HPJ Pathfinding

Summary

HPJ Pathfinding Package is a pathfinding solution that is based on the Jump Point Search algorithm. HPJ Allows for multiple maps, with large amount of units and obstacles at speeds much faster than A*. HPJ does include basic Navigation Agents, and Navigation Obstacles that work with almost no setup. HPJ plans to add more functionality, QOL features, map types, and pathfinding types in the future.

Algorithm

Jump Point Search (JPS) has several benefits from A* Pathfinding.

- JPS is about 10-100x more efficient pathfinding algorithm.
- Longer paths scale much better at range then A*, receiving even better than 100x with a big enough Map.

Maps

Maps are the core of the package, you can easily move, adjust, paint obstacles and geometric features like Water, or more Tile Types you choose to add such as Mountain or Building.

Bridges

Bridges are an automatic method for Agents to move from one map to another. You can add as many bridges you need, The pathfinding will use Node Based Pathfinding to find which bridge to cross to get to a Map multiple bridges away.

Agents

Agents are fairly basic, they lerp from the Starting location to the Ending location. You can add the GroundCast.cs Class to have them attach the terrain, or ground. Agents will teleport to the closest Valid Tile to them if an obstacle moves into them and try to recalculate their path to their destination.

Obstacles

Obstacles are built in objects, but they are very simple. They change the tiles below them to Obstacle and as you move them they will adjust the tiles below them.

Future Features

I plan on adding more types of maps “Hex, Navmesh, 3D Navigation”, and more Map Adjustability like different axes, not just the XZ Axis. I plan to add Obstacle Avoidance for the Agents. I Plan to add Obstacles that adjust Tiles according to a 3D Mesh.Finally I plan to add more quality of life to all the existing features. Feel free to come into the HPJ Discord for feature requests.
https://discord.gg/jzWmVWa4JP

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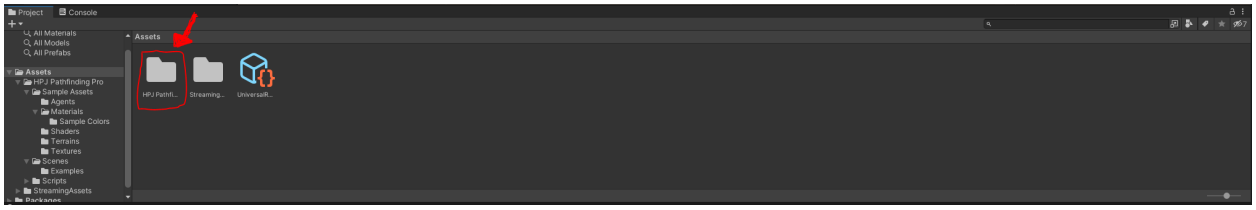
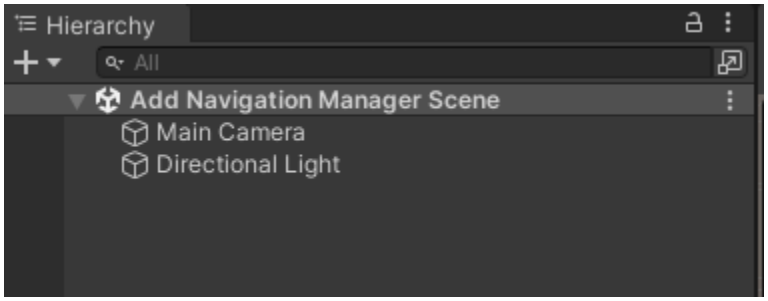
Getting Started

Getting started is very easy with HPJ pathfinding.

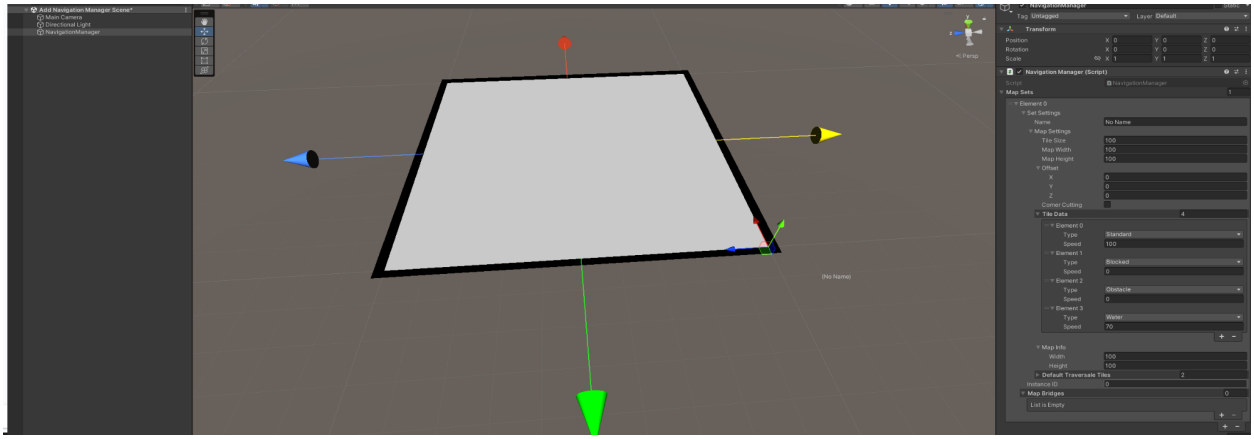
1. Import the package



2. Go to your desired scene and add a NavigationManager.cs to the scene.
    a. Note: You can only have one NavigationManger instance at one time, the rest will automatically be deleted.



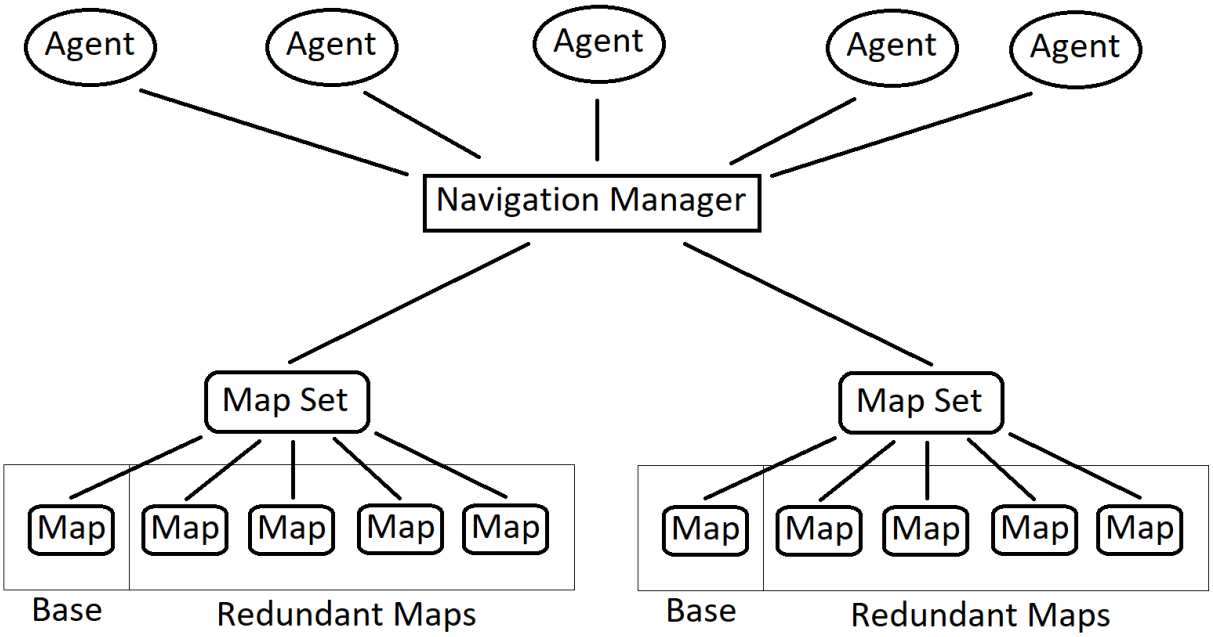
3. You're done! Now all you need to do is generate one map!



Navigation Manager

Using the Manager should be fairly simple and each section will be explained in each of their areas. If you go to your Manager Settings you will follow.

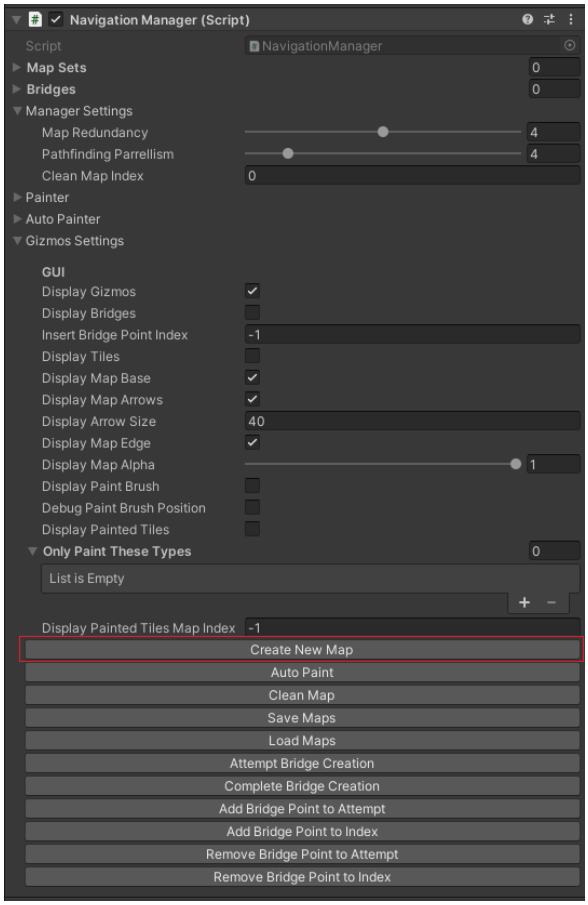
Map Redundancy is the amount of duplicate versions of each map you want made for each map. Each Map gets its own thread and the Pathfinding Parallelism is an additional amount of multithreading each map can use to pathfind more workers.



Maps

All the tools you will need are either on the Navigation Manager buttons, in the Map settings or on the GUI.

Map Creation

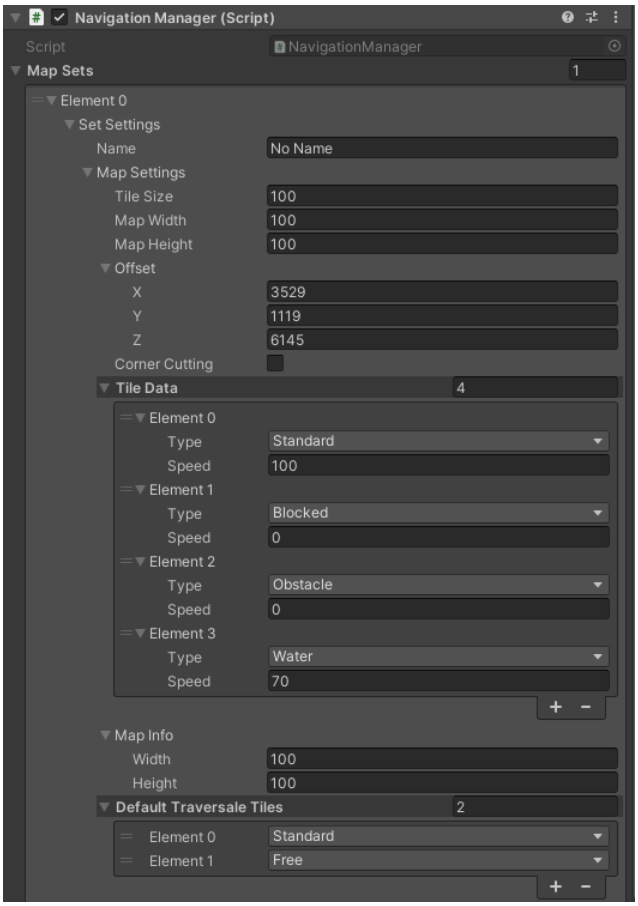


To create a new map you can just press the Create New Map button as seen in the image to the left.

Below you can manually adjust the map.
Tile Size and Offset are in cm NOT meters.
The Tile Data is the speeds in percent that Agents will move at while on top of that speed. Default is 100%.

Map Width is the tile count in the x direction
Map Height is the tile count in the y direction.

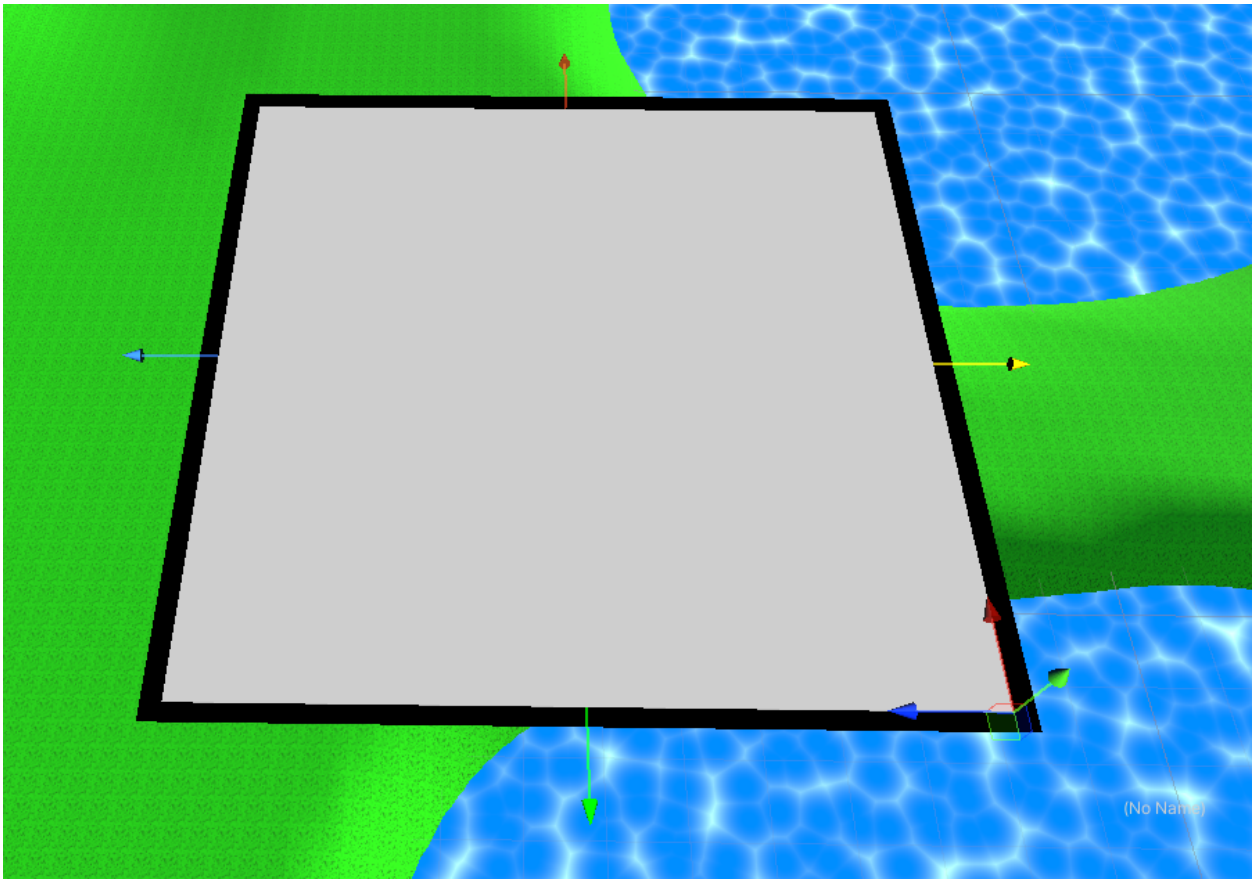
As seen below.



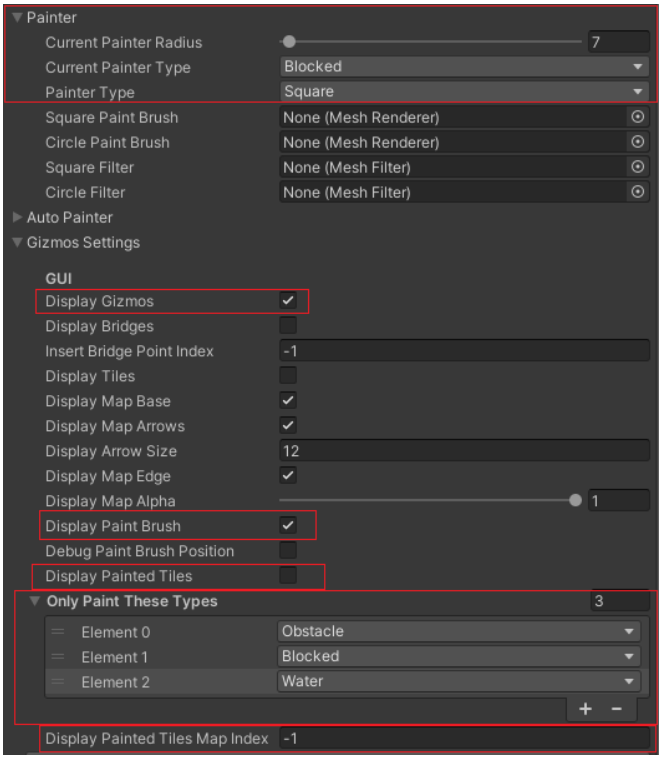
Map Adjustments

You can easily move your maps around with the transform handle on the corner of each map when the navigation manager is selected.

You can also resize the map by shift dragging the arrows on each side of the map



Painter

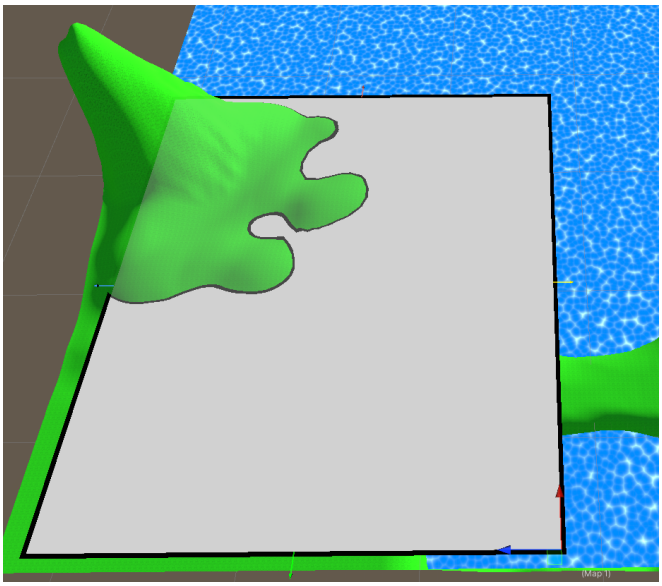


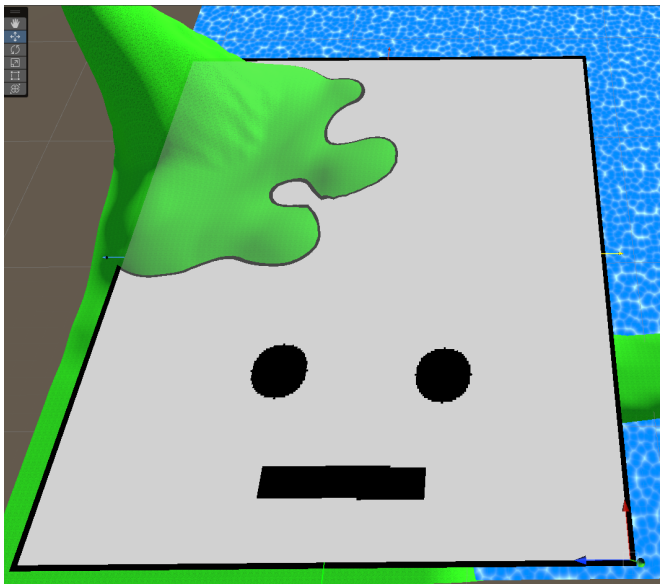
Before you start using the painter make sure in the Gizmos Settings that “Display Gizmos” is on,“Display Paint Brush” is on, and “Display Painted Tiles” is on. Make sure that you add tile types to “Only Paint These Types”. As Seen to the left

Also make sure that you have the Navigation Manager selected in the Hierarchy. As seen below.

To paint you need to make sure to shift left click. Then press and hold the “C” Key to paint or press and hold the “V” Key to erase. The paint brush will appear at the closest visible map you hover over.

You can adjust the shape and size of the paint brush as well as the paint type at the top of the painter.

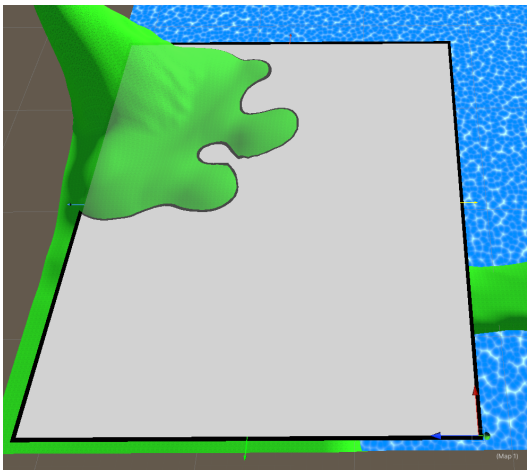


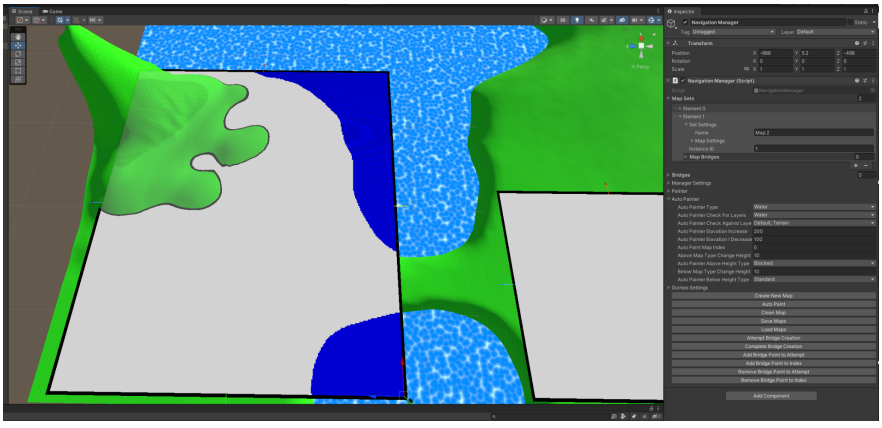


Auto-Painter

The auto painter is a tool for you to use so you can paint geometry, water or other features in your map without having to go in and paint it yourself. Simply fill out your settings and press the “Auto Paint” button.

- “Auto Painter Type” is the tile type you wish to paint if the RayCast hits the “Auto Painter Check For Layers”. It will not paint if it hits the Against layermask “Auto Painter Check For Layers”
    - Elevation Increase is the distance the RayCast jumps above the map height to start the RayCast
    - Elevation Decrease the the distance the RayCast jump below the map height
    - Map index is the Map you wish to Auto-Paint
- “Above Map Type Change Height” is the height above the map height where you can get a specific tile change base on elevation difference. Good to use to mark out mountains.
    - “Auto Paint Above Height Type” is the tile type the above elevation check will change too
- “Below Map Type Change Height” is the height below the map height where you can get a specific tile change base on elevation difference. Good to use to mark out holes.
    - “Auto Paint Below Height Type” is the tile type the below elevation check will change too



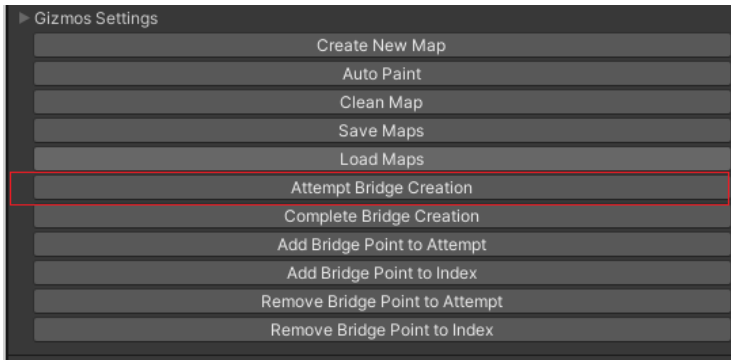


Bridges

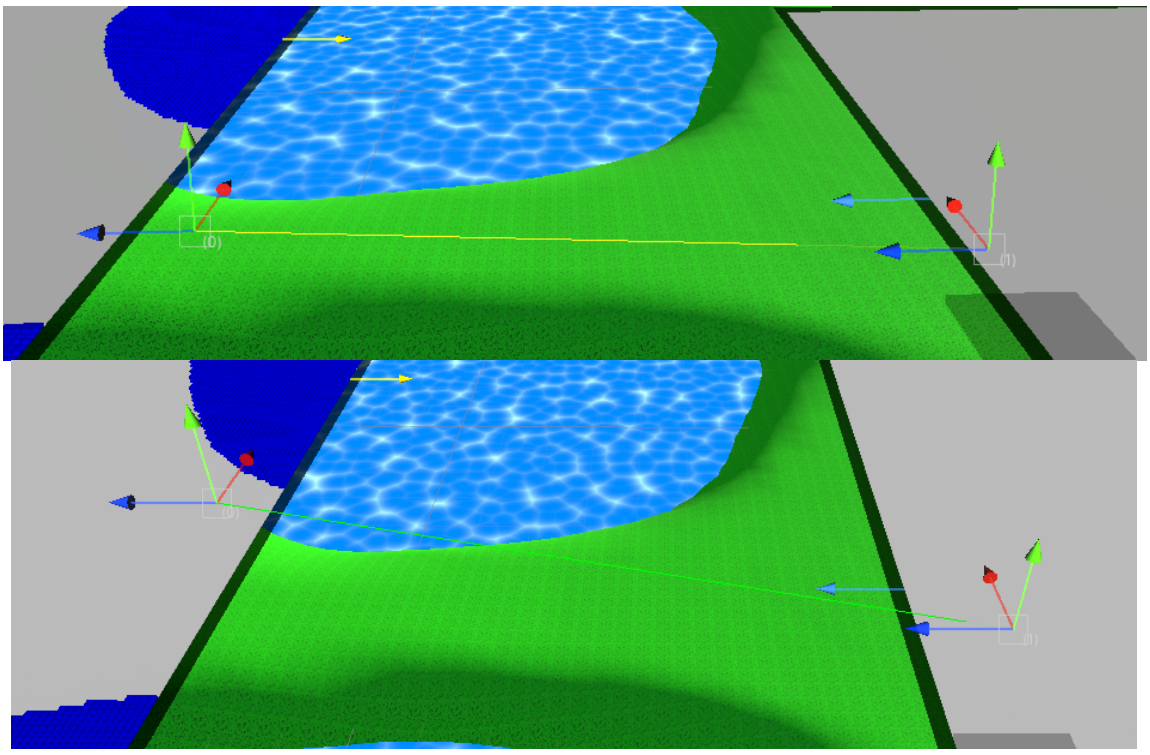
Bridges are a way for your agents to move from one map to another, and if need be another and another till it gets to the map the agents map is at.

Note: The bridge entrance points need to be kept clear and must be able to be pathfound too are the pathfinding will fail.

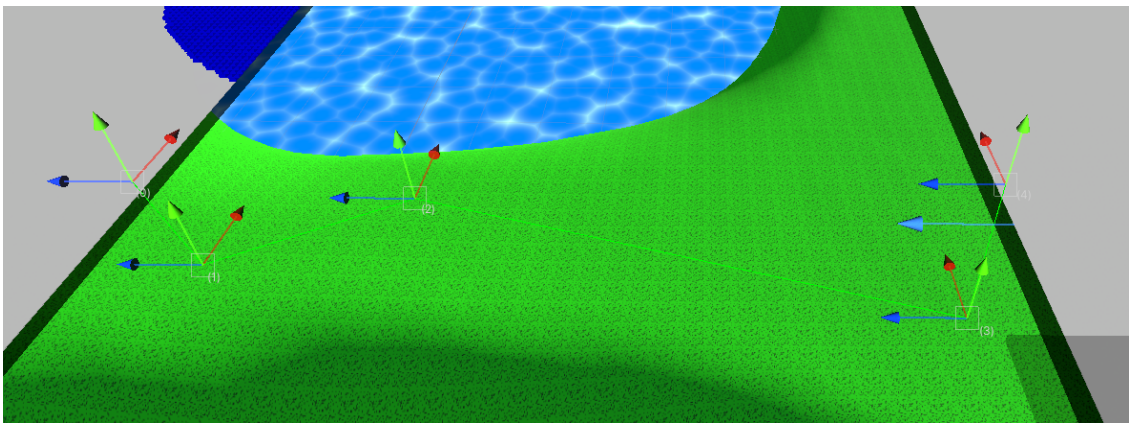
1. To create a bridge you have to click the “Attempt Bridge Creation” Button to start. Note: Make sure that “Display Bridges” in the Gizmos settings is on.



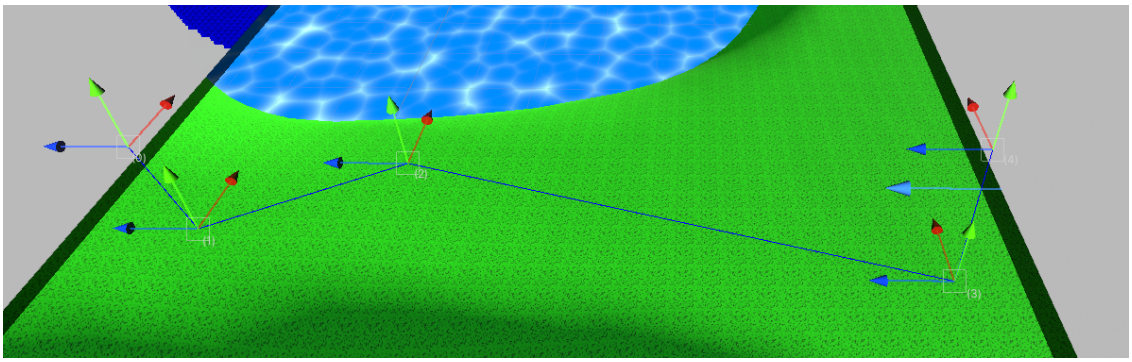
2. Then you must move index 0 point of the bridge to the one map, then you must move the last index point to a different map. You can use the transformation handle to move them. Note: The map it assigns itself to is the one its closest too. The x and z coordinates also must be within the bounds of the map. A valid bridge will be connected by a blue or green line, while a invalid bridge will be connected by a yellow or a red line.
3. Note: Currently you cannot delete bridge points. Have to deselect the navigation manager and start again.



4. You can now add intermediate points by pressing the “Add Bridge Point to Attempt” to add in points. They can also be moved with their transform handles.

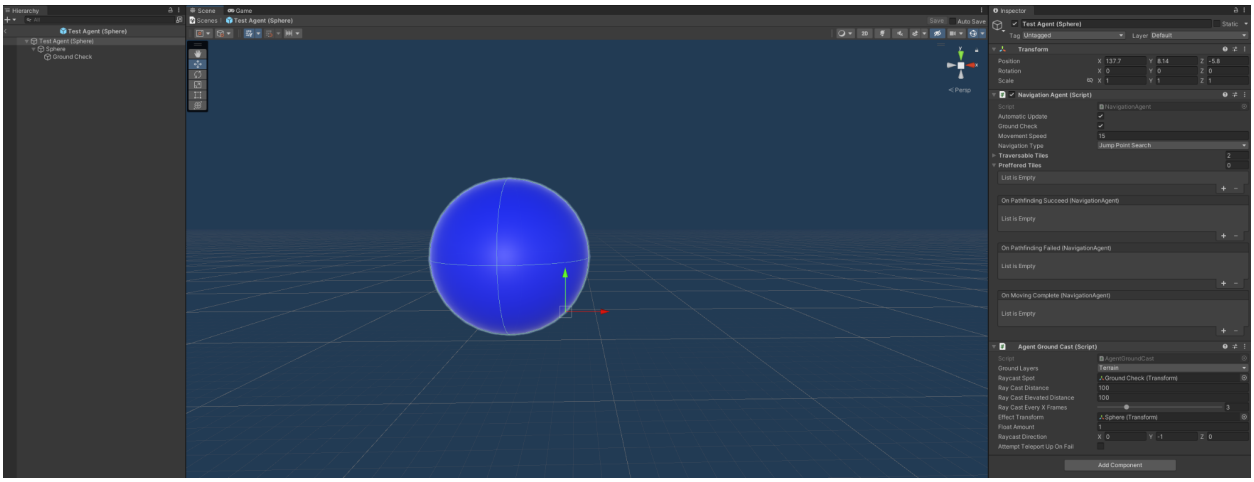


5. Finally press the “Complete Bridge Creation” button to finalize the bridge. After this point you can always adjust the bridge as needed. Adjust the “Insert Bridge Point Index” to add a bridge point to the bridge at that index. You will know you succeeded if the bridge line has become blue.



Navigation Agents

Navigation Agents are simple. All you need to do is add the NavigationAgent.cs script to the gameobject you wish to move. Make sure you spawn your agents within the bounds of a map, if not then any pathfinding will be void.



The navigation agent will automatically work as long as there is a navigation manager in the scene. You can call Agent.SetDestination(); to move the agent.

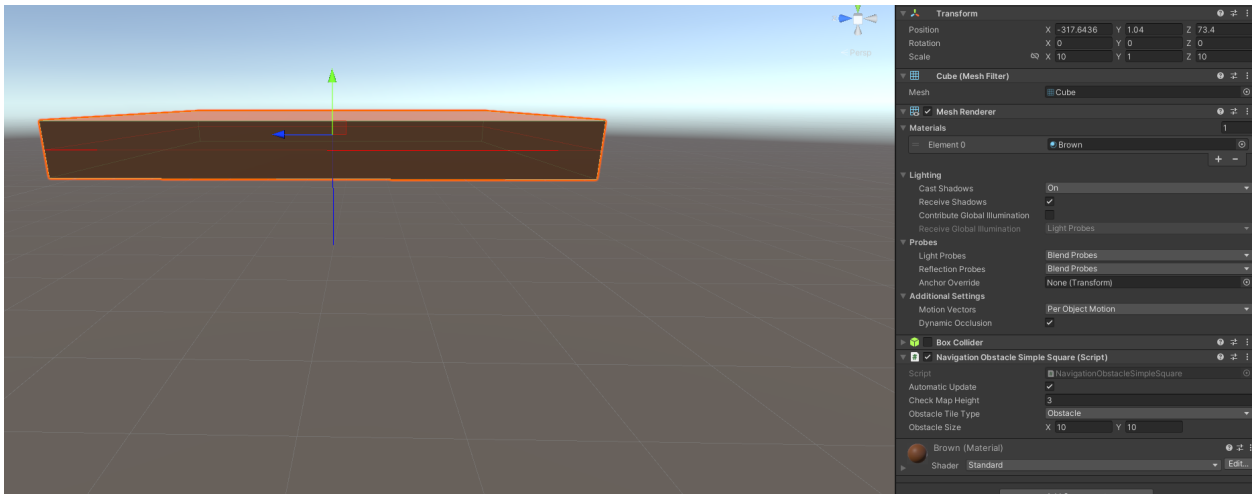
```
1   using UnityEngine;
2   using HPJ.Presentation.Agents;
3
        Unity Script | 0 references
4   public class SamplePracticeScript : MonoBehaviour
5   {
6       public Vector3 Destination = new Vector3();
7       public NavigationAgent Agent;
8
            Unity Message | 0 references
9       public void Start()
10      {
11          // Sets the Agents Destination
12          Agent.SetDestination(Destination);
13
14          // This can be called seperately if you don't want the agent to move itself
15          Agent.AutoUpdateAgent();
16      }
17  }
18
```

Further Agent documentation to be added.

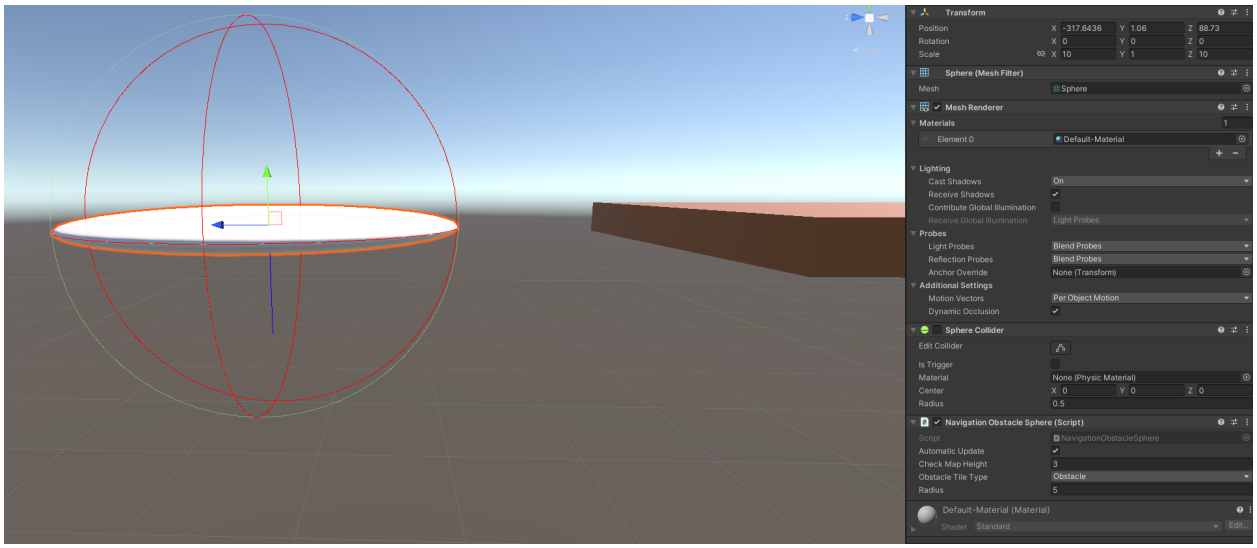
Navigation Obstacles

Navigation Obstacles are objects you can put on prefabs or scene objects to adjust the tile around them. Currently you can use NavigationObstacleSimpleSquare.cs or NavigationObstacleSphere.cs.

Squares allow you to change their width and height. The “Check Map Height” is the height above the object where it will count as on that map. You can be ontop of multiple maps at once. “Obstacle Tile Type” is the type the tiles will become.



The navigation obstacle sphere works very much like the square, but with a radius instead.



FAQ

Q: Where can i go to request help, or ask questions

You want to report a bug, ask help or request features? Come join us at out at our discord!
https://discord.gg/jzWmVWa4JP