

3D sound for Unity: the SteamAudio package

0) Introductory word

We will work with the Unity package, version 2020.3.x. I assume here that the Unity basics on 3D object manipulation and simulation are known. Please use headphones to get maximum effect regarding sound rendering.

1) Install SteamAudio

Download the SteamAudio package for Unity in

<https://valvesoftware.github.io/steam-audio/downloads.html>

Open a new Unity project and import the package `SteamAudio`. A `SteamAudio` tab will appear in your unity interface. Nothing else to do now.

Documentation is

<https://valvesoftware.github.io/steam-audio/doc/unity/index.html>

2) Simple Audio Setup

We need 2 things:

a) Sound Source

Create an object (anything will do, from a small sphere to any object imported via the Asset Store). Add a `AudioSource` component (`Component>Audio>AudioSource`) to it.

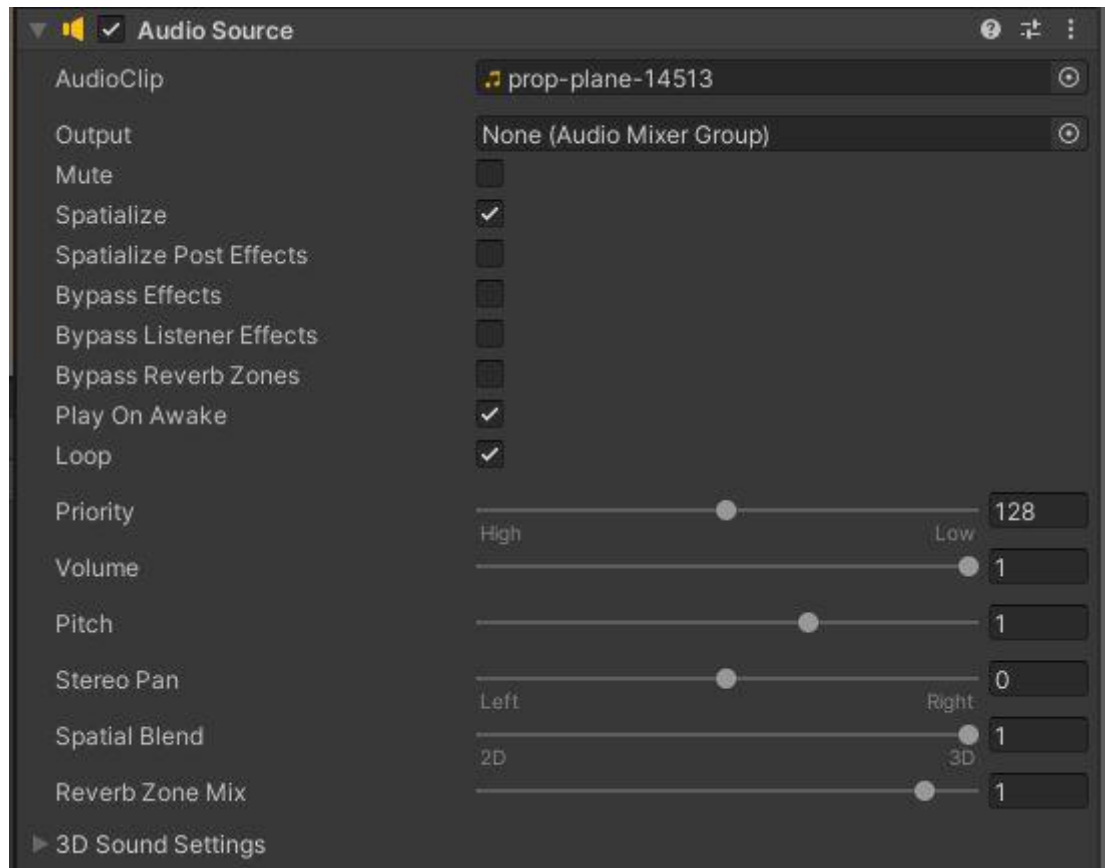
Refer to <https://docs.unity3d.com/ScriptReference/AudioSource.html>

You will need a sound audio clip to play. Many resources are available online, for example:

<https://freesound.org/>

Activate “Loop” option to make sure you will hear something continuous. In this example I selected a sound of an engine, but anything will work.

Note that although the “Spatialize” option is selected, no real 3D audio effect is available at this point because unity does not have a default spatializer. We will go through the spatializing process later.



b) Audio Listener

We need something to listen to the sound (ears). This is achieved with a `AudioListener` Component, attached to any Unity object. BUT:

- An `AudioListener` is created with a camera by default
- Only ONE `audioListener` may be active at any given time (Unity console will warn you about this if this is not the case).

Your scene has a `MainCamera`, with an `AudioListener` attached, so nothing to do: you will hear the sound as if you were located at the camera's location (conveniently this is also the place of visual rendering). By default, the system will render the same sound for both ears (mono).

Now press "Play": you should hear the sound coming from the sound source as a "flat" sound.

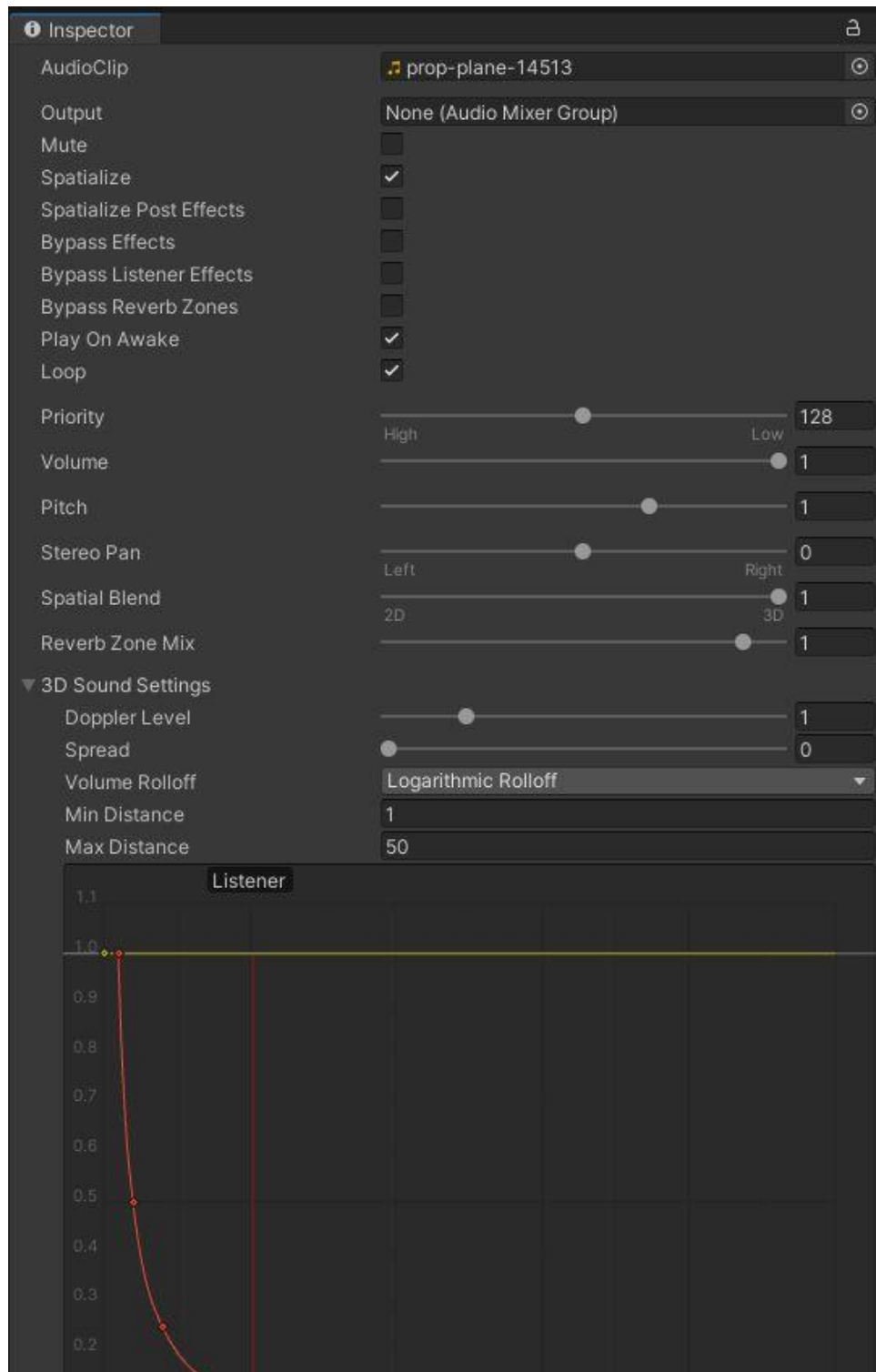
3) Spatializing Sound

Getting 3D sound is a two-step process:

a) Adjusting 3d options in the AudioSource

This step is necessary to get the basic 3D information to the sound listener

- Check the “Spatialize” option
- Set the “Stereo Pan” to zero (balance left/right ear)
- Set spatial Blend to “1” (default is zero, i.e. no 3d)
- Adjust 3d settings: you can increase/decrease Doppler effect, and adjust Volume Rolloff (decreasing with distance). Default values are ok, but you can adjust the Min and Max distance rolloff depending on the size of the scene and motion of objects. D

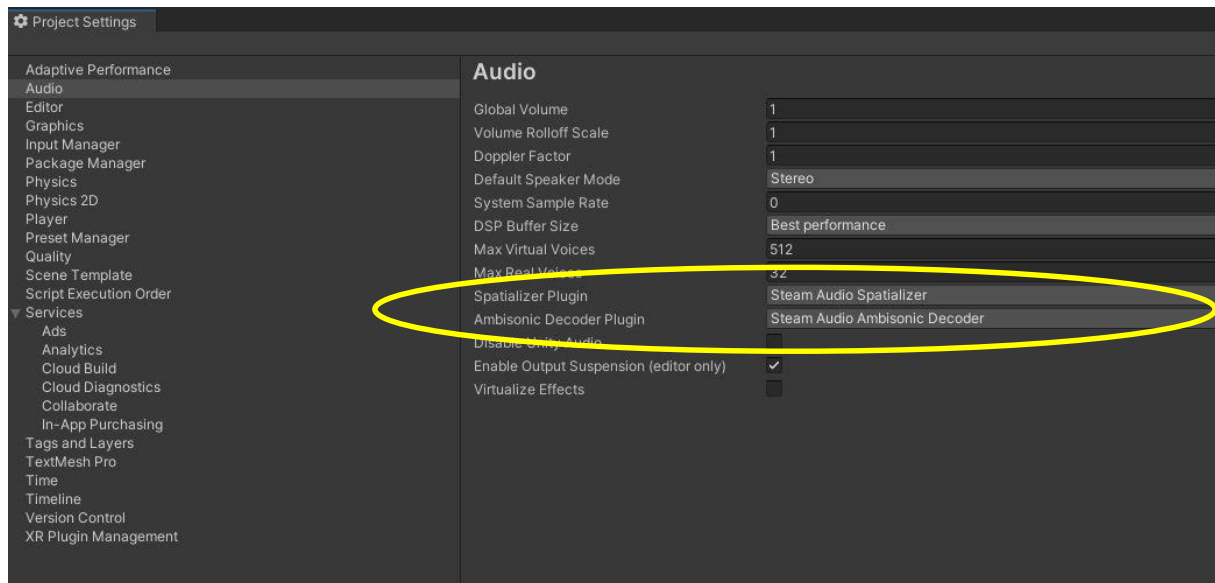


Note: Doppler effect will only be noticeable with audio source moving quickly.

b) Adding sound spatializing effects

We need a little more work to obtain “true” 3D sound effects (distance, azimuth, elevation and occlusions).

First, set the global Audio Settings of Unity to select the proper (Steam) Spatializer for rendering:



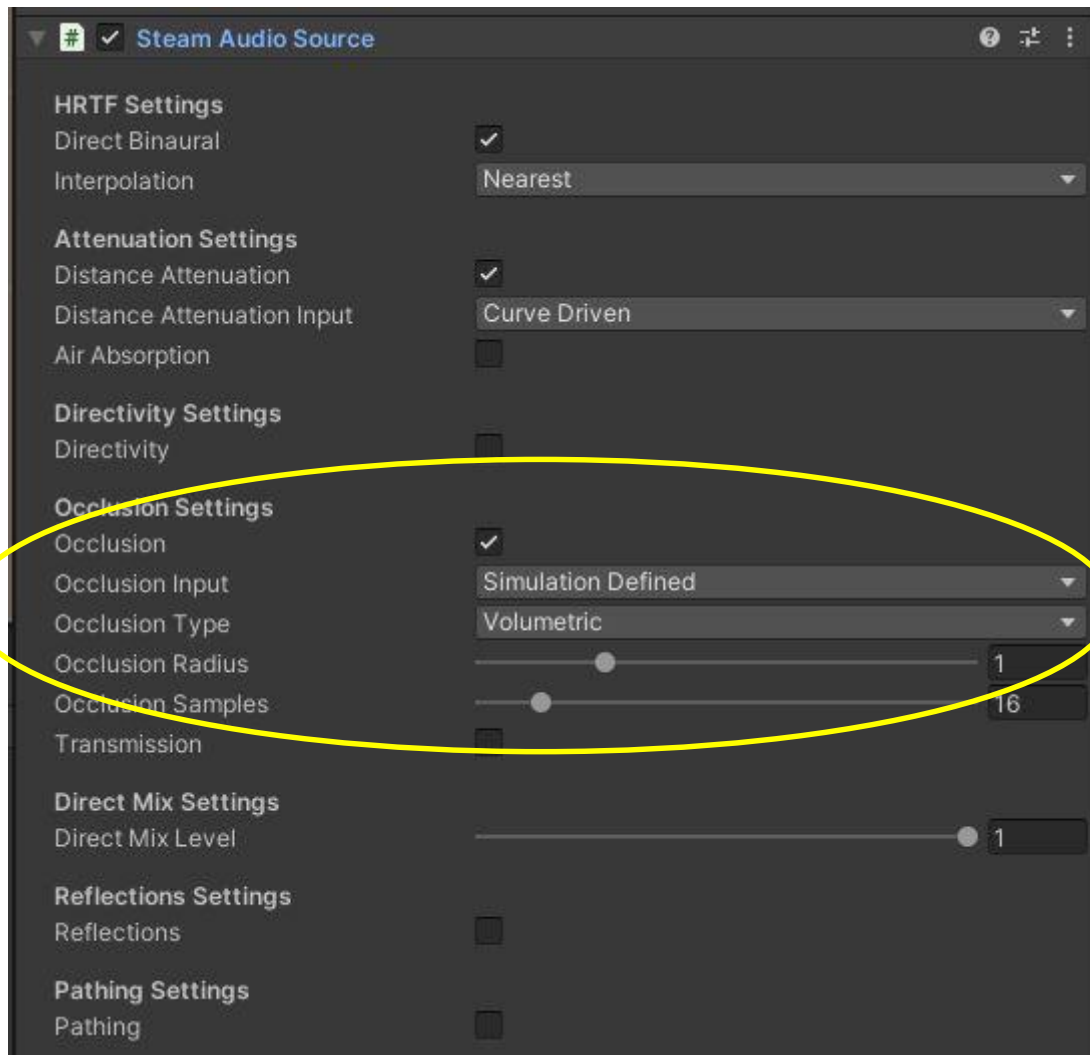
Note that you can modify some global settings, like the amount of Doppler, Rolloff and Volume. This is not recommended, unless you want to affect your scene globally.

Also, if you have a fancy speaker setting (e.g. Surround sound), you can adjust rendering here.

Now you can (finally) get a proper 3d sound rendering to your object(s) by adding a SteamAudioSource component (Component>SteamAudio>SteamAudioSource)

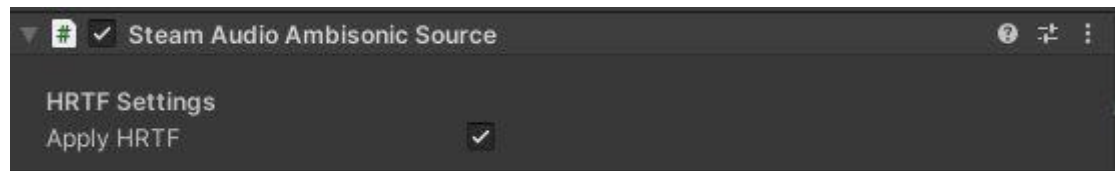
See documentation for details. Important stuff:

- Direct binaural for speedy rendering in headphones
- Uncheck “air absorption” (costly)
- Occlusions should be turned on but set to “Volumetric”.
- “Occlusion Radius” sets the (audio) size of your audio source



c) Better sound rendering

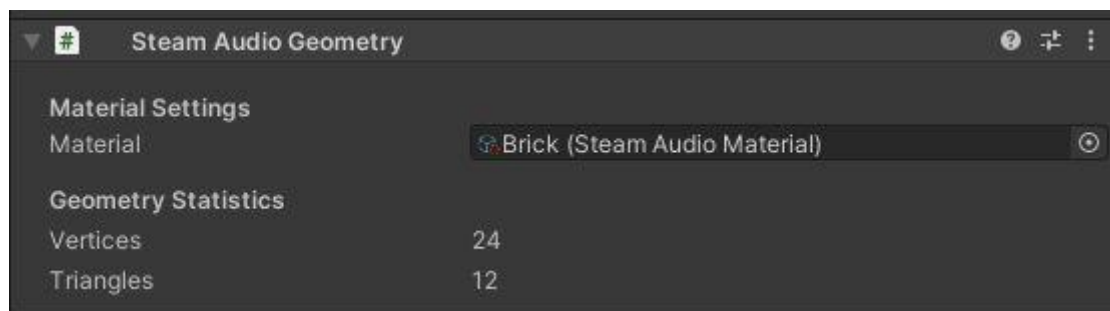
- Customized sound rendering is possible through the use of HRTFs (see course). You can select your own HRTF in the `SteamAudio>Settings` menu. HRTF databases in SOFA format (Spatially Oriented Format for Acoustics) can be found on the net. For instance:
<http://sofacoustics.org/data/database/ari> (altb) /
- If you have a true 3D sound (captured with an ambisonic microphone), you can add a `SteamAudio Ambisonic Source` component to your (existing) audio source. Rendering can still be binaural (and thus use your HRTF) by checking the proper settings:



4) Now you try it !

- a) Make **your own sound source** spatialized
- b) **Create a rectangular wall** that you place between you and the source.

Your “Wall” object does not (yet) occlude the sound source in audio. To do so, the 3D object must have a “sound material”. This is achieved by adding a `SteamAudioGeometry` component to your object:



You can select a number of predefined Materials created for the Steam Renderer. Do not expect these to be realistic though.

- c) Create a script that moves the source around (left-right-up-down-near-far) and observe how the sound rendering changes. You can also change the occluding material and hear the difference.

Again, for more details (sound directivity, absorption, mixing 2D and 3D sound), see:

<https://valvesoftware.github.io/steam-audio/doc/unity/guide.html>

Comparison of spatializers:

<https://www.dear-reality.com/blogs/overview/dearvr-unity-examined-in-masters-thesis>