

# **G'AUDIO** **CRAFT**

USER MANUAL V1.0.0 FOR UNITY

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# 1. Introduction

G'Audio Craft is an interactive 3D audio plugin for 3D game engines. With G'Audio Craft, content producers can create state-of-the-art spatial sound in their work.

Below are some notable features of G'Audio Craft, with more to come:

- **Guaranteed sound quality**

G'Audio Core, the best binaural rendering technology, comes integrated into G'Audio Craft. Built on G'Audio's top-notch technology, which was adopted as part of international standard MPEG H 3D-Audio, G'Audio Core provides accurate sound reproduction, allowing the listener to hear sounds as the producer intended. G'Audio Core is the secret sauce behind G'Audio Craft, enabling it to generate realistic audio experiences that reflect game characters' motions, sound object positions within the space, and materials of any object that may be positioned around sound sources.

- **Intuitive user interface**

A simple click and drag is all you need to transform your audio experience from 2D to 3D. Spatialization is intuitively visualized on screen, allowing users to easily review up-to-date audio production progress.

- **Universal compatibility**

Content built with G'Audio Craft runs smoothly on major VR hardware platforms including HTC Vive, Oculus Rift, and Gear VR. G'Audio Craft also supports major operating systems such as Microsoft Windows, macOS, iOS, and Android.

## 2. Getting started

### 2.1. System requirements

The following systems are verified to run G'Audio Craft so far — more will be tested shortly. If you encounter any issues while using G'Audio Craft on systems that are not listed below, please contact us at [support@gaudiolab.com](mailto:support@gaudiolab.com).

#### Unity

5.3 or later

**Note:** G'Audio Craft is compatible with Unity versions higher than 5.2 — the versions below 5.2 do not support the spatializer plugin.

#### Device and Architecture

G'Audio Craft is compatible with devices that support 64-bit architecture.

### 2.2. Installation

- 1) Download G'Audio Craft from the *Products > G'Audio Craft* tab at <https://www.gaudiolab.com/product/craft>.
- 2) Import G'Audio Craft in a Unity project by selecting the package file from *Asset > Import Package > Custom Package*.

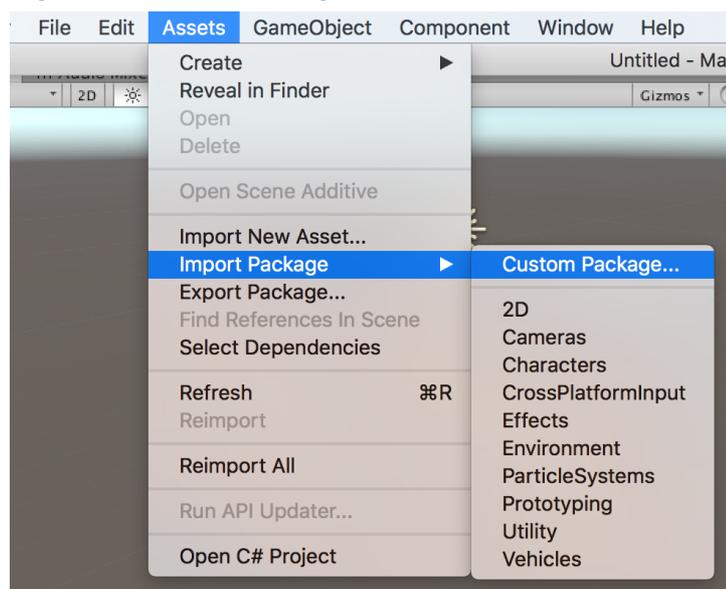
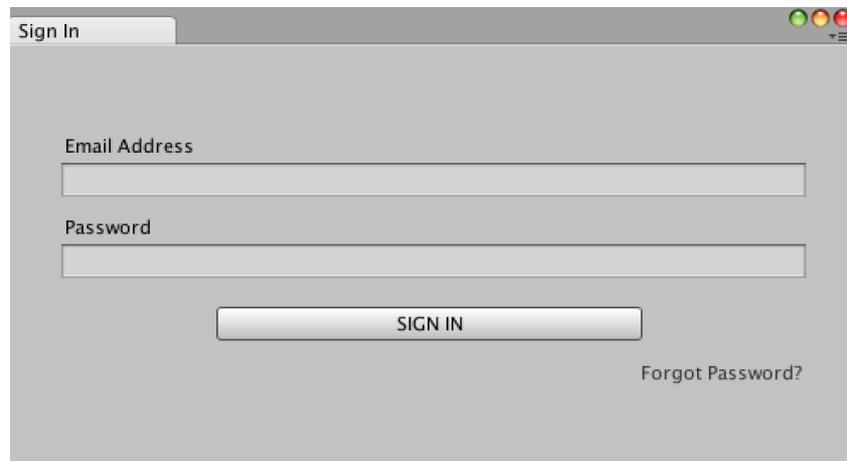


Figure 1. Importing G'Audio Craft to Unity project

- 3) Activate your product from *G'Audio* > *Sign In* with the account you previously created on our website.



*Figure 2. G'Audio Craft login window*

- 4) Your project window should now look like this.



*Figure 3. G'Audio Craft imported*

## 2.3. Settings

In order to use G'Audio Craft, you must first choose G'Audio Craft as the default spatializer. In your Unity project, go to *Edit > Project Settings > Audio*. In *AudioManager* window, change the settings as shown below.

### Doppler Factor

It is recommended to set **Doppler Factor** to 0. The default value 1 tends to over-apply Doppler Factor and make sounds too loose.

### System Sample Rate

Set **System Sample Rate** to 44100.

### DSP Buffer Size

It is recommended to choose either **Good Latency** or **Best Performance** for optimal spatial sound.

### Spatializer Plugin

Select G'Audio Craft as the **Spatializer Plugin**.

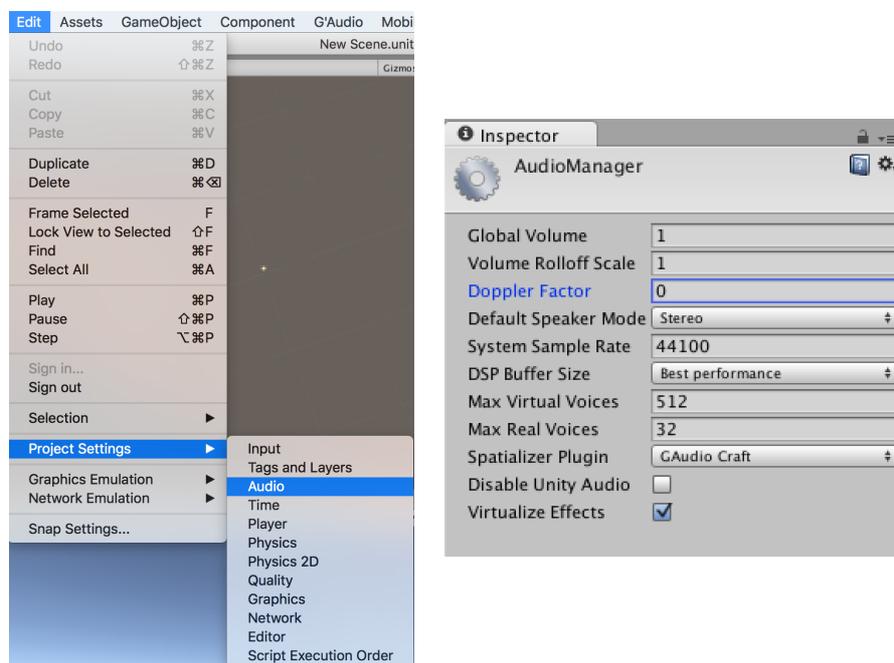


Figure 4. G'Audio Craft as default spatializer

## 3. Features and Functions of G'Audio Craft

G'Audio Craft consists of six major components and features. Audio that has been spatialized with G'Audio Craft will pass through the G'Audio Core engine for playback. Each component and feature is described below.

### 3.1. Craft Audio Source

*Craft Audio Source* allows users to easily spatialize all kinds of audio files, be it mono, stereo, or any other multichannel audio. One simple click on the *Spatialize* button recreates sounds in 3D while reflecting changes in positions (elevation, azimuth, distance) of sound objects and game players in real-time.

You can also manipulate directivity and occlusion effects manually using this component.

### 3.2. Craft Spatialize Occlusion Filter

Sounds are altered depending on what kinds of objects are placed between the listener and sound sources. This phenomenon is called occlusion, and it is essential in creating an authentic sound experience. G'Audio Craft gives users the flexibility to either manually adjust the occlusion level, or automatically detect game objects around sound sources through *Craft Spatialize Occlusion Filter*. Once *Craft Spatialize Occlusion Filter* is enabled after being attached to *Craft Audio Source* and the detection radius is set, game objects located between the listener and sound source within the radius will affect how sound is heard by the listener.

### 3.3. Craft Spatialize Directivity Filter

Sounds are altered depending on the direction where sound sources are facing. This phenomenon is called directivity, and it is essential in creating an authentic sound experience. G'Audio Craft gives users the flexibility to either manually adjust the directivity level through *Craft Spatialize Directivity Filter*.

### 3.4. Craft Material

*Craft Material* works closely with *Craft Occlusion Detector*. With *Craft Material*, you can choose a preset for the material of an obstacle inside the occlusion detection radius defined in *Craft Occlusion Detector*. It is also possible to customize the

occlusion parameter instead of choosing a preset. More presets will be available in future versions of G'Audio Craft.

### **3.5. Craft Space**

Providing a sense of what type of environment a player is in can take VR experiences to the next level of realism. *Craft Space* uses RIR (room impulse response) for reverberation, which means that sound waves gained in various real-life room settings, such as a warehouse or church, are used. With the help of RIR, G'Audio Craft maximizes realism and enhances the sound quality of room reverberation effects. Traditionally, excessive computation power was needed to process RIR, but *Craft Space* achieves great sound quality while effectively reducing the computational workload. *Craft Space* offers several presets for reverberation, with more to come in the near future.

Another distinguishing property of *Craft Space* is its use of audio mixers in Unity. You can build a number of audio mixers with different reverb presets so that you can control reverb and spatialization on each audio source separately. This allows for more sophisticated audio engineering and provides more accurate audio simulation. If audio that is already spatialized gets reverberated, it may interfere with the binaural cues of the audio and corrupt the producer's original intention. G'Audio Craft minimizes that risk by addressing spatialization and reverberation independently.

### **3.6. Craft Audio Filters**

*Craft Audio Filters* is a component that came about because Unity's default audio filters. Since G'Audio Craft uses its own audio source (*Craft Audio Source*) instead of Unity's *Audio Source* for spatialization, Unity's default audio filters cannot be used directly. *Craft Audio Filters* provides the same audio filters as Unity's and can be used for audio spatialized by *Craft Audio Source*.

### **3.7. Craft Scene Audio Settings**

*Craft Scene Audio Settings* is where you can modify preferences of your working parameters like world scale.

### 3.8. Craft Debug

Log information becomes available when *Craft Debug* is activated. The log can be used to monitor the performance of the plugin in case issues arise during development.

## 4. Spatializing Audio with G'Audio Craft

With G'Audio Craft, full 3D audio is just a few clicks away. *Craft Audio Source* is used to spatialize audio.

### 4.1. Key elements of *Craft Audio Source*

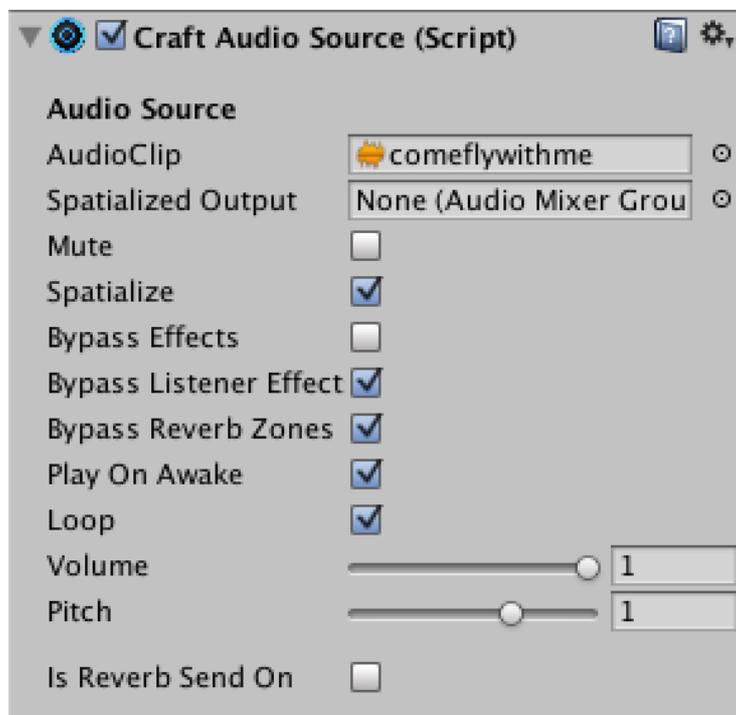


Figure 5. *Craft Audio Source*

**AudioClip** The audio file that you want to spatialize is inserted here.

**Spatialized Output** This corresponds to the *Output* in Unity's *Audio Source*. The spatialized sound can be output through an audio mixer for detailed audio engineering.

**Spatialize** This button will trigger spatialization of the audio clip inserted above.

**Directivity, Occlusion, and Reverb** in the *Spatialize Filter* section will be elaborated on in

## 5. ADDING OTHER EFFECTS TO SPATIAL AUDIO.

## 4.2. How to spatialize audio with Craft Audio Source

- 1) Choose G'Audio Craft as the default spatializer. Refer back to **2.3. Settings** for detailed information.
- 2) Go to **Add Component** and insert a *Craft Audio Source* to a game object.

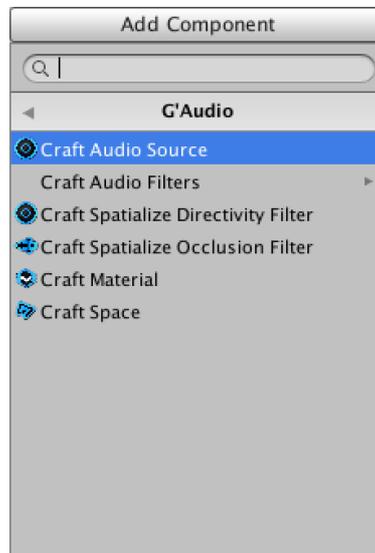


Figure 6. Adding Craft Audio Source in inspector window

**Tip:** You can also add *Craft Audio Source* by dragging *CraftAudioSource* from *G'Audio > Scripts > CraftComponents* in the project window to the game object's inspector window.

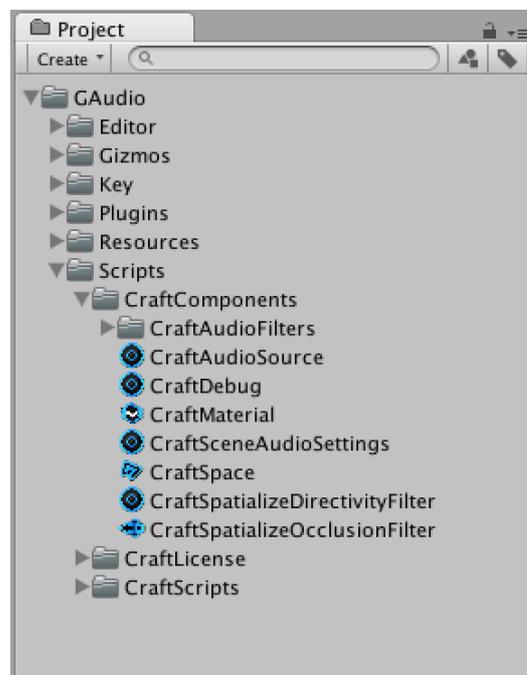


Figure 7. Adding Craft Audio Source from project window

- 3) Add an audio file to the AudioClip and click Spatialize in *Craft Audio Source* inspector window. The object with spatial audio is visualized with G'Audio Lab logo in the scene.

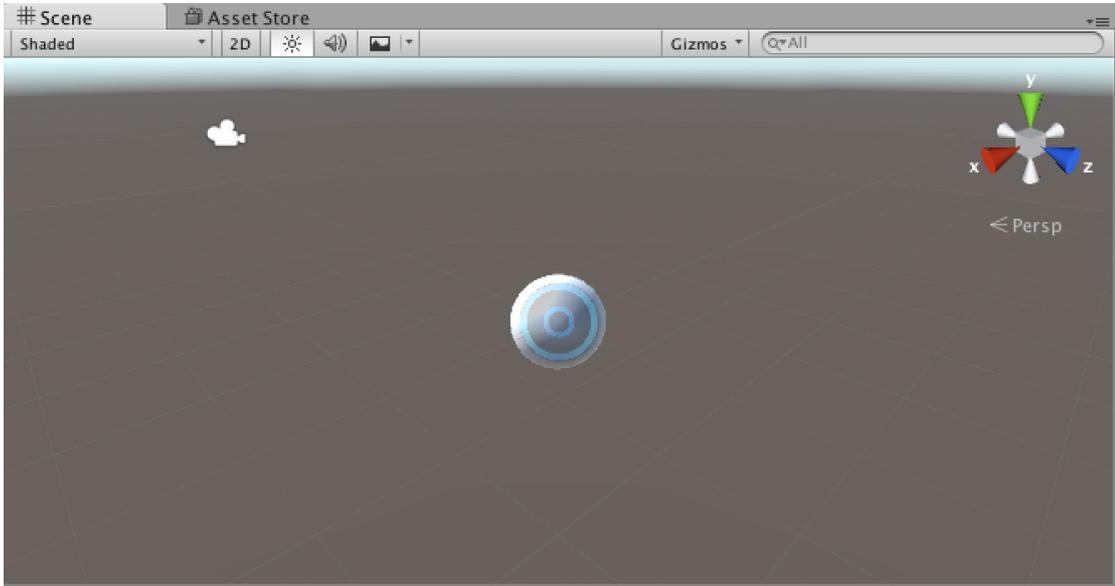


Figure 8. Spatial audio visualized in scene window

**Note:** All audio files supported in Unity can be used in G'Audio Craft.

**Note:** Double check which object is the audio listener. If set incorrectly, spatial audio will not be properly audible.

## 5. Adding Other Effects to Spatialized Audio

Features such as directivity, occlusion, and reverberation can enrich the sound experience with more lifelike audio in a virtual environment.

**Note:** You should already have created spatial audio using *Craft Audio Source* before applying directivity, occlusion, and reverberation to the audio.

### 5.1. Directivity

Directivity effect describes a pattern where an object radiates sound in certain directions. For example, if a player walks around a jukebox, the music will sound louder in the front and quieter from behind.

You can adjust the directivity level from *Craft Spatialize Directivity Filter*. The closer the parameter is to 1, the more directional the sound becomes. The directivity parameter is 0 when the sound is omni-directional. Directivity pattern is visualized as a sector of a circle in the scene.

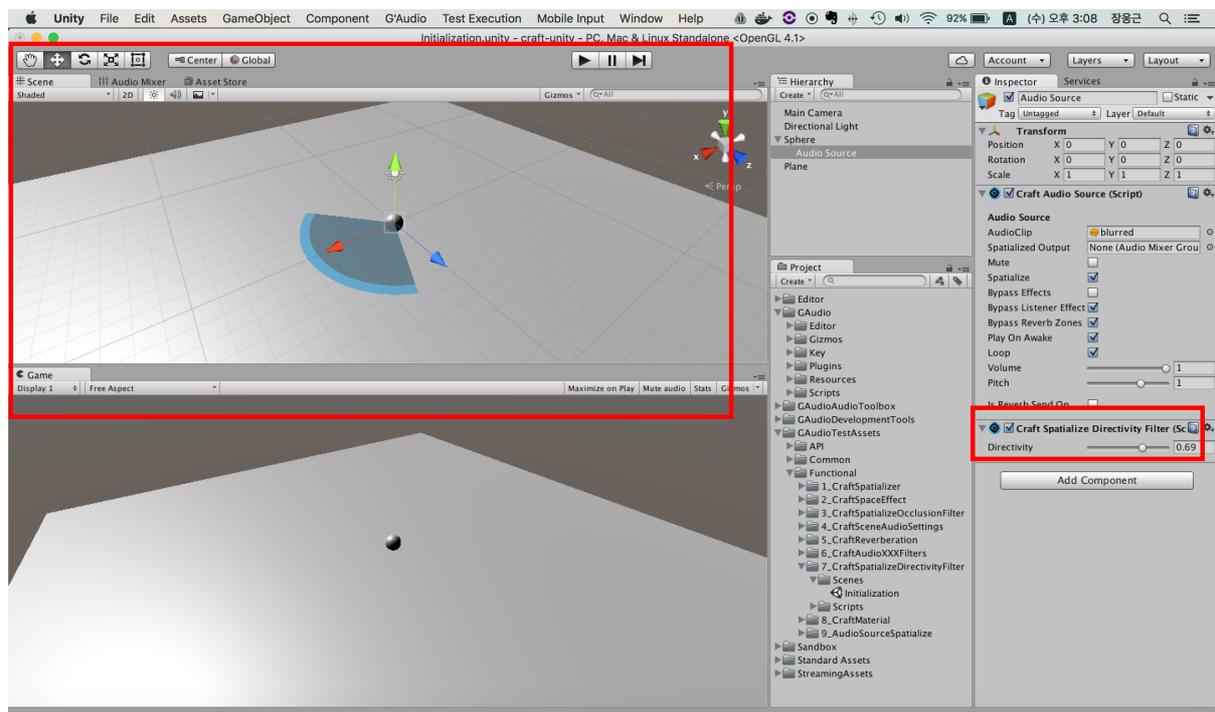


Figure 9. Directivity feature in Craft Audio Source

### 5.2. Occlusion

Users can create occlusion effects either manually in *Craft Spatialize Occlusion Filter* handle occlusion automatically. Each option is explained below.

## Producing Occlusion Effects Manually

- 1) Click Add Component and add Craft Spatialize Occlusion Filter to the audio source where Craft Audio Source is already attached to.
- 2) Set the Occlusion level in Craft Spatialize Occlusion Filter between 0 and 1. The value of 1 indicates maximum occlusion effect and 0 indicates none. The occlusion pattern is visualized as a sphere in the scene, where the sphere becomes more transparent as it becomes less occluded.

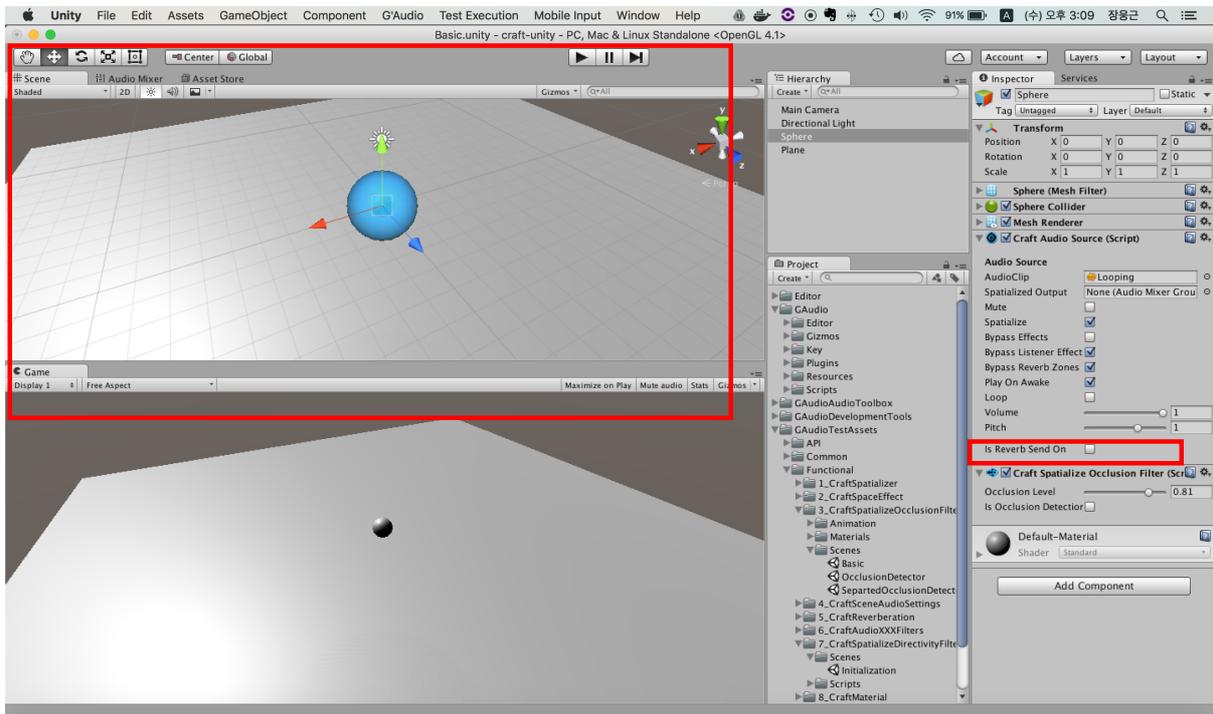


Figure 10. Adjusting occlusion in Craft Audio Source

## Producing Occlusion Effects Automatically

- 1) Click Add Component and add *Craft Spatialize Occlusion Filter* to the audio source where *Craft Audio Source* is already attached to. Click *Occlusion Detector* and *Detection Radius* checkbox.

**Tip:** You can also add *Craft Spatialize Occlusion Filter* by dragging *CraftSpatializeOcclusionFilter* from *G'Audio > Scripts > CraftComponents* in the project window to the game object's inspector window.

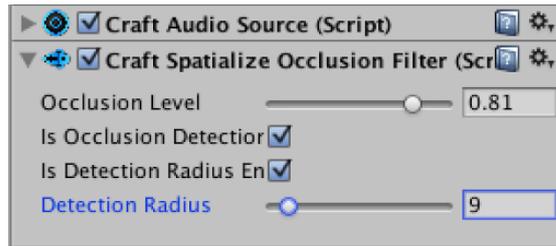


Figure 11. Craft Occlusion Detector

- 2) Set Detection Radius. The Detection Radius will be visualized as a semi-sphere in the scene. Make sure the radius is wide enough to cover all objects that you wish to make occlusion effects for. Note that if *Craft Material* is used, the occlusion parameter will be disabled in *Craft Audio Source*.

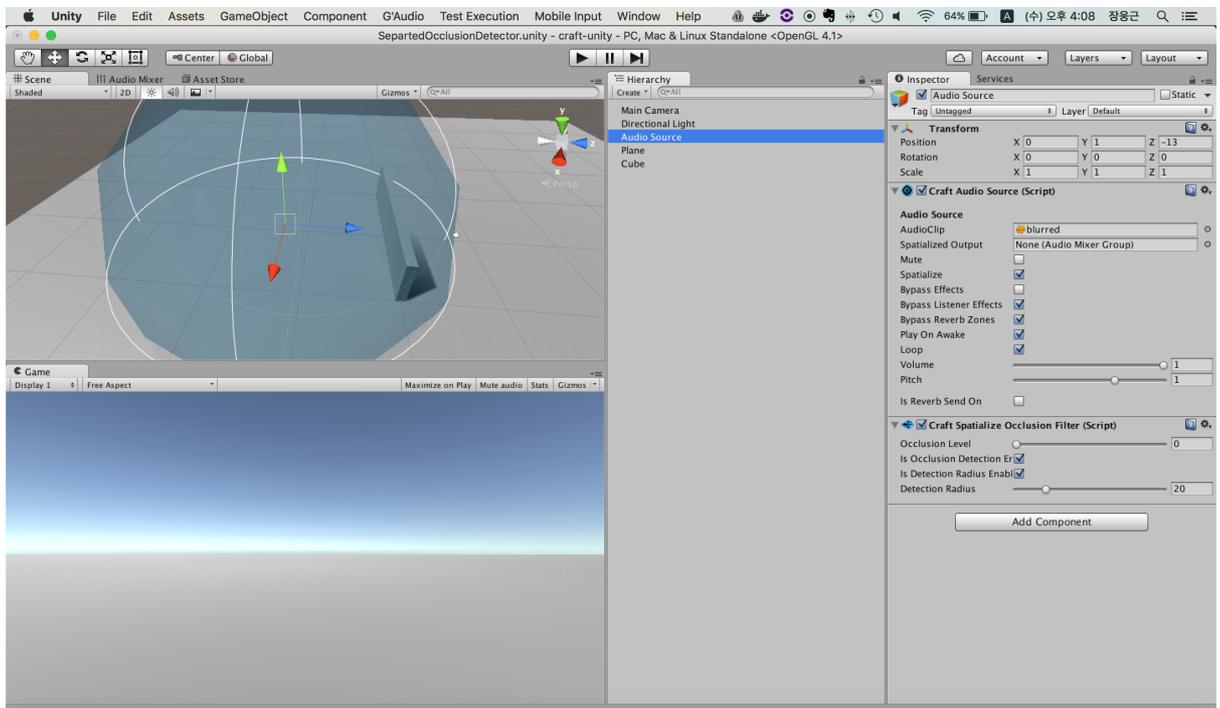


Figure 12. Occlusion radius visualized in the scene window

- 3) Add the component *Craft Material* to a game object (e.g. wall). The occlusion level will change automatically depending on your preset choice.



Figure 13. Craft Material window

- 4) In play mode, the player is seen with a flat grey circle around the character. Occlusion is triggered when the player enters the occlusion semi-sphere, and a purple ball appears at the wall where occlusion is being applied. This shows that the audio listener is now hearing occluded sound passing through the wall.

If the player moves sideways so that the wall is not blocking the audio source anymore, the purple ball disappears and the player can now hear clearer and louder sound.

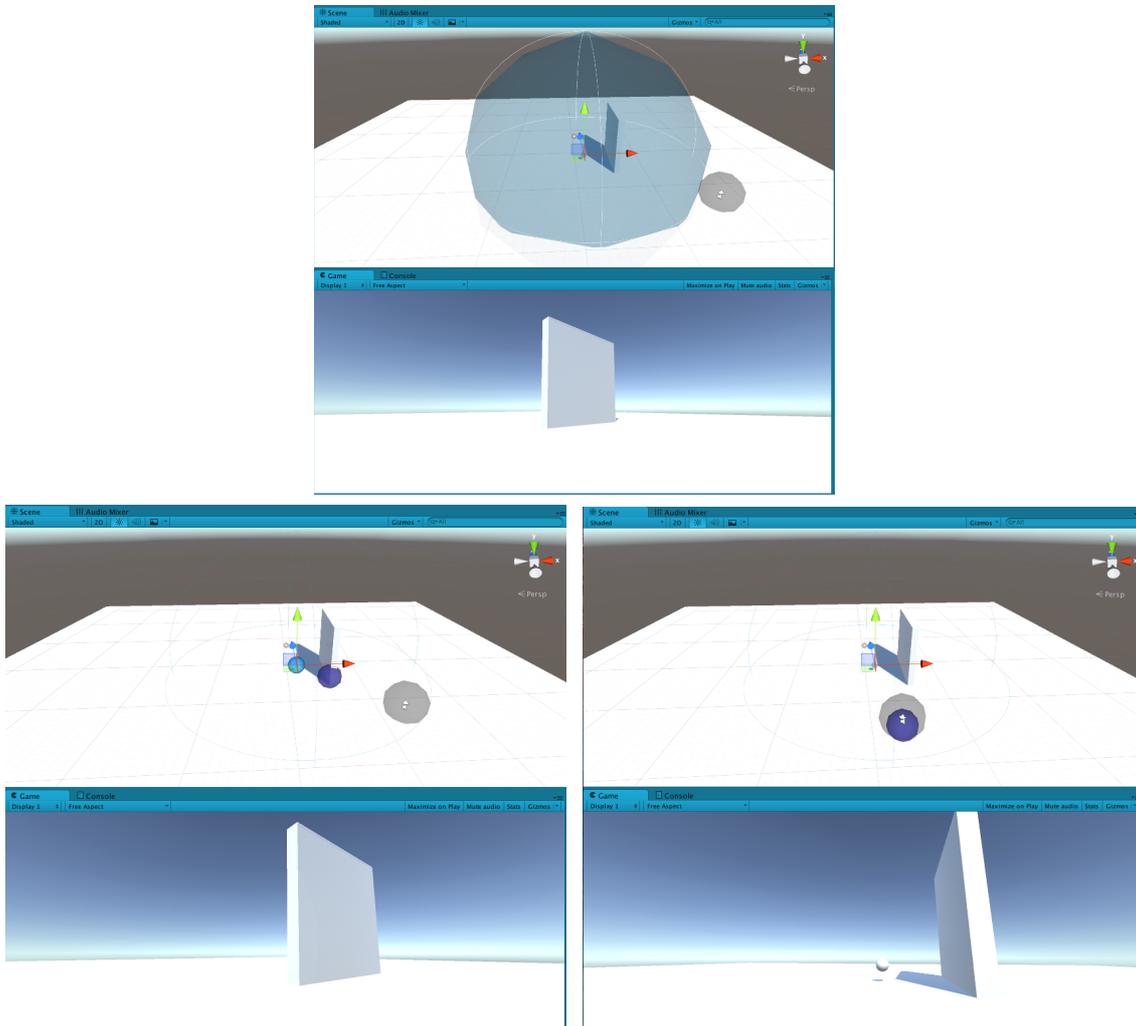


Figure 14. Visualization of occlusion by Craft Occlusion Detector

## 5.3. Reverberation

G'Audio Craft uses audio mixers for room reverberation effects. Detailed steps are outlined below.

### 5.3.1. Creating reverb audio mixer groups

- 1) Create a new *Audio Mixer*.

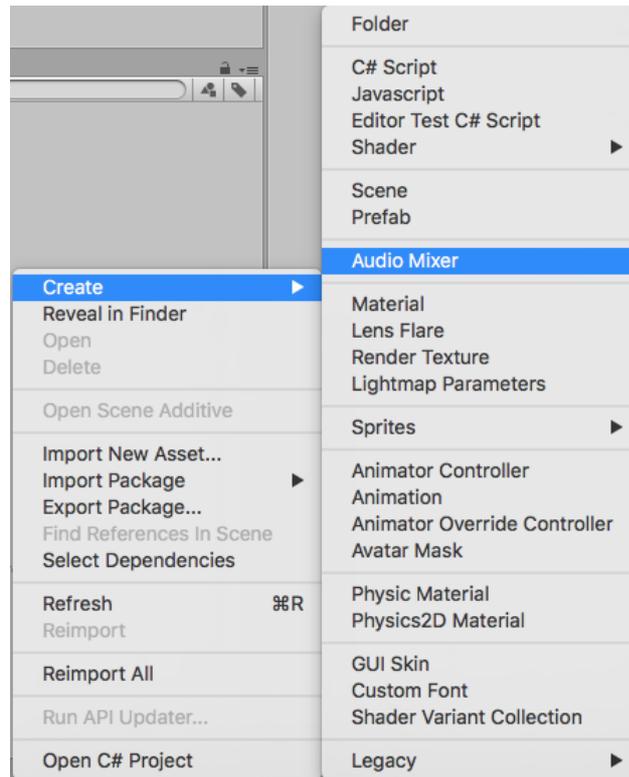


Figure 15. Creating audio mixer

- 2) Create different audio mixer groups inside the audio mixer. These groups will be put on the spaces you wish to reverb.
- 3) Add *G'Audio Craft Space* to each mixer group. You can select a preset from the inspector window of the audio mixer group. You may add other audio plugins for sound effects to the mixer instead of the presets in *Craft Space*.  
**Note:** Do not add *G'Audio Craft* in the mixer to avoid distortion in sound.

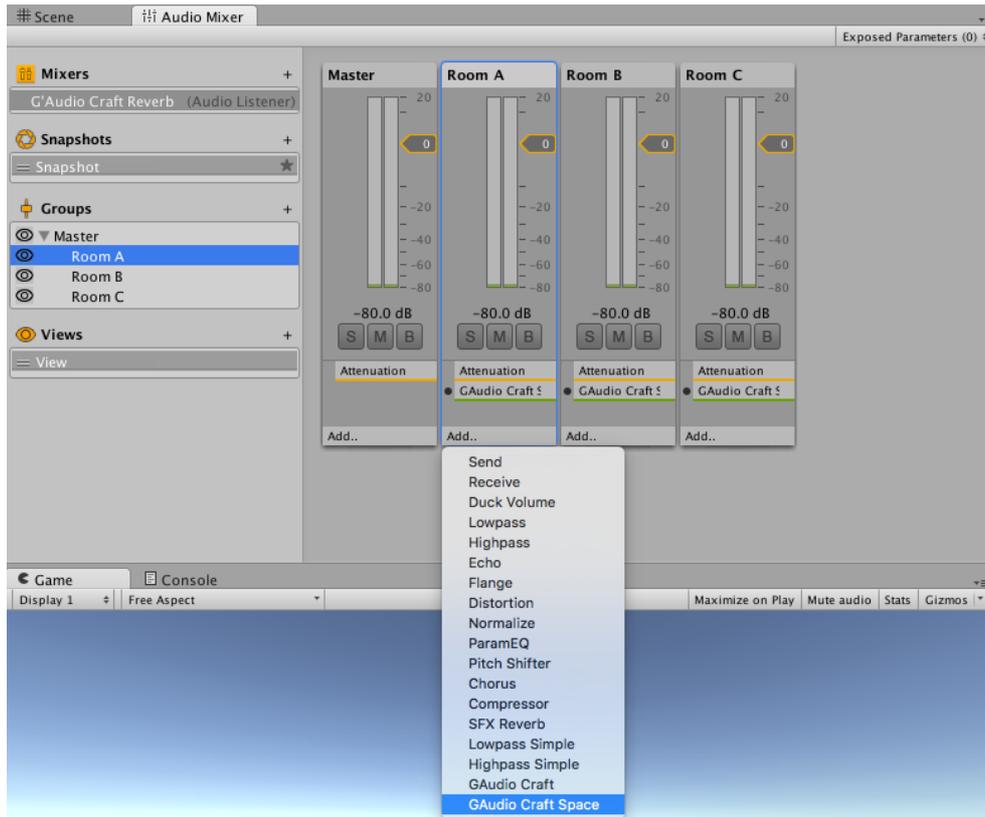


Figure 16. Audio mixer window with G'Audio Craft Space

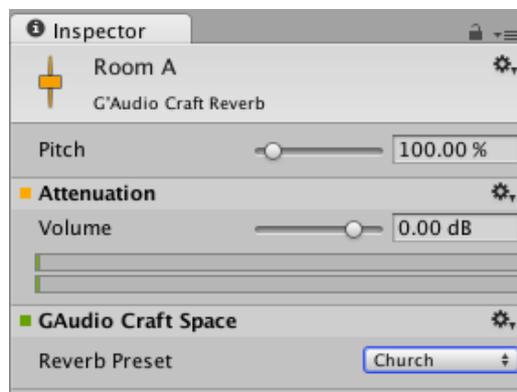


Figure 17. G'Audio Craft Space window

### 5.3.2. Defining space to apply reverb

There are two ways to define reverb area depending on your game scenarios: through *Craft Audio Source* and through *Craft Space*.

#### Using *Craft Audio Source*

- 1) Enable Reverb Send On in *Craft Audio Source* of the sound object you wish to reverberate. In this example, the sphere in the center is already spatialized with *Craft Audio Source*.
- 2) Adjust reverb gain from 0 to 1.

3) Drag a reverb audio mixer group to Output AudioMixer Group.

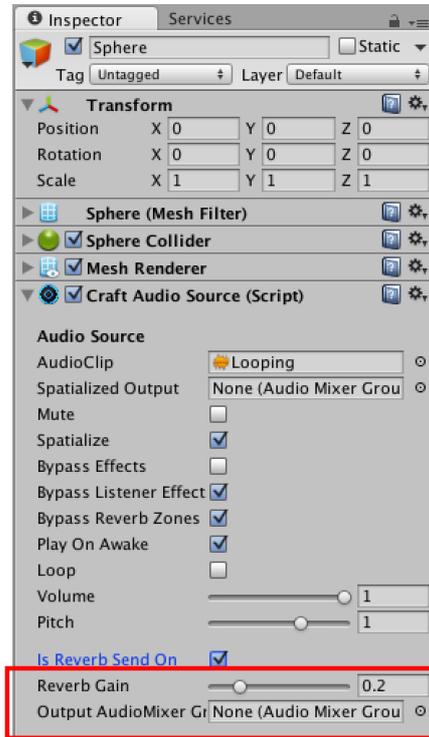


Figure 18. Reverb feature in Craft Audio Source

## Using Craft Space

- 1) Create an empty game object and add a collider to create a space where reverb will be applied.
- 2) Drag *CraftSpace* from *G'Audio > Scripts > CraftComponents* folder in the project window to the inspector window of the newly created object.
- 3) Drag the previously created audio mixer group to the corresponding room.

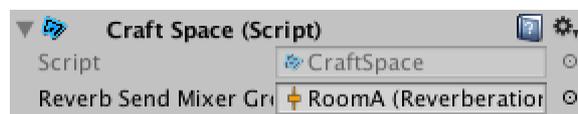


Figure 19. Craft Space in inspector window

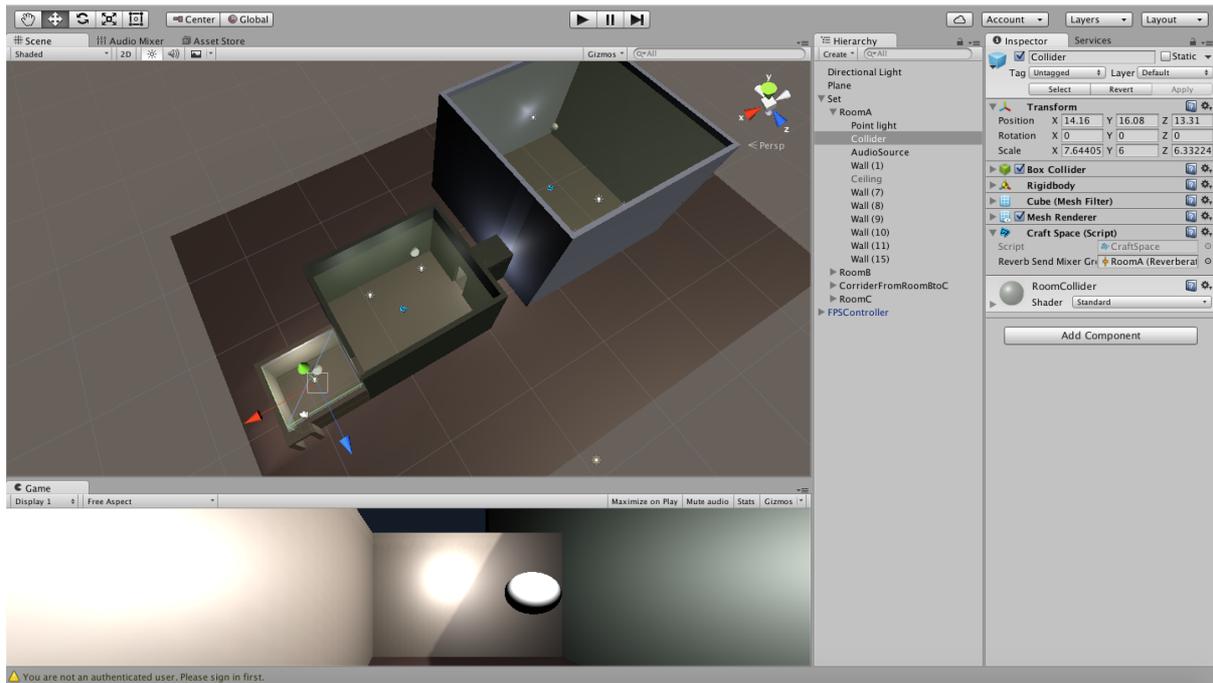


Figure 20. Defining reverb area with Craft Space

**Tip:** If there is only one reverb space defined, then it is more convenient to just use *Craft Audio Source*. However, if you want to have more than one reverb space with audio transition effects, it is recommended to use *Craft Space*. Read **5.3.3. Audio Transition** to learn how to create audio transition.

### 5.3.3. Audio transition

If you have several spaces in one scene, audio mixer snapshots are useful in creating smooth transitions from one room to another. A snapshot is like a photo that captures certain status of audio mixers. Some coding may be needed in this step.

- 1) Create snapshots to simulate scenarios of entering different rooms. For example, if you want to simulate entering Room A, you can create a snapshot in which the volume of the audio mixer groups for Room B and Room C are lowered.
- 2) Write a script to trigger the transition and add it to the space where the transition will take place. Define the transition snapshot in the transition script. Sample code is listed below.

```

using UnityEngine;
using UnityEngine.Audio;
using System.Collections;

public class SnapshotTransitionMaker : MonoBehaviour
{
    public AudioManagerSnapshot spatializedSnapshot;
    public AudioManagerSnapshot reverbSnapshot;
    [Range(0f, 50f)] public float timeToReach;

    void OnTriggerEnter(Collider others)
    {
        if (others.CompareTag("Player")) {
            spatializedSnapshot.TransitionTo(timeToReach);
            reverbSnapshot.TransitionTo(timeToReach);
        }
    }
}

```

Figure 21. Sample code for audio transition

## 5.4. Audio Filters

To add audio filters to spatialized audio, click **Add Component** and add one of the *Craft Audio Filters* to the audio source with *Craft Audio Source* enabled.

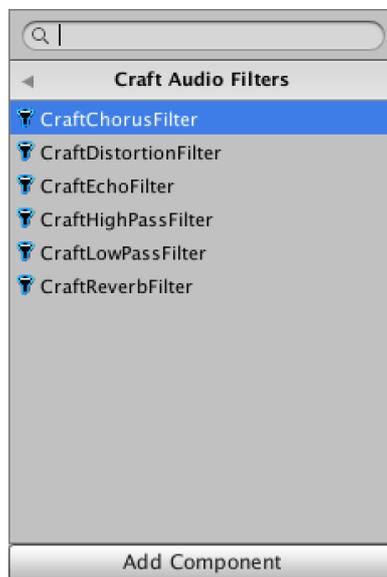


Figure 22. Craft Audio Filters

**Tip:** You can also add the filters from *G'Audio > Scripts > CraftComponents > CraftAudio Filters* folder from the project window.

## 5.5. World Scale

- 1) Click G'Audio > Preference

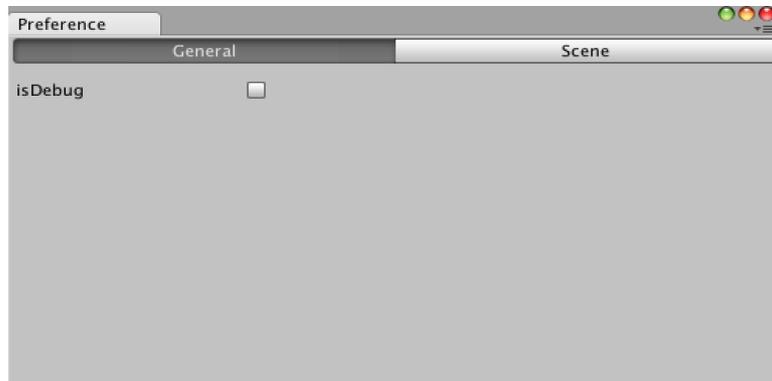


Figure 23. Craft Preference Menu

- 2) Go to Scene tab

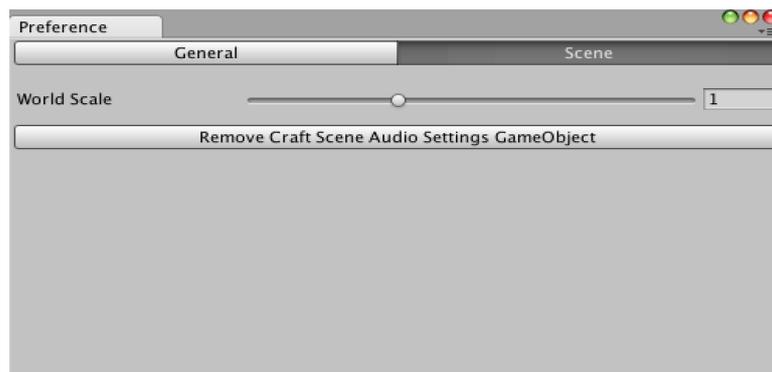


Figure 24. Craft Preference Scene Tab

- 3) Click "Generate Craft Scene Audio Settings GameObject". Then you will see *Scene Audio Settings GameObject* is added into the scene, and also its inspector is drawn to Preference Window like below.
- 4) You can adjust the world scale. The closer the parameter approaches is to 1, the more world scale becomes larger.

## 6. Build settings

### 6.1. iOS

When building for iOS, G'Audio Craft needs to be registered in the startup code of the application. Follow the steps below.

#### Set-up before build

Select ILLP as the scripting backend to compile for architecture ARM64 in iOS

#### Set-up after build

iOS XCode project will be created after build. Insert the following codes to *AppController.h* file and *AppController.mm* file.

- 1) *AppController.h*

```
#Include "AudioPluginInterface.h"
```

- 2) *AppController.mm*: insert the code below into *iOS preStartUnity* callback to register G'Audio Craft as Unity-native plugin.

```
(void) preStartUnity  
{UnityRegisterAudioPlugin(&UnityGetAudioEffectDefinitions);}
```

### 6.2. Other platforms

In *Build Settings*, change *Architecture* to *x86\_64*. Otherwise the spatializer will not be applied in the final output.

## 7. Troubleshooting

Known bugs and issues will be updated soon. If you have any other questions or comments, or need some clarification, please contact us at [support@gaudiolab.com](mailto:support@gaudiolab.com).