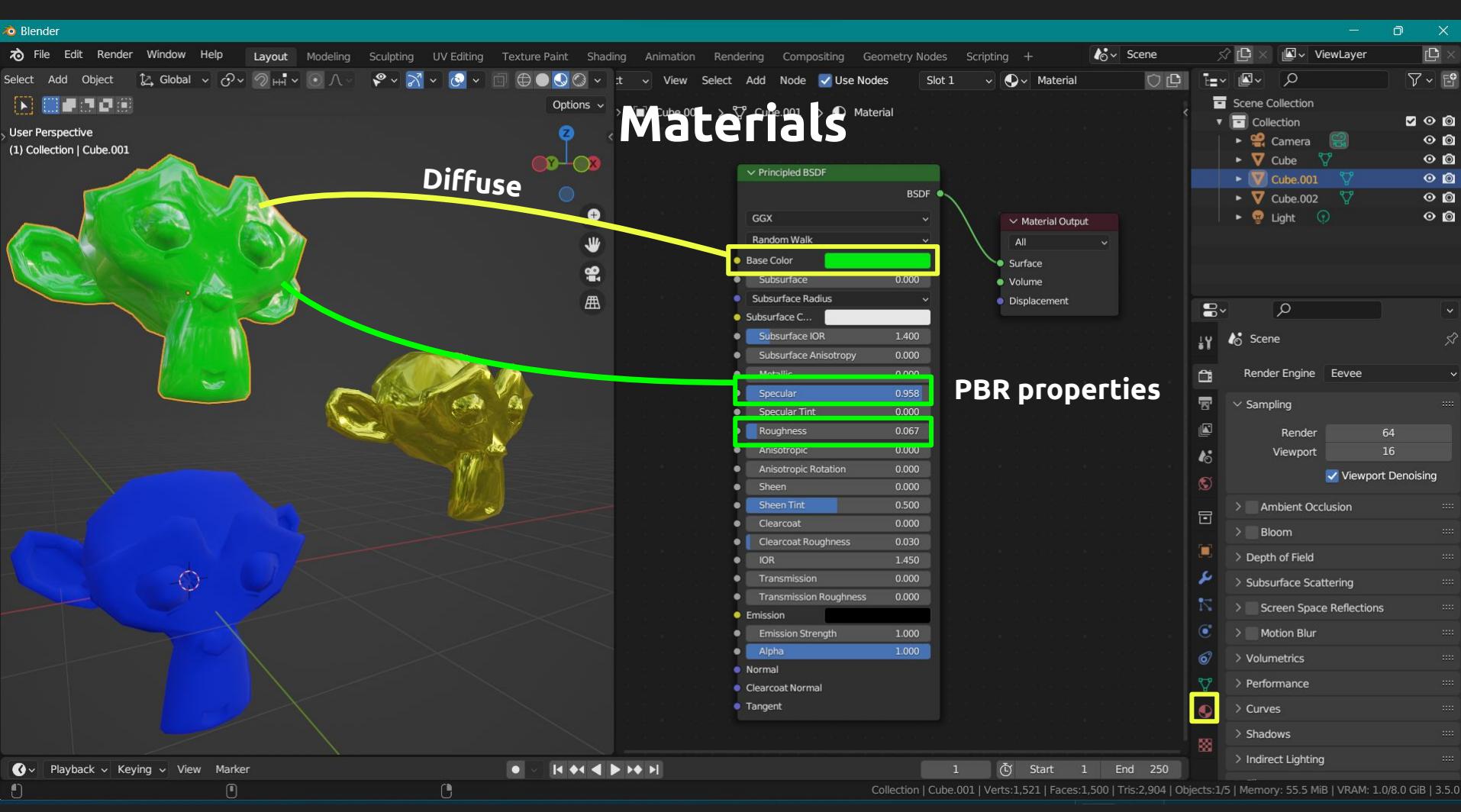
Indirect Lighting

Playback Keying View Marker

Node Context Menu

1 Start 1 End 250

Collection | Cube | Verts:1,521 | Faces:1,500 | Tris:2,904 | Objects:1/5 | Memory: 55.4 MiB | VRAM: 1.0/8.0 GiB | 3.5.0



Blender

File Edit Render Window Help Layout Modeling Sculpting UV Editing Texture Paint Shading Animation Rendering Compositing Geometry Nodes Scripting + Scene ViewLayer

Select Add Object Global View Select Add Node Use Nodes Slot 1 Material.002 Material.002

User Perspective (1) Collection | Cube.002

Materials

Diffuse

Advanced PBR properties

Principled BSDF

BSDF

GGX Random Walk

Base Color (yellow box)

Subsurface 0.000

Subsurface Radius

Subsurface C... 0.000

Subsurface IOR 1.400

Subsurface Anisotropy 0.000

Metallic **0.905** (blue box)

Specular 0.056

Specular Tint 0.000

Roughness 0.067

Anisotropic 0.000

Anisotropic Rotation 0.000

Sheen 0.000

Sheen Tint 0.500

Clearcoat 0.000

Clearcoat Roughness 0.030

IOR 1.450

Transmission 0.000

Transmission Roughness 0.000

Emission

Emission Strength 1.000

Alpha 1.000

Normal

Clearcoat Normal

Tangent

Material Output All

Surface Volume Displacement

Scene Collection Collection Camera Cube Cube.001 Cube.002 Light

Scene

Render Engine Eevee

Sampling

Render 64

Viewport 16

Viewport Denoising

Ambient Occlusion

Bloom

Depth of Field

Subsurface Scattering

Screen Space Reflections

Motion Blur

Volumetrics

Performance

Curves

Shadows

Indirect Lighting

Playback Keying View Marker

Object Context Menu

1 Start 1 End 250

Collection | Cube.002 | Verts:1,521 | Faces:1,500 | Tris:2,904 | Objects:1/5 | Memory: 55.5 MiB | VRAM: 1.0/8.0 GiB | 3.50

Select Rotate View

File Edit Render Window Help Layout Modeling Sculpting UV Editing Texture Paint Shading Animation Rendering Compositing Geometry Nodes Scripting + Scene ViewLayer

User Perspective
(1) Collection | Suzanne

Object Mode View Select Add Object Global View Select Add Node Use Nodes Slot 1

Suzanne > Suzanne > suzanne1

Object Context Menu

- Shade Smooth
- Shade Auto Smooth
- Shade Flat
- Join Ctrl J
- Convert To
- Set Origin
- Copy Objects Ctrl C
- Paste Objects Ctrl V
- Duplicate Objects Shift D
- Duplicate Linked Alt D
- Rename Active Object... F2
- Mirror
- Snap
- Parent
- Move to Collection M
- Insert Keyframe... I
- Delete X

Shade Smooth

Principled BSDF

BSDF

GGX Random Walk

Base Color Subsurface Subsurface Radius

Subsurface Color Subsurface IOR Subsurface Anisotropy

Metallic Specular Specular Tint

Roughness Anisotropic Anisotropic Rotation

Anisotropic Sheen Sheen Tint

Clearcoat Clearcoat Roughness IOR

Transmission Transmission Transmission Roughness

Emission Emission Strength Alpha

Normal Clearcoat Normal Tangent

Material Output

- All
- Surface
- Volume
- Displacement

Collection | Suzanne | Verts:1,014 | Faces:1,000 | Tris:1,936 | Objects:2/4 | Memory: 40.7 MiB | VRAM: 1.5/8.0 GiB | 3.50

Scene Collection

Collection

- Camera
- Light
- Suzanne
- Suzanne.001

Suzanne > suzanne1

suzanne1

Preview

Surface

Use Nodes

Surface Principled BSDF

GGX Random Walk

Base Color 0.000

Subsurface 1.000

Subsurface Radius 0.200

Subsurface Anisotropy 0.100

Subsurface Color 1.400

Subsurface IOR 0.000

Subsurface Anisotropy 0.000

Metallic 1.000

Blender

File Edit Render Window Help Layout Modeling Sculpting UV Editing Texture Paint Shading Animation Rendering Compositing Geometry Nodes Scripting + Scene ViewLayer

Add Node Use Nodes Slot 1 suzanne2

to add a new node: Shift+a or

Suzanne.001 > Suzanne.001 > suzanne2

User Perspective (1) Collection | Suzanne.001

Texture Coordinate
Generated Normal UV Object Camera Window Reflection
Color1 Color2 Scale 5.000

Principled BSDF
GGX Random Walk
Base Color
Subsurface Subsurface Radius Subsurface Color
Subsurface IOR Subsurface Anisotropy Metallic Specular Specular Tint Roughness Anisotropic Anisotropic Rotation Sheen Sheen Tint Clearcoat Clearcoat Roughness IOR Transmission Emission Emission Strength Alpha Normal Clearcoat Normal
Tangent

Material Output All Surface Volume Displacement

Add Search... Input Output Shader Texture
Brick Texture Checker Texture Environment Texture Gradient Texture IES Texture Image Texture Magic Texture Musgrave Texture Noise Texture Point Density Sky Texture Voronoi Texture Wave Texture White Noise Texture

Image Textures

Procedural textures
Textures defined mathematically

Scene Collection Collection Camera Light Suzanne Suzanne.001

Suzanne.001 > suzanne2

suzanne2

Preview Surface

Use Nodes Surface Principled BSDF GGX Random Walk
Base Color Checker Texture Subsurface 0.000 Subsurface Radius 1.000 Subsurface IOR 1.400 Subsurface Anisotropy 0.000 Metallic 0.000 Specular 0.107 Specular Tint 0.000 Roughness 0.925 Anisotropic 0.000 Anisotropic Rotation 0.000 Sheen 0.000 Sheen Tint 0.500 Clearcoat 0.000 Clearcoat Roughness 0.030 IOR 1.450 Transmission 0.000 Transmission Roughness 0.000 Emission Emission Strength 1.000 Alpha 1.000 Normal Clearcoat Normal
Tangent

Collection | Suzanne.001 | Verts:1,014 | Faces:1,000 | Tris:1,936 | Objects:1/4 | Memory: 54.2 MiB | VRAM: 1.5/8.0 GiB | 3.50

Blender

File Edit Render Window Help Layout Modeling Sculpting UV Editing Texture Paint Shading Animation Rendering Compositing Geometry Nodes Scripting + Scene ViewLayer

User Perspective (1) Collection | Suzanne

Options > Suzanne > Suzanne > suzanne1

Slot 1 suzanne1

Shading Options > Suzanne > suzanne1

Scene Collection Collection Camera Light Suzanne Suzanne.001

Suzanne > suzanne1

suzanne1

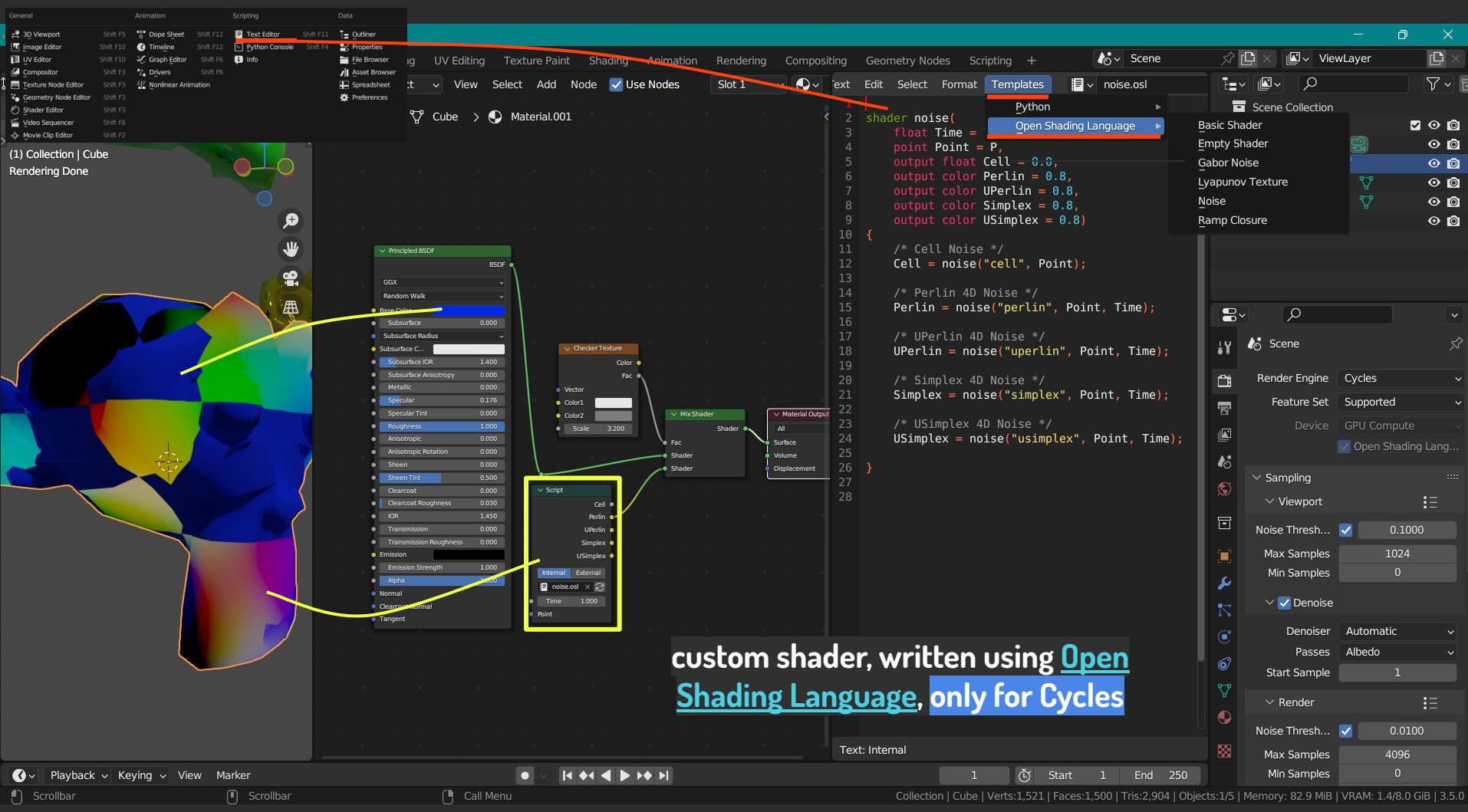
shiny

opaque

A texture affects the color of a material as well as other properties.

Collection | Suzanne | Verts:1,014 | Faces:1,000 | Tris:1,936 | Objects:1/4 | Memory: 54.3 MiB | VRAM: 1.5/8.0 GiB | 3.50

The image shows the Blender interface with a 3D Viewport on the left displaying a shiny blue skull model. To the right is the Node Editor, showing the material setup for the skull. A 'Principled BSDF' node is connected to a 'Material Output' node. A 'Checker Texture' node is also connected to the BSDF node. The 'Color' input of the Checker Texture node is linked to a 'Vector' output from a 'Texture Coordinate' node. The 'Fac' input of the Checker Texture node is linked to a 'Scale' input with a value of 5.000. The 'Base Color' input of the BSDF node is set to a blue color. The 'Surface' output of the Material Output node is highlighted with a green circle. Labels 'shiny' and 'opaque' are overlaid on the image to indicate the visual effect of the material settings. A large text at the bottom states: 'A texture affects the color of a material as well as other properties.'



Shading demo

<https://www.shadertoy.com/view/4sSfzK>

Surface

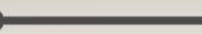
Metal



Dielectric



Roughness



Base Color



Lighting

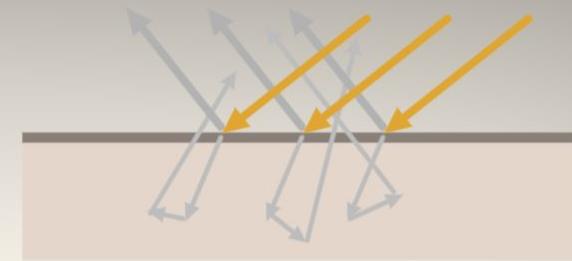
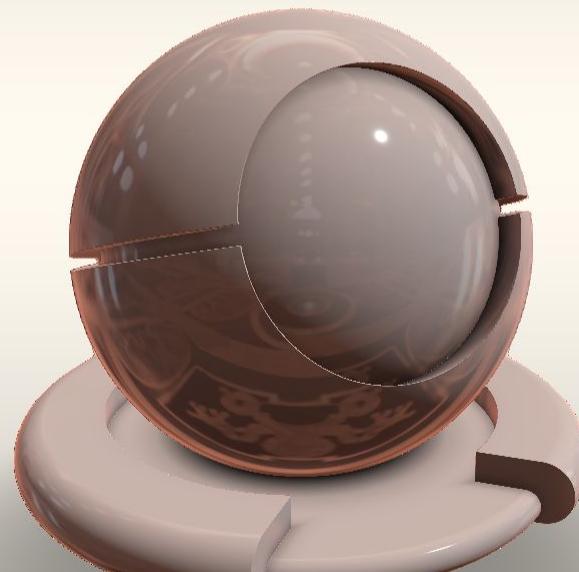
Diffuse

Specular

Distribution

Fresnel

Geometry



After hitting the surface light rays reflect and refract according to Snell's law

Blender

File Edit Render Window Help Layout Modeling Sculpting UV Editing Texture Paint Shading Animation Rendering Compositing Geometry Nodes Scripting + Scene ViewLayer

User Perspective
(1) Collection | C
Sample 528/1024

Object Global Rotate View Object Context Menu

Render / Output

Render Image F12
Render Animation Ctrl F12
Render Audio...
View Render F11
View Animation Ctrl F11
Lock Interface

Scene Collection
Collection
Camera
Cube
Cube.001
Cube.002
Light

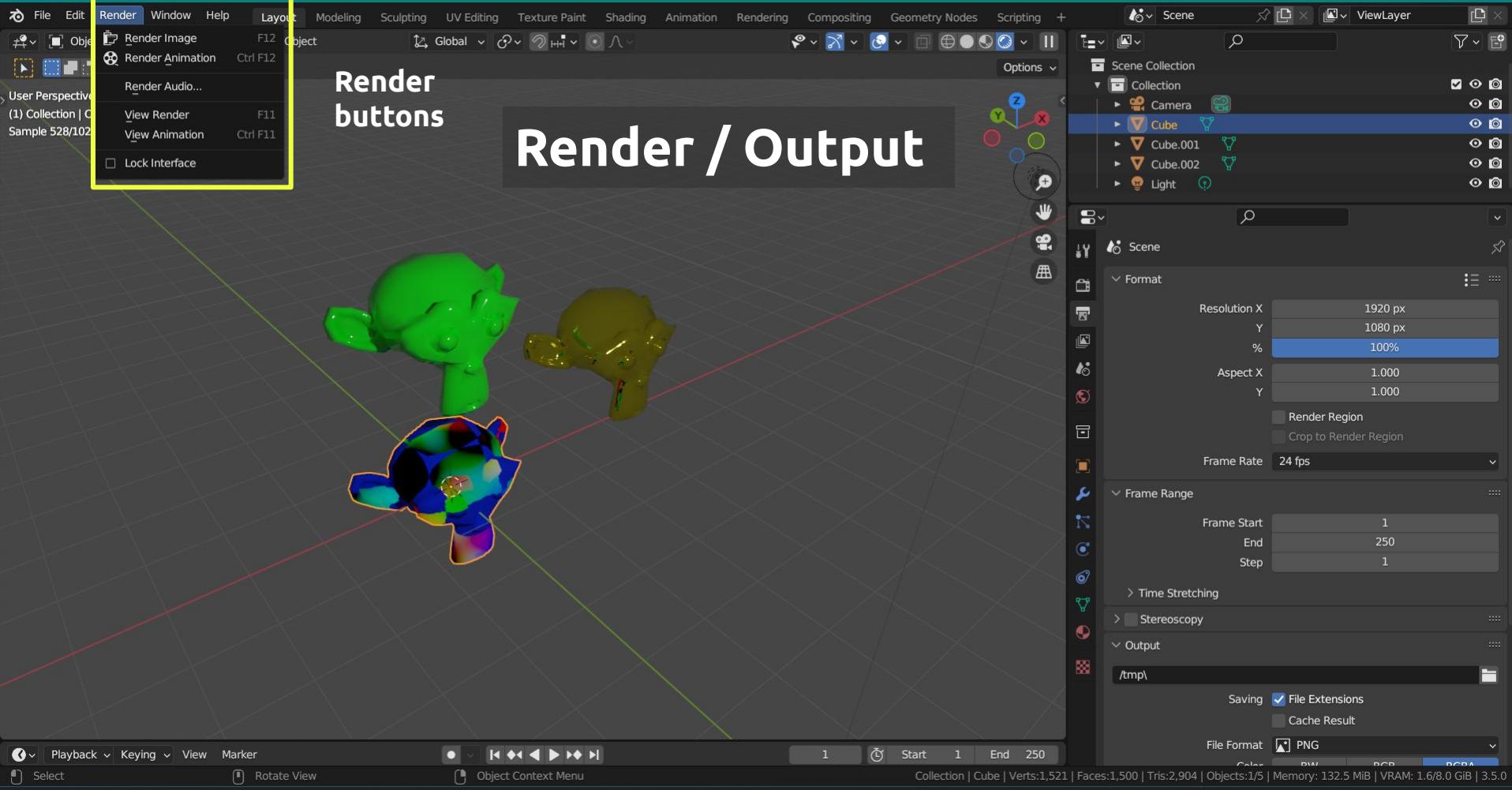
Scene
Format
Resolution X 1920 px
Y 1080 px
% 100%
Aspect X 1.000
Y 1.000
Render Region
Crop to Render Region
Frame Rate 24 fps
Frame Range
Frame Start 1
End 250
Step 1
Time Stretching
Stereoscopy
Output
/tmp/
Saving File Extensions
 Cache Result
File Format PNG
Color RGB
Alpha Alpha
Alpha+ Alpha+
Alpha- Alpha-

Playback Keying View Marker

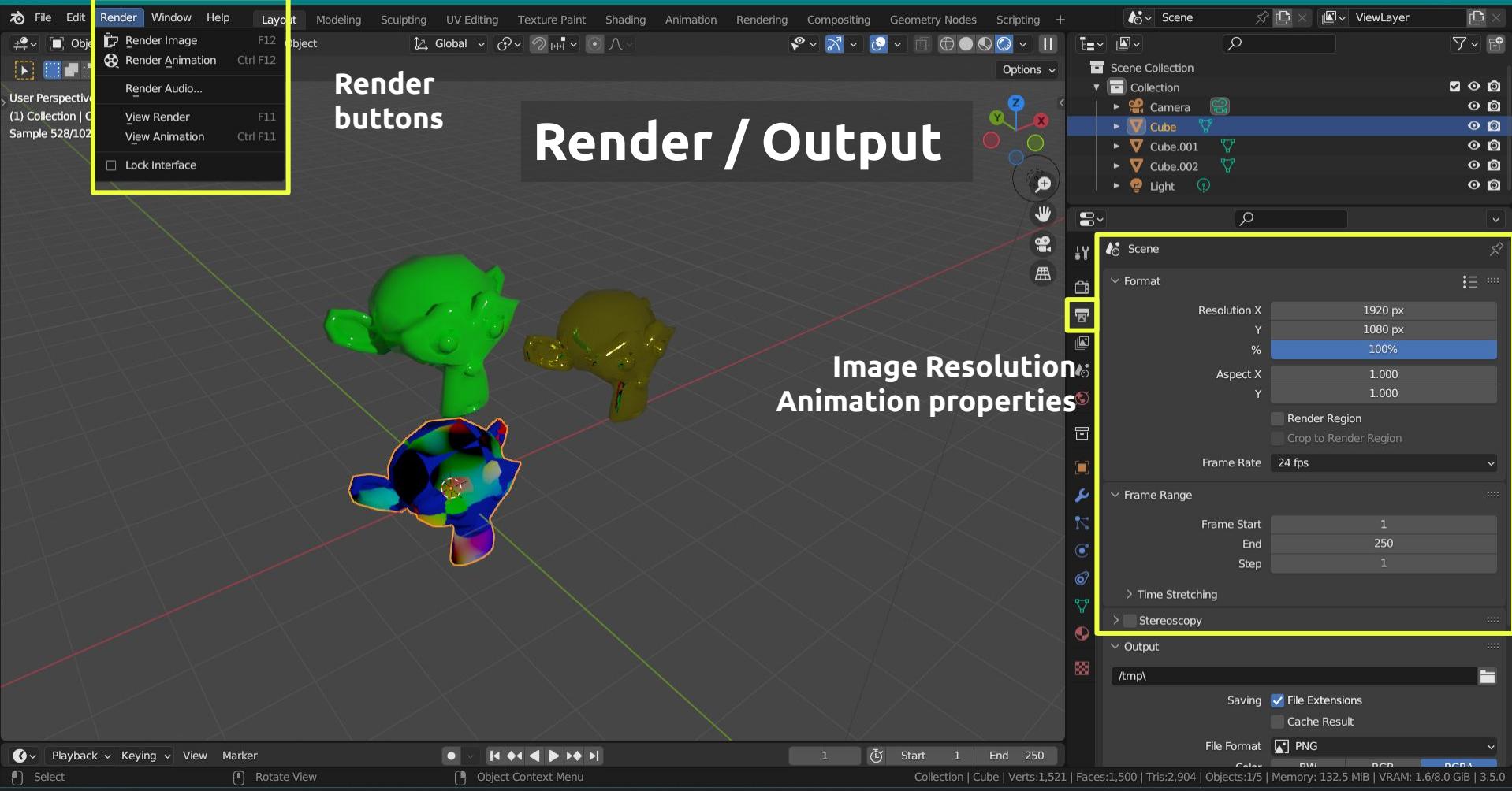
1 Start 1 End 250

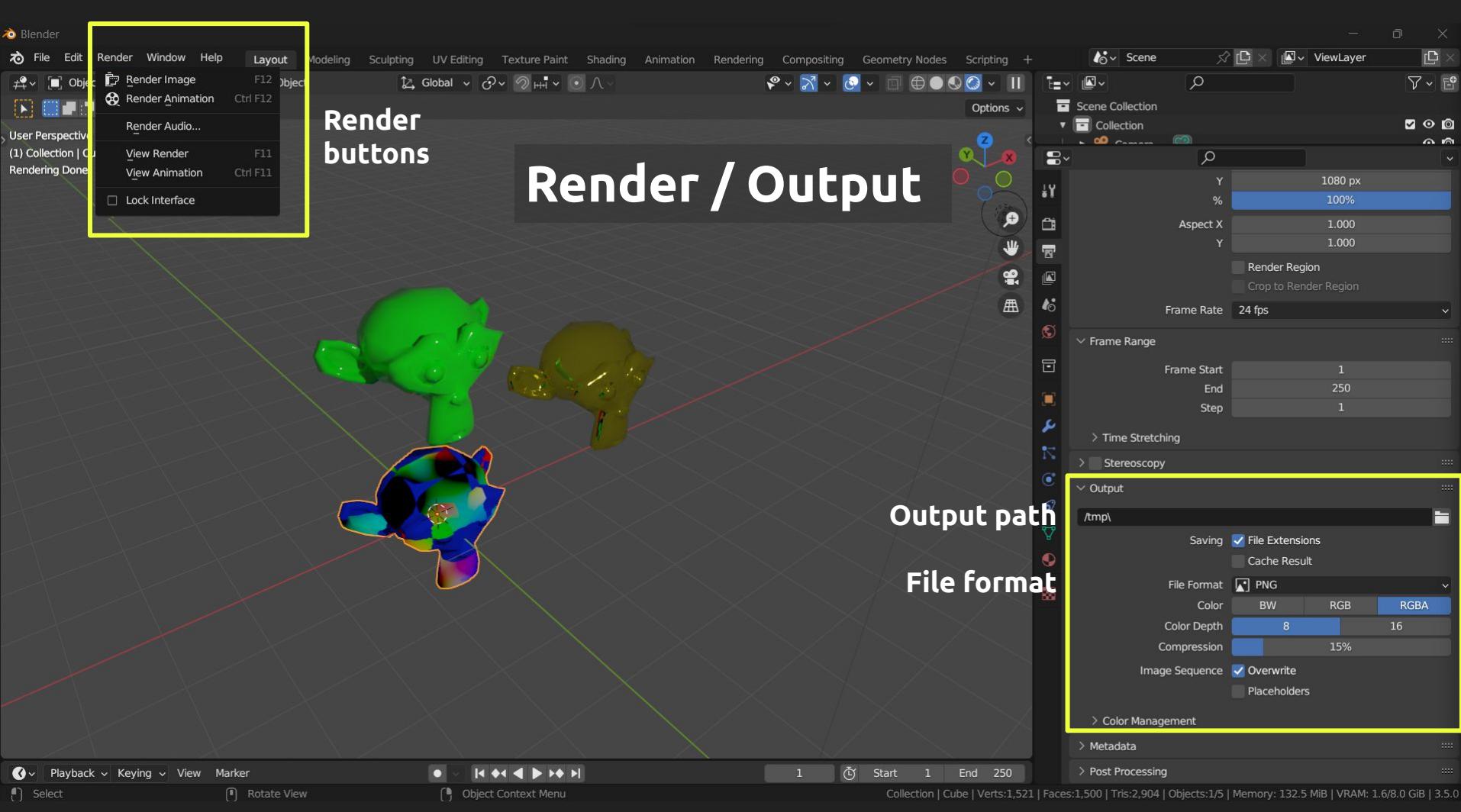
Collection | Cube | Verts:1,521 Faces:1,500 Tris:2,904 Objects:1/5 Memory: 132.5 MiB VRAM: 1.6/8.0 GiB 3.50

Blender

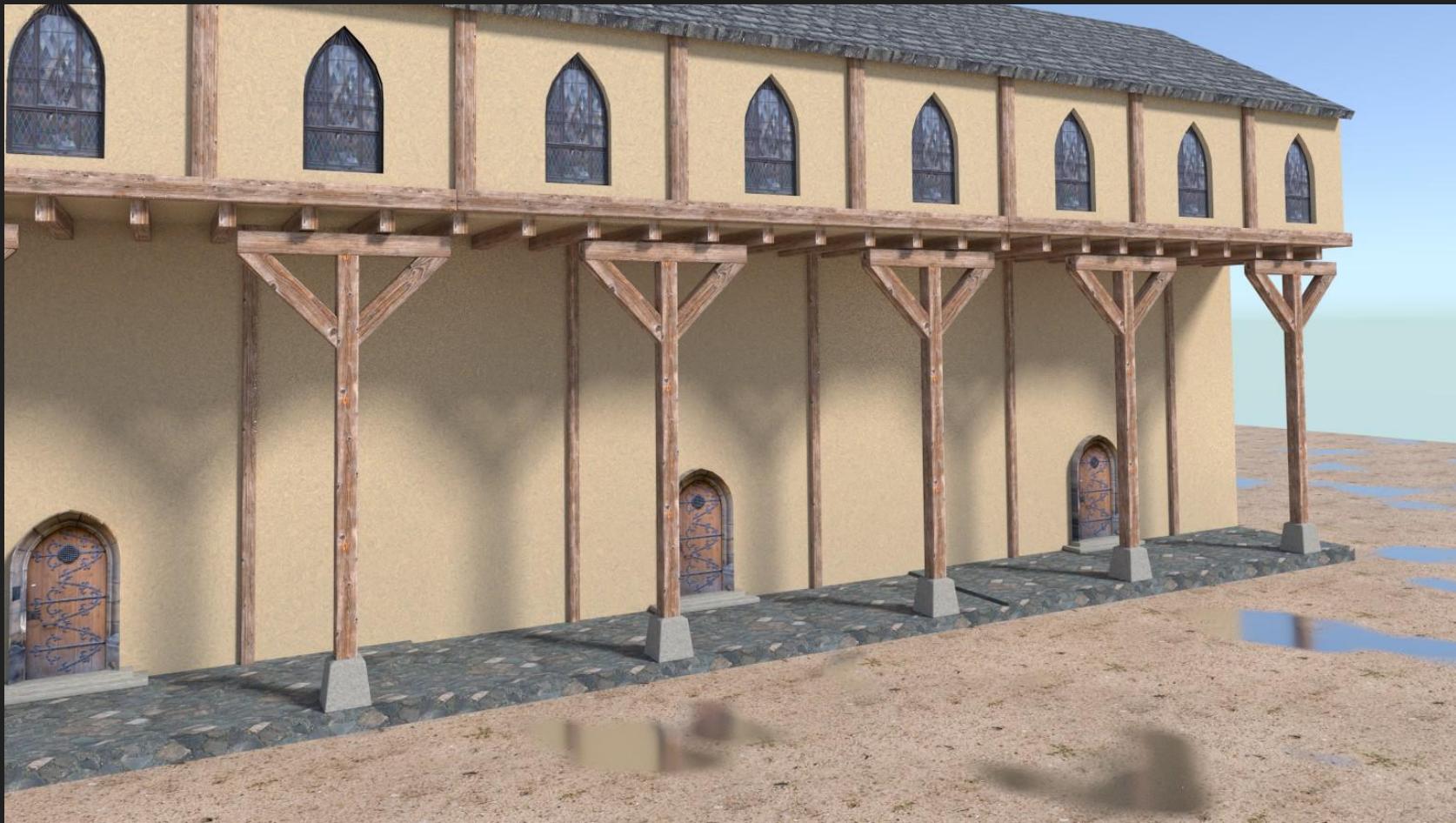


Blender

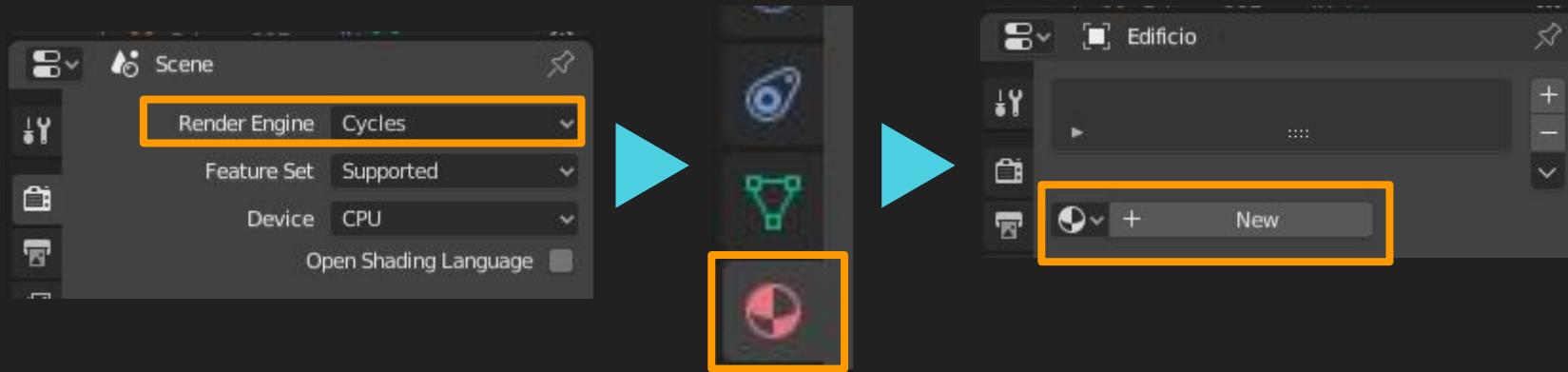




Esercizio: definizione di materiali, shaders e textures.

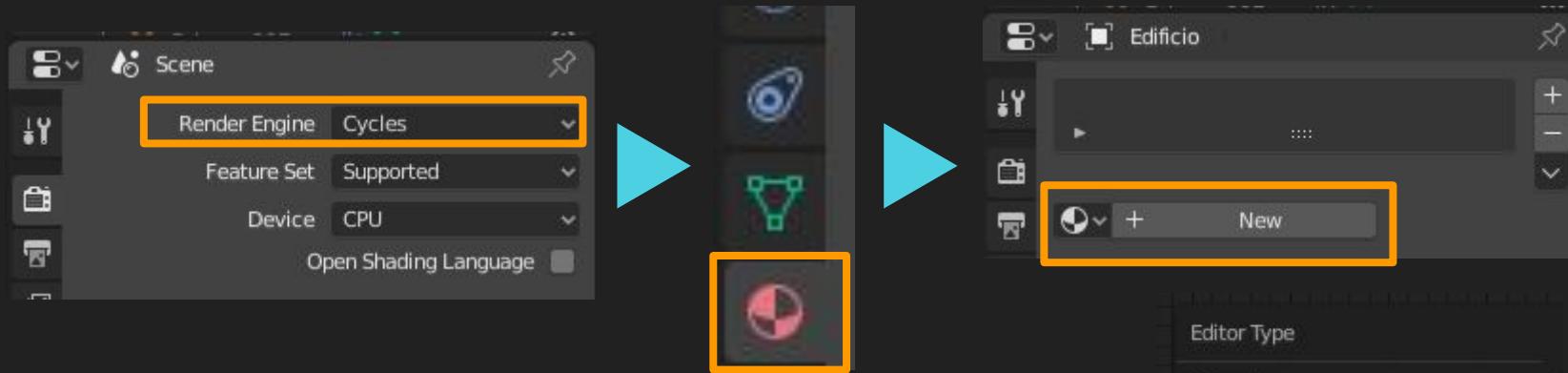


Abilito **Cycles render** e vado nel pannello **Materials**
con l'edificio selezionato aggiungo un materiale mediante il pulsante **New**



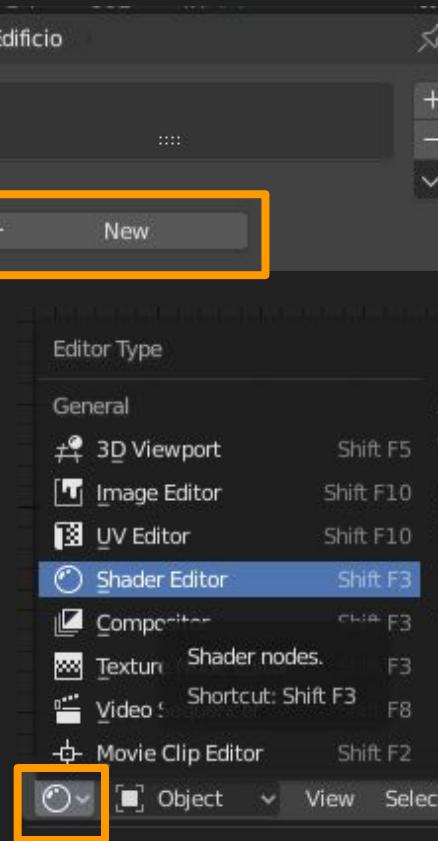
Il materiale sarà **l'intonaco** base del nostro edificio,
quindi nominiamo il materiale “**intonaco**”

Abilito **Cycles render** e vado nel pannello **Materials**
con l'edificio selezionato aggiungo un materiale mediante il pulsante **New**



Il materiale sarà **l'intonaco** base del nostro edificio,
quindi nominiamo il materiale "**intonaco**"

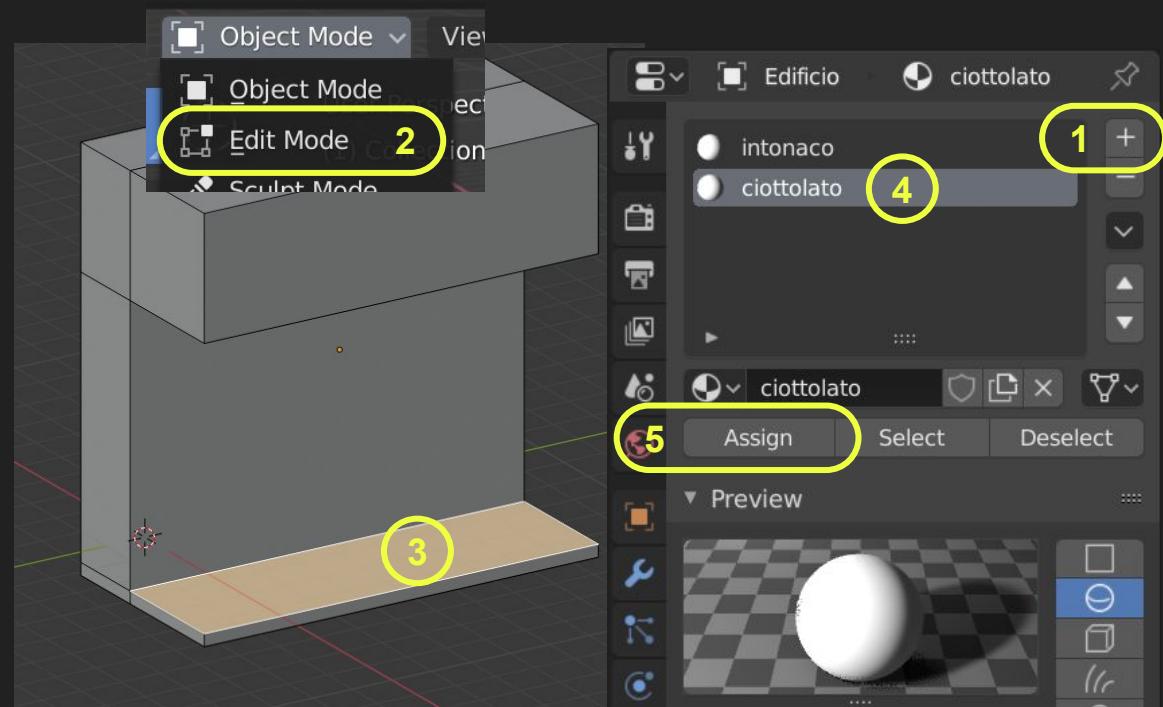
Per gestire le proprietà del materiale appena creato
apriamo un pannello **shader editor** al posto della
timeline



Assegno **materiali diversi** alla geometria facce, sempre curandomi di dare nomi significativi.

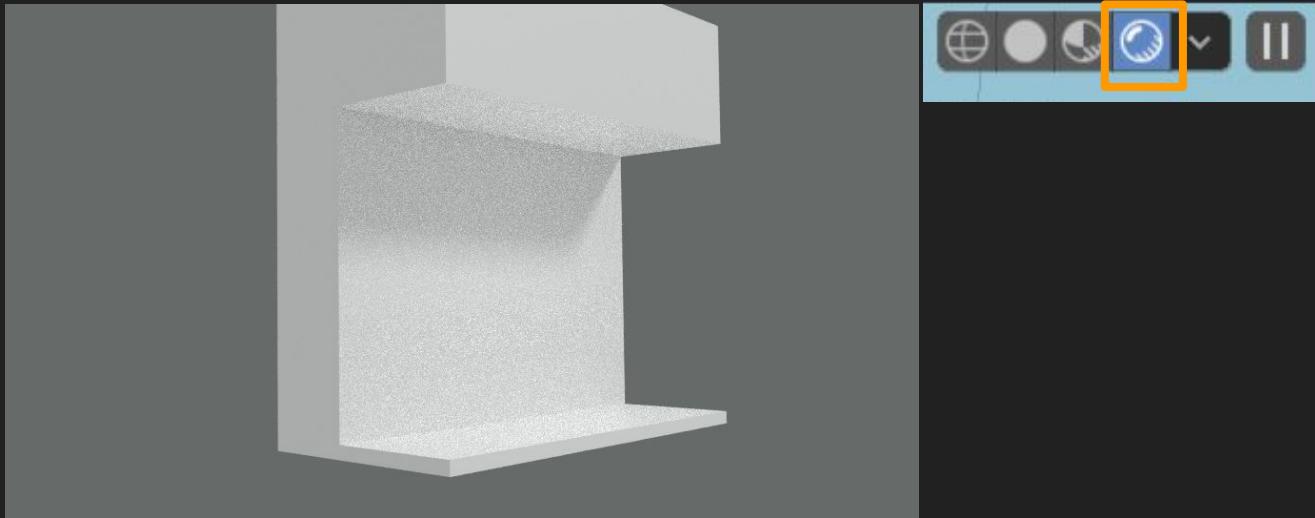
Per assegnare materiali diversi alle facce della mesh:

1. Creo un secondo materiale (+)
2. Vado in **Edit Mode**
3. **Selezione** le facce
4. **Selezione** il **materiale** da applicare
5. Premere il bottone "**Assign**" sotto la lista dei materiali



Per avere feedback visivo sui materiali di scena anche senza renderizzare posso modificare il **Viewport color** così da visualizzare ogni materiale con un colore diverso

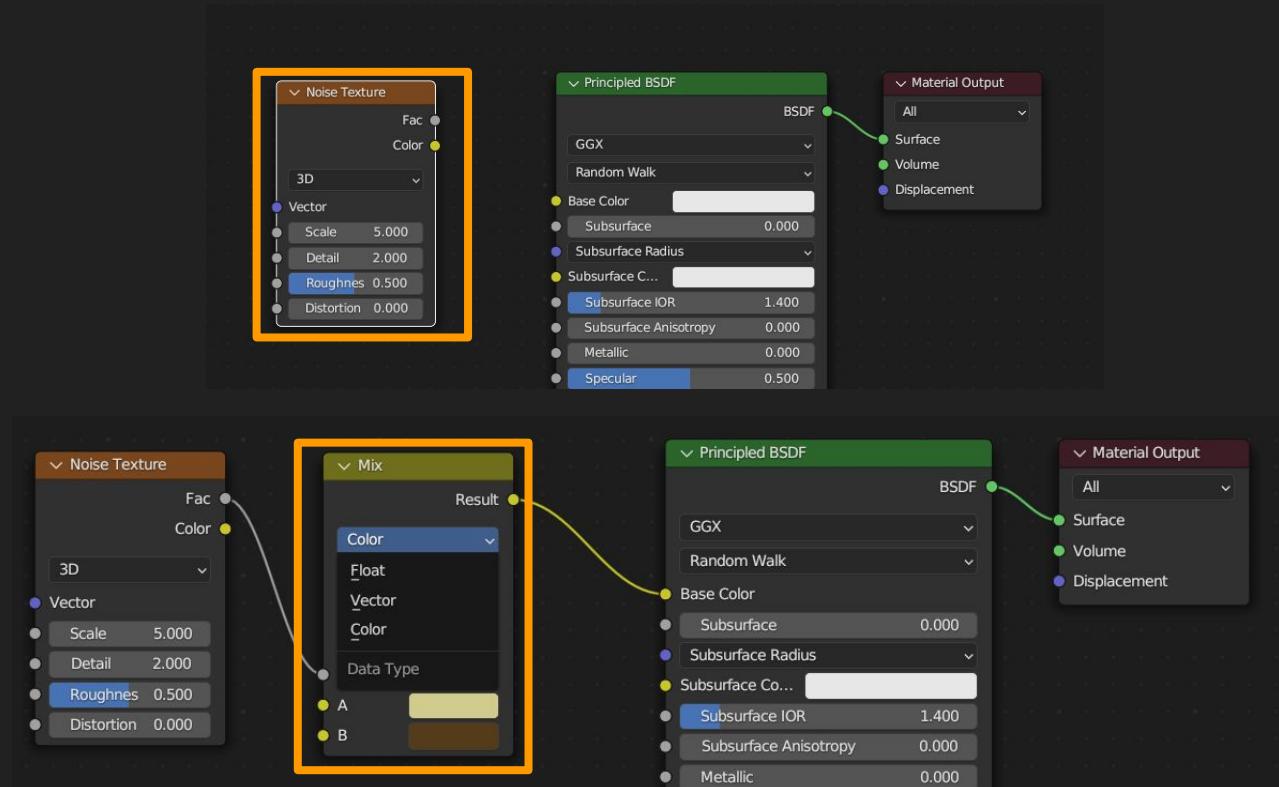
Per visualizzare i materiali, Cycles ci permette di vedere direttamente nella 3D view il **modello renderizzato** abilitando la visualizzazione Rendered



La luce e la camera sono già presenti ed impostate nella Collection "luci_cam"
per visualizzarle occorre abilitarle dall'outliner

Assegnati i materiali è possibile iniziare a definire le tipologie di **shader** per ciascun materiale

La **creazione di un materiale** in cycles con i nodi procede **da sinistra verso destra**

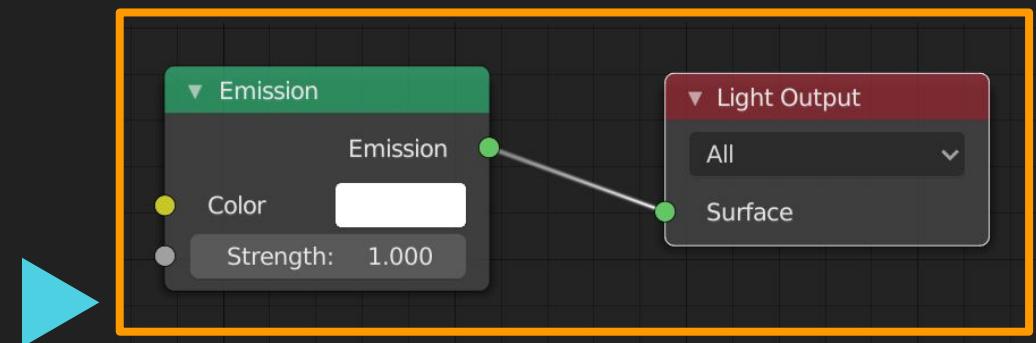
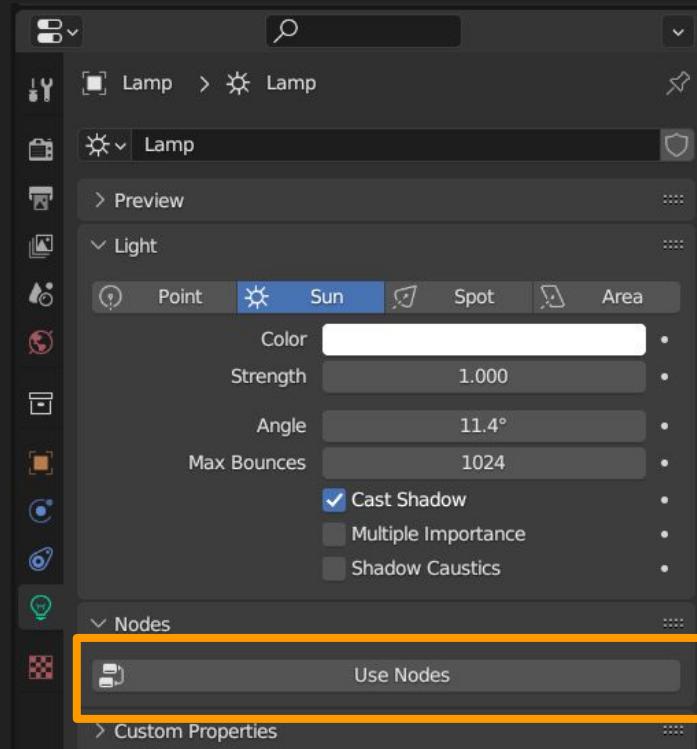


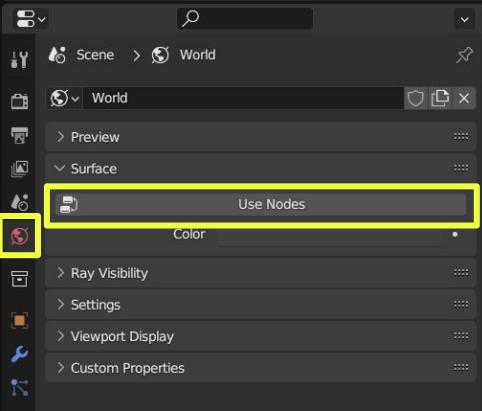
iniziamo con l'intonaco usando una **texture noise** (rumore) che definirà le **variazioni di colore**

Per **collegare** i nodi occorre **cliccare e trascinare** i pallini colorati

per rimuovere una connessione premere **CTRL** e tracciare una **linea** per tagliare una connessione

Anche le **luci** di scena ed il **mondo** che circonda la scena seguono lo stesso paradigma dei nodi





Anche le **luci** di scena ed il **mondo**
che circonda la scena seguono lo stesso paradigma dei nodi

The image shows the Blender Node Editor on the left and the Properties panel on the right. The node graph consists of three nodes: 'Sky Texture', 'Background', and 'World Output'. The 'Sky Texture' node has its 'Color' output connected to the 'Background' node's 'Color' input. The 'Background' node has its 'Strength' output connected to the 'World Output' node's 'Surface' input. The Properties panel shows the 'World' tab selected, with the 'Surface' settings expanded. It displays the 'Background' node's color as 'Sky Texture' and strength as '1.000'. Other settings like Ray Visibility, Volume, and Surface sampling are also visible.

World

Scene > World

Sky Texture

Background

World Output

Surface

Volume

Ray Visibility

Settings

Viewport Display

Custom Properties

Use Nodes

Color

Strength 1.000

All

Surface

Volume

Background

Color

Hosek / Wilkie

Turbidity 2.200

Ground Alb 0.300

Vector

Sampling Manual

Map Resolution 256

Max Bounces 1024

Shadow Caustics

UV Mapping

Per definire il materiale del **pavimento** utilizzeremo l'UV Mapping

La **Mappatura UV** (UV Mapping) è il processo di modellazione 3D che permette di creare la **rappresentazione 2D di un'immagine 3D**.[\[wiki\]](#)

UV Mapping

Per definire il materiale del **pavimento** utilizza-

La **Mappatura UV** (UV Ma-
un'immagine 3D.[wiki]

Nothing better than christmas chocolates to
explain **#UVmapping** to your kids **#CGI #3D**
#material #texture

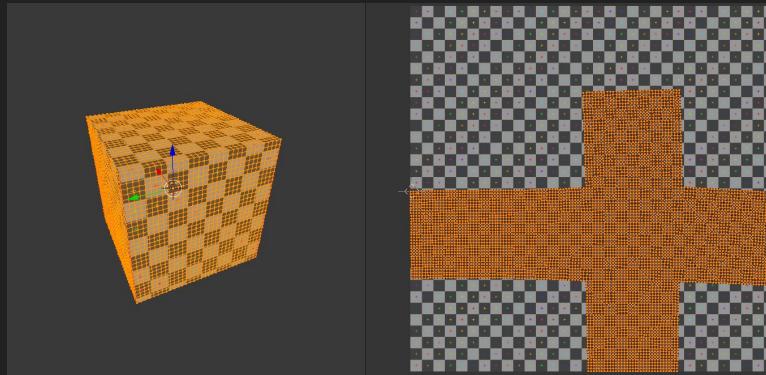
are la **rappresentazione 2D** di



UV Mapping

Per definire il materiale del **pavimento** utilizzeremo l'UV Mapping

La **Mappatura UV** (UV Mapping) è il processo di modellazione 3D che permette di creare la **rappresentazione 2D di un'immagine 3D**.[\[wiki\]](#)



La **mesh 3d (XYZ)** viene quindi rappresentata da **coordinate bidimensionali dette uv**.

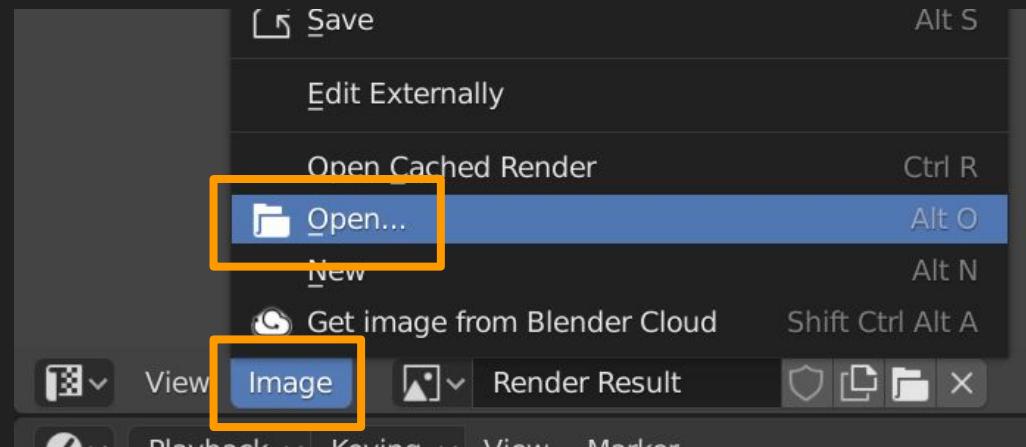
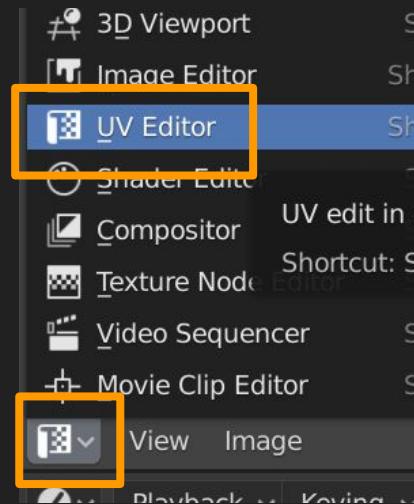
Per effettuare questa mappatura esistono degli strumenti chiamati **unwrap** ossia spacchettamento

In pratica le facce di una geometria vengono aperte e poggiate sulla superficie dell'immagine

UV Mapping

Per UnWrappare la mesh vado in Edit Mode

ed abilito l'**UV editor**



Nel pannello, vado in **Image** → **Open image** ed apro la texture "BrickFloor.jpg"

UV Mapping



UV Mapping

Per visualizzare l'effetto in modalità Rendered devo impostare i nodi affinchè utilizzino la texture con modalità UVMapping



To remap the uv-coords:

G → Grab/Move

R → Rotate

S → Scale

User Perspective
(49) Edificio

View Select Add Mesh Vertex Edge Face UV Global Options

Object View Select Add Node Use Nodes Slot 1 Material

Edificio > Cube > Material

UV Map

From Instancer

UVMap

BrickFloor.jpg

Color

Alpha

Linear

Flat

Repeat

Single Image

Color Space sRGB

Alpha Straight

Vector

Principled BSDF

BSDF

GGX

Random Walk

Base Color

Subsurface 0.000

Subsurface Radius

Subsurface C... 0.000

Subsurface IOR 1.400

Subsurface Anisotropy 0.000

Metallic 0.000

Specular 0.500

Specular Tint 0.000

Roughness 0.500

Material Output

All

Surface

Volume

Displacement

Playback Keying View Marker

49

Start 1 End 250

0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250

Edificio | Verts:8/24 | Edges:12/44 | Faces:5/22 | Tris:44 | Objects:1/3 | Memory: 66

Completare



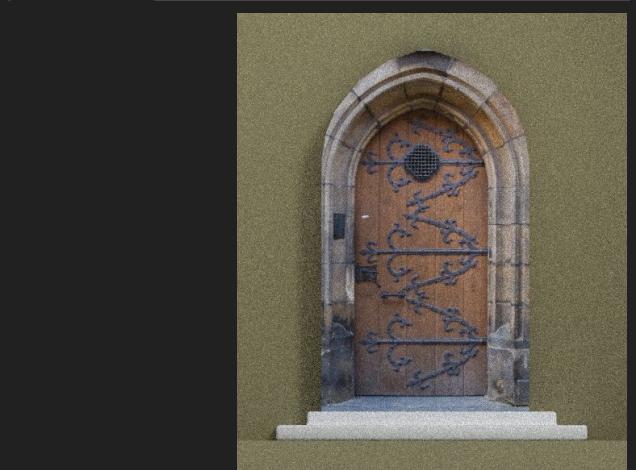
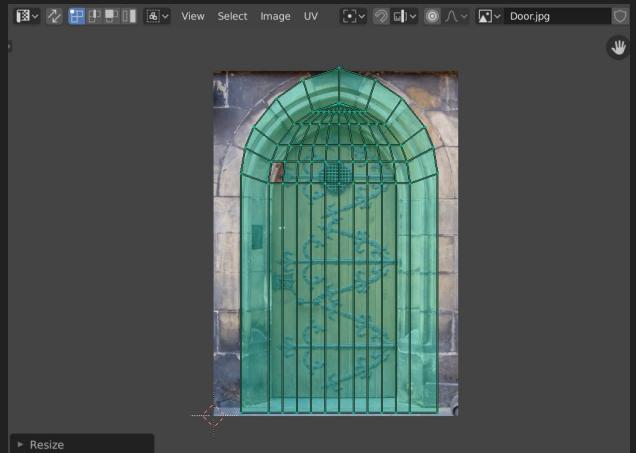
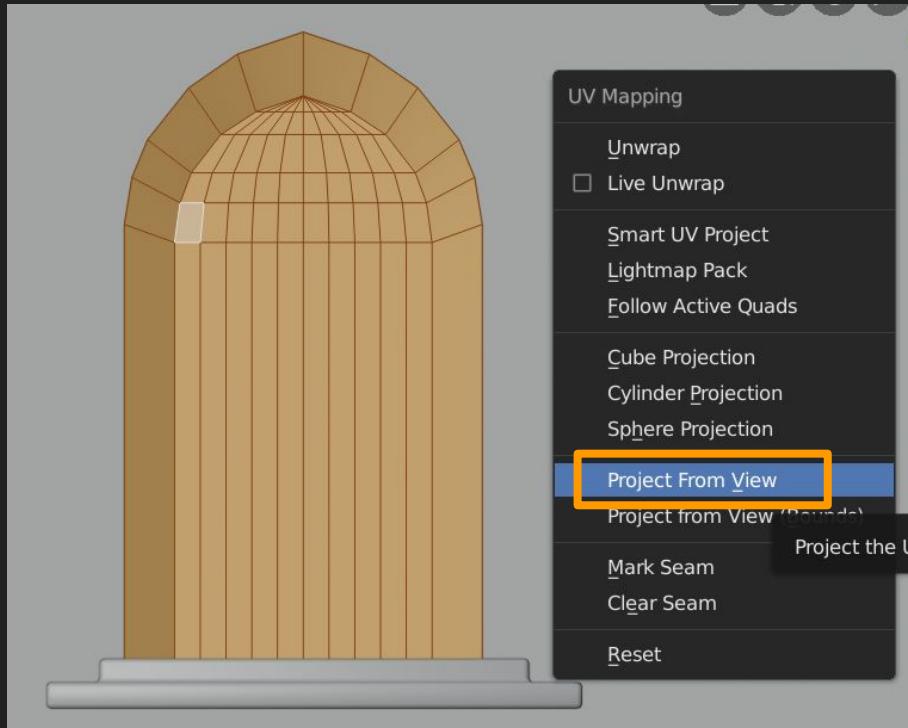
Utilizzando le medesime tecniche texturizzo gli oggetti presenti nella **edificio_elementi** (per texturizzare la porta, seguono dettagli nelle slides successive)

Se la texture appare troppo grande o posizionata male la posso **scalare e ruotare** nell'**UV Editor**

Per comodità posso utilizzare la tecnica del **Follow Active Quad** per texturizzare superfici con quad continui come le colonne

NB: tutte gli **oggetti istanziati**, cioè che posseggono la stessa mesh, erediteranno gli stessi materiali e lo stesso unwrap

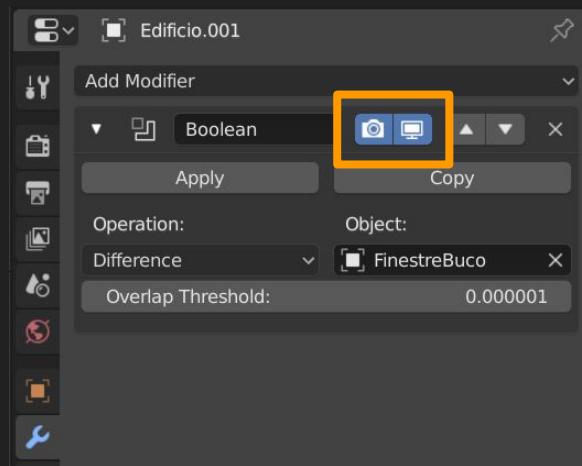
Per texturizzare la porta mi posiziono in **vista frontale ortogonale** ed utilizzo L'Unwrap di tipo **project from view**



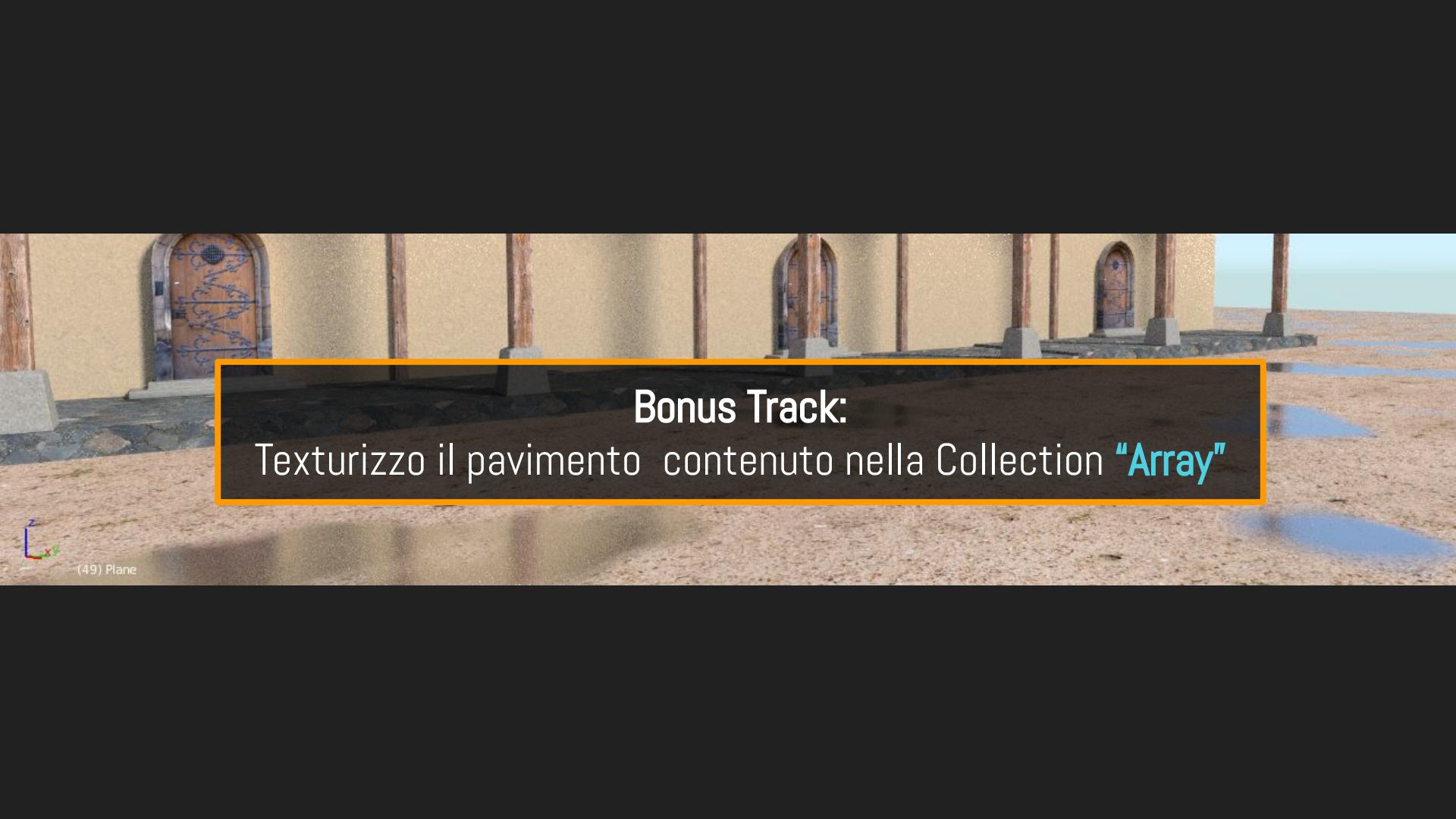
Questo unwrap proietta i vertici sulla **texture** dalla vista in cui mi trovo

Utilizzando le medesime tecniche texturizzo gli oggetti presenti nella **Collection "dettagli"**

Per mostrare i buchi per le finestre **seleziono l'edificio** ed abilito il **modificatore Boolean** preimpostato

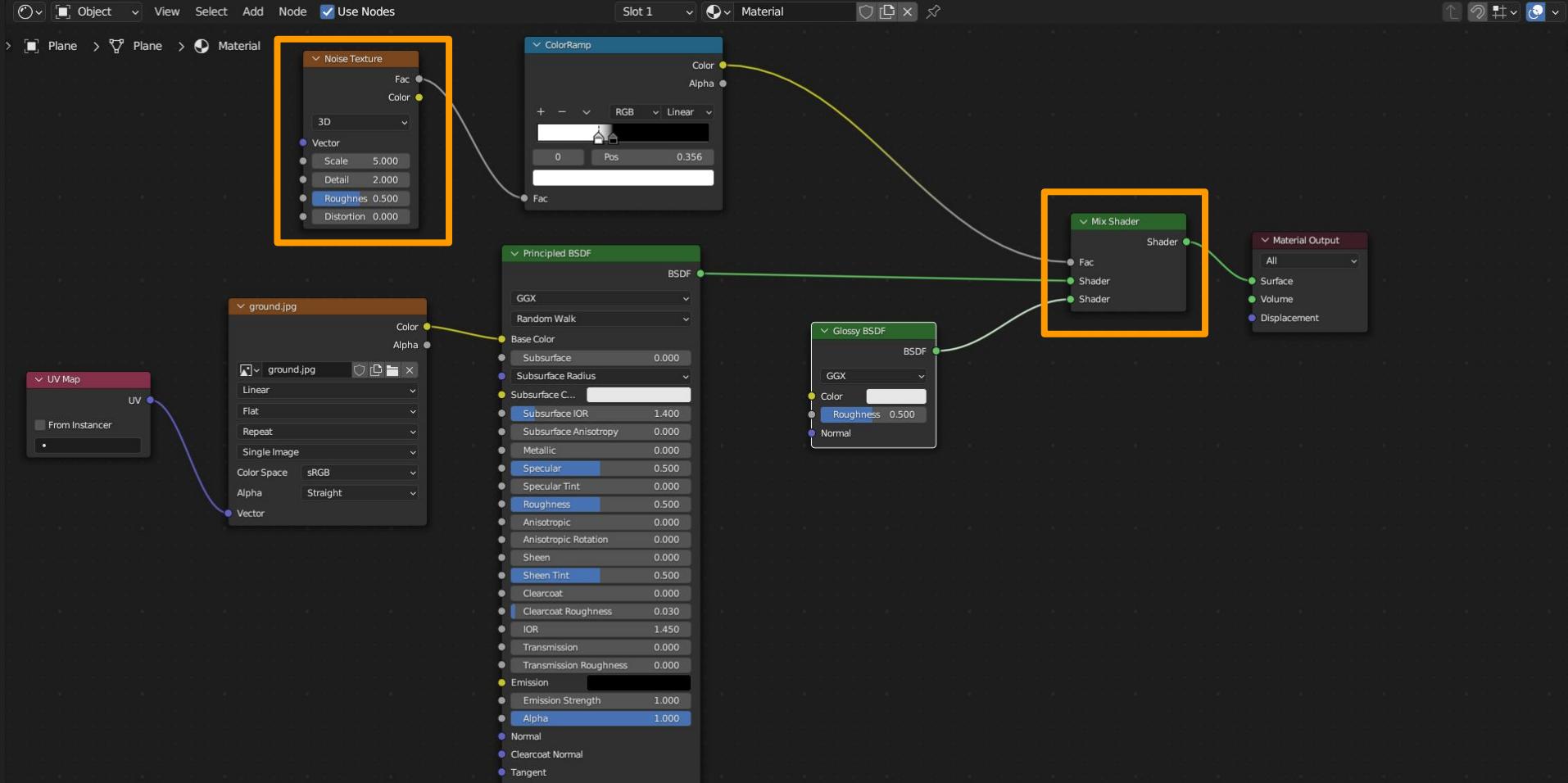


Per migliorare la resa visiva **aumento la luminosità** della lampada in scena e della sky texture



Bonus Track:
Texturizzo il pavimento contenuto nella Collection “**Array**”


(49) Plane



Mediante una texture **noise** effettuo un **mix tra opaco e lucido** per creare delle **pozzanghere**



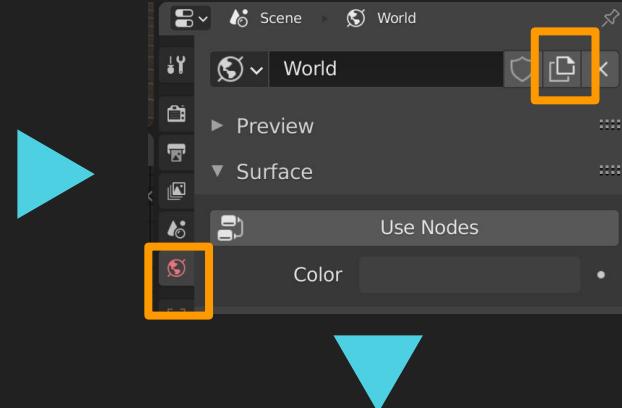
Bonus Track #2:

Inserisco una texture **environment** per illuminare il world

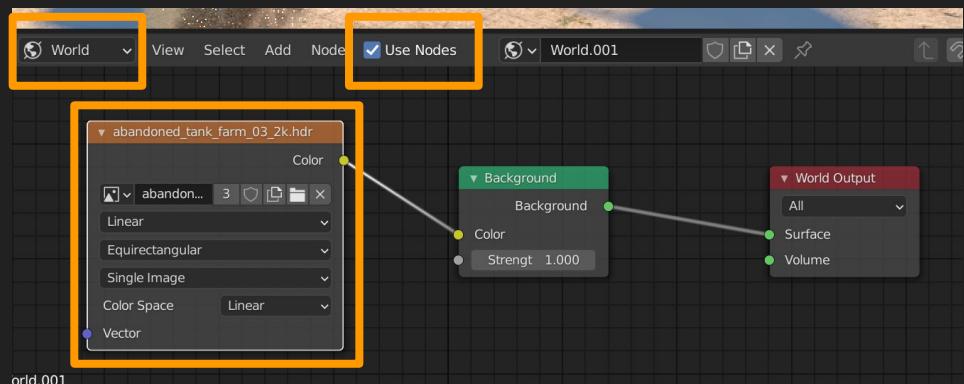
Recupero una texture di tipo 360
equirettangolare



Creo un nuovo world



Nello shading del world abilito i nodi



e collego il file .hdr scaricato mediante una **Environment texture**

Rendering in Cycles

Blender® [C] EmentsOfCG_2022-2023\Paolo\shading, texturing, rendering\PorticoFinal_2023.blend

File Edit Object Mode View Select Add Object Global Local Viewport Shading Animation Rendering Compositing Scripting +

Scene Collection Camera Options II

Sample 1/10

Camera Perspective (49) Scene Collection | Camera

Viewport Sampling

Property for the viewport shading mode > Rendered

Property for the render output

Render Engine Cycles
Feature Set Supported
Device GPU Compute
Open Shading Language

Sampling

Threshold: 0.1000
Max Samples: 10
Min Samples: 0

Denoise

Denoiser: Automatic
Passes: Albedo
Start Sample: 1

Render

Noise Threshold: 0.0100
Max Samples: 10
Min Samples: 0
Time Limit: 0.00

Denoise

Denoiser: OpenImageDenoise
Passes: Albedo and Normal

Playback Keying View Marker

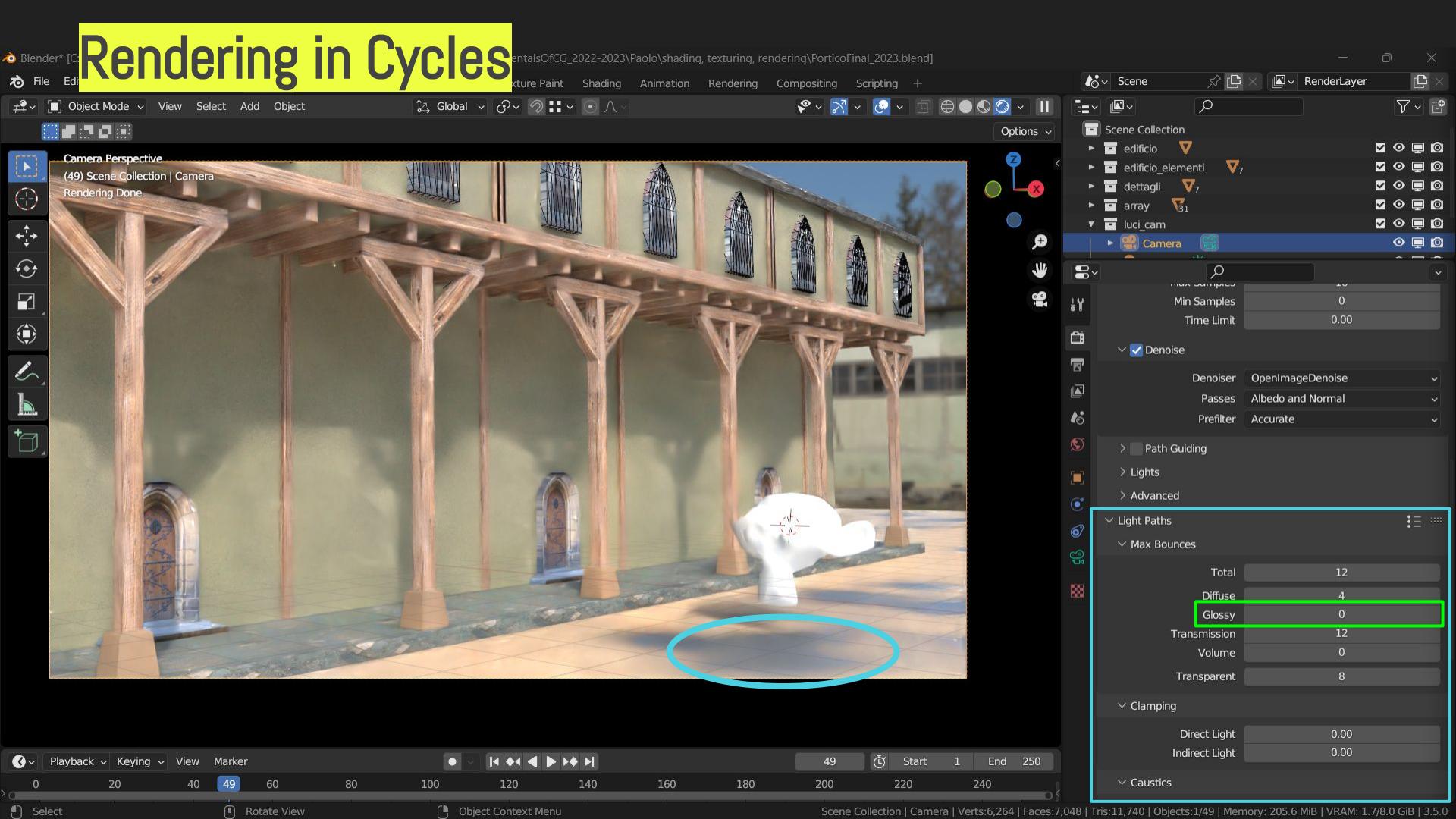
49 Start 1 End 250

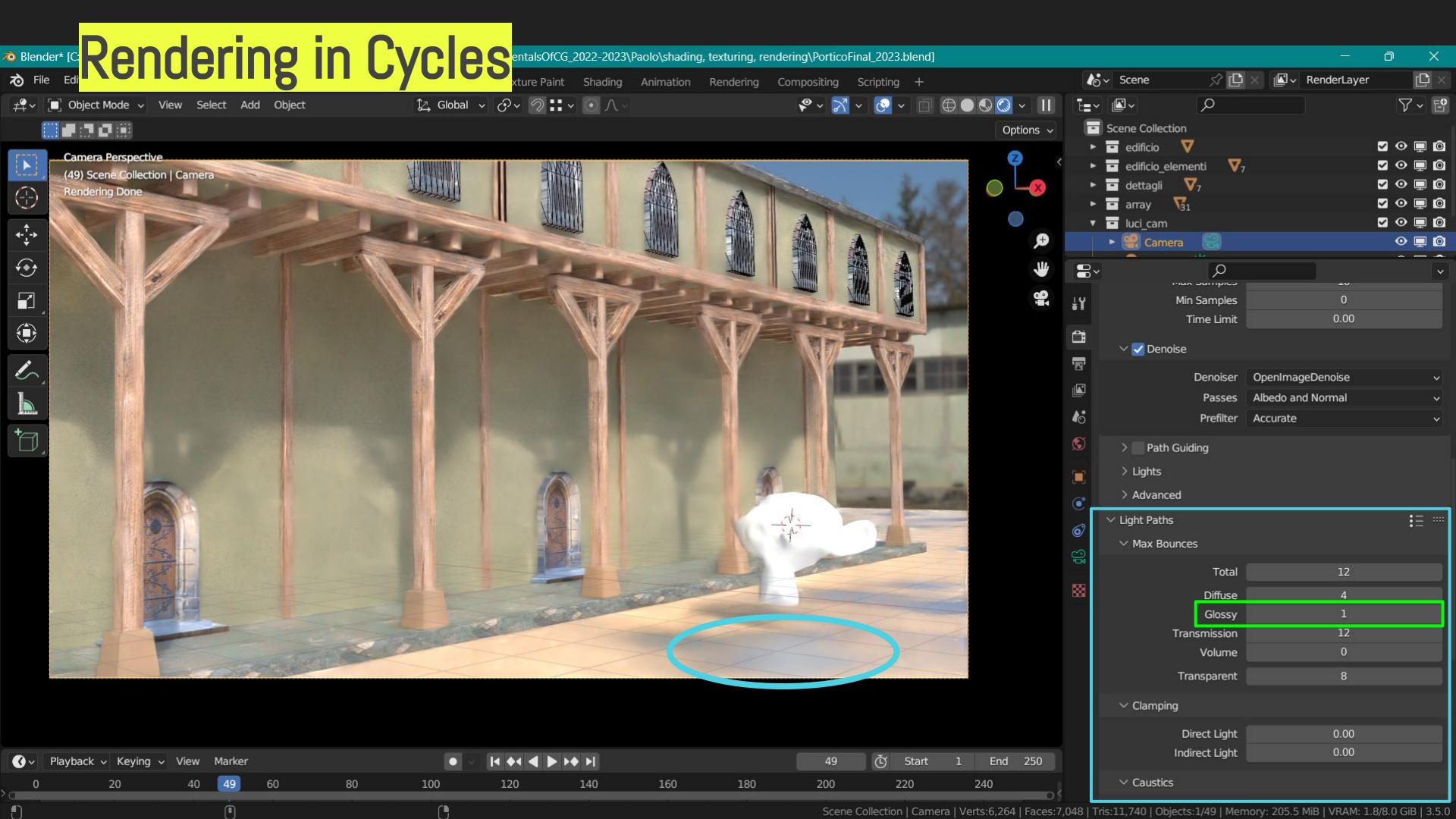
0 20 40 60 80 100 120 140 160 180 200 220 240

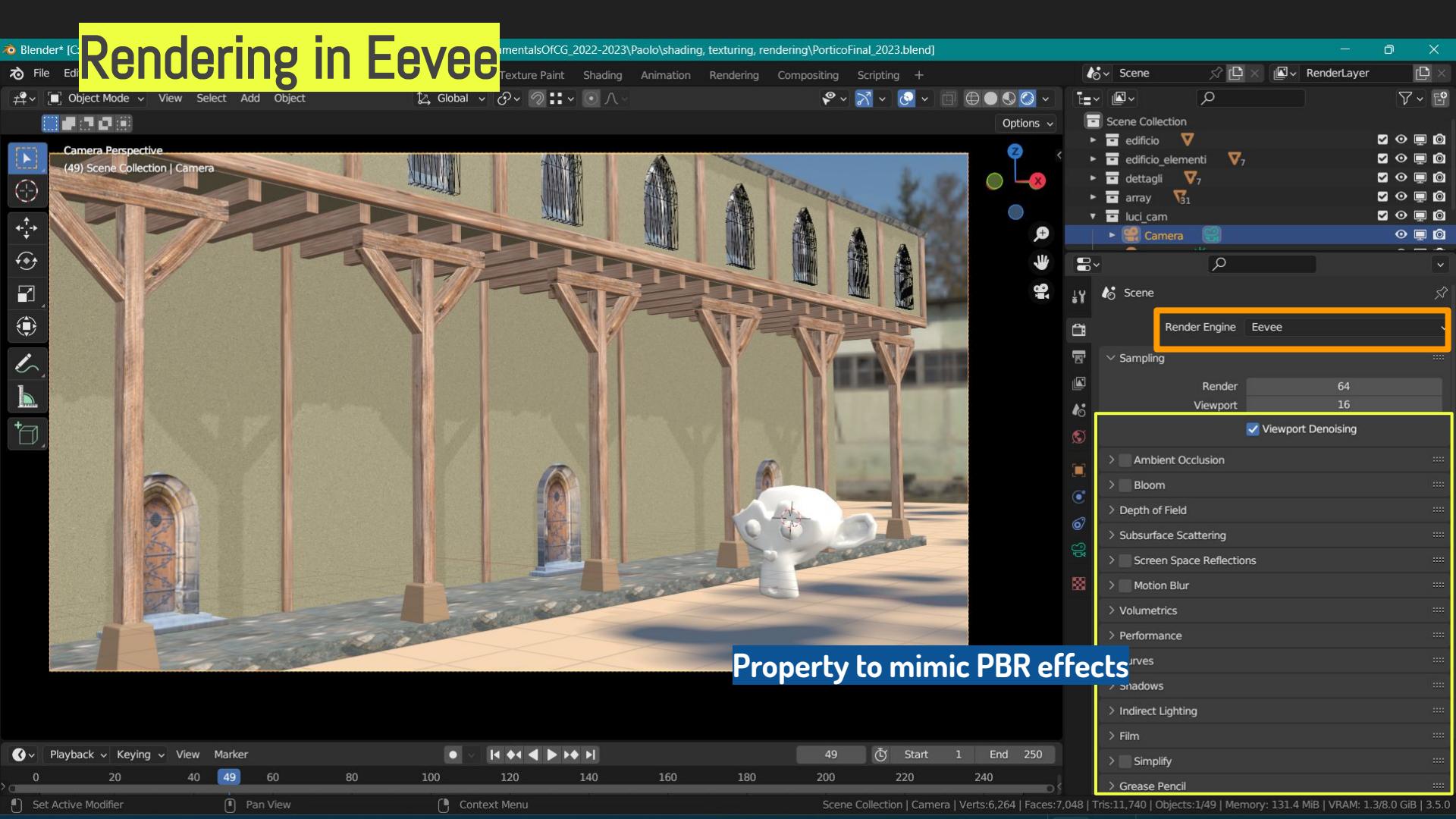
Select Rotate View Object Context Menu

Scene Collection | Camera | Verts:6,264 | Faces:7,048 | Tris:11,740 | Objects:1/49 | Memory: 237.6 MB | VRAM: 1.8/8.0 GB | 3.50

The image displays the Blender 2.8 interface with a focus on rendering in Cycles. The main 3D Viewport shows a detailed architectural model of a portico. The Render properties panel on the right is open, showing settings for both Viewport and Render modes. A large blue box highlights the 'Sampling' section in the Viewport tab, which includes controls for Threshold, Max Samples, and Min Samples. Another blue box highlights the 'Render' tab, which includes Noise Threshold, Max Samples, Min Samples, and Time Limit. A yellow box highlights the status bar in the 3D Viewport with the text 'Sample 1/10'. The timeline at the bottom indicates the current frame is 49.









Grazie per la
vostra attenzione

Domande?