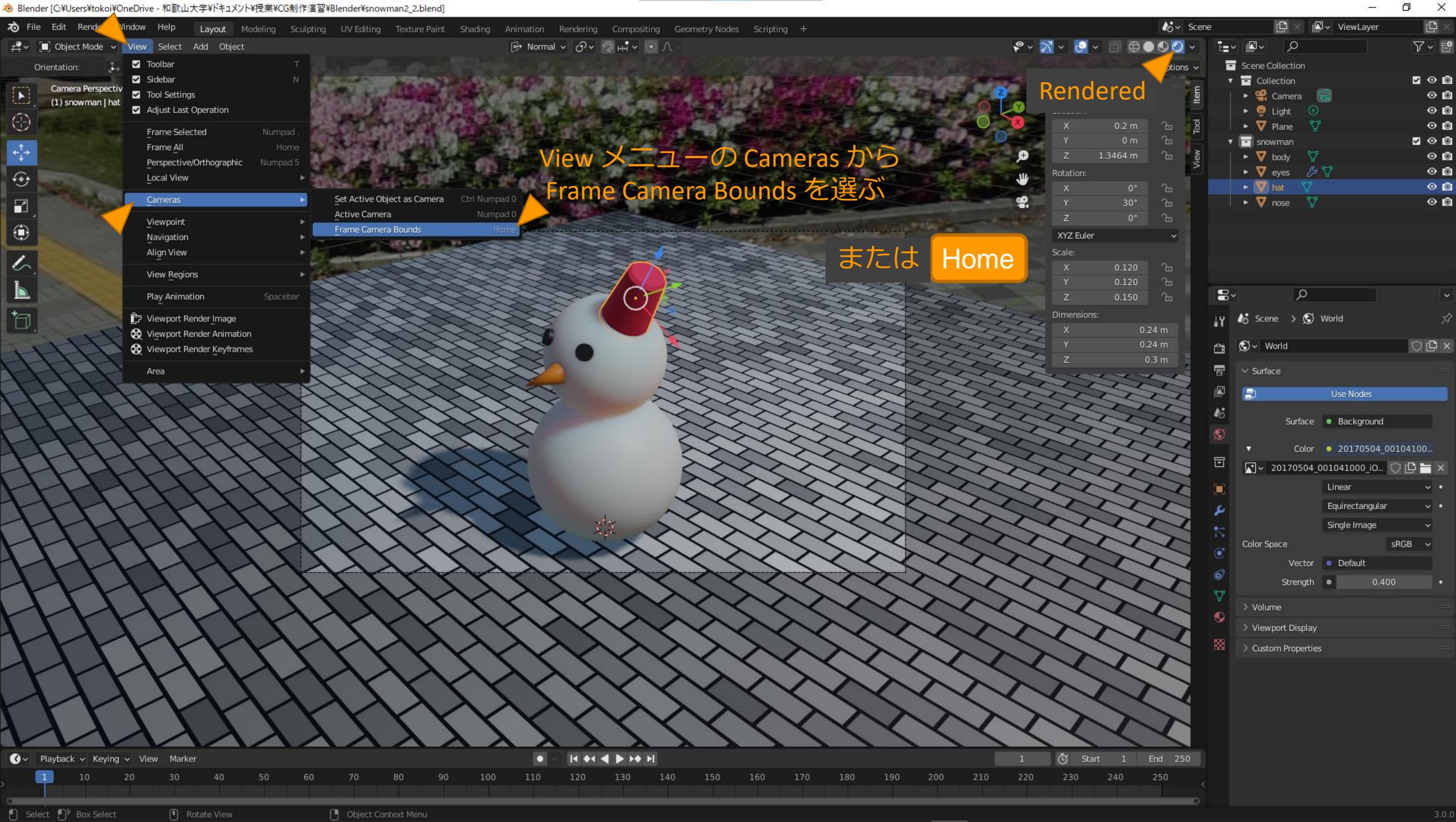


マテリアルの設定

色を付ける



Subsurface Scattering

表面下散乱

Blender 3D modeling interface showing a snowman model on a brick surface.

The scene contains the following objects:

- Collection: Camera, Light, Plane
- snowman: body, eyes, hat, nose

The "body" object is selected, highlighted by an orange outline. Its properties are displayed in the Transform panel:

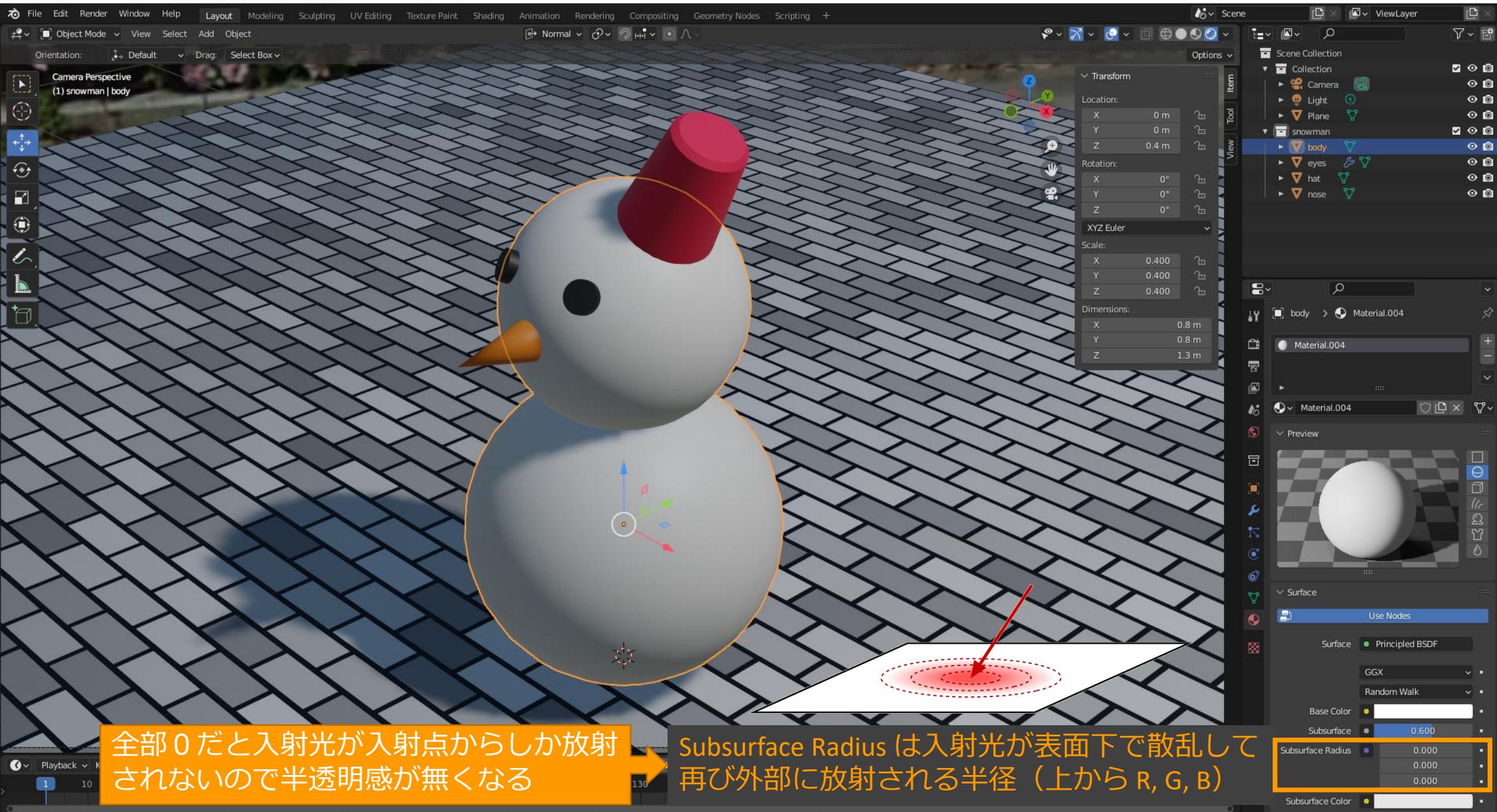
Location:	X: 0 m, Y: 0 m, Z: 0.4 m
Rotation:	X: 0°, Y: 0°, Z: 0°
XYZ Euler	(button)
Scale:	X: 0.400, Y: 0.400, Z: 0.400
Dimensions:	X: 0.8 m, Y: 0.8 m, Z: 1.3 m

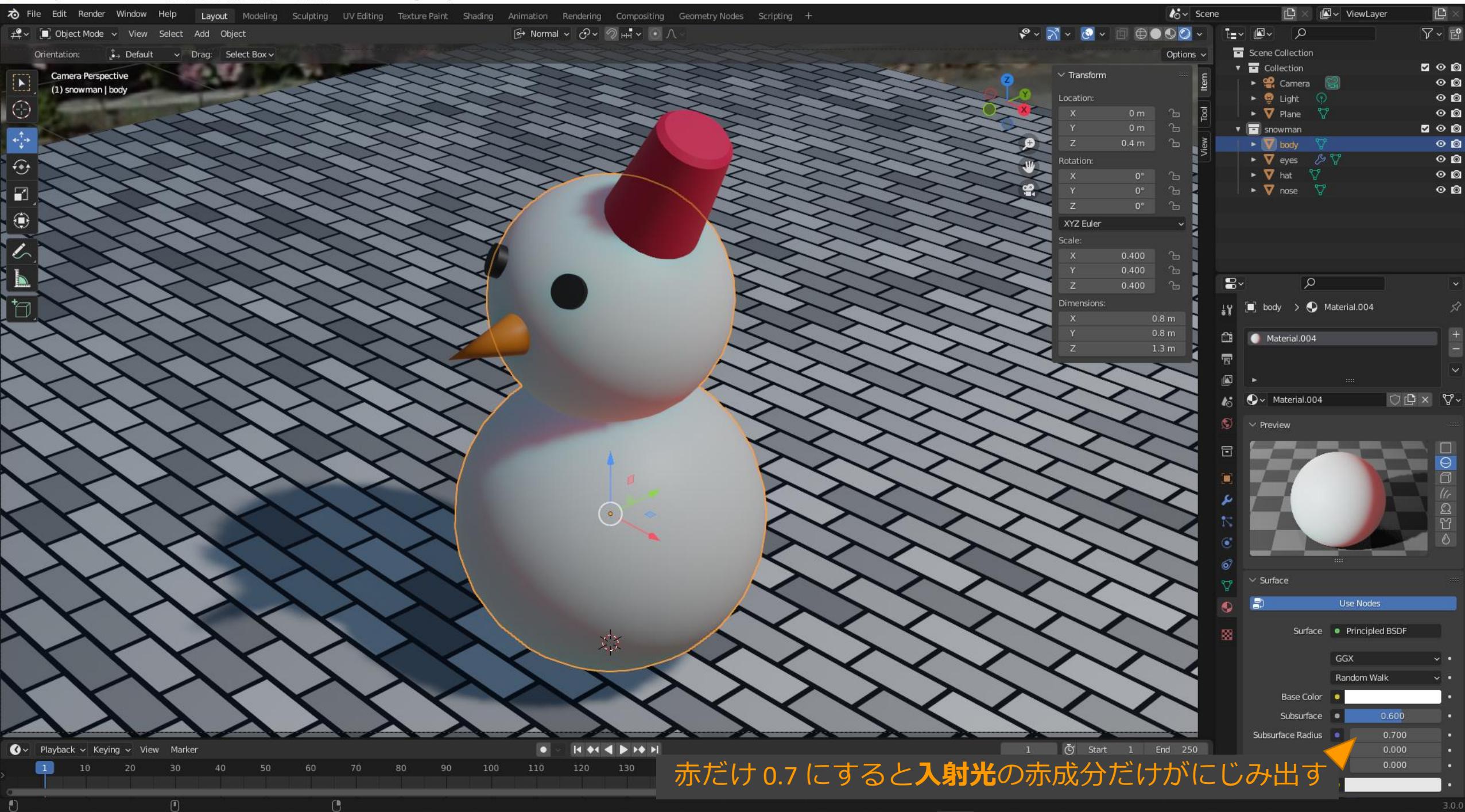
The Material Properties panel shows the "Material.004" assigned to the "body" object. A callout points to the "Preview" section, which displays a sphere with a checkered pattern representing the material's surface properties.

Annotations in Japanese:

- Previewを開く (Open Preview) - Points to the preview image in the Material Properties panel.
- Materialのプロパティを表示する (Show Material Properties) - Points to the "body" object in the Outliner panel.
- body (胴体) を選択 (Select body (torso)) - Points to the 3D Viewport with a mouse cursor icon.

Blender interface elements visible include the top menu bar (File, Edit, Render, Window, Help, Layout, Modeling, Sculpting, UV Editing, Texture Paint, Shading, Animation, Rendering, Compositing, Geometry Nodes, Scripting), toolbars on the left, and the Outliner, Properties, and Render panels on the right.





The image shows the Blender 3D Editor interface. In the center 3D Viewport, a snowman model is positioned on a brick-paved ground. The snowman has a large white body, a red cylindrical hat, and a black coal-like nose. A small orange cone is attached to its left side. The camera perspective is set to "Camera Perspective".

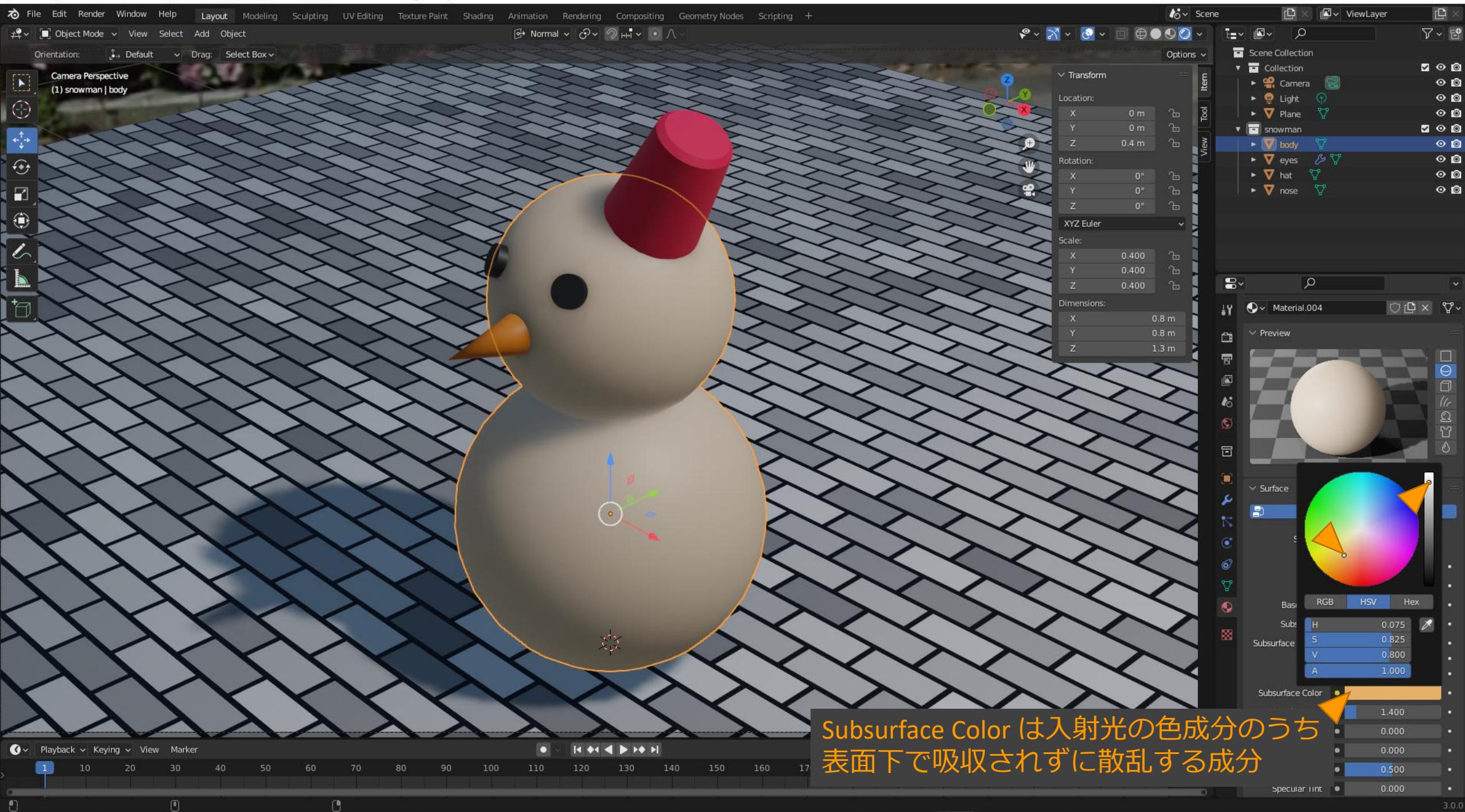
In the top header bar, the file path is displayed as "Blender* [C:\Users\yotokoi\OneDrive - 和歌山大学\ドキュメント\授業\CG制作演習\Blender\snowman2_2.blend]". The menu bar includes File, Edit, Render, Window, Help, Layout, Modeling, Sculpting, UV Editing, Texture Paint, Shading, Animation, Rendering, Compositing, Geometry Nodes, Scripting, and a plus sign icon.

The right-hand side panel contains the "Scene" tab, which displays the "Scene Collection" and the "snowman" object. The "snowman" object is expanded to show its components: "body", "eyes", "hat", and "nose". The "body" component is selected, indicated by a blue border.

The "Properties" panel on the right shows the "Transform" settings for the selected "body" object. The location is at X: 0 m, Y: 0 m, Z: 0.4 m. The rotation is at X: 0°, Y: 0°, Z: 0°. The scale is at X: 0.400, Y: 0.400, Z: 0.400. The dimensions are X: 0.8 m, Y: 0.8 m, Z: 1.3 m.

The "Material" panel on the far right shows the material settings for the selected "body" object. The material is named "Material.004". The "Surface" section uses "Principled BSDF" with "GGX" roughness and "Random Walk" sampling. The "Base Color" is set to yellow (R: 0.600). The "Subsurface" section is active, with "Radius" set to 0.300. The "Subsurface Color" is set to yellow.

A text overlay in the bottom right corner of the image reads: "雪は白いので全部同じ値にした方が雪っぽくなる" (Snow is white, so setting all values to the same will make it look more like snow).



Subsurface Color は入射光の色成分のうち
表面下で吸収されずに散乱する成分

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

Orientation: Default Drag: Select Box

Camera Perspective
(1) snowman | body

Transform

Location:

- X 0 m
- Y 0 m
- Z 0.4 m

Rotation:

- X 0°
- Y 0°
- Z 0°

XYZ Euler

Scale:

- X 0.400
- Y 0.400
- Z 0.400

Dimensions:

- X 0.8 m
- Y 0.8 m
- Z 1.3 m

Scene Collection

- Collection
- Camera
- Light
- Plane
- snowman
 - body
 - eyes
 - hat
 - nose

Material.004

Preview

Surface

Use Nodes

Subsurface

Principled BSDF

GGX

Random Walk

Base Color

Subsurface

Subsurface Radius

Subsurface Color

Subsurface IOR

Subsurface Anisot...

Metallic

Specular

Specular Tint

Playback Keying View Marker

1 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

Pan View Region Context Menu

3D Viewport: Camera Perspective (1) snowman | body

3D Viewport Transform: Location X: 0 m, Y: 0 m, Z: 0.4 m; Rotation X: 0°, Y: 0°, Z: 0°; Scale X: 0.400, Y: 0.400, Z: 0.400; Dimensions X: 0.8 m, Y: 0.8 m, Z: 1.3 m

Material Properties: Surface: Principled BSDF, GGX, Random Walk, Base Color: #FFFF00, Subsurface: 0.000, Subsurface Radius: 0.300, Subsurface Color: #FFCC00, Subsurface IOR: 1.400, Subsurface Anisot...: 0.000, Metallic: 0.000, Specular: 0.500, Specular Tint: 0.000

Text: Subsurface は Base Color と Subsurface Color の混合比

Metallic

金属質感

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

Orientation: Default Drag: Select Box

Camera Perspective
(1) snowman | body

Transform

Location:

- X 0 m
- Y 0 m
- Z 0.4 m

Rotation:

- X 0°
- Y 0°
- Z 0°

XYZ Euler

Scale:

- X 0.400
- Y 0.400
- Z 0.400

Dimensions:

- X 0.8 m
- Y 0.8 m
- Z 1.3 m

Surface

Use Nodes

Surface Principled BSDF

GGX Random Walk

Base Color

Subsurface 0.000 0.300 0.300 0.300

Subsurface Anisotropic 1.400

Metallic 0.000

Specular 0.500

Specular Tint 0.000

Roughness 0.500

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

Scene Collection

Collection Camera Light Plane

snowman

- body
- eyes
- hat
- nose

Item View Tool Options

Playback Keying View Marker

1 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 Start 1 End 250

1 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

Box Select Rotate View Object Context Menu

金属は表面下散乱が発生しないから
Subsurface は 0 にしておく

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

Orientation: Default Drag: Select Box

Camera Perspective
(1) snowman | body

Transform

Location:

- X 0 m
- Y 0 m
- Z 0.4 m

Rotation:

- X 0°
- Y 0°
- Z 0°

XYZ Euler

Scale:

- X 0.400
- Y 0.400
- Z 0.400

Dimensions:

- X 0.8 m
- Y 0.8 m
- Z 1.3 m

Surface

Use Nodes

Surface Principled BSDF

GGX Random Walk

Base Color

Subsurface

Subsurface Radius

Metallic Specular

Specular Tint

Roughness Anisotropic

Anisotropic Rotation Sheen

Sheen Tint

Clearcoat

Clearcoat Roughness

IOR Transmission

Transmission Roughness

3.00

Playback Keying View Marker

1 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

Scene Collection

Collection Camera Light Plane

snowman

body eyes hat nose

Metallic を 1 にすると金属的になる

Blender 3D modeling interface showing a snowman model on a brick surface. The right panel displays the Material Properties and Outliner.

Material Properties Panel:

- Surface:** Principled BSDF
- GGX**
- Random Walk**
- Base Color:** Yellow
- Subsurface:** 0.000
- Subsurface Radius:** 0.300
- Subsurface Color:** Orange
- Subsurface IOR:** 1.400
- Subsurface Anisotropic:** 1.000
- Roughness:** 0.200 (highlighted with an orange arrow)
- 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

Outliner Panel:

- Collection: Camera, Light, Plane
- snowman:
 - body
 - eyes
 - hat
 - nose

Annotations:

- Yellow callout: ハイライトが小さくなる (Highlights become smaller)
- Dark gray callout: Roughness を小さくする (Reduce Roughness)

Blender interface elements include the top menu bar (File, Edit, Render, Window, Help, Layout, Modeling, Sculpting, UV Editing, Texture Paint, Shading, Animation, Rendering, Compositing, Geometry Nodes, Scripting), tool shelf on the left, and timeline at the bottom.

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

Orientation: Default Drag: Select Box

Camera Perspective
(1) snowman | body

Transform

Location:

- X 0 m
- Y 0 m
- Z 0.4 m

Rotation:

- X 0°
- Y 0°
- Z 0°

XYZ Euler

Scale:

- X 0.400
- Y 0.400
- Z 0.400

Dimensions:

- X 0.8 m
- Y 0.8 m
- Z 1.3 m

Surface

Use Nodes

Surface Principled BSDF

GGX Random Walk

Base Color

Subsurface

Subsurface Radius

Subsurface Color

Subsurface IOR

Subsurface Anisotropic

Roughness

Anisotropic

Anisotropic Rotation

Sheen

Sheen Tint

Clearcoat

Clearcoat Roughness

IOR

Transmission

Transmission Roughness

Scene Collection

Collection Camera Light Plane

snowman

- body
- eyes
- hat
- nose

ViewLayer

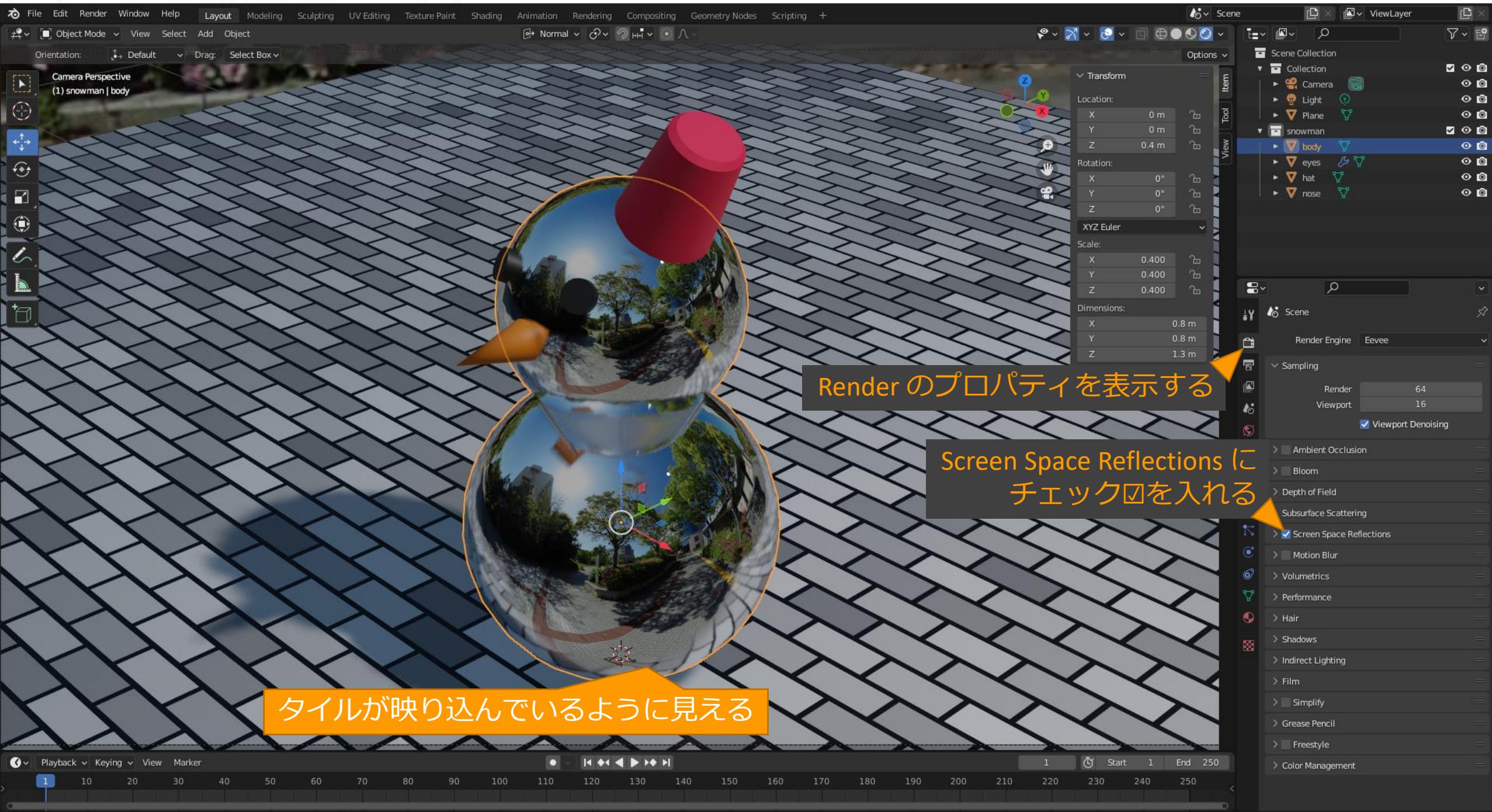
Playback Keying View Marker

1 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

1 Start 1 End 250

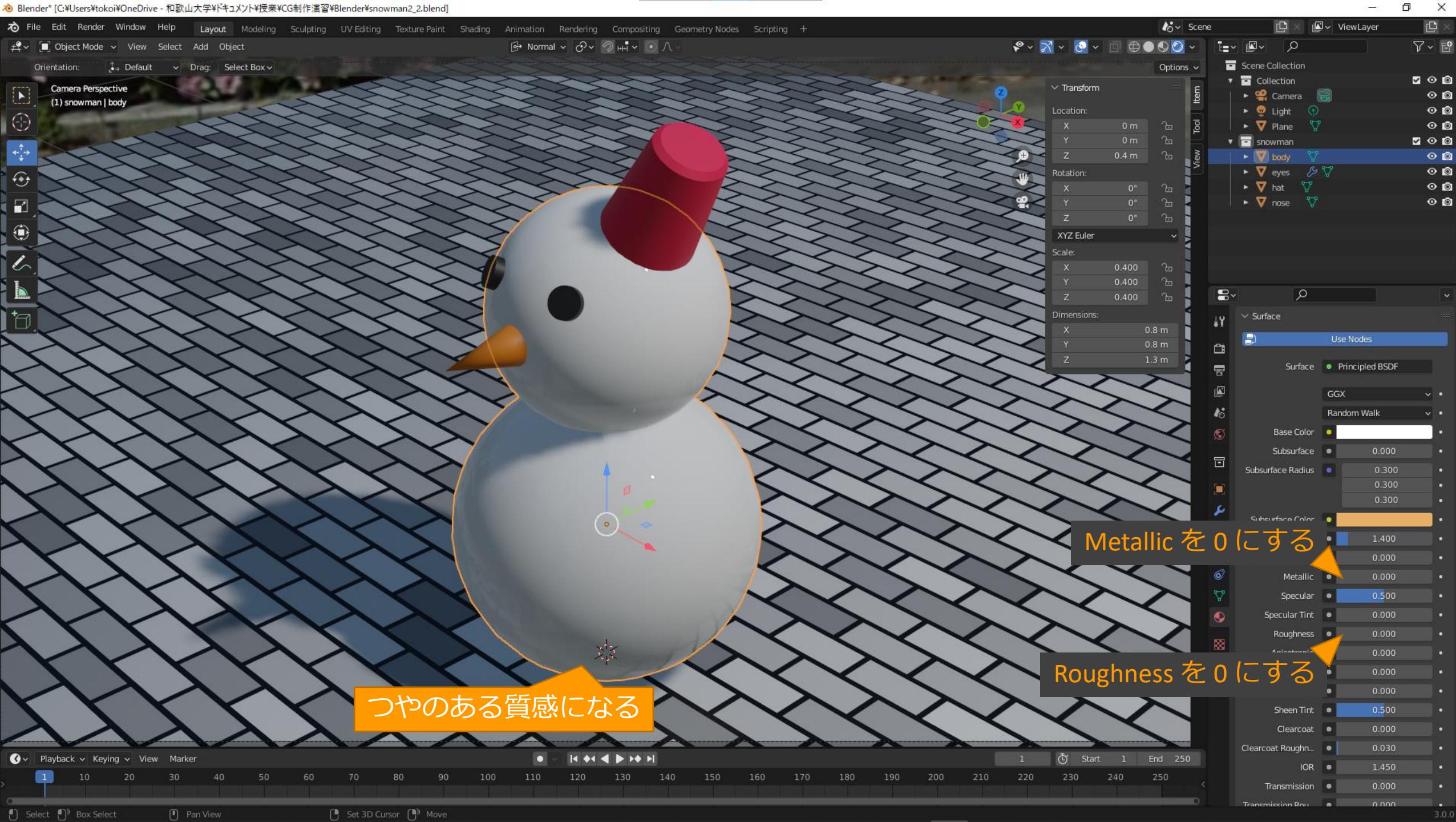
しかしタイルが映り込んでいない

Roughness を 0 にすると鏡になる



Roughness と Specular

表面粗さと鏡面反射



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

Orientation: Default Drag: Select Box

Camera Perspective
(1) snowman | body

Transform

Location:

- X 0 m
- Y 0 m
- Z 0.4 m

Rotation:

- X 0°
- Y 0°
- Z 0°

XYZ Euler

Scale:

- X 0.400

Base Color は反射の色として使われる

RGB HSV Hex

H 0.717	S 0.868	V 1.000
A 1.000		

Base Color

Subsurface 0.000

Subsurface Radius 0.300

Subsurface Color

Subsurface IOR 1.400

Subsurface Anisot... 0.000

Metallic 0.000

Specular 0.500

Specular Tint 0.000

Roughness 0.000

Anisotropic 0.000

Anisotropic Rotati... 0.000

Sheen 0.000

Sheen Tint 0.500

Clearcoat 0.000

Clearcoat Rough... 0.030

IOR 1.450

Transmission 0.000

Transmission Rou...

3.00

Scene Collection

Collection

- Camera
- Light
- Plane

snowman

- body
- eyes
- hat
- mouse

ViewLayer

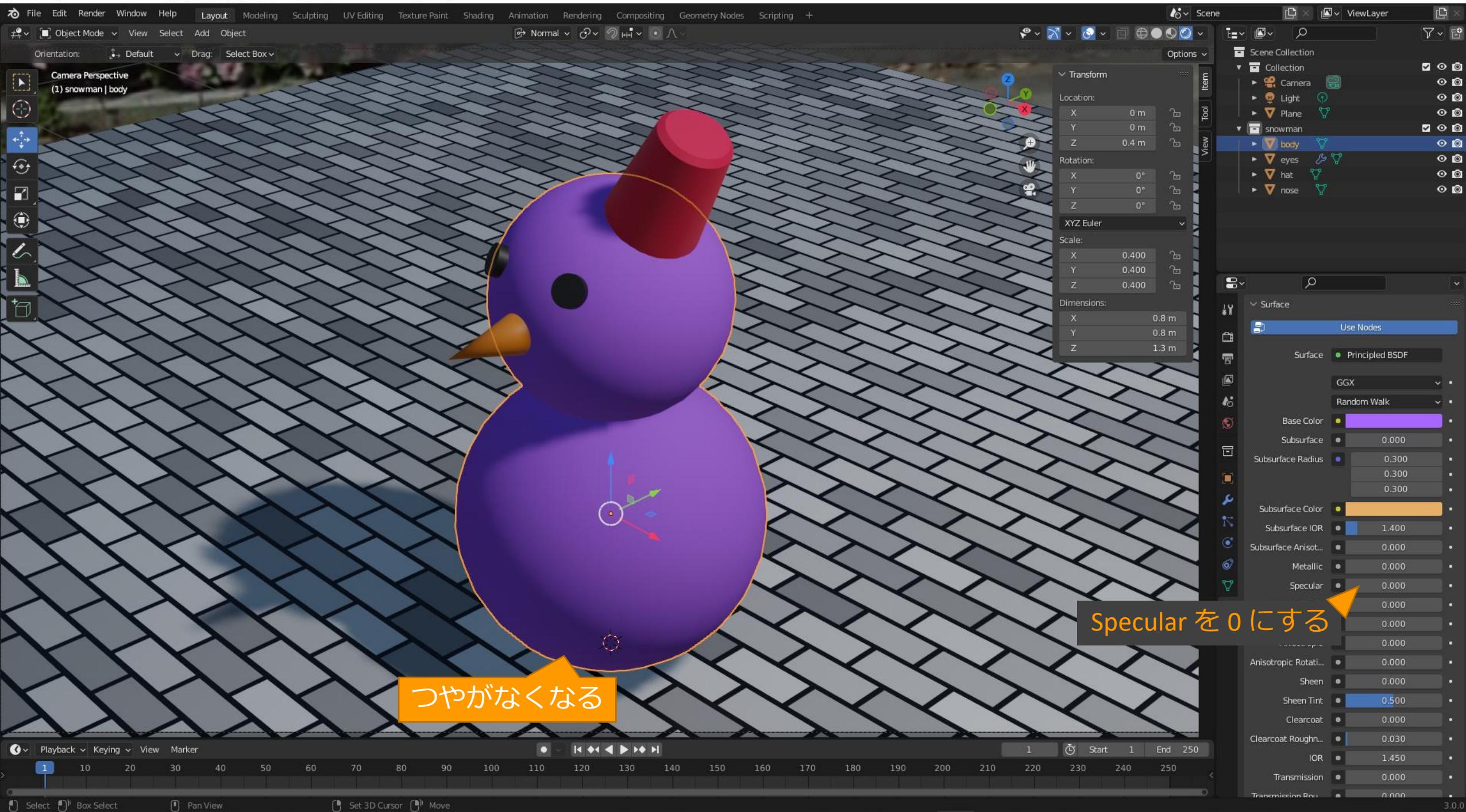
Playback Keying View Marker

1 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

Start 1 End 250

1 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

3.00



Blender 3D modeling interface showing a snowman model on a brick surface.

The scene is in Camera Perspective mode, showing a snowman with a purple body, orange hat, and red scarf. The snowman is positioned on a brick surface.

The Transform panel on the right shows the object's location at (0 m, 0 m, 0.4 m), rotation at (0°, 0°, 0°), and scale at (0.400, 0.400, 0.400). Dimensions are listed as X: 0.8 m, Y: 0.8 m, Z: 1.3 m.

The Outliner panel shows the scene structure:

- Collection
- Camera
- Light
- Plane
- snowman
 - body
 - eyes
 - hat
 - nose

The Properties panel on the right displays the material settings for the snowman's body:

- Surface: Principled BSDF
- GGX
- Random Walk
- Base Color: yellow
- Subsurface: 0.000
- Subsurface Radius: 0.300
- Subsurface Radius: 0.300
- Subsurface Radius: 0.300
- Subsurface Color: orange
- Subsurface IOR: 1.400
- Subsurface Anisotropy: 0.000
- Metallic: 0.000
- Specular: 0.000
- Specular Tint: 0.000
- Roughness: 0.200
- Transmission: 0.000
- Sheen Tint: 0.500
- Clearcoat: 0.000
- Clearcoat Roughness: 0.030
- IOR: 1.450
- Transmission: 0.000
- Transmission Roughness: 0.000

Annotations in Japanese:

- An orange arrow points to the "Roughness" slider in the Properties panel with the text "Roughness を上げてみる".
- An orange box with the text "変わらない" is placed over the snowman's body.

Timeline at the bottom shows frame 1, Start, End 1, End 250.

Blender 3D modeling interface showing a purple snowman model on a brick surface. The interface includes:

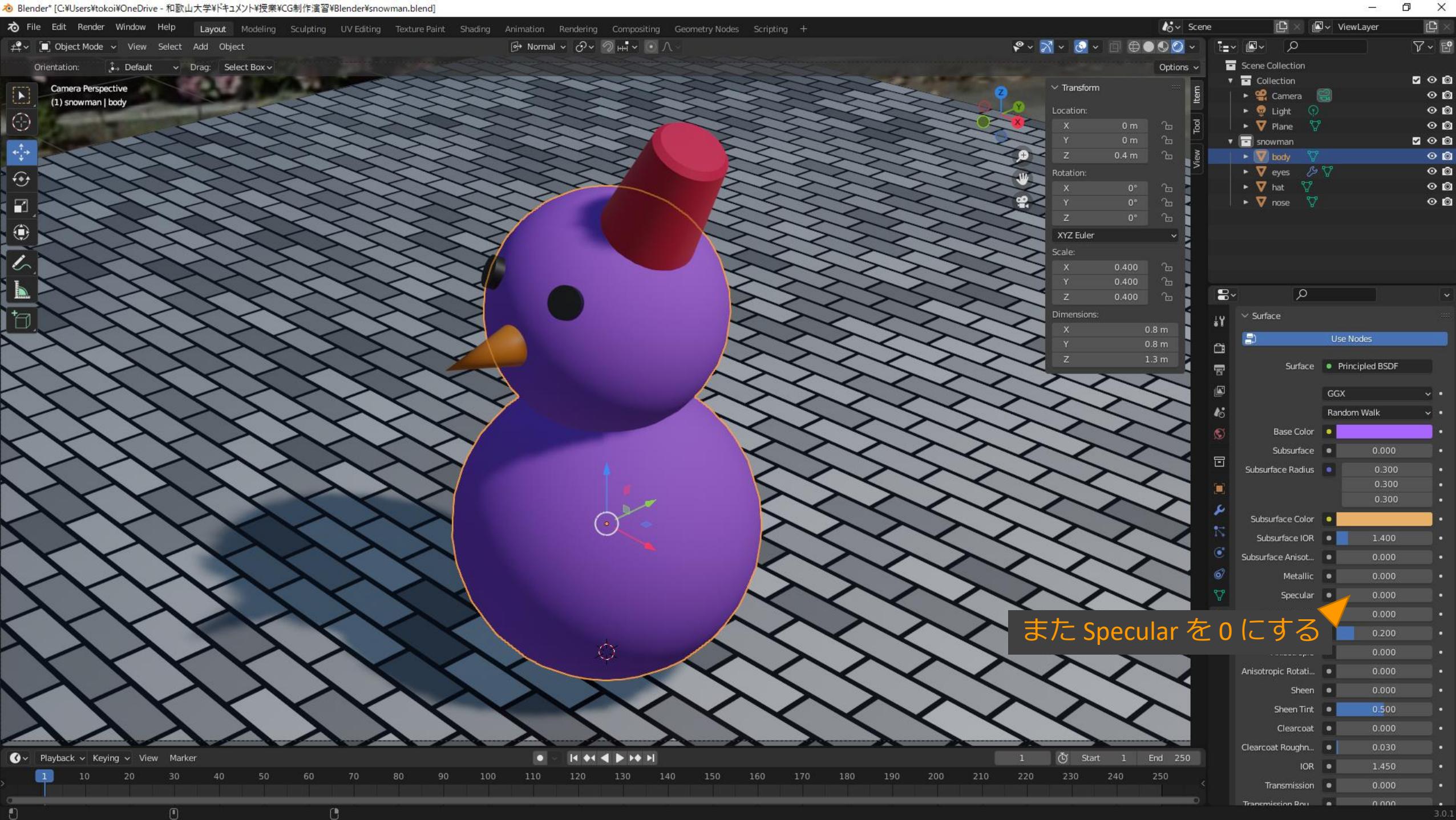
- Header Bar:** File, Edit, Render, Window, Help, Layout, Modeling, Sculpting, UV Editing, Texture Paint, Shading, Animation, Rendering, Compositing, Geometry Nodes, Scripting, +
- Toolbar:** Orientation (Default), Drag (Select Box), Camera Perspective (1) snowman | body.
- 3D Viewport:** Shows the purple snowman model on a brick surface. A callout box points to the snowman's body with the text "Specular Roughness" and "鏡面反射係数 表面粗さ係数". Another callout box points to the body with the text "ハイライトが大きくなっている" (The highlight is getting larger). A third callout box points to the "Specular" value in the Properties panel with the text "Specular を上げてみる" (Try increasing Specular).
- Properties Panel:** Shows Transform (Location: X: 0 m, Y: 0 m, Z: 0.4 m; Rotation: X: 0°, Y: 0°, Z: 0°; Scale: X: 0.400, Y: 0.400, Z: 0.400; Dimensions: X: 0.8 m, Y: 0.8 m, Z: 1.3 m).
- Scene Panel:** Scene Collection (Collection, Camera, Light, Plane), snowman (body, eyes, hat, nose).
- Surface Panel:** Principled BSDF settings (GGX, Random Walk, Base Color: purple, Subsurface: 0.000, Subsurface Radius: 0.300, Subsurface Color: orange, Subsurface IOR: 1.400, Subsurface Anisotropy: 0.000, Metallic: 0.000, Specular: 0.800, 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).
- Timeline:** Shows frames 1 to 250 with markers at frame 1.

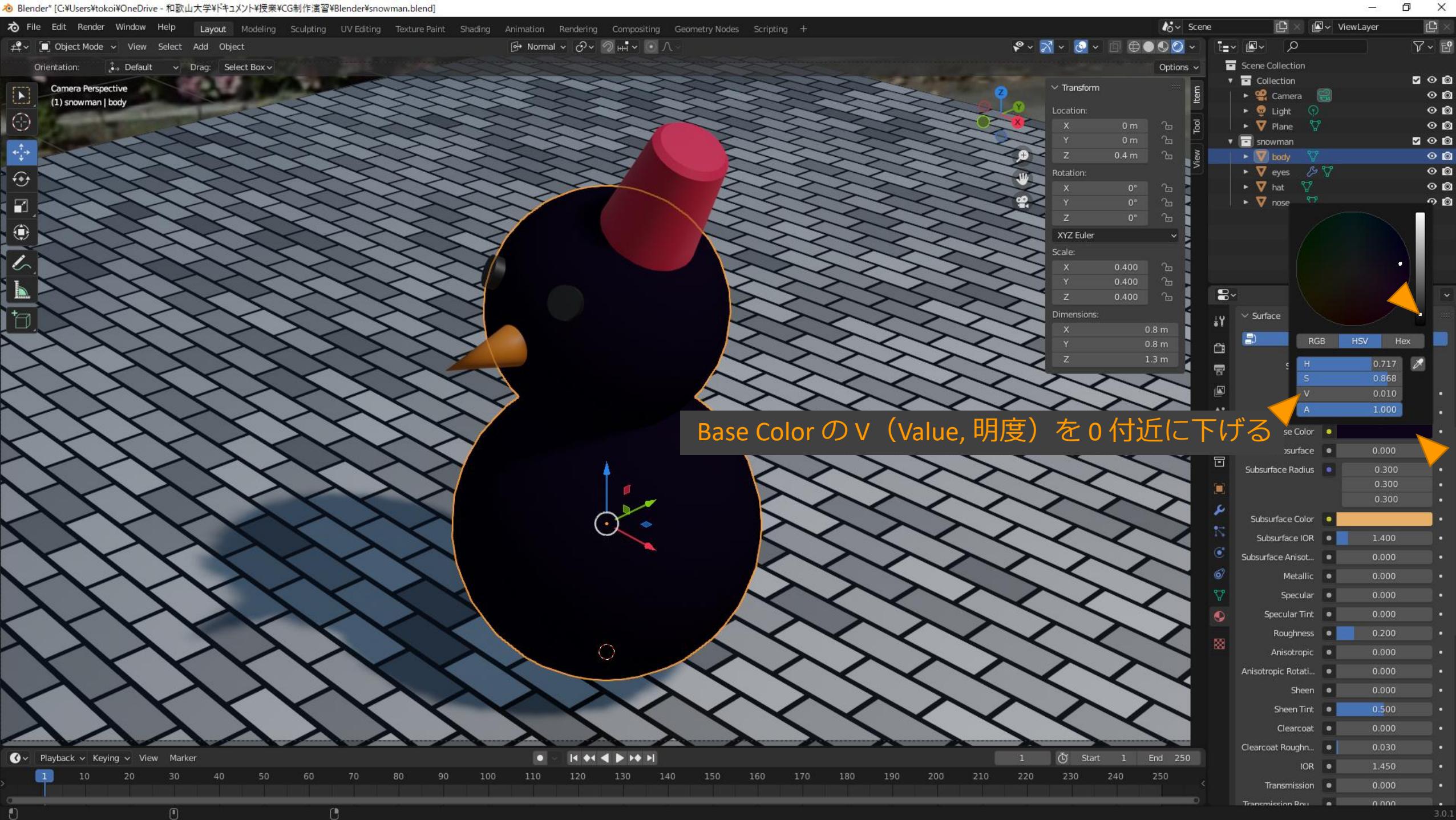
Roughness

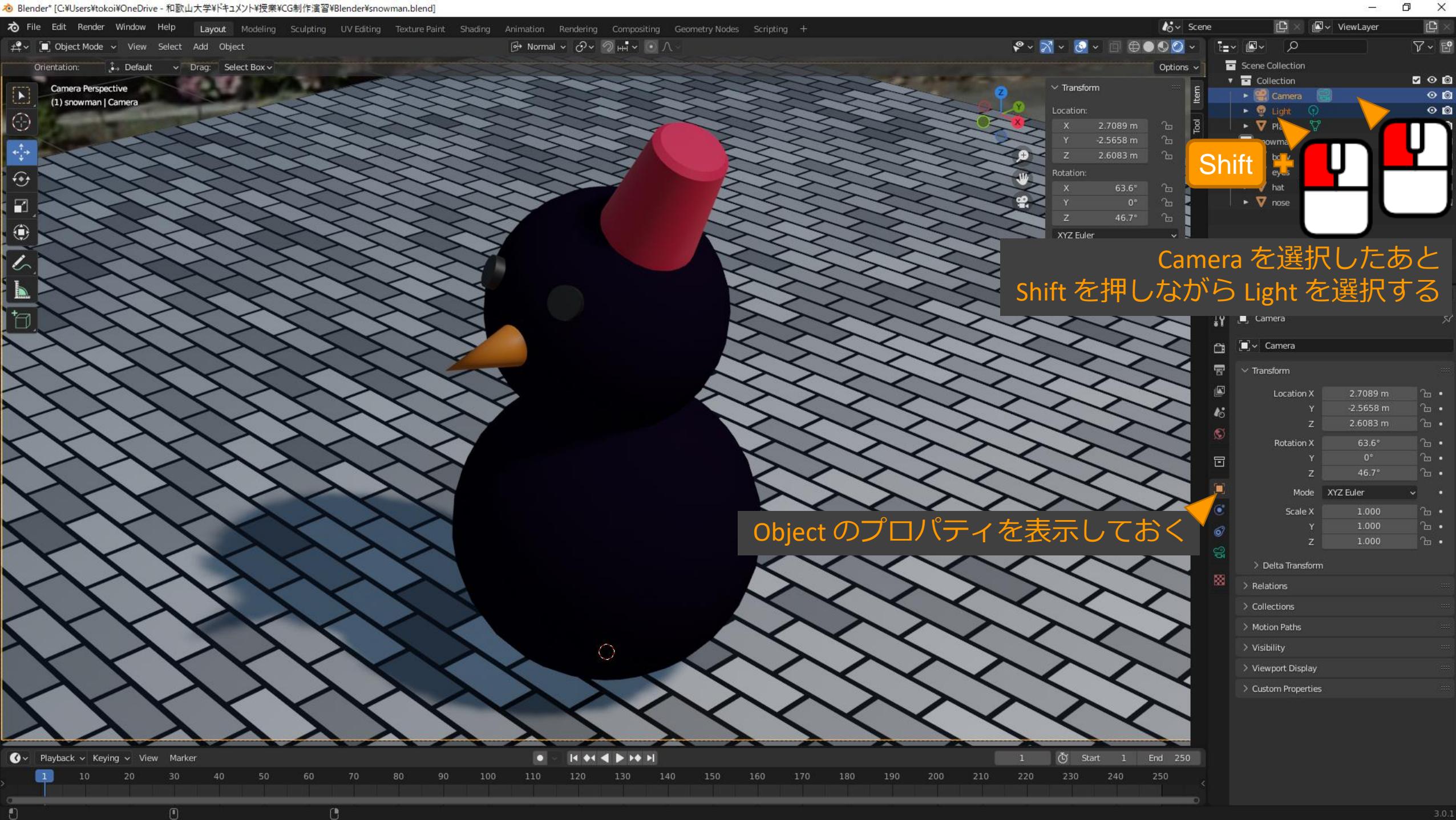


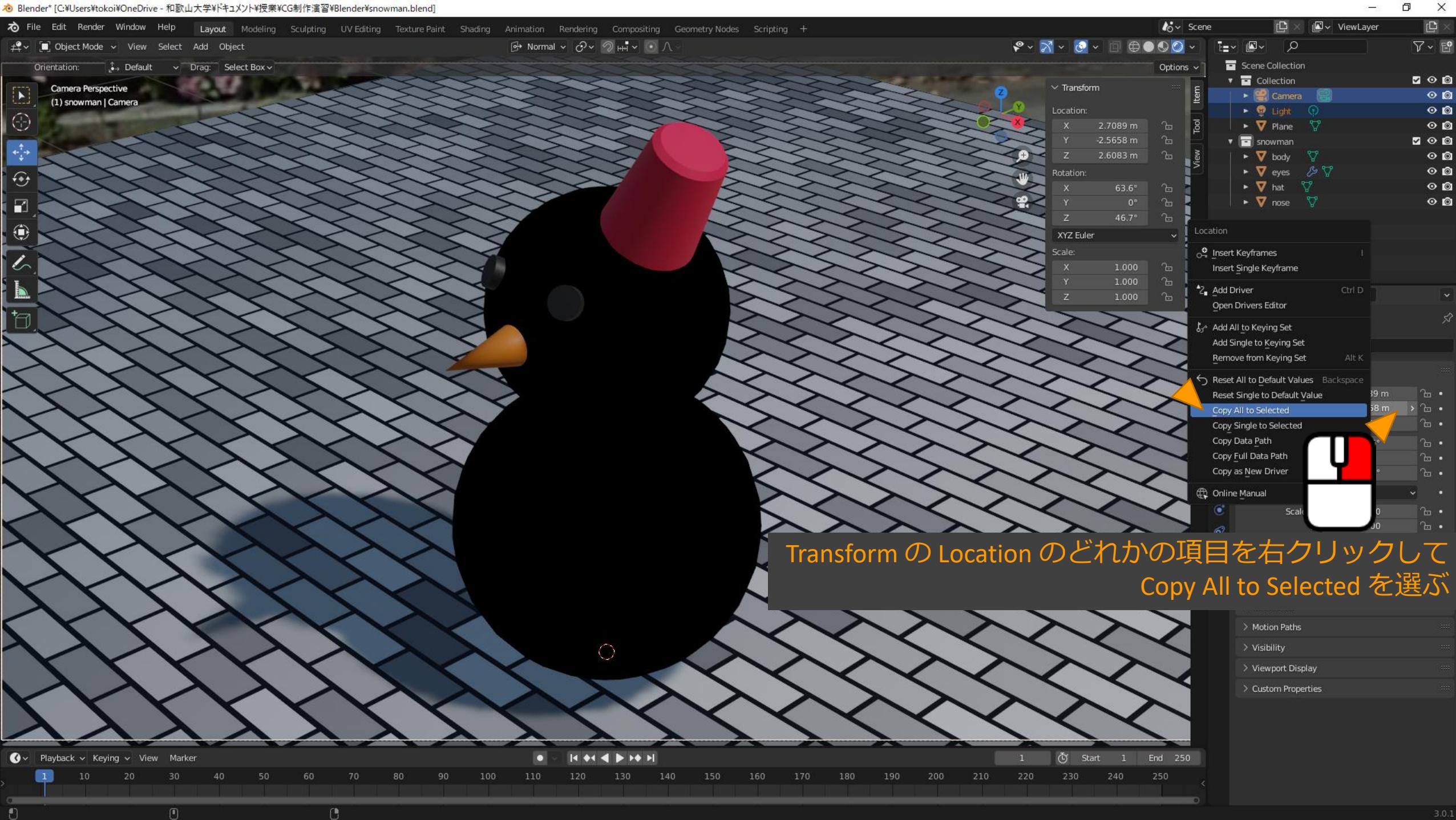
Sheen

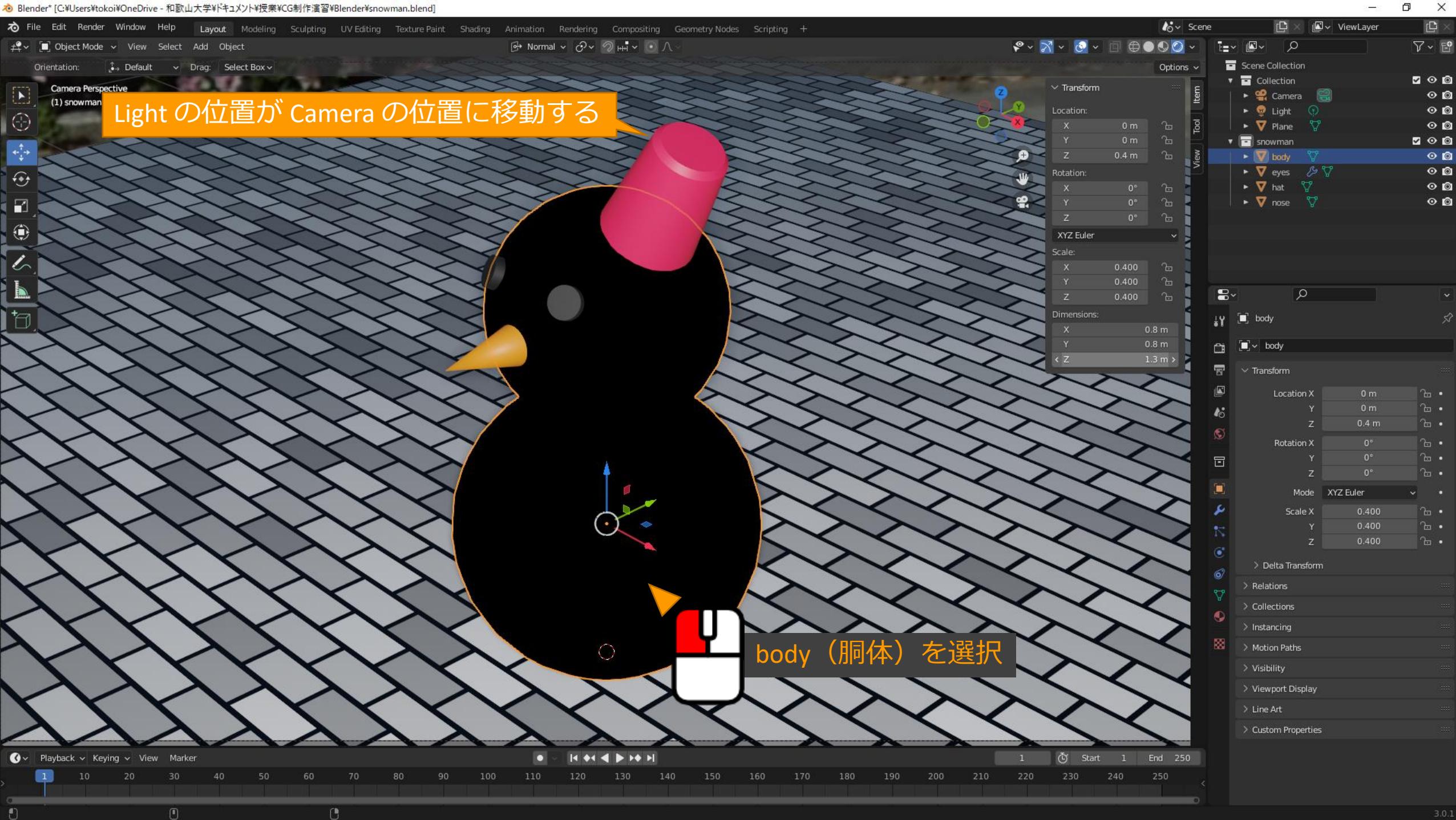
布の光沢

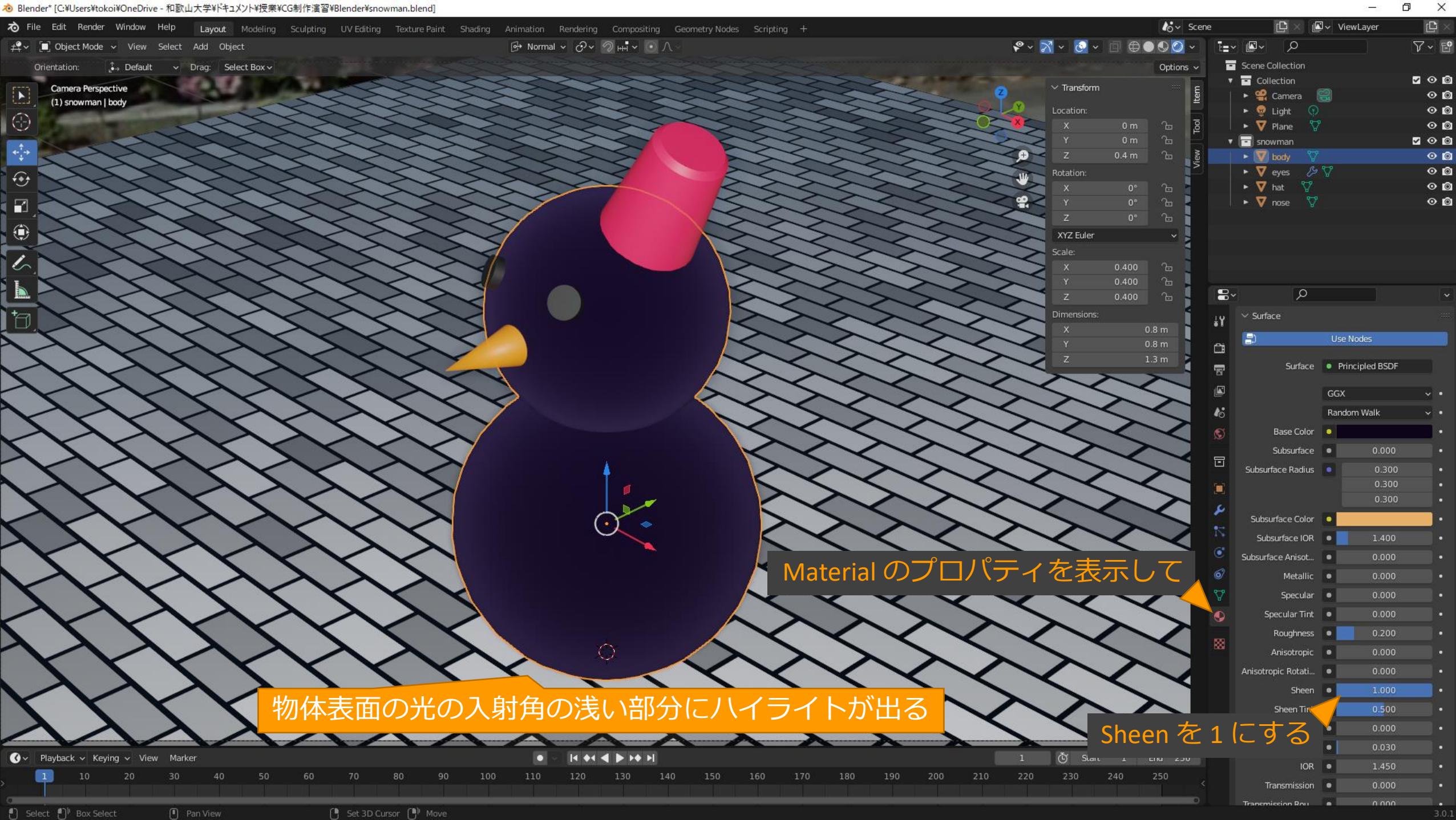






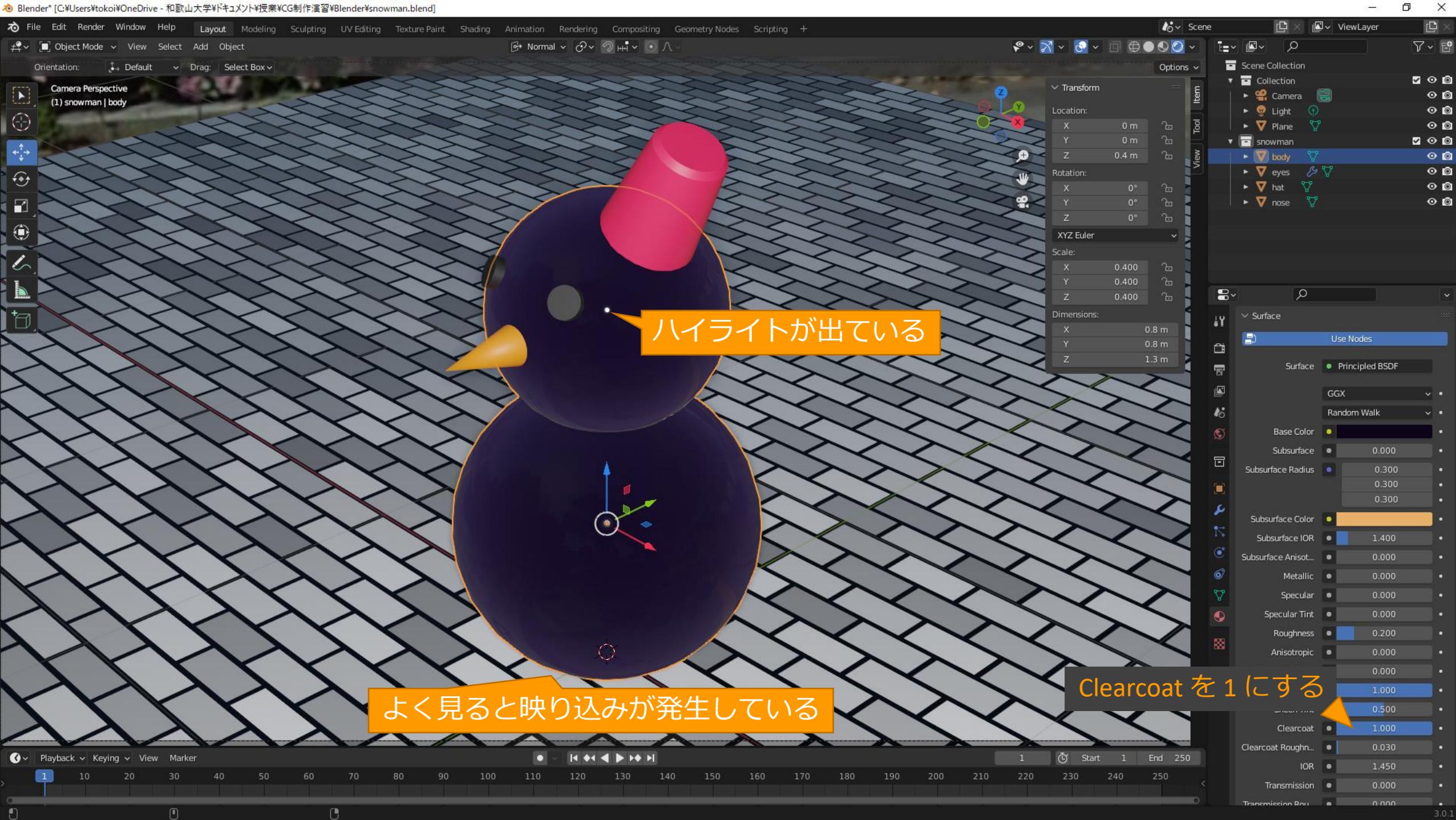


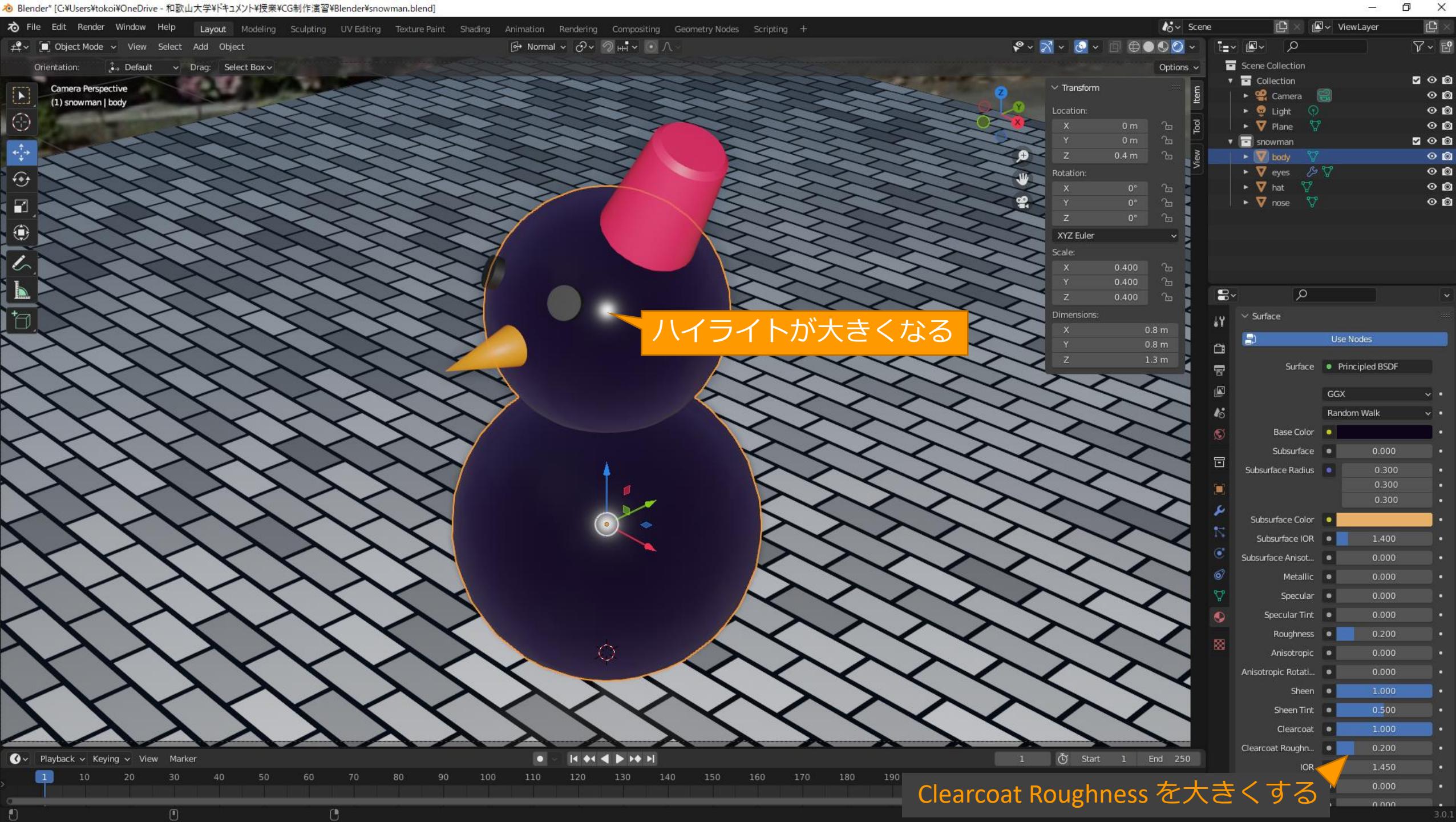




Clearcoat

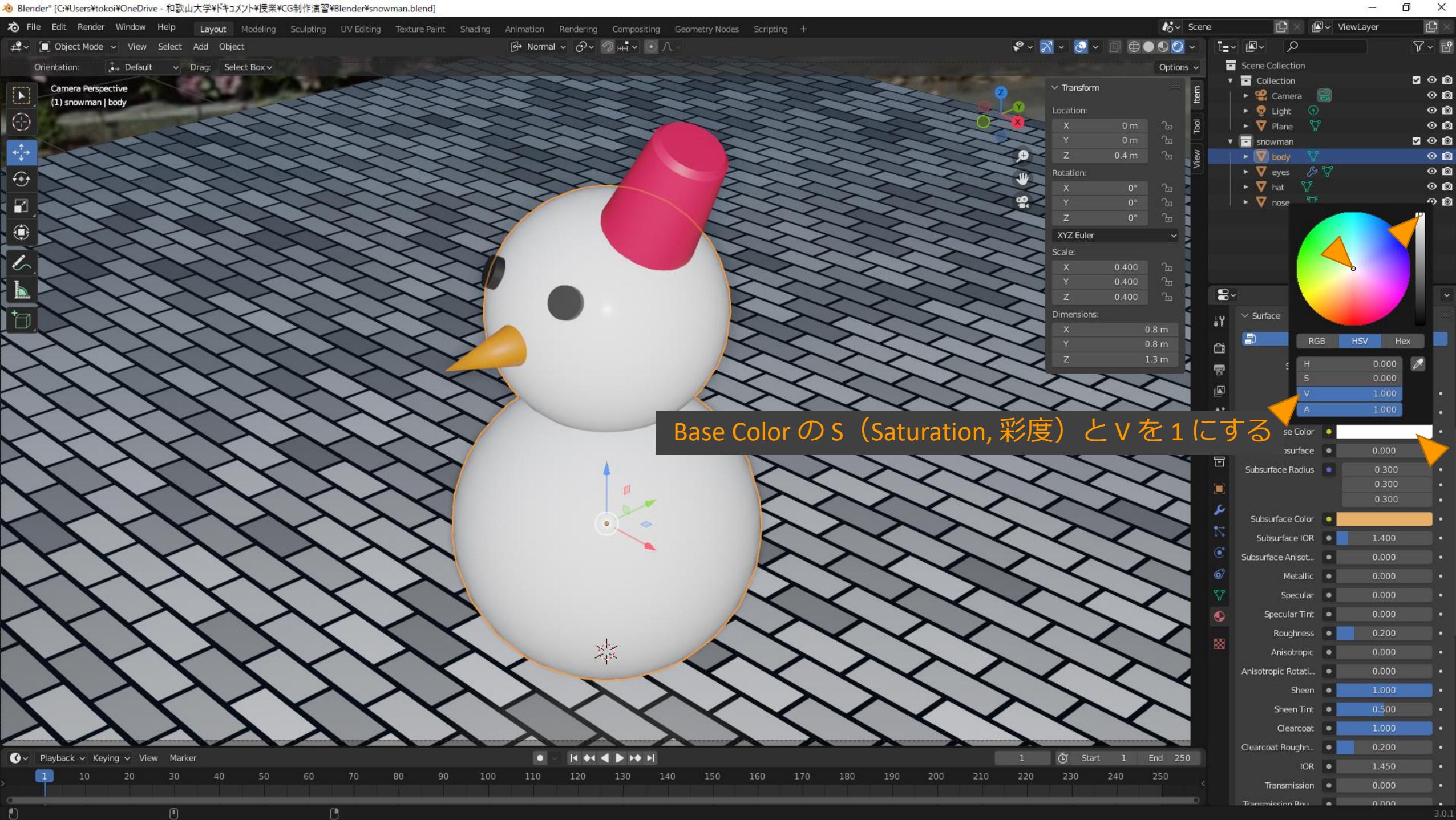
釉薬（うわぐすり）のつや

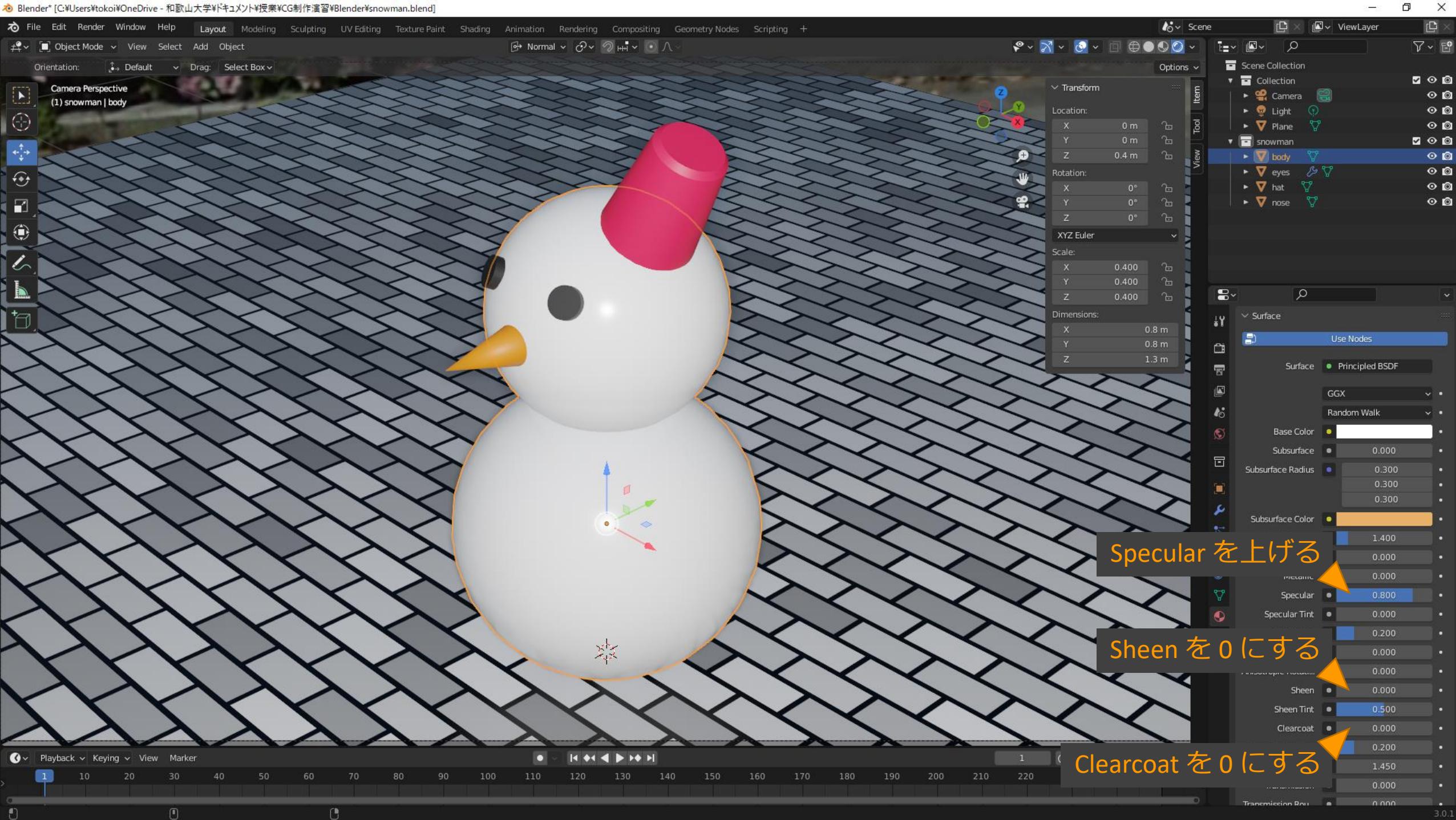


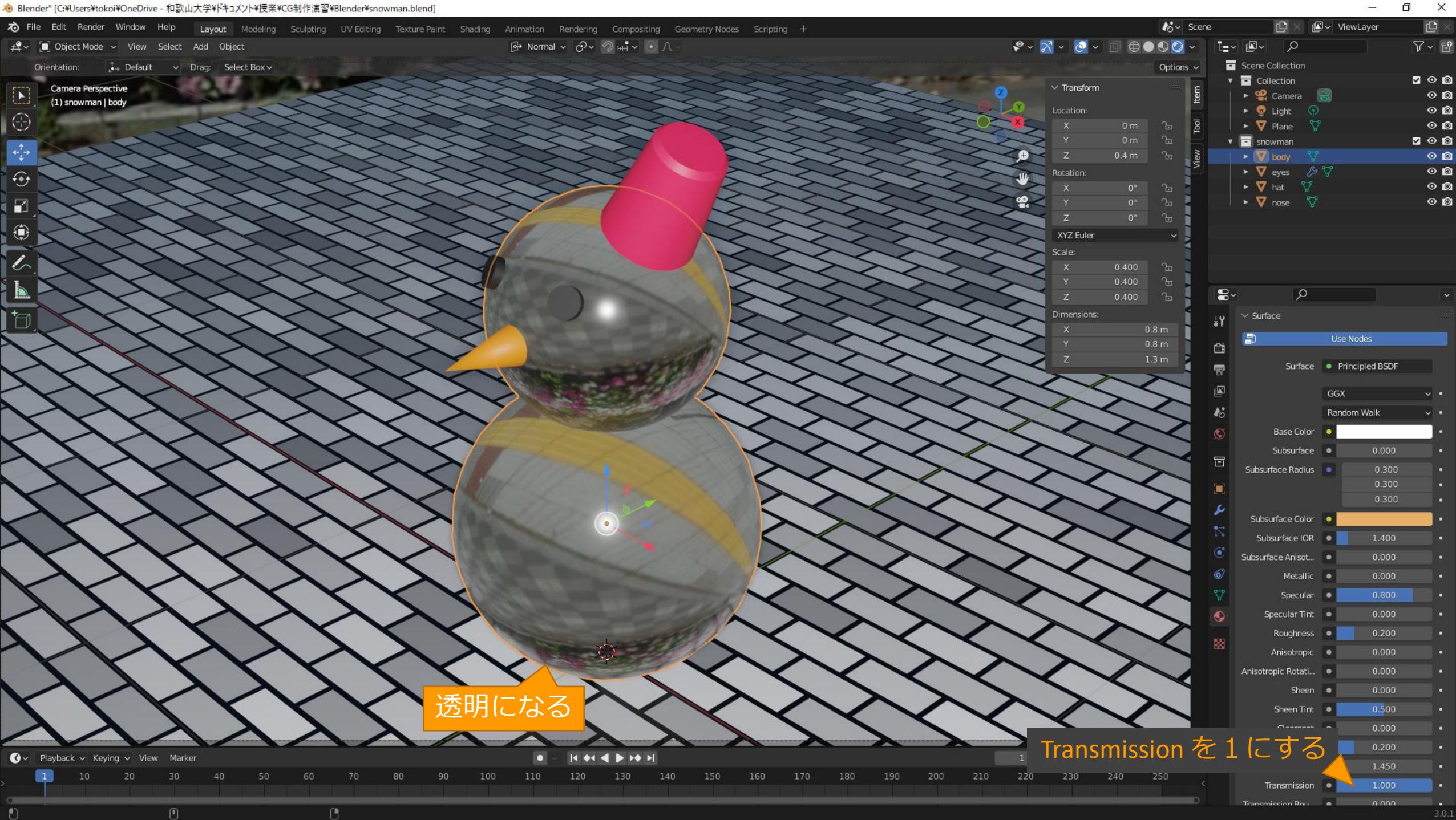


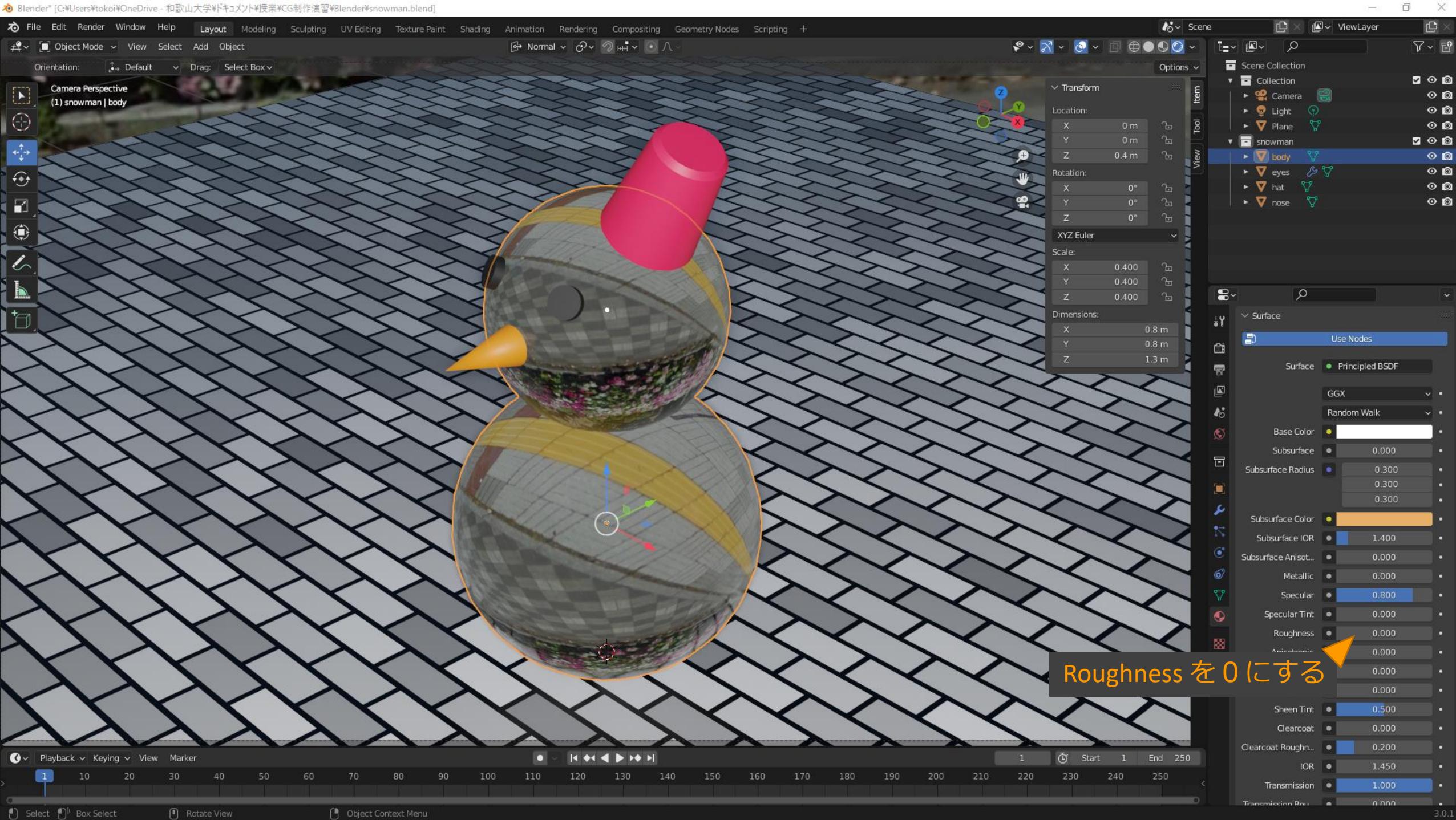
Transmission

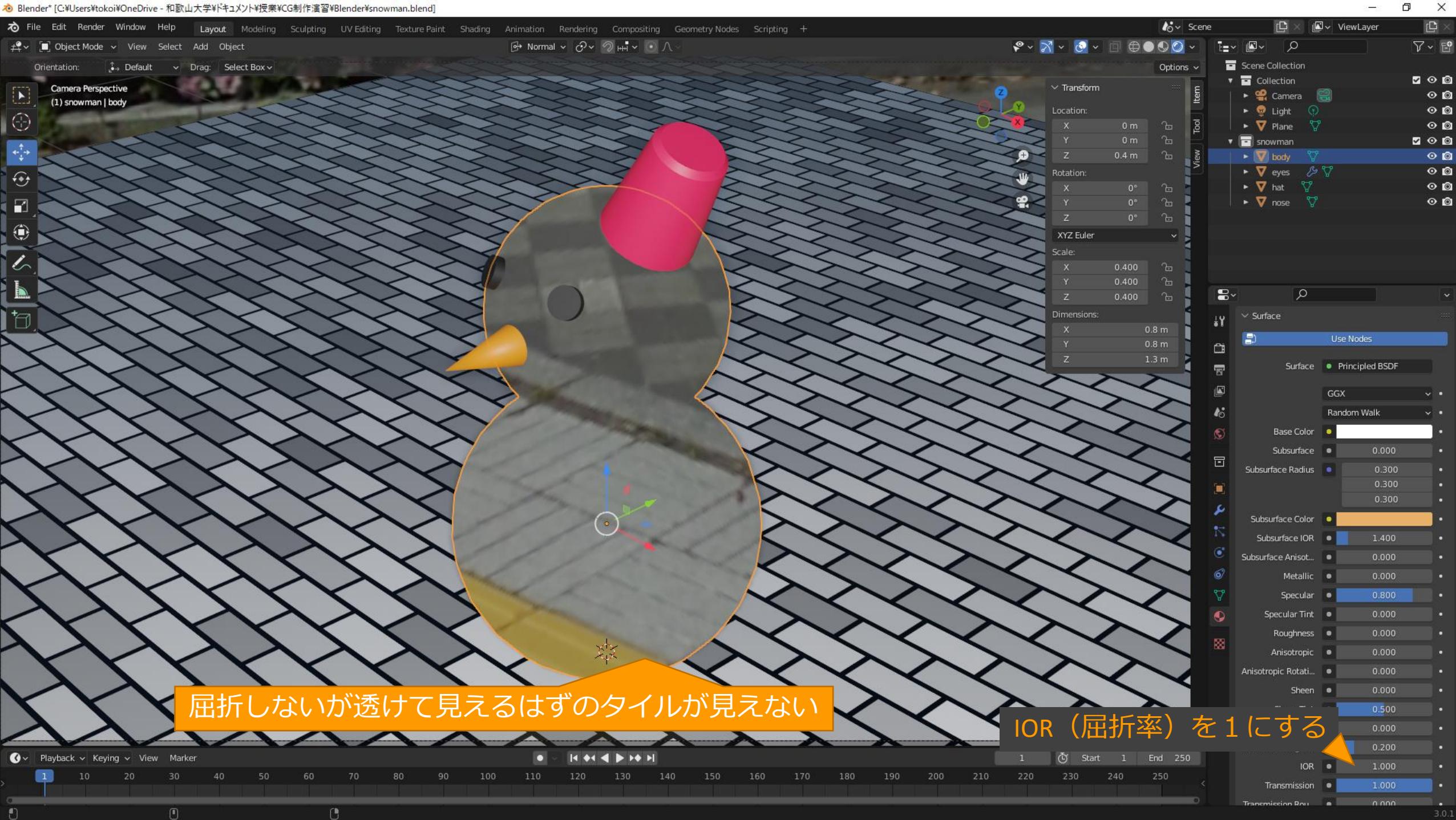
透明感

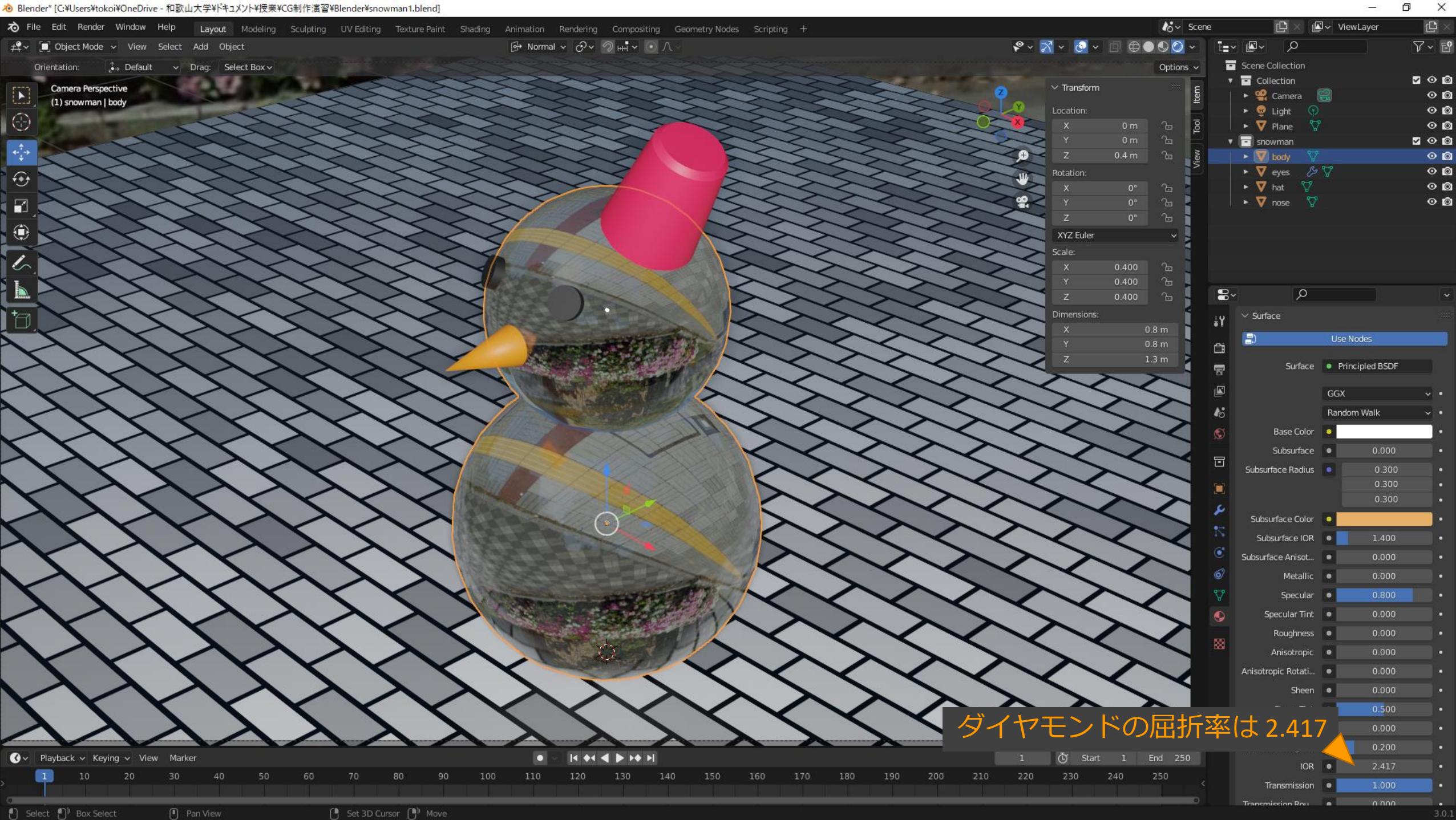


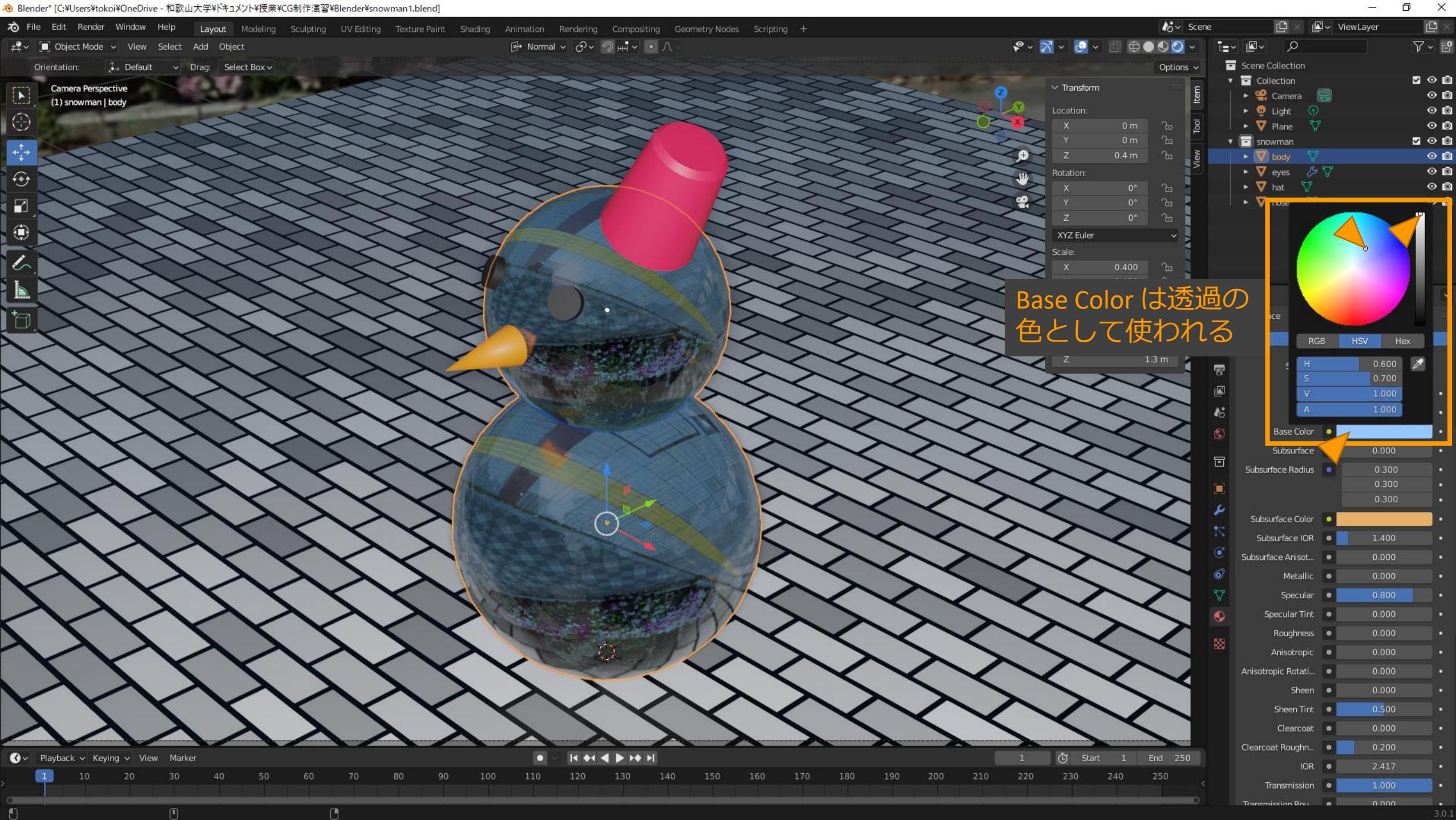


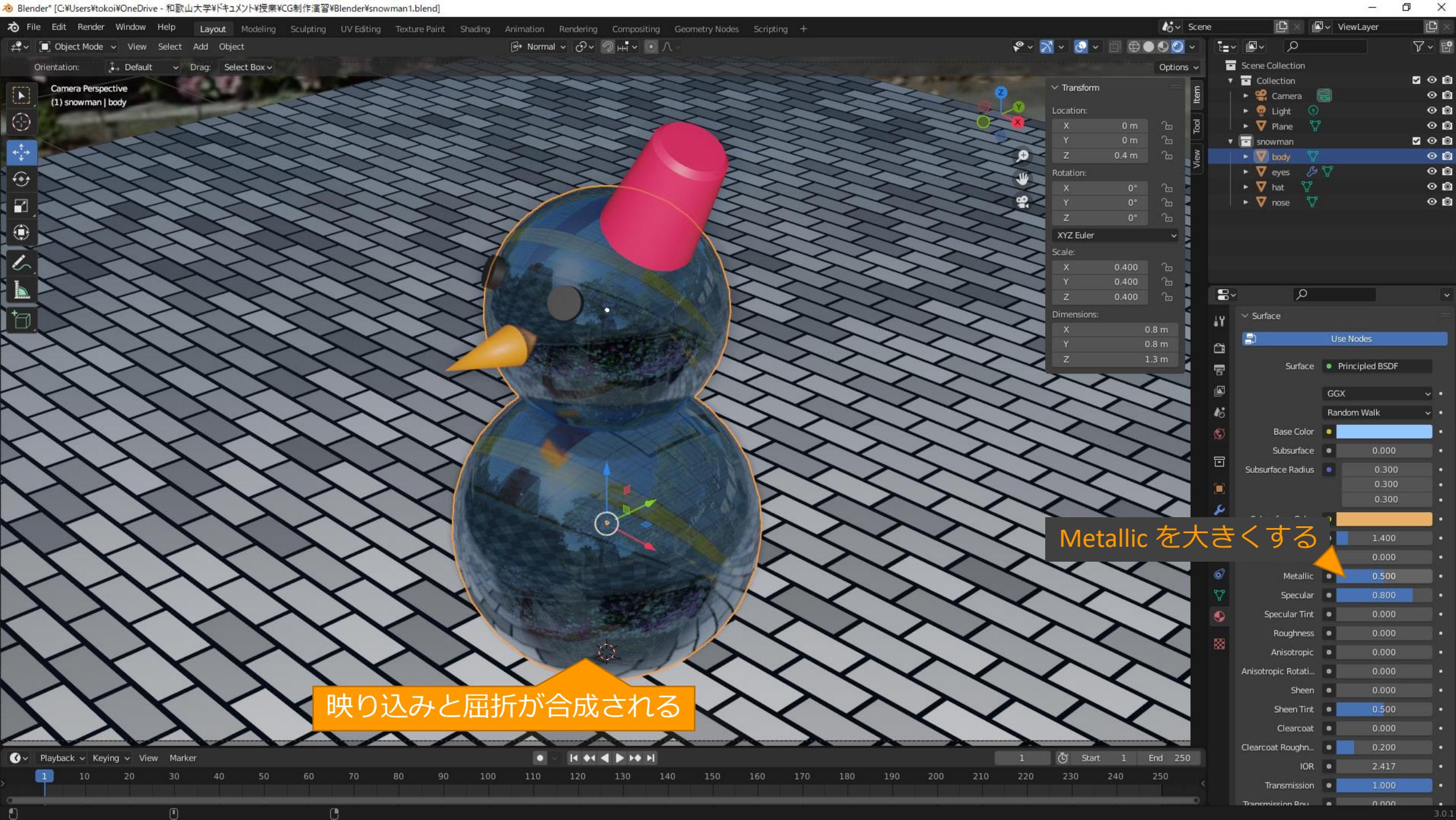






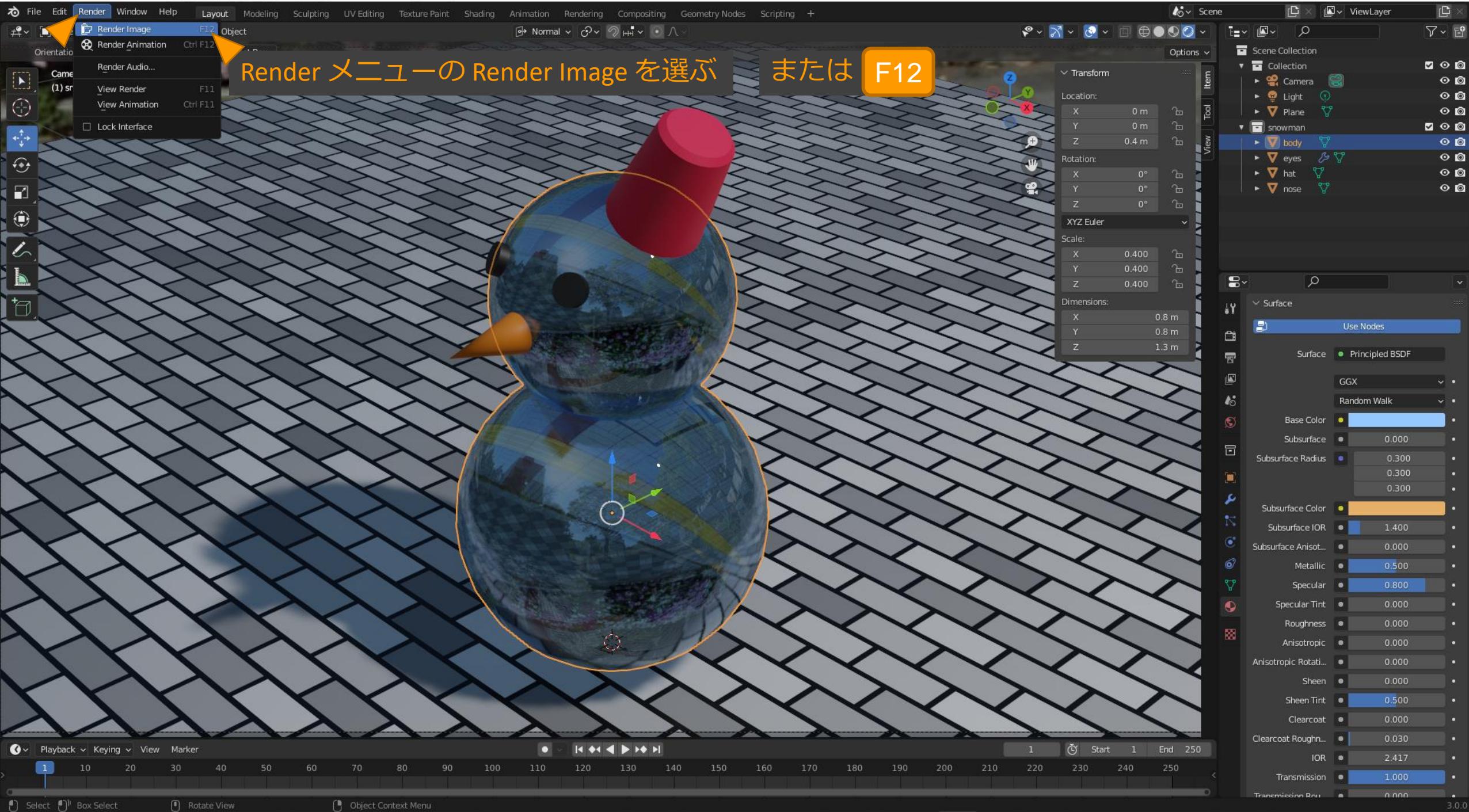






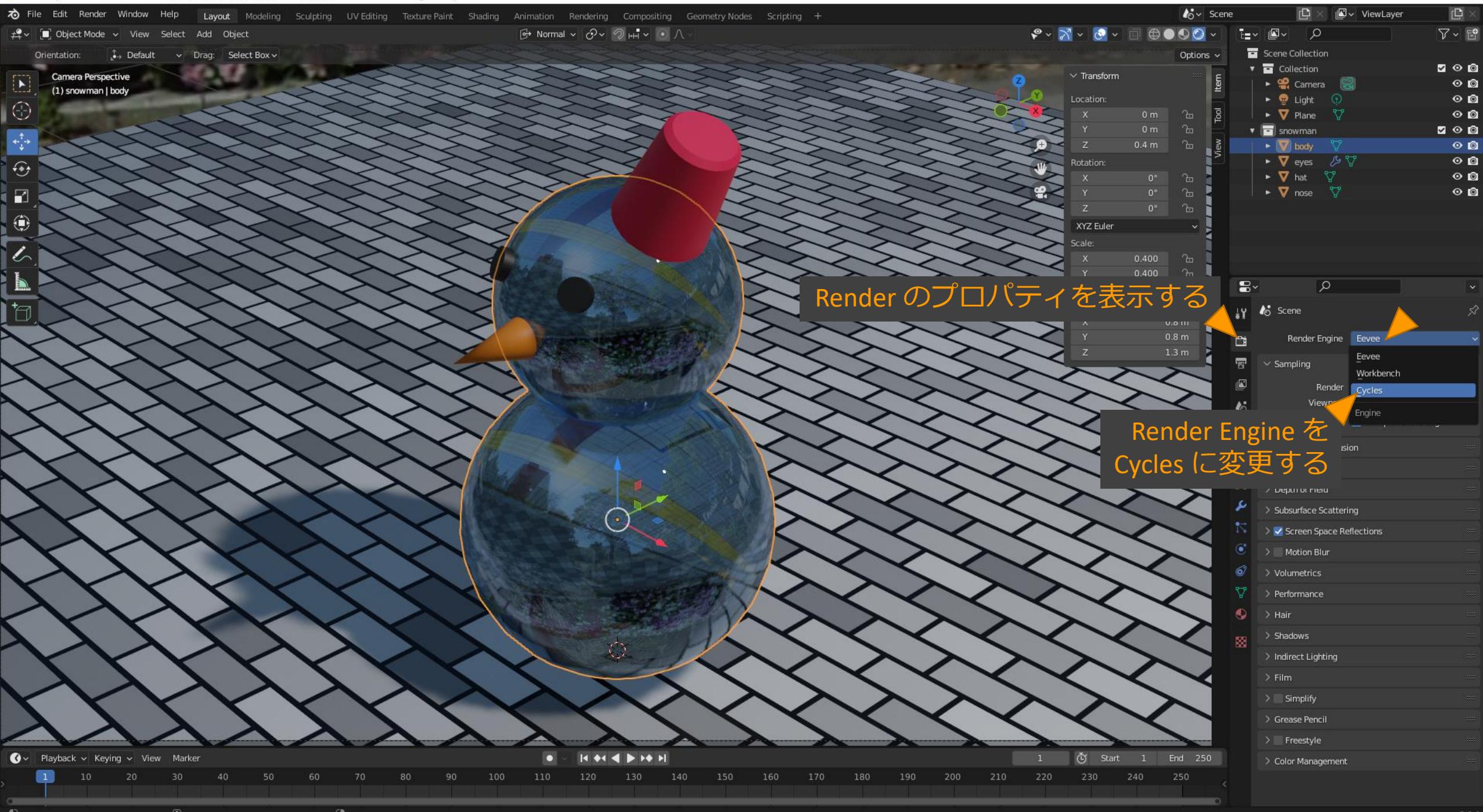
Render Engine

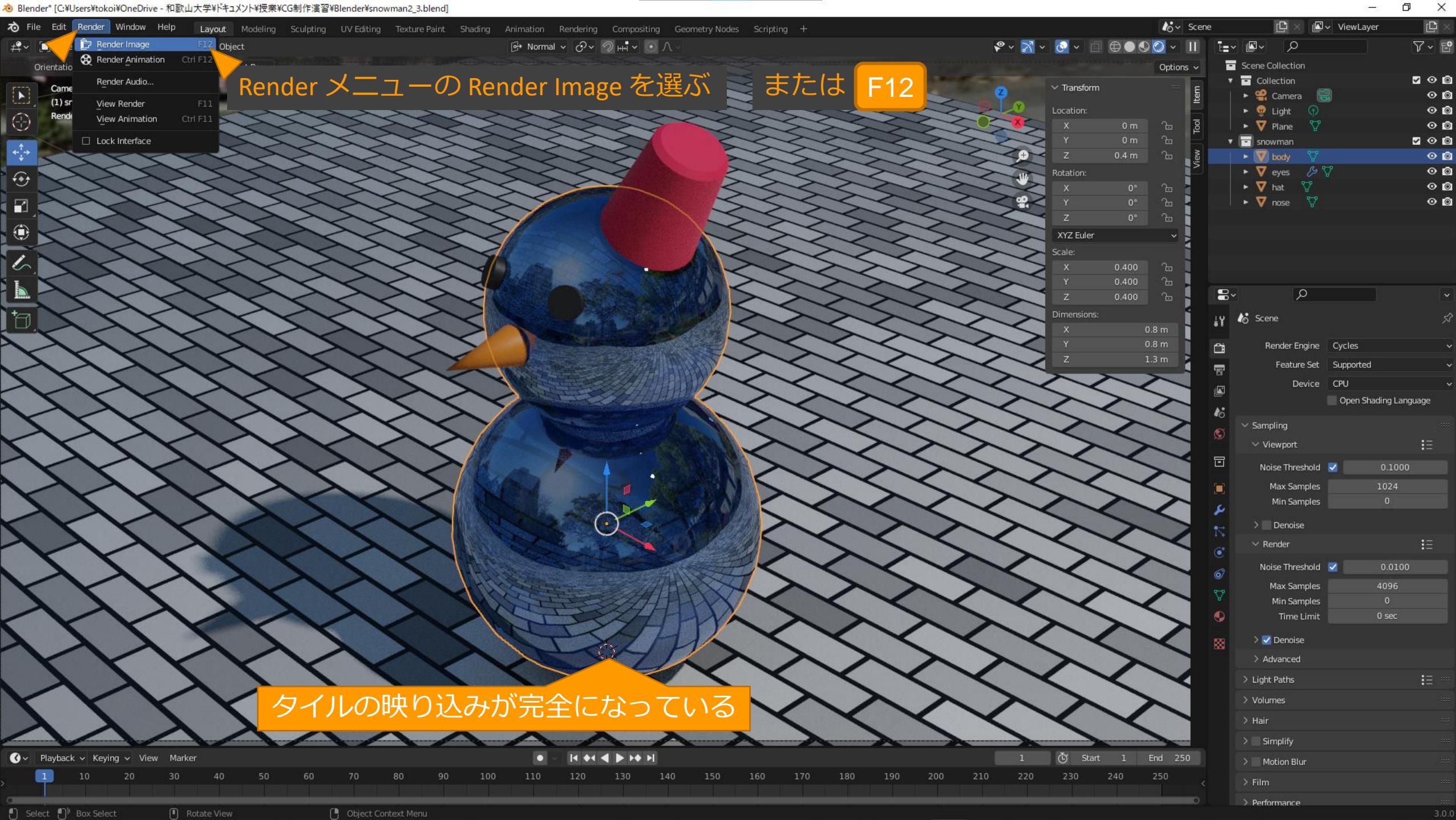
Eevee & Cycles





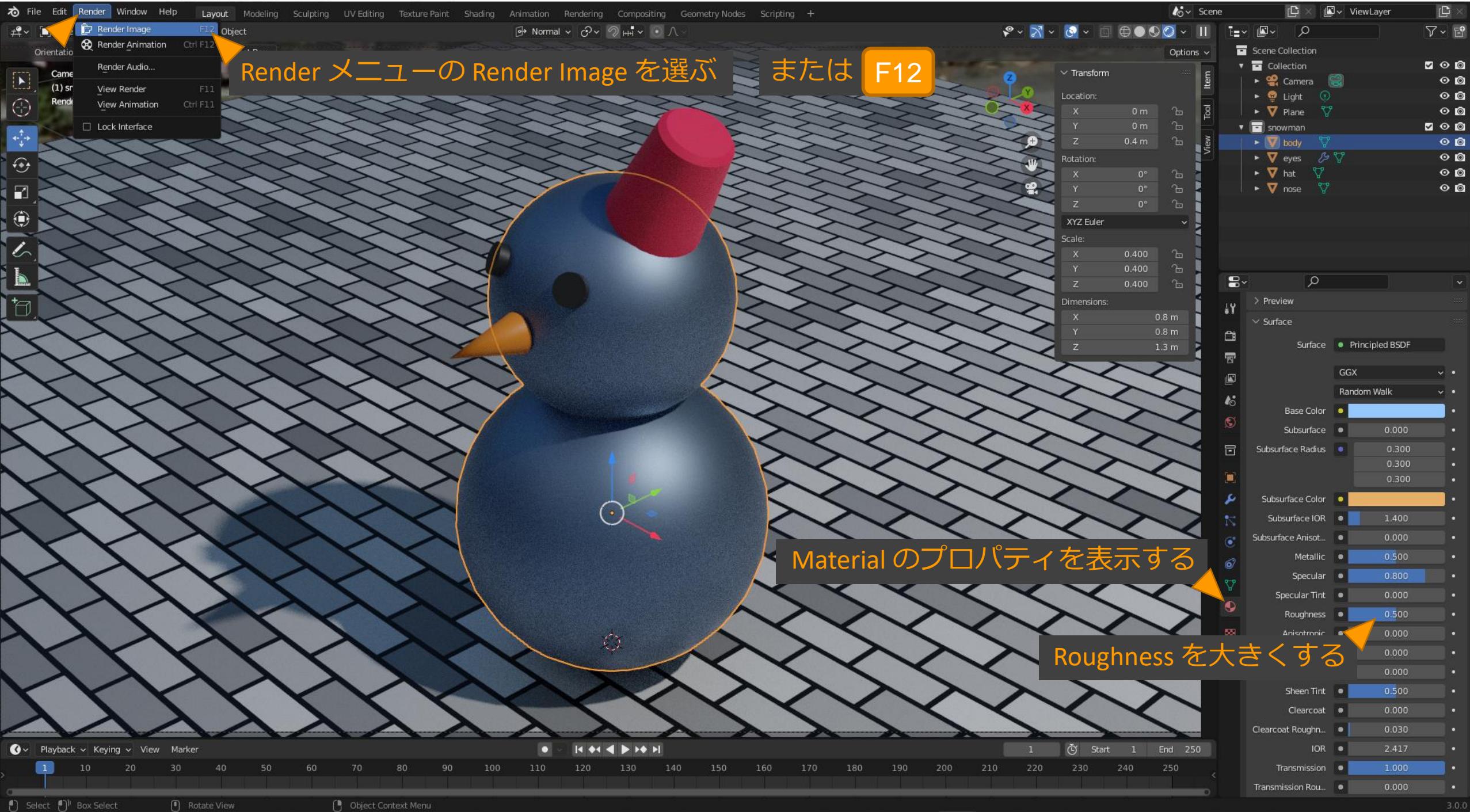
レンダリング時間：0分08秒





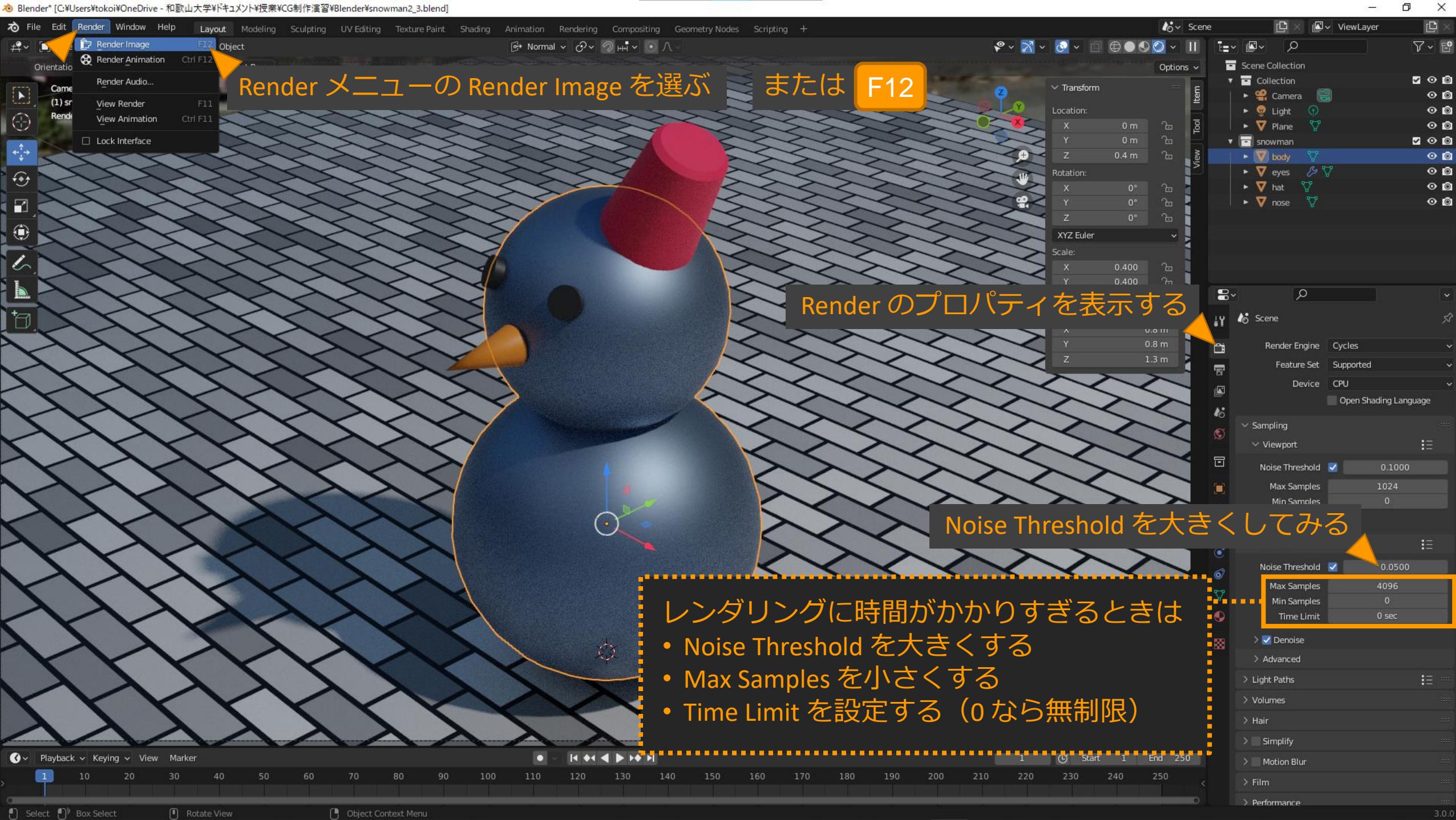


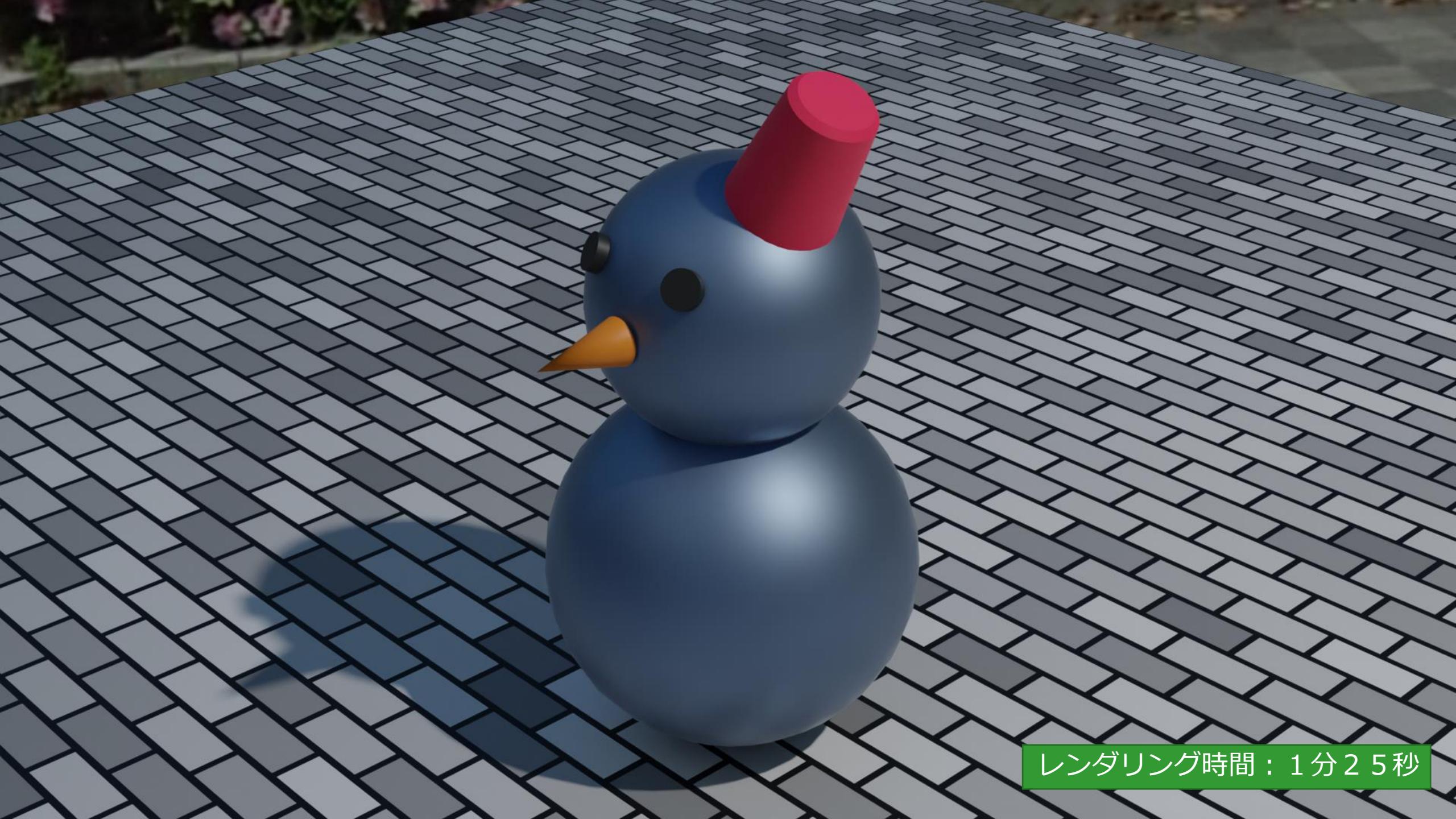
レンダリング時間：6分57秒



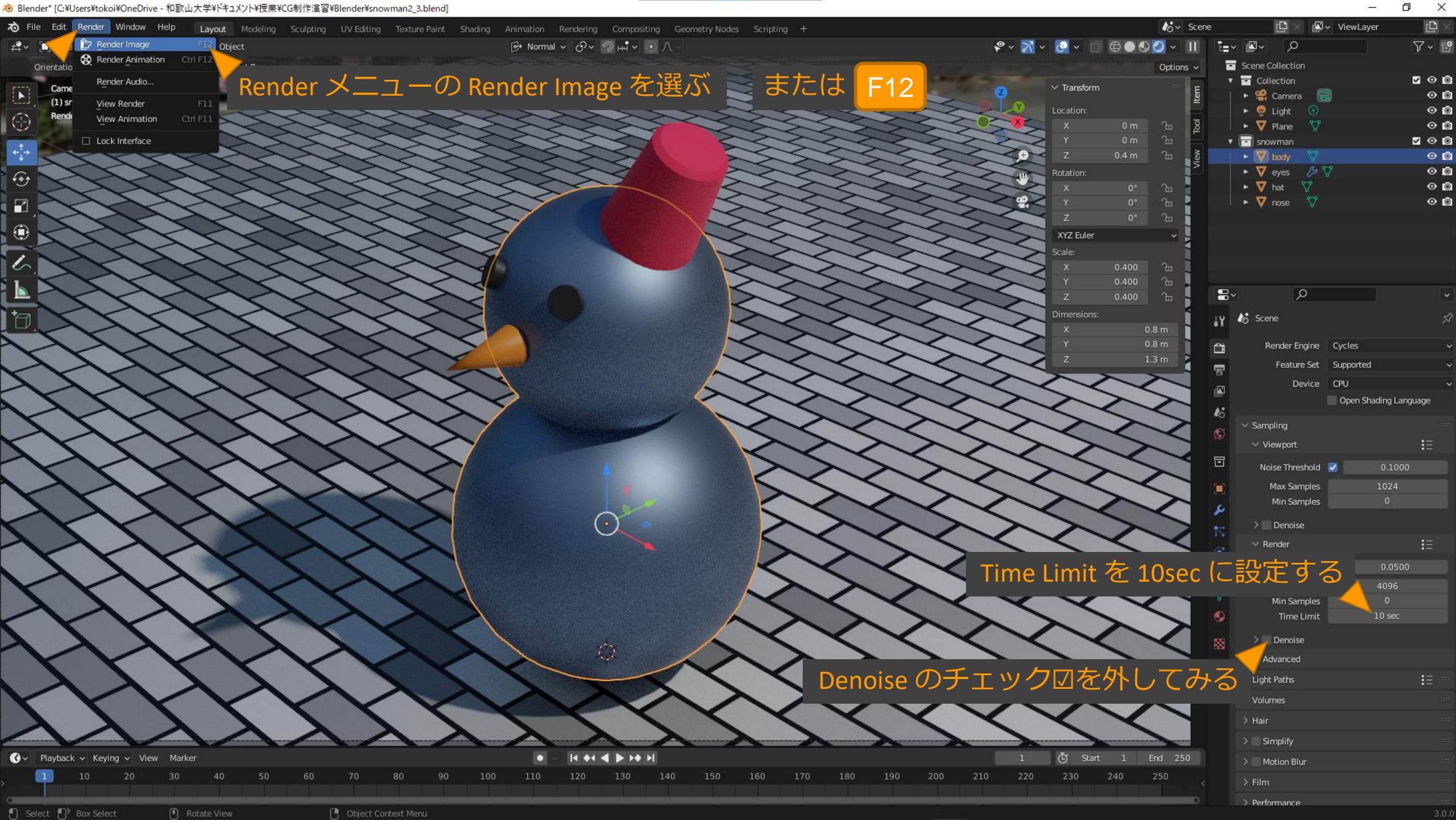


レンダリング時間：8分23秒





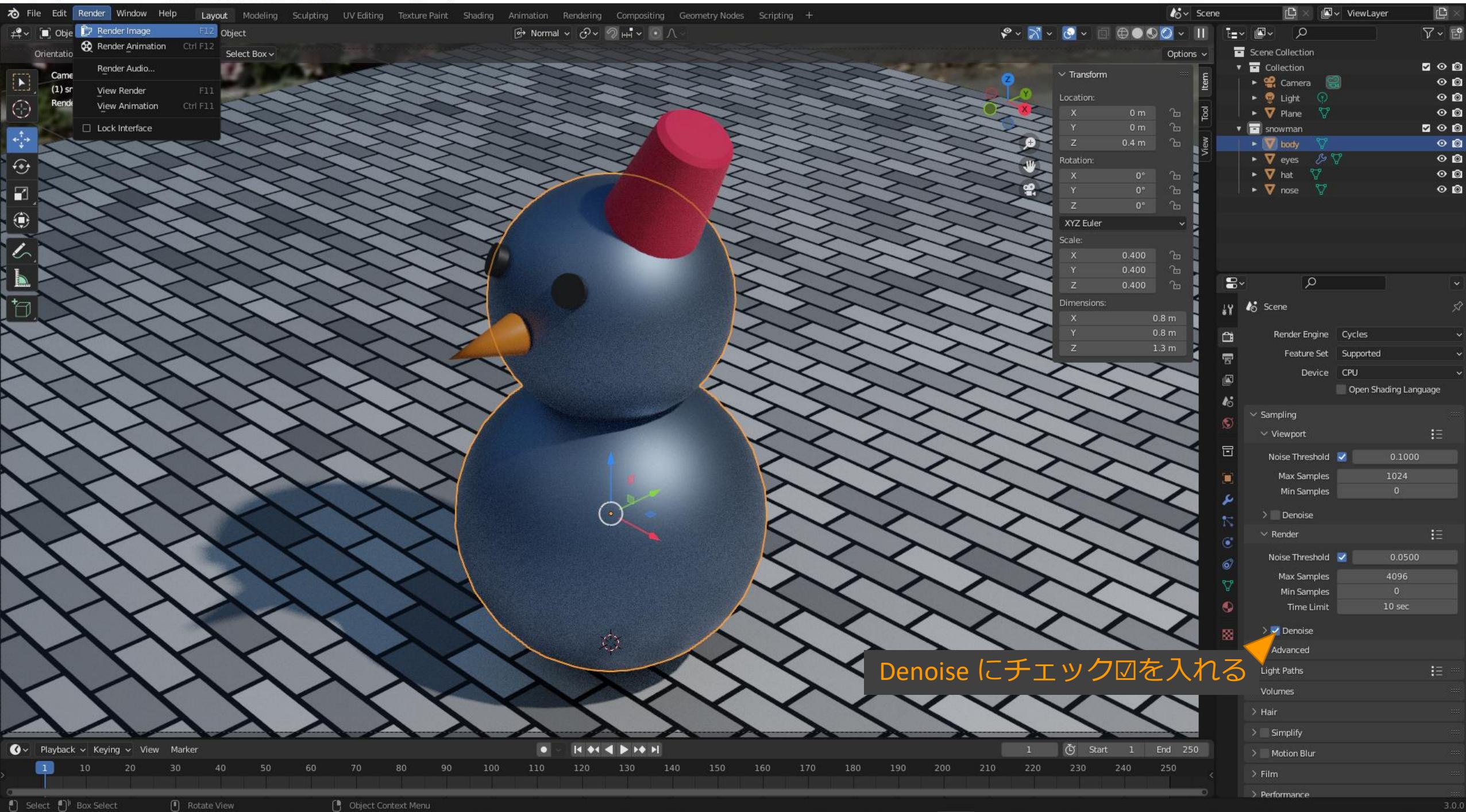
レンダリング時間：1分25秒





ノイズが多い

レンダリング時間：0分12秒





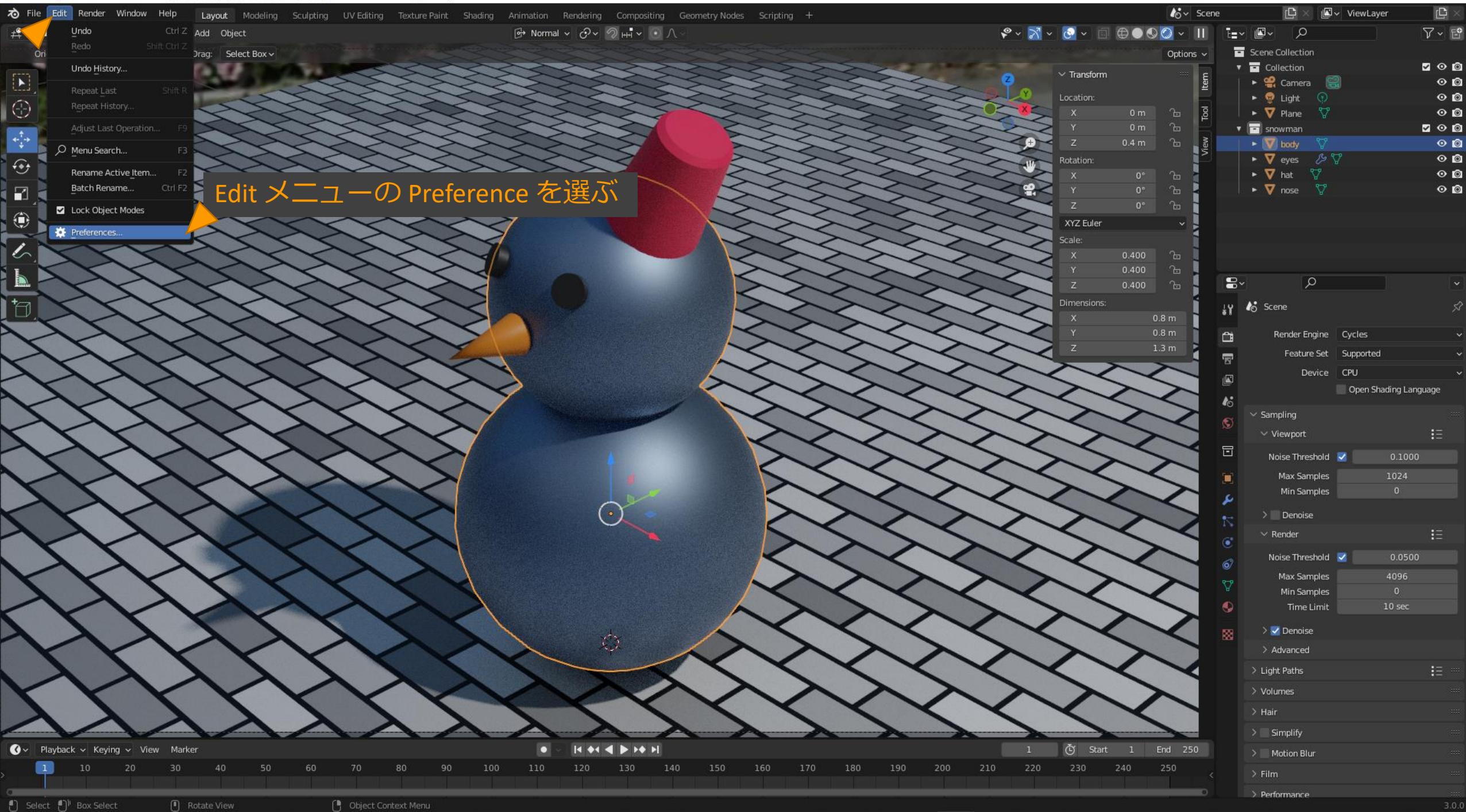
レンダリング時間：0分17秒

Render Engine まとめ

- Eevee は高速だが複雑な光学現象を再現できない
- Cycles は複雑な光学現象を再現できるが時間がかかる
 - レンダリングの精度を落とせば時間を短縮できる
 - Denoise によってノイズは効果的に削減できる
 - 事後処理なので光学現象を完全に再現できているかどうか不明
- レンダリングの精度と処理速度はトレードオフの関係
 - Cycles を使うならコア数の多い高速な CPU が望ましい
 - あるいは高速な GPU を搭載していることが望ましい

GPU レンダリング

NVIDIA/AMD のビデオカードが入っていれば非常に速くなるかもしれない



Cycles のレンダリングに GPU を使う

