



Animation (with Blender)

Multimedia Techniques & Applications

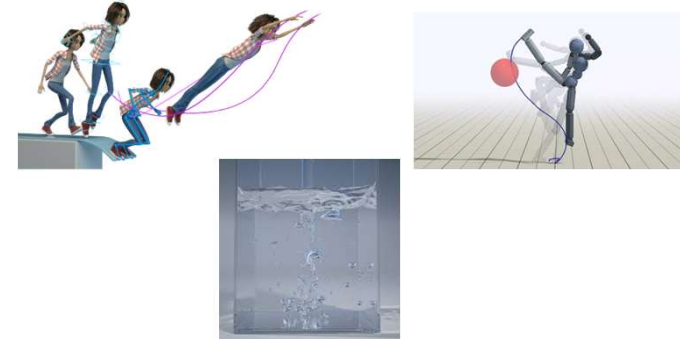
Yu-Ting Wu

1

Recap.

- **The goal of animation:**

- Describe how do geometry/objects change/move with time

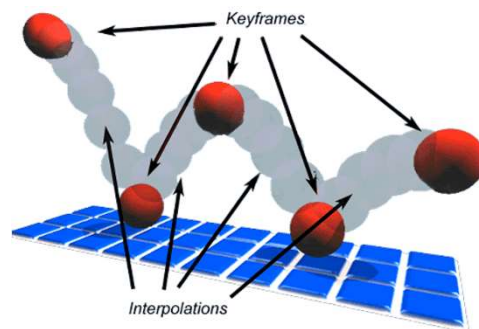


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Recap.

- **Keyframe Interpolation**



3

3

This Week's Course

- We will introduce the minimal knowledges for creating an animation in **Blender**
 - Remember it is better to add "virtual objects" in your final project
- We will introduce:
 - Basic operations
 - 3D models loading
 - Materials and lighting
 - Keyframes insertion
 - Animation rendering
- There are lots of resources on the internet !

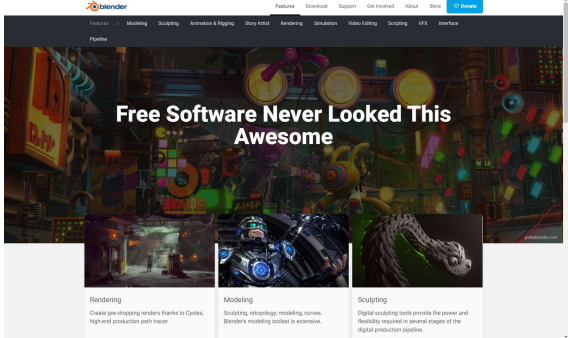
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blender

- One of the most popular professional **modeling tool**
- Most important, it is **free!**



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5

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Installation

- The newest version: 3.1
- However, I suggested to install **ver. 2.80** because it is guaranteed to work for **Matchmove**, which will be taught next week
 - <https://download.blender.org/release/Blender2.80/>
- TA has also installed Blender ver. 2.80 on the computers in the classroom (B1F-04)

6

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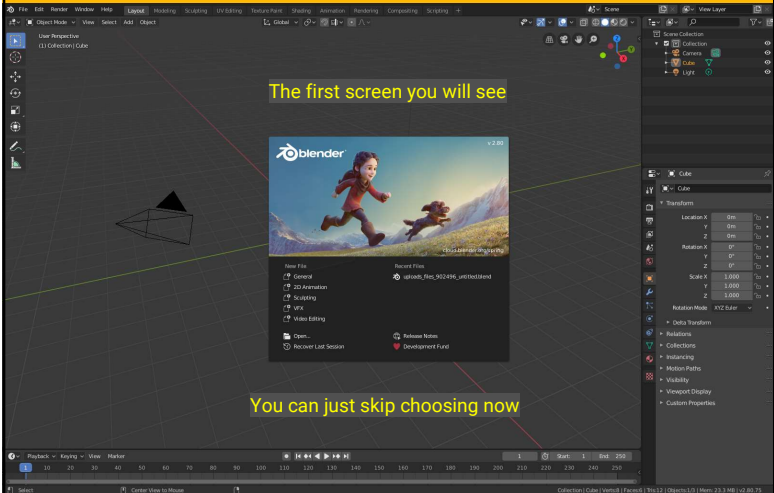
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Blender Editor Overview

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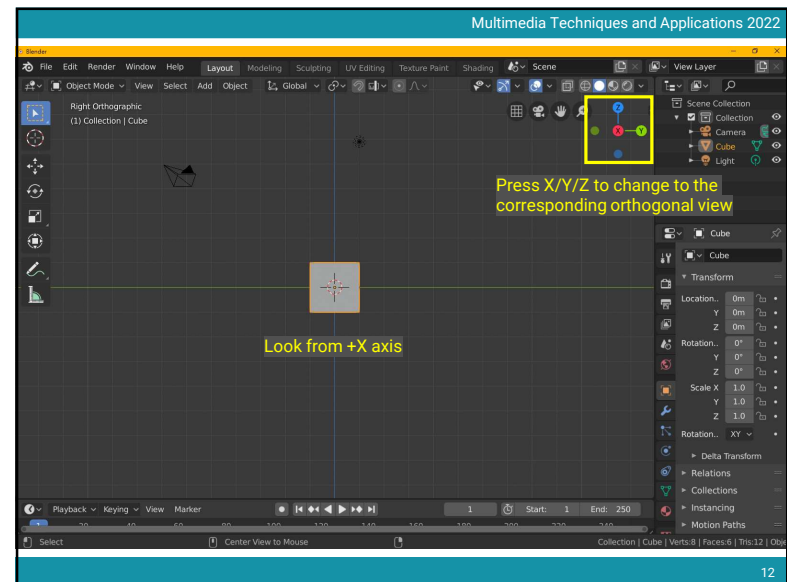
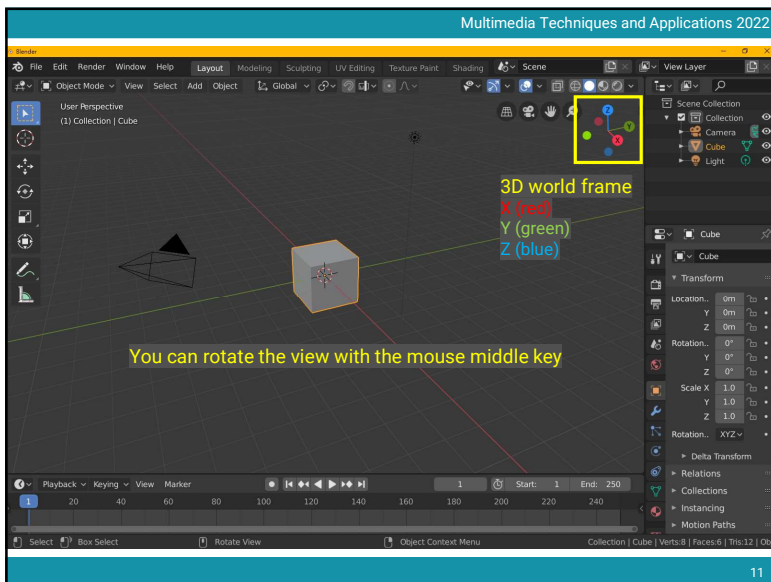
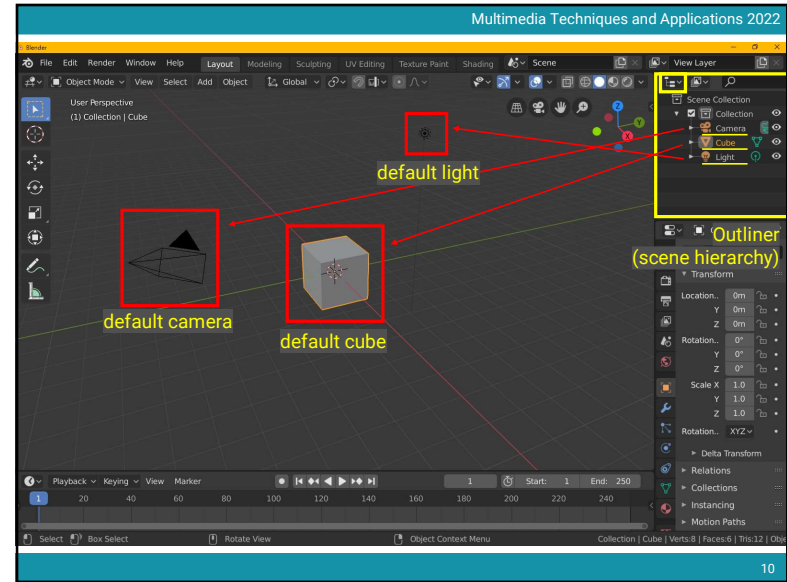
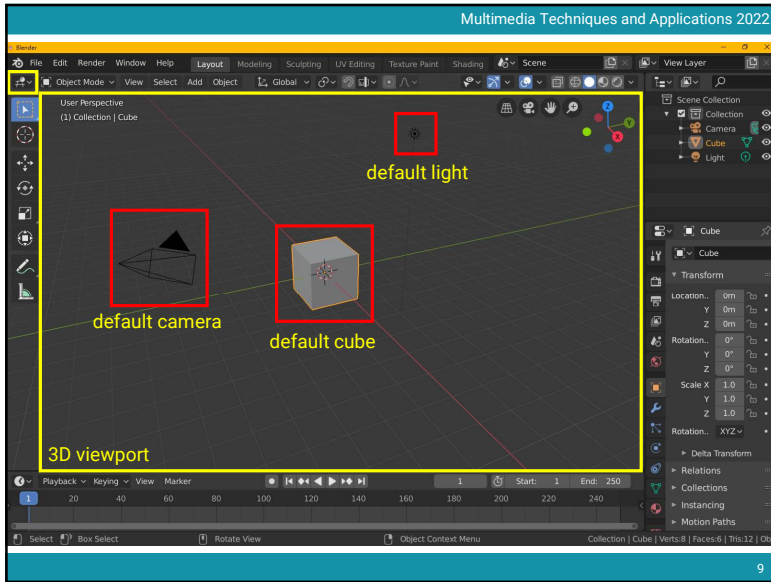
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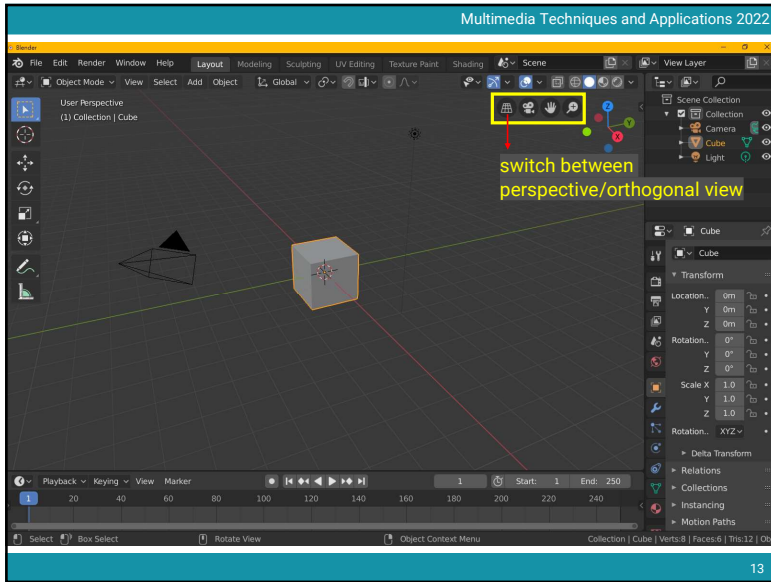


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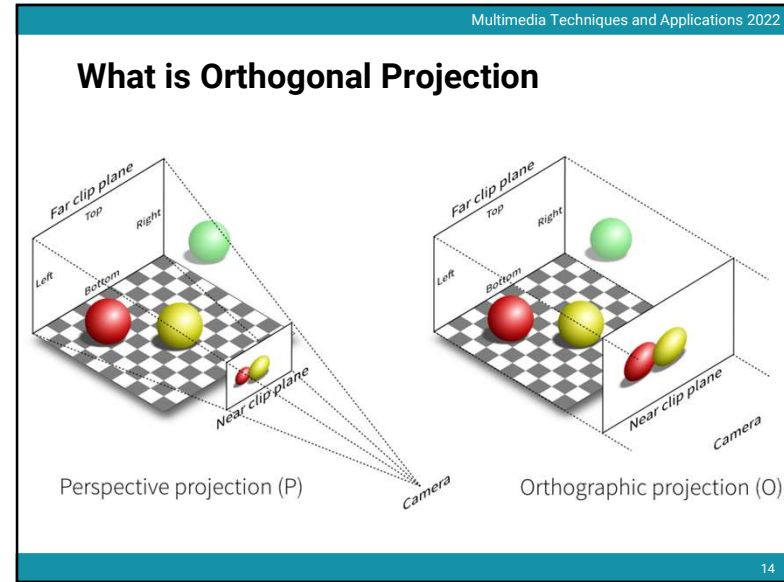
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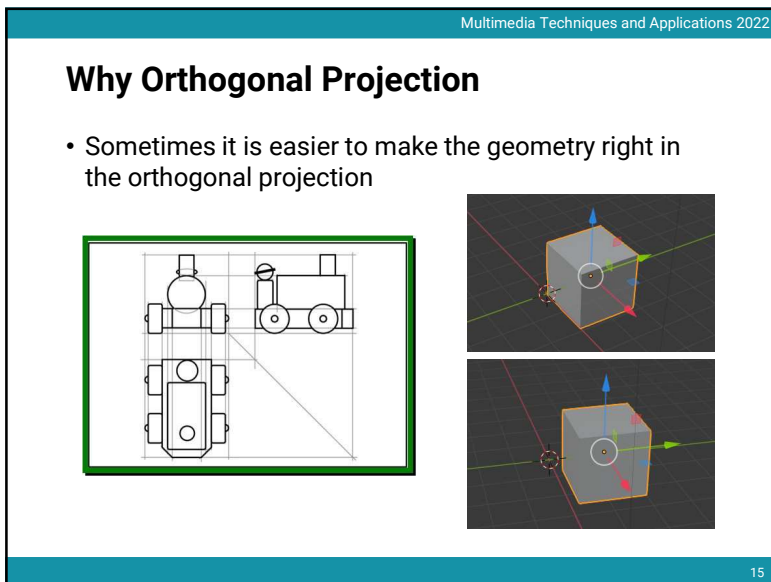
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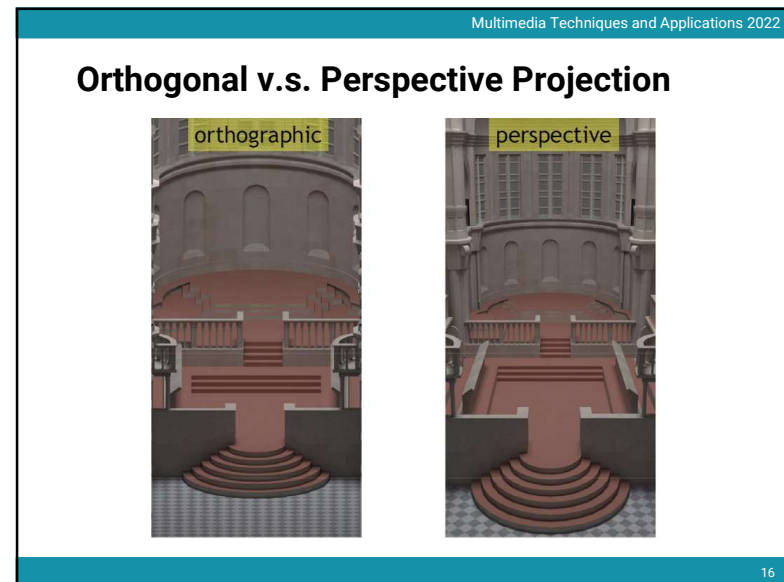
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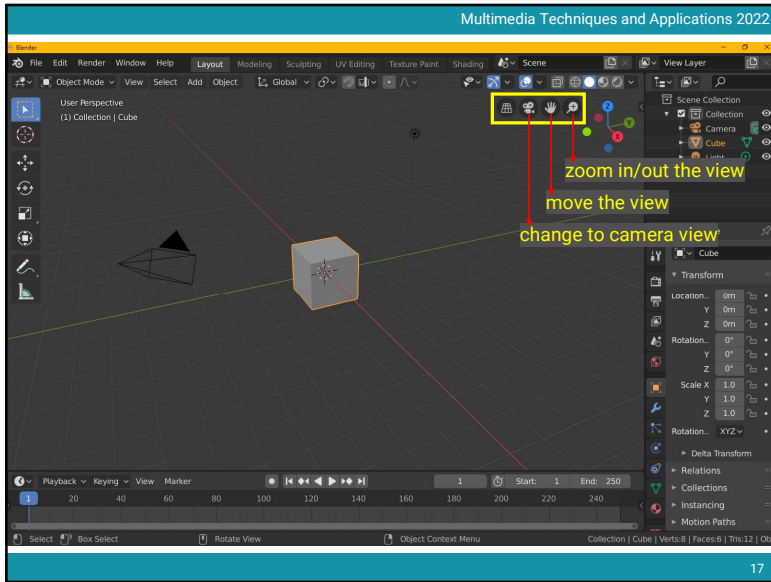
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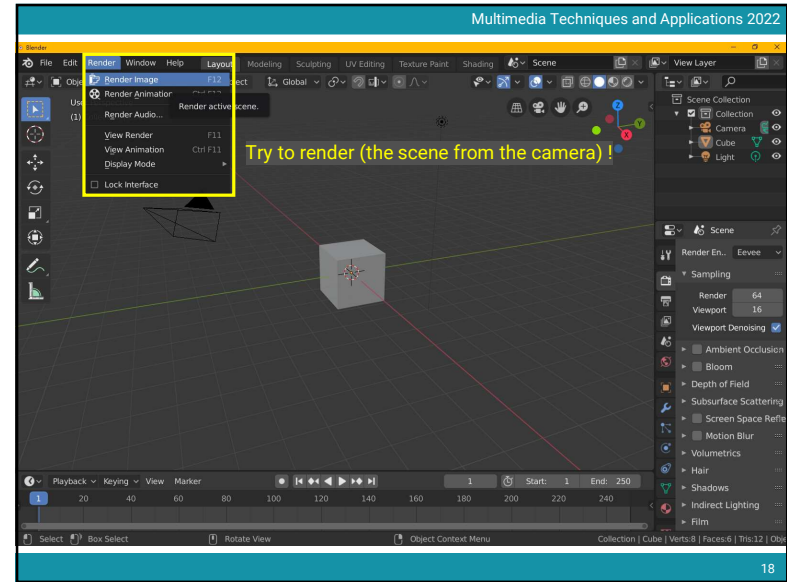
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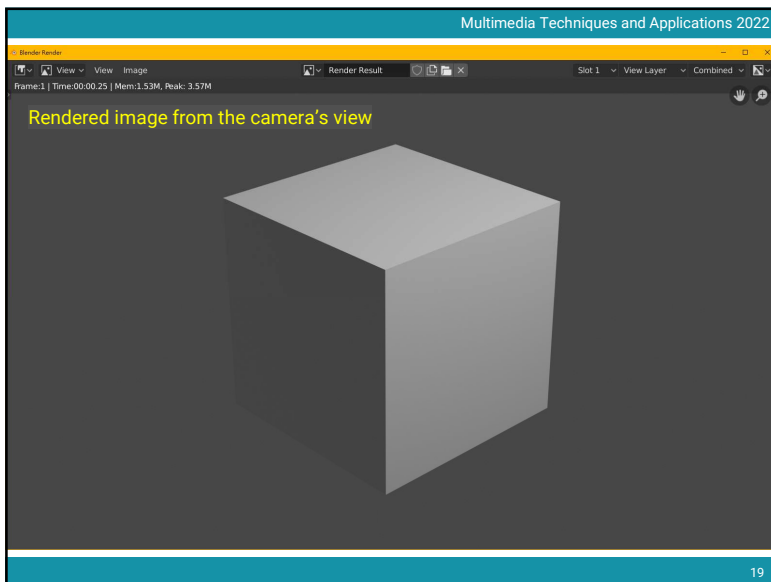
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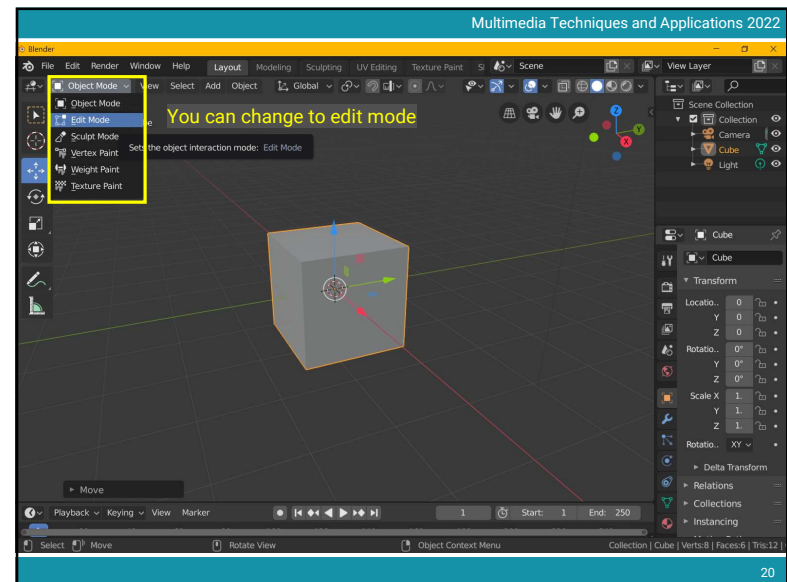
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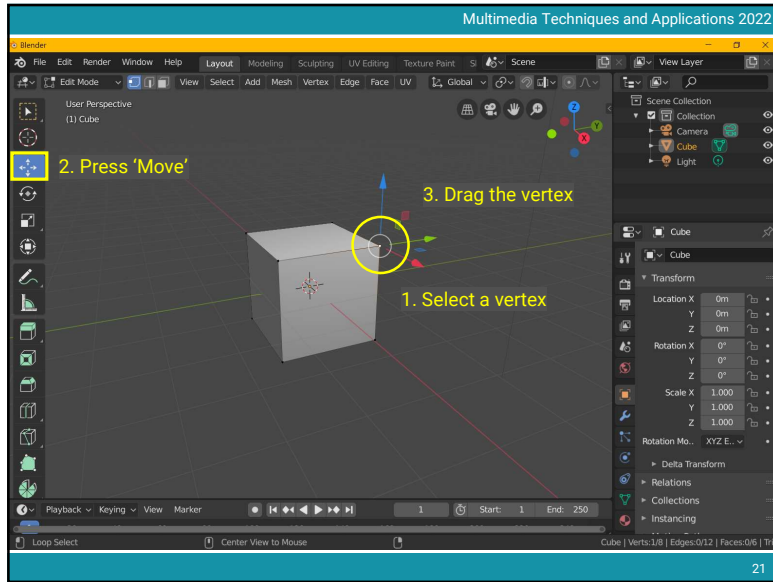
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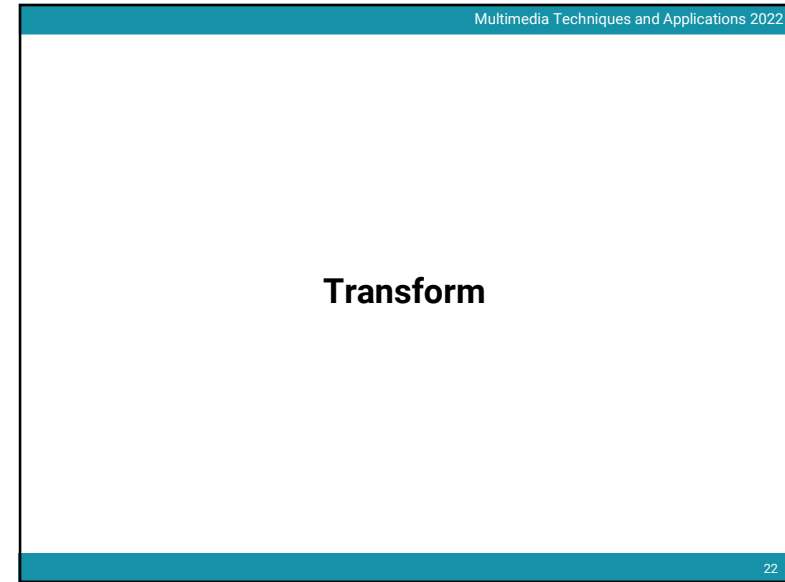
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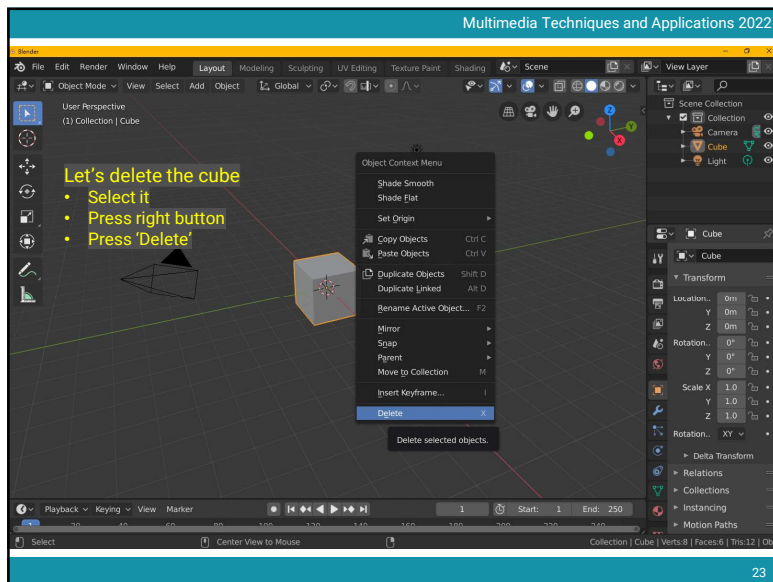
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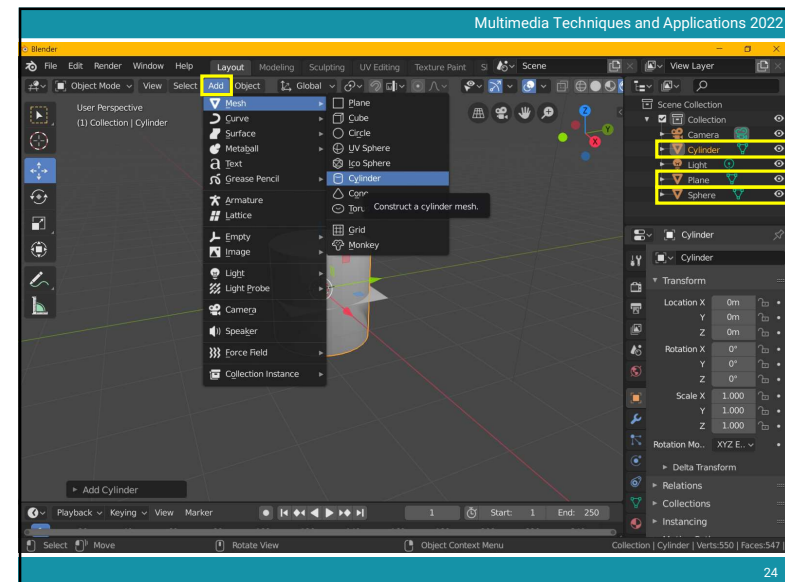
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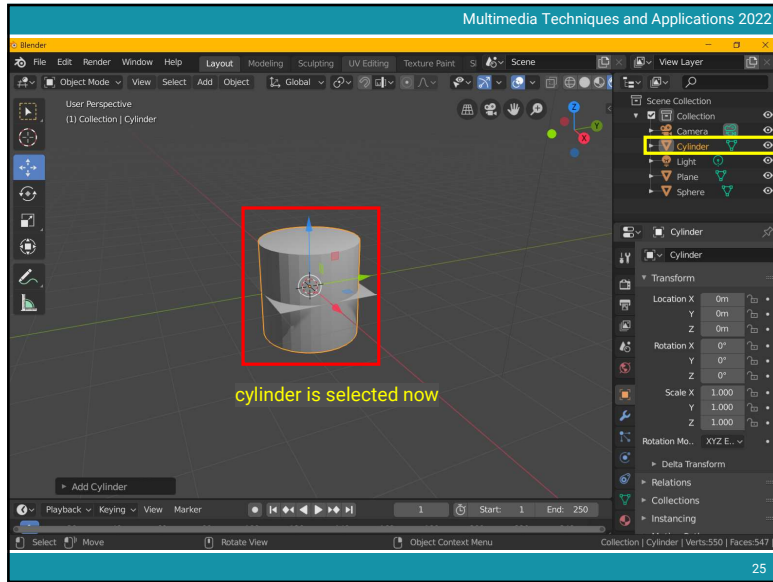
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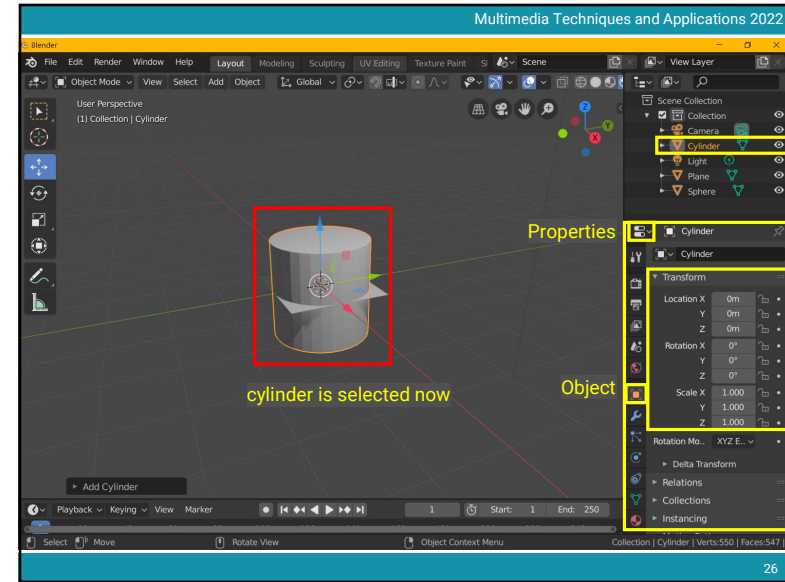
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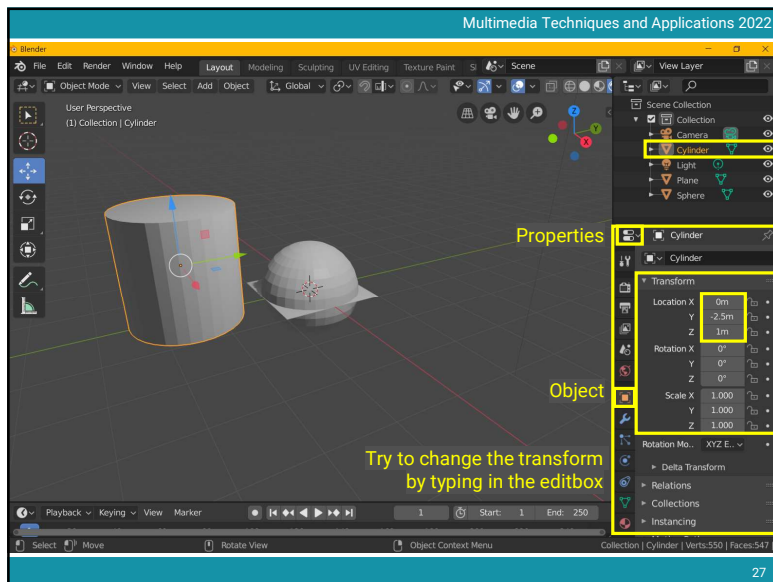
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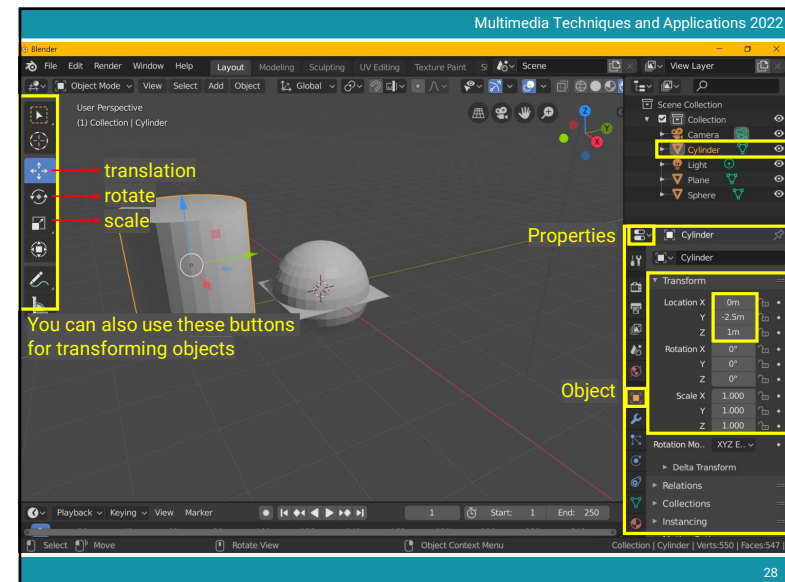
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28

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Recap: Object Space and World Space

- Shapes (or objects) are defined in **object space** and transformed to **world space**
- Why?
 - Reuse model
 - Object instancing

Store a 4x4 matrix instead of an entire model

Object Space

World Space

World Transformation

(3, 3, 0)

(2, 0, 0)

(4, 0, 3)

29

29

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Try to set different world transforms to the objects

30

30

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Materials

31

31

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Change to 'rendered mode'

rendered

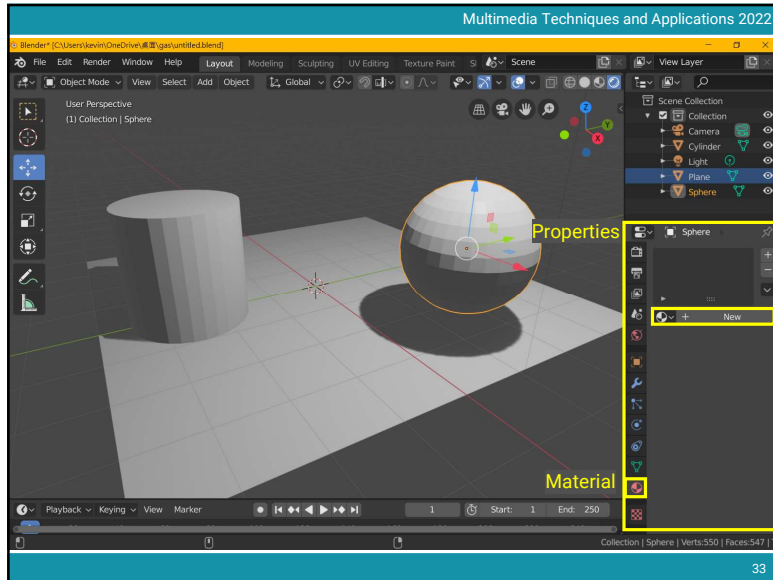
dev mode

solid mode

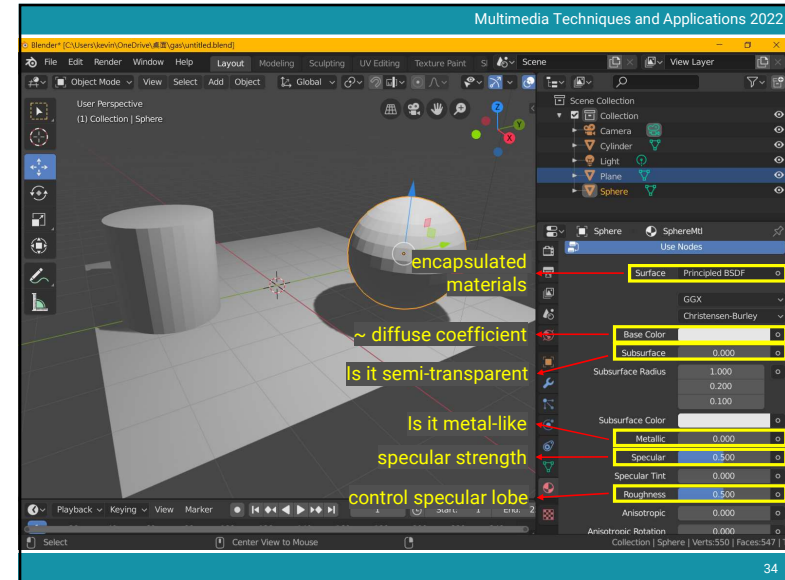
wireframe mode

32

32



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34

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Recap: Basics of Local Shading

- **Diffuse reflection**
 - Light goes everywhere; colored by object color
- **Specular reflection**
 - Happens only near mirror configuration; usually white
- **Ambient reflection**
 - Constant accounted for other source of illumination

ambient diffuse specular

35

35

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Recap: Diffuse Shading

- Assume light reflects **equally in all directions**
 - The surface is rough with lots of tiny microfacets
- Therefore, surface looks same color from all views (**view independent**)

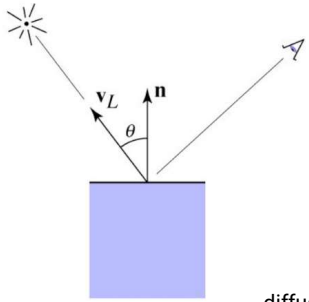
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36

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Recap: Diffuse Shading (cont.)

- Applies to diffuse, Lambertian or matte surface



illumination from source

$$L_d = k_d I \max(0, n \cdot V_L)$$

diffuse coefficient

diffusely reflected light


37

37

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Recap: Specular Shading

- Some surfaces have highlights, mirror-like reflection
- **View direction dependent**
- Especially obvious for smooth shiny surfaces



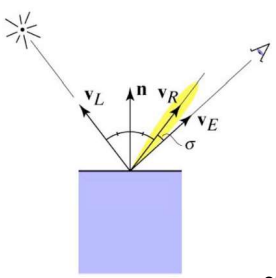
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38

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Recap: Specular Shading (cont.)

- Also known as glossy
- Phong specular model [1975]
 - Fall off gradually from the perfect reflection direction



$$V_R = V_L + 2((n \cdot V_L) n - V_L)$$

$$= 2(n \cdot V_L) n - V_L$$

$$L_s = k_s I \max(0, \cos \sigma)^n$$

$$= k_s I \max(0, V_E \cdot V_R)^n$$

specular coefficient

specularly reflected light

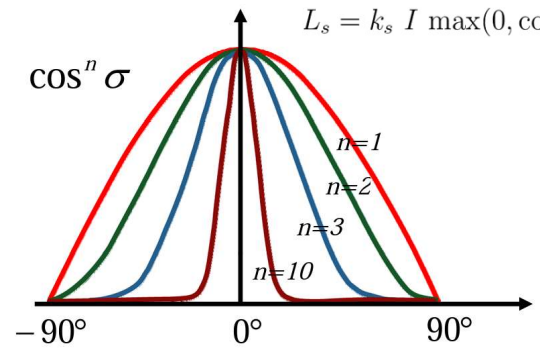
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Recap: Specular Shading (cont.)

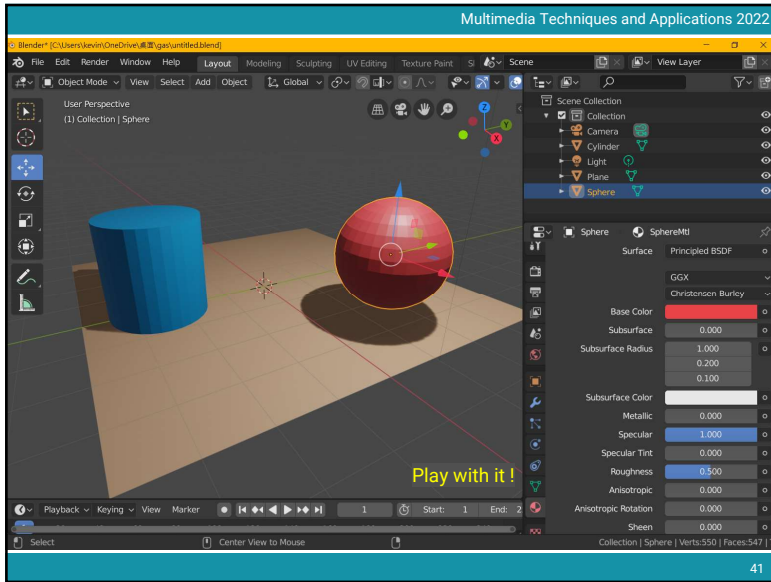
- Increase n narrows the lobe



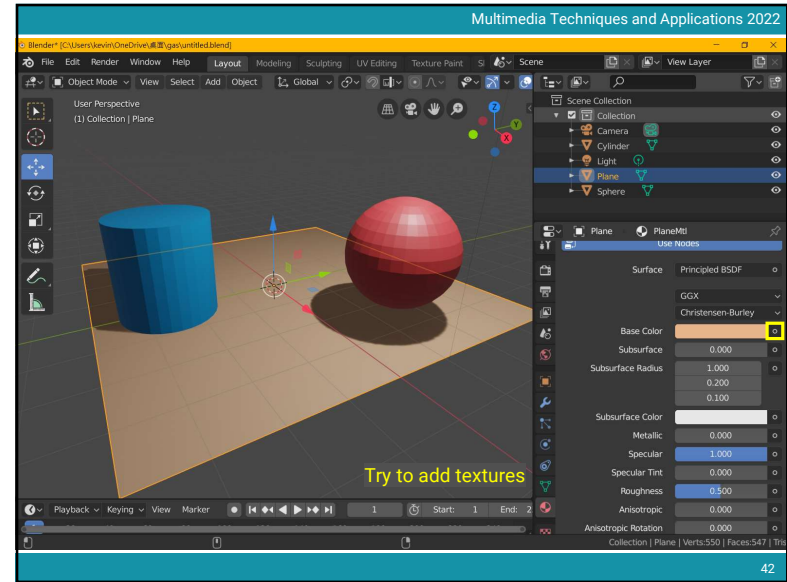
$$L_s = k_s I \max(0, \cos \alpha)^n$$

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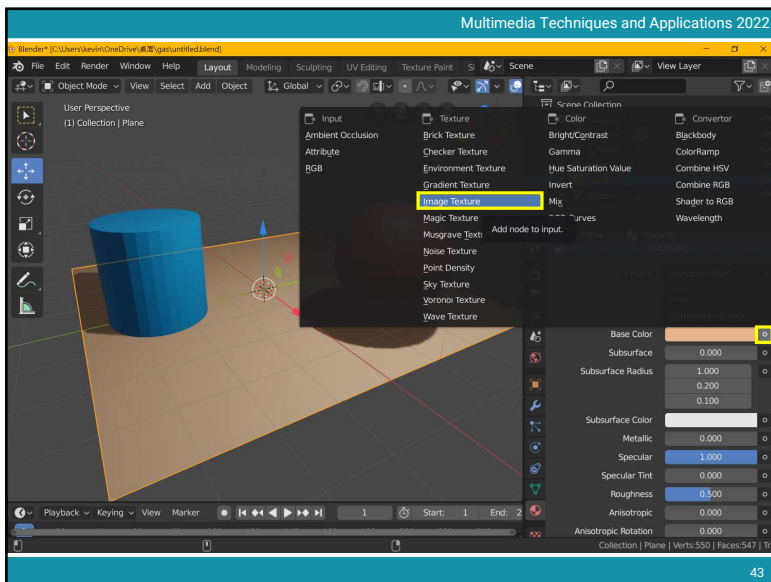
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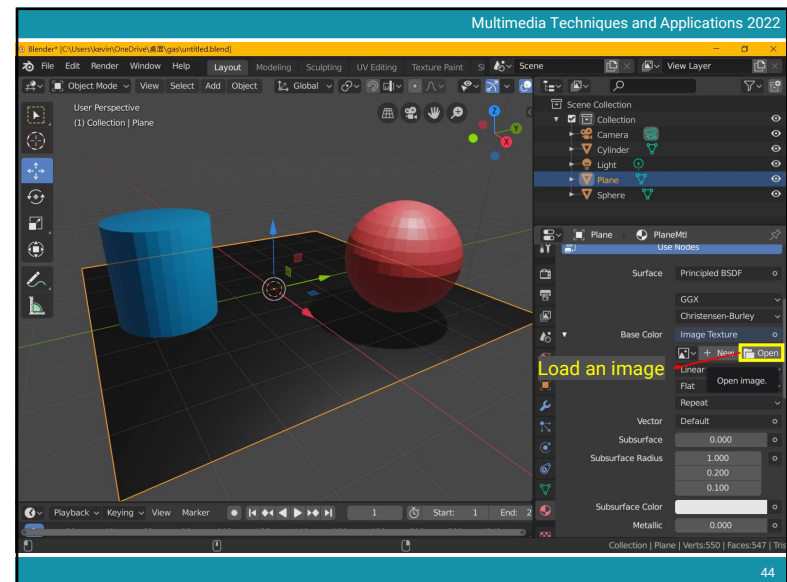
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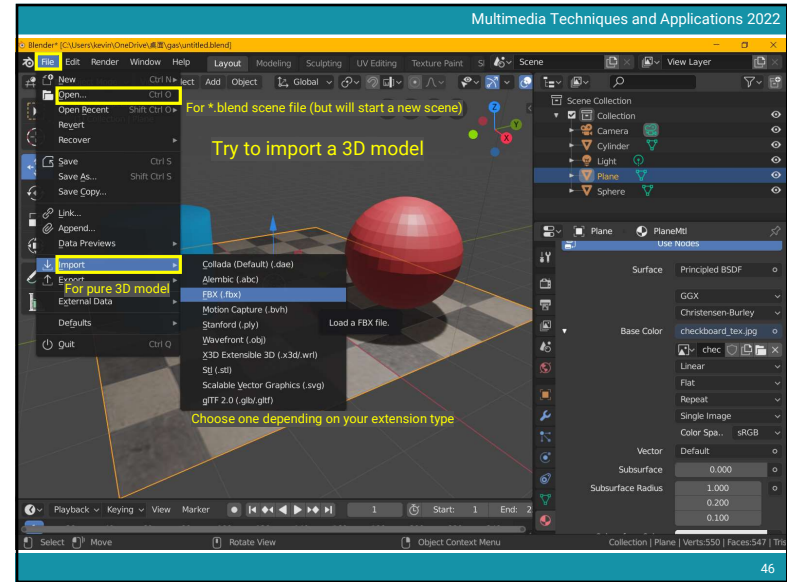
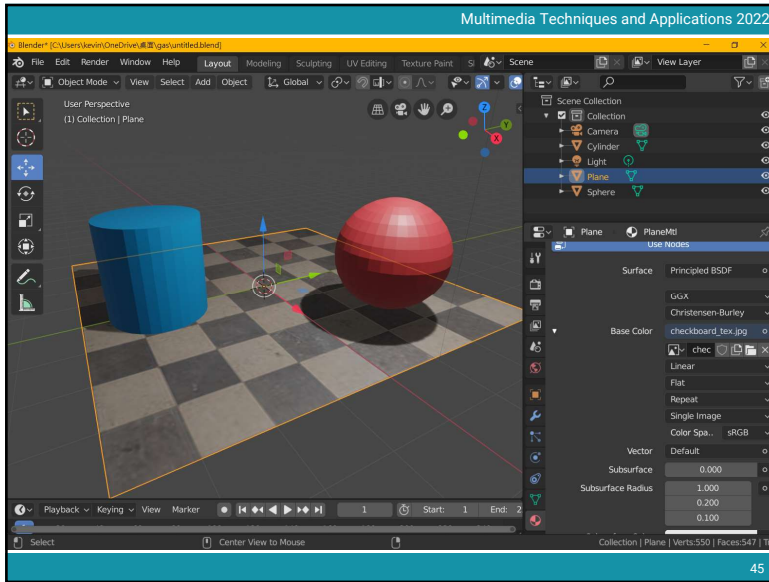
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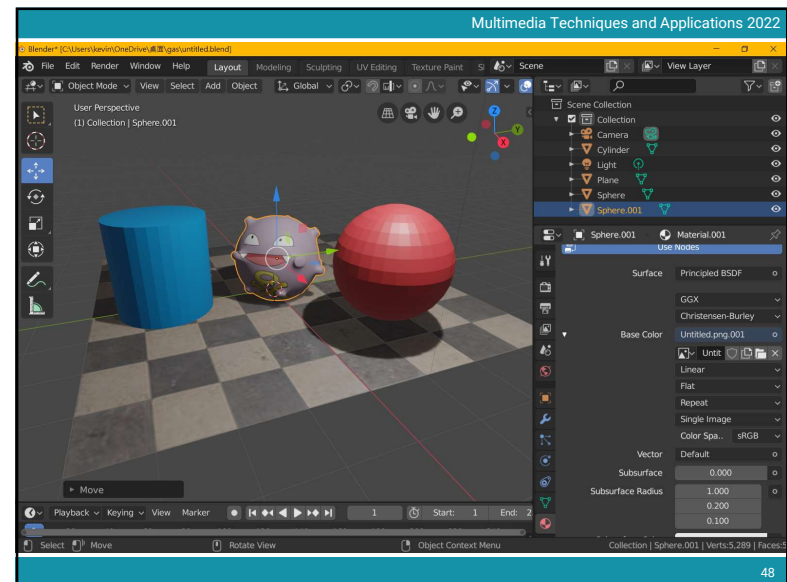
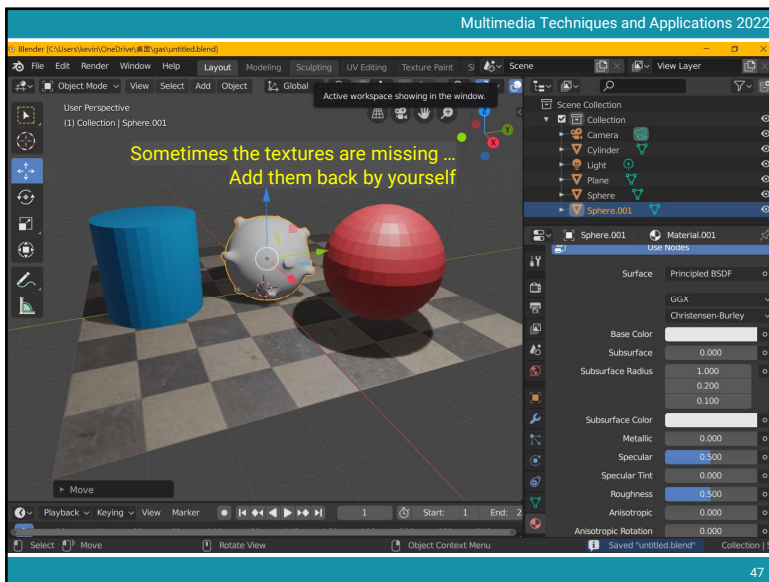


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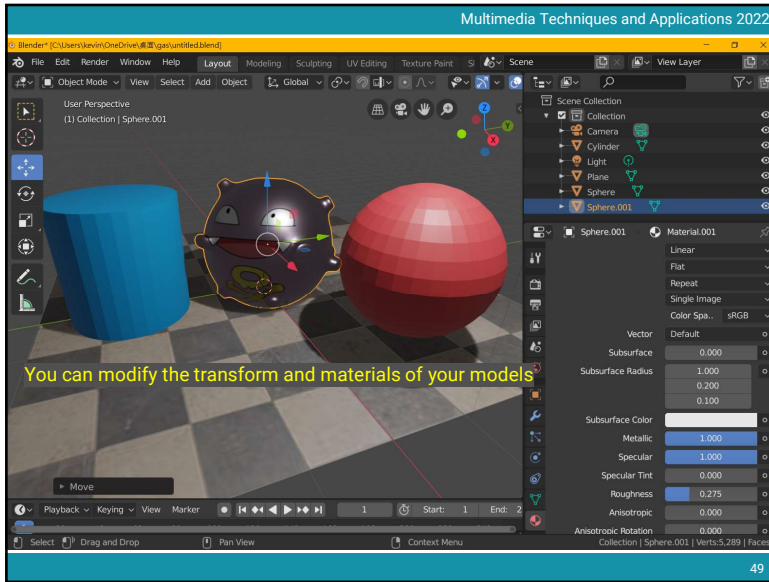
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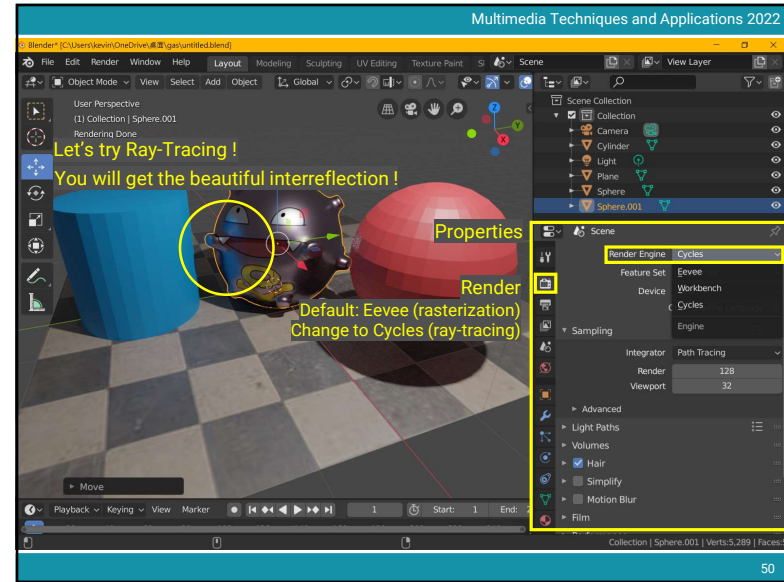


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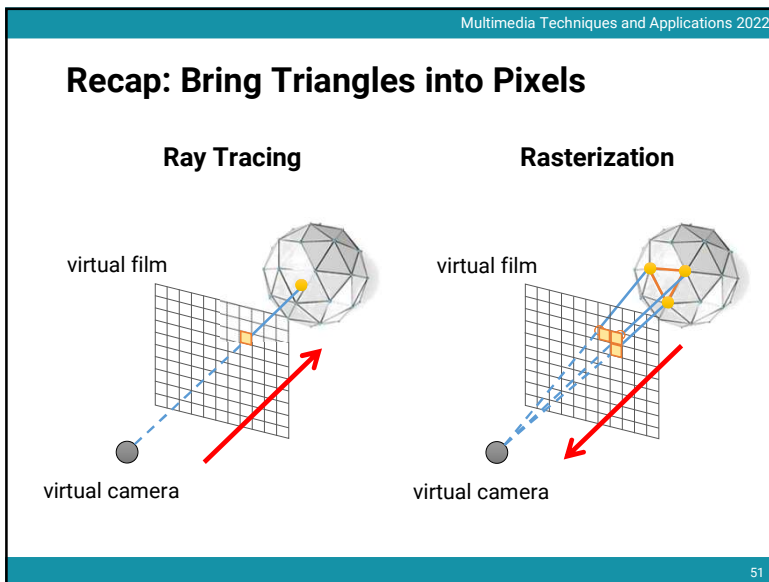
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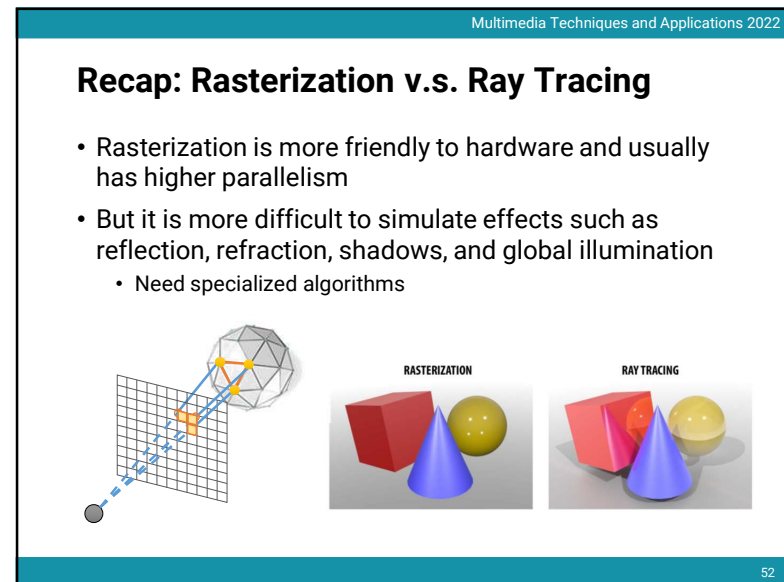
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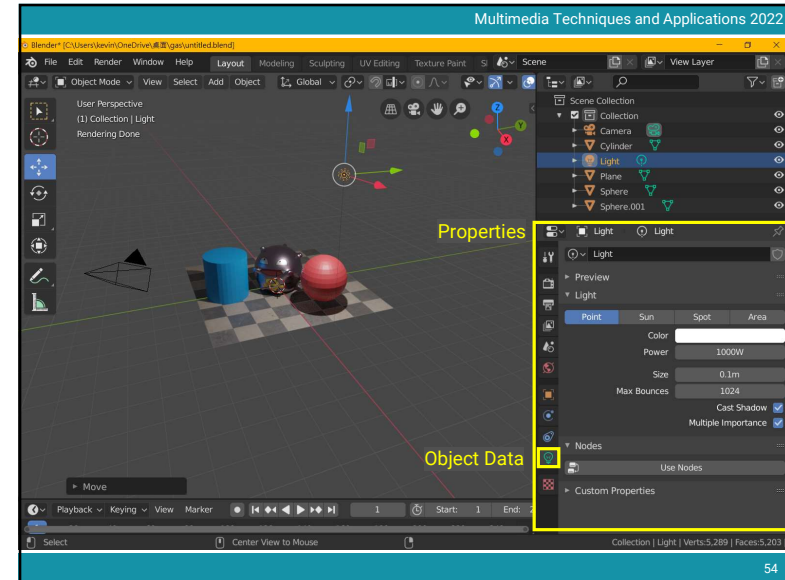
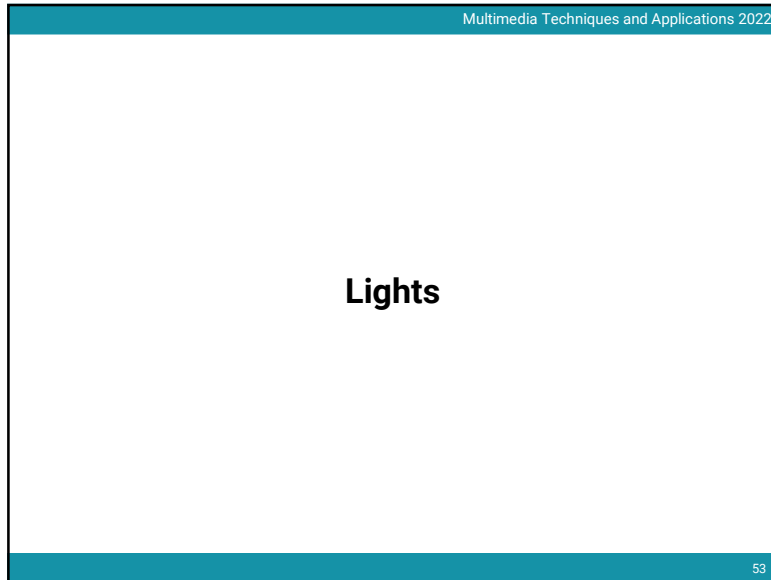
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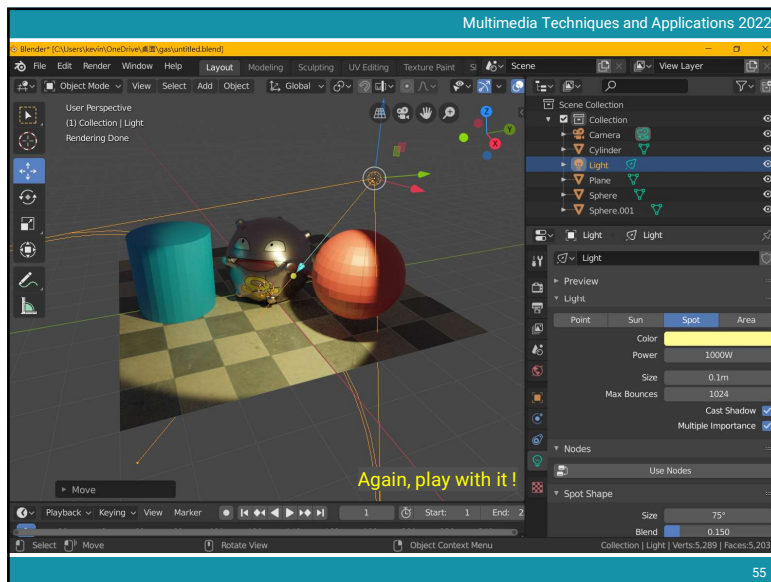


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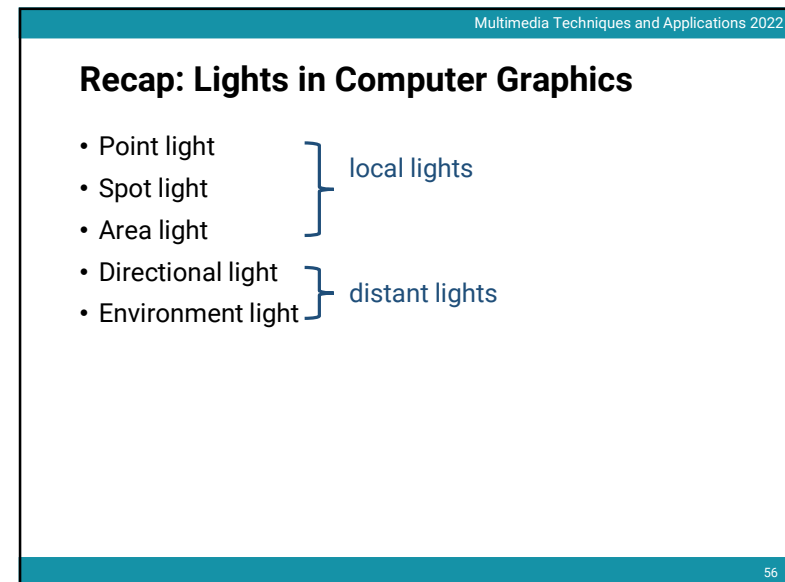


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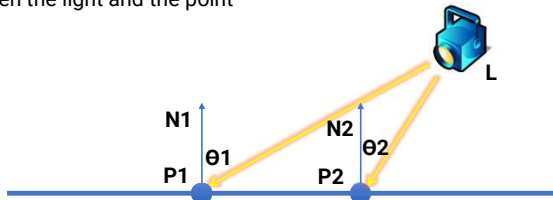
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56

Recap: Local Lights

- The distance between a light and a surface is **not** long enough compared to the scene scale
- The position of a light need to be taken into account during shading
 - **Lighting direction** = $|\mathbf{L} - \mathbf{P}|$
 - **Lighting attenuation** is proportional to the square of distance between the light and the point

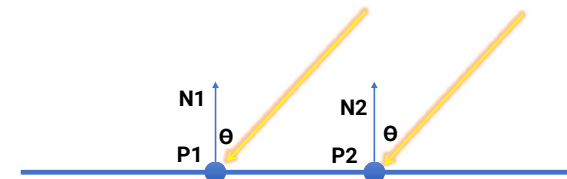


57

57

Recap: Distant Lights

- The distance between a light and a surface is long enough compared to the scene scale and **can be ignored**
 - **Lighting direction is fixed**
 - **No lighting attenuation**
- **Directional light (sun)** is the most common distant light



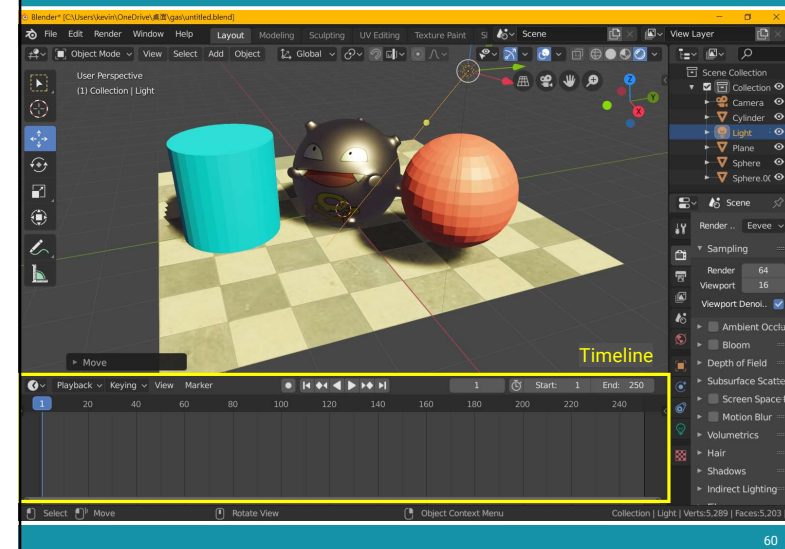
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58

Animation

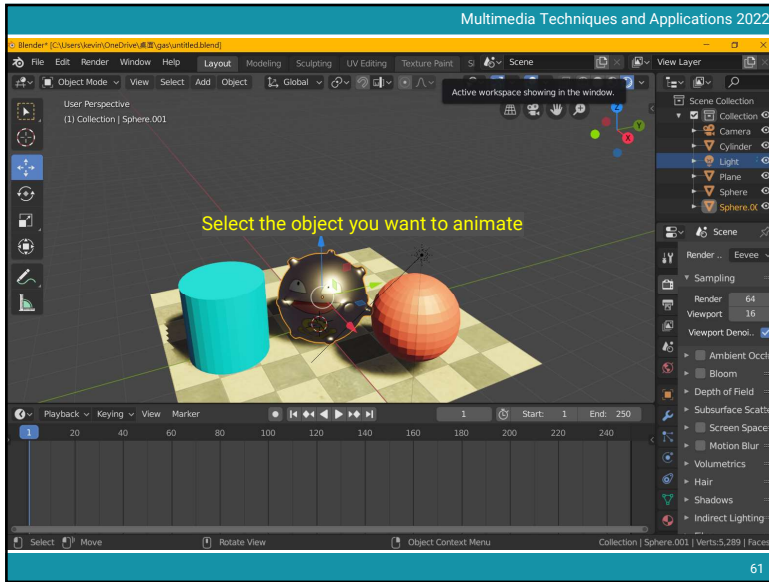
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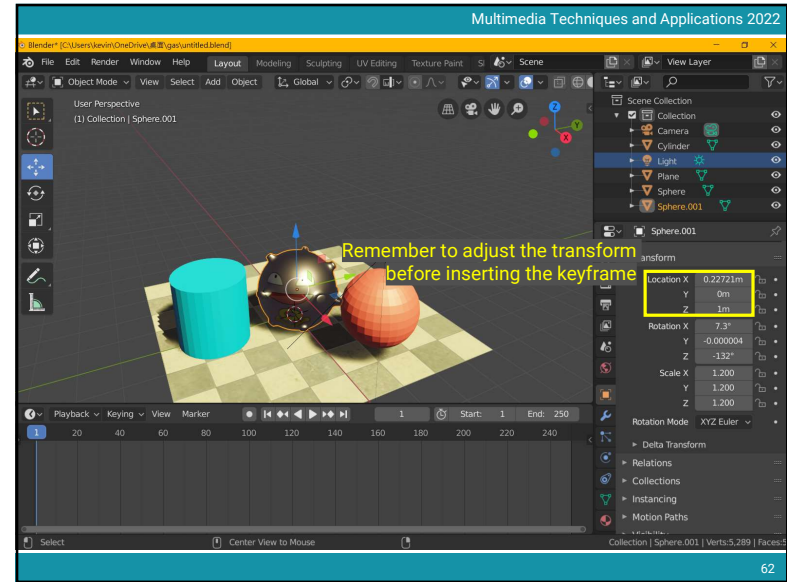


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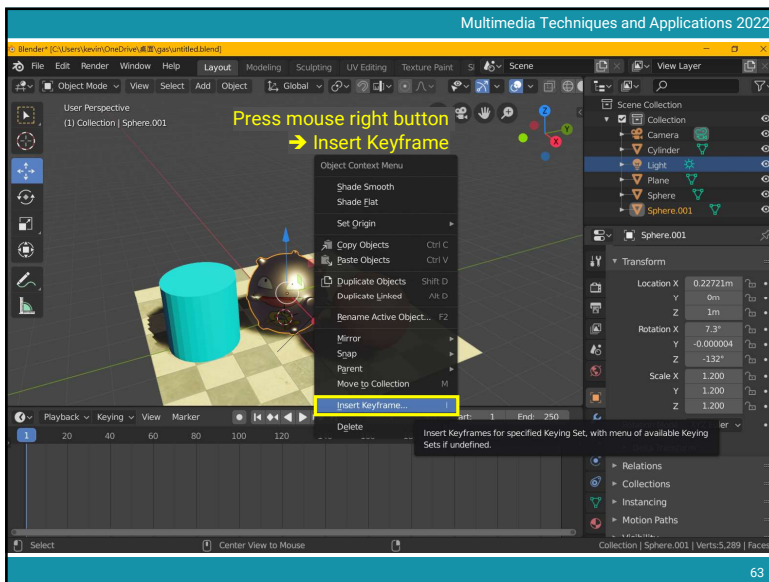
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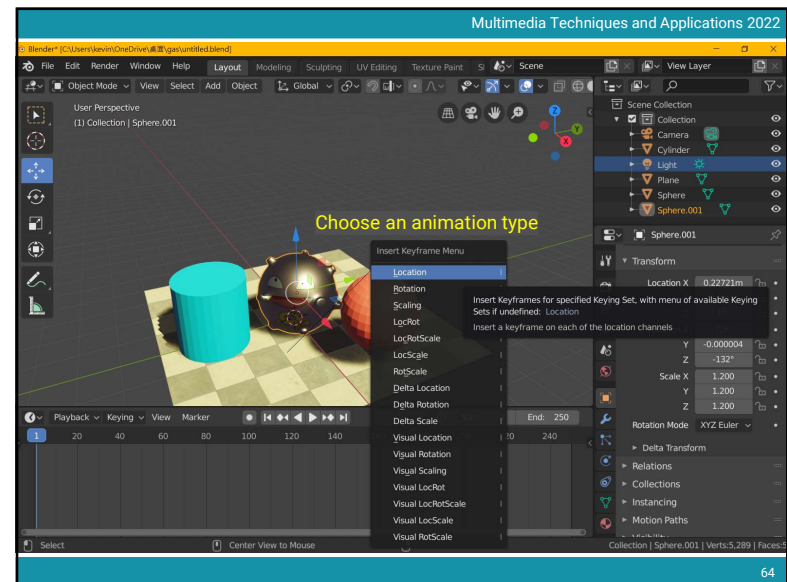
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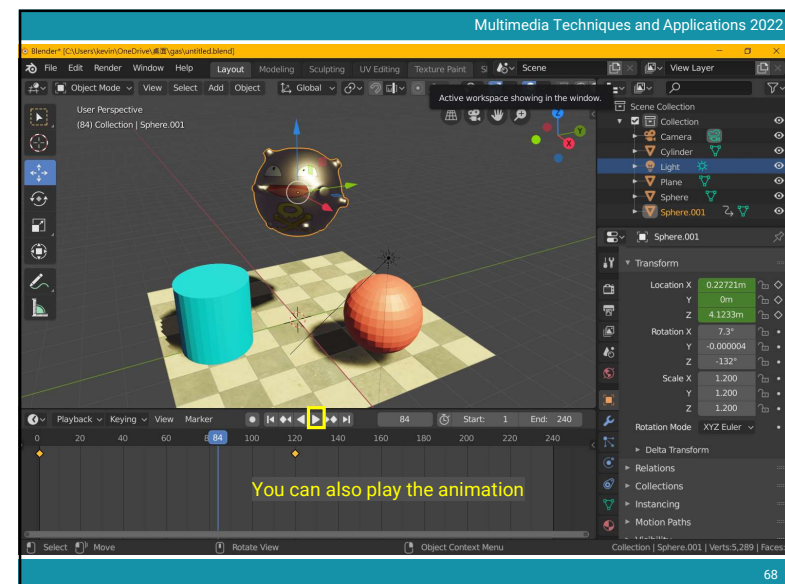
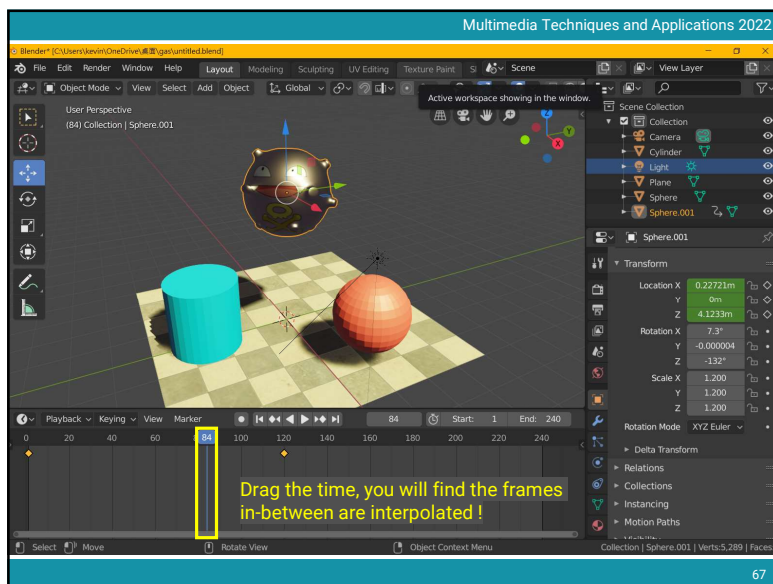
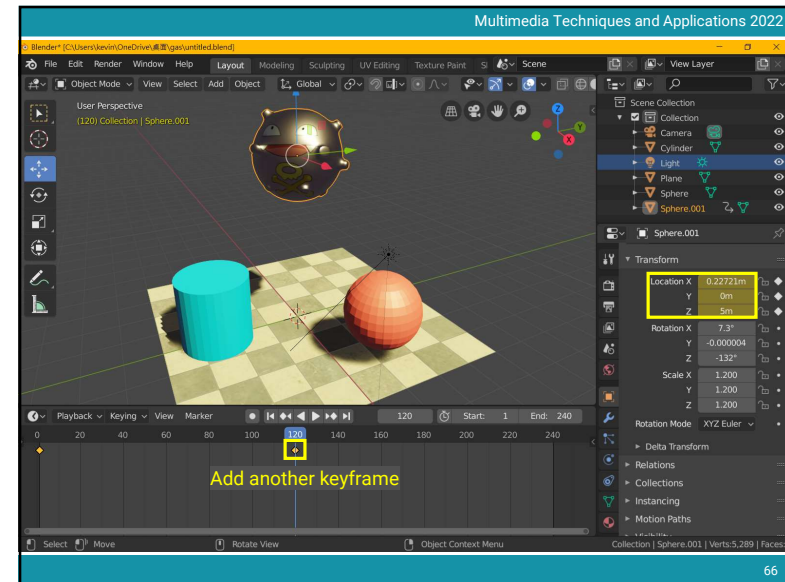
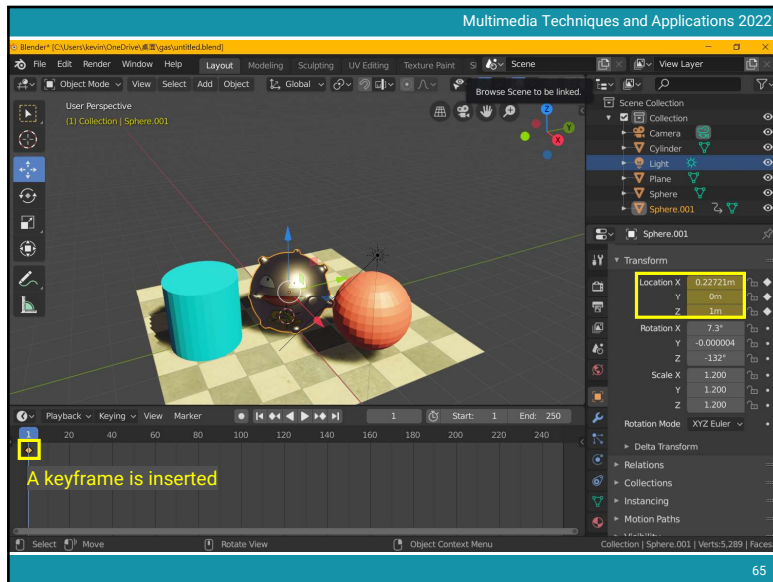
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63

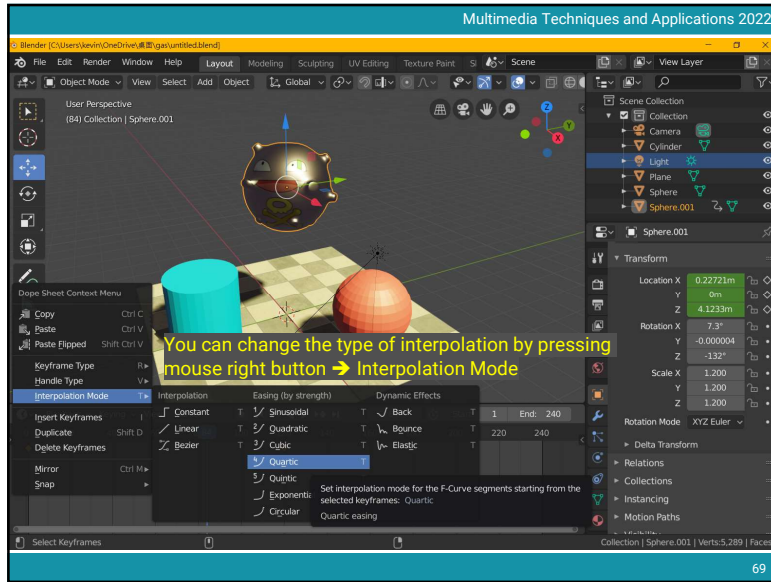


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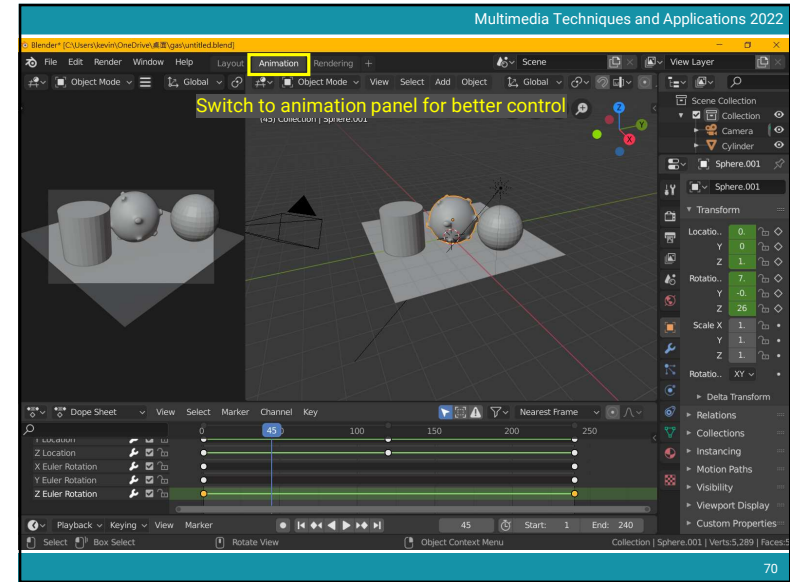


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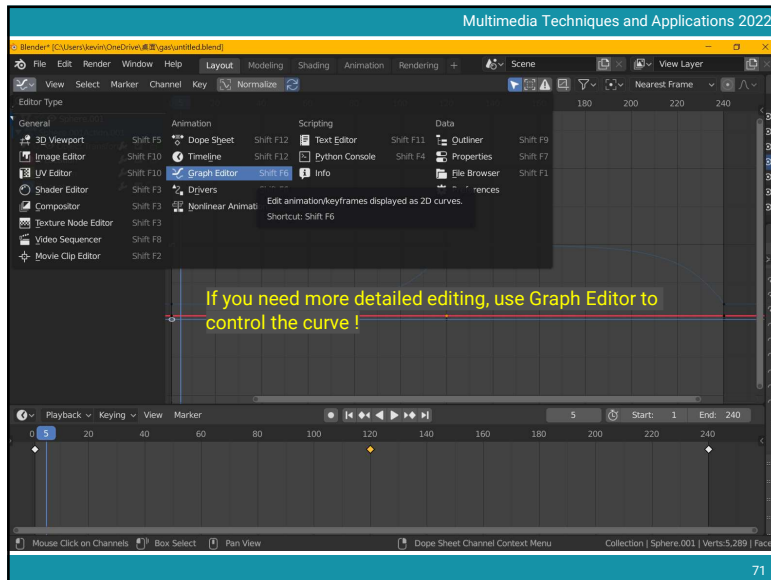
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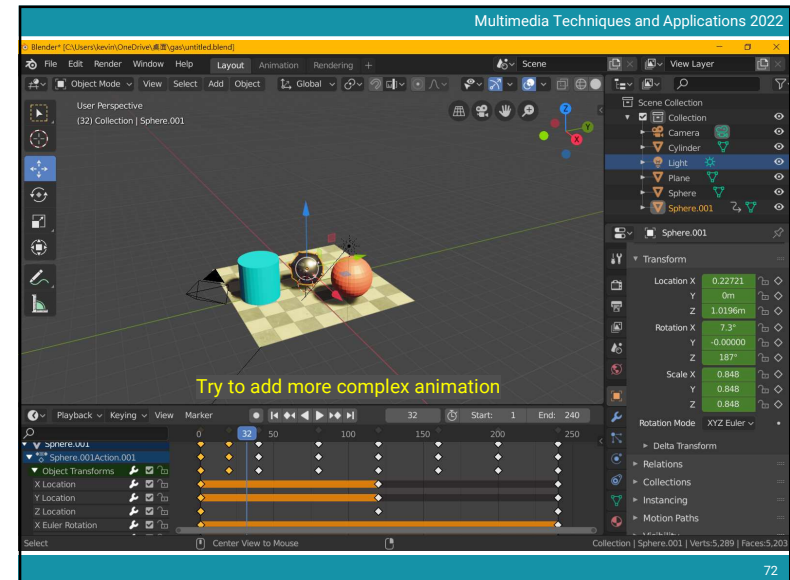
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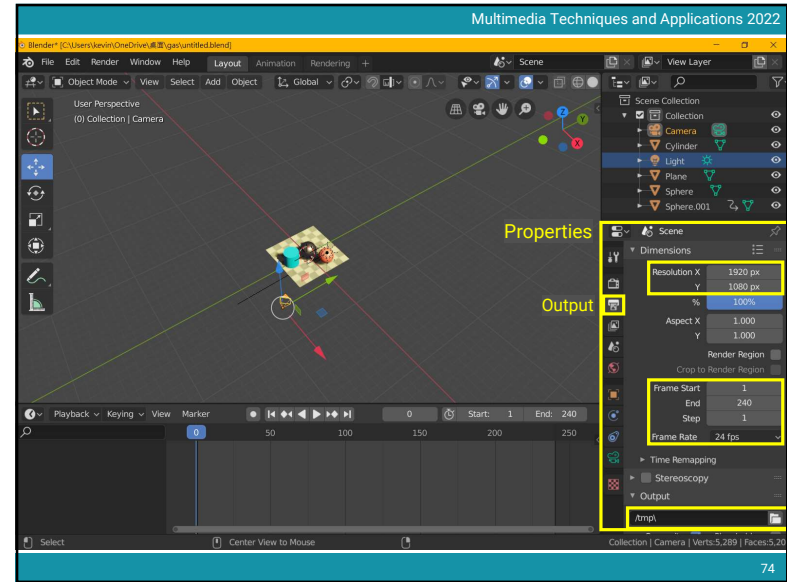
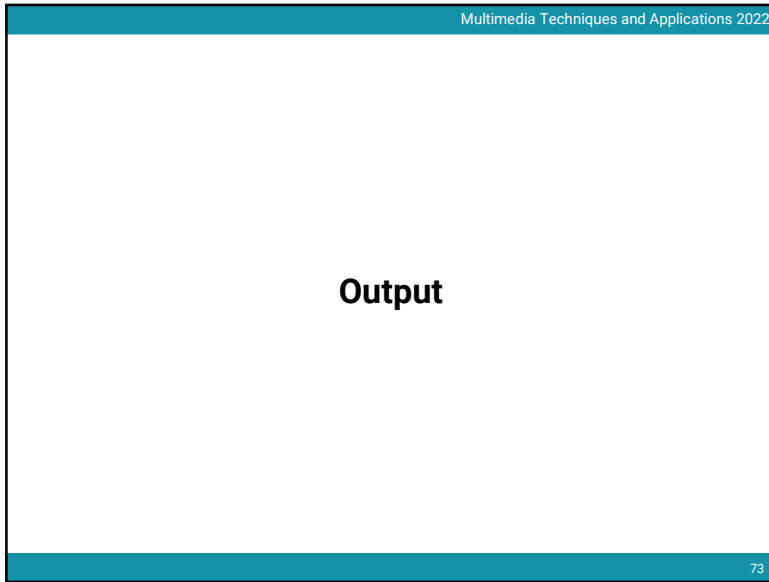
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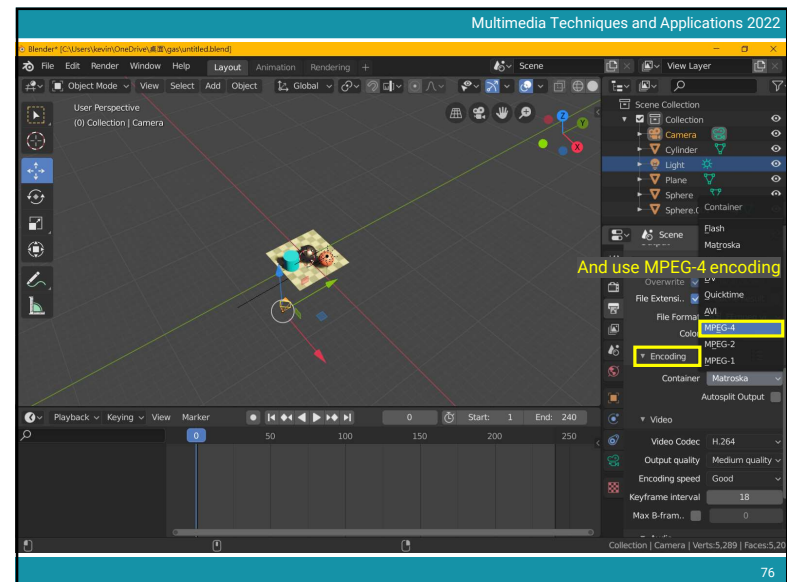
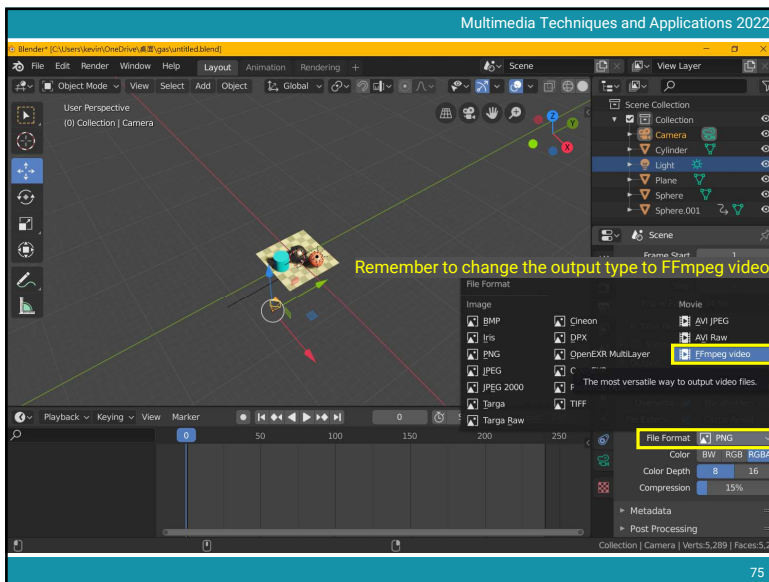


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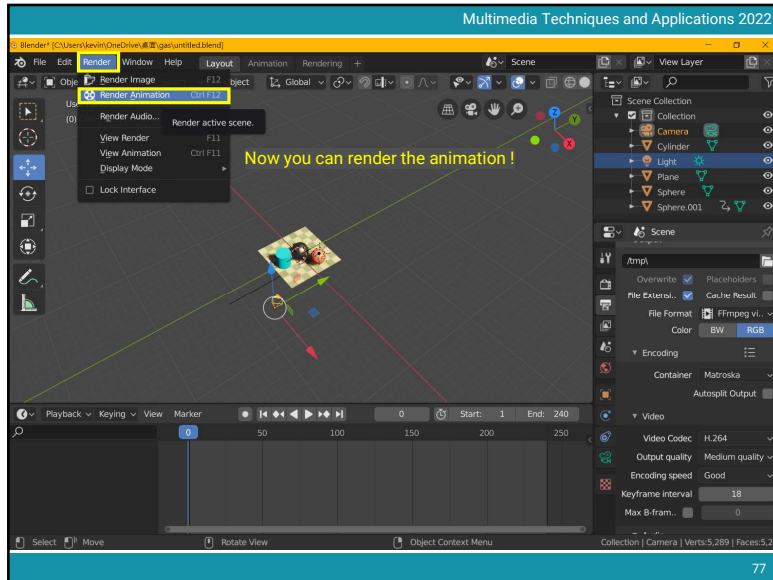
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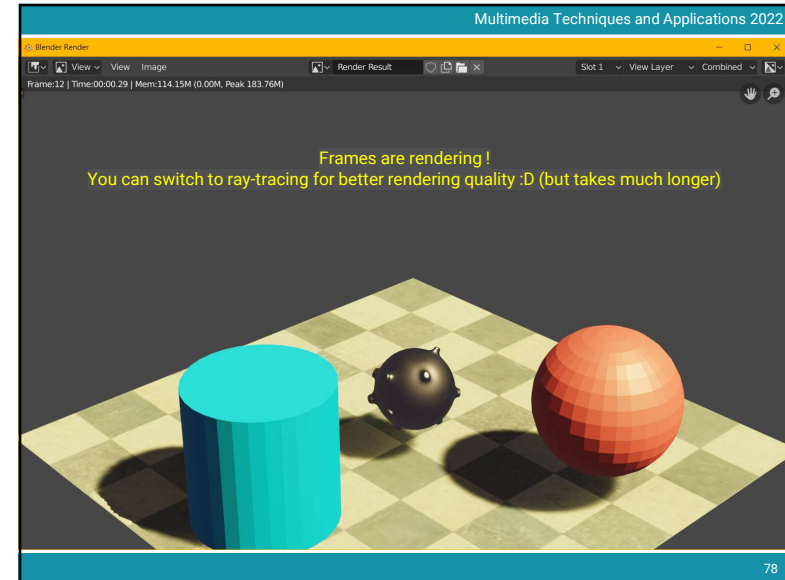


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76



77



78

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Homework #2

- Create a **short animation** using blender
 - Find 3D models on the internet and load them in blender (20%)
 - Add animation of translation (20%)
 - Add animation of rotation (20%)
 - Add animation of scaling (20%)
 - A short one-page report for describing your work (10%)
 - Creativity and quality (10%)
- Personal work
- Due date: 5/29
- 15% for the final grading
- Hand in your *.blend file and the output *.mp4 video
 - 1920 x 1080, 24fps

79

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Homework #2

- Where to download the 3D models?
 - Google is your best friend
 - Search "free 3D models"
 - Some example websites:
 - Free3D: <https://free3d.com/3d-models/blender>
 - CgTrader: <https://www.cgtrader.com/free-3d-models>
 - TurboSquid: <https://www.turbosquid.com/Search/3D-Models/free>
 - A collection: <https://tw.eagle.cool/blog/post/best-websites-to-download-free-3d-model-with-high-quality>
- You can restrict the file types to *.blend, *.obj, *.fbx

80