Responsive Spatial Audio for Immersive Gaming

Introduction

Responsive Spatial Audio for Immersive Gaming is a powerful easy to use toolkit which allows you to develop accessible 3D games for blind players with only a few clicks. Find our paper published in ASSETS here.

For list and details on GameObjects and Components which help you build accessible games, you might find the *Description* section useful.

If you'd like to dive right in, check out the *Quick Start* section.

For the key mappings, check the *Controls* section.

Commonly known issues and their solution is mentioned in *FAQ* section.

Description

Description of GameObjects:

Accessible GameObjects are self sufficient entities which provide a set of accessible functions. All the functions are parameterized and programmable. These can be found in the GameObjects→Accessibility menu item in Unity editor.

1. Accessible FPS Controller – GameObject
   FPS controller script is attached to this Object which controls the movements of the player.

- Annoucer: Screen Reader script uses this as the audiosource for text to speech for metadata at various places in the game. Transform of annoucer is linked to the parent object
- BodyScanCamera: The viewport of this camera is the extent of the BodyScan coverage.
  - Script – Alt Body Scan Camera:
    Function of the script is triggered when the bodyscan angle (Frustrum) is changed
- FirstPersonCharacter:
  - Camera attached to this is the main camera and game frustum.
  - Script - Inventory Reducer – Handles the number of items you can carry. You can specify the maximum number of items to be allowed
  - Script - Slow Motion Reducer – Handles changing of the game speed to slow motion
  - Script – Environment Scanner – Handles the Body Scan and Select and Reach feature of the game. Scans the objects in the frustum and on selecting an object, guides the player to the object using spatial sound and NavAgent.
  - Keyboard Event Dispatcher – Checks each frame for keyboard events
  - Close Eyes – Blacks out the screen to play without visual cues

2. Bump Noise Manager – GameObject

- Script – Bump Noise Manager – Tracks the First-Person Controller and produces a bump sound when it collides with an object at collider hit point of controller.

3. Vantage Point – GameObject
   This adds a box collider with an audio description at POIs in the game. Different descriptions needed to be given depending on the entry point into the box collider.
4. Vantage Point Handler – GameObject

- Script – Vantage Point Handler – Script aligns the First-Person Controller to a vantage point using spatial beeping sound, with an orientation dependent pitch

5. Nav Agent – GameObject
   Its an AI path finder which leads to your selected accessible object from a BodyScan. It bakes a default NavMesh. To tweak the NavMesh check the Navigation tab
6. Music Manager – GameObject

- Script - AudioManager – Script to change or play audio based on the building/location the user is in. Also, change the audio pitch with the game speed.

7. Inventory UI – GameObject
   It gives you an inventory UI which can be further tweaked to be used as an accessible game UI.
8. Audio Compass – GameObject
   This tool helps in indicating the global North and South in the game and is available on demand of the player. There is an option of reading the directions verbally in a spatial manner

- Script – Alt North South Sound
    - Audio Clip of North and South sound can be changed
    - Distance between the north and south AudioSource positions can be changed
    - Volume of sounds can be changed
    - Wait between the playing of north and south sound can be changed.

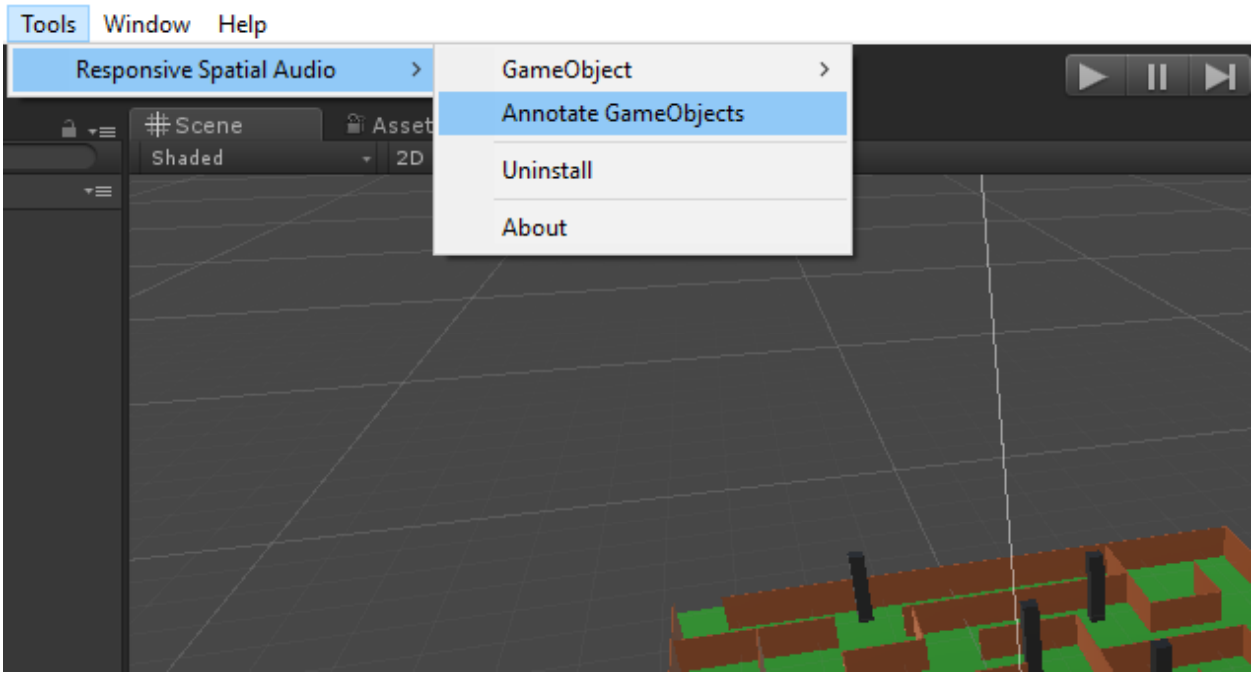
Description of Components:

Accessible components make existing GameObjects accessible. These can be found in the Components→Accessibility menu item in Unity editor.

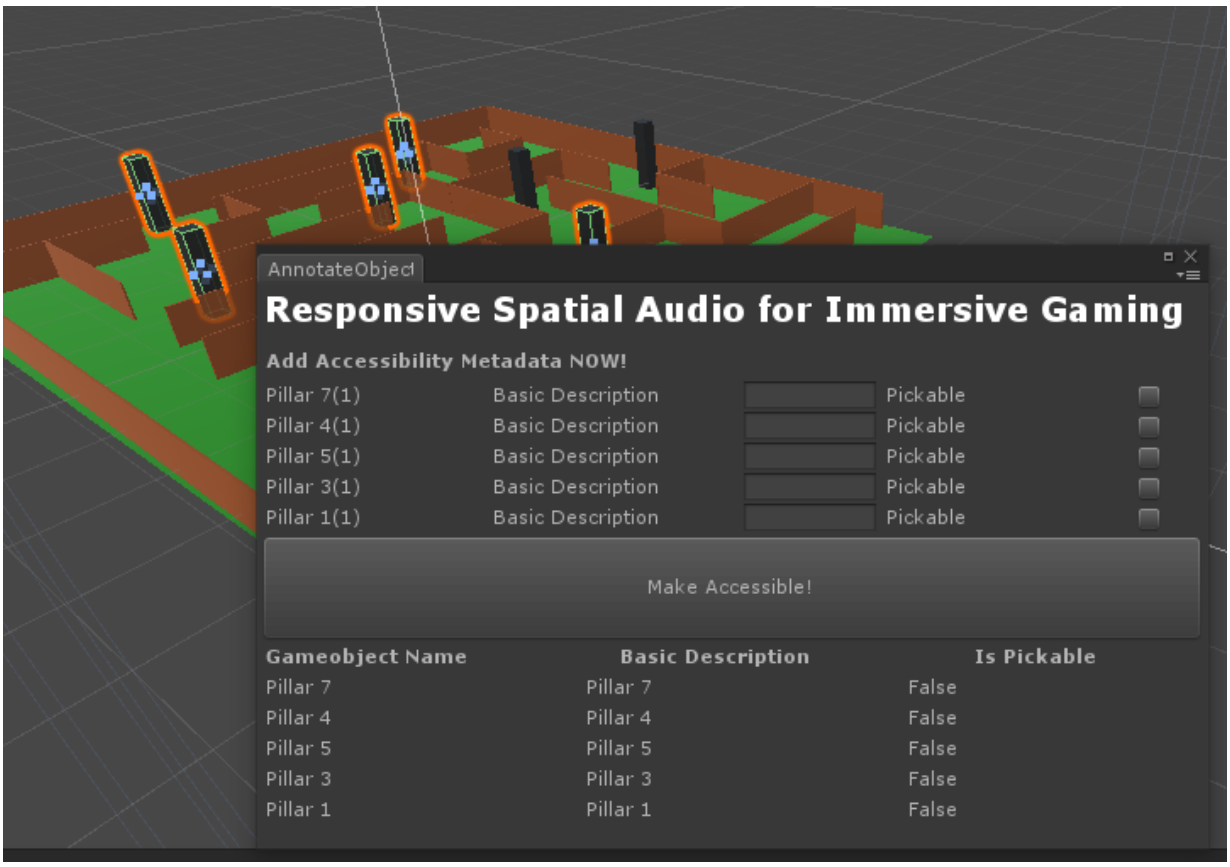
- Accessibility component – Makes any GameObject accessible. It adds Accessibility Metadata script for storing the metadata of the GameObject, Accessibility Sound Generator for generating temporary wave files to be played by the object when it comes under bodyscan or bumped and an Audio Source for playing the metadata attached to the GameObject spatially
- Pickable – It makes a GameObject pickable, pickable objects are spoken out in a different tone in bodyscan. This stores the inventory metadata of the GameObject.

Description of automation tools:

Annotate GameObjects tool helps in adding metadata information to your scene an effortless process. This can be found under the Tools → Responsive Spatial Audio menu.



Annotate GameObjects helps in adding metadata to multiple GameObjects straight from the editor window. To do so follow the following steps:



Step 1

Click on the GameObjects you want to make accessible, you can select multiple objects by Ctlr + Click

Step 2

The selected GameObjects will show up in the Annotate GameObjects tool. The top half lets you add/modify accessibility information and the ability to make it pickable and show the number of similar items selected (similar items will get the same basic description). While, the bottom half shows the state of accessibility of the selected items. These are not grouped like the former and can be seen individually.

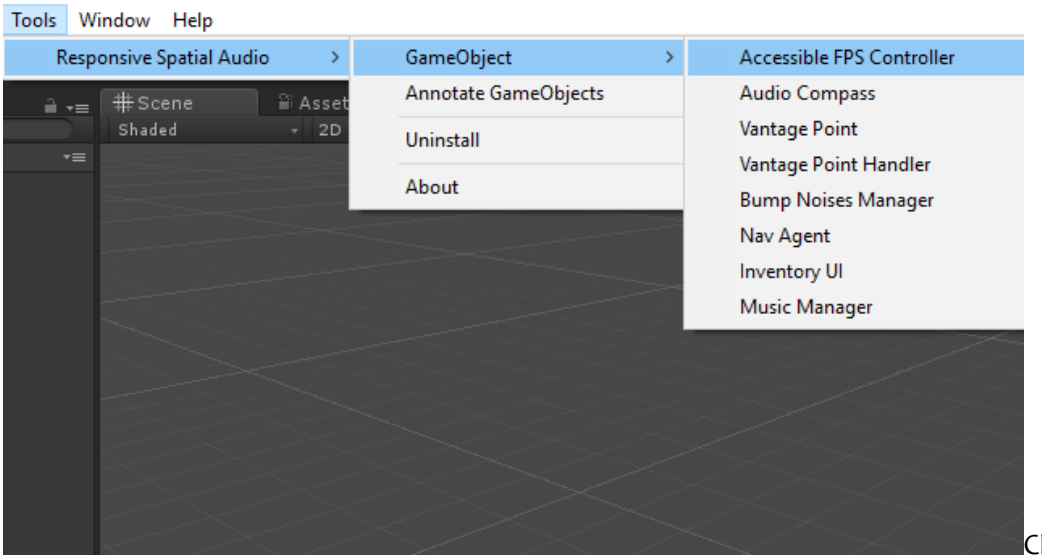
Step 3

Make the necessary changes and click the *Make Accessible!* Button. The changes will reflect to the selected objects in the bottom half and the necessary scripts with appropriate data will be added to the selected GameObjects.

Quick Start

Here is how you setup an accessible FPS game quickly – without unnecessary explanations or fine-tuning

Step 1

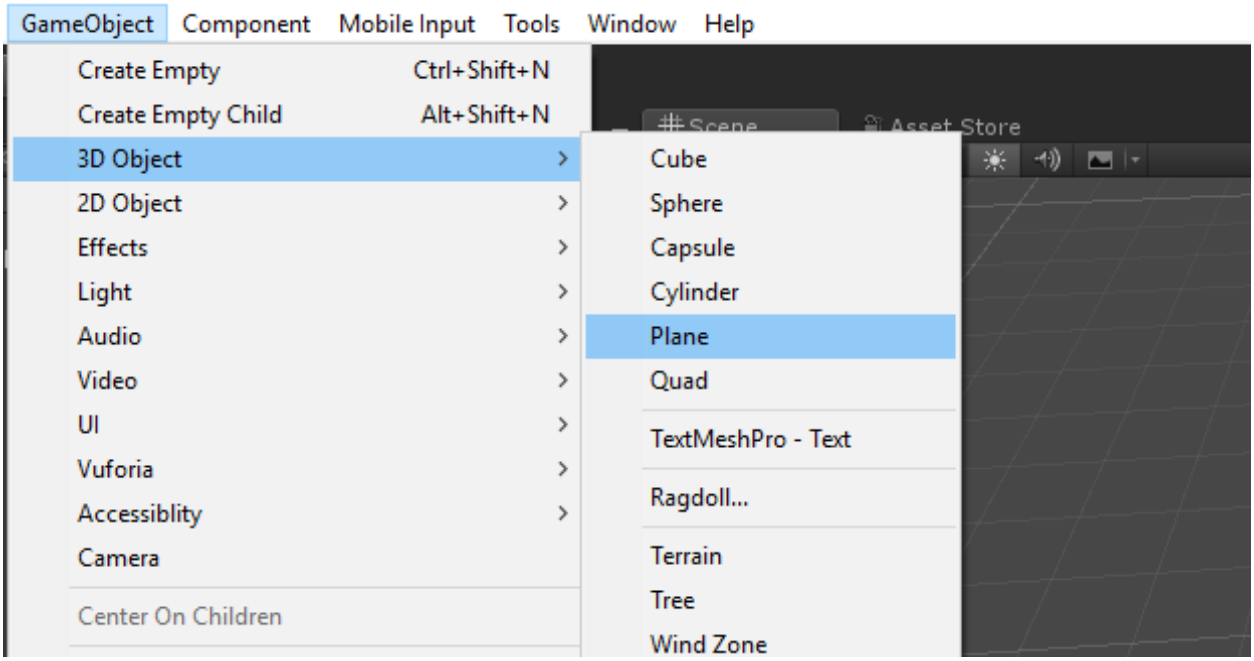


Click GameObject from the menu bar and go to Tools → Responsive Spatial Audio and click on AccessibleFPSController, and delete the existing MainCamera from the current Scene

From the Responsive Spatial Audio option continue clicking on BumpNoisesManager and AudioCompass

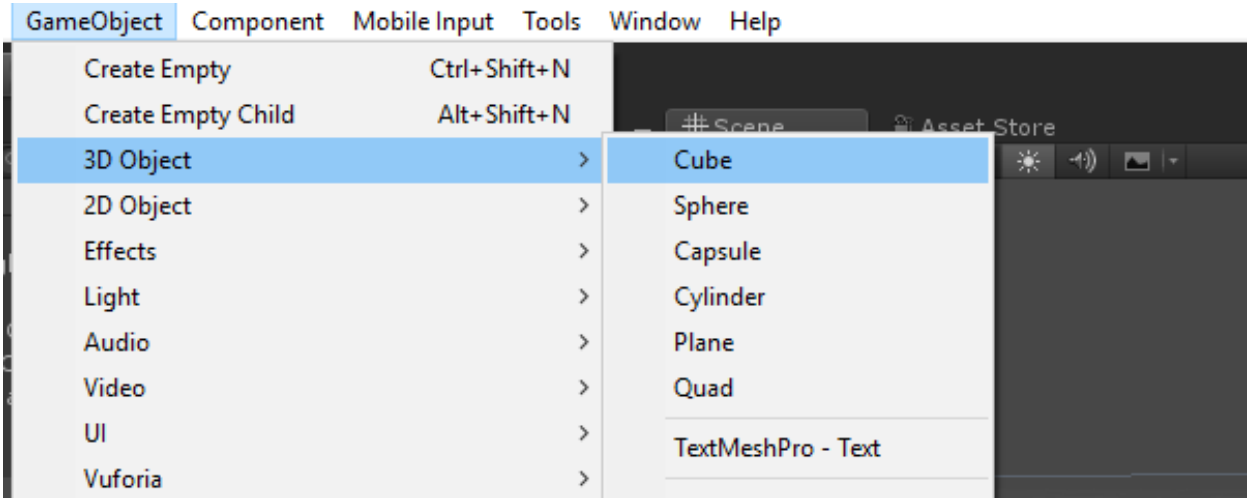
You can play around with the settings later. For most purposes, the default settings will be fine.

Step 2



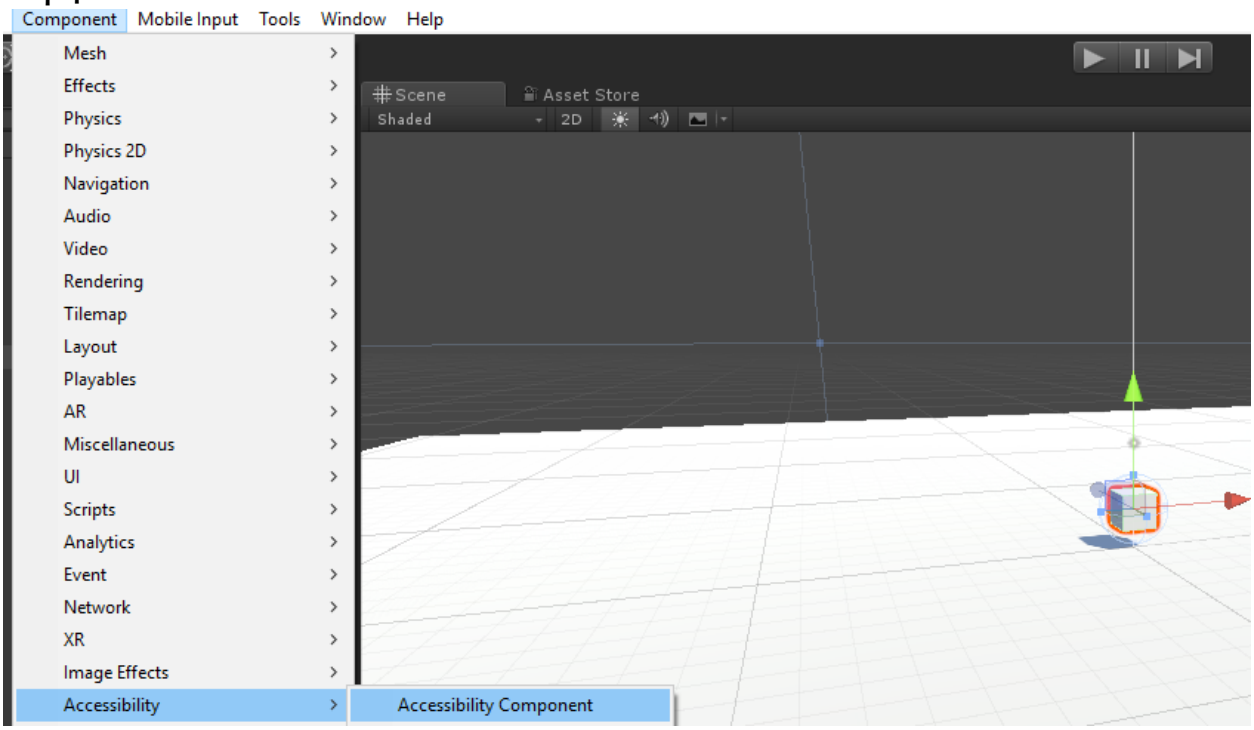
Import a basic shape like a plane or a terrain to give a base for GameObjects to rest on. Resize the plane/terrain to accommodate your player and additional basic objects

Step 3



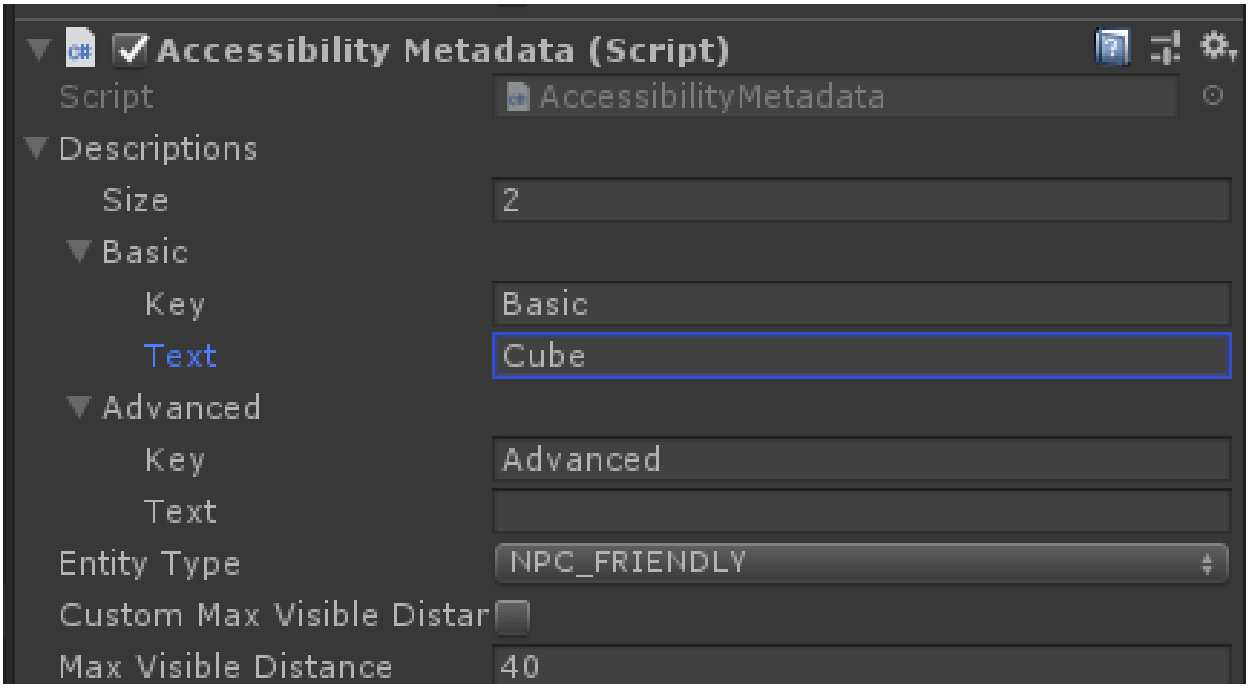
Import your own models or basic shapes given in Unity

Step 4



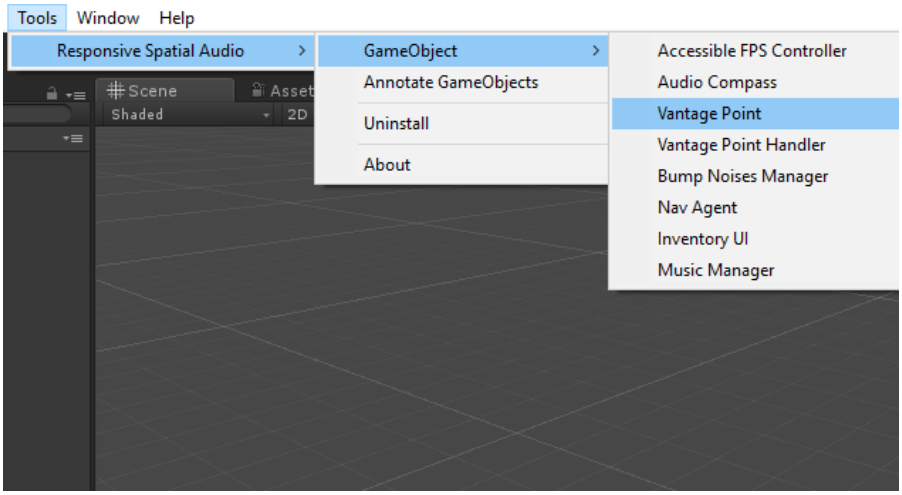
With the GameObject selected in the Hierarchy menu, goto Component → Accessibility and click on Accessibility Component

Step 5



Add meta data information in Accessibility Metadata component attached to the GameObject in the Inspector window

Step 6



Click GameObject from the menu bar and go to Accessibility and click on Vantage Point. Reposition this green wirefame wall and add appropriate information to what can be seen from the facing direction and the opposite direction. For more details on the GameObjects, check the Descriptions section.

Click play button in the Unity Editor. You can initiate bodyscan by pressing the left analog stick on your Xbox One controller, while the bodyscan is going on, press the left analog stick to select the object just spoken out in the bodyscan. A navigation agent(NavAgent) will appear guiding you to the selected object. If you bump in an accessiblie object metadata associated with the object is played.

If the vantage point lies in vicinity a prompt saying vantage point available will be heard and beeps to orient you to the vantage point will start playing.

Controls

Controls are mapped to Xbox One controller and few accessory controls to the keyboard, these can be modified in the *Actions.cs* script found in Assets→Scripts→Dispatch folder

Left Analog Stick – Move in the direction of the Analog stick

Right Analog Stick – Rotate the head of the in game player or change view angle

On click Left Analog Stick – BodyScan

On click Right Analog Stick – Select and Reach

Y (Xbox) – Pick up a pickable object

A (Xbox) – Activate audio compass

X (Xbox) – Spatial direction callout

F – Reduce BodyScan angle

G – Increase BodyScan angle

H – Increase BodyScan radius

J – Decrease BodyScan radius

C – Toggle blind mode (Removes all visual output)

FAQ

Q: Why does the text to speech engine doesn't work after building the game?

A: You'll need to copy the text to speech engine from the project files into the game data folder of your built game. Simply, copy the *ExternalCMD* folder, found in the assets folder and copy it into your game data folder.

Q: Why does the FPS controller doesn't move using the joystick analog sticks?

A: You'll need to map the Xbox one controller's joystick axis in the Unity editor. Go to Edit-> Project Settings -> Input and add two new entries. The details of which should look as shown below: