CMPS 327: Introduction to Video Game Design and Development

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Lecture 6: Unity Basics II

About Today's Lecture

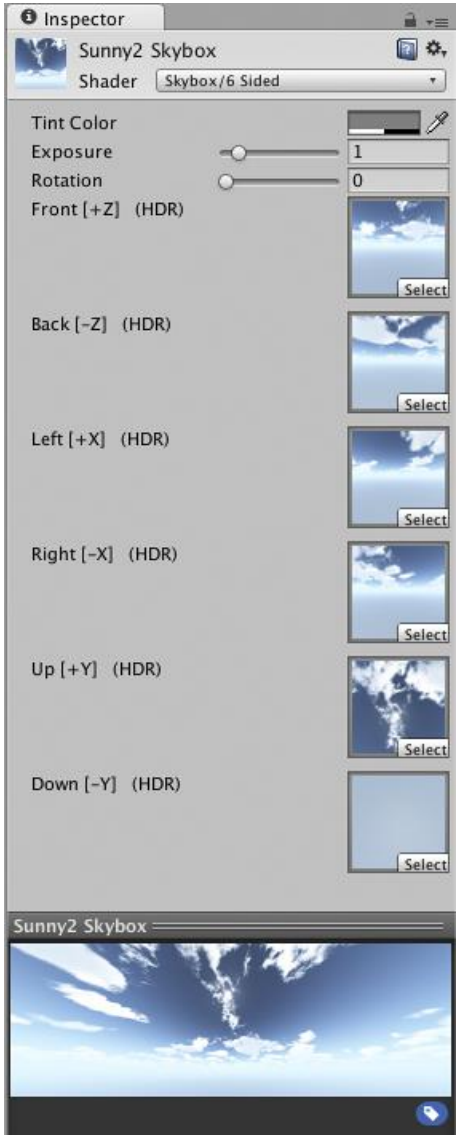
- Creating game environment
  - Skybox
  - First person controller
  - Terrain
  - Trees
  - Grass
  - Water
  - Lights

Unity Asset Store

- Download and Import Standard Assets
  - https://assetstore.unity.com/packages/essentials/asset-packs/standard-assets-32351
- Skyboxes:
  - https://assetstore.unity.com/packages/2d/textures-materials/sky/classic-skybox-24923
  - https://assetstore.unity.com/packages/2d/textures-materials/sky/worldskies-free-86517
- A project with these assets is available on Moodle as a starting point for this lecture.

Skybox

- Skyboxes are a wrapper around your entire scene that shows what the world looks like beyond your geometry.
- To change skybox : Add Skybox component to the camera



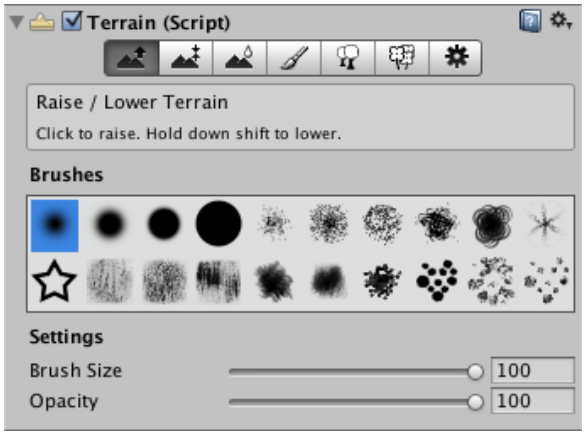
https://docs.unity3d.com/Manual/class-Skybox.html

Terrain

- Unity's Terrain system allows you to add vast landscapes to your games.
- At runtime, terrain rendering is highly optimized for rendering efficiency
- In the editor, a selection of tools is available to make terrains easy and quick to create.

https://docs.unity3d.com/Manual/script-Terrain.html

Creating a Terrain



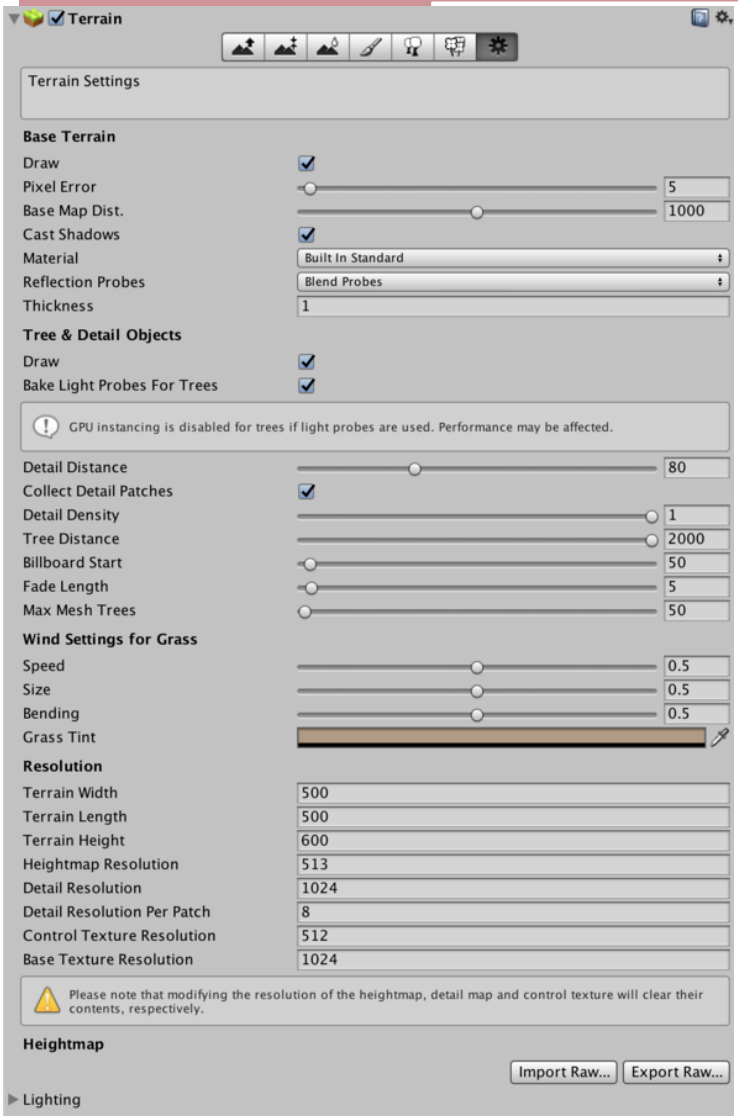
- GameObject > 3D Object > Terrain
- This also adds a corresponding Terrain Asset to the Project view
- When you do this, the landscape is initially a large, flat plane.
- The Terrain's Inspector window provides a number of tools you can use to create detailed landscape features.

Terrain Keyboard Shortcuts

- Press the keys from F1 to F6 to select the corresponding terrain tool (for example, F1 selects the Raise/Lower tool).
- The comma (,) and period (.) keys cycle through the available brushes.
- Shift-comma (<) and Shift-dot (>) cycle through the available objects for trees, Textures and details.

Terrain Settings

- Terrain Width
  - Size of the terrain object in its X axis (in world units).
- Terrain Length
  - Size of the terrain object in its Z axis (in world units).
- Terrain Height
  - Difference in Y coordinate between the lowest possible heightmap value and the highest (in world units).



https://docs.unity3d.com/Manual/terrain-OtherSettings.html

Terrain Height Tools

- Raise/Lower Height tool
  - When you paint with this tool, the height will be increased as you sweep the mouse over the terrain
  - The height will accumulate if you hold the mouse in one place
  - If you hold down the shift key, the height will be lowered

Terrain Height Tools

- Set Height
  - Similar to the Raise/Lower tool except that it has an additional property to set the target height
  - When you paint on the object, the terrain will be lowered in areas above that height and raised in areas below it
  - You can use the Height property slider to set the height manually or you can shift-click on the terrain to sample the height at the mouse position
  - Handy for creating features like roads, platforms and steps.

Terrain Height Tools

- Smooth Height
  - Does not significantly raise or lower the terrain height but rather averages out nearby area.
  - Somewhat like the blur tool in an image editor.
  - This softens the landscape and reduces the appearance of abrupt changes

Terrain Textures

- The paintbrush button on the toolbar enables texture painting. 
- Initially, the terrain has no textures assigned for painting. If you click the Edit Textures button and select Add Texture from the menu, you will see the Add Terrain Texture window. Here you can set a texture and its properties.

Texture Painting

- The first texture you add will be used as a “background” to cover the terrain.
- You can add as many textures as you like
  - the subsequent ones will be available for painting using the familiar brush tools.
- Options for brush
  - Brush Size
  - Opacity
- Tiling Setting for each texture

Add First Person Controller

- Part of Standard Assets
- Go to this folder:
  - Assets\Standard Assets\Characters\FirstPersonCharacter\Prefabs
- Drag and drop FPSController to your Hierarchy tab
- Change position
  - above the terrain

Trees

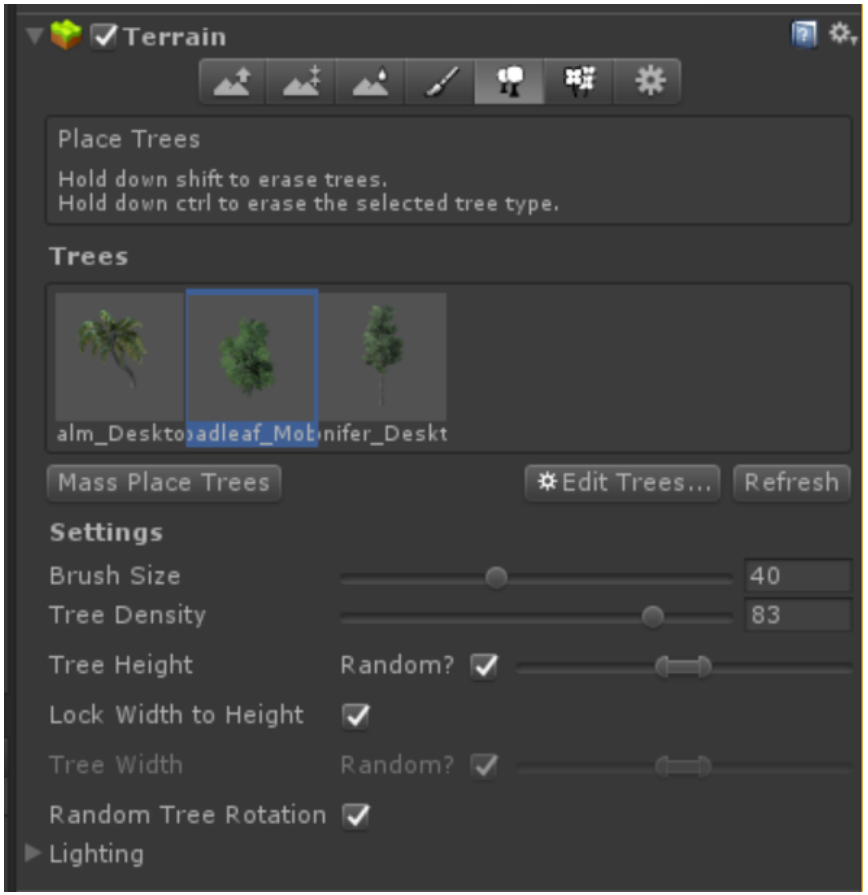
- Unity terrains can be furnished with trees.
- Patches of trees can be painted onto a terrain in much the same way that heightmaps and textures are painted but the trees are solid 3D objects that grow from the surface.
- Unity uses optimizations (e.g., billboarding for distant trees) to maintain good rendering performance, so you can have dense forests with thousands of trees and still keep an acceptable framerate.

Adding Trees

- The tree button on the toolbar enables tree painting.
- Initially, the terrain will have no trees available but if you click the Edit Trees button and select Add Tree you will see a window to select a tree asset from your project.
- With a tree selected, you can paint onto the landscape in the same way you paint textures or heightmaps.

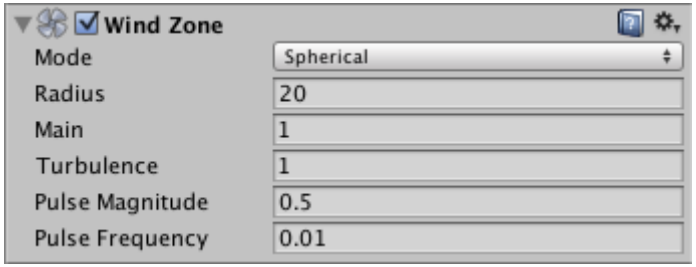
Removing Trees

- You can remove trees from an area by holding the shift key while you paint
- Remove just the currently selected tree type by holding down the control key.



Making trees bend in the wind

- Add Wind Zone
  - GameObject > 3D Object > Wind Zone
- Mode
  - Directional
    - Affect the whole terrain at once
  - Spherical
    - Wind blows outwards within a sphere defined by the Radius property

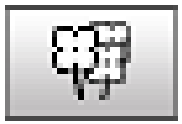


https://docs.unity3d.com/Manual/terrain-WindZones.html

Grass and Other Details

- A terrain can have grass clumps and other small objects such as rocks covering its surface.
- Grass is rendered by using 2D images to represent the individual clumps while other details are generated from standard meshes.

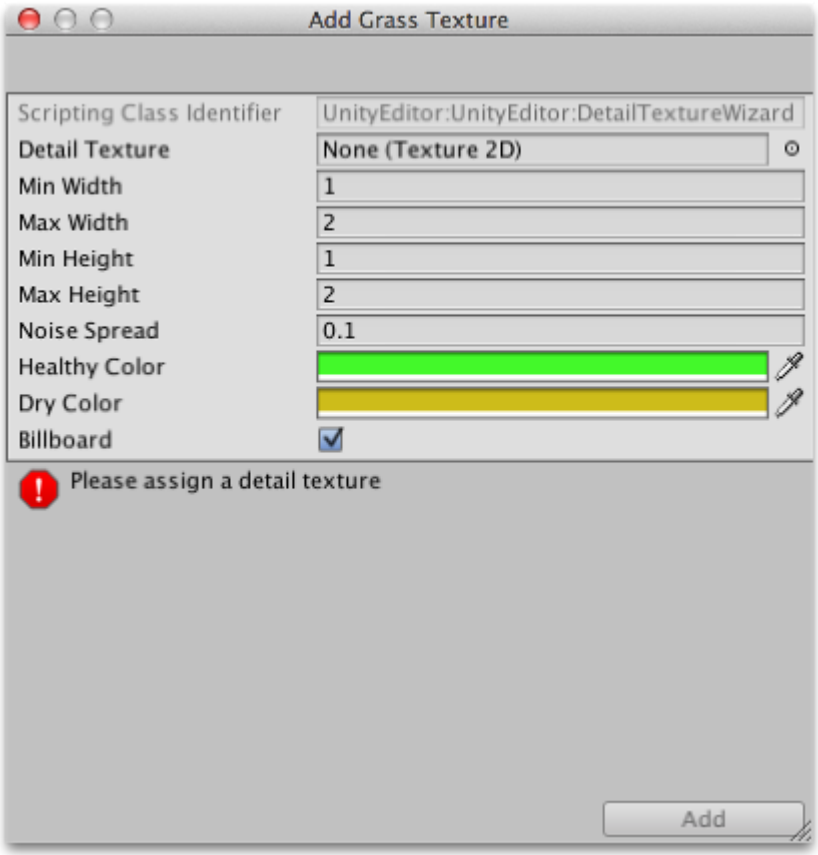
Enabling Grass/Details



- Initially, the terrain has no grass or details available
- Click the Edit Details button in the inspector
  - you will see the Add Grass Texture and Add Detail Mesh options on the menu that appears.
  - A window will appear to let you choose the assets you want to add to the terrain for painting.
- Wind zone will affect the grass as well

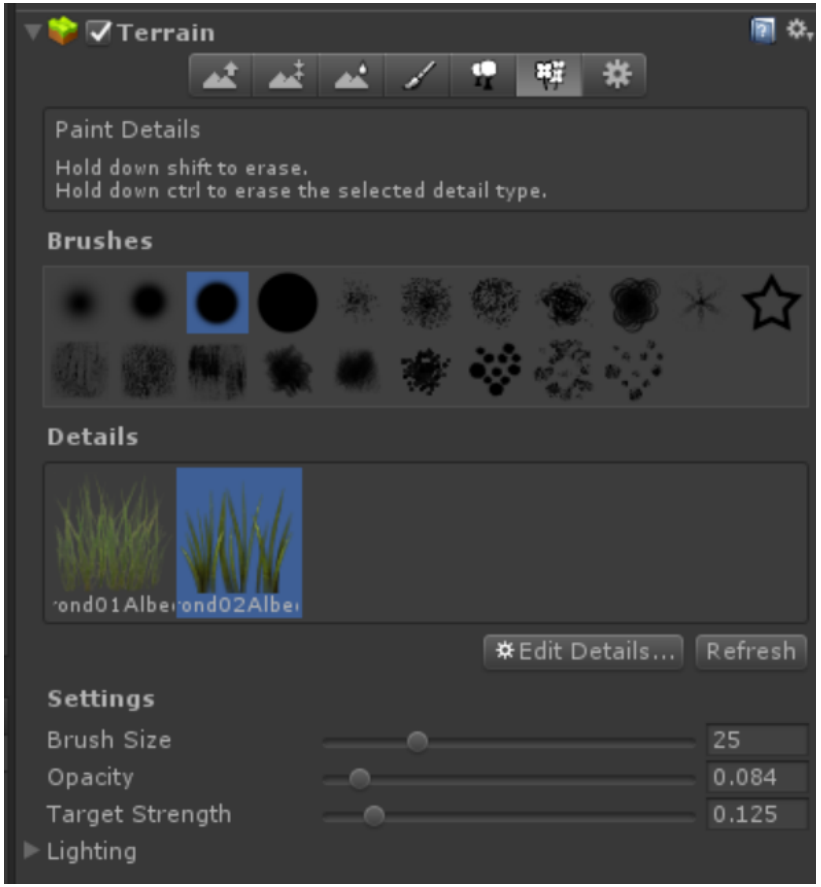
Changing the Size of Grass

- While adding grass you can also change its size
- Change the width and height



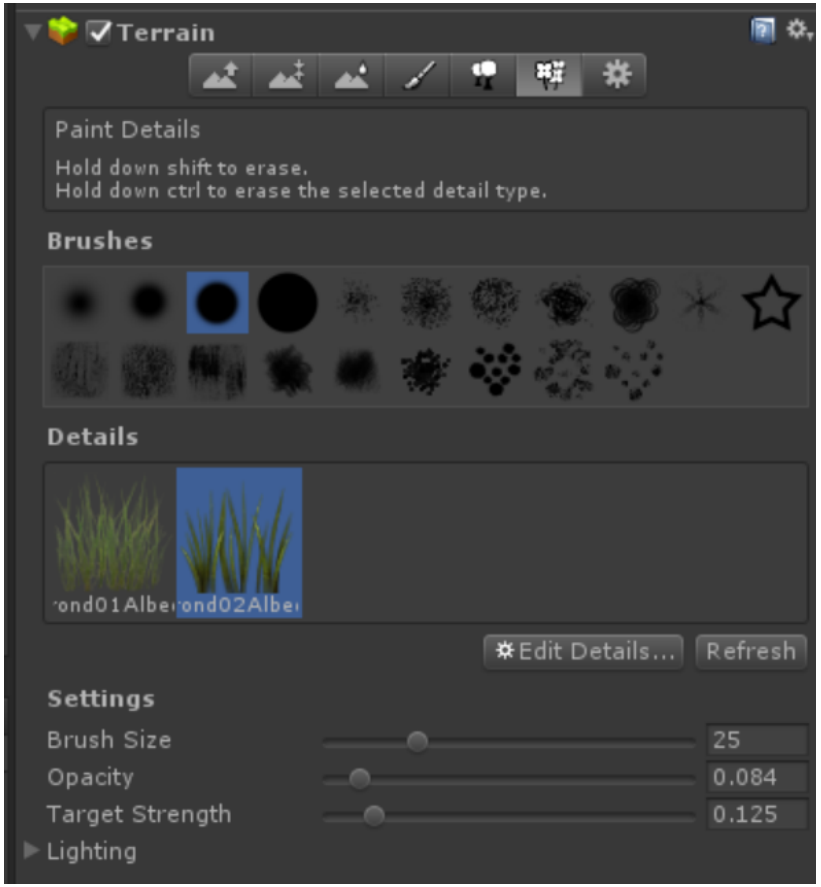
Grass

- Adjust brush size
- Opacity
  - The transparency of the brush
- Target Strength
  - The maximum opacity you can reach by painting continuously
- Hold Shift and Click to remove grass



Remove Grass

- Select grass type to remove under Details
- Hold Shift and then click to remove grass while painting



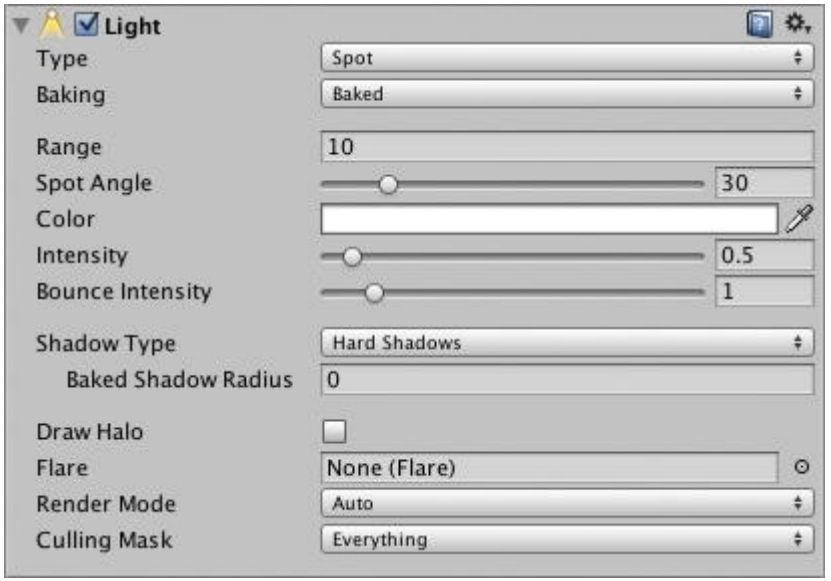
Water

- Unity includes several water Prefabs (including the necessary Shaders, scripts and art Assets) within the Standard Assets packages.
- Separate daylight and nighttime water Prefabs are provided.

- You can adjust position and scale based on your needs

https://docs.unity3d.com/Manual/HOWTO-Water.html

Lights



- Lights are an essential part of every scene
- Lights can be added to your scene from the GameObject->Light menu
- By simply changing the Color of a light, you can give a whole different mood to the scene.

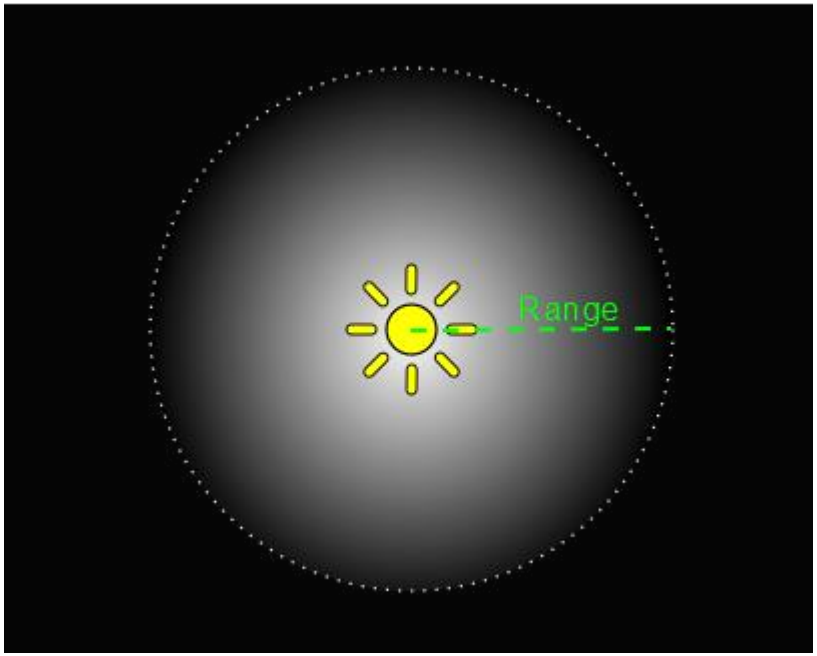
Types of Lights

- Point lights
- Spot lights
- Directional lights
- Area Light
- …

https://docs.unity3d.com/Manual/Lighting.html

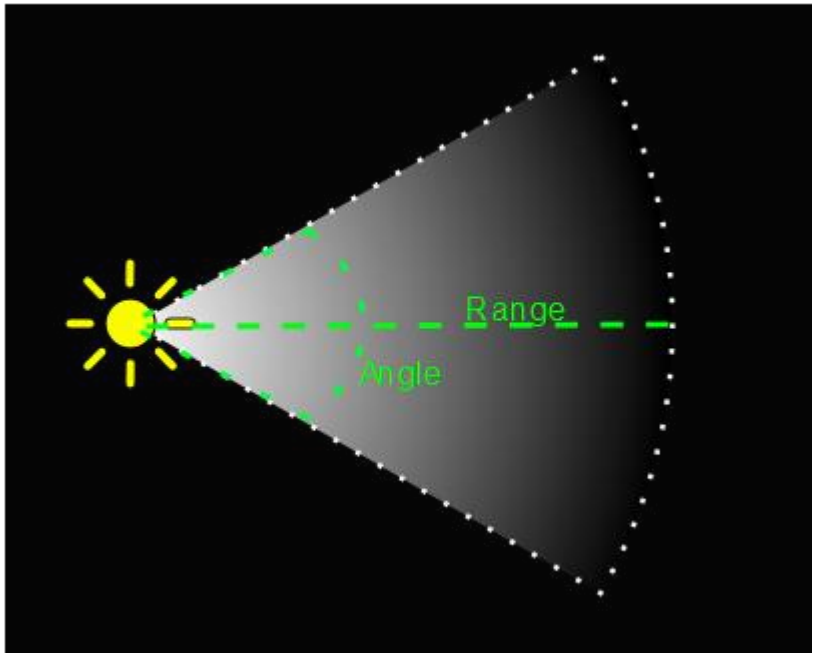
Point Light

- A point light is located at a point in space and sends light out in all directions equally



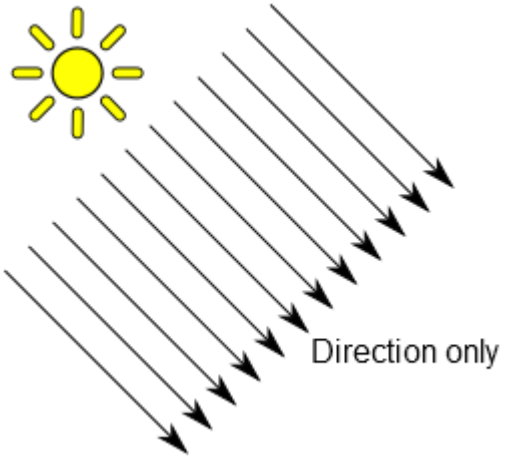
Spot Light

- Like a point light, a spot light has a specified location and range over which the light falls off.
- However, the spot light is constrained to an angle, resulting in a cone-shaped region of illumination.



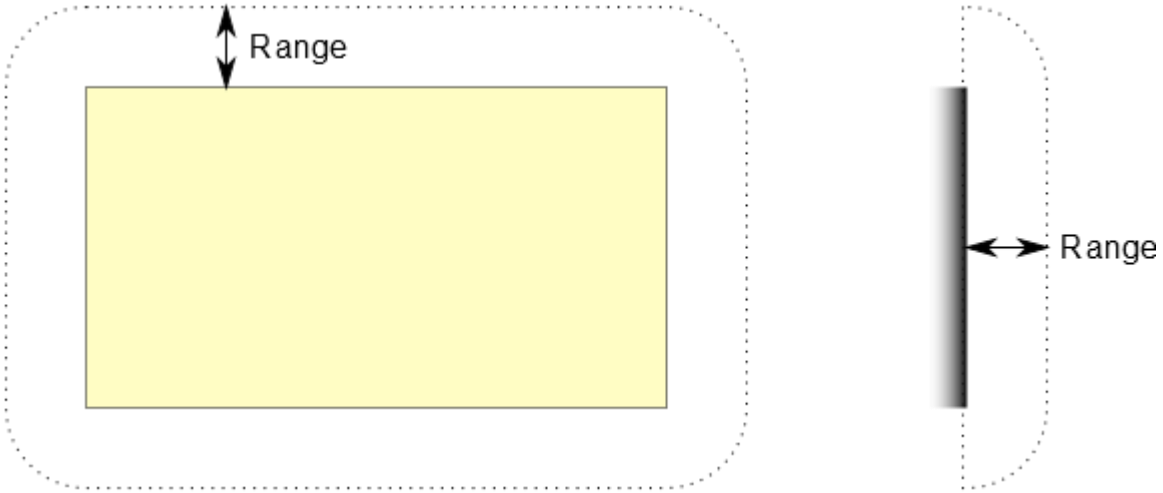
Directional lights

- Directional lights are very useful for creating effects such as sunlight in your scenes.
- Behaving in many ways like the sun, directional lights can be thought of as distant light sources which exist infinitely far away.



Area Light

- An Area Light is defined by a rectangle in space
- Light is emitted in all directions uniformly across their surface area, but only from one side of the rectangle
- Computationally Expensive



Summary

- Creating Game Environment
  - Terrain, trees, grass, water, skybox, Lights
  - First Person Controller

- Watch Videos
  - https://www.youtube.com/watch?v=eGu9_8HS2uI
  - https://www.youtube.com/watch?v=u5DNkxkXBeI
  - https://www.youtube.com/watch?v=OD88_KGYXbg