Terrain in Unity

Creating and editing outdoor landscapes

Programming – Game Development Foundations

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What is a terrain system?

- Terrains have some key differences from other 3D models.
  - Size, workflow, integration with trees and foliage

- A terrain system is a set of tools and components built to address these needs.

Size

- Terrains are often *huge* – many kilometres across!

- Inefficient to render as a normal 3D mesh
  - Lots of memory
  - Usually don't want to render the whole thing
  - Different detail required nearby vs. in the distance

- Terrain systems often dynamically create their meshes
  - Using terrain data
  - Based on player position and visibility
  - Detail up close, shapes only in distance

Workflow

- Terrain is often about level design as well as art

- Very useful to create and modify terrain in our level design tools rather than in our 3D packages.
  - Even a part of many games, eg: Minecraft

Detail integration (eg: trees and foliage)

- Terrain systems often feature support for grass, trees, and other dynamic detail
  - Often not efficient to build into normal 3D meshes
  - Can be efficiently rendered with specialised systems
  - Often useful to edit in the same workflow as the terrain

Types of terrain system

- There are multiple approaches to terrain systems.

- The most common are:
  - Heightmap-based (such as in Skyrim)
  - Voxel-based (such as in Minecraft)

Heightmap-based terrain systems

- In a heightmap-based terrain system:
  - Shape of the terrain determined by a “heightmap”, which is a 2D grid of height values.
  - Heightmap often stored as a greyscale texture.
  - Additional texture often used to assign visible textures.

- Characteristics:
  - Simple to implement
  - Very easy to work with for large areas
  - Does not directly support concave terrain, such as caves or overhangs.

Heightmap-based terrain systems

A screenshot from Double Fine's *Brutal Legend*, which uses heightmap-based terrain.

Voxel-based terrain systems

- “Voxel” means “volumetric pixel”

- In a voxel-based terrain system:
  - Shape of the terrain determined by a 3D grid.
  - Data stored in grid depends on terrain system. Often a “block type” or similar.

- Characteristics:
  - More complex to implement and work with
  - Does support concave terrain, such as caves or overhangs
  - Does *not* have to look “blocky” like Minecraft.

Voxel-based terrain systems

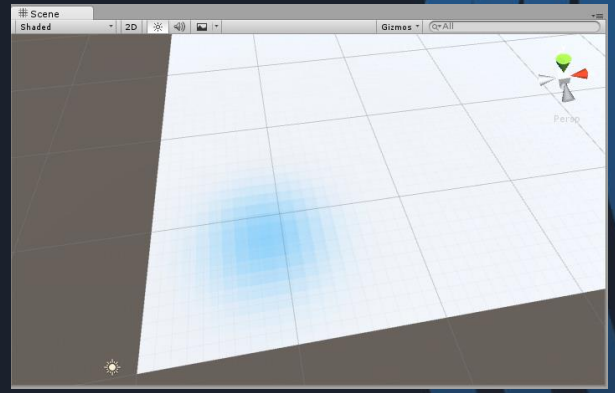
A screenshot from Mojang's *Minecraft*, which uses a voxel-based terrain.

Unity’s built-in terrain

- Heightmap-based
- Editing integrated with Unity’s Scene view and Inspector
- Starter pack of assets available from Unity via Asset Store
  - Ground textures
  - Grass
  - Trees
- Various voxel-based systems are available on Asset Store

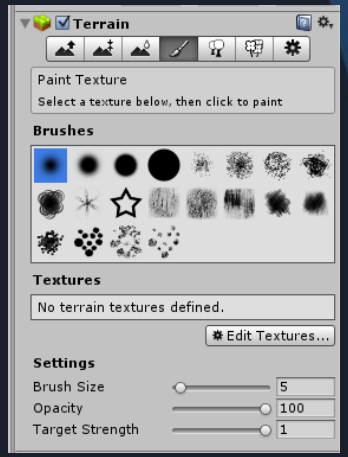
Creating a terrain

- To create a terrain:
  - GameObject -> 3D Object -> Terrain



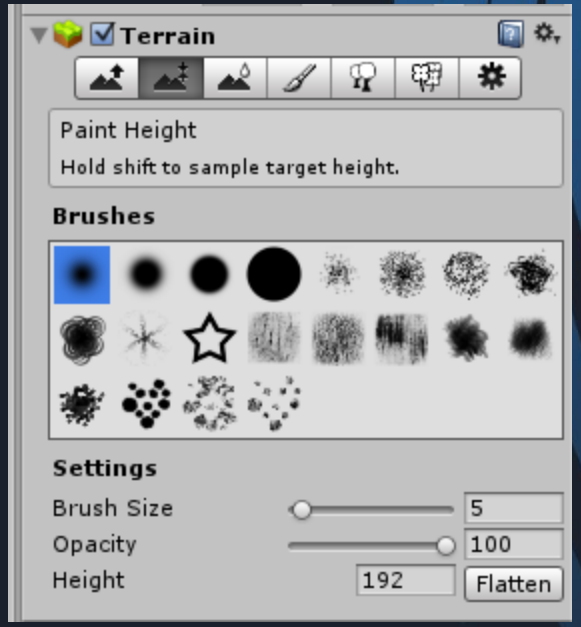
- Note that this will create a terrain asset in your Project folder.

- Selecting the terrain in your scene will show:
  - The Terrain Inspector panel
  - A “brush” when the mouse is over the terrain



Shaping the terrain

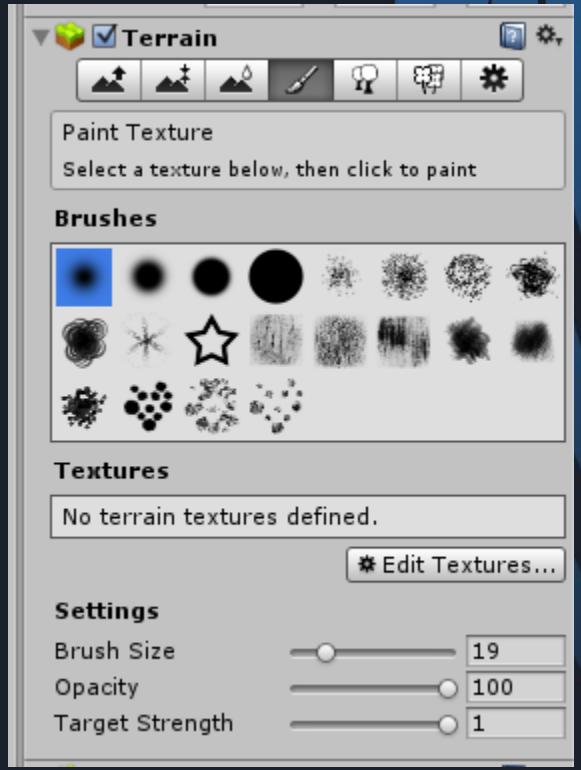
- First three tabs are:
  - Raise / Lower
  - Paint Height
  - Smooth Height



- Allow you to modify the physical shape of your terrain using the brush.

Texturing the terrain

- Fourth tab is:
  - Paint Texture
- Allows you to paint textures onto your terrain using the brush.
- Use “Edit Textures...” to add textures to use.

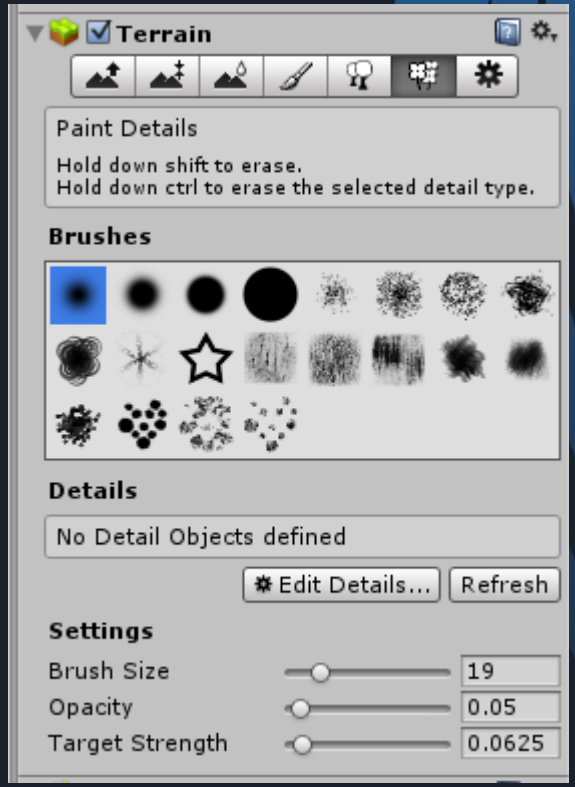


Adding details to terrain

- Fifth and sixth tabs are:
  - Place Trees
  - Paint Details

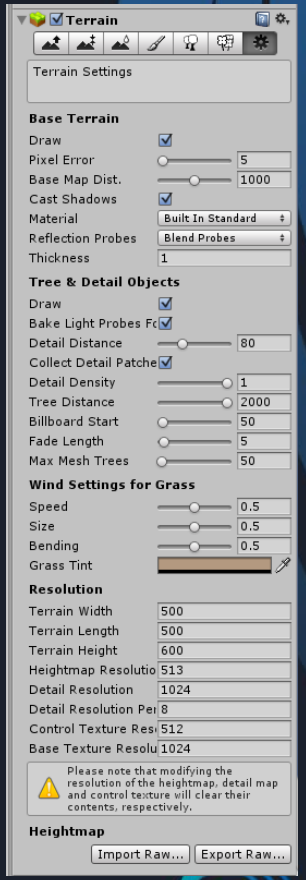
- Allow mass addition of trees, grass and other details to your terrain.

- Use “Edit Trees” or “Edit Details...” to add assets to use.



Terrain settings

- Final tab is:
  - Terrain Settings
- Allows us to change properties of the entire Terrain asset:
  - Size, resolution and detail settings
- Note that changing some settings can lose data!
- Can also export the heightmap to modify with other tools, or load heightmaps made with other tools.



Summary

- Terrain systems are tools and functionality designed for the special case of designing and rendering terrain
- Common terrain systems are heightmap-based or voxel-based
- Unity has a built-in, heightmap-based terrain system
- With the provided tools you can alter the height of the terrain, and paint textures, trees, grass and other detail onto it

References

- *Unity Manual*, Terrain Engine chapter, Unity Technologies, accessed 20/01/2015
  - http://docs.unity3d.com/Manual/script-Terrain.html