Steam Audio Unity Plugin

Introduction

Thanks for trying out Steam Audio. It is a complete solution for adding 3D audio and environmental effects to your game or VR experience. It has the following capabilities:

- **3D audio for direct sound.** Steam Audio binaurally renders direct sound using HRTFs to accurately model the direction of a sound source relative to the listener. Users can get an impression of the height of the source, as well as whether the source is in front of or behind them.
- **Occlusion and partial occlusion**. Steam Audio can quickly model raycast occlusion of direct sound by solid objects. Steam Audio also models partial occlusion for non-point sources.
- **Model a wide range of environmental effects.** Steam Audio can model many kinds of environmental audio effects, including slap echoes, flutter echoes, occlusion of sound by buildings, propagation of occluded sound along alternate paths, through doorways, and more.
- **Create environmental effects and reverbs tailored to your scene.** Steam Audio analyzes the size, shape, layout, and material properties of rooms and objects in your scene. It uses this information to automatically calculate environmental effects by simulating the physics of sound.
- **Automate the process of creating environmental effects.** With Steam Audio, you don't have to manually place effect filters throughout your scene, and you don't have to manually tweak the filters everywhere. Steam Audio uses an automated real-time or pre-computation based process where environmental audio properties are calculated (using physics principles) throughout your scene.
- **Generate high-quality convolution reverb.** Steam Audio can calculate convolution reverb. This involves calculating Impulse Responses (IRs) at several points throughout the scene. Convolution reverb results in compelling environments that sound more realistic than with parametric reverb. This is particularly true for outdoor spaces, where parametric reverbs have several limitations.
- **Head tracking support.** For VR applications, Steam Audio can use head tracking information to make the sound field change smoothly and accurately as the listener turns or moves their head.

How Steam Audio Works

This section describes the various parts of Steam Audio, focusing on the way in which the computational load is divided between multiple threads. Steam Audio interacts with three main threads:

1. **Game Thread**. This thread controls the game state, and sends this information to the Simulation Thread. In Unity parlance, the Game Thread is the thread on which MonoBehavior.Update is executed. This thread is managed by the game engine, and runs as fast as the game engine chooses to execute it, which might be 60 Hz assuming vsync is enabled.

2. **Simulation Thread.** This thread actually carries out the sound propagation simulation, and performs the bulk of the computational work. It uses source and listener information provided by the Game Thread, and calculates an impulse response for use by the Rendering Thread. This process involves ray tracing. This thread is managed internally by Steam Audio, and runs as fast as it can, but no faster than the Rendering Thread.

3. **Rendering Thread.** This thread applies direct occlusion, 3D audio, and environmental effects to each sound source. Steam Audio inserts DSP code into the main audio thread, to perform convolutions with multi-channel impulse responses. This thread runs at the audio DSP rate, which is typically 512 or 1024 samples per frame, and 44100 (or 48000, depending on the audio driver) samples per second.

Integration and Platforms

Steam Audio supports **Unity 5.3 or higher**. If you are using a different game engine or audio middleware, you will need to use the Steam Audio C API. Refer to the *Steam Audio API Reference* for further information.

The Steam Audio Unity plugin currently supports:

- Windows 7 or later (32-bit and 64-bit)
- Linux (32-bit and 64-bit, tested with Ubuntu 16.04 LTS)
- macOS 10.7 or later
- Android 4.1 or later

Unity Integration

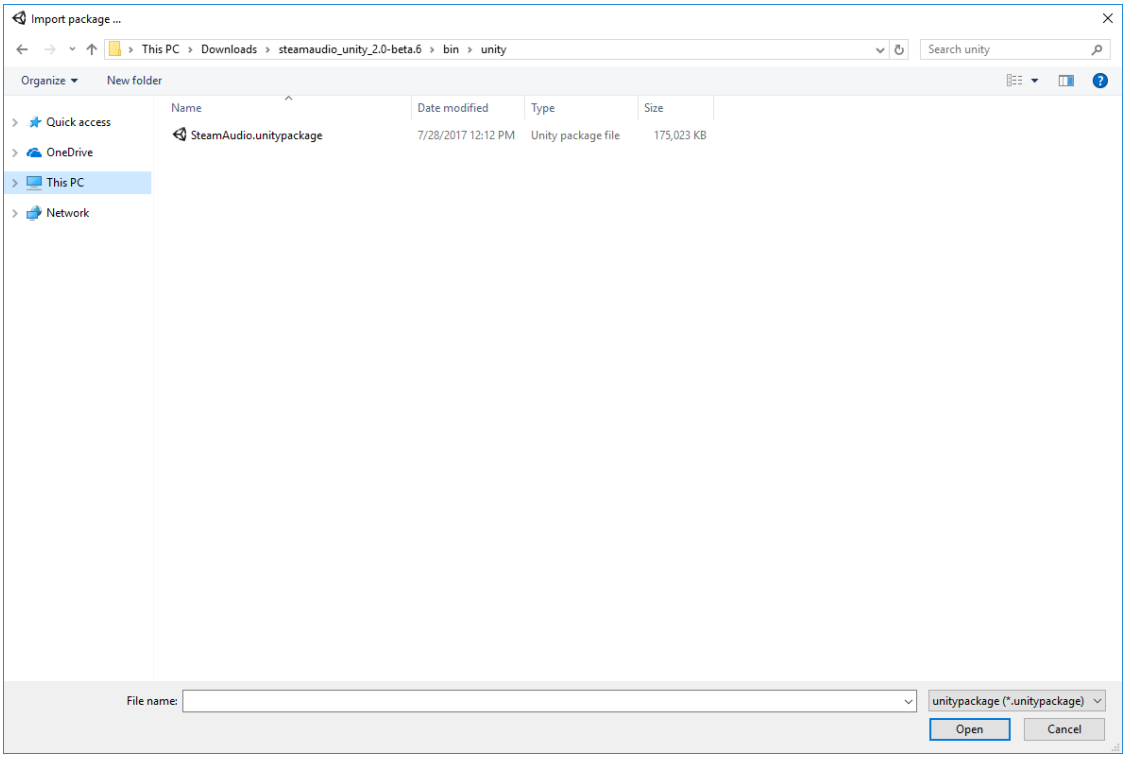
This chapter explains how to use Steam Audio with Unity. It assumes that you are using Unity's built-in native audio engine. Support for third-party audio middleware like FMOD Studio and Audiokinetic Wwise will be available soon.

Setting Up Your Unity Project

Importing Steam Audio

Before using Steam Audio in Unity, you must add it to your Unity project. To integrate Steam Audio into your Unity project:

1. From the Unity menu, choose **Assets** > **Import Package** > **Custom Package**.
2. Navigate to the directory where you downloaded Steam Audio. Within this folder, navigate to the bin/unity/ subdirectory.
3. Double-click the SteamAudio.unitypackage file.
4. In the Import dialog box that appears, make sure everything is selected, and click the **Import** button.

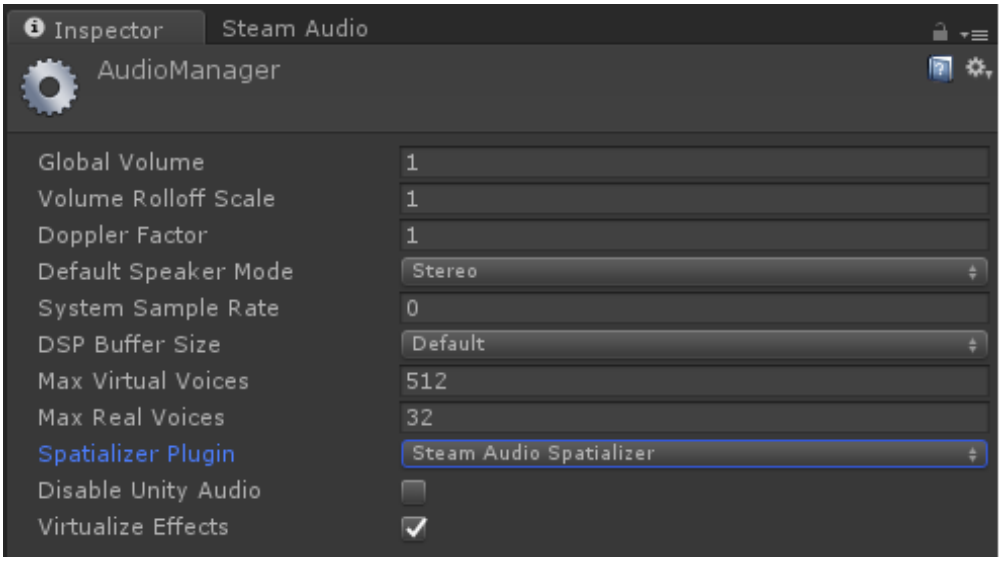


Importing Steam Audio into a Unity project.

Unity Project Settings

Before using Steam Audio to spatialize Audio Sources in Unity, you must select Steam Audio as your spatializer plugin:

1. Click **Edit** > **Project Settings** > **Audio**.
2. Under **Spatializer Plugin**, choose **Steam Audio Spatializer**.



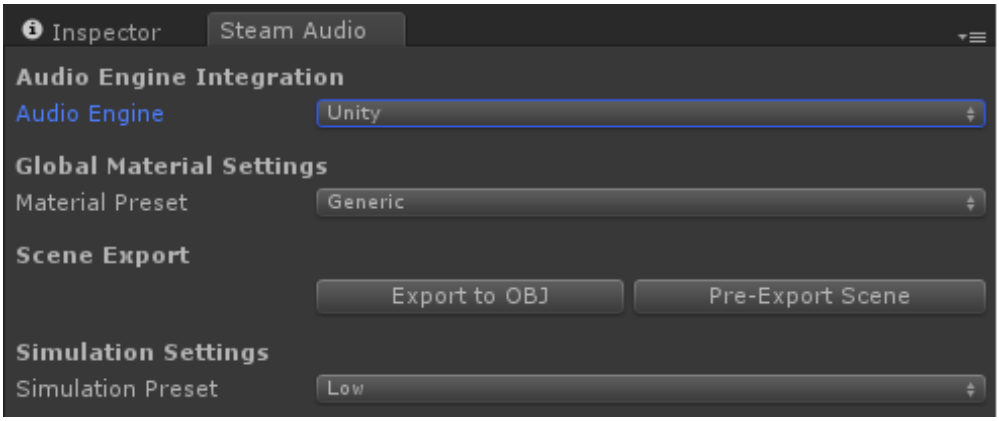
Setting Steam Audio as the spatializer plugin.

NOTE This step is not required if you are only using Steam Audio for listener-centric reverb.

Steam Audio Settings

For each scene where you plan to use Steam Audio, you must set up Steam Audio to work with your audio engine (in this case, Unity's built-in audio engine):

1. Click **Window** > **Steam Audio**. You may dock the Steam Audio window that appears to any part of the Unity window that you prefer.
2. Under **Audio Engine**, choose **Unity**.



Specifying the audio engine.

Steam Audio Manager

A Steam Audio Manager component must be present in your scene to use Steam Audio. A GameObject named **Steam Audio Manager Settings**, containing a Steam Audio Manager component, will be created automatically when you click **Window** > **Steam Audio**.

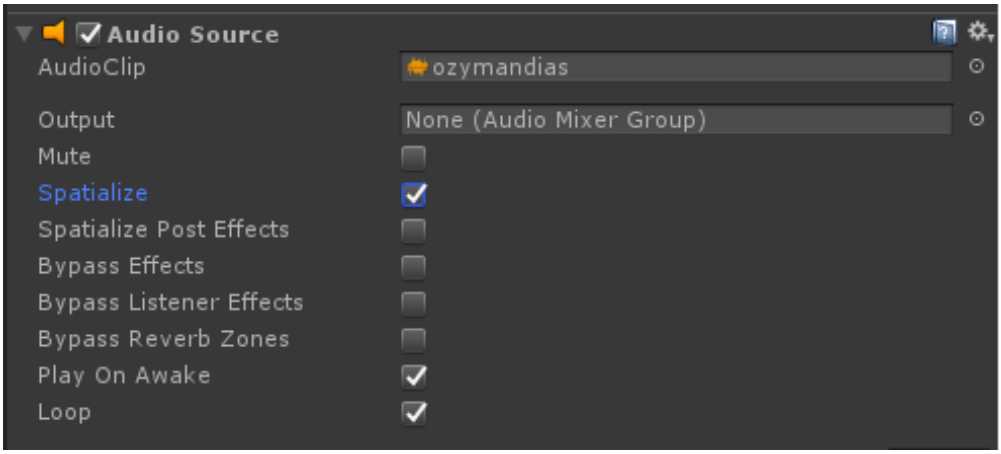
Direct Sound

Steam Audio offers an easy way to model the direct (straight-line) path of sound from the source to the listener, including effects like distance attenuation, occlusion, transmission, and HRTF-based binaural rendering. This is in contrast to indirect sound, including effects like reflections and reverb, which will be discussed later.

3D Audio

Each sound source in Unity is represented by an Audio Source component attached to a GameObject. To add 3D audio with default settings, without adding any occlusion or indirect sound:

1. Select the GameObject containing the Audio Source.
2. In the Inspector view, under the Audio Source component, check **Spatialize**.



Spatializing an Audio Source with default settings.

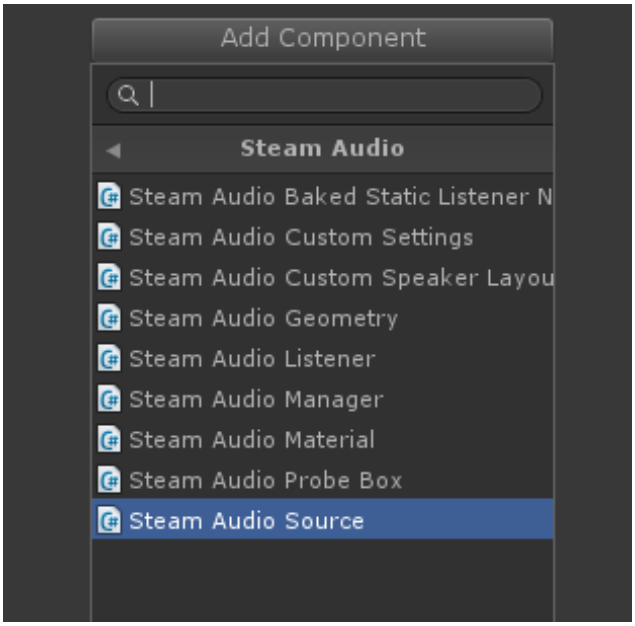
Direct Sound Settings

Steam Audio uses the following settings by default when spatializing an Audio Source:

- HRTF-based binaural rendering is enabled.
- Physics-based attenuation is off; the distance curve configured on the Audio Source is used.
- Frequency-dependent air absorption is off.
- Occlusion and transmission are off.
- Indirect sound (reflections and reverb) are off.

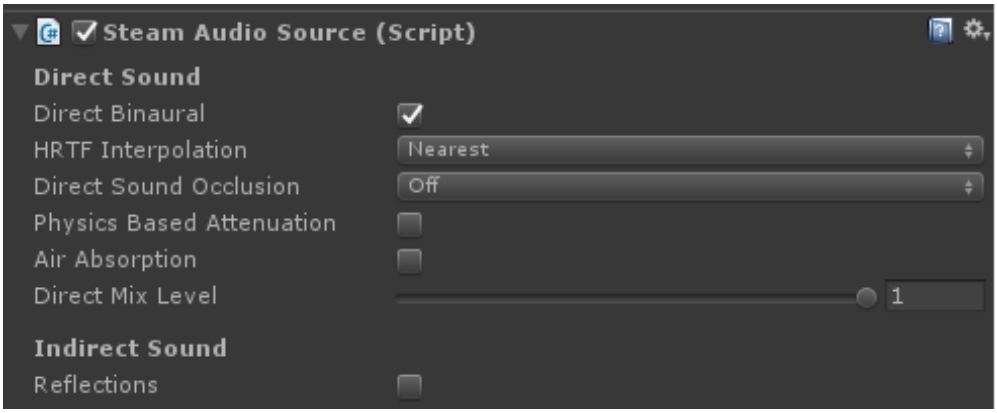
To change the default settings that are used by Steam Audio when spatializing an Audio Source, you must add a **Steam Audio Source** component to the GameObject containing the Audio Source component:

1. Select the GameObject containing the Audio Source.
2. In the Inspector view, click **Add Component**.
3. In the Add Component menu, select **Steam Audio** > **Steam Audio Source**.



Adding a Steam Audio Source component.

In this section, we only describe the direct sound settings for the Steam Audio Source component. **Direct sound settings can be changed while in Play mode in Unity** or programmatically while playing the game. Indirect sound settings will be discussed in a later section.



Configuring direct sound settings for a Steam Audio Source.

Direct Binaural

Check this box to enable HRTF-based 3D audio for direct sound. If unchecked, panning is used.

HRTF Interpolation

HRTF Interpolation specifies what interpolation scheme to use for HRTF-based 3D audio processing.

- **Nearest**. This option uses the HRTF from the direction nearest to the direction of the source for which HRTF data is available.
- **Bilinear**. This option uses an HRTF generated after interpolating from four directions nearest to the direction of the source, for which HRTF data is available. Bilinear HRTF interpolation may result in smoother audio for some kinds of sources when the listener looks around, but has higher CPU usage (up to 2x) than Nearest HRTF interpolation.

Physics-Based Attenuation

When checked, physics-based distance attenuation (inverse distance falloff) is applied to the audio.

NOTE Physics-based attenuation is applied on top of any distance attenuation specified in the 3D Sound Settings of an Audio Source. To avoid applying distance attenuation multiple times, you can uncheck Physics Based Attenuation on the Steam Audio Source. Alternatively, ensure that no distance attenuation is applied by the Audio Source, either by setting **Spatial Blend** to **2D** or by making the distance curve flat.

Air Absorption

When checked, frequency-dependent, distance-based air absorption is applied to the audio. Higher frequencies are attenuated more quickly than lower frequencies over distance.

Direct Mix Level

Direct Mix Level adjusts the contribution of direct sound to the overall mix.

Occlusion

Steam Audio can model how sound is occluded by, and passes through, solid objects. Before changing any of the occlusion settings described below, you must set up your scene geometry for use by Steam Audio; see the next section for details.

Direct Sound Occlusion

This specifies how occlusion is modeled, i.e., how solid objects affect sound passing through them.

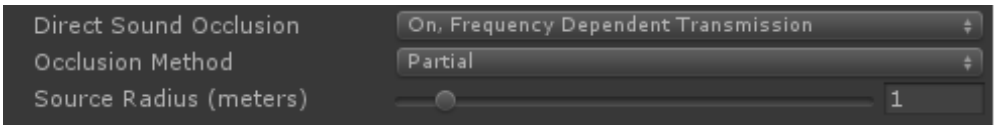
- **Off**. Occlusion calculations are disabled. Sounds can be heard through walls and other solid objects. The scene setup does not need to be performed.
- **On, No Transmission**. Occlusion calculations are enabled. Occluded sound is inaudible.
- **On, Frequency Independent Transmission**. Occlusion calculations are enabled. Occluded sound is attenuated as it passes through geometry, based on the material properties of the occluding object. The attenuation is independent of frequency: the low, medium, and high frequency transmission coefficients are averaged, and the average value is used as a frequency-independent transmission coefficient.

- **On, Frequency Dependent Transmission**. Occlusion calculations are enabled. Occluded sound is filtered as it passes through geometry, based on the material properties of the occluding object. The filtering is dependent on frequency, so for example high frequencies may be attenuated more than low frequencies as the sound passes through geometry.

Occlusion Method

This dropdown is displayed whenever Direct Sound Occlusion is set to anything other than Off. It controls how occlusion calculations are performed.

- **Raycast**. Performs a single raycast from the source to the listener to determine occlusion. If the ray is occluded, direct sound is considered occluded. As described in the next section, the scene needs to be setup for Steam Audio.
- **Partial**. Performs multiple raycasts from the source to the listener based on the Source Radius setting. The proportion of rays that are occluded determine how much of the direct sound is considered occluded. Transmission calculations, if enabled, are only applied to the occluded portion of the direct sound. As described in next section, the scene needs to be setup for Steam Audio.



Configuring direct sound occlusion for a Steam Audio Source.

Source Radius

This slider is only displayed when Occlusion Method is set to Partial. It configures the apparent size of the sound source. The larger the source radius, the larger an object must be in order to fully occlude sound emitted by the source.

Scene Setup

To use Steam Audio for occlusion and environmental effects in your video game or VR experience, the scene needs to be set up by tagging geometry and specifying acoustic materials for the objects in your scene.

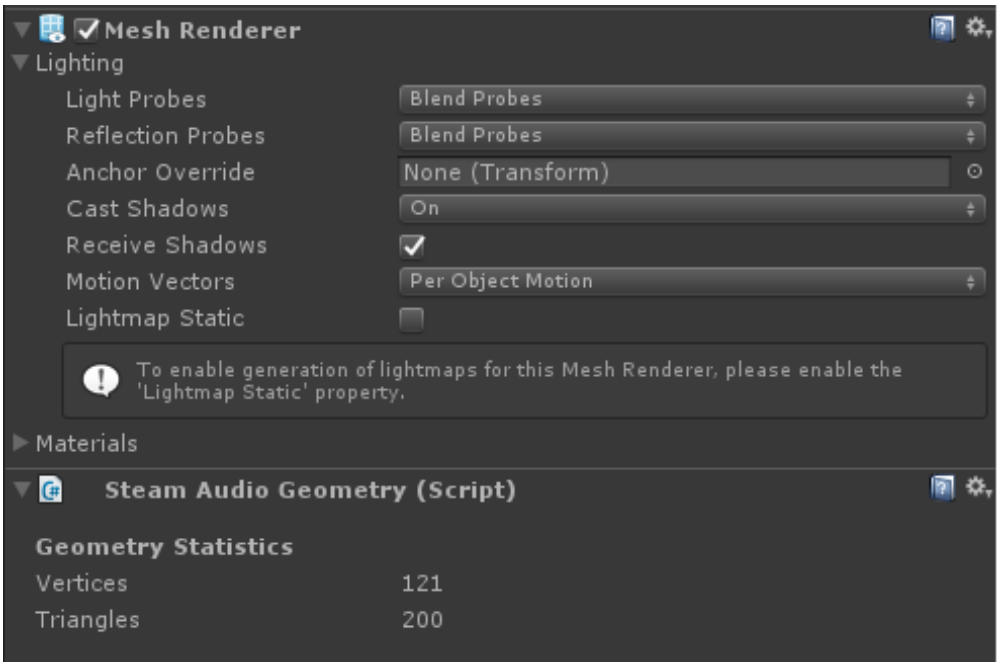
Tagging Geometry

Steam Audio needs to know what objects in your scene should be used to model occlusion and calculate environmental effects. You can specify this by tagging the relevant objects in multiple different ways.

Tagging Triangle Meshes

Any object with a Mesh Renderer component can be tagged with a **Steam Audio Geometry** component. Follow the steps below:

1. Select the GameObject with Mesh Renderer you wish to tag.
2. In the Inspector view, click **Add Component**.
3. In the Add Component menu, click **Steam Audio** > **Steam Audio Geometry**.

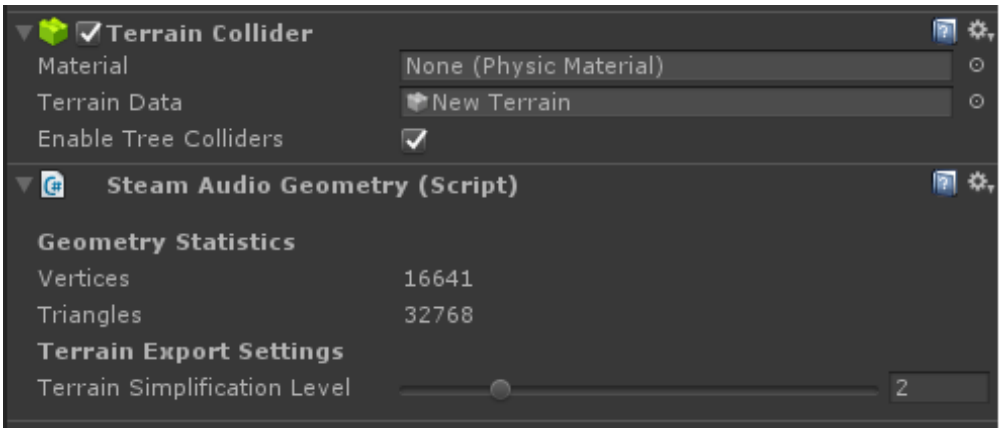


Adding a Steam Audio Geometry component to a Mesh Renderer.

Tagging Terrain

Any object with a Terrain component can be tagged with a **Steam Audio Geometry** component.

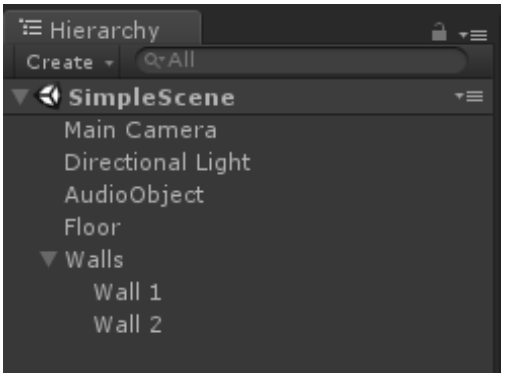
Geometry that is represented by a Terrain component can be quite complex. This can slow down the calculation of occlusion and environmental effects. To speed things up, you can adjust the **Terrain Simplification Level** slider on the Steam Audio Geometry component. As you increase this value, Steam Audio will reduce the level of detail in the terrain. This will result in faster calculation of environmental effects.



Adding a Steam Audio Geometry component to a Terrain.

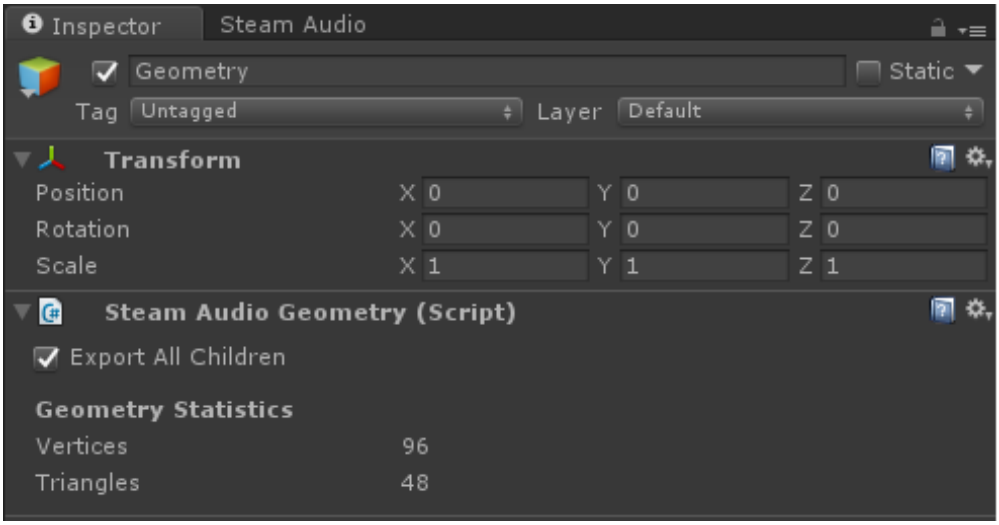
Tagging a Hierarchy of Objects

A scene is often organized as a hierarchy of objects. The scene hierarchy can be seen in the Hierarchy window in Unity.



The scene hierarchy.

Any game object in the hierarchy window with child objects can tagged with a **Steam Audio Geometry** component. An option to **Export All Children** will be available in this case. If the option is selected, the geometry of all children with a **Mesh Renderer** or **Terrain** attached to them will be combined and used to model occlusion and environmental effects.



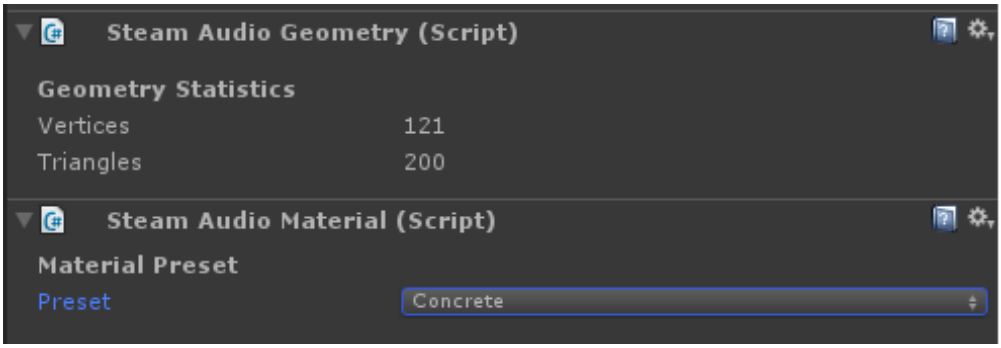
Using Export All Children to tag a hierarchy of objects.

NOTE Tagging an object with Steam Audio Geometry does not require you to create an additional mesh first. Steam Audio can directly use the same meshes used for visual rendering. Not all objects have a noticeable influence on environmental effects. For example, in a large hangar, the room itself obviously influences the environmental effect. A small tin can on the floor, though, most likely doesn't. But large amounts of small objects can collectively influence the environmental effects. For example, while a single wooden crate might not influence the hangar reverb, large stacks of crates are likely to have some impact.

Specifying Acoustic Materials

After tagging objects, the next step is to tell Steam Audio what they are made of. You can specify the acoustic material of an object as follows:

1. Select the GameObject whose material you wish to specify.
2. In the Inspector view, click **Add Component**.
3. In the Add Component menu, click **Steam Audio** > **Steam Audio Material**.

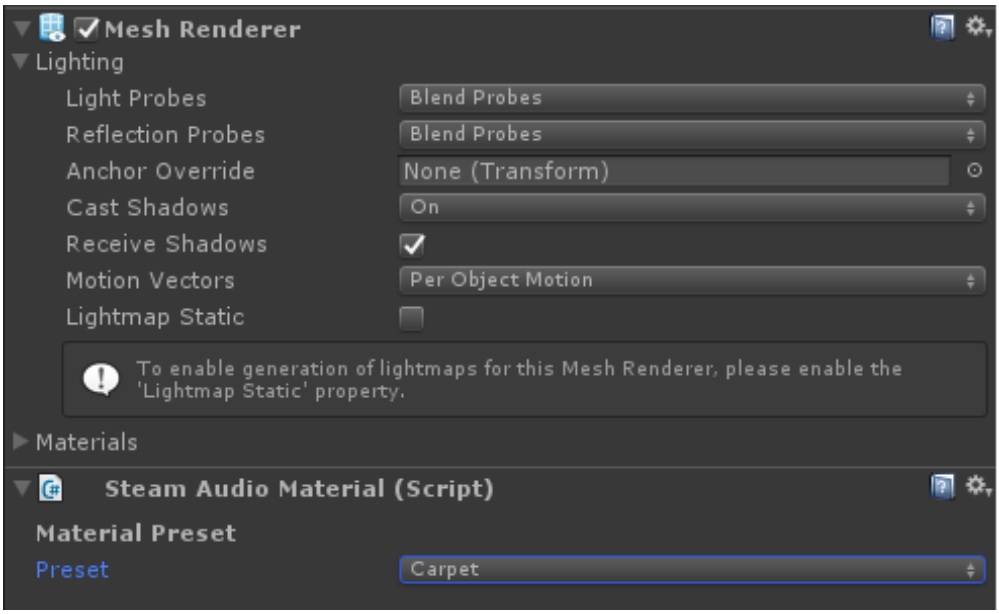


Adding a Steam Audio Material component.

In the Steam Audio Material component that appears, click the **Preset** drop-down and choose a material preset.

Acoustic Material for Object Hierarchies

If you have an object with a Steam Audio Geometry component with Export All Children checked, and you attach a Steam Audio Material component to it, all its children are assigned the material of the root object. It is possible to assign a child object a different material by attaching a Steam Audio Material component to the child object.



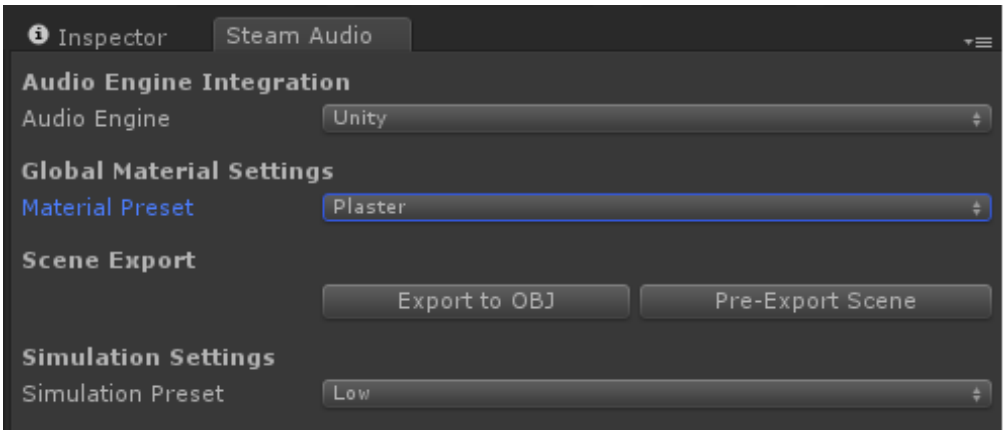
Steam Audio Material attached to a GameObject without Steam Audio Geometry.

NOTE If a Steam Audio Material component is added to a child object in a hierarchy, the material will be assigned only to the mesh or terrain attached to that particular child object. If the child object has its own children, the material of the children objects will not be affected.

Global Default Materials

For scenes where most objects are made of the same material, barring a few exceptions, you can save time by specifying a global default material. Then, you only have to add Steam Audio Material components to objects whose material is different from the default. To specify a global default material:

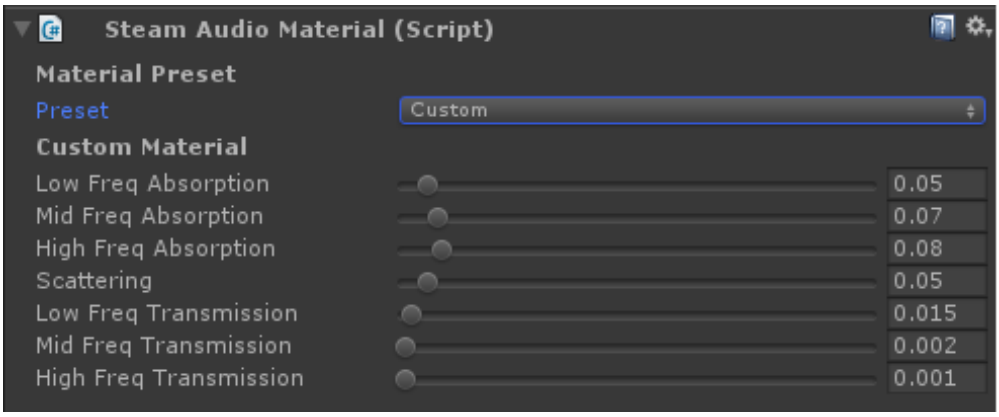
1. In Unity's main menu, click **Window** > **Steam Audio**.
2. Choose a material from the **Material Preset** drop-down box.



Specifying a global default material.

Adjusting Material Properties

Instead of choosing a material preset, you can use a custom material. To do so, select **Custom** from the Preset drop-down, either on a Steam Audio Material component, or for the global default material. Several sliders appear, allowing you to customize the material.



Customizing a Steam Audio Material.

Absorption

The first three sliders, **Low Freq Absorption**, **Mid Freq Absorption**, and **High Freq Absorption**, let you specify how much sound the material absorbs at different frequencies. For example, setting High Freq Absorption to 1 means that the material absorbs all high frequency sound that reaches it. This adds a low-pass filtering effect to any sound reflected by the object.

NOTE The center frequencies for the three frequency bands are 400 Hz, 2.5 KHz, and 15 KHz.

Scattering

The fourth slider, **Scattering**, lets you specify how "rough" the surface is when reflecting sound. Surfaces with a high scattering value randomly reflect sound in all directions; surfaces with a low scattering value reflect sound in a mirror-like manner.

Transmission

The fifth through seventh sliders, **Low Freq Transmission**, **Mid Freq Transmission**, and **High Freq Transmission**, let you specify how much sound the material transmits at different frequencies. For example, setting High Freq Transmission to 0 means that no high frequency sound passes through the material. This adds a low-pass filtering effect to any sound passing through the object.

Scene Pre-Export

You must "pre-export" the scene before hitting Play in the Unity editor or building a player, to ensure scene setup changes are available to Steam Audio. To pre-export:

1. In Unity's main menu, click **Window** > **Steam Audio**.
2. Click **Pre-Export Scene**.

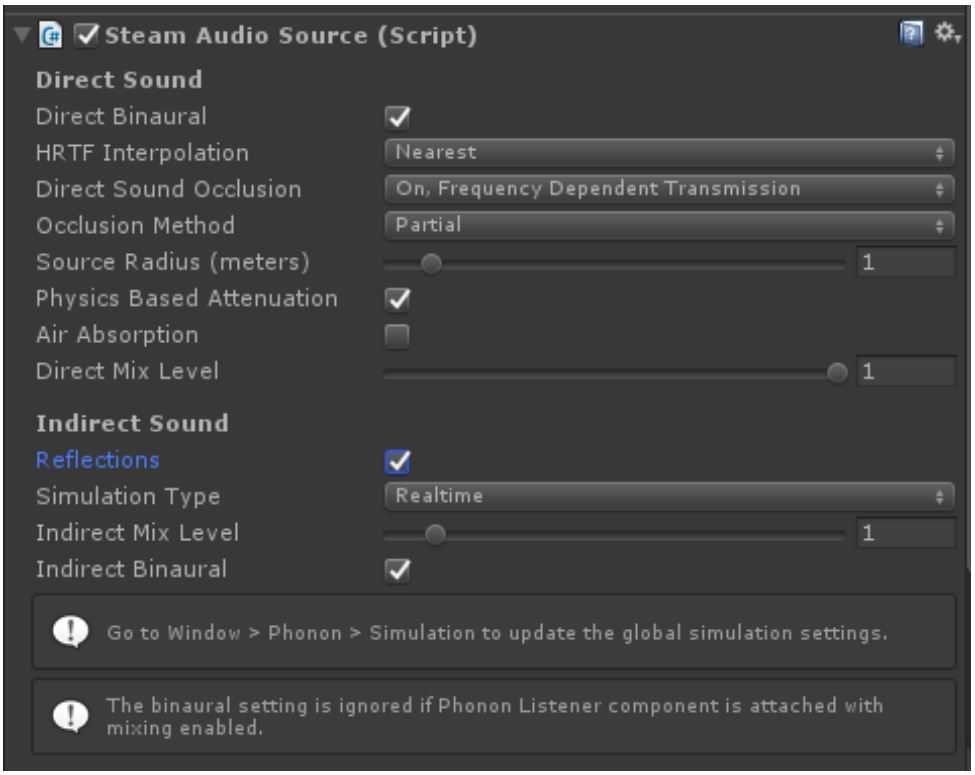
Indirect Sound

Steam Audio offers an easy way to add environmental effects to your video games and VR experiences. Before Steam Audio can apply environmental effects to the Audio Source, a **Steam Audio Source** component must be attached to the Audio Source. This can be done as follows:

1. Select the GameObject containing the Audio Source.
2. In the Inspector view, click **Add Component**.
3. In the Add Component menu, select **Steam Audio** > **Steam Audio Source**.

Indirect Sound Settings

The Steam Audio Source component tells Unity what settings to use when applying environmental effects to the audio emitted by an Audio Source. Indirect sound settings can be changed while in Play mode or programmatically.



Configuring indirect sound settings on a Steam Audio Source.

NOTE The Steam Audio Source component should be attached only to an Audio Source.

Reflections

If checked, Steam Audio will apply physics-based environmental effects to the audio emitted by the Audio Source. If unchecked, only direct sound settings (including occlusion) are applied.

Simulation Type

This determines what kind of simulation is performed to calculate environmental effects.

- **Realtime**. Environmental effects are continuously simulated in real-time, during gameplay. This allows for more flexibility in incorporating changes to the scene and sources, but incurs a CPU overhead.
- **Baked Static Source**. The Audio Source must be static to use this simulation mode. Environmental effects are precomputed from the source position during the design phase and saved with the scene. For largely static scenes, this mode allows you to reduce CPU overhead at the cost of increased memory consumption.
- **Baked Static Listener**. The Audio Listener must be static or restricted to a few static positions to use this simulation mode. The listener is free to look around but cannot move around. Environmental effects are precomputed at a pre-determined listener position during the design phase and saved with the scene. Audio Sources can freely

move when using this mode. For a VR experience where the camera can only transport to a few locations, this mode allows you to reduce CPU overhead at the cost of increased memory consumption.

Indirect Mix Level

Indirect Mix Level adjusts the contribution of indirect sound to the overall mix.

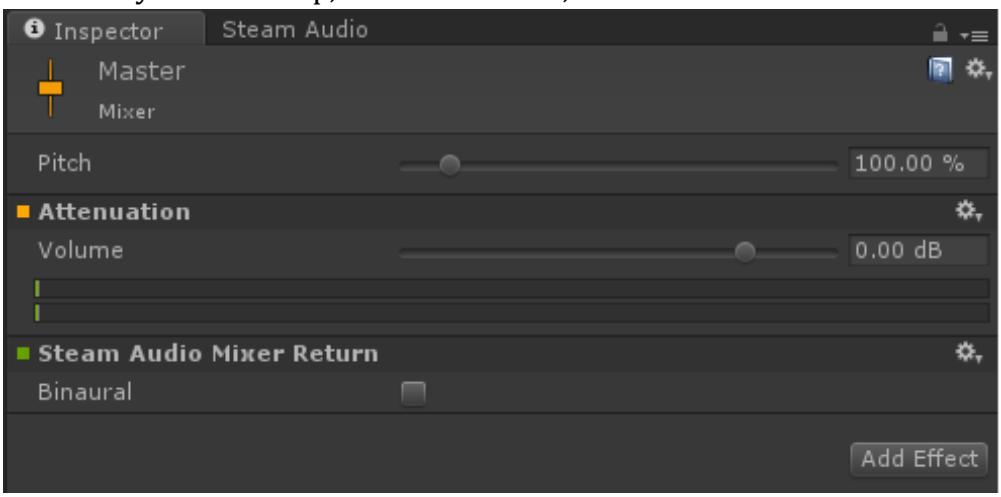
Indirect Binaural

If checked, renders indirect sound with HRTF-based 3D audio. This gives a better sense of directionality to indirect sound and improves immersion. There is a small increase in CPU overhead when checked.

Accelerated Mixing

If you are using Audio Mixers in your project, you can use the Steam Audio Mixer Return effect to reduce the CPU overhead of audio processing for environmental effects. This can be done as follows:

1. In the Audio Mixer view, select the Audio Mixer you want to use for mixing indirect sound.
2. In any Mixer Group, click **Add Effect**, and choose **Steam Audio Mixer Return**.



Adding the Steam Audio Mixer Return effect to a Mixer Group.

When using the Steam Audio Mixer Return effect, the following things happen:

- If indirect sound is enabled for a Steam Audio Source, then the indirect sound for that source is *not* sent to the Audio Source's output. It is retained internally by Steam Audio for mixing. Only direct sound is sent to the Audio Source's output.
- All of the indirect sound for all Steam Audio Sources is mixed, and inserted back into the audio pipeline at the Mixer Group to which the Steam Audio Mixer Return effect has been added.

- Since indirect sound is taken out of Unity's audio pipeline at the Audio Source, any effects applied between the Audio Source and the Steam Audio Mixer Return effect will not apply to indirect sound.

Steam Audio Mixer Return Settings

The following settings can be configured on a Steam Audio Mixer Return effect:

Binaural

If checked, applies HRTF-based 3D audio rendering to indirect sound.

NOTE When a Steam Audio Mixer Return effect is attached to an Audio Mixer, the Binaural setting of the Steam Audio Mixer Return effect overrides the Indirect Binaural settings on Steam Audio Source components in the scene.

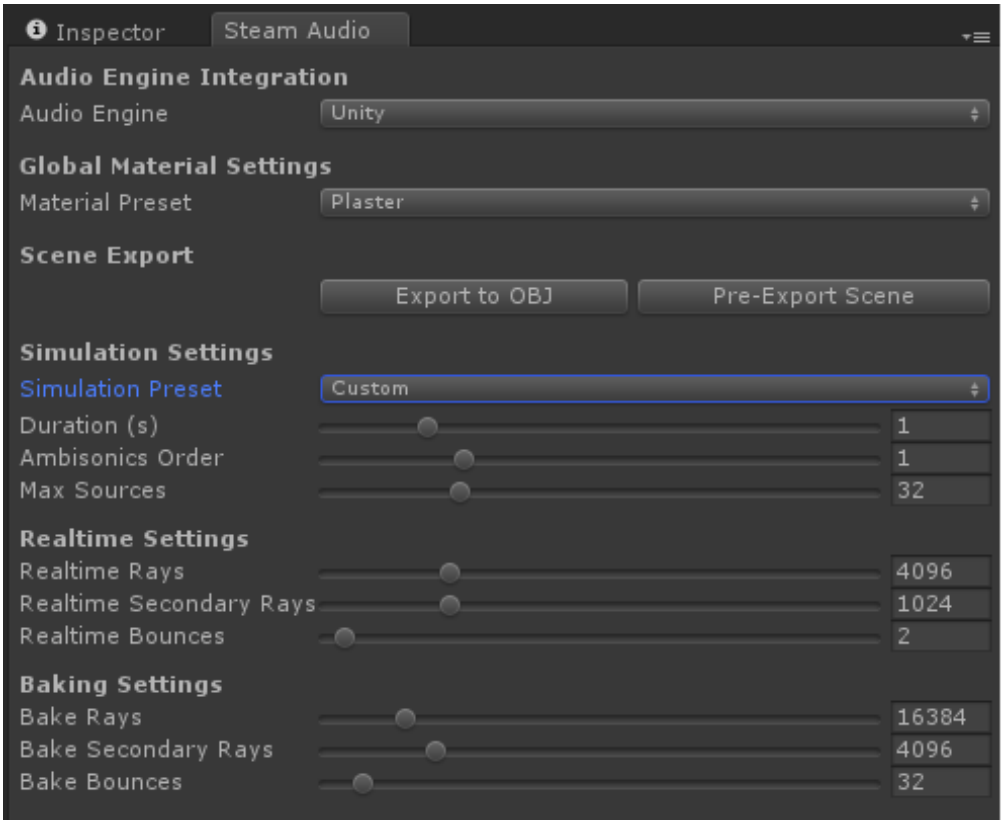
Simulation Settings

Steam Audio allows you to balance its compute requirements and simulation output quality. To adjust these settings:

1. In Unity's main menu, click **Window** > **Steam Audio**.
2. Under **Simulation Preset**, choose from Low, Medium, High, or Custom.

Custom Preset for Simulation Settings

The custom simulation preset lets you configure various aspects of how Steam Audio simulates indirect sound. These options cannot be changed in Play mode or programmatically.



Specifying custom simulation settings.

- **Duration**. This is the length of the impulse responses to generate. Increasing this improves the quality of the simulation, but beyond a certain point (depending on the number of sound sources), may result in audio glitching.
- **Ambisonics Order**. This determines the directionality of environmental effects. Increasing this increases the compute complexity quadratically. Use zero order Ambisonics if no directionality is needed in environmental effects. Otherwise, first order Ambisonics should provide a good tradeoff between directionality and CPU usage.
- **Max Sources**. This is the maximum number of Steam Audio Sources and Steam Audio Reverb effects combined that can be used for modeling indirect sound.
- **Realtime Rays**. This is the number of primary and reflection rays to trace from the listener position for real-time computation of environmental effects. Increasing this improves the quality of the simulation, at the cost of performance.
- **Realtime Secondary Rays**. This is the number of directions that are sampled when simulating diffuse reflection. Setting this number too low may reduce the overall quality.

- **Realtime Bounces**. Number of times the rays are allowed to bounce off of solid objects in real-time. Increasing this improves the quality of the simulation, at the cost of performance.
- **Bake Rays**. This is the number of primary and reflection rays to trace from the listener position for baked computation of environmental effects. Increasing this improves the quality of the simulation while increasing the overall time to bake environmental effects.
- **Bake Secondary Rays**. This is the number of directions that are sampled when simulating diffuse reflection. Setting this number too low may reduce the overall quality.
- **Bake Bounces**. Number of times the rays are allowed to bounce off of solid objects during baking. Increasing this improves the quality of the simulation while increasing the overall time to bake environmental effects.

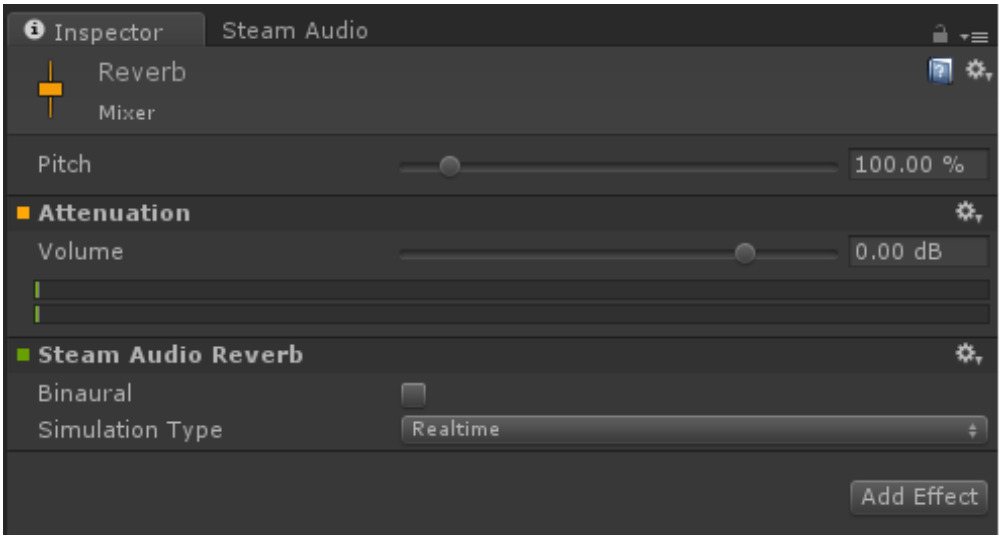
Reverb

Steam Audio also lets you apply listener-centric reverb to audio flowing through any Mixer Group in Unity. This helps reduce CPU usage, since indirect sound effects are applied after multiple sounds are mixed. When using listener-centric reverb, Steam Audio calculates and applies a reverb filter based on the listener's position in the scene; it does not take source positions into account.

To use Steam Audio for modeling listener-centric reverb:

1. In the Audio Mixer tab, select the Mixer Group to which you want to apply listener-centric reverb.
2. Click **Add Effect**, then choose **Steam Audio Reverb**.

After doing this, Steam Audio will apply listener-centric reverb to all audio reaching the Mixer Group, either from Audio Sources whose output is set to the Mixer Group, or from other Mixer Groups that route audio to the selected Mixer Group.



Using the Steam Audio Reverb effect for modeling listener-centric reverb.

The following settings can be configured for the Steam Audio Reverb effect:

Simulation Type

Simulation Type determines what kind of simulation is performed to calculate reverb.

- **Realtime**. Reverb is continuously simulated in real-time, during gameplay. This allows for more flexibility in incorporating changes to the scene and sources, but incurs a CPU overhead.
- **Baked**. Reverb is precomputed over a grid of listener positions during the design phase and saved with the scene. For largely static scenes, this mode allows you to reduce CPU overhead at the cost of increased memory consumption.

Binaural

If checked, applies HRTF-based 3D audio rendering to reverb.

NOTE Listener-centric reverb (using the Steam Audio Reverb effect) and accelerated mixing (using the Steam Audio Mixer Return effect) are mutually-exclusive features. You cannot use both kinds of effects at the same time.

3D Audio For Indirect Sound

Steam Audio provides the following ways of applying HRTF-based 3D audio rendering to indirect sound:

- If not using accelerated mixing, you can check Indirect Binaural on an individual Steam Audio Source.
- If using accelerated mixing, you can check Indirect Binaural on the Steam Audio Mixer Return effect.
- If using listener-centric reverb, you can check Indirect Binaural on the Steam Audio Reverb effect.

Baking Indirect Sound

A few additional steps need to be performed to use the **Baked Static Source** or **Baked Static Listener** options in a Steam Audio Source and the **Baked** setting in a Steam Audio Reverb effect. You must create probe boxes, assign them in the Steam Audio Source component or Steam Audio Reverb effect, and perform a bake.

Creating Probe Boxes

Steam Audio uses *probes* to store baked environmental effect data. A Probe Box is a way to create and manage probes. To create a Probe Box:

1. In Unity's main menu, click **GameObject** > **Create Empty**.
2. In the Hierarchy view, give the newly-created GameObject any preferred name. **All Probe Boxes should have a unique name.**
3. In the Inspector view, click **Add Component**.
4. In the Add Component menu, click **Steam Audio** > **Steam Audio Probe Box**.
5. Adjust the position and size of the Probe Box using Unity's translate, rotate, and scale tools.
6. Choose an appropriate **Placement Strategy**. (See below for details.)
7. Click **Generate Probes**.

Creating probes for baked indirect sound using a Steam Audio Probe Box.

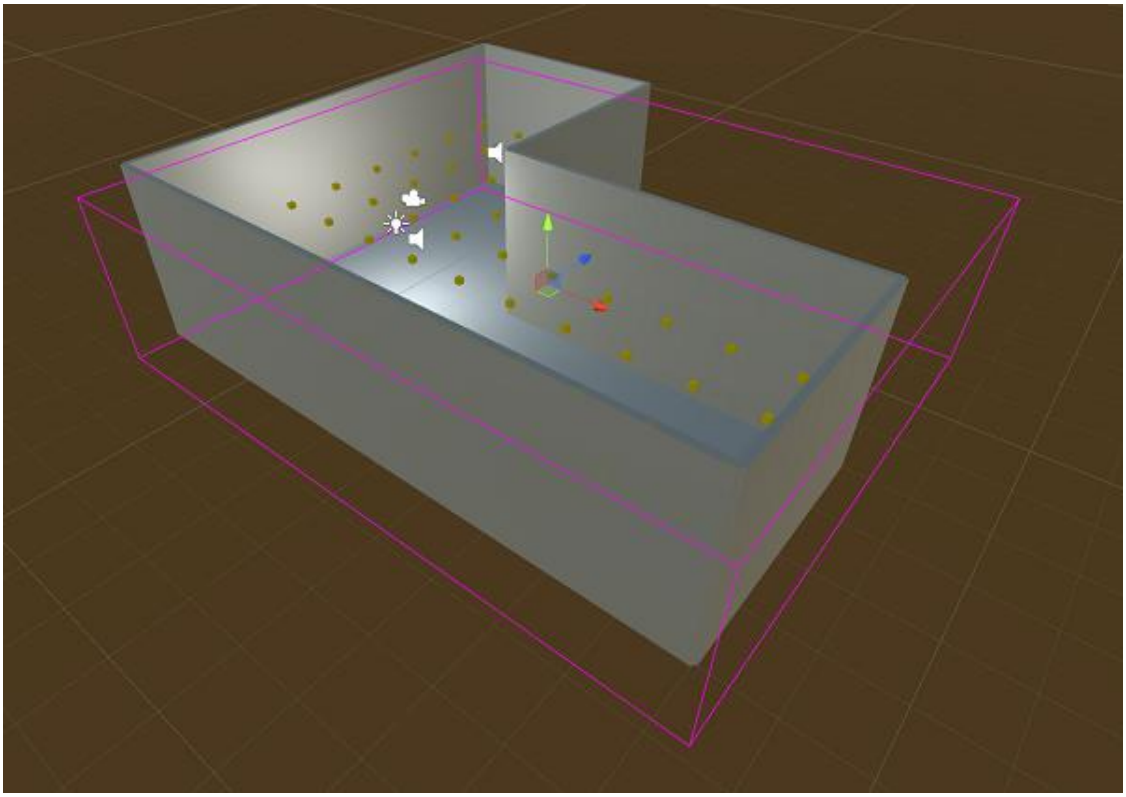
Dimensions

A Probe Box is a parallelopiped volume. The position, shape, and scale of the probe box is determined by the local to world transformation matrix of the GameObject to which Probe Box component is attached.

Placement Strategy

Steam Audio currently supports the following strategies to generate probes within a Probe Box.

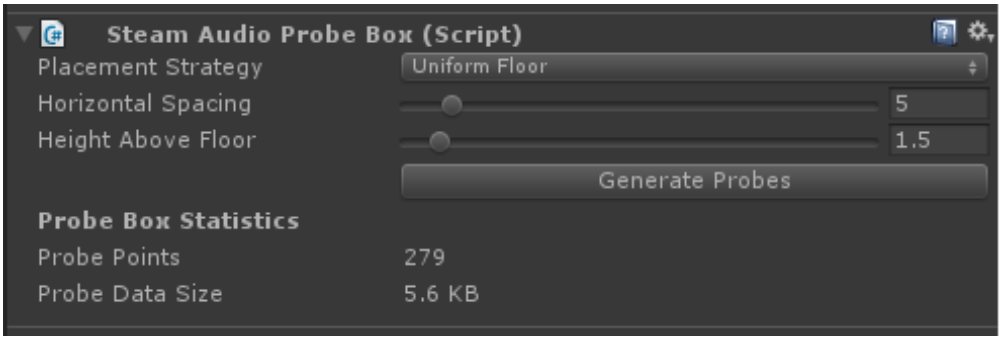
- **Centroid**. Places a single probe at the center of the Probe Box.
- **Uniform Floor**. Places probes at a certain height above the floor in the direction of the local down vector of the probe box with a certain spacing between them. The height is specified by the **Height Above Floor** parameter. Spacing is specified by the **Horizontal Spacing** parameter.



A Steam Audio Probe Box, with probes generated.

Probe Box Statistics

Probe Box Statistics provides information about the number of probes and the size of the baked data at the probes.



Probe Box statistics.

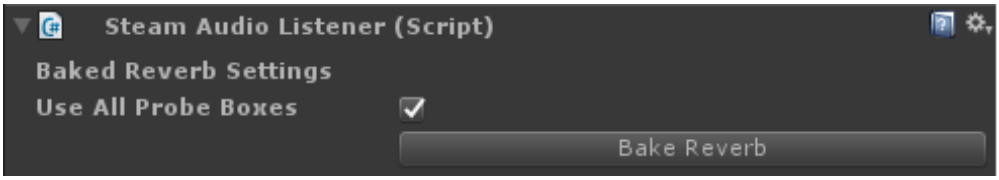
Baked Reverb Settings

To configure baked reverb, you must first add a Steam Audio Listener component to the GameObject that contains the Unity Audio Listener component:

1. Select the GameObject containing the Audio Listener.
2. In the Inspector view, click **Add Component**.

3. In the Add Component menu, click **Steam Audio** > **Steam Audio Listener**.

Baked Reverb Settings will be displayed in the Steam Audio Listener component. The environmental effect that is baked at a probe's location represents the reverb at that location.



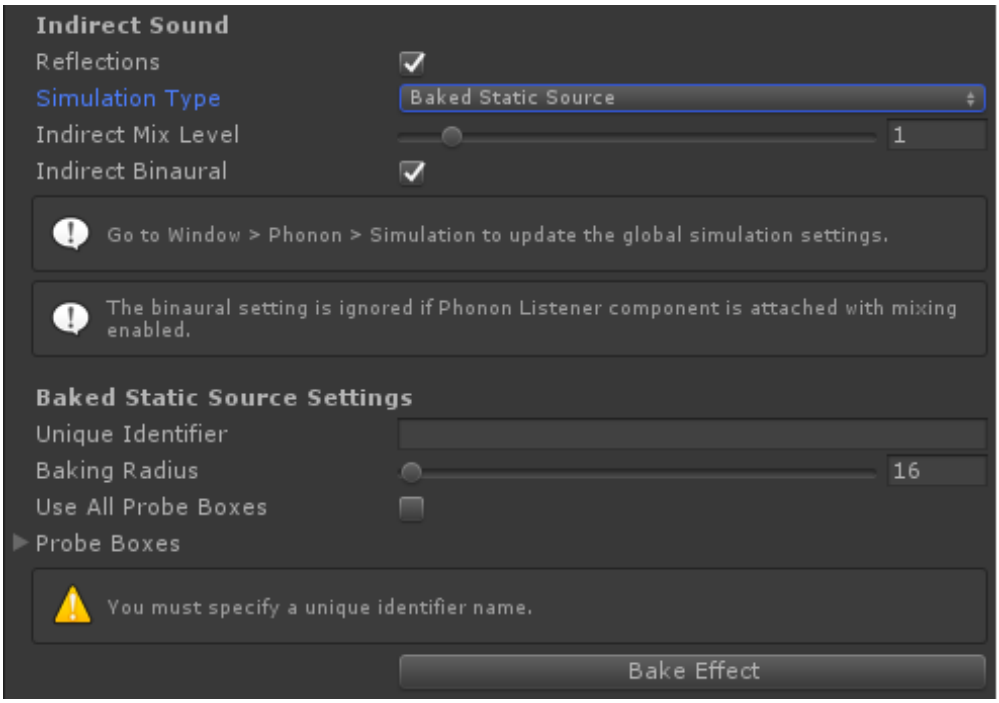
Baked reverb settings in a Steam Audio Listener component.

Use All Probe Boxes

If checked, all Probe Boxes are used when baking reverb. If unchecked, you can specify a list of Probe Boxes for which to bake reverb.

Baked Static Source Settings

Baked Static Source settings will be displayed in a Steam Audio Source component when its Simulation Type is set to Baked Static Source. The environmental effect that is baked at a probe's location represents sound propagation from the source location to the probe's location.



Baked Static Source settings in a Steam Audio Source component.

Unique Identifier

Each Steam Audio Source whose Simulation Type is set to Baked Static Source must have a unique identifier.

Baking Radius

Environmental effects are baked for all probes within the baking radius of a Steam Audio Source. A smaller baking radius implies fewer probes need to be baked, so less data needs to be stored.

Use All Probe Boxes

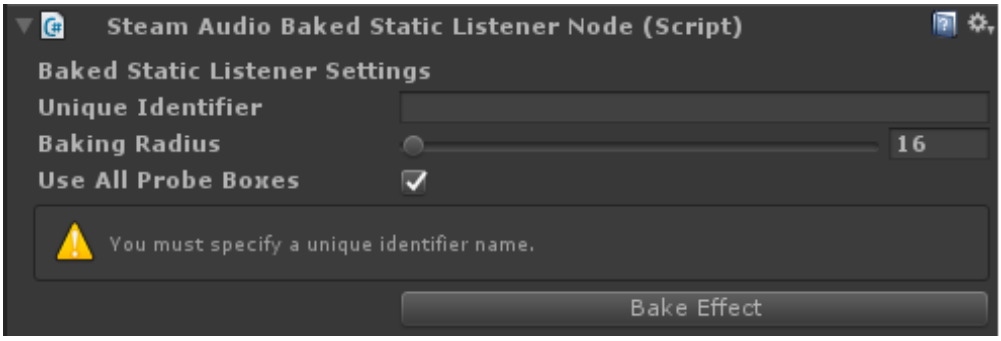
If checked, all Probe Boxes are used when baking environmental effects for the source. If unchecked, you can specify a list of Probe Boxes for which to bake environmental effects.

Baked Static Listener Settings

To use Baked Static Listener simulation on a Steam Audio Source, you must first create one or more **Steam Audio Baked Static Listener Node** components. You must also add and configure a Steam Audio Listener component to the Audio Listener.

Baked Static Listener Nodes

One or more **Steam Audio Baked Static Listener Node** components must be attached to GameObjects at the fixed locations to which Audio Listener can transport. Bakes performed at each Baked Static Listener Node represent sound propagation from each probe location to the location of the static listener node.



Configuring a Steam Audio Baked Static Listener Node.

Unique Identifier

Each Steam Audio Baked Static Listener Node component must have a unique identifier.

Baking Radius

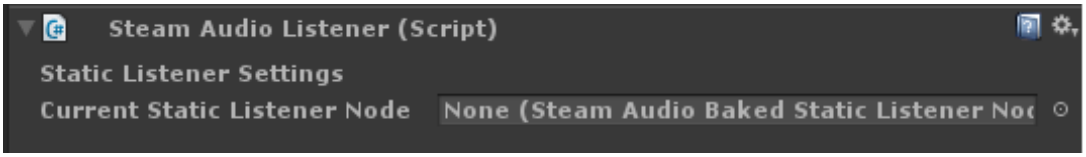
Environmental effects are baked for all probes within the baking radius of a Baked Static Listener Node. A smaller baking radius implies fewer probes need to be baked, so less data needs to be stored.

Use All Probe Boxes

If checked, all Probe Boxes are used when baking environmental effects for the static listener. If unchecked, you can specify a list of Probe Boxes for which to bake environmental effects.

Steam Audio Listener configuration

A **Steam Audio Listener** component needs to be attached to the Audio Listener when Simulation Type is set to Baked Static Listener for any Steam Audio Source component. The following settings must be configured:



Configuring a Steam Audio Listener component for Baked Static Listeners.

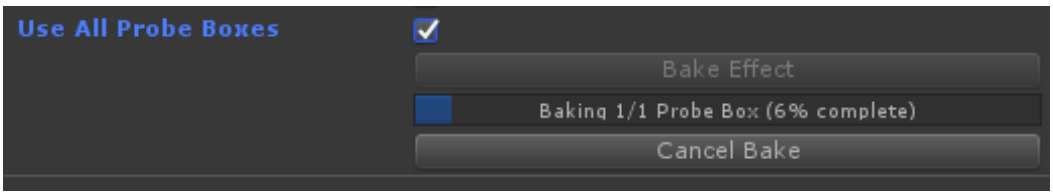
Current Static Listener Node

Points to the latest Steam Audio Baked Static Listener Node where the Audio Listener is located.

NOTE You must also attach Baked Static Listener Node components to use Baked Static Listener settings in a Steam Audio Source.

Baking

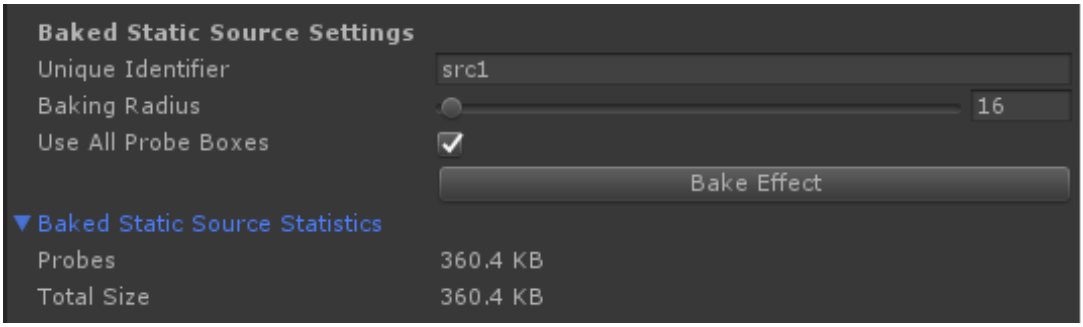
Click **Bake** on a Steam Audio Source or Steam Audio Listener component to bake the corresponding environmental effects. The baked data is stored in the Probe Boxes selected within Steam Audio Source or Steam Audio Listener components.



Baking indirect sound.

Baked Data Statistics

Baked data statistics for a component are readily available in a foldout at the end of the component. The actual name of the foldout may vary depending on the component baked, i.e. Steam Audio Source, Steam Audio Listener, or Steam Audio Baked Static Listener Node.



Baked data statistics.

Advanced Options

The following advanced options are available on the Steam Audio tab.

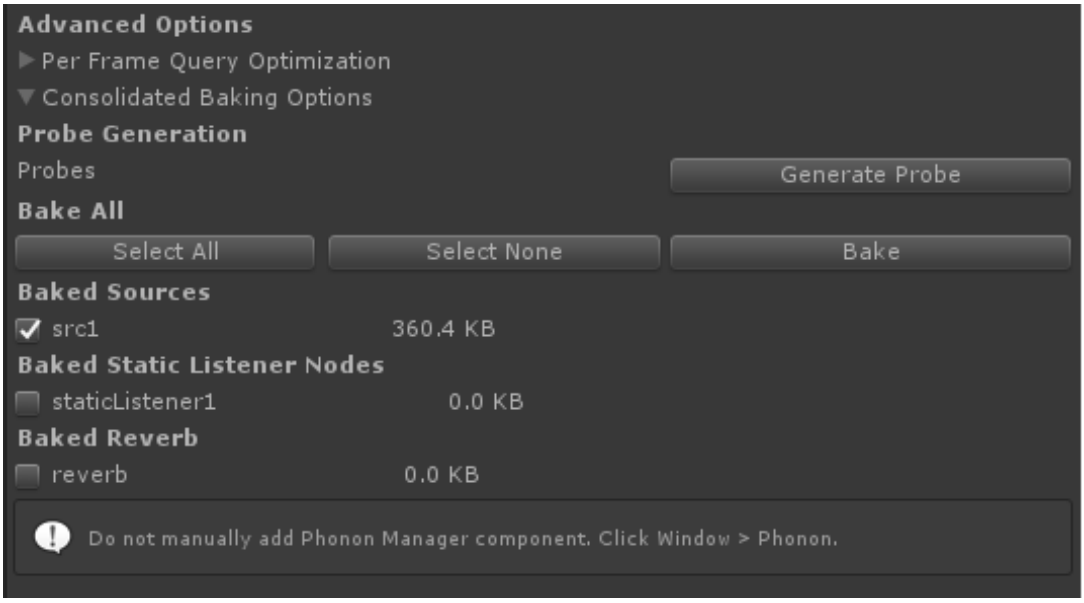
Per Frame Query Optimization

Steam Audio searches the Unity scene graph for an Audio Listener and a Steam Audio Listener every frame. This requires making an expensive FindObjectOfType call per frame in Unity. When **Update Component** is unchecked in Per Frame Query Optimization, this per frame call to FindObjectOfType will not be made. This option should be used if the Audio Listener or Steam Audio Listener are not expected to change during the game.

Per Frame Query Optimization

Consolidated Baking Options

Provides a single place for generating probes and baking data for various Steam Audio components. This option is provided primarily for convenience in accessing all baking-related functionality from one place. It is still possible to generate probes and bake data individually for each component.



Consolidated Baking Options