4. Lighting, using camera and rendering

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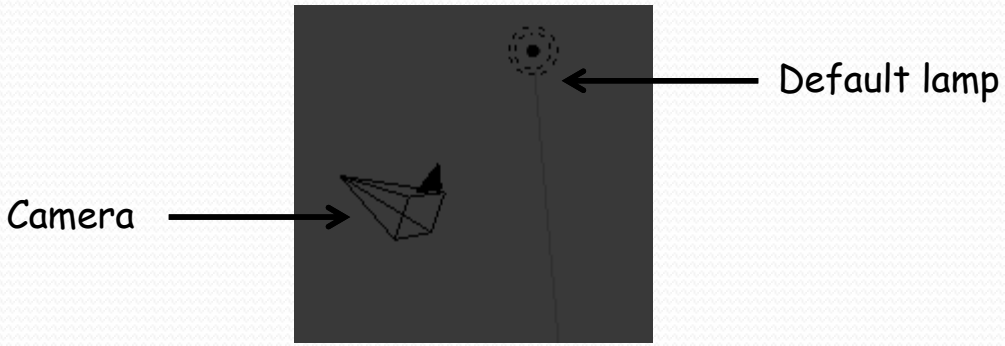
2020

Outline

I. Lighting Types and Settings
II. Cameras
III. Rendering

Introduction

- The default scene in Blender contains a Cube object, a Camera and a Lamp

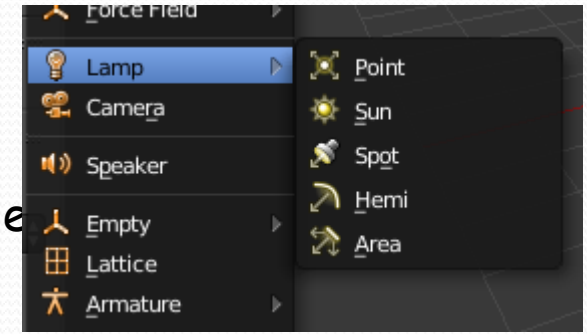


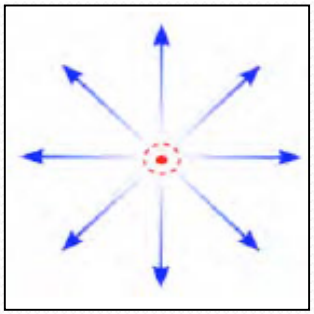
- The lamp allows lighting the scene
- The camera sees the final output which will be render out
- An accurate setting of the light and the camera is important to obtain an impressive result

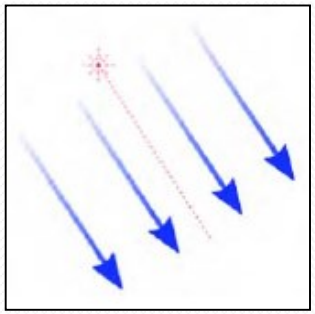
I. Light types and settings

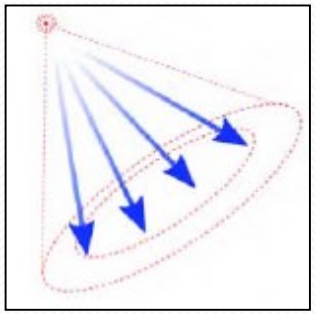
1. Lamp types

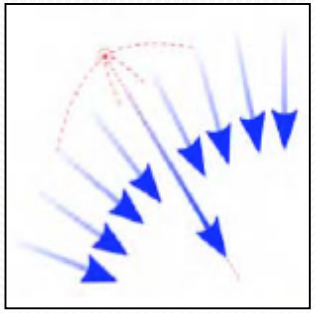
- There are different kinds of lamps available to use in Blender:
  - **Point**: Basic Blender Lamp, shines all directions
  - **Sun**: Provides even angle of light, regardless of placement from objects
  - **Spot**: Shines a direct angle of light
  - **Hemi**: A wider light, much like area lights
  - **Area**: Provides large area lighting, can be scale

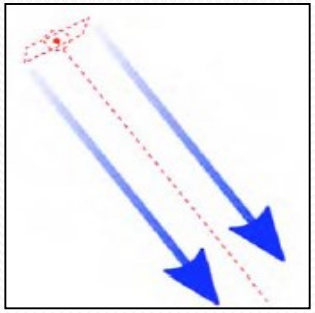



Point


Sun


Spot

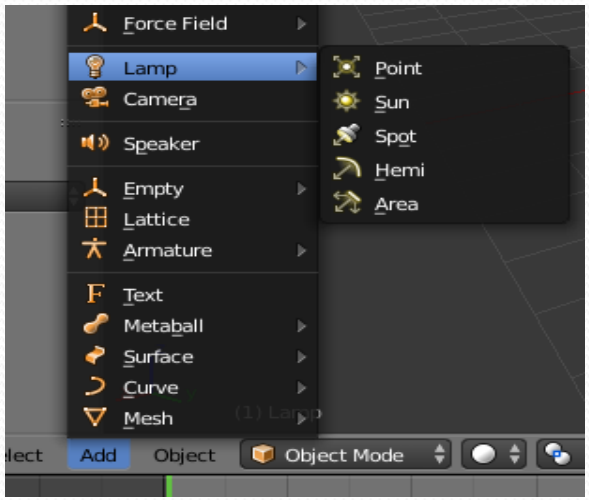

Hemi

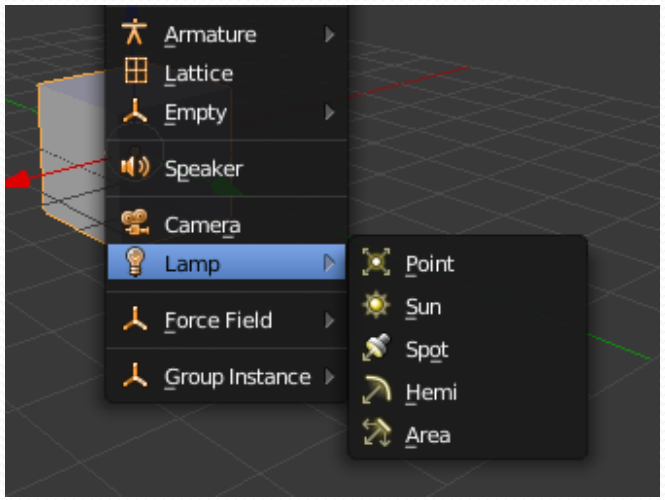

Area

I. Light types and settings

1. Lamp types

- Different ways to add any of these lights into the scene :
  - Through the Lamp area in the Add menu
  - Using Shift+A in the viewport then choose Add > Lamp and select your type



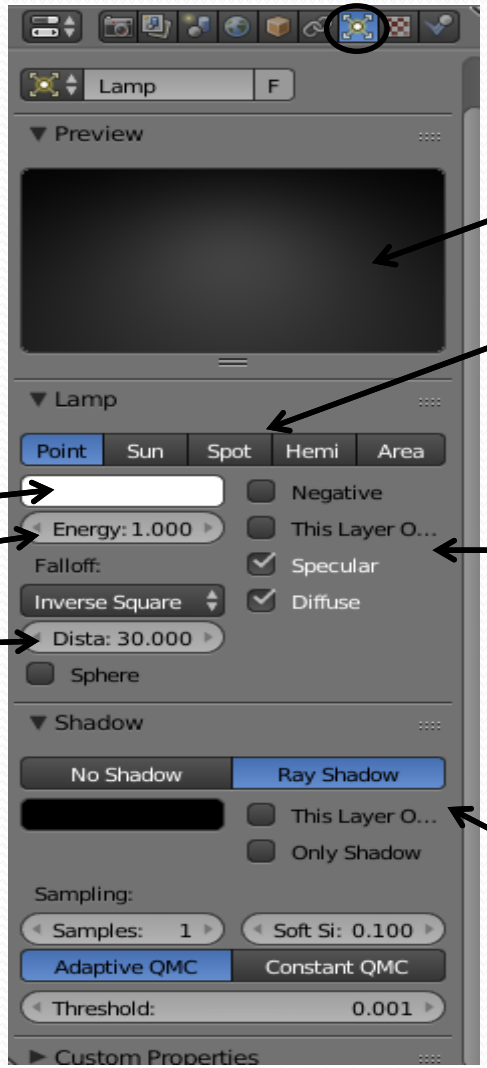


  - **Better when adding a lamp: go to top view to add the lamp then to front view to adjust height.**

I. Light types and settings

2. Lamp properties

- Each of lamp type has options that apply to it
- These options can be accessed via the Lamp Properties panel
- There are generic options and some specific options
- Most important generic options:
  - Light color
  - Energy (Brightness)
  - Distance (how far the light shines)
- Shadow
- Adding texture to the lamp
- Sun and Spot lamps give some different options.



Preview window

Lamp type

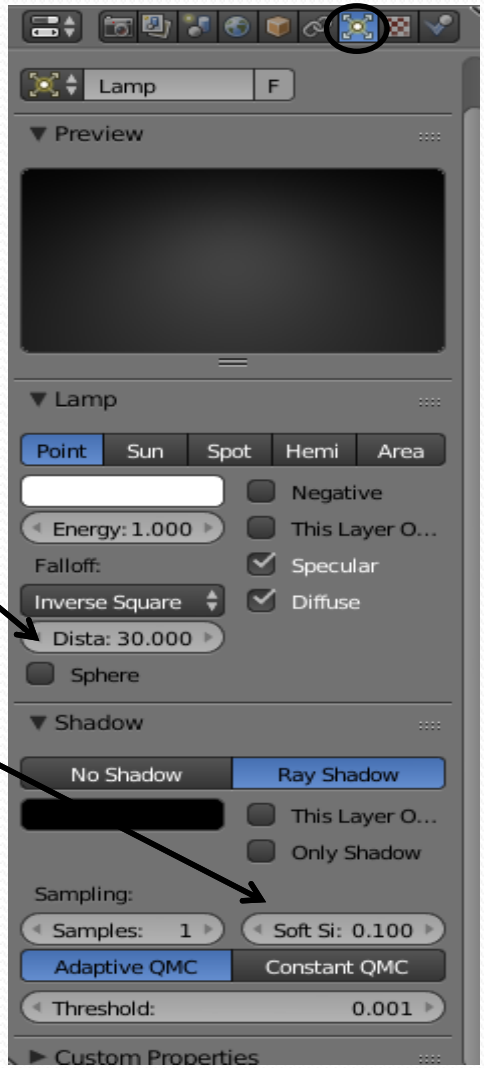
General settings

Shadow options

I. Light types and settings

2. point Light

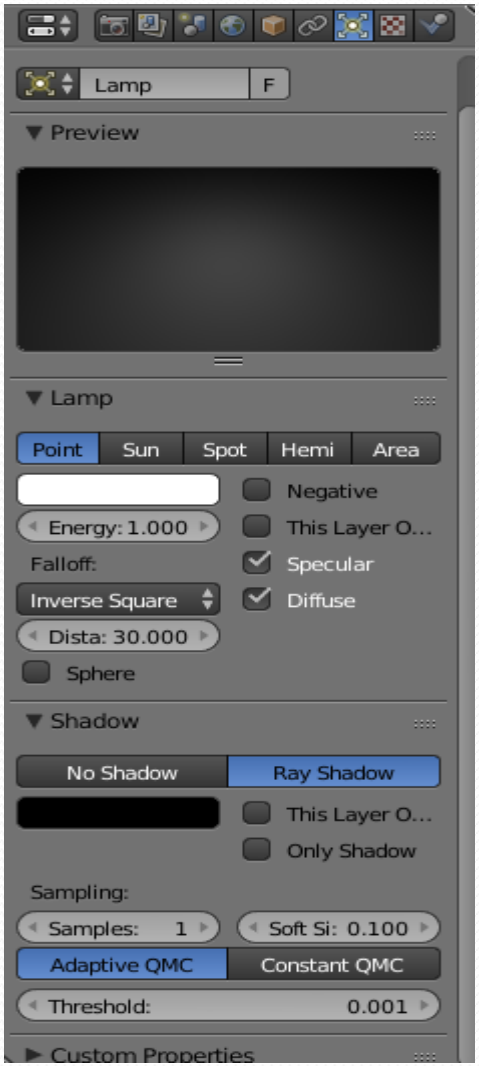
- Options:
  - Light color
  - Energy (Brightness)
  - Falloff Distance
  - Negative
  - Sphere
- Shadow:
  - hardness
- Adding texture to the lamp
  - With lamp selected add a texture.



I. Light types and settings

2. point Light

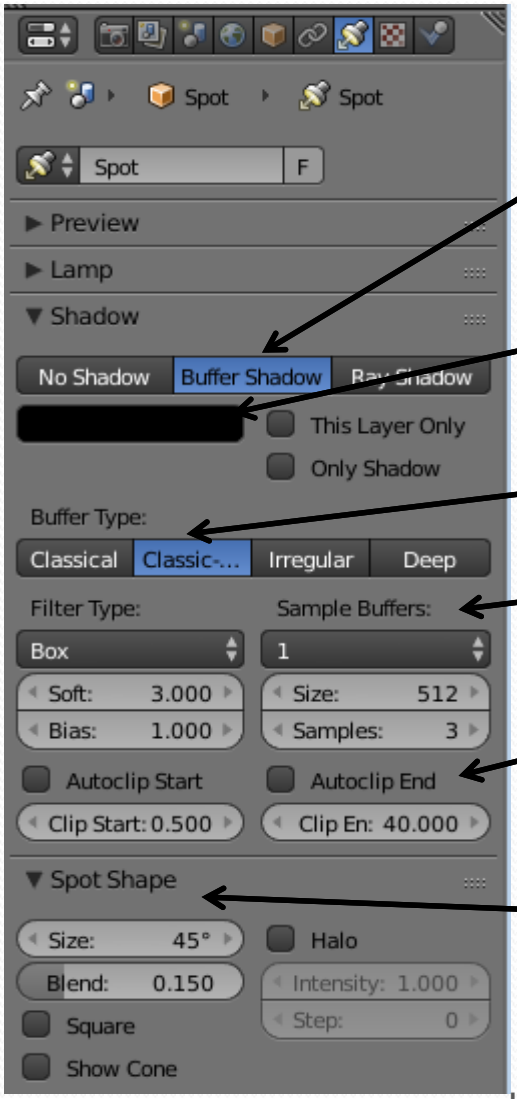
- **Sphere** : will light just inside the sphere area (sphere area depends on the distance value).
- **This layer only:** limits the effects of the light to the objects exist in the same layer as the lamp.
- **Negative:** reverses the illumination power of the lamp, emits darkness instead of light.
- **Shadow :** Rayshadow selected
- Sampling: the method how the shadows are calculated: **hardness:** soften the shadow. Samples



I. Light types and settings

3. Spotlight properties

- Spotlight allows creating great effects
- It can be scaled, rotated and positioned to cast shadow as the other lamp types
- It can be used with halo effects: giving a simulation of a light shining through a fog



Shadow type

Shadow color

Buffer type

Filter & sample

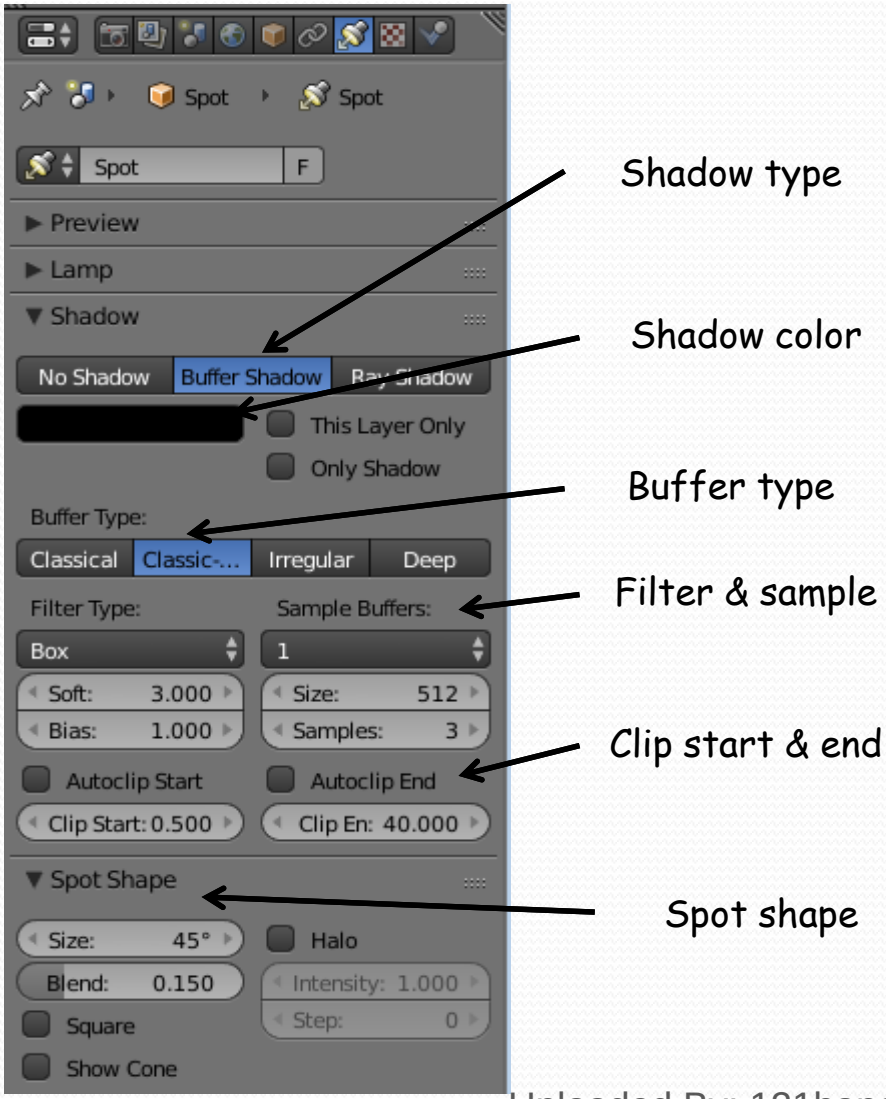
Clip start & end

Spot shape

I. Light types and settings

3. Spotlight properties

- **Spot Shape:** Set the Angle **Size**, **Blend** (edge softness- With low amounts of spot blend, the circle of light cast by a spotlight has sharply defined edges. As the blend is increased, the edges of the circle fade.), and **Shape** (round or square). You can also give it a haze with the **Halo** settings and intensity.



I. Light types and settings

3. Spotlight properties

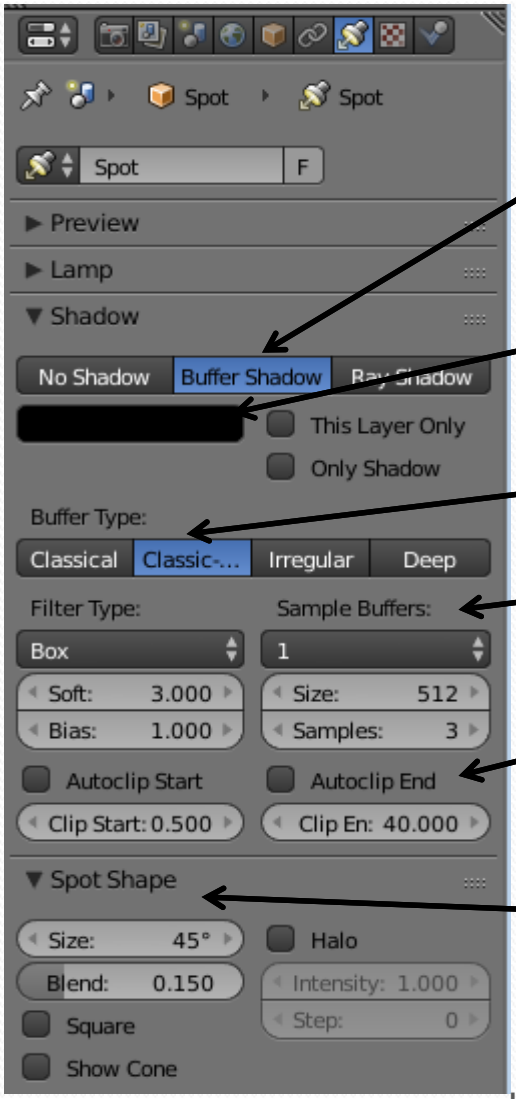
Changing the spot size

Adding spot blend

I. Light types and settings

3. Spotlight properties

- *Raytraced shadows :*
  - provide more physically accurate results, but can be slow to render.
- *Buffer shadows :*
  - *quicker to render, but less accurate*
  - *Has* Clip Start and Clip End: Gives a range for calculating shadows



Shadow type

Shadow color

Buffer type

Filter & sample

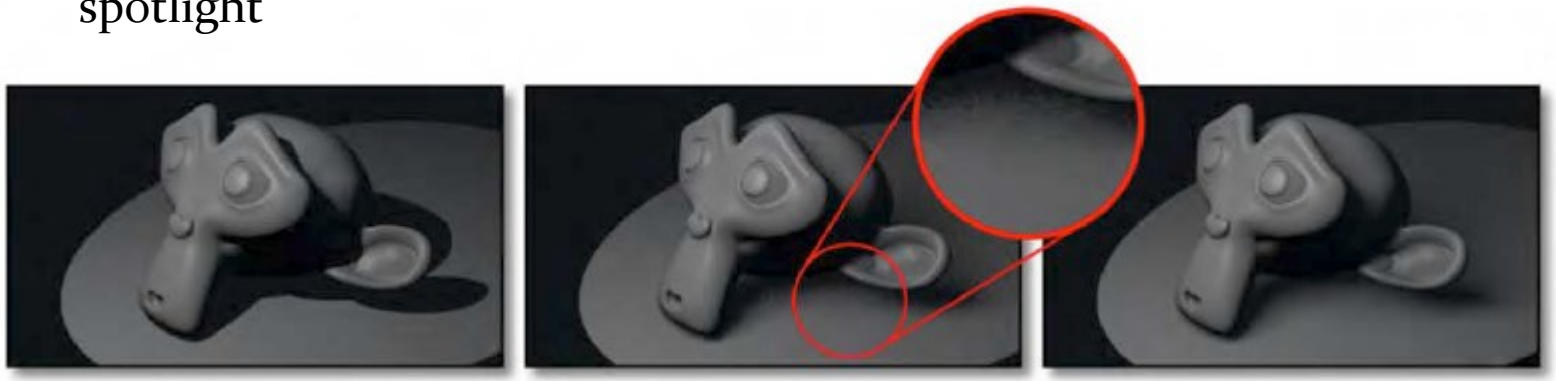
Clip start & end

Spot shape

I. Light types and settings

3. Spotlight properties

Different Soft Size values applied in the shadow settings of a spotlight



Different amounts of shadow samples with the same soft size

Activity

Activity 4.1	**Title:** Test Spotlight effects
Type:	Individual activity – Lab exercise
Goal:	Familiarize students with Spot lamp effects ILO P1
Outline:	Students should experiment the Spotlight effects, by following these steps: • Place a monkey and a plan objects in the viewport as shown in Figure 1 • Add a Spot Lamp to the scene and set it as shown in Figure 2 • Vary the following parameters: – Light color – Energy – Distance – Spot size (in the shadow settings) – Spot size by adding spot blind (in the shadow settings) – Soft size (in the shadow settings) – Shadow samples (in the shadow settings) – Buffer type • Student should prepare a brief synthesis containing different screenshots of different tests
Timeline	One course session
Assessment	Assess the synthesis prepared by each student

Activity

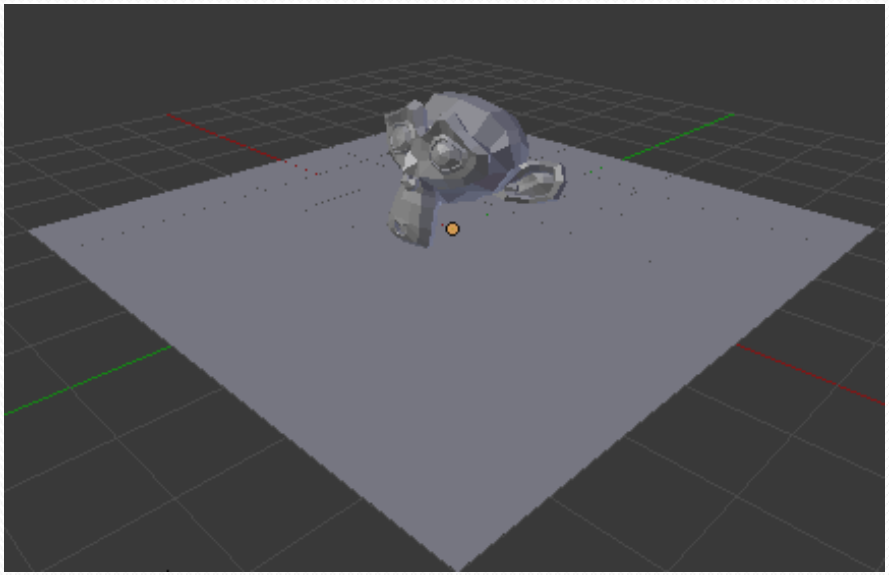


Figure 1

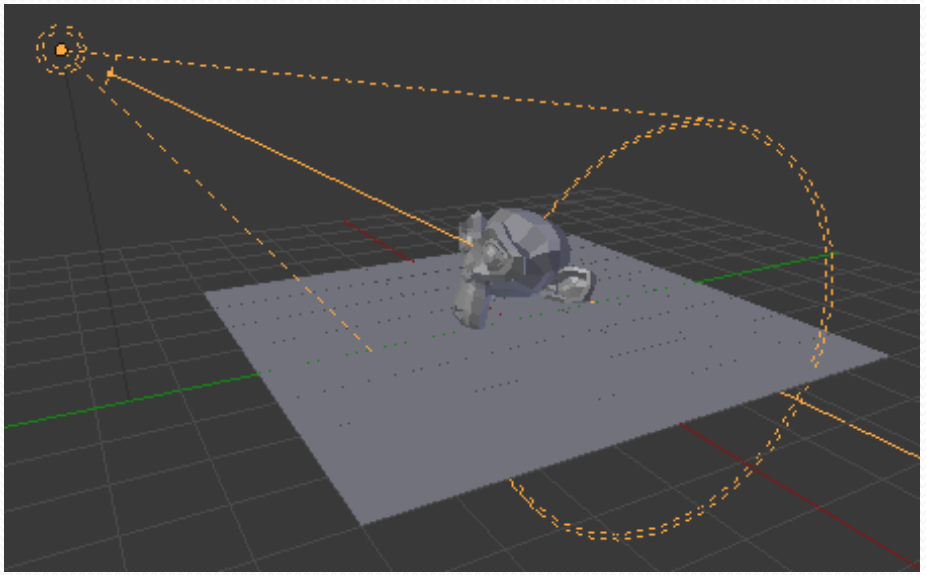
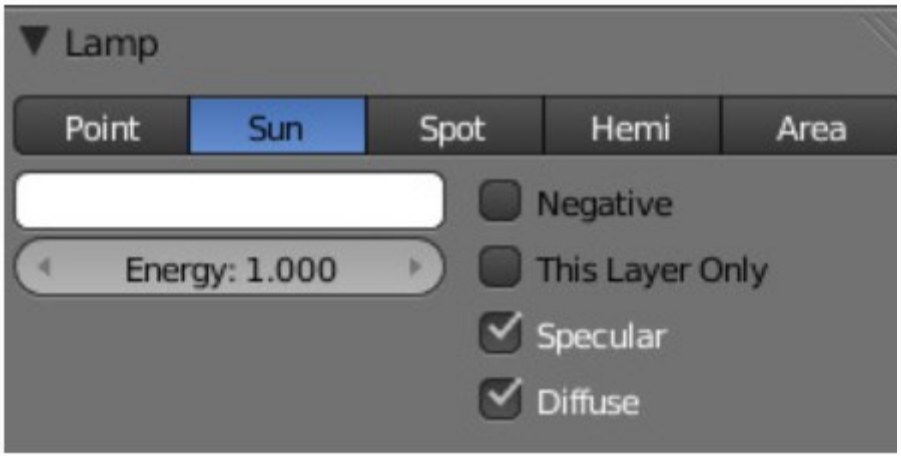


Figure 2

I. Light types and settings

1. Sun Lamp

- **Sun lamps emit light in a given direction**. Their position is not taken into account; they are always located outside of the scene, infinitely far away, and will not result in any distance falloff



Sky & Atmosphere

I. Light types and settings : *Sun Lamp*

- **Sky :**
  - This button enables the sky settings: it will create a "sky", with a "sun" if visible, and mix it with the background as defined in *World* settings.
  - **Turbidity** This is a general parameter that affects sun view, sky and atmosphere; it is an **atmosphere parameter where low values describe clear sky, and high values shows more foggy sky**. In general, low values give a clear, deep blue sky, with "little" sun; high values give a more reddish sky, with a big halo around the sun. it can modify the "intensity" of the sun lighting.
  - Here are its specific controls:
    - Blending will be used to **blend the sky and sun** with the background defined in the *World* settings.
- **Factor** Controls how much the sky and sun effect is applied to the World background.
- **Color space** These buttons allows you to select which color space the effect uses, with the following choices: CIE, REC709, SMPTE
- Exposure : This number button allows you to modify the exposure of the rendered Sky and Sun.
- **Horizon Brightness** Controls brightness of colors at the horizon. Its value should be in the range (0.0 to 10.0); values near zero means no horizontal brightness, and large values for this parameter increase horizon brightness. Spread Controls spread of light at the horizon. Its value should be in the range (0.0 to 10.0); values low in the range result in less spread of light at horizon, and values high in the range result in horizon light spread in through all the sky.
- **Sun Brightness** Controls the sun brightness. Its value should be in the range (0.0 to 10.0); with low values the sky has no sun and with high values the sky only has sun.
- **Size Controls** the size of sun. Its values should be in the range (0.0 to 10.0), but note that low values result in large sun size, and high values result in small sun size. Note that the overall brightness of the sun remains constant (set by *Brightness*), so the larger the sun (the smaller *Size*), the more it "vanishes" in the sky, and *vice versa*.
- Back-light For "**Back Scatter Light**", result on sun's color, high values result in more light around the sun. Its values range is (-1.0 to 1.0). Negative values result in less light around sun.

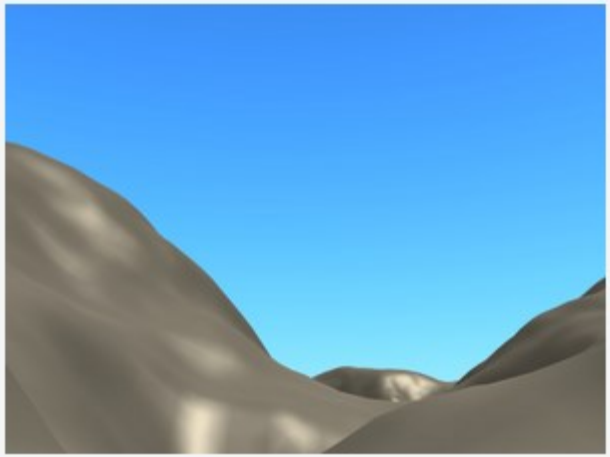
I. Light types and settings : *Sun Lamp*

Atmosphere

- This button enables the atmosphere settings. It will not modify the background, but it tries to simulate the effects of an atmosphere: scattering of the sunlight in the atmosphere, its attenuation,
- Intensity Sun Sets sun intensity. Its values are in range (0.0 to 10.0). High values result in bluer light on far objects.
- Distance: to convert Blender units into an understandable unit for atmosphere effect, it starts from 0 and high values result in more yellow light in the scene.
- Scattering Inscattering This factor can be used to decrease the effect of light inscattered into atmosphere between the camera and objects in the scene. This value should be 1.0 but can be changed to create some nice, but not realistic, images.
- Extinction This factor can be use to decrease the effect of extinction light from objects in the scene. Like *Inscattering* factor, this parameter should be 1.0 but you can change it; low values result in less light extinction. Its value is in the range (0.0 to 1.0).

I. Light types and settings

1. Sun Lamp



With sun right overhead (mid-day).

With sun deep "under the Earth" (midnight).

Sun slightly above the horizon (start of twilight).

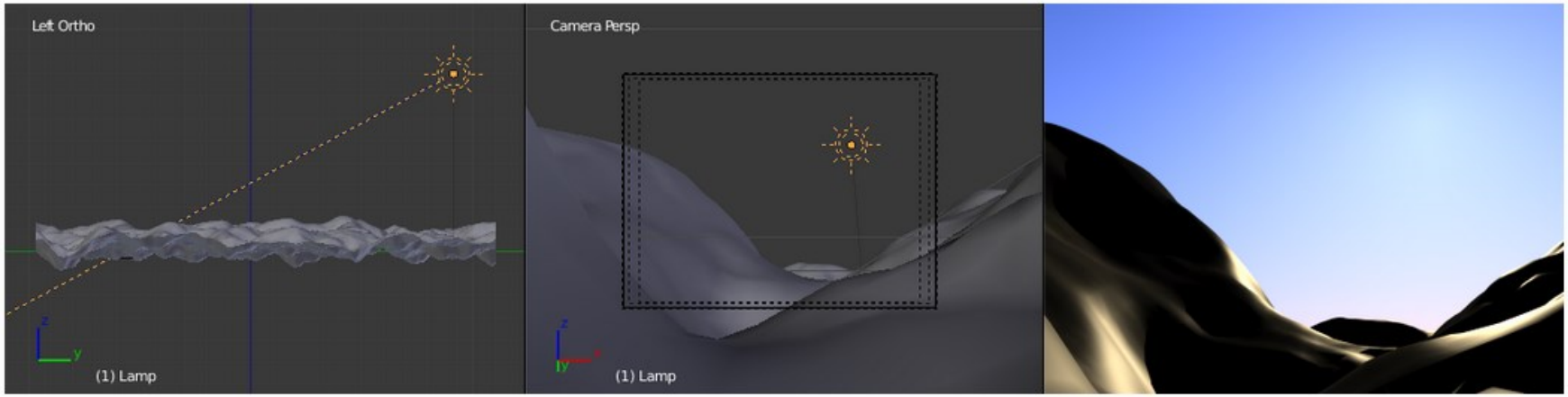
Sun slightly below the horizon (end of twilight).

Variations in Sun orientation, Sun Size to 5.0, all other settings to default.

I. Light types and settings

1. Sun Lamp

- Simulates various properties of real sky and atmosphere
- When the Sun is high, the sky is blue (and the horizon, somewhat whitish). When the Sun is near the horizon, the sky is dark blue/purple, and the horizon turns orange.
- Sun light source; the position of the lamp has no importance, its rotation is crucial: it determines which hour it is.



I. Light types and settings

1. Sun Lamp

- Two important angles :
  - **The "incidence" angle** (between the light direction and the X-Y plane), which determines the "hour" of the day (as you might expect, the default rotation – straight down – is "mid-day", a light pointing straight up is "midnight", and so on...).
  - **The rotation around the Z** axis determines the position of the sun around the camera.

- Note : to have a good idea of where the sun is in your world, relative to the camera in your 3D View, you should always try to have the dashed "light line" of the lamp crossing the center of the camera

I. Light types and settings

1. Sun Lamp

To see the sun in the rendered scene the light should be rotated (pointing) towards the camera plane.
Rotating the sun around the z axis will move the light on the camera plan
Changing x axis (in rot) will move the sun up and down
Better begins by rotation camera 0 on z. go right view, manipulate the rotation of the light beginning from 0 0 0 rotation

Activity:

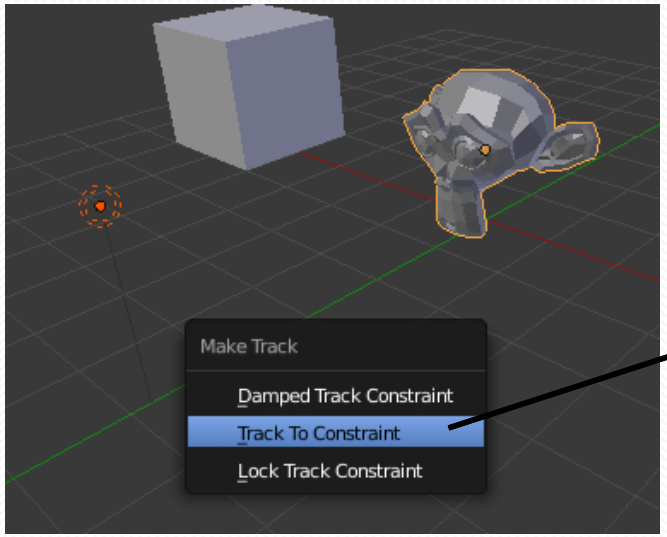
- You can add and extrude a **plane**
  - Exp: at pos (000) and rot (000) s (3 4 0.1)
- Better when adding a lamp: go to top view add the lamp then to front view to adjust height.
- **Adjust the camera** so that it faces the scene and the sky (front ortho)
  - exp: pos (0 -5 0.6), Rot (90 0 0)
- **Adjust the sun** so that it is below the plane and rotated to the cam
  - Exp: Pos (0.8 0.1 – 0.6), Rot (-90 0 0)
- **Check sky and atmosphere**
  - Change size to 4, brightness to 2 and can reduce back
- **Try other options:** Change size to 10

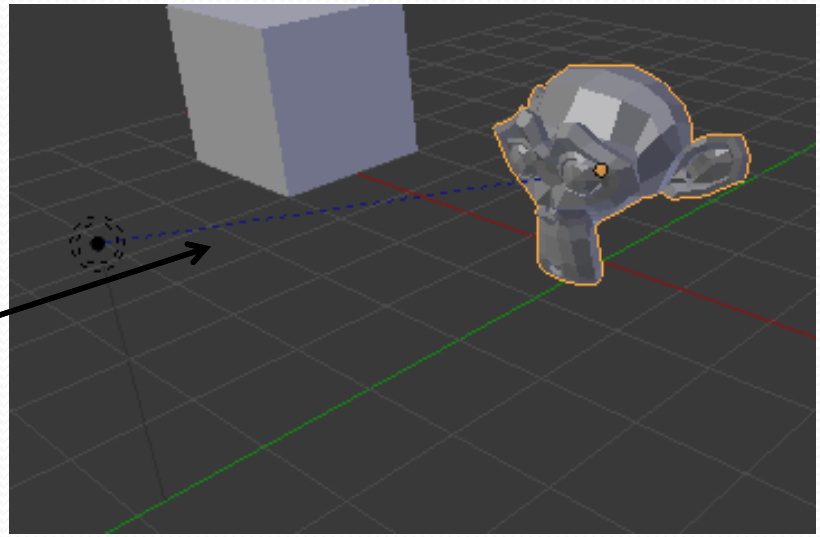
Apply different lights to the scene

- Lighting consists of a **key light**, which is the main light source, and as needed fill lights to add ambiance to otherwise unlit areas.
- Different lights can be used together to get different effects
- Purpose: use key light (principal light source) and then fill lights as needed
- Decide carefully the location of the key light taking into account these considerations:
  - The key light is the strongest light source in the scene
  - The key light should be strategically positioned so as to define the form of the objects in a scene.
  - The key light is the main light for casting shadows

Tracking lights to objects

- Tracking lights to objects:
  - It Allows light to track to the main object in the scene
  - It's applied as follows:
    - RMB-select the light
    - Shift-RMB-select the object
    - Press Ctrl+T and choose Track To Constraint from the menu

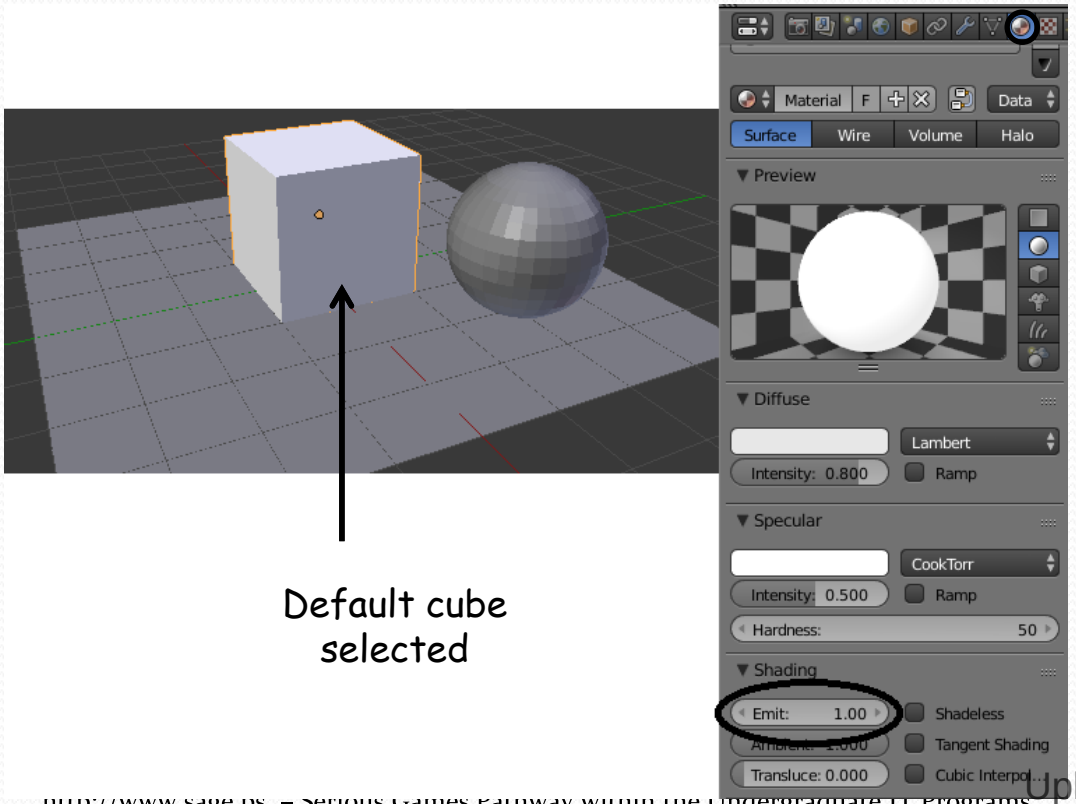




- The light will always point to the object
- The light can point to an empty target (using an empty object)

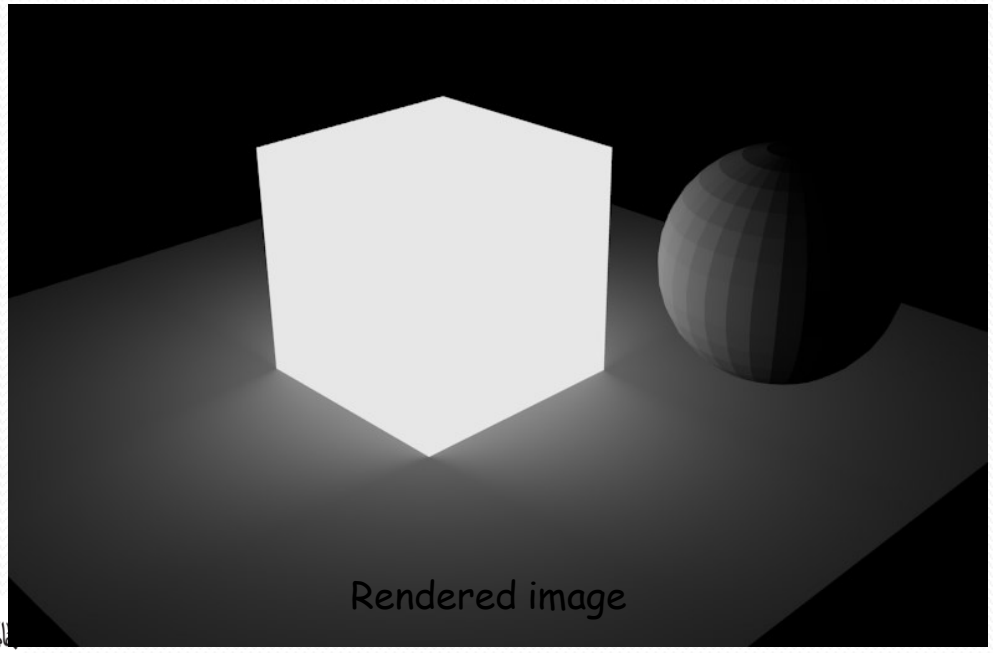
Indirect lighting

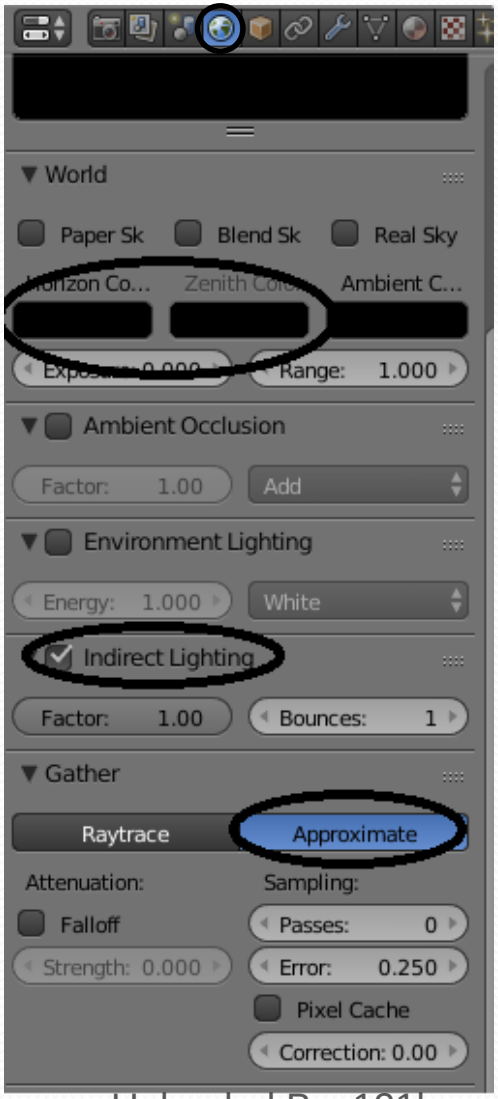
- Indirect lighting: It is the ability to make objects emit their own light
- To make objects emit their own light, follow these steps:
  - Select the object and set up its material with the *Emit* feature on



Indirect lighting

- In the world settings, set the *Horizon and Zenith* colors to black
- In the world settings, find the panel labeled *Gather* and turn on *Approximate*
- Check and open the panel named *Indirect Lighting*
- Set the *Factor* slider and *Bounces* which controls the light effects (how many times the light bounces)





Activity

- **Activity 4.2:** Experiment light settings (30 min)
  - Using a monkey and a plan objects, as shown in Figure 1 (activity 4.1), test the following settings:
    - Apply different lights to the scene
    - Use many lights together
    - Use tracking lights to objects
  - Add a cube to the scene, nearby to the monkey, and apply the indirect lighting effect to this cube
  - Give screenshots for each setting

II. Cameras

The camera is the our eye into the scene- is what we see finally when rendering.

- Fixing Up the Camera View
- Lining up the Camera
- Tracking to an Object
- Tracking to an Empty Target
- Multiple Cameras

II. Cameras
Lining up the Camera

- Techniques for aiming the camera at a given object:

  - navigate in the 3D view to the point of view you would like the camera to have, and then press Ctrl+Alt+numpad 0

  - use *fly mode* by pressing Shift+F with the mouse over the 3D view, Click the LMB causes the view to halt.

II. Cameras

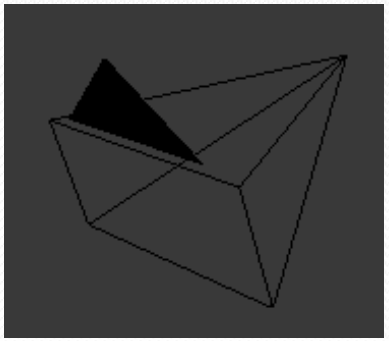
Split the view

- In reality, lining up the camera can be deceptively difficult. Fortunately, there are some techniques for aiming the camera at a given object:
  - **Navigate in the 3D view** to the point of view you would like the camera to have, and then press **Ctrl+Alt+numpad 0**, which causes the camera to jump to where your view is taken from, and look into the scene from your point of view.
  - Use fly mode by pressing **Shift+F** with the mouse over the 3D view. In this mode, the view pivots around to follow your mouse pointer. Using the W and S keys or rolling the MMB causes the view to accelerate in and out of the scene. Clicking the LMB causes the view to halt, whereas clicking the RMB resets the view to the starting position. Using this technique from the camera view moves the camera.

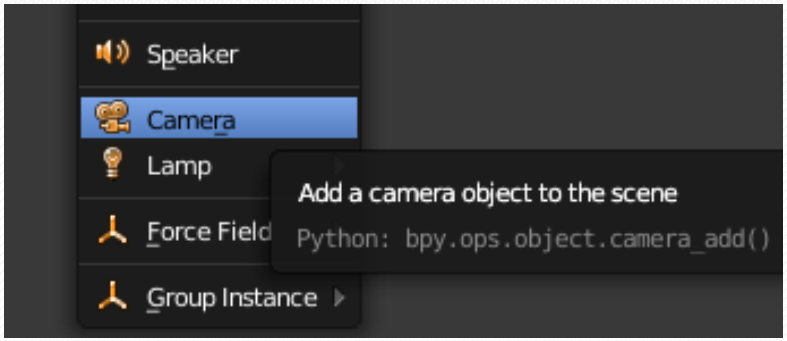
II. Cameras

1. Camera settings

- The scene contain one camera by default
- The black triangle mark the square face of the camera and represent which way is up
- It is possible to use many cameras
- To add new camera, use "Shift+A"
- To change the active camera, select that camera and press "Ctrl+Numpad 0"
- The camera is manipulated like any other object
- Resolution in render manipulate the size of camera view area



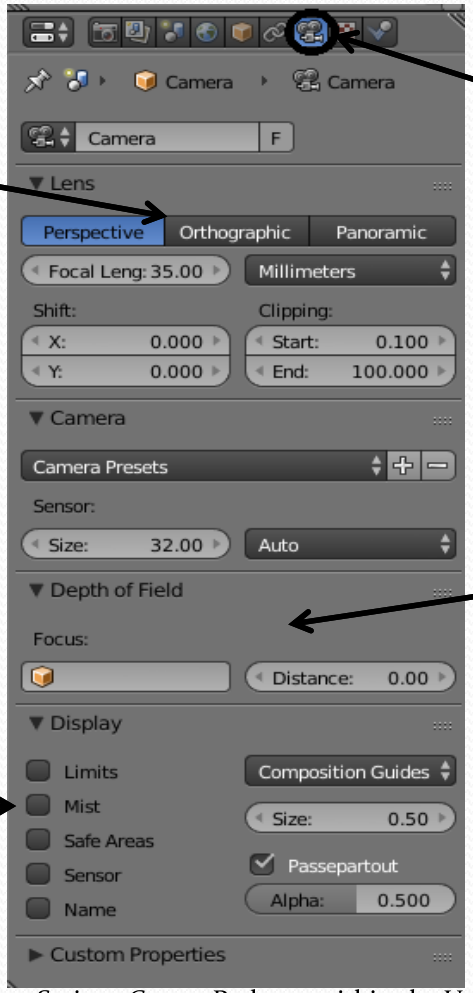
The camera



Shfit+A

II. Cameras

- Like all other objects, the camera has settings:



Camera button

Camera view types

Depth of Field

Display options

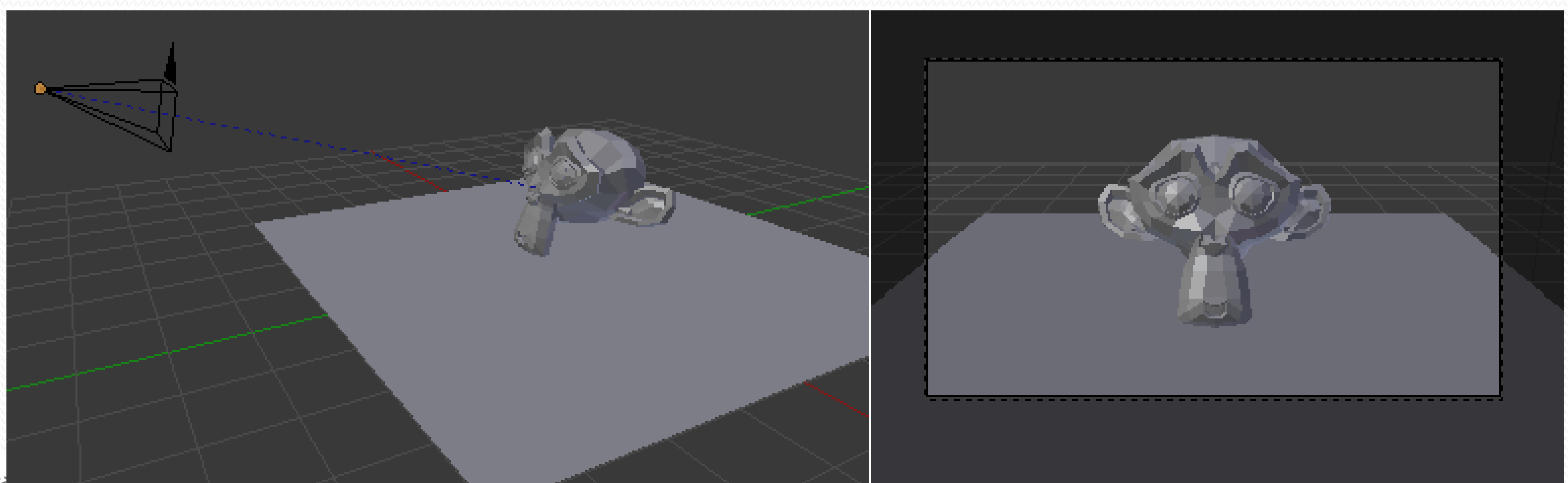
II. Cameras

- Like all other objects, the camera has settings:
- **Perspective/Orthographic:** Used to set the camera from showing a true-life perspective view to an orthographic view.
- **Lens (Focal):** Set-up a lens length much like a real camera. 35mm is a good, safe setting, but wide and tight angle setting work for different needs. Zoom.
- **Panoramic:** Changes camera view to reflect a cylindrical camera.
- **Shift:** Pushes the view left, right, up, down from actual camera view, without changing perspective.
- **Clipping:** Start and End- How close and how far an object can get to the camera and still be seen. In very large scenes, this needs to be set higher or things "disappear" from view.
- DOF- (Depth-of-field): Used with nodes to blur foreground and background objects.
- **Limits:** Draws a line in the scene to help you visualize the camera's range.
- **Size:** How big to **draw the camera** on the screen. You can also control size with scale.
- **Show Mist:** Used to give you a visual display of how far the camera sees if using Mist
- Safe Area: Displays the inner dashed box to help with placement of objects and text
- **Name:** With all objects, the name of the object or camera can be displayed on the screen, but this will display the name in the camera view.
- **Passepartout:** Shades the area on the screen outside of the camera's view. You can control the darkness of the shaded area with the Alpha slider.

Cameras

Tracking an object

- Make the camera automatically face the target object.
- To track an object, follow these steps:
  - RMB-select the camera
  - Shift-RMB-select the target object so that both the camera and the model are selected
  - Press Ctrl+T
  - Choose Track To Constraint on the menu that appears
- Remove Track : by Alt T or on Constraints panel remove track to constraint.

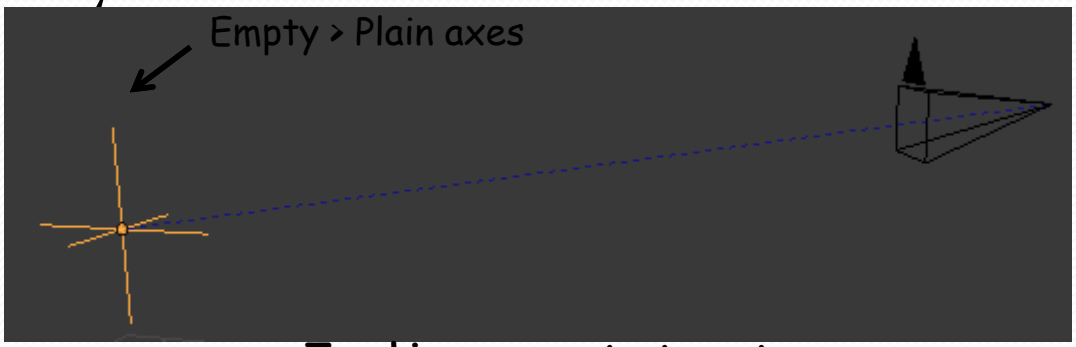


Split view showing what the camera sees

Cameras

Tracking an empty object

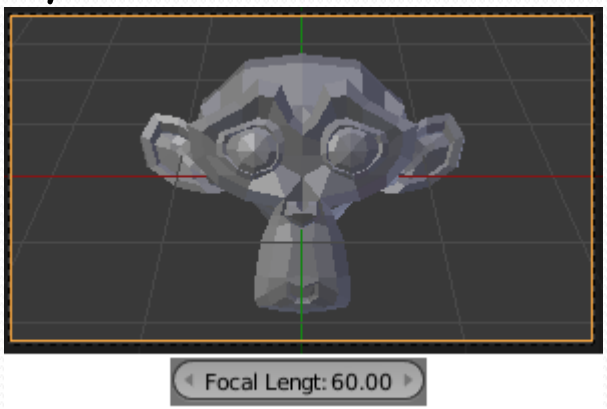
- In the case of animation, the camera should not follow the target object around
- The solution is to track an empty target
- This target will control where the camera should be pointed
- This procedure is realized as follows:
  - Insert an empty into the scene by pressing Shift+A and then selecting Add > Empty
  - RMB-select first the camera, and then Shift-RMB-select the empty
  - Press Ctrl+T and choose Track To Constraint
- The camera will always look toward the empty, Simply **place the empty where you need the camera to look.**



Tracking an empty target

Solution

- The default camera gives a limited view of meshes (perspective distortion)
- In order to decrease this distortion, follow these steps:
  - Select the camera and go to the Object Data tab
  - Go down to the Lens section, and change the Focal length from 35 to a greater value : The scene as viewed through the camera will appear to jump to a bigger size.
- It is also useful to enable the "Passepartout" option in the Display panel in order to make the model very clear



Multiple Cameras

- You can add multiple cameras to the scene
- Set the active camera by selecting the camera then go to view- cameras- set active object as camera (Ctrl + Numpad0).
- Align camera to view : Go to view- adjust the 3d view then go to view – align view- align active camera to view (ctrl+Alt+numpad0).

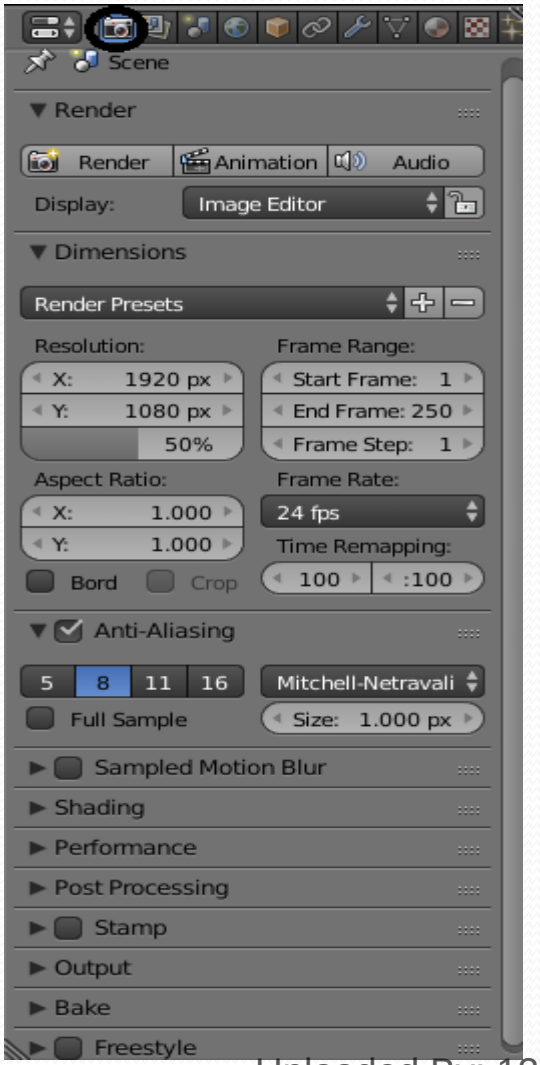
Reposition the camera by LMB in camera view, or by Shift+F

Activity

- **Activity 4.3**: Experiment camera tracking and fixing up settings (15 min)
  - Using a primitive mesh, test the following camera operations :
    - Tracking to an object
    - Tracking to an empty target
    - Fixing up the view
  - Give screenshots for each operation

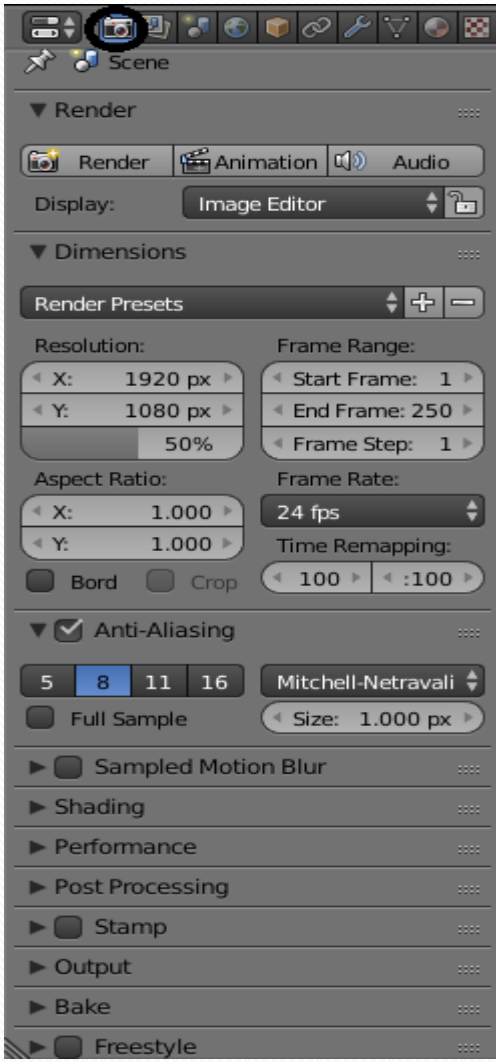
III. Rendering

- What you want as an output from your scene
- The render window gives you the output of the scene
- The render settings panel is located in the properties panel and it is displayed by default
- The render settings panel contains the specifications of the output of the scene (format, resolution, size,…)



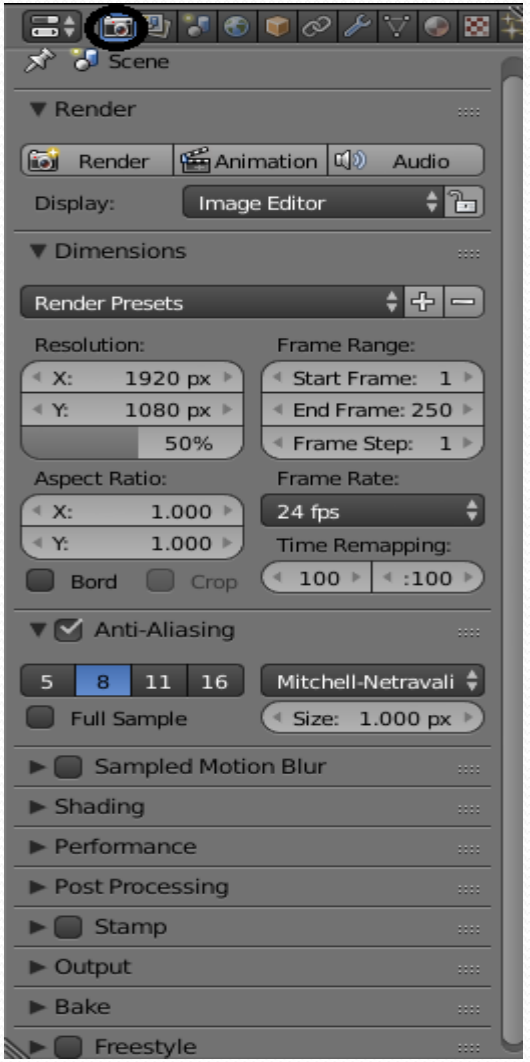
III. Rendering

- Render/Animation/Audio Buttons:
- **Display**: if your render occurs in a viewport or in a new window
- **Dimensions:**
  - **Resolution-size** (Manual input of x and y values for rendering size instead of using presets.),
  - frame range: Set the start and end frame for each rendering and the number of steps.
  - scaling and Aspect ratio : Setting the size of the render display in the 3D window
  - frame rate: Animation playback rate.
  - If you make an animation and it runs too fast or slow, you can change the mapping and scale the time with Old Map and New Map.
- Anti-Aliasing: Output quality settings. Samples with smooth the edges of objects. Default is 8.



III. Rendering

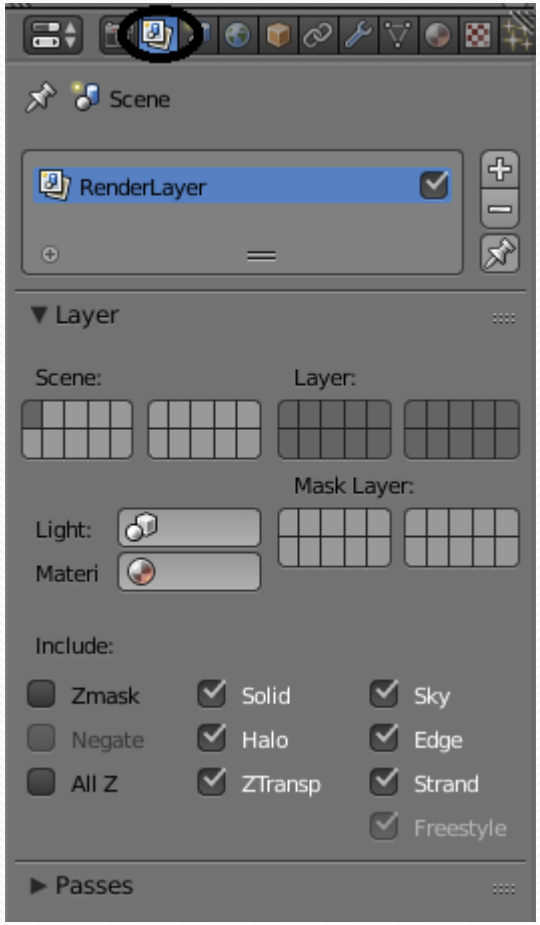
- **Shading**: Settings that can be turned off to exclude features from the render;
  - the "Alpha Sky" drop down menu gives options for the render background.
- **Output**: Set file types for outputs and saving locations. You can also set compression quality for images. It's always a good idea to type the file extensions when naming output files. For movies, there will be encoding options in a panel.
- Performance: Settings for render performance.
- Stamp: Labeling for frames and movies if needed.
- Bake: Baking is a feature where certain processes can be saved to speed rendering.
- Frame rate. Animation playback rate (25 FPS for PAL output, 30 FPS for NTSC output).



III. Rendering

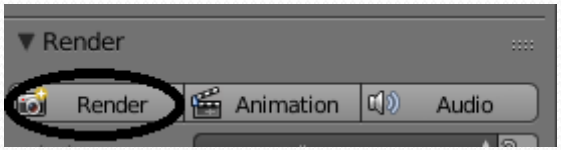
- Render Layers: Control which layers or groups to render.

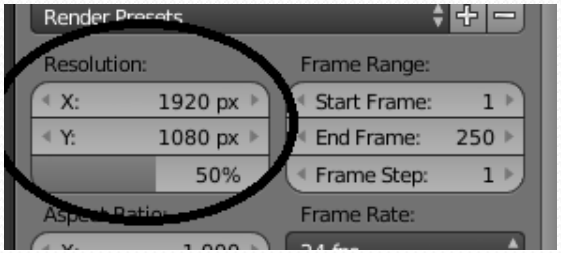
- allow you to render your scene in separate layers, usually with the intension of compositing them back together afterwards.
- The Layer Panel shows many settings:
  - **Scene**: The Scene Layers, showing which are currently visible and will be rendered.
  - **Layer**: The Scene Layers which are associated with the active Render Layer.
  - **Mask Layer**: Objects on these will mask out other objects appearing behind them.
  - **Material**: Overrides all material settings to use the Material chosen here.
  - **Light**: Enter the name of a light group, and the scene will be lit with only those lights.
  - Include Options: Each render layer has its own set of features which can be enabled/disabled to save time and give you control when working with passes

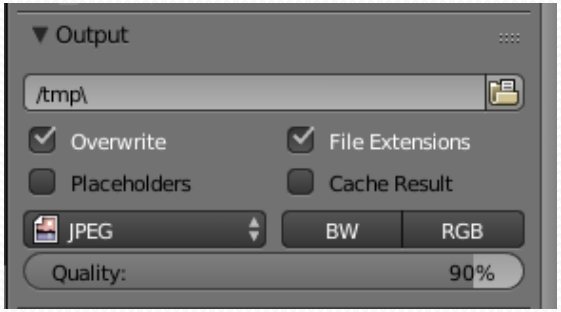


Render a simple image

- In order to render a simple image, follow these steps:
  - Choice the Render button in the Render panel or Press the "F12" button.
  - Choice a high resolution to obtain a high quality image
  - Set all of the remaining rendering settings (previously discussed) especially the output settings
  - Press "F3" button to open the file save window and give your file a name and set the location



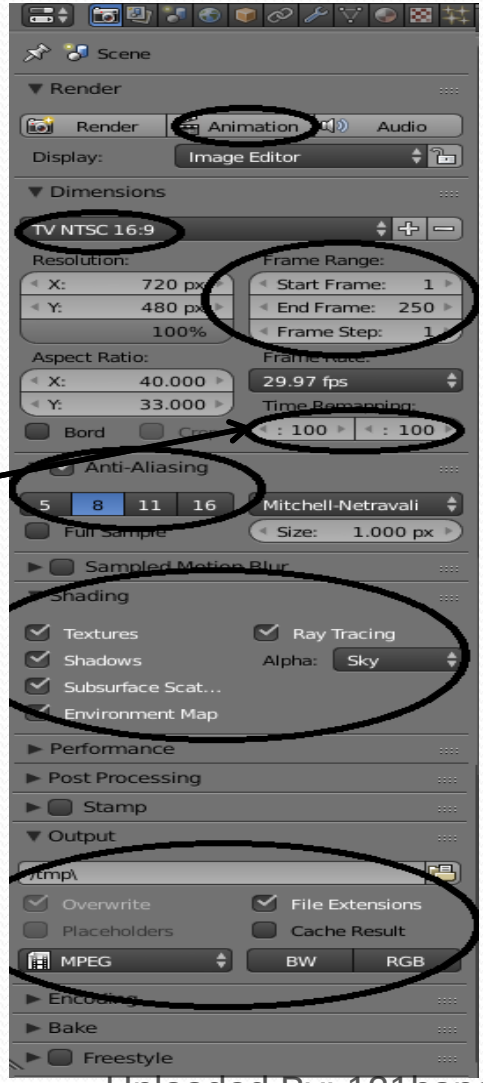




File save window

Render a movie file

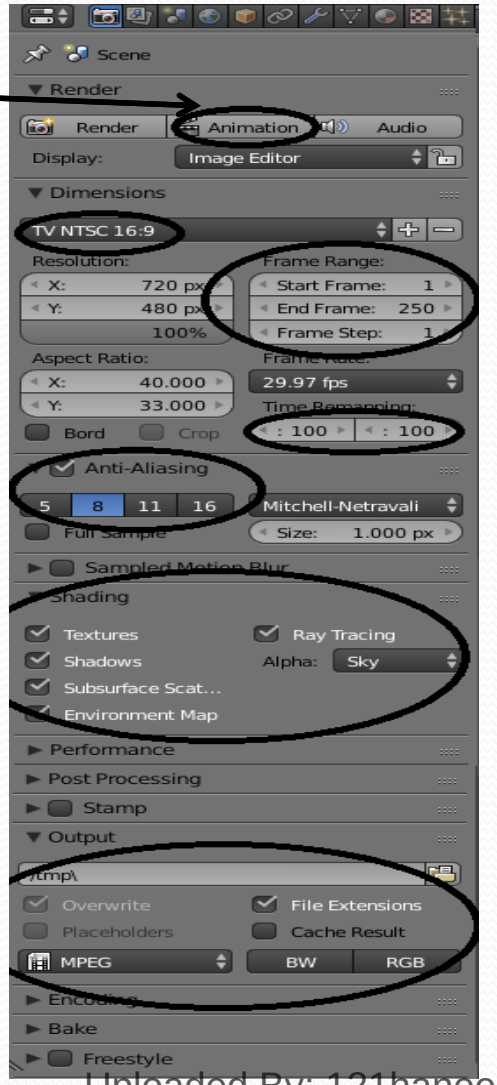
- Rendering a movie ⟹ You have a scene with animation
- Here are the steps to create a movie file:
  - In the Dimensions tab, select the encoding format and check the output resolution
  - Check that the 'Start' and 'End' frames of the animation are selected and check the frames per second setting
  - Make sure 'Anti-Aliasing' is ticked and that 8 is selected
  - In the Shading tab make sure Shadow and ray tracing are ticked
  - In the Output tab select the file format from the format selection dropdown menu (try AVI)
  - click the file folder button and set your location and name of the movie file.
  - If you want, set the additional options in Performance, post Processing, Encoding and Stamp tabs
  - Finally, press the 'Animation' button in the render tab



Render a movie file

- Rendering a movie ⟹ You have a scene with animation

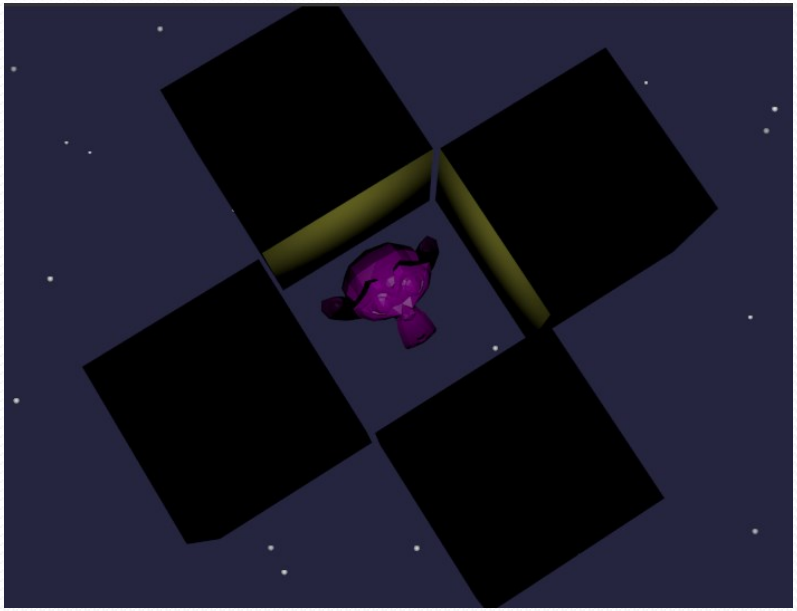
- The movie may take a while to compile (minutes, hours, days depending on complexity and computer speed) since it needs to render each and every frame of the movie.



Activity

- **Activity 4.4**: Experiment rendering types (30 min)
  - Which are the possible rendering types in Blender?
  - Explain each type of rendering and test its settings
  - Give example for each rendering type

Activity

Activity 4.5	**Title:** Use lighting and world settings
Type:	Individual activity – Home work
Goal:	Discover some lighting and world settings ILO P1
Outline:	A student should use four cubes, a monkey object, Blender lighting and world settings to create a rendered image that looks something like this image. 
Timeline	One class session
Assessment	Assess the final work of each student and his contributions

Thank you for your attention!