audiokinetic

The Wwise Project Adventure

A Handbook for Creating Interactive Audio Using Wwise

Damian Kastbauer

2014.1.1

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Wwise 2014.1.1 Build 5179

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The Adventure Begins

While interactive audio continues to scale in complexity, certain implementation and workflow fundamentals remain the same. The Wwise sound engine and authoring application has been built from the ground up to support current and next gen audio integration in a flexible and dynamic productivity pipeline.

Building on the concepts explained in *Wwise Fundamentals*, the *Wwise Project Adventure* shows how to implement interactive and dynamic audio for a fictional game project. This comprehensive overview covers the process from start to finish, and the companion Wwise project allows you to take a hands-on approach to investigating the techniques. Whether you take a hands-on approach with the tutorial, or simply follow along in the accompanying project is up to you.

This book is intended for readers with some experience with digital audio in addition to basic experience with audio for games. Links to additional information to extend your knowledge into different areas of implementation are provided throughout this document. It does not replace the user documentation, but instead provides a way to access the details through specific examples and illustrations of techniques using the Wwise authoring application.

Our case study is a fantasy adventure game set deep in a forest, with danger lurking at every turn. An occasional dungeon gives the hero an opportunity to purge the scourge that lies within its darkened corridors. Armed with a trusty sword and the steadfast courage to persevere, the hero follows the path to riches that lie just ahead on the horizon.

Welcome to the Wwise Project Adventure!

Chapter 1. Setting the Ambient Stage

Overview

The stage is set before a single piece of geometry has been placed. The goal is simple: create a lush and non-repetitive ambient background to support hours of travel through the deep forest that lies ahead.

This chapter will take you through the process of:

- Importing audio files.
- Setting up a looping background ambient audio source.
- Randomizing playback of background ambient elements.
- Randomizing the 3D position of elements.
- Applying real-time parameter control to blend containers using Crossfade.
- Using sound emitters as part of ambient design.
- Creating attenuation ShareSets.
- Subscribing attenuations to game objects.
- Using SoundSeed Air - Wind.
- Master-Mixer hierarchy organization.

Building the Foundation

Importing Audio Files

We'll begin by importing a single audio file into a new Wwise project with the intention of using it as a looping ambient background. There are a few things to keep in mind about the process of bringing content into the project.

At a very basic level, Wwise distinguishes between the following two types of assets:

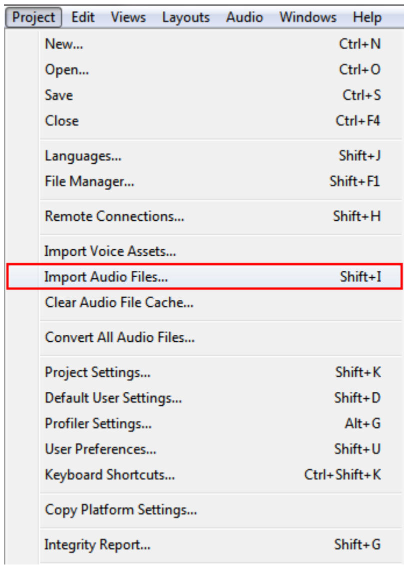
- Original assets imported into Wwise.
- Versions of these assets created for the various game platforms.

Wwise stores these two types of assets in different locations within the project folder, so they can be managed independently. Any imported assets are stored in the Originals project folder by default. Since these assets are usually shared by several people on your team, this folder can be located anywhere on your network and can easily be managed by your source control system.

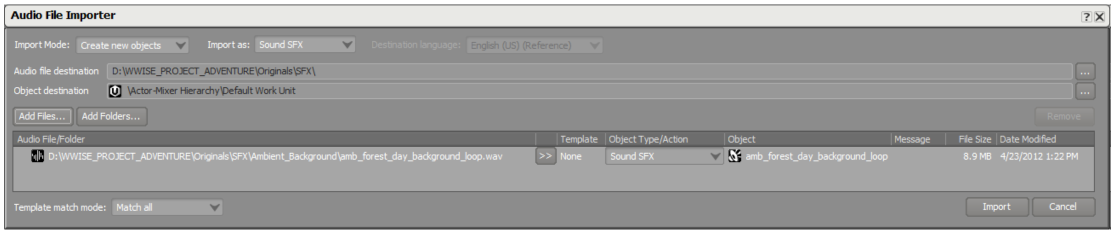
The import process includes the following operations:

- The original media (WAV) files are validated by Wwise before being copied into the project's Originals folder.
- Audio sources are created for the media files.
- Sound or music objects that contain audio sources are created in Wwise and are displayed in their respective hierarchies on the Audio tab of the Project Explorer.

Importing files into the Actor-Mixer hierarchy using the Audio File Importer allows you to import individual files or groups of files by folder. You can import through the Project menu, or by right-clicking the work unit or container where you want the audio files.


Project
Edit
Views
Layouts
Audio
Windows
Help
New... Ctrl+N
Open... Ctrl+O
Save Ctrl+S
Close Ctrl+F4
Languages... Shift+J
File Manager... Shift+F1
Remote Connections... Shift+H
Import Voice Assets...
Import Audio Files... Shift+I
Clear Audio File Cache...
Convert All Audio Files...
Project Settings... Shift+K
Default User Settings... Shift+D
Profiler Settings... Alt+G
User Preferences... Shift+U
Keyboard Shortcuts... Ctrl+Shift+K
Copy Platform Settings...
Integrity Report... Shift+G

Importing audio files from the Project menu


Audio File Importer

Import Mode: Create new objects
Import as: Sound SFX
Destination language: English (US) (Reference)
Audio file destination: D:\WWISE_PROJECT_ADVENTURE\Originals\SFX\
Object destination: \Actor-Mixer Hierarchy\Default Work Unit

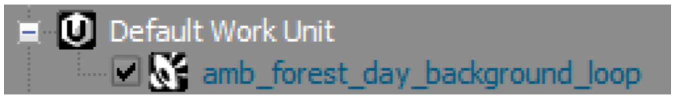
Audio File/Folder		Template	Object Type/Action	Object	Message	File Size	Date Modified
D:\WWISE_PROJECT_ADVENTURE\Originals\SFX\Ambient_Background\amb_forest_day_background_loop.wav	>>	None	Sound SFX	amb_forest_day_background_loop		8.9 MB	4/23/2012 1:22 PM

Template match mode: Match all

The Audio File Importer showing a single file to be imported as a Sound SFX

Alternately you can drag and drop audio files from folders directly into the Wwise hierarchy.

In the following example we'll import an ambient sound file for use as the basis of our ambient sound system. This file used can be found in the project folder: /Originals/SFX/Ambient_Background/ambient_forest_day_background_loop.wav.

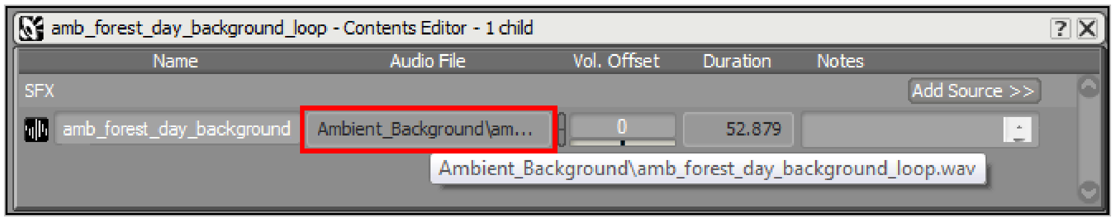


Imported sound file

Designer Note

Sound, music, or motion fx objects associated with sources that are not converted for the current platform appear blue in the Audio tab of the Project Explorer. Once a sound source has been converted to the target platform format, the text appears white. If a sound object has been created with no valid source, the text will appear red.

The imported file is added to a sound object, which includes a reference to the imported media file(s). When you load a sound object into the Property Editor, its sources are displayed in the Contents Editor.

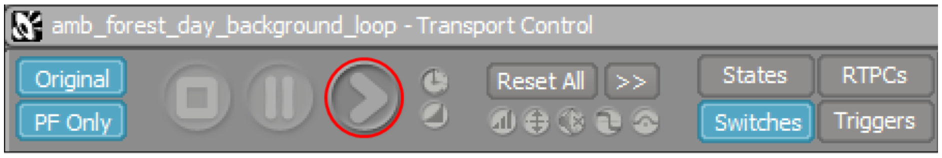

amb_forest_day_background_loop - Contents Editor - 1 child
Name
Audio File
Vol. Offset
Duration
Notes
SFX
Add Source >>
amb_forest_day_background
Ambient_Background\am...
0
52.879
Ambient_Background\amb_forest_day_background_loop.wav

Sound SFX object showing the source audio file location

Designer Note

A sound object can contain multiple sources including alternate versions, silence, plug-ins and different language versions for localization.

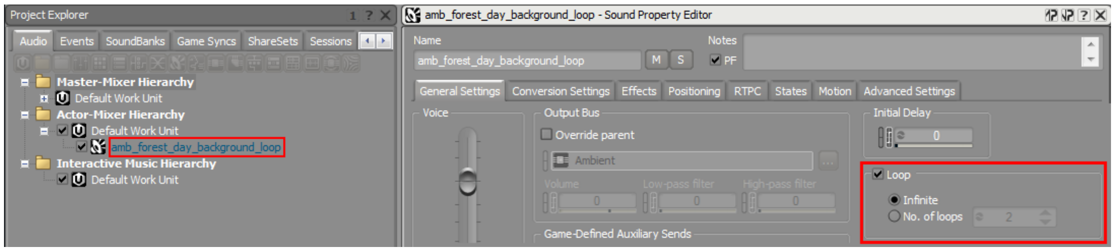
A sound object can be auditioned by using the Transport Control. After double-clicking the ambient_forest_day_background_loop sound object, click the play icon to play the object loaded in the Transport Control. Alternately, pressing the spacebar plays and stops the sound object.



Transport Control showing the play icon

Setting Up a Looping Sound

Now that a background forest day ambience audio file has been added to the project, it needs to be set to loop for it to continue playing. You have the option to loop the sound or motion fx object indefinitely, or to specify the number of times it will be looped.



Looping properties of a Sound SFX

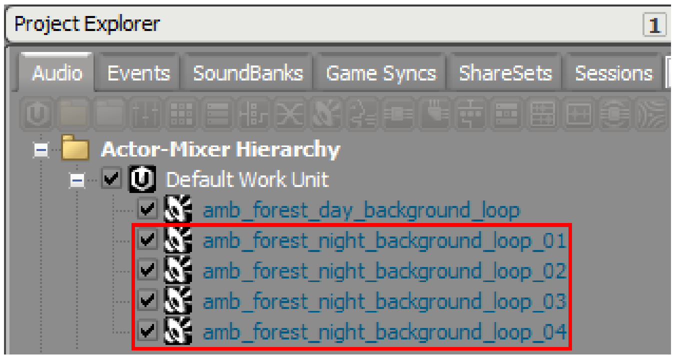
By default, double-clicking an object displays the object's properties. This action changes the focus of the Sound Property Editor to the object that was selected.

Looping Multiple Sound Files

While playing a single sound file with no audible loop point continues to be a relevant technique, it has become equally common practice to assemble a loop through the randomized combination of individual sound files. For example, instead of playing back a single two minute sound file, you could instead choose to randomize the playback of four 30 second files.

Moving forward with this approach for the night forest ambient background, we'll start with a single ambient sound file that has been edited into four smaller files. These files will then be imported and parented within a random container. By randomizing the order in which these four files are played back, the eventual loop composition will be created differently each time.

Start first by importing the four individual files, either using the audio file importer (as shown above) or by dragging and dropping them into the default work unit from their source folder.



Actor-Mixer Hierarchy
Default Work Unit
amb_forest_day_background_loop
amb_forest_night_background_loop_01
amb_forest_night_background_loop_02
amb_forest_night_background_loop_03
amb_forest_night_background_loop_04

Multiple sound files imported

To accommodate the complex nature of audio within a game, different types of objects can exist within the Wwise project hierarchy. You can use a combination of the following object types to group your assets and build a structure for your project.

- Sound objects
- Motion FX objects
- Actor-Mixers
- Containers

The Actor-Mixer hierarchy includes four container types:

- ▦

  - Random Container: a group of one or more sounds, motion fx objects, and/or containers that are played back in a random order.
- ☰

  - Sequence Container: a group of one or more sounds, motion fx objects, and/or containers that are played by according to a specific playlist.
- ⊞

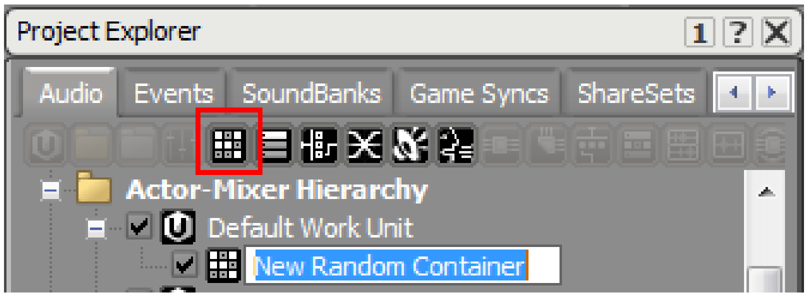
  - Switch Container: a group of one or more sounds, motion fx objects, and/or containers that are organized into a series of switches or states that correspond to the different alternatives that exist for a particular element in the game.
- ✕

- Blend Container: a group of one or more sounds, motion fx objects, and/or containers that are played back simultaneously. The sounds and containers within the blend container can be grouped into blend tracks where sound properties are mapped to game parameter values using RTPCs. Crossfades can also be applied between the sounds within a blend track based on the value of a game parameter.

The next step in the process uses multiple audio files whose order will be randomized when played. For this example we will be creating a random container. A random container or other type of sound object can be created a few different ways:

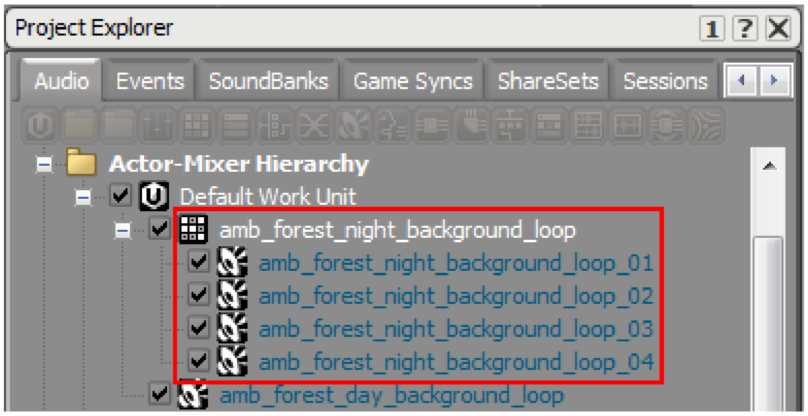
- Using the Project Explorer toolbar
- Through the right-click contextual menu
- Using a shortcut key command (Help menu: Wwise Shortcuts Quick Reference Card)

By selecting the default work unit and then clicking the random container icon in the Project Explorer toolbar, a new random container is created within the selected work unit or sound object.



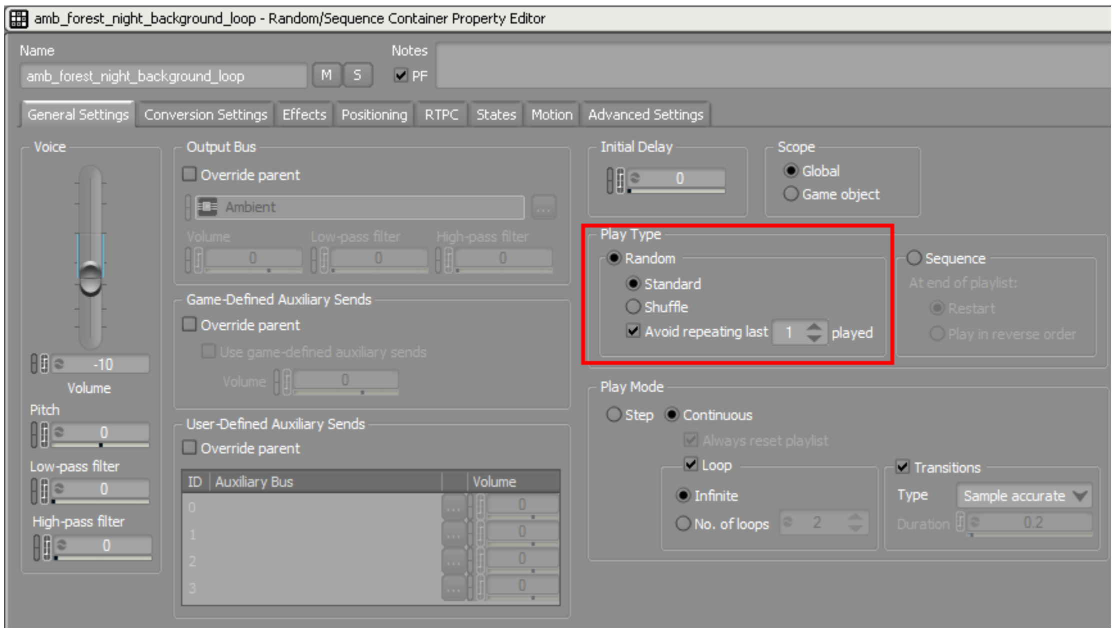
Creating a random container from the Project Explorer toolbar

Once the random container has been created and named, sound objects can be dragged and dropped directly into it.


Project Explorer
Audio
Events
SoundBanks
Game Syncs
ShareSets
Sessions
Actor-Mixer Hierarchy
Default Work Unit
amb_forest_night_background_loop
amb_forest_night_background_loop_01
amb_forest_night_background_loop_02
amb_forest_night_background_loop_03
amb_forest_night_background_loop_04
amb_forest_day_background_loop

Random container containing multiple ambient sound files

Now that the four smaller pieces of the background forest night ambience loop have been added to the container, their order of playback will be stepped through based on the properties set in the Random Container Property Editor. In Wwise, random can mean either a standard random selection, where each object within the container has an equal chance of being selected for playback, or a shuffle selection, where objects are removed from the selection pool after they have been played. You can double-click your random container to display its random properties.


amb_forest_night_background_loop - Random/Sequence Container Property Editor

Name: amb_forest_night_background_loop

Notes: PF ✓

General Settings | Conversion Settings | Effects | Positioning | RTPC | States | Motion | Advanced Settings

Voice: Volume -10; Pitch 0; Low-pass filter 0; High-pass filter 0

Output Bus: Override parent ☐; Ambient; Volume 0; Low-pass filter 0; High-pass filter 0

Game-Defined Auxiliary Sends: Override parent ☐; Use game-defined auxiliary sends ☐; Volume 0

User-Defined Auxiliary Sends: Override parent ☐

ID	Auxiliary Bus	Volume
0		0
1		0
2		0
3		0

Initial Delay: 0

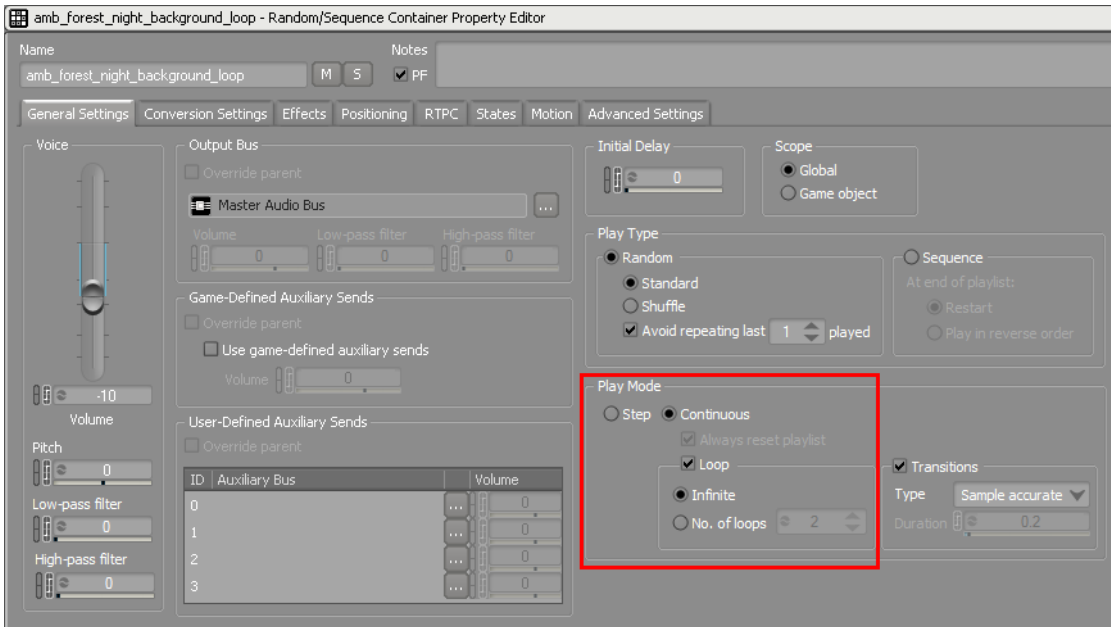
Scope: [✓ Global] Game object

Play Type: [✓ Random] Sequence
- [✓ Standard] Shuffle
- Avoid repeating last 1 played ✓
- At end of playlist: [✓ Restart] Play in reverse order

Play Mode: Step [✓ Continuous]
- Always reset playlist ✓
- Loop ✓: [✓ Infinite] No. of loops 2
- Transitions ✓: Type Sample accurate; Duration 0.2

Play type properties for a random container

The same looping functionality exists within the properties of a random container, where a group of audio files can be randomized within the container and looped in the same way.



amb_forest_night_background_loop - Random/Sequence Container Property Editor

Name: amb_forest_night_background_loop

Notes: PF ✓

General Settings | Conversion Settings | Effects | Positioning | RTPC | States | Motion | Advanced Settings

Voice: Volume -10; Pitch 0; Low-pass filter 0; High-pass filter 0

Output Bus: Override parent ☐; Master Audio Bus; Volume 0; Low-pass filter 0; High-pass filter 0

Game-Defined Auxiliary Sends: Override parent ☐; Use game-defined auxiliary sends ☐; Volume 0

User-Defined Auxiliary Sends: Override parent ☐

ID	Auxiliary Bus	Volume
0		0
1		0
2		0
3		0

Initial Delay: 0

Scope: ● Global ○ Game object

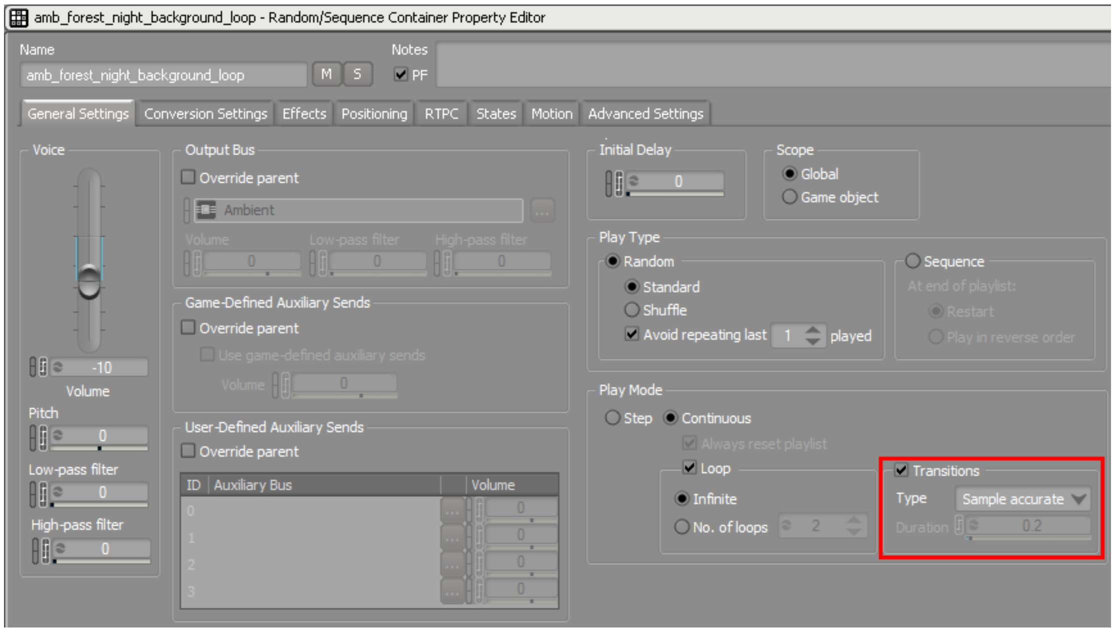
Play Type: ● Random (● Standard ○ Shuffle; ✓ Avoid repeating last 1 played) ○ Sequence (At end of playlist: ● Restart ○ Play in reverse order)

Play Mode: ○ Step ● Continuous; ✓ Always reset playlist; ✓ Loop (● Infinite ○ No. of loops 2)

✓ Transitions; Type: Sample accurate; Duration 0.2

Looping sounds in a random container using continuous play mode

Once the files have been defined as random and are continuously looping, you can also control the way that sounds transition or flow from one sound to the next. Enabling the transition property as part of the looping play mode gives you additional control over the sound.



amb_forest_night_background_loop - Random/Sequence Container Property Editor

Name: amb_forest_night_background_loop

Notes: PF ✓

General Settings | Conversion Settings | Effects | Positioning | RTPC | States | Motion | Advanced Settings

Voice: Volume -10; Pitch 0; Low-pass filter 0; High-pass filter 0

Output Bus: Override parent ☐; Ambient; Volume 0; Low-pass filter 0; High-pass filter 0

Game-Defined Auxiliary Sends: Override parent ☐; Use game-defined auxiliary sends ☐; Volume 0

User-Defined Auxiliary Sends: Override parent ☐

ID	Auxiliary Bus	Volume
0		0
1		0
2		0
3		0

Initial Delay: 0

Scope: ● Global ○ Game object

Play Type: ● Random (● Standard ○ Shuffle; ✓ Avoid repeating last 1 played) ○ Sequence (At end of playlist: ● Restart ○ Play in reverse order)

Play Mode: ○ Step ● Continuous; ✓ Always reset playlist; ✓ Loop (● Infinite ○ No. of loops 2)

✓ Transitions; Type: Sample accurate; Duration 0.2

Adding a transition type between sound files in a loop

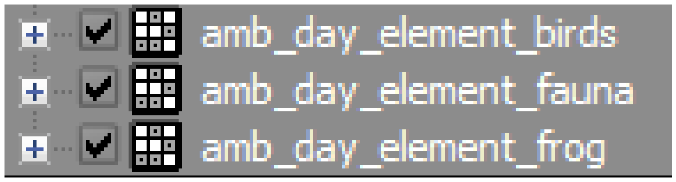
In this example, a sample accurate transition creates a seamless looping ambient file. Other transition options include: delay (silence), Crossfade using constant power, Crossfade using a constant amplitude, and trigger rate.

The power of this approach is in the diversity that can be gained by the recombination of multiple sound files at runtime, as opposed to using a single file of predetermined length. Additionally, by enabling control over the way that sounds transition, the diversity and complexity gained can deliver varied and non-repetitive loops. Whether you're dealing with mono, stereo, quad, or surround ambient backgrounds, each of these looping methodologies are supported.

In this section we've successfully begun the process of creating the ambient background system. With limited resources it's possible to convey a rich sense of environment using creatively designed and implemented loops as the foundation.

Adding Detail to a Developing Soundscape

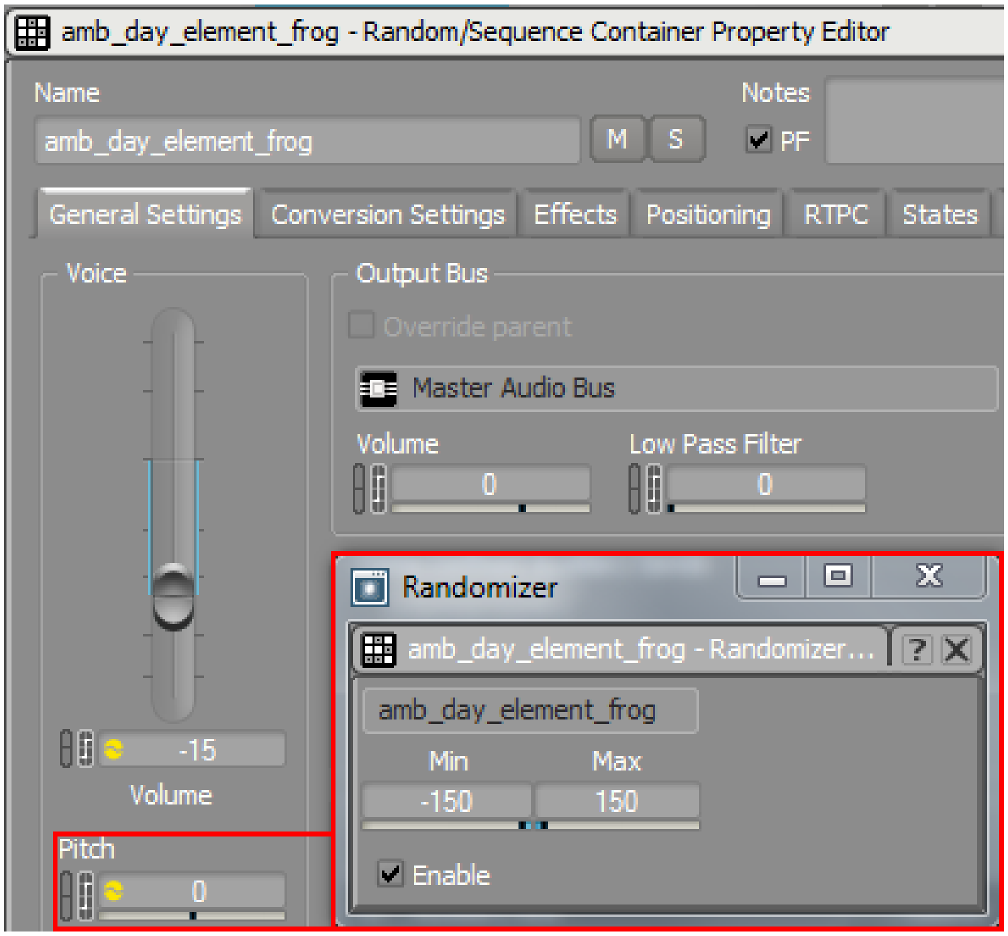
Now that the background ambience has been established, we'll add dynamics and variability using techniques not available with a single looping file or set of files. A forest in the daytime is comprised of many individual sounds, all sounding in unison. We've created several containers of daytime ambient elements such as birds, crickets, owl hoots, or wolf calls that we'll employ to continue building a more complex ambient background.


amb_day_element_birds
amb_day_element_fauna
amb_day_element_frog

Random Containers of daytime ambient elements

Randomizing Properties

In addition to setting a static value for volume, pitch, and LPF in the Property Editor, you can also vary these settings using the Randomizer. The Randomizer allows you to specify a range of values that can be randomized between for any of the given properties. Double-clicking the randomizer button in the property box allows you to author a minimum and maximum amount of random variation. In this example, the pitch randomizer has been enabled and a random variation of -150 to 150 cents has been specified.


amb_day_element_frog - Random/Sequence Container Property Editor

Name: amb_day_element_frog

[✓ PF]

Output Bus: [ ] Override parent

Master Audio Bus

Volume: 0

Low Pass Filter: 0

Volume: -15

Pitch: 0

Randomizer

amb_day_element_frog - Randomizer...

amb_day_element_frog

Min	Max
-150	150

[✓ Enable]

Showing pitch randomization between -150 cents and +150 cents

When a Randomizer is enabled, it turns from grey to yellow to indicate its activation.

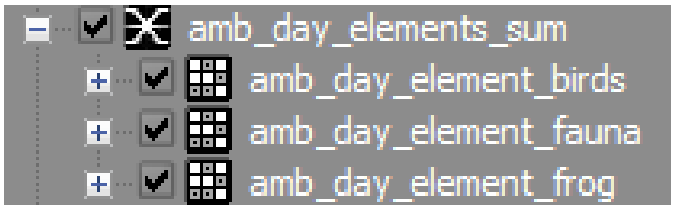
Designer Note

Maximizing the randomness of each individual set of content will help you get the most out of each type of sound. While you may be able to dramatically vary the pitch of a single cricket chirp without it sounding strange, an animal call may not have the same ability to be pitched in the extreme without sounding abnormal.

Using the Blend Container to Combine Sounds

Once the individual elements have been added to random containers, and you have spent some time diversifying their pitch, volume, and LPF properties, it’s time to combine them into the sound of an animal chorus. One way to play multiple containers of individual elements is by using the blend container. A single blend container with no blend tracks will play all child objects simultaneously. This methodology allows for the summing of multiple sounds and helps keep things organized.

Additionally we'll want each container to loop its contents, so that the sound of each element can repeat over time along with the daytime ambient background.



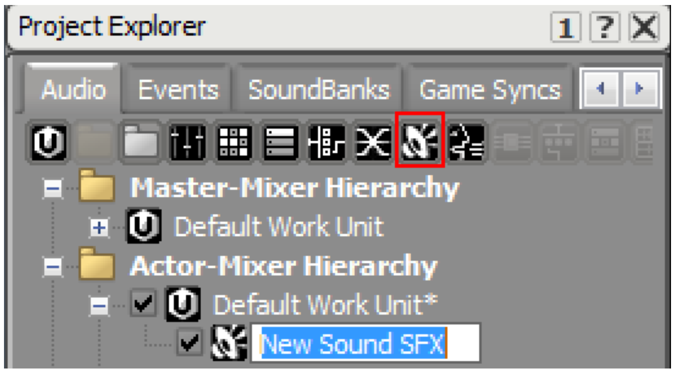
amb_day_elements_sum
amb_day_element_birds
amb_day_element_fauna
amb_day_element_frog

Grouping multiple ambient daytime elements within a blend container

Weighted Randomization Using the Silence Plug-in

If we were to loop all of these sounds constantly, they would quickly become overwhelming. By introducing silence between each sound file, the sounds play less frequently and the daytime forest soundscape is given balance. The addition of a Wwise silence plug-in to a Sound SFX object allows for silence as part of the randomization between sound files.

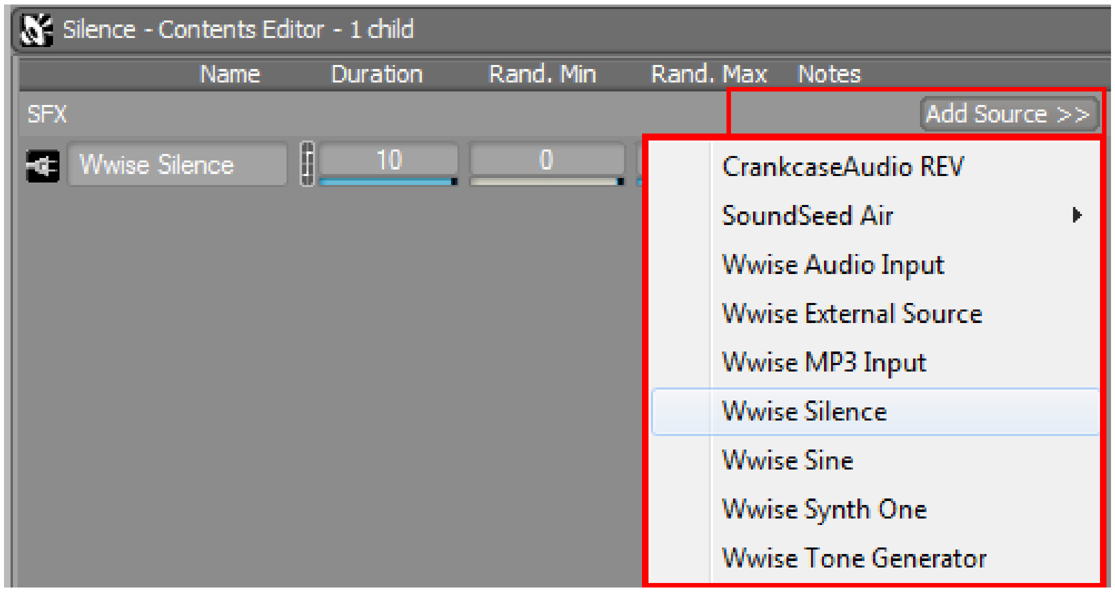
Begin by adding a new Sound SFX object to the default work unit by clicking the Sound SFX icon in the Project Explorer toolbar, a new Sound SFX is created. Alternately, Sound SFX can be created from the contextual menu or by using shortcut keys.



Master-Mixer Hierarchy
Default Work Unit
Actor-Mixer Hierarchy
Default Work Unit*
New Sound SFX

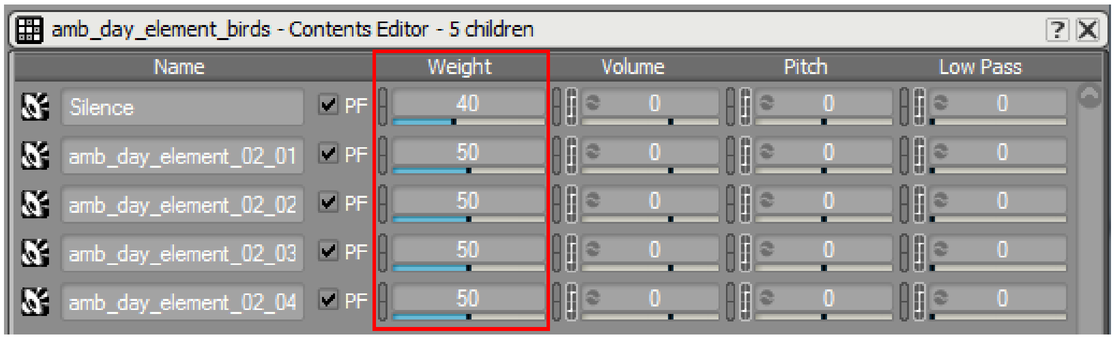
Creating a Sound SFX from the Project Explorer toolbar

After double-clicking to select the new Sound SFX, you can add silence using the Add Source menu in the Contents Editor. You can set a static duration in addition to a random minimum and maximum duration with the Wwise silence plug-in. The random minimum works in conjunction with the static delay by subtracting from the duration value.



Creating a silence source plug-in for a sound object

By specifying the weight of each Sound SFX, you have control over the probability of playback for each audio file within the random container. By weighting the silence object appropriately, you can predictably add a comfortable sense of repetition during the playback of individual audio files. This ensures that birds don't chirp too often and allows for a randomized duration of silence between bird call variations.



amb_day_element_birds - Contents Editor - 5 children

Name		Weight	Volume	Pitch	Low Pass
Silence	✓ PF	40	0	0	0
amb_day_element_02_01	✓ PF	50	0	0	0
amb_day_element_02_02	✓ PF	50	0	0	0
amb_day_element_02_03	✓ PF	50	0	0	0
amb_day_element_02_04	✓ PF	50	0	0	0

Controlling sound playback probability using the weight setting

Designer Note

You don't have to worry about getting individual weights to add up to 100%; Wwise takes care of the math for this automatically based on the values you input.

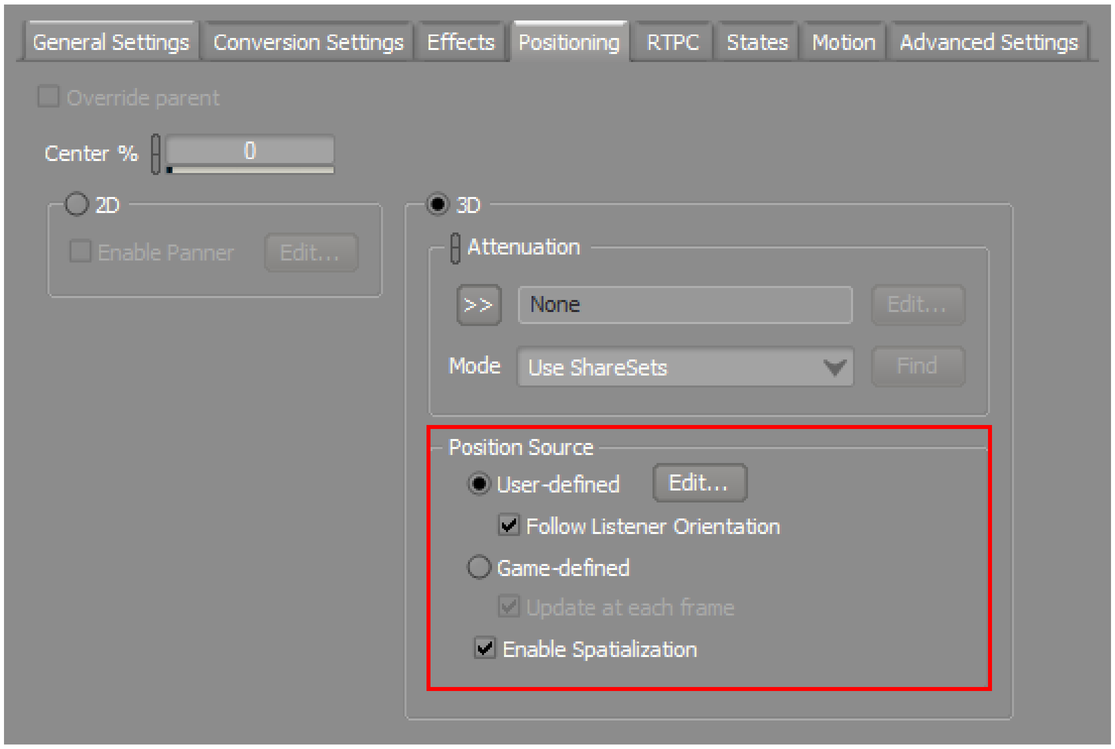
Randomized Positioning of Sounds

We now have the individual daytime nature sound types randomizing and summed together within a blend container. Next, we'll introduce user-defined 3D positioning in order to giving the soundscape some life.

Designer Note

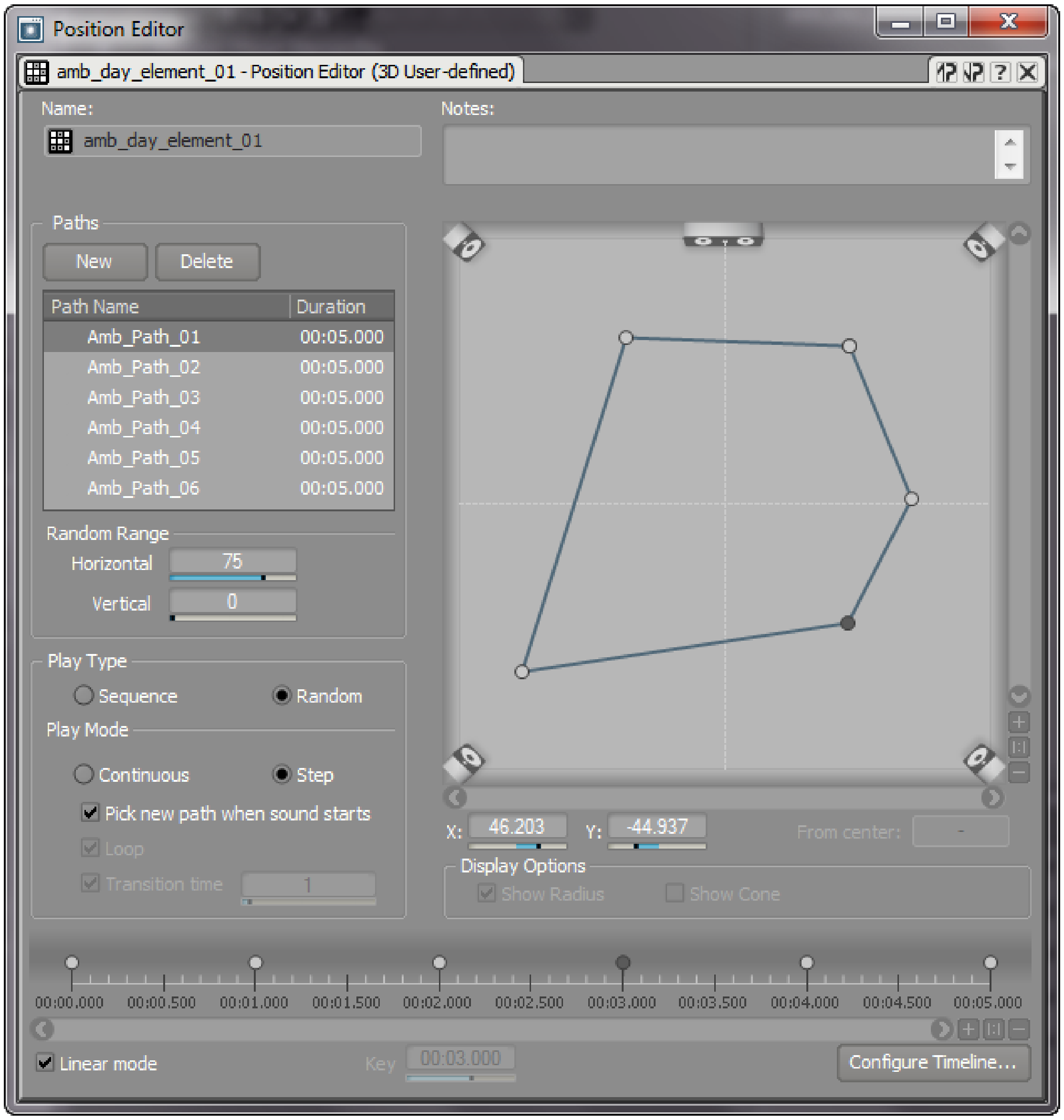
The Position Editor (3D User-defined) allows for the definition of spatial positioning for an object in a surround environment using animation paths. You can create many different versions of a path and then animate the sound or music along these paths. You can also define how the different paths will be played back. The paths you create will override the position and orientation in the game.

After selecting one of the random containers of elements, you can make changes in Positioning tab of the Property Editor. By changing the position source from the default Game-defined to User-defined, you can access the Position Editor where you can author to determine user-defined playback position of sounds. This technique is used to enable positional movement for static sounds and also to add positional randomness to the ambient elements that have been prepared.



Setting up user defined positioning for ambient elements

Multiple paths can be created that can be followed or randomized between to simulate the effect of having many individual sounds coming from different directions.


Position Editor

amb_day_element_01 - Position Editor (3D User-defined)

Name: amb_day_element_01

Notes:

Paths

New Delete

Path Name	Duration
Amb_Path_01	00:05.000
Amb_Path_02	00:05.000
Amb_Path_03	00:05.000
Amb_Path_04	00:05.000
Amb_Path_05	00:05.000
Amb_Path_06	00:05.000

Random Range

Horizontal	75
Vertical	0

Play Type: Sequence [✓ Random]

Play Mode: Continuous [✓ Step]

[✓] Pick new path when sound starts

[✓] Loop

[✓] Transition time 1

X: 46.203 Y: -44.937 From center: -

Display Options: [✓] Show Radius, [ ] Show Cone

00:00.000 00:00.500 00:01.000 00:01.500 00:02.000 00:02.500 00:03.000 00:03.500 00:04.000 00:04.500 00:05.000

[✓] Linear mode Key 00:03.000 Configure Timeline...

Defining where sounds will play according to speaker placement using the Position Editor

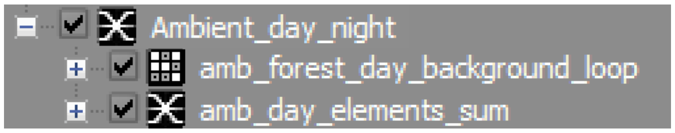
Designer Note

How to work with the Position Editor is covered extensively in the Video Tutorial - Positioning and Distance Attenuation and in the documentation: Wwise Help > Wwise Reference > Positioning > **Position Editor** (3D User-defined)

The ambient day and night elements included in the accompanying project have been created using user-defined 3D positioning and can be referenced for further insight into this technique.

Creating the Combined Daytime Forest Ambient Combination

Now that both the looping ambient background random container and the blend container of individual daytime elements have been created, it's time to combine them within a single blend container.


Ambient_day_night
amb_forest_day_background_loop
amb_day_elements_sum

Using a blend container to combine the ambient background loop and daytime elements

The randomized daytime elements are now playing in conjunction with the looping ambient background to create a soundscape that is different every time. There is always room to add additional variation to sound files themselves, or through property randomization. Finding the right balance between content and implementation is a good way to optimize resources and reduce player listening fatigue. Combining techniques from both of these aspects of integration is oftentimes the best way to create a successful, non-repetitive playback system that fits the scope of the game.

Section Summary

Throughout this section we have created the following sound objects:

- Random container with multiple daytime forest ambient background files looping via transition.
- Blend container containing ambient daytime elements summed with weighted silence and positioned randomly in 3D.

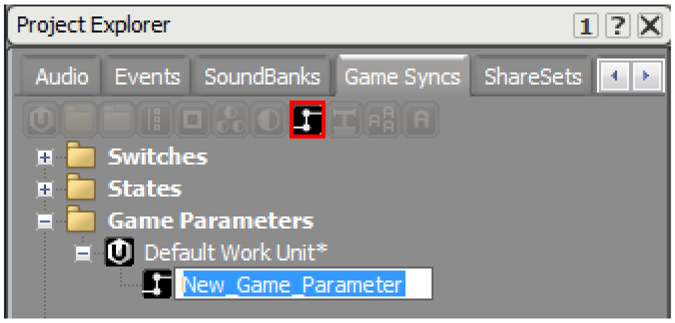
Introduction of a Day and Night Cycle

After a day of travel through the forest, the sun begins to set and the adventure begins to turn ominous. Growing shadows on the trees transform a once idyllic path into a dark and foreboding passage. In order to effectively convey the passage of time, we expect the sounds to accurately reflect the visual environment and mirror the same sense of despair and unease.

Establishing a Game Parameter

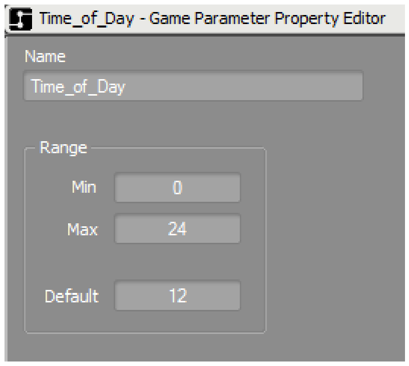
We'll start by having the programmer pass the same information from the game controlling the visual time of day as a game parameter to Wwise. Used in conjunction with a blend container that contains the ambient background and individual elements of the system, we can effectively control the ambient soundscape in time with the rest of the game.

To begin with, we'll create a new game parameter for Time_of_Day. Start by selecting the default work unit from the game syncs tab in the Project Explorer. This allows you to add a new game parameter from the Project Explorer toolbar by clicking on the game parameter icon. Alternately, a game parameter can be created from the contextual menu for a game parameter work unit or by using shortcut keys.



Creating a game parameter from the Project Explorer toolbar

Once the game parameter has been named, the parameter range can be established in the Property Editor. We'll set up the Time_of_Day game parameter using values from 0-24, allowing for the parametrization of sounds according to a 24-hour clock with 0 representing 12am.


Time_of_Day - Game Parameter Property Editor

Name: Time_of_Day

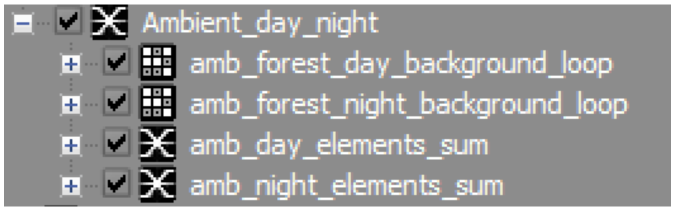
Range
Min: 0
Max: 24
Default: 12

Setting the Time_of_Day game parameter values

Creating the Ambient System

Now that we have a game parameter in place that we can use to drive the time of day simulation, we'll employ a blend container to play back both the looping background and randomized positional ambient sounds simultaneously. Once everything is set up, the forest ambience represents a fully dynamic day and night cycle that can be controlled and auditioned using the game parameter within the authoring application.

Using the techniques outlined in the previous section, we can move forward with the creation of a nighttime ambience that includes the same features implemented for the daytime. However, instead of putting the day and night containers within their own parent blend container, we'll be adding all of them to a single blend container called Ambient_day_night that will be used to govern the entire ambient forest system.

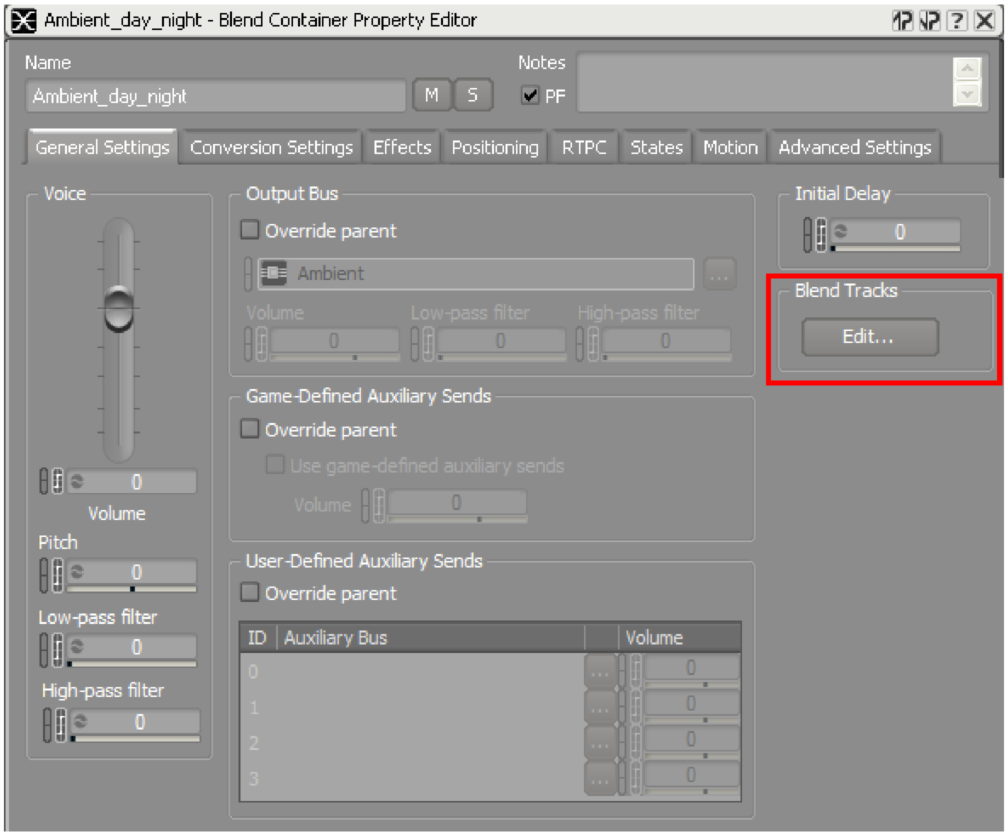

Ambient_day_night
amb_forest_day_background_loop
amb_forest_night_background_loop
amb_day_elements_sum
amb_night_elements_sum

Adding all of the day and night containers to a single ambient blend container

Using the Blend Track Editor

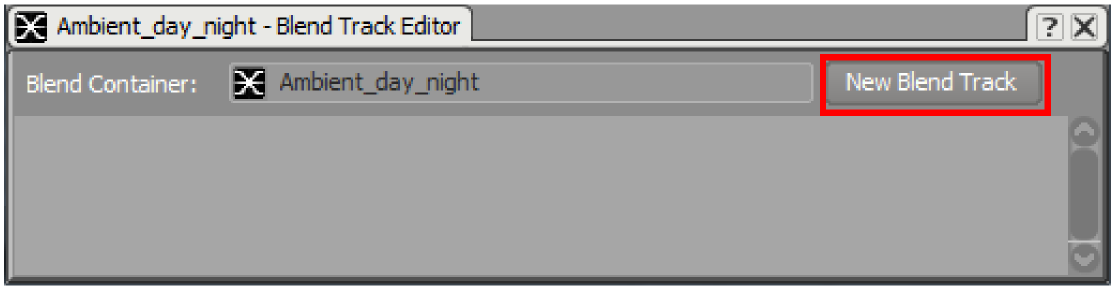
Now that everything is in the blend container and playing simultaneously, we need a way to isolate the day and night elements and integrate the Time_of_Day game parameter. A special function of the blend container is the Blend Track Editor, which is used to modify the contents of containers so that their properties can be controlled by RTPC curves and Crossfades.

Blend tracks can be accessed in the General Settings tab of the Blend Container Property Editor.



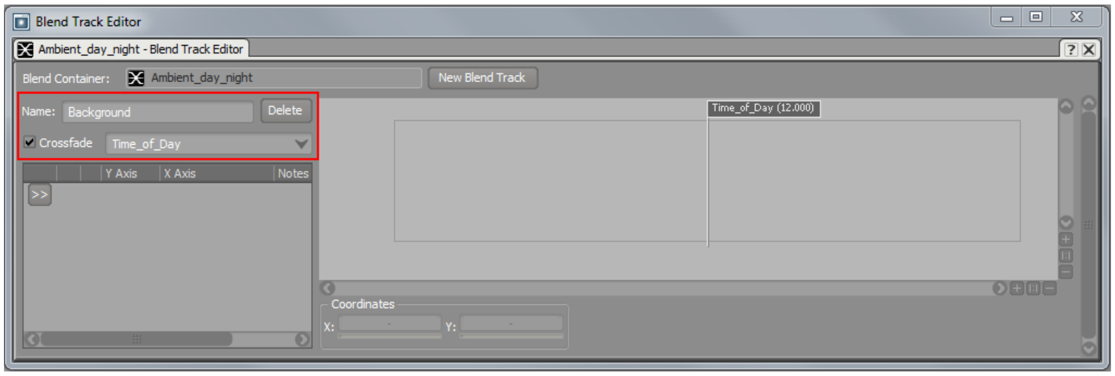
Opening the Blend Track Editor from the Property Editor

The Blend Track Editor is made up of two main areas: one where blocks can be crossfaded, and another where RTPC curves can be added and modified using the graph view. These areas are enabled by adding a new blend track from the Blend Track Editor.



Adding a new blend track to an empty blend container using the Blend Track Editor

Once a new blend track has been added, it can be named after the ambient background. Enabling the Crossfade option lets you select a game parameter which can be used to transition between containers or other sound objects on the blend track.



Blend Container: Ambient_day_night

Name: Background

☑ Crossfade Time_of_Day

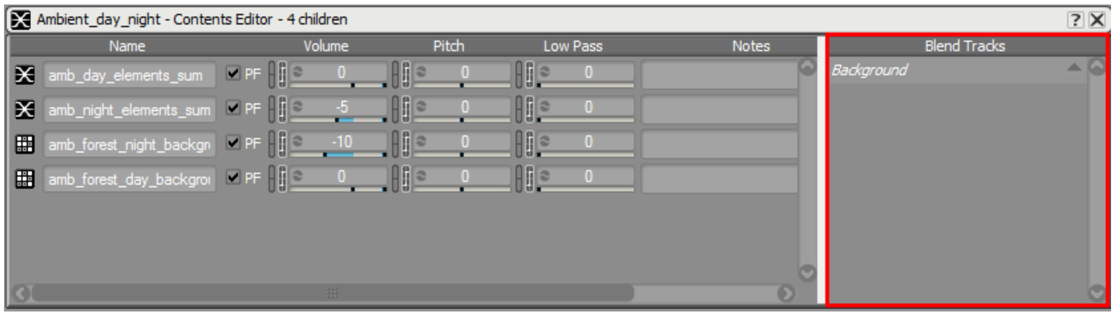
Enabling the Crossfade on a new blend track

By adding a Crossfade to the Background blend track using the Time_of_Day game parameter, you can position containers according to values of the game parameter. The positioning of containers on the blend track determines the amount of overlap or Crossfade.

Designer Note

Changing between game parameters with different ranges can affect the range of the blend track's audio blocks. In this case, a decision must be made whether to Stretch the audio blocks or Preserve their position after the change in game parameter.

Now that a blend track has been added and the ability to crossfade has been established, containers can be assigned to blend tracks in the Contents Editor.



Ambient_day_night - Contents Editor - 4 children

Name		Volume	Pitch	Low Pass	Notes
amb_day_elements_sum	☑ PF	0	0	0	
amb_night_elements_sum	☑ PF	-5	0	0	
amb_forest_night_backgr	☑ PF	-10	0	0	
amb_forest_day_backgroi	☑ PF	0	0	0	

Blend Tracks

Background

Blend tracks section of the Contents Editor

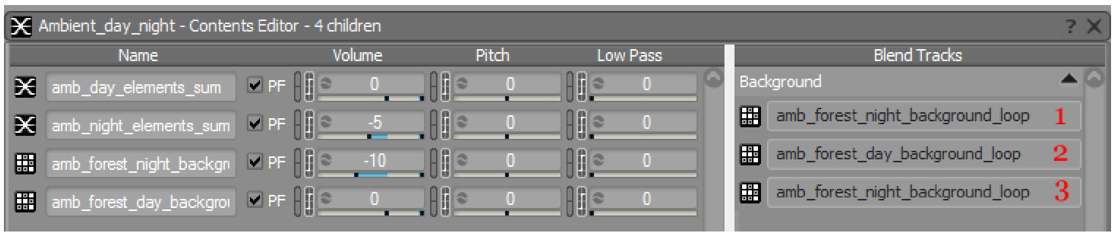
Setting Container Order within Blend Tracks

Now you can drag and drop containers within the blend container into the blend tracks section. When setting up a blend track in the Contents Editor, **it is important to position containers in the order you want them to show up**, from left to right in the Blend Track Editor.

You can see how the order relates to positioning in this example:

Blend Track: Background

1. **Random container:** amb_forest_night_background_loop
2. **Random container:** amb_forest_day_background_loop
3. **Random container:** amb_forest_night_background_loop

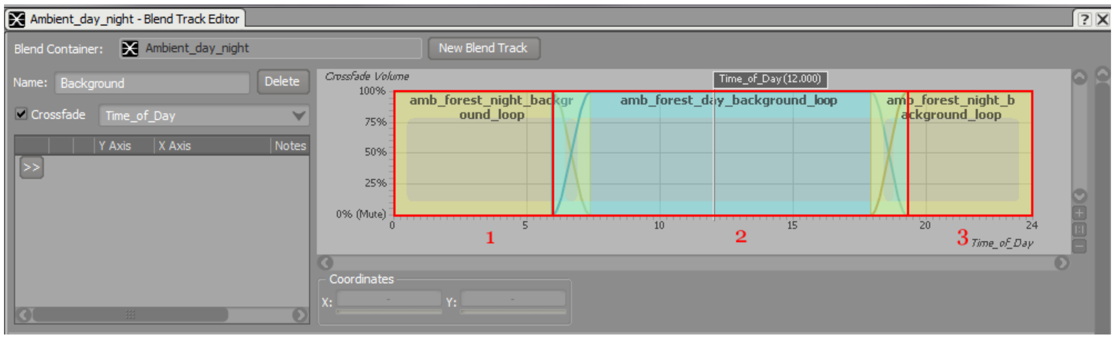


Ambient_day_night - Contents Editor - 4 children

Name		Volume	Pitch	Low Pass
amb_day_elements_sum	✓ PF	0	0	0
amb_night_elements_sum	✓ PF	-5	0	0
amb_forest_night_backgn	✓ PF	-10	0	0
amb_forest_day_backgrou	✓ PF	0	0	0

Blend Tracks	
Background	
amb_forest_night_background_loop	1
amb_forest_day_background_loop	2
amb_forest_night_background_loop	3

Random Container order on a Blend Track represented in the Contents Editor

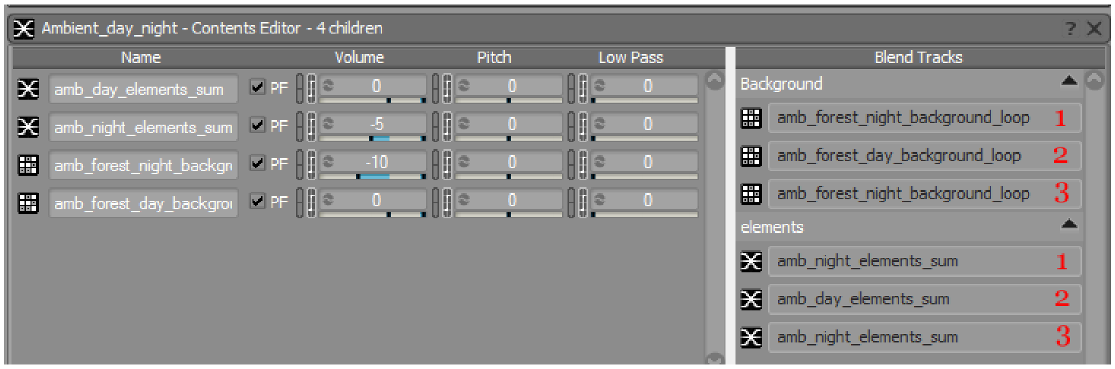


Adding an additional blend track with ordered containers

To complete the full scope of our ambient system implementation, the ambient day and night elements need to be added to their own blend track.

Blend Track: Elements

1. **Random container:** amb_night_elements_sum
2. **Random container:** amb_day_elements_sum
3. **Random container:** amb_night_elements_sum



Ambient_day_night - Contents Editor - 4 children

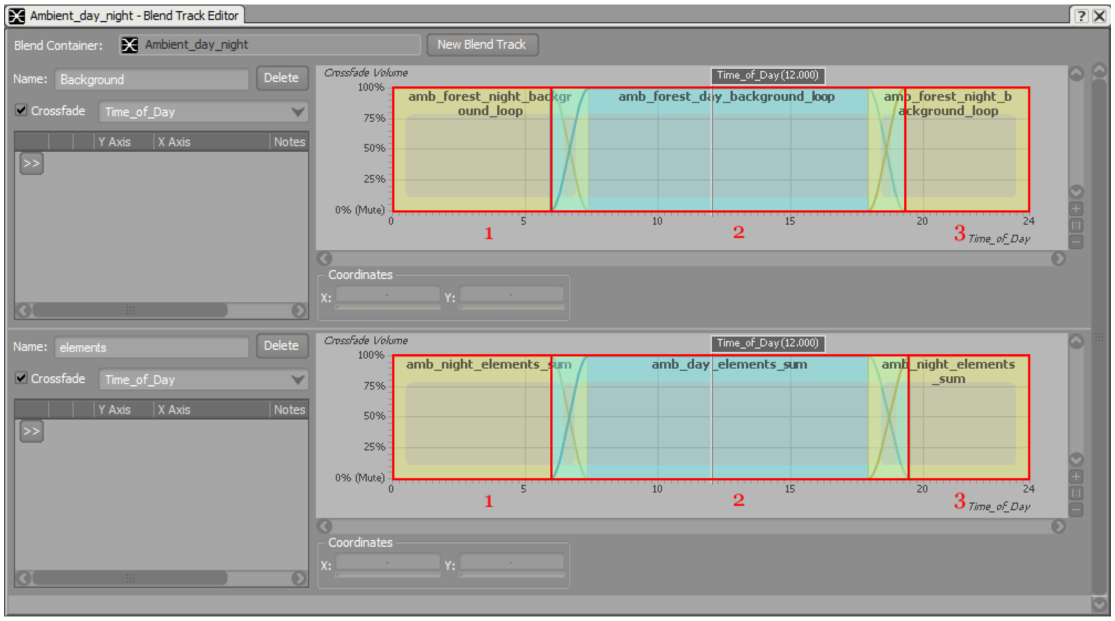
Name		Volume	Pitch	Low Pass
amb_day_elements_sum	PF	0	0	0
amb_night_elements_sum	PF	-5	0	0
amb_forest_night_backgr	PF	-10	0	0
amb_forest_day_backgrou	PF	0	0	0

Blend Tracks

Background
- amb_forest_night_background_loop 1
- amb_forest_day_background_loop 2
- amb_forest_night_background_loop 3

elements
- amb_night_elements_sum 1
- amb_day_elements_sum 2
- amb_night_elements_sum 3

Container order on a Blend Track represented in the Contents Editor



Ambient_day_night - Blend Track Editor

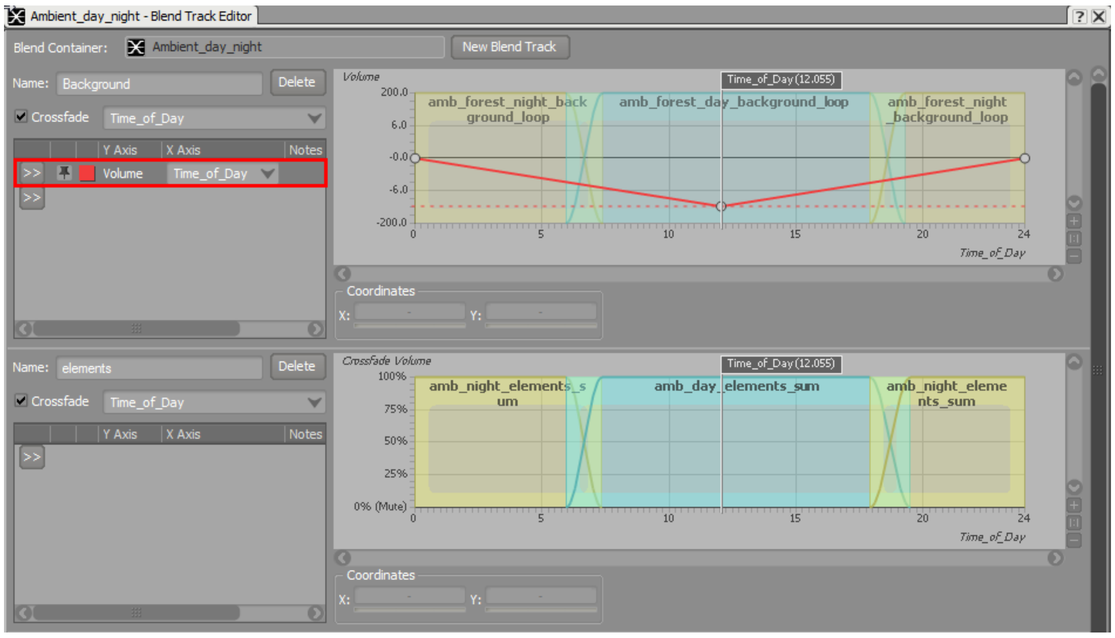
Blend Container: Ambient_day_night

Name: Background
Crossfade: Time_of_Day

Name: elements
Crossfade: Time_of_Day

Adding an additional blend track with ordered containers

The Time_of_Day game parameter cursor can now be used to audition the Crossfade between containers for both background and ambient elements. You can also modify the points of these curves and Crossfade types in real time during playback. Furthermore, game parameters can be used in conjunction with blend tracks to affect the volume, pitch, and low pass filter parametrically.



An example of using a game parameter in conjunction with volume to affect a blend track

Preparing the Event

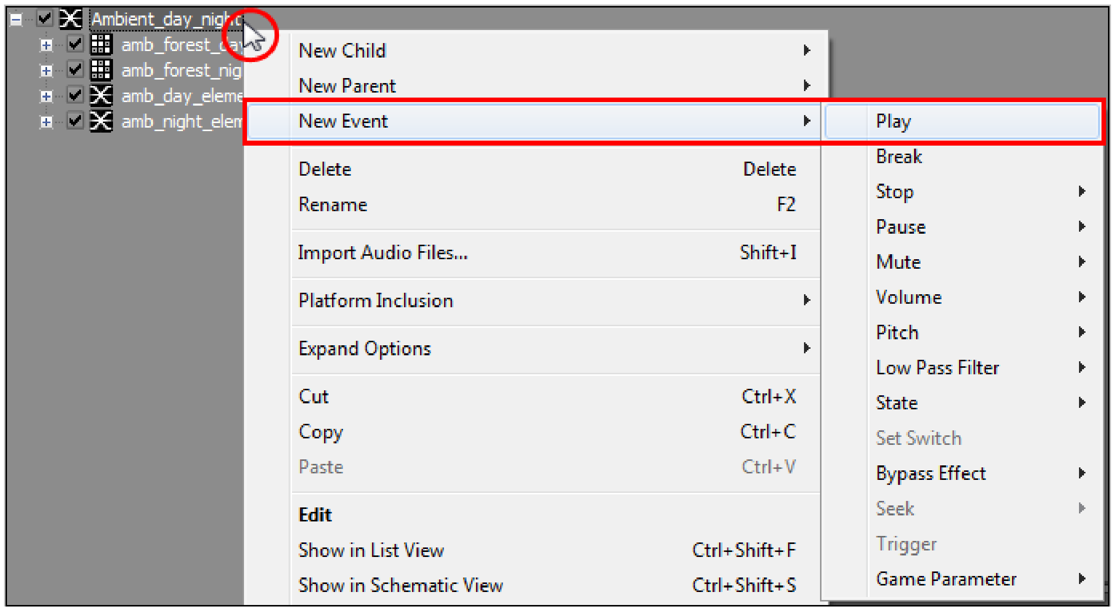
Now that the dynamic ambient system has been created, it's time to prepare the loop to be played and stopped by the game engine. Wwise uses events as sound, music, and dialogue instructions to the game. Events determine which sound, music, motion, or dialogue is played at any particular point in the game and can be used to control other aspects through the use of different actions (Play/Pause/Stop a Sound, change its Volume, Pitch or Low Pass Filter, etc.).

Events can also apply actions to the different structures within your project hierarchy. Each event can contain one action or a series of actions. The actions you select specify whether the Wwise objects will play, pause, stop, and so on.

To prepare our ambient system to be played and stopped by the game engine when the hero enters and exits the forest, two events need to be created:

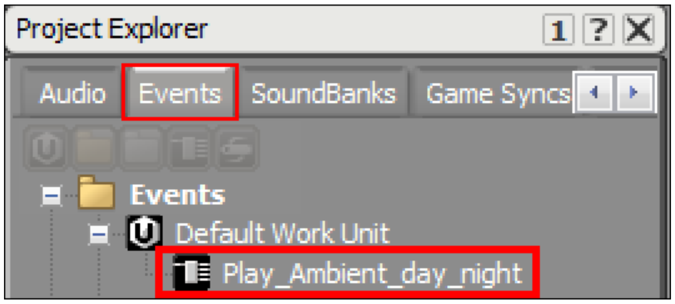
- Play_Ambient_Forest
- Stop_Ambient_Forest

We'll begin the process of creating a new play event by navigating to the Ambient_day_night blend container and selecting New Event > Play in the contextual menu.



Creating a new event using the contextual menu

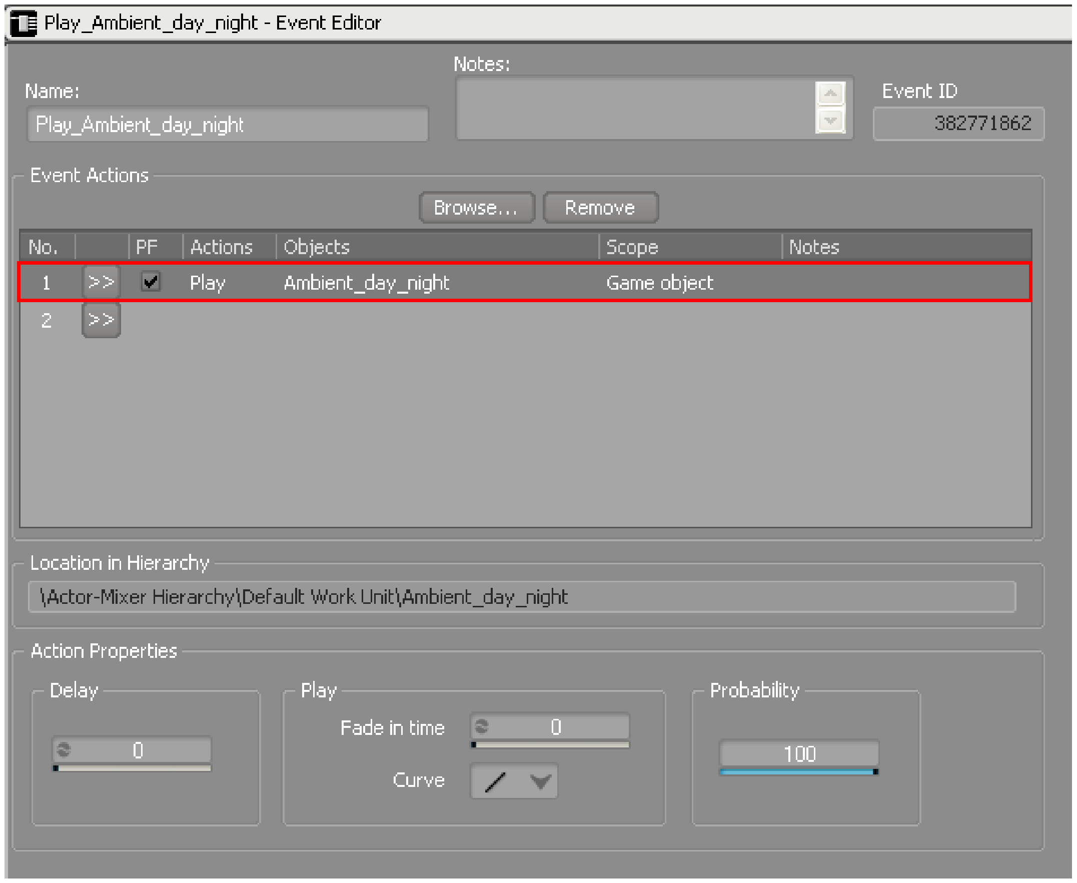
This creates a new play event named after the container in the events section of the Project Explorer as part of the default work unit.



A newly created event in the events tab of the Project Explorer

Harnessing Event Actions

When the event is created, the Event Editor is brought into focus to reflect the new event. The new event is created with the Ambient_day_night blend container added to it with a Play action type.


Play_Ambient_day_night - Event Editor

Name: Play_Ambient_day_night

Notes:

Event ID 382771862

Event Actions

No.		PF	Actions	Objects	Scope	Notes
1	>>	✓	Play	Ambient_day_night	Game object	
2	>>					

Location in Hierarchy: \Actor-Mixer Hierarchy\Default Work Unit\Ambient_day_night

Action Properties

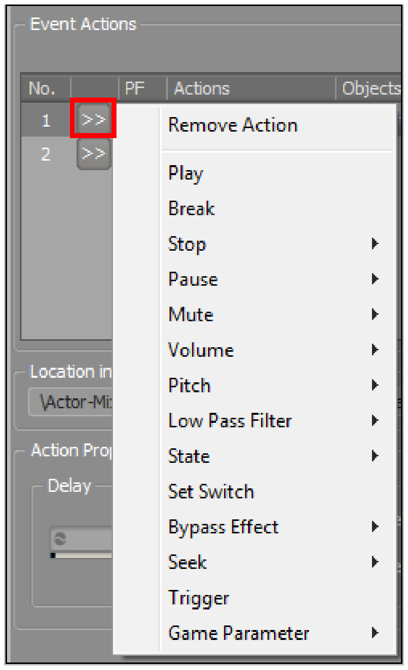
Delay: 0

Play: Fade in time 0; Curve

Probability: 100

An event created using the Play action in conjunction with the Ambient_day_night blend container

Event actions can also be removed or added to an event using the Selector.



Accessing additional event action options using the Selector

The Event Editor also shows the location of the object for each event action and any properties available for a given event action.

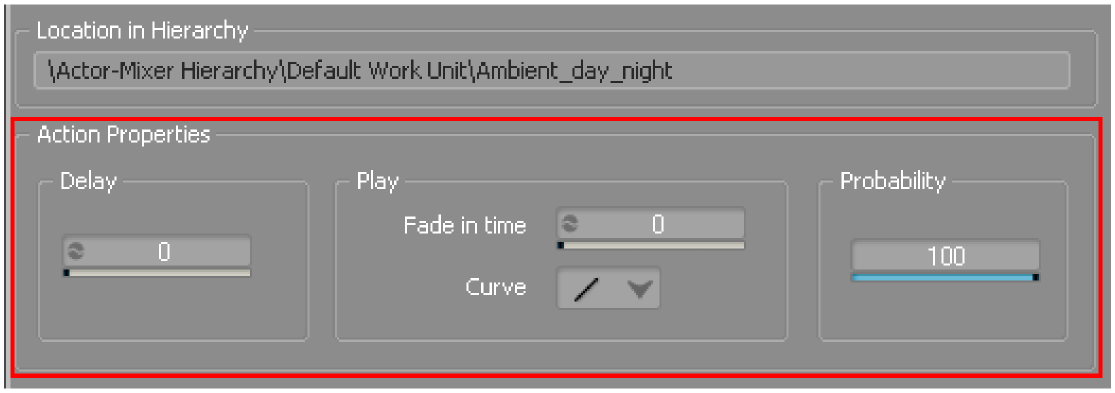
Designer Note

Each event action has a different set of action properties that can be modified to produce the desired effects. See the help documentation for a full listing of event actions and properties:

Wwise Help > Wwise Reference > Events > **Event Editor**

Wwise Help > Where to Begin? > Wwise Fundamentals > Understanding Events > **Action Events**

Wwise Help > Interacting with the Game > Managing Events > Overview > **Types of Event Actions**



Action properties available for the Play event action

The action properties that can be used to modify the Play event action include:

- **Delay** - the amount of time that goes by before the action is performed.
  - Default value: 0, Default Slider Range: 0 to 10, Input Range: 0 to 600, Units: Seconds.
- **Fade in time** - the amount of time it takes for the object to fade in.
  - Default value: 0, Default Slider Range: 0 to 10, Input Range: 0 to 60, Units: Seconds
  - The fade in begins after the specified delay, if any.
- **Curve** - the curve shape that defines how the object fades in.
- **Probability**- Percentage of probability that an event action will play.
  - Default value: 100, Default Slider Range: 0 to 100, Input Range: 0 to 100, Units: Percentage

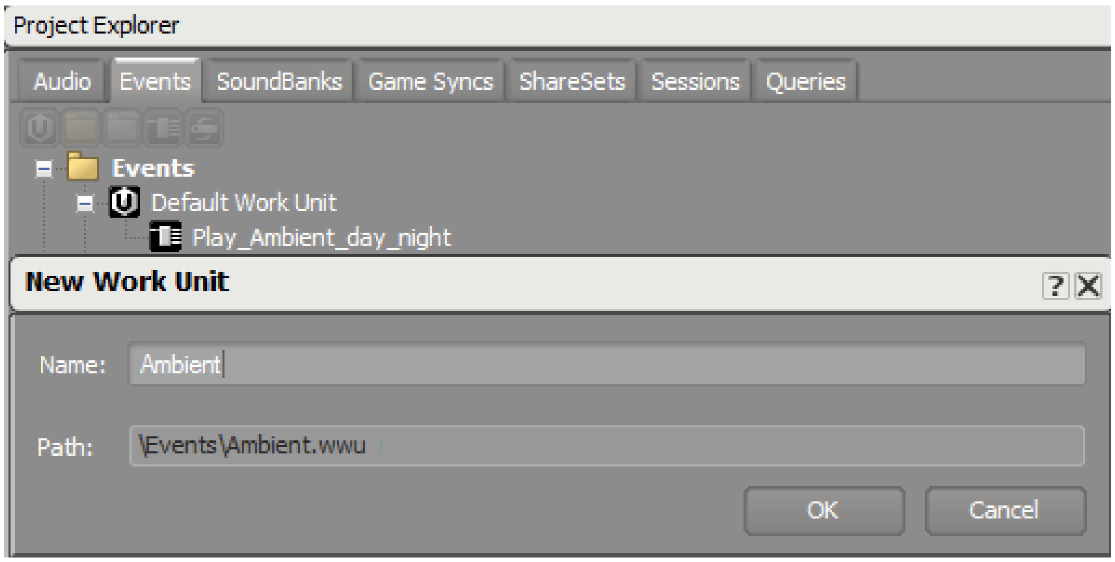
Creating Work Units

We'll approach the creation of a stop event for the Ambient_day_night blend container a little bit differently.

First, we'll create a new work unit called Ambient in the events section of the Project Explorer to begin separating out different components of the project.

At the foundation of Wwise Workgroups is the work unit. Work units are distinct XML files that contain information related to a particular section or element within your project. These work units can help you organize and manage the different elements within a project. Hierarchies of nested work units can now be created and organized in physical folders and subfolders.

Creating a new work unit can be done through the Project Explorer toolbar by clicking on the work unit icon. Alternately, a work unit can be created from the contextual menu from the event heading title.

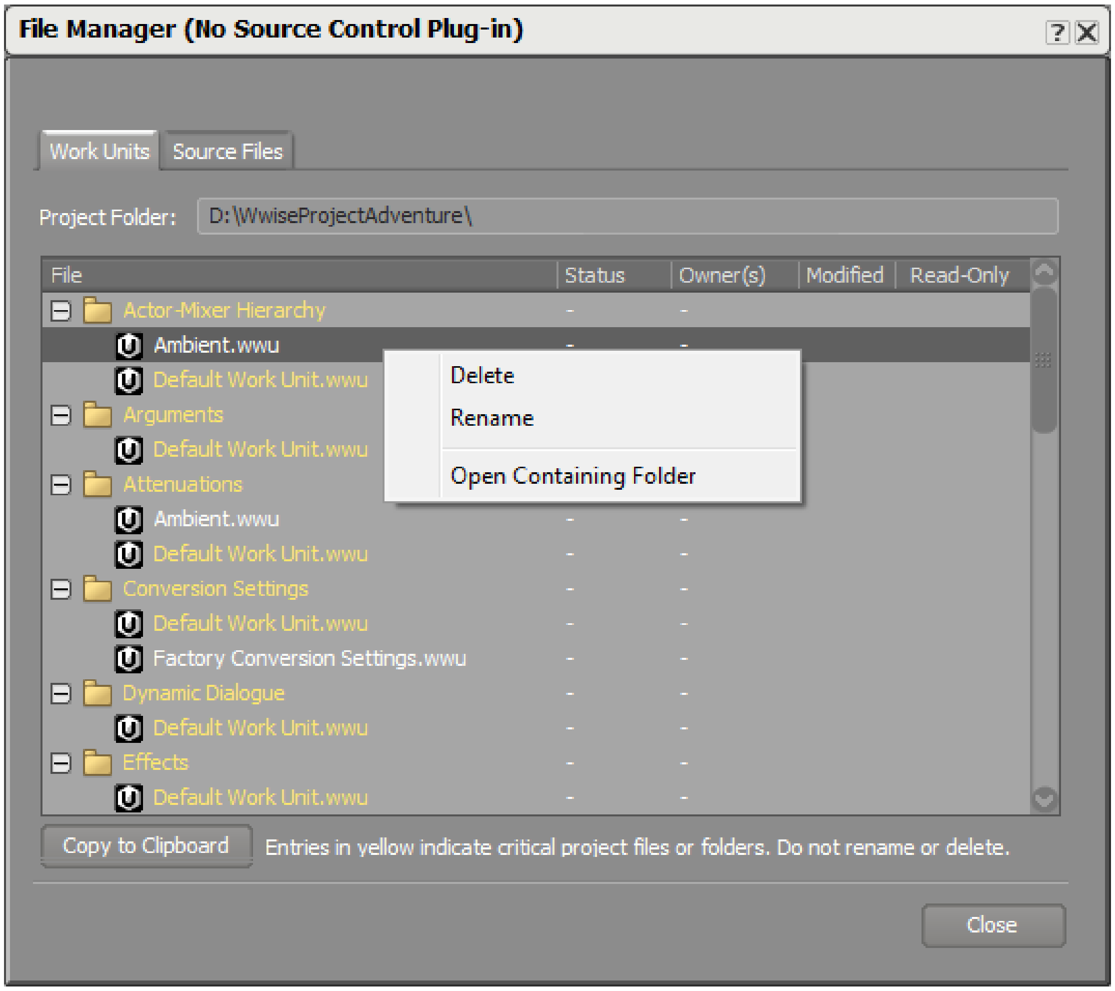


Name: Ambient

Path: \Events\Ambient.wwu

Creating and naming a new work unit

After a work unit is created, you can delete, move and rename it in the Project Explorer. You can also make these changes to work units and source files from the File Manager. The File Manager can be accessed through the Project menu.



Project Folder: D:\WwiseProjectAdventure\

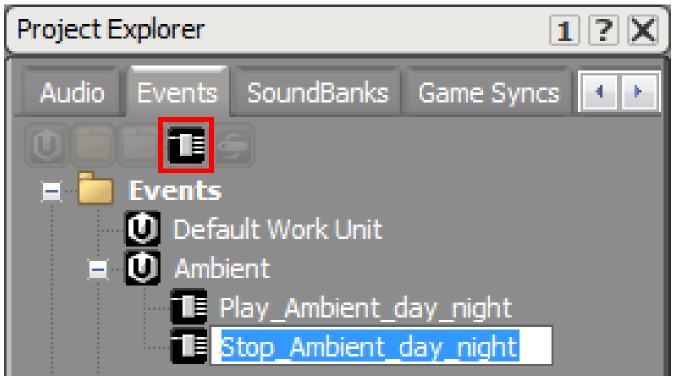
File	Status	Owner(s)	Modified	Read-Only
Actor-Mixer Hierarchy	-	-		
Ambient.wwu	-	-		
Default Work Unit.wwu				
Arguments				
Default Work Unit.wwu				
Attenuations				
Ambient.wwu	-	-		
Default Work Unit.wwu	-	-		
Conversion Settings	-	-		
Default Work Unit.wwu	-	-		
Factory Conversion Settings.wwu	-	-		
Dynamic Dialogue	-	-		
Default Work Unit.wwu	-	-		
Effects	-	-		
Default Work Unit.wwu	-	-		

Entries in yellow indicate critical project files or folders. Do not rename or delete.

Using the File Manager to delete, rename, or move work units and source files

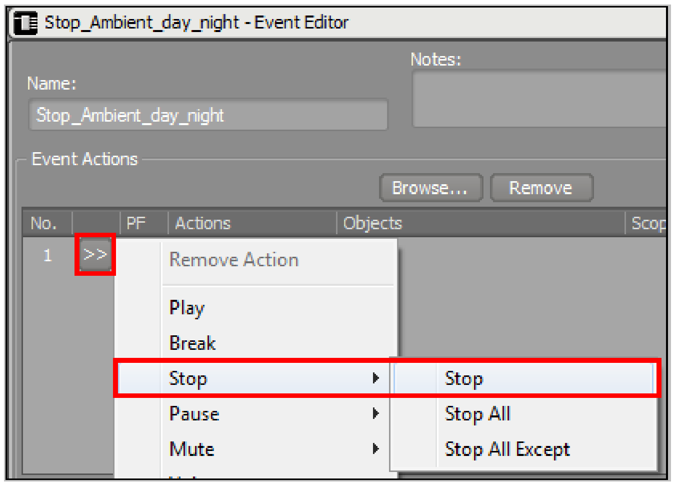
Now that our Ambient event work unit has been created, we can move our previously created Play_Ambient_day_night event by dragging and dropping it from the Default Work Unit.

We can now add a new event called Stop_Ambient_day_night through the Project Explorer toolbar by clicking on the event icon. Alternately, an event can be created from the contextual menu or by using shortcut keys.



Creating a new event in the Ambient work unit

Double-clicking the newly created Stop_Ambient_day_night event will open it in the Event Editor. The next step is to add a Stop action by using the event action Selector and selecting Stop>Stop from the selection of event actions.

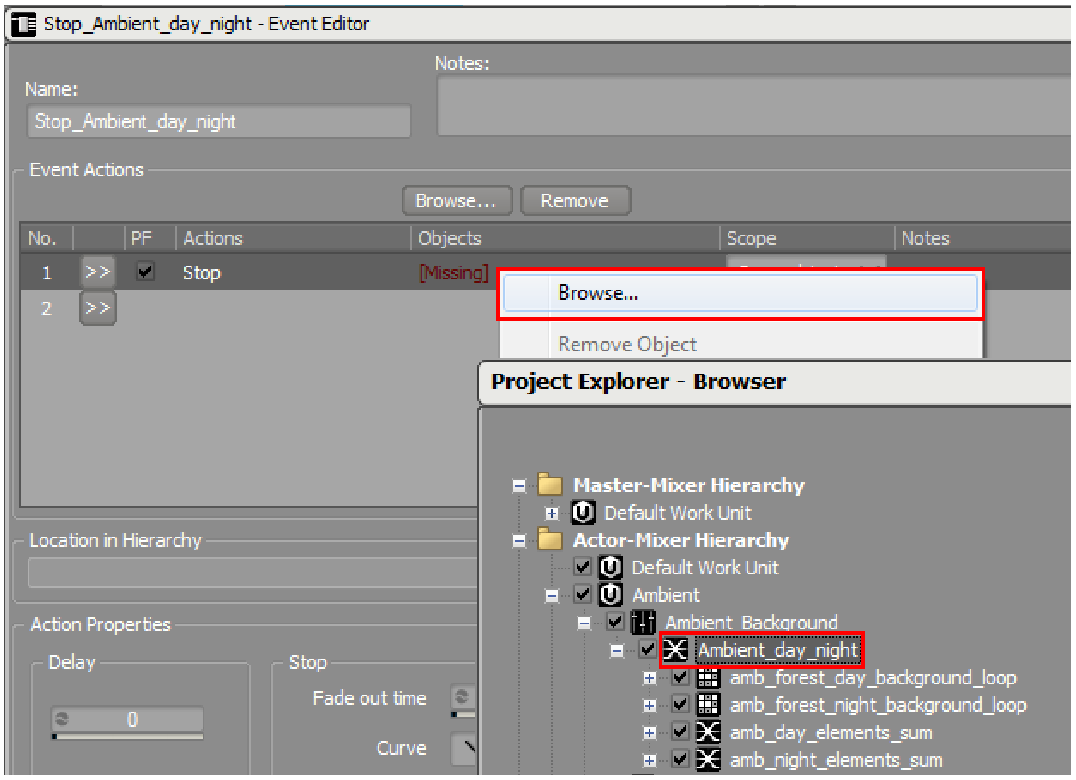


Adding a Stop event action to a new event

Once an event action has been added to the event, it needs to be assigned an object to which the action will be applied or it will show as Missing in the Objects column. When the event is requested by the game, the specified action needs to be applied to one of the four object types:

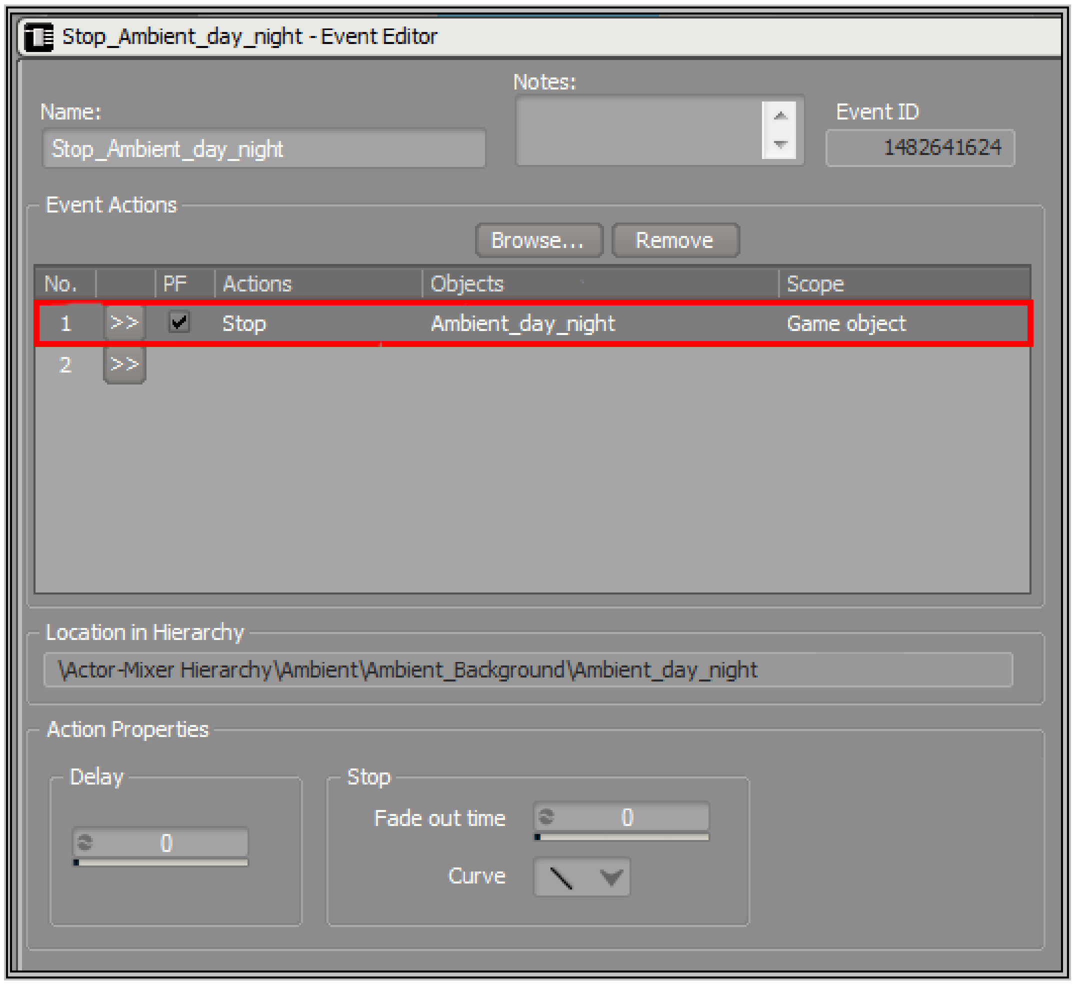
- Sound objects
- Motion FX objects
- Actor-Mixers
- Containers

These objects can be navigated to using the Project Explorer - Browser or dragged and dropped from the Project Explorer over text in the object column on the event action in the Event Editor.



Navigating to the Ambient_day_night blend container using the Project Explorer - Browser

Once an object has been added, its location in the hierarchy is updated and the action properties are available for adjustment.



Name: Stop_Ambient_day_night

Event ID: 1482641624

Event Actions

No.		PF	Actions	Objects	Scope
1	>>	✓	Stop	Ambient_day_night	Game object
2	>>				

Location in Hierarchy: \Actor-Mixer Hierarchy\Ambient\Ambient_Background\Ambient_day_night

Action Properties

Delay: 0

Stop: Fade out time 0, Curve

An event created using the Stop action in conjunction with the Ambient_day_night blend container

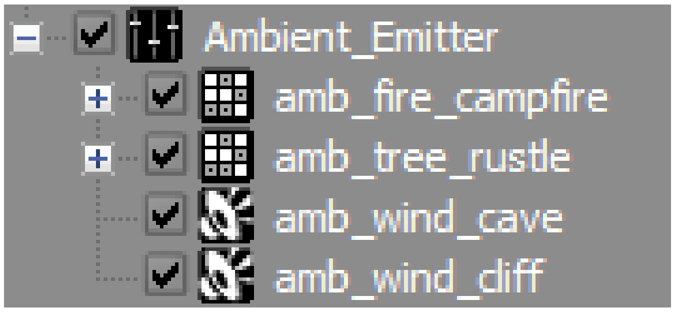
After events have been created, they can be integrated into the game engine so that they are called at the appropriate times in the game. Because of the abstract nature of events, their components can continue to be fine-tuned within the authoring application throughout development without having to re-integrate them into the game engine.

Section Summary

Adding blend tracks gives you the power to order and Crossfade objects and to modify dynamically them with game parameters within the blend container. The addition of events and event actions determine which sound, music, motion, or dialogue is played and how it will play at any particular point in the game. As the sun sets after a long day of travel, and the sound of birds is replaced with crickets and the occasional wolf howl, the benefits of this dynamic ambience can really be appreciated.

Sound Emitters in the Game World

With a looping background in place that changes based on the time of day, we can focus on adding positional sounds at specific locations in the forest to help fill in the environment, things like rivers, waterfalls, fire pits, and birds in trees. We'll begin by setting up several random containers that can be used to add further definition to the world.



Prepared sounds for use as 3D Emitters

Creating Attenuation ShareSets

The fundamental difference between the previous ambient background implementation and the explicit placement of a sound in 3D space is in the way sound changes based on the listener position. A listener is a virtual microphone in the game that helps assign sounds to particular speakers to simulate a 3D environment. Attenuation ShareSets can be authored to control the distance based playback of sounds in relation to the listener.

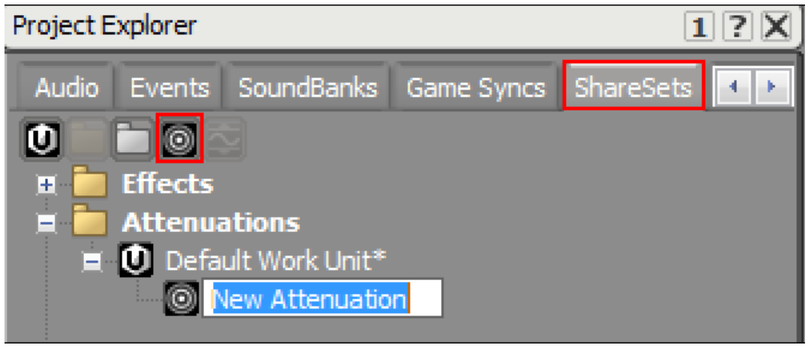
Designer Note

The Attenuation Editor allows you to define the distance-based attenuation properties for a particular object. By creating a series of curves to define the relationship between specific Wwise properties, such as volume and low pass filter, and the distance between the emitting source and the listener, you can simulate sophisticated distance-based attenuation for the sounds, music, and motion in-game. You can further refine attenuations using sound cones, which simulate attenuation based on the orientation of the game object in relation to the listener.

Game objects are the central concept in Wwise because every event triggered in the sound engine is associated with a game object. A game object generally represents a particular object or element in your game that can emit a sound, including characters, weapons, ambient objects, such as torches, and so on.

Creating and Establishing Generalized Attenuations

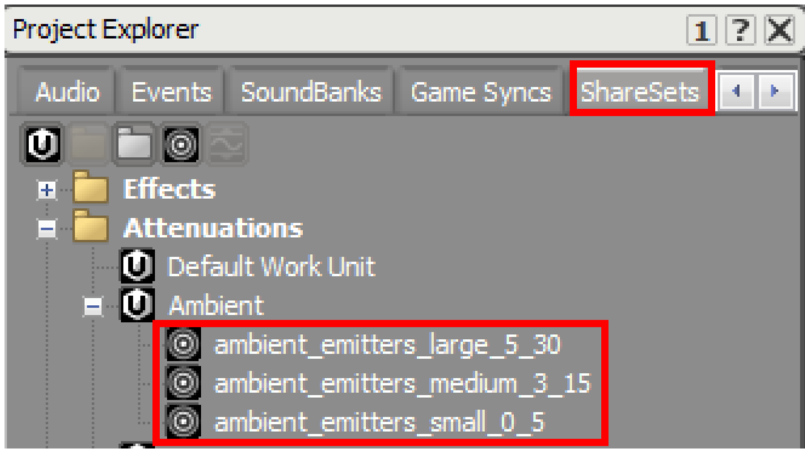
By selecting the default work unit from the ShareSets tab in the Project Explorer, a new attenuation can be added from the Project Explorer toolbar by clicking on the game parameter icon. Alternately, an attenuation can be created from the contextual menu for an attenuation work unit or by using shortcut keys.



Adding a new attenuation ShareSet

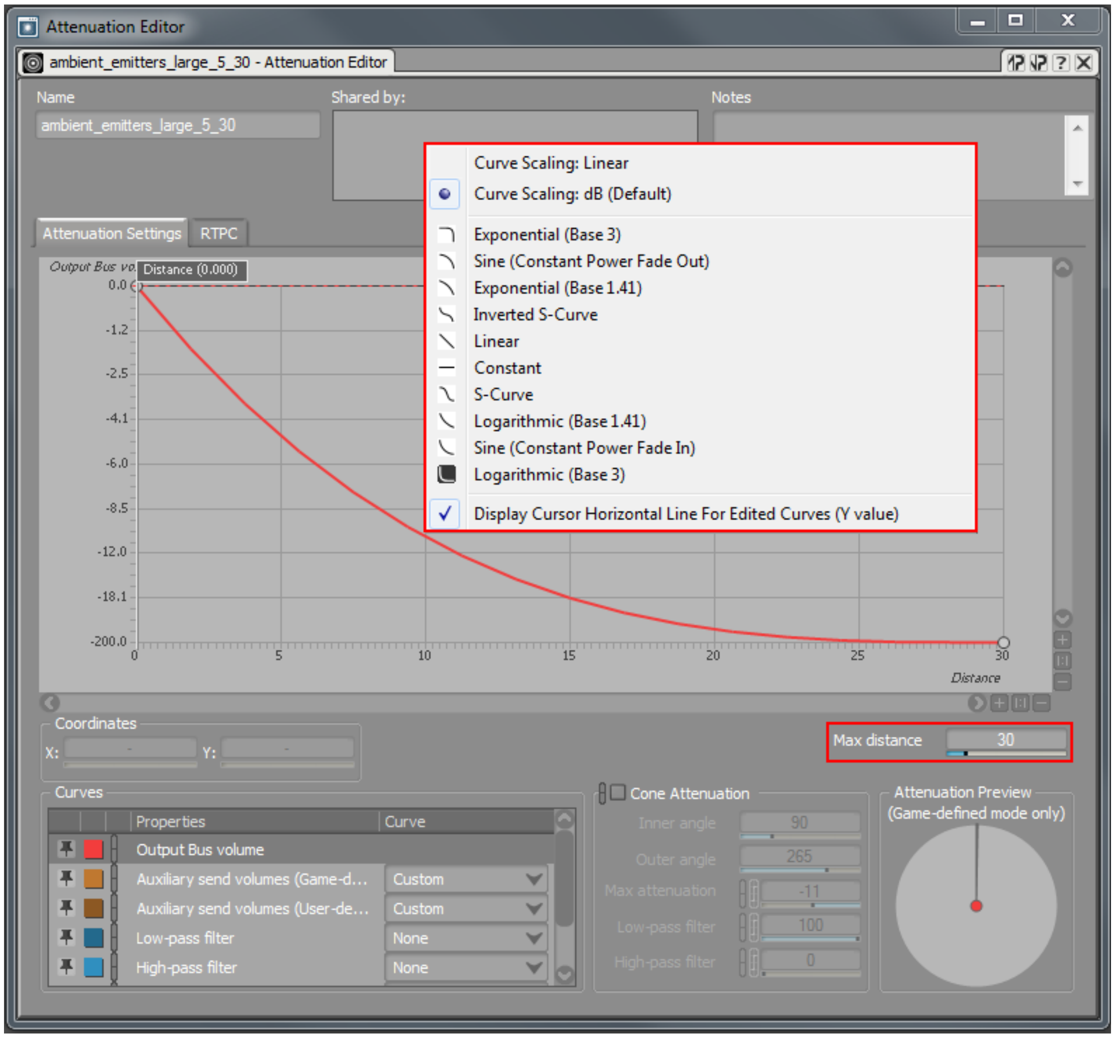
Creating generalized attenuations that can be used in many scenarios is a good place to start. Adding further attenuations that address specific distance-based problems or special effects can be created on an as-needed basis throughout the course of the project.

We'll begin by defining generalized attenuations for Ambient Emitters: Large, Medium, and Small. We'll also imbed some information regarding distance, within the attenuation name, in order to give some indication of what their intended use is. When working with a naming standard throughout your project, it is important to try and adopt some conventions that will be clear to people who may be working with sound objects, events, game syncs, or ShareSets you have created.



Project Explorer ShareSets showing a set of general attenuations

Once created, you can control the amount of reverb, LPF and spread by adjusting the curve properties. Each curve defines properties based on the maximum distance set for the attenuation. The maximum distance is distance from the emitting source where the sound reaches its lowest level. The attenuation of the object remains constant beyond the max distance.



Name: ambient_emitters_large_5_30

Max distance: 30

	Properties	Curve
🟥	Output Bus volume	
🟧	Auxiliary send volumes (Game-d...	Custom
🟫	Auxiliary send volumes (User-de...	Custom
🟦	Low-pass filter	None
🟦	High-pass filter	None

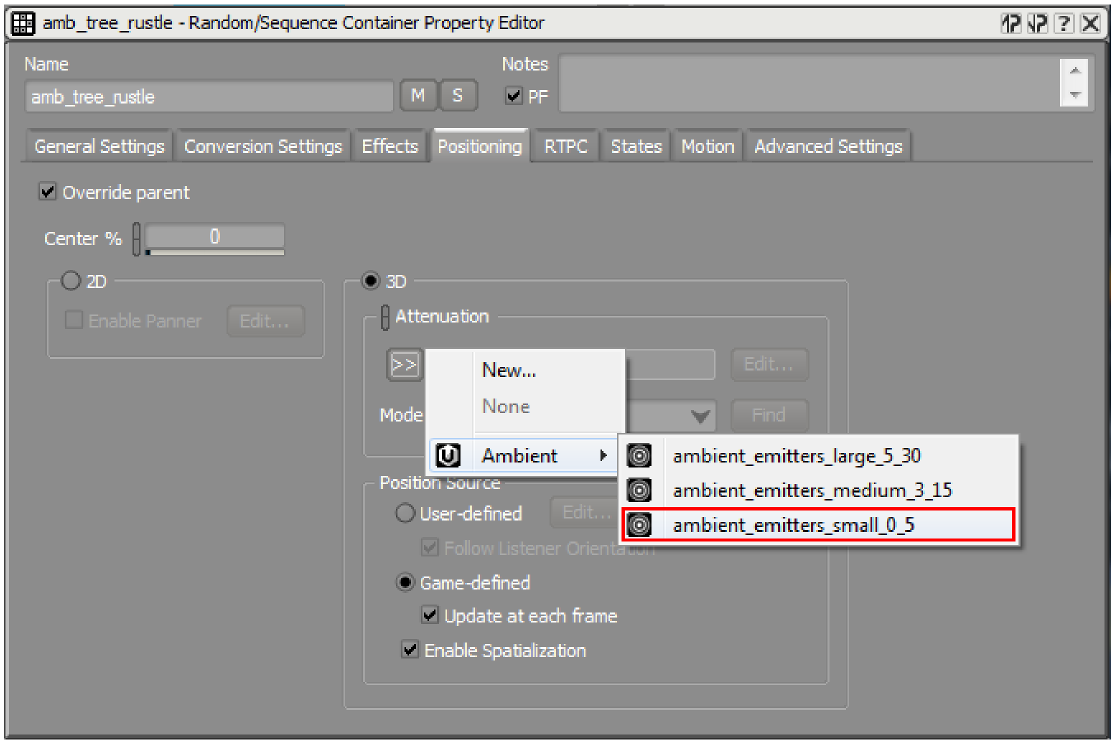
Inner angle	90
Outer angle	265
Max attenuation	-11
Low-pass filter	100
High-pass filter	0

Defining curve properties, max distance, and the attenuation feature set

Subscribing Sound Objects to an Attenuation

Now that we have established a few generalized attenuations for ambient emitters, any level of the Actor-Mixer hierarchy can subscribe to them. Remember that any children of the parent sound object will inherit the subscription unless overridden. In the first example, we'll subscribe the ambient_tree_rustle sound object to the ambient_emitters_small_0_5 attenuation so that we only hear trees when the listener is within five game units of the emitter.

We begin by overriding the parent object (if any) and changing the sound to 3D in the positioning tab. Clicking the Selector button (>>) allows you to navigate the attenuation ShareSet hierarchy and select the attenuation you want to subscribe to.

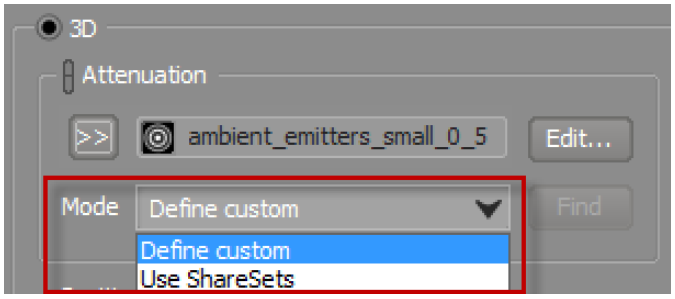


Subscribing a sound object to an attenuation

Now, when the ambient_tree_rustle sound object is played, it will obey the definition of the ambient_emitters_small_0_5 attenuation and you will hear the soft rustling of leaves when the listener is close to the emitter. If the properties of the attenuation change, any sound object that is subscribed to it will also change.

Using Spread as Part of an Attenuation

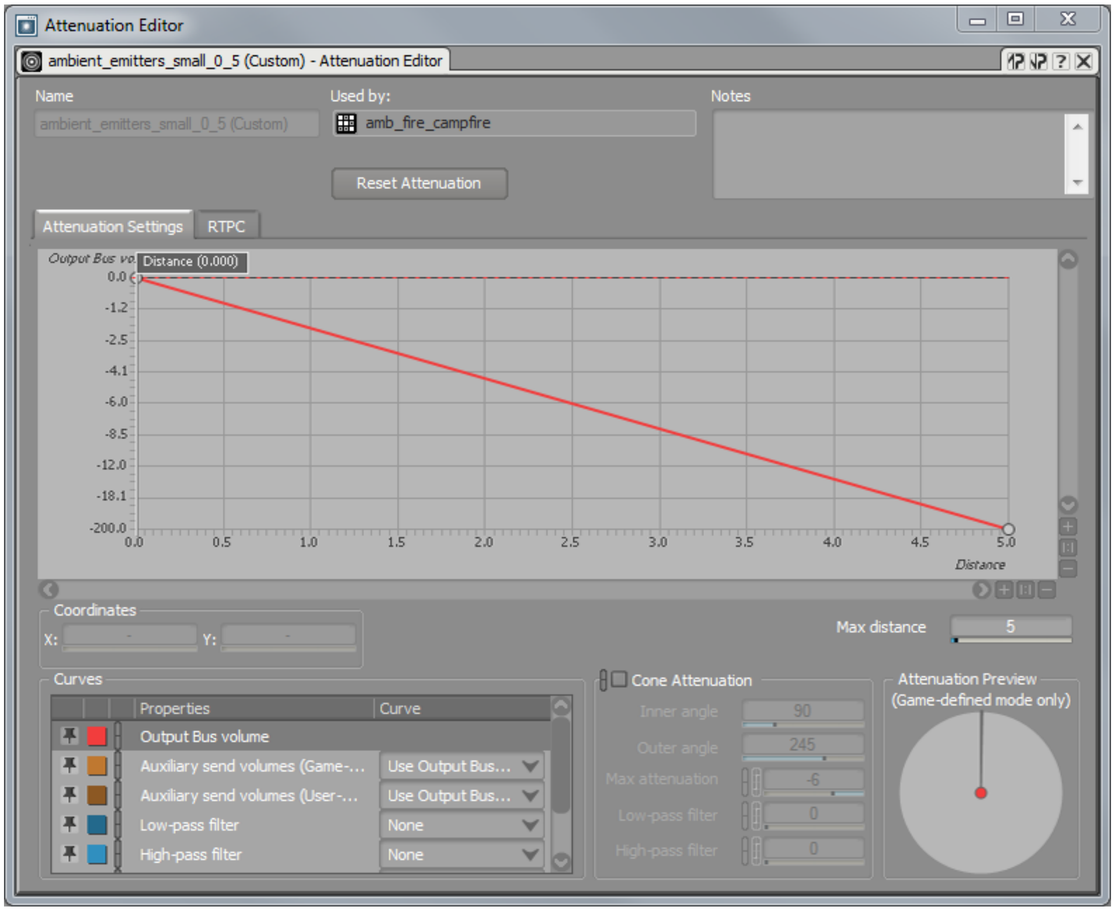
In the next example, we'll take the same ambient_emitters_small_0_5 attenuation ShareSet and subscribe the ambient_fire_campfire sound object to it. Additionally, we will set the mode to Define Custom in order to use the same ambient_emitters_small_0_5 attenuation, but also Spread the sound at close distance for that particular object.



ambient_emitters_small_0_5

Mode: Define custom

Defining a custom attenuation mode



Name: ambient_emitters_small_0_5 (Custom)

Used by: amb_fire_campfire

Max distance: 5

Curves

Properties	Curve
Output Bus volume	
Auxiliary send volumes (Game-...	Use Output Bus...
Auxiliary send volumes (User-...	Use Output Bus...
Low-pass filter	None
High-pass filter	None

Cone Attenuation

Inner angle	90
Outer angle	245
Max attenuation	-6
Low-pass filter	0
High-pass filter	0

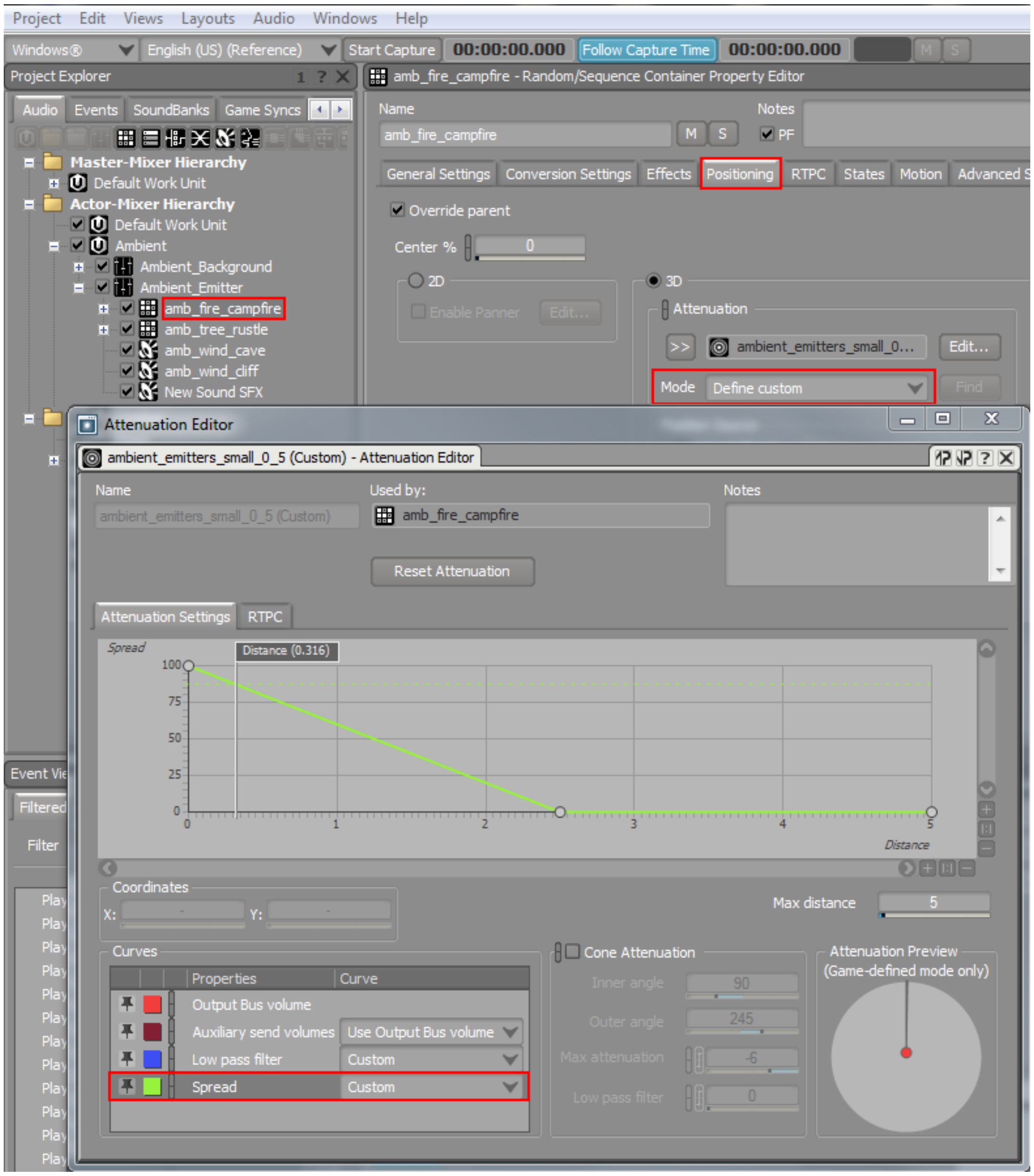
Attenuation editor displaying custom properties

Now that the ambient_fire_campfire sound object has been changed to Define Custom as its attenuation mode, it is now using a unique instance of the attenuation that is not shared (or sharable) with any other sound object.

Designer Note

Spread specifies the amount or percentage of audio that is spread to neighboring speakers, allowing for sounds to change over distance from a point source at low values to a completely diffused propagation at high values. For multichannel sounds, each channel is spread separately.

In the following image, the sound of the campfire is set to begin spreading between the available speakers at half its maximum distance (2.5) until it is 100% spread at its minimum (0).



Windows® · English (US) (Reference) · 00:00:00.000 · 00:00:00.000

Name: amb_fire_campfire
Override parent: ✓
Center %: 0
3D
Attenuation: ambient_emitters_small_0…
Mode: Define custom

Name: ambient_emitters_small_0_5 (Custom)
Used by: amb_fire_campfire
Max distance: 5

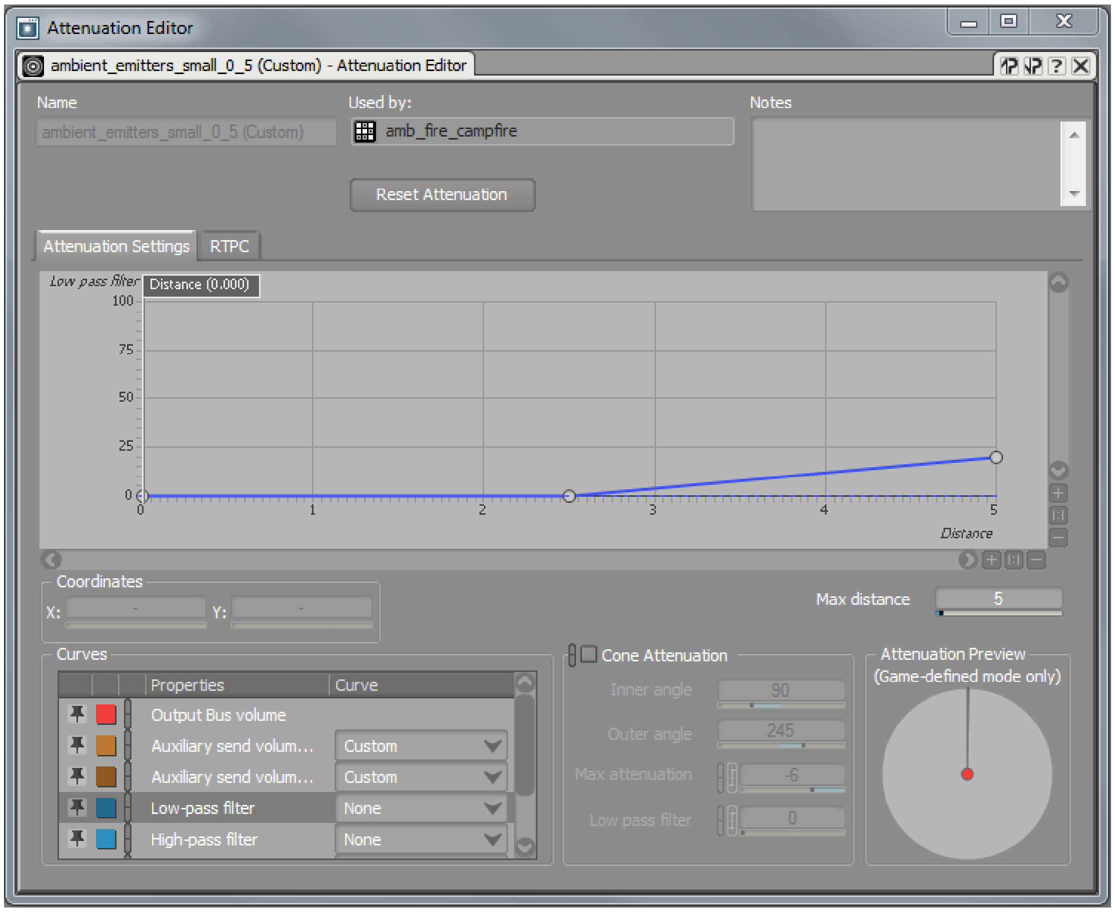
Properties	Curve
🟥 Output Bus volume	
🟥 Auxiliary send volumes	Use Output Bus volume
🟦 Low pass filter	Custom
🟩 Spread	Custom

Inner angle: 90 · Outer angle: 245 · Max attenuation: -6 · Low pass filter: 0

Spread authored in the Attenuation Editor and modified by the distance parameter

Using Low Pass Filter as Part of an Attenuation

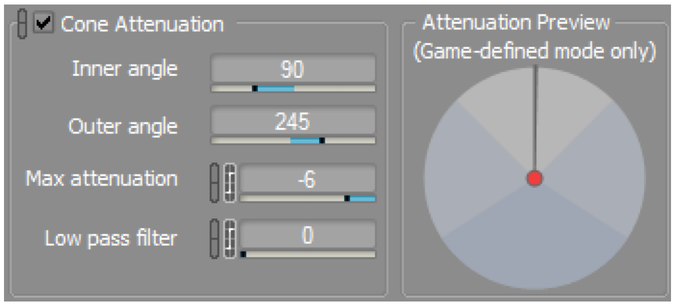
To add further realism to the sound of fire over distance, we can also enable a custom low pass filter that will begin cutting high frequencies as the listener gets further away.



Low pass filter authored in the Attenuation
Editor and modified by the distance parameter

Adjusting Cone Attenuation Properties

Cone Attenuation properties can be adjusted to further influence the directionality of sounds that subscribe to an attenuation ShareSet. Doing so allows you to focus sounds in the world by restricting the angle of sound propagation based on the game objects orientation. This can be especially useful for vehicles, projectiles, and objects that require a more focused positional sound.



Cone Attenuation ✓

Inner angle 90

Outer angle 245

Max attenuation -6

Low pass filter 0

Enabling Cone Attenuation properties

Section Summary

Attenuations are specific sets of rules that determine how the sound of objects will change over distance within your game. They're highly customizable and can be used as creatively or realistically as your vision requires. Whether you strive for a heightened sense of reality or a creative impressionistic aesthetic, the flexibility of attenuations allows you to tailor the sonic propagation palette to your needs.

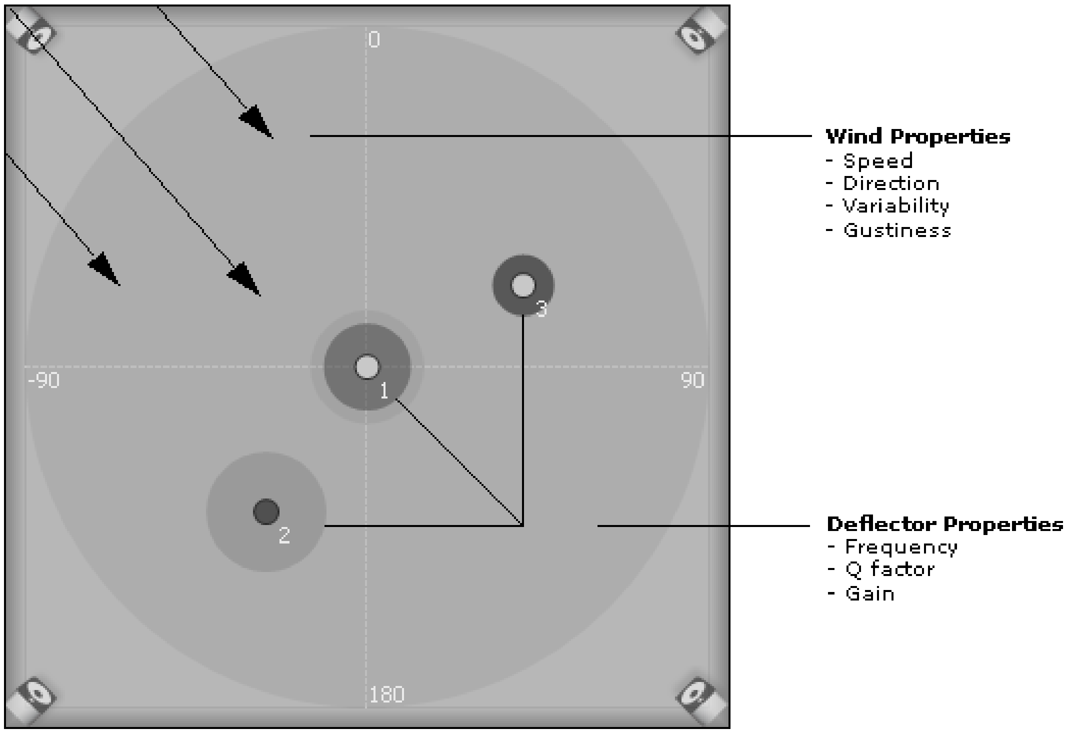
SoundSeed Air -Wind

Whether you find yourself at the edge of a cliff overlooking the path ahead, or standing at the mouth of a dungeon thinking about what might be lurking in the shadows, the sound of wind can help add an epic tone to the situation. The SoundSeed Wind plug-in has been created as a runtime-efficient solution to the challenge of authoring dynamic wind elements.

The SoundSeed Wind plug-in is a Wwise source plug-in that generates wind sounds as they pass through and around objects. These sounds are generated by using time-varying parameter sets to drive a synthesis algorithm. No source audio files are necessary as the wind sounds are completely synthesized. SoundSeed Wind allows you to save memory in-game because there is no longer a need for the long looping wind ambience .wav files that would have traditionally been used.

SoundSeed Wind emulates the flow of wind through a scene; the direction specifies the point of entry of wind flow on to a scene. Thus you should expect pressure waves to hit the deflectors closest to the entry point first. The flow will then propagate through the scene as it is pushed by incoming wind. As it propagates, you will hear deflector objects that are placed farther from the entry point as they encounter the oncoming pressure wave. Note that higher wind speeds at the entry point push the flow at a quicker rate than slower speeds.

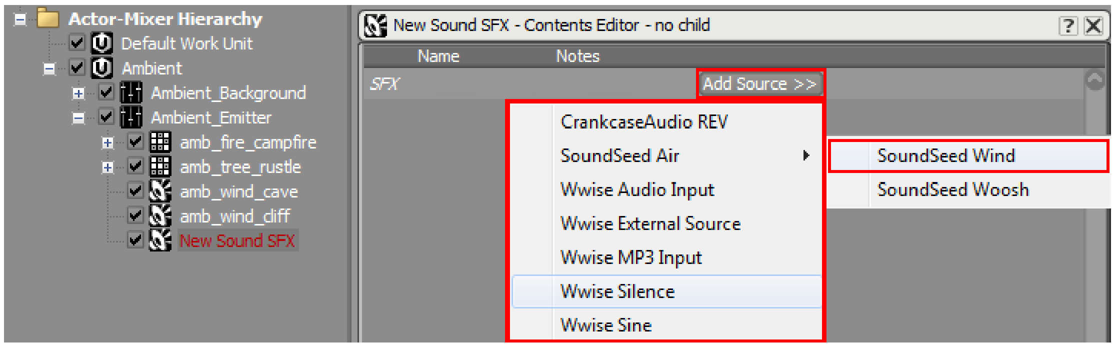
The following illustration demonstrates a typical scene where wind and a series of deflectors are defined using a set of properties. Deflectors will appear smaller or larger in size and lighter or darker in color, depending on the frequency and gain property values assigned to them.



Deflector and wind properties

The biggest benefits to synthesized wind are the ability to dynamically manipulate the wind model in real time, the randomness of generating sound differently every time, and the memory savings incurred by removing audio content from the equation. What would normally have taken a many seconds long audio file can now be replaced by realistic models authored within Wwise. These authored sounds are further modifiable by game parameters at runtime, as well as from within the authoring application while connected to the game.

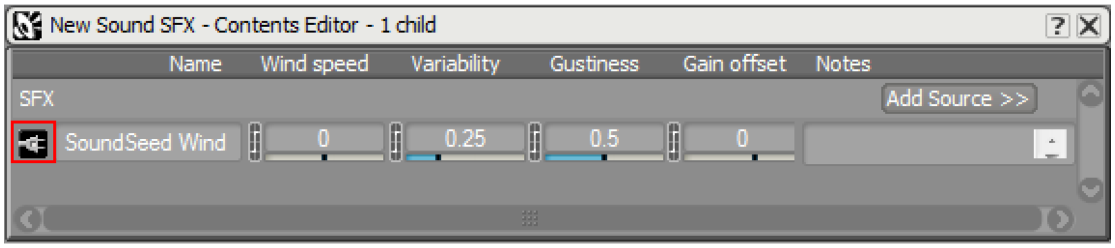
Adding the SoundSeed Wind plug-in to a new Sound SFX is accomplished in the same manner as the silence plug-in covered in the ambient chapter.



Adding SoundSeed Air Wind to an empty Sound SFX

SoundSeed Wind - Deflectors

The first step in creating a wind model begins with the placement of a deflector (or deflectors), which is used to generate wind as it passes through and around the objects. The Source Plug-in Editor can be accessed in the Contents Editor by double-clicking the plug-in icon.

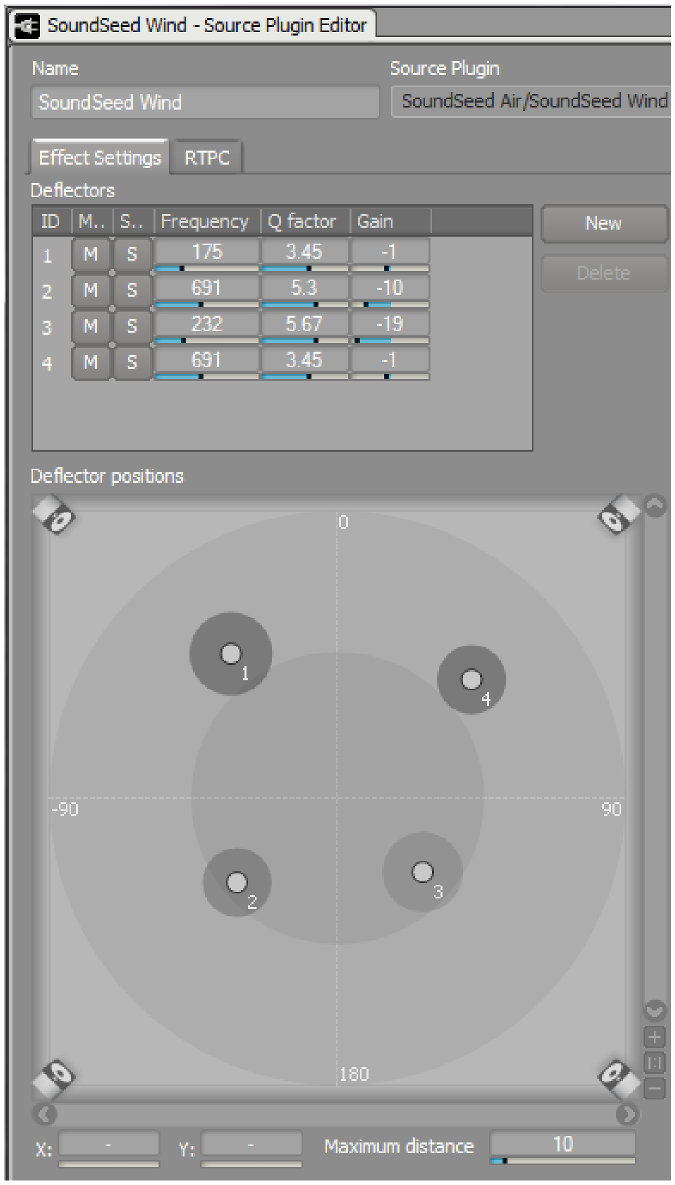

New Sound SFX - Contents Editor - 1 child

Name	Wind speed	Variability	Gustiness	Gain offset	Notes
SFX					
SoundSeed Wind	0	0.25	0.5	0	

Wind Source plug-in icon

The attributes available include:

- **Frequency**: Represents the size of the deflector.
- **Q factor**: Is used to simulate deflector surface type.
    - Regular (high Q) /round or irregular (low Q)
- **Gain**: Control of the amplitude of each deflector.


SoundSeed Wind - Source Plugin Editor

Name: SoundSeed Wind

Source Plugin: SoundSeed Air/SoundSeed Wind

Effect Settings | RTPC

Deflectors

ID	M..	S..	Frequency	Q factor	Gain
1	M	S	175	3.45	-1
2	M	S	691	5.3	-10
3	M	S	232	5.67	-19
4	M	S	691	3.45	-1

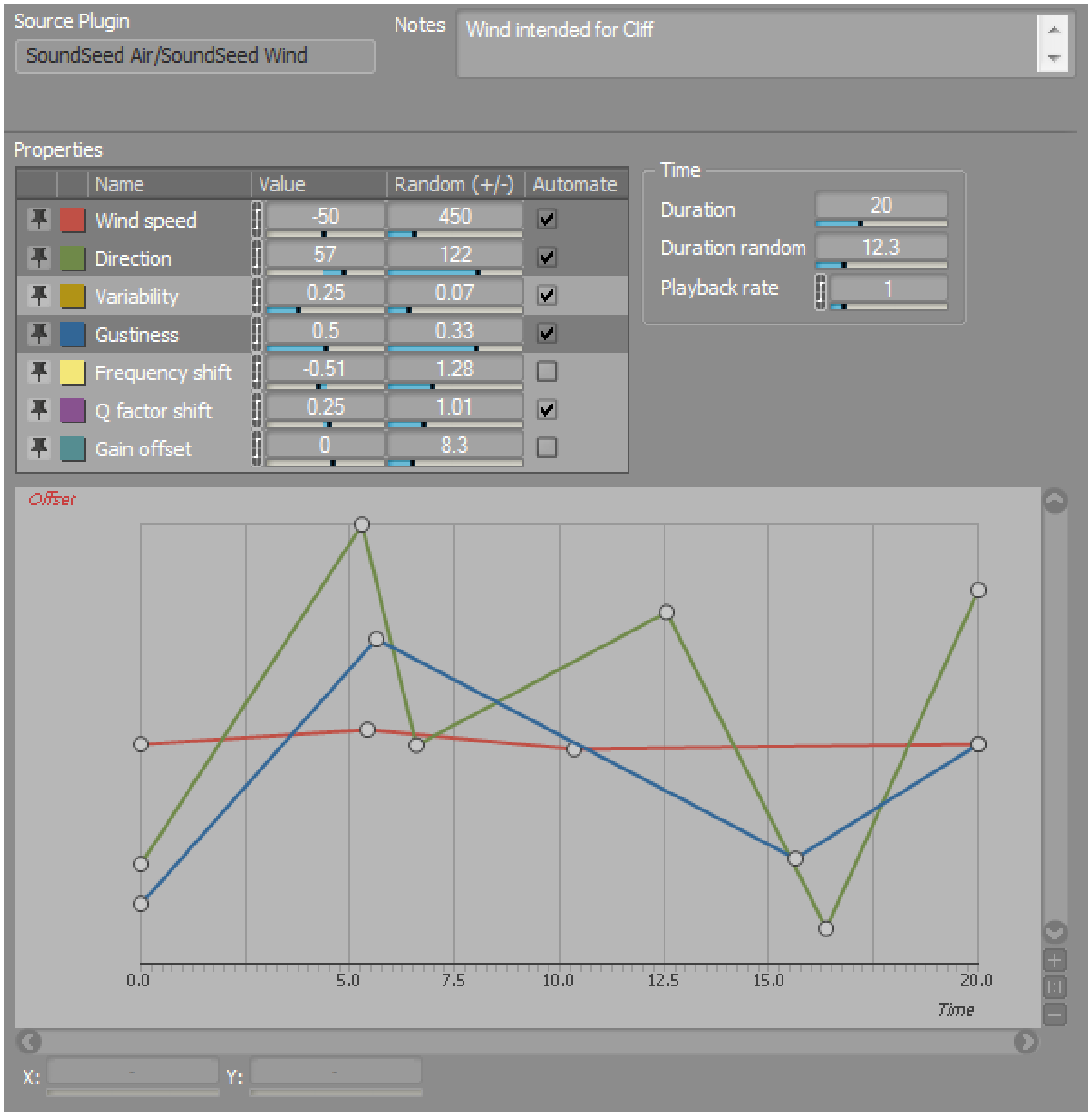
Deflector positions

X: - Y: - Maximum distance 10

Positioned deflectors

SoundSeed Wind - Properties

Like any tool, you can experiment to create and discover the sound you want. For both wind and deflector properties, a fixed value can be set along with a positive or negative deviation. All of these properties can be further automated over time, by adding any number of points in the curve editor.



Source Plugin: SoundSeed Air/SoundSeed Wind

Notes: Wind intended for Cliff

Properties

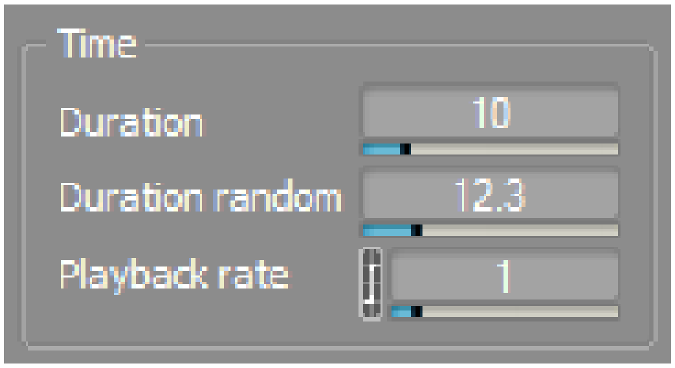
	Name	Value	Random (+/-)	Automate
🟥	Wind speed	-50	450	✓
🟩	Direction	57	122	✓
🟨	Variability	0.25	0.07	✓
🟦	Gustiness	0.5	0.33	✓
🟨	Frequency shift	-0.51	1.28	☐
🟪	Q factor shift	0.25	1.01	✓
🟦	Gain offset	0	8.3	☐

Time

Duration	20
Duration random	12.3
Playback rate	1

Wind properties and property automation using the curve editor

The Playback rate can be modified using an RTPC in the Time section of Properties, as can any property with an RTPC indicator. Looping needs to be enabled in the General Settings tab, just like any sound object, while fixed parameters for loop duration and additional random duration are set in the Time section.



Duration 10

Duration random 12.3

Playback rate 1

Properties for time related functionality

SoundSeed Wind - RTPC

With properties mapped to game parameters, you can use information from the game to control various aspect of the wind sound. Imagine using the player velocity to control the wind speed as they plummet through the air after a successful jump, or mapping the gusts to an altitude game parameter that changes as the player ascends along a mountain pass. By bringing parameter control to your wind models, you can dynamically represent and better reflect the intention of the gameplay and scenario.

Ambient Summary

In this chapter we have established some fundamental processes for building dynamic and varied soundscapes. Many of the techniques covered in this chapter will continue to inform the rest of this document and serve as the building blocks of interactive audio.

Throughout this chapter we have:

- Created various types of sound objects
- Used sound objects as building blocks for an ambient soundscape system
- Established looping backgrounds
- Created a system to randomly playback individual ambient elements

Stepped through the process of:

- Importing simple sounds to containers
- Using blend containers to sum and playback multiple sound objects simultaneously
- Creating a game parameter that can be used to modify properties
- Using the Time_of_Day parameter to Crossfade between containers

Also touched on:

- Using attenuation ShareSets to manage distance based falloff
- The use of SoundSeed Air - Wind to author realistic sounding dynamic wind
- Leveraging paths using the Position Editor to randomly position individual ambient elements in 3D space.

And created the following objects:

- Looping background random containers.
- Ambient_day_night blend container that Crossfades between content using blend tracks based on a time of day game parameter.
- SoundSeed Wind models to be used as positional sound emitters.
- Generalized attenuation ShareSets for ambient emitters.

Ambient Additional Resources

Wwise Knowledge Base - How does Wwise handle multichannel sources with 3D positioning?

Wwise Knowledge Base - How do I simulate a sound that is not a point sound source?

Video Tutorial - Using the interface

Video Tutorial - Importing Audio Files

Video Tutorial - Building Sound Hierarchies

Video Tutorial - More Learning Resources

Video Tutorial - SoundSeed Air Wind Overview

Video Tutorial - Using the Blend Container

Video Tutorial - Relation between Sound- Source and Audio File

Chapter 2. Establishing Character

Overview

From the hero’s first steps through the forest, to the upgrading of armor after a dungeon crawl, movement sounds help to anchor the player firmly in the game world. While the content demands of character sounds can vary wildly across different game types, the fundamentals remain consistent across any genre.

In this chapter we'll walk through the following process:

- Creating player and Non-Player Character (NPC) movement sets.
- Understanding switch groups, switches, and how to use them.
- Establishing multi-level switches to manage:
  - Surface Type
  - Player Type
  - Step Type

Character sounds persist throughout every area and scenario of the game world. Special care and handling should be used when defining the aesthetic and implementation that result in sounds heard frequently throughout gameplay. Thankfully there are several different ways to approach movement sounds for any situation.

Footsteps and Movement - Establishing Needs

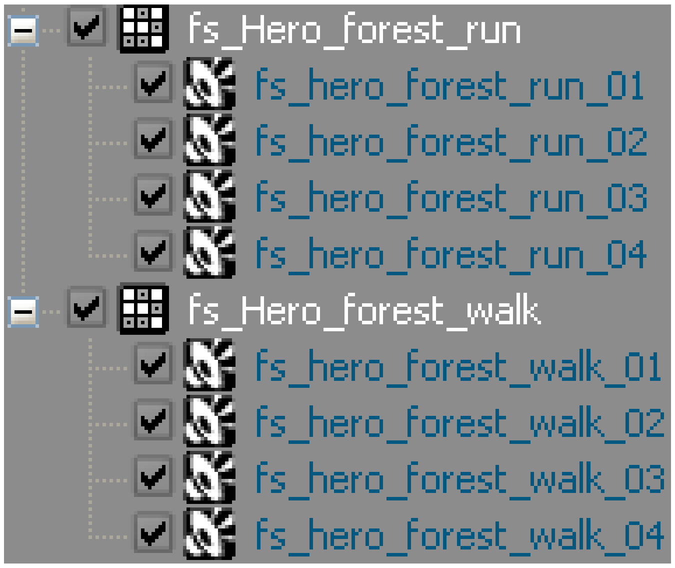
To establish audio content needs, it's important to understand a few things about how to best support gameplay when it comes to movement sounds. You can easily create a simplified step system, but a varied system produces a better experience. The importance of varied footstep sounds in a game can be a delicate balance of finding the right places to put resources without ending up with a system that uses up all of the available memory.

Think about the following questions to help you determine how extensive the footstep system should be:

- How many step types will characters have? (Walk, run, scuff, turn...)
- How many surface types need to be represented with sound? (Dirt, stone, sand...)
- How will footstep sounds be triggered? (Animation, programatically...)
- How often will you hear footsteps for an extended period of time? (2-5 minutes, 10-20 minutes...)

Simple Steps

A simplified footstep system might consist of a randomized container of individual footstep audio files played each time a characters step reaches a certain frame of animation. These animation-based footsteps are usually marked (or tagged) with a Wwise event for each frame of animation, where the footstep is meant to play back a sound. Different types of steps such as walk, run, turn, scuff, jump, land, etc. would then be explicitly tagged to a frame of animation, corresponding to an event comprised of the correct sounding steps.



```
fs_Hero_forest_run
    fs_hero_forest_run_01
    fs_hero_forest_run_02
    fs_hero_forest_run_03
    fs_hero_forest_run_04
fs_Hero_forest_walk
    fs_hero_forest_walk_01
    fs_hero_forest_walk_02
    fs_hero_forest_walk_03
    fs_hero_forest_walk_04
```

Simplified footsteps implementation

While this technique may still have its place in games where there are few footsteps, the simplified system quickly shows its limitations because of its recognizable repetition and the inability for sound designers to manage variables from within the authoring application.

Switching System Introduction

Switches represent the different alternatives that exist for a particular game object within the game. Sound, music, and motion objects are organized and assigned to switches so that the appropriate sound or motion object will play when a change is made from one alternative to another in game. The Wwise objects that are assigned to a switch are grouped into a switch container. When an event signals a change, the switch container verifies the switch and the correct sound, music, or motion object is played.

To take this a step further, we are going to build a cascading set of switch groups that work in concert to play the correct footstep sound based on:

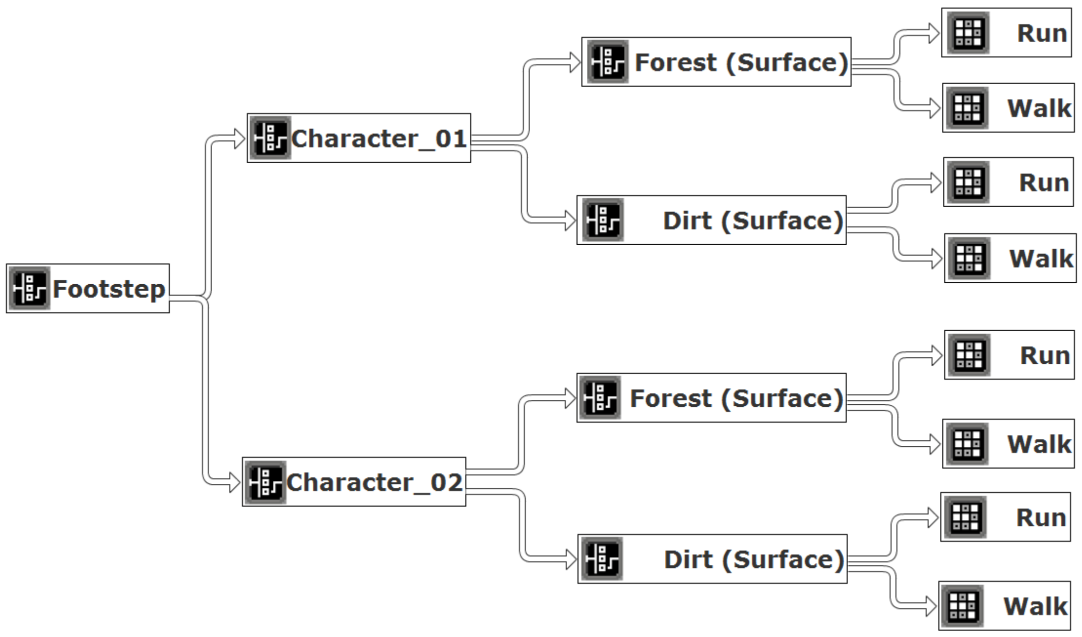
- Step Type
- Surface Type
- Character Type

To unleash the full power of switches a programmer will need to define these in the game engine to drive the system.

It's common for every asset in a game to include metadata about what the asset is, be it a rock texture or character model, along with the properties that define it. By using these already existing definitions, or creating this data to control the switching system, we move closer to a data-driven pipeline making things easier to manage and scale throughout development.

Designer Note

Using information from the game to drive the switching system in Wwise is something that should be discussed with an audio programmer as soon as possible during the development cycle. There are great opportunities to automate much of the challenge that comes with this aspect of implementation.

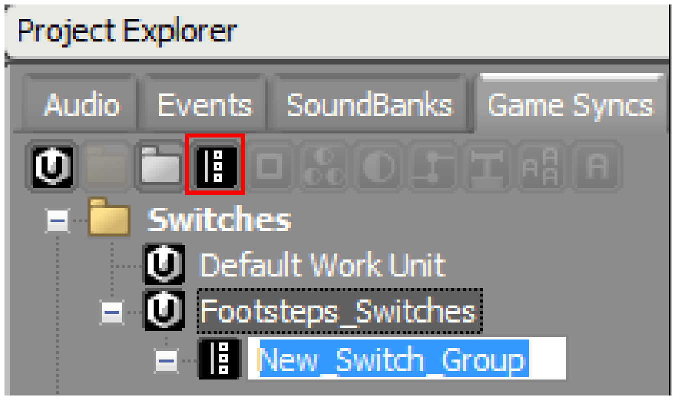


Multi-level switch system showing switch between: character type, surface type, and step type.

While seemingly complex compared to the simple method of footstep implementation, the flexibility of using information from the game allows for greater control of the resulting sound and puts creative control in the hands of the sound designer.

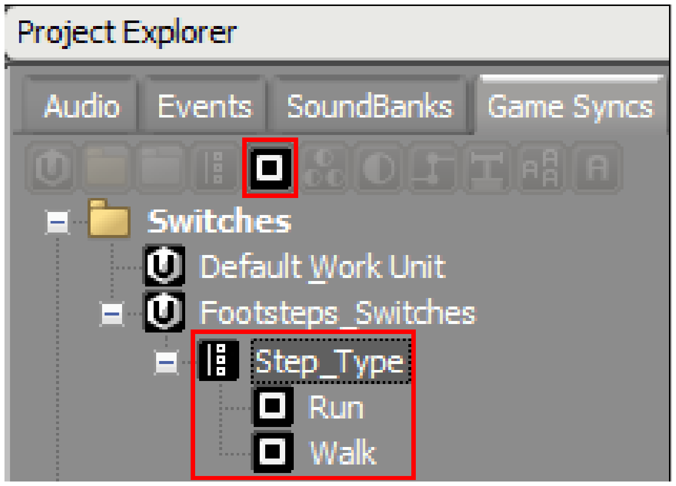
Defining Step Type

We'll start by creating a new work unit for our footstep switch and add a Switch Group for Step_Type to change between walking and running switches. By selecting the new Footstep_Switches work unit and then clicking the switch group icon in the Project Explorer toolbar, a new switch group is created.



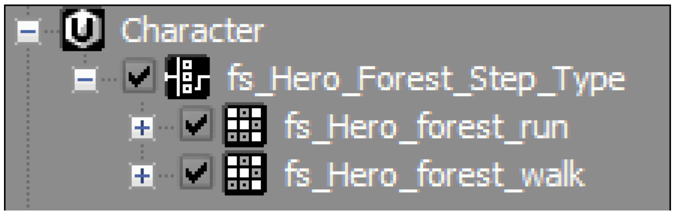
Creating a switch group in the "Footstep" switch work unit

Once the new switch Step_Type switch group has been created, switches can be added by selecting the new switch group and then clicking the switch icon in the Project Explorer toolbar. New switches are created: one for each step type: Walk and Run. Alternately, switches and switch groups can be created from the contextual menu or by using shortcut keys.



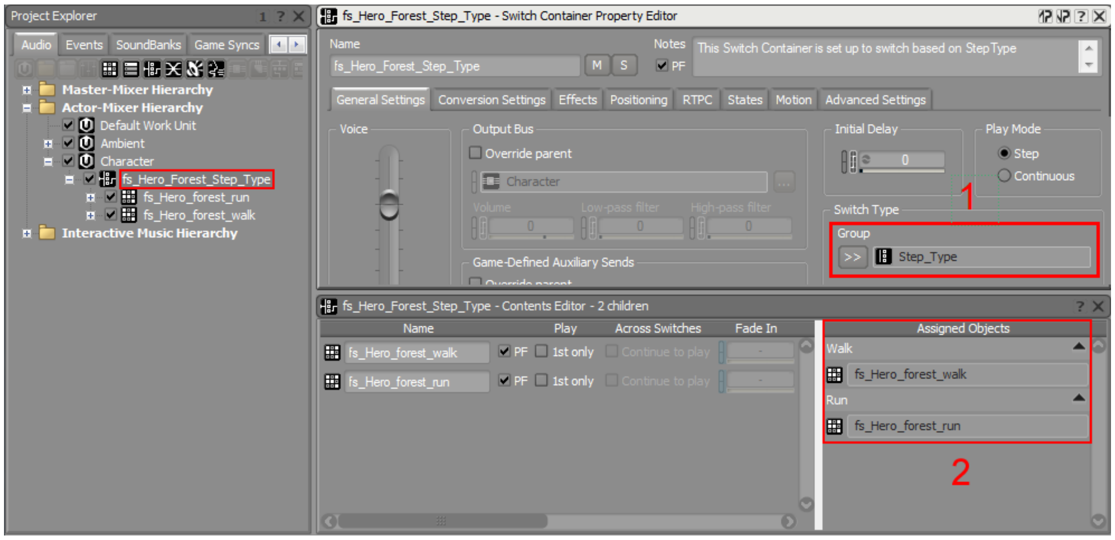
Creation of the Step_Type switch group and corresponding Run and Walk Switches

A new switch container which contains both run and walk random containers can now be created.



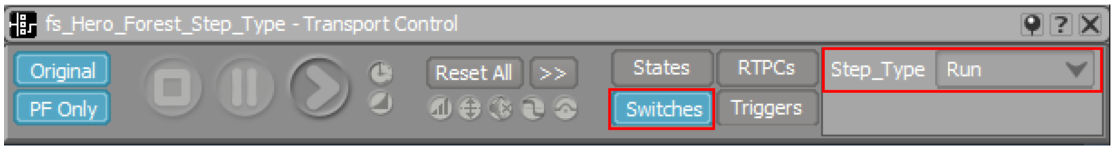
A switch container containing both run and walk random containers

The switch type can then be defined by using the switch type Selector button (>>) and selecting the new Step_Type Switch Group (1). Next, the walk and run random containers can be assigned by dragging and dropping them to the appropriate Switch in the Assigned Objects area of Content Editor (2).



Adding the Step_Type switch group and assigning objects

Auditioning the different step types can be done through the Transport Control. After selecting the fs_Hero_Forest_Step_Type switch container by double clicking it, clicking the play icon or pressing the spacebar will play the object. Setting the switch can be done from the game syncs section of the Transport Control. When selected, any associated game syncs available for the object will be displayed.



Transport Control showing the selected switches game sync and available switches for the selected game object

Defining Surface Type

One of the greatest potentials for diversification, and something that immediately communicates a sense of place to the player, is the inclusion of different footstep surface types. While these may be represented in the game visually, it may take extra effort to communicate information about the surface type a character is traversing as a switch. Ideally the game engine has a way to specify the surface type of a traversal area, and this specification can be posted to Wwise as a switch.

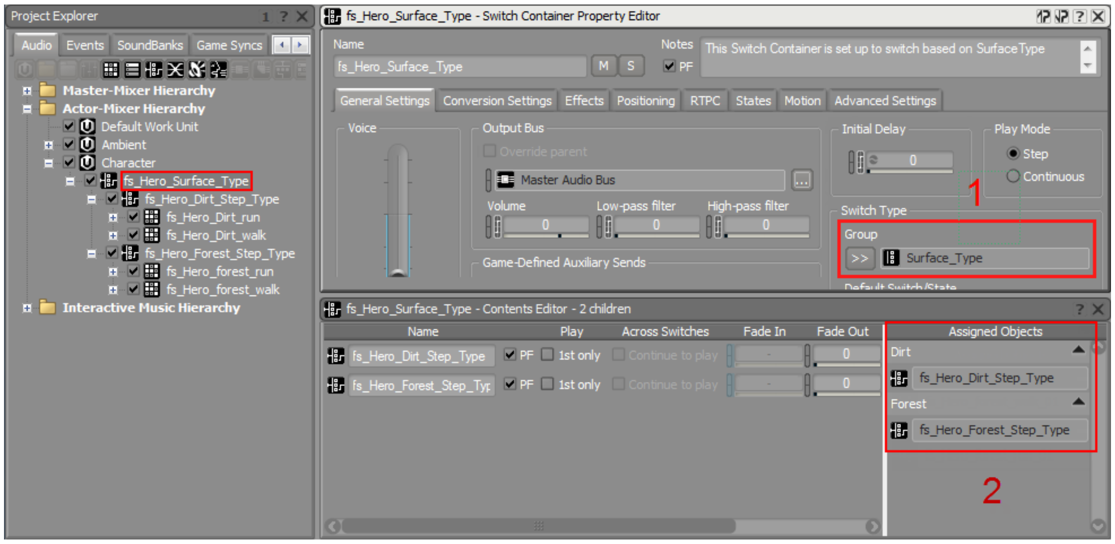
Programmer Note

There is a helpful footstep integration example that comes as part of the Wwise Programmer SDK.

Designer Note

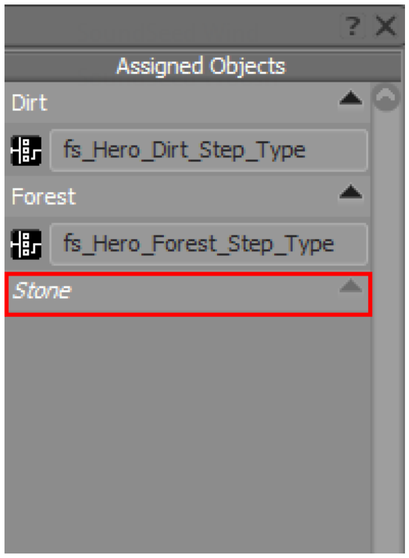
Once surface type is communicated to Wwise, there are other applications and uses for this information. If, for instance, you were building a dynamic rain system, you could use surface type to change rain drop impact playing back positionally from different surfaces in the game world. Also, most physics impact sounds benefit from knowing the surface material being impacted. As an example, the sound of a wood plank falling on dirt will have a much duller sound than on concrete.

As in the previous section, we'll create a new switch container and subscribe it a new Surface_Type switch group (1). We can then add the random containers to the appropriate switches for either dirt or forest in the assigned objects area of the Content Editor (2).



Adding the Surface_Type switch group, and assigning objects

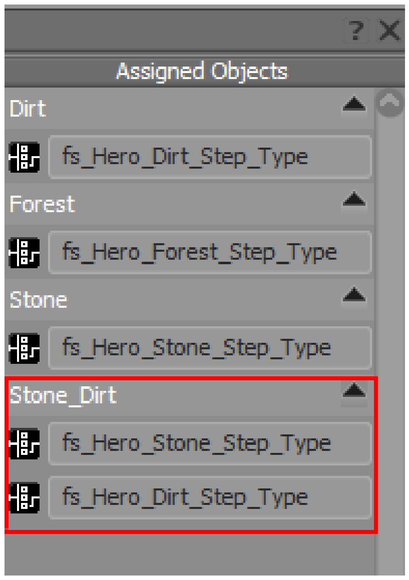
Using a multi-level switching system contributes to an organized and consolidated working methodology which is supported within the Wwise hierarchy. It also helps to keep the implementation clear and concise. Furthermore, switches can be added to switch groups as new types become available in the game, which makes scaling a straightforward endeavor. As an example, if we want to add an additional switch for the Stone surface type, we can add it to the switch group, and it will show up in the Assigned Objects section of the Contents Editor for any sound object subscribed to the Surface_Type group.



Adding an additional switch to an existing switch group

Let's say the sound content for the Stone footsteps hasn't been delivered yet. We can temporarily use any available audio content until it is ready to be replaced. Temporarily assigning content allows for immediate feedback and helps validate a working system. This can be further verified by looking at the capture log returned from the game as part of the Wwise Profiler. (See Optimization 10.4 Understanding the Different Types of Profiling in Wwise)

This level of abstraction also allows you to share content between Switches and, when combined elementally, can produce additional variations without the need for additional content. For instance, combining Dirt and Stone sounds could produce a dirty/stone surface type variation using content that already exists.



Assigned Objects

Dirt
- fs_Hero_Dirt_Step_Type

Forest
- fs_Hero_Forest_Step_Type

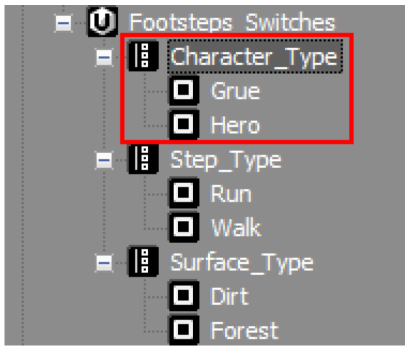
Stone
- fs_Hero_Stone_Step_Type

Stone_Dirt
- fs_Hero_Stone_Step_Type
- fs_Hero_Dirt_Step_Type

Adding multiple sound objects to a single switch

Defining Character Type

Taking this a step further, we can also add a Switch Group for the Character_Type:



- Footsteps_Switches
  - Character_Type
    - Grue
    - Hero
  - Step_Type
    - Run
    - Walk
  - Surface_Type
    - Dirt
    - Forest

Character_Type switch group and switches

All Together Now

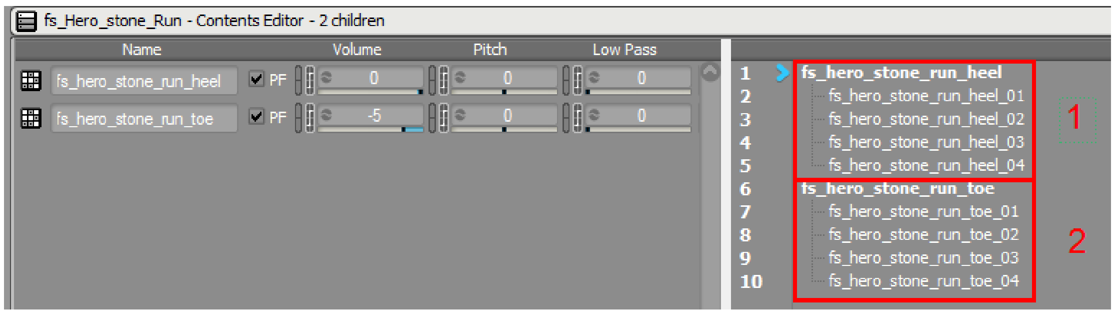
We now have switching information communicated from the game to Wwise for three different aspects of character sound:

- Step Type
- Surface Type
- Character Type

The combination of these switches when the Footstep event is triggered by the game will cause a sound from the correct character, step and surface type sound object to be played. Now instead of having multiple events to keep track of, we can simply pass a single event for a 'footstep' from the game and let switches handle the correct playback of sound as defined by the game.

Designer Note

Another technique used sometimes at the content level is the separation of heel and toe variations. This adds further diversity through randomized combination and, if the content is designed appropriately, can exponentially increase the variations and further reduce the chance for repetition. By setting up a sequence container with a randomized Heel container (1) followed by a randomized Toe container (2), each step can be composed on-the-fly when a footstep is requested. Further memory savings may be possible if you're able to share heel or toe components between different surfaces. By working elementally with the techniques available within the Wwise authoring application, you can increase variation and reduce your memory footprint, which is a winning prospect for any development.



fs_Hero_stone_Run - Contents Editor - 2 children

Name		Volume	Pitch	Low Pass
fs_hero_stone_run_heel	✓ PF	0	0	0
fs_hero_stone_run_toe	✓ PF	-5	0	0

1 fs_hero_stone_run_heel
2 fs_hero_stone_run_heel_01
3 fs_hero_stone_run_heel_02
4 fs_hero_stone_run_heel_03
5 fs_hero_stone_run_heel_04
6 fs_hero_stone_run_toe
7 fs_hero_stone_run_toe_01
8 fs_hero_stone_run_toe_02
9 fs_hero_stone_run_toe_03
10 fs_hero_stone_run_toe_04

Sequencing heel and toe to reproduce a single footstep

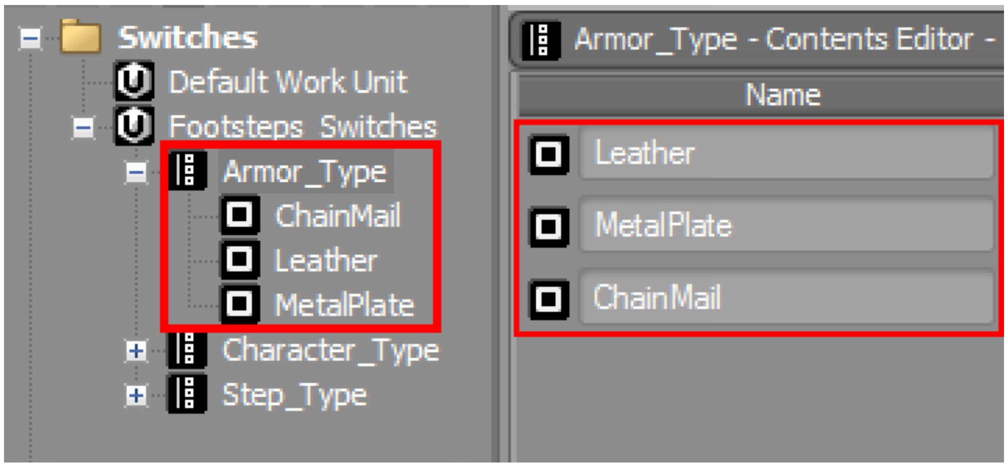
Regardless of the level of detail your game and implementation requires, Switches provide an efficient way to deal with groups of content whose playback is dependent on information from the game engine.

Movement

Another key aspect to movement sound is the sound of clothing material as a character travels through the world. Whether it's age-old leather, chain-mail, or plate style armor, the distinguishing characteristics add to the footstep sounds and help bring an additional level of believability. The sound of movement is especially important if different types of wearables can be changed or added during the course of gameplay. Changing out the sound whenever possible helps to reinforce a choice made by the player and adds to the level of realism throughout their experience.

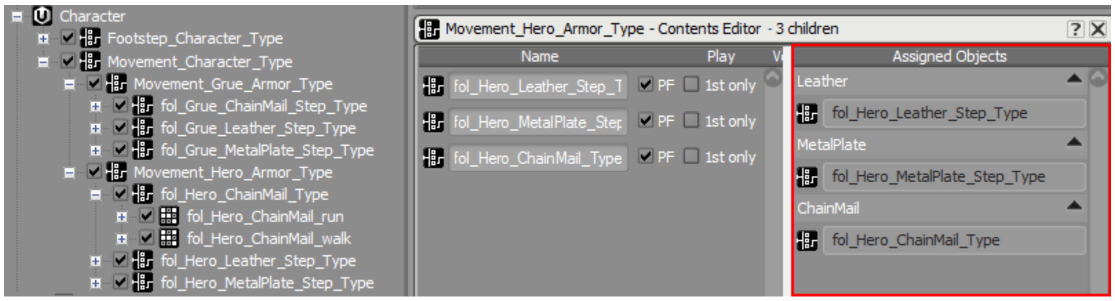
Defining Armor Type

Similar to the switching system implemented for footsteps, we'll use the Character_Type and Step_Type switches in addition to a new switch for Armor_Type.



Armor_Type switch group and switches

With each of these switches being used to drive the switching system, the hierarchy can be organized to switch between appropriate sound content.



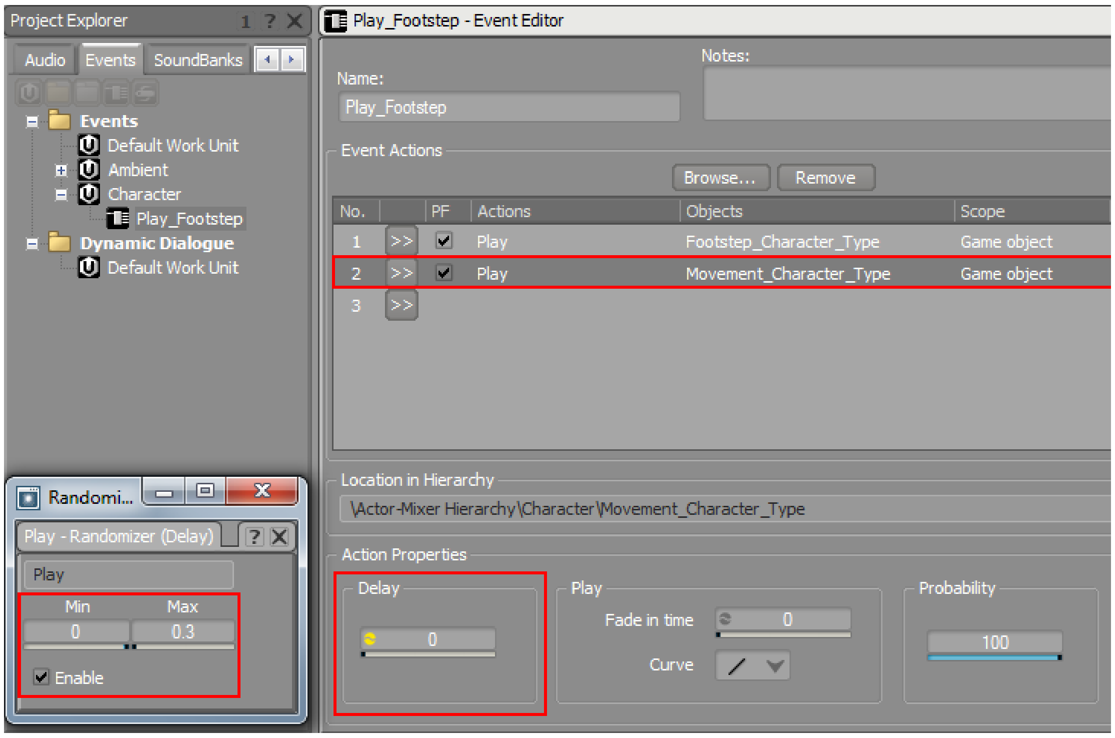
Movement switches with assigned step types

Creating the Movement Event

Once we've got everything switching appropriately and all the content in place, it's time to add the parent movement switch container to the footstep event using the Play action.

Design Note

Depending on the sound content for movement, playing the armor material sound simultaneously with the sound of the footstep may not be desirable. In situations where it is preferable to give the footstep some room to be heard, the delay property can be used as part of the movement play action. Further adding a fixed delay offset to the movement sound, in addition to delay randomization, increases the randomness and lends itself to a more realistic representation.



Name: Play_Footstep

Notes:

Event Actions

No.		PF	Actions	Objects	Scope
1	>>	✓	Play	Footstep_Character_Type	Game object
2	>>	✓	Play	Movement_Character_Type	Game object
3	>>				

Location in Hierarchy: \Actor-Mixer Hierarchy\Character\Movement_Character_Type

Action Properties

Delay: 0

Play: Fade in time: 0; Curve

Probability: 100

Play - Randomizer (Delay): Min 0, Max 0.3, ✓ Enable

Movement switch and delay offset properties

Using this technique we can better represent the sound of movement between footsteps, it also adds a feeling of variation and uniqueness to each footstep event.

Other switch specific functions, such as the ability to drive switches based on game parameters, continuous switch mode, and fade behaviors are additional techniques for creative implementation. Furthermore, switches can be a handy organizational tool and a convenient way to harness game information as part of a streamlined workflow.

Character Summary

Throughout this chapter we've come to a greater understanding of switch groups, switches, and their use as part of a system that works in conjunction with game information. The strength of building a system based on information from the game is in the ability to change, control, and manipulate content within the tool, without changing code. It also puts control over behaviors independent of the game in the hands of the sound designer.

Throughout this chapter we have:

- Discussed establishing a simplified model of footsteps.
- Developed an understanding of switch groups, switches, and their use.
- Discussed the randomization of properties within a sound object.
- Arranged containers within the assigned objects section of the Contents Editor.

Stepped through the process of:

- Creating sets of player and Non-Player Character (NPC) footstep random containers based on:
  - Character type
  - Surface material type
  - Footstep type
- Creating sets of player and Non-Player Character (NPC) movement random containers based on:
  - Character Type
  - Footstep Type
  - Armor Type
- Establishing switches to manage:
  - Surface Type
  - Player Type
  - Step Type
- Creating a multi-level switching system for footsteps and movement.

Also touched on:

- Using delay offset in the Event to introduce natural randomness in movement sounds.

Throughout this section we have created the following objects:

- A multi-level switching system that determines the character, surface, and step type when the footstep event is played.
- A multi-level switching system for movement sounds with randomized delay offset in the footstep event.

- A footstep event comprised of play actions for both footstep and movement switch systems.

Character Additional Resources

Wwise Help > Where to Begin? > Wwise Fundamentals > What are Game Syncs? > **Understanding Switches**

Wwise Help > Interacting with the Game > **Working with Switches**

Wwise SDK - Windows » Sound Engine Integration Walkthrough » Integrate Wwise Elements into Your Game » **Integrating Switches**

Video Tutorial - Creating Footsteps using Random and Switch

Chapter 3. Preparing for Combat

Overview

The sounds of combat serve as punctuation marks along the journey, as the hero battles across the ambient soundscape we've created thus far. With each new encounter, each enemy variation, each weapon upgrade, sound has the ability to reward the player with dynamic audio that equals the unfolding drama on-screen.

This chapter will take you through the process of:

- Defining sound sets for different weapon types.
- Generative weapon swings using SoundSeed Whoosh.
- Understanding different implementation techniques for impacts.
- Attenuations for player vs. NPC.

Starting with a list of available weapon types is one way to approach the sometimes sizable task of combat sound. Once the list has been defined, it's important to understand the different ways that weapons will be triggered, and how to organize them within the project.

Some questions to ask about combat:

- How will combat sound be triggered by the game engine?
- Do most of the combat actions rely on the animation system?
- Is hit detection for impacts handled separately from animations?

When locked in mortal combat with a foe of ill repute, one of the roles that sound plays is in communicating success or failure for each attempted strike. Once you have determined how combat sounds will be played back, you can make sure the actions are represented with the appropriate sound.

Defining Sound Sets for Weapon Types

At the basic level, you can usually count on the playback of swings and impact to share the same implementation technique across different weapons. Additional accents and special moves may be unique; however, there is usually a logic to what attacks can be shared by multiple weapons and which may require special handling. Whether designing a single sound for each action, or working from a pool of basic sounds that can be used as building blocks, how you approach the design often begins with knowing how it will be implemented in the game.

In this example, we are going to use unique weapon swing sounds created using the SoundSeed Air - Whoosh plug-in. The Whoosh plug-in generates sounds made as a simulated object passes through the air. This makes it perfectly suited for close combat weapon swooshes, bullet fly-bys, and other motion sounds.

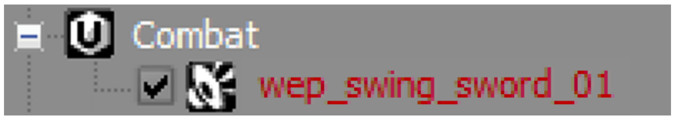
We'll also take a different approach for weapon impacts and combine different material type sounds, based on the surface type (or types) being impacted. This methodology allows us to get a maximum of diversity out of a core set of audio files, by utilizing the surface type switches already created for footsteps.

SoundSeed Air - Whoosh

The SoundSeed line of plug-ins has been created to further extend the functionality of the Wwise authoring application and provide a unique solution to a common problem. When faced with the challenge of keeping repetitive sounds fresh, dynamic, and varied, SoundSeed provides resource conscious creative tools that bring the design of sound one step closer to the game.

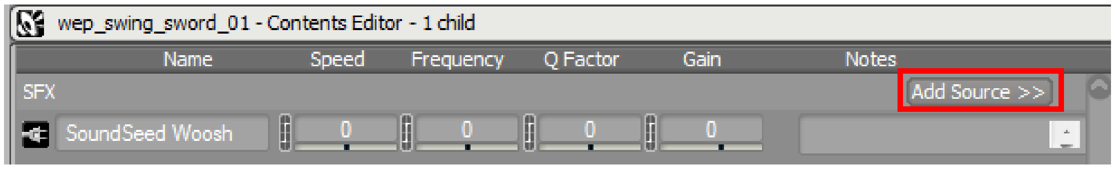
The SoundSeed Whoosh plug-in is a source plug-in that generates sounds as an object passes through the air. To create these types of sounds, the characteristics of the deflector object are defined along with the trajectory movement and speed of the object. No source audio files are necessary as the whoosh sounds are completely synthesized. SoundSeed Whoosh allows you to save memory in-game because .wav file variations are no longer necessary. Additionally, the Whoosh source can be used to create variations using the multiple randomization features.

We'll begin by creating the first of many sword swings that will be available to the hero. It begins with an empty Sound SFX in the Combat work unit nested into the Swing actor-mixer.



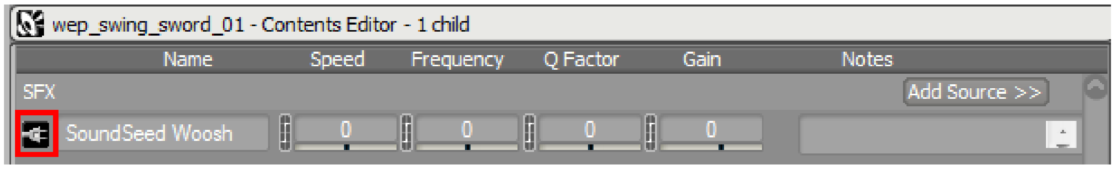
An empty Sound SFX in preparation for adding a whoosh source

We can now add a SoundSeed Air - SoundSeed Whoosh plug-in by navigating to the Add Source Selector button (>>) in the upper-right corner of the Contents Editor.

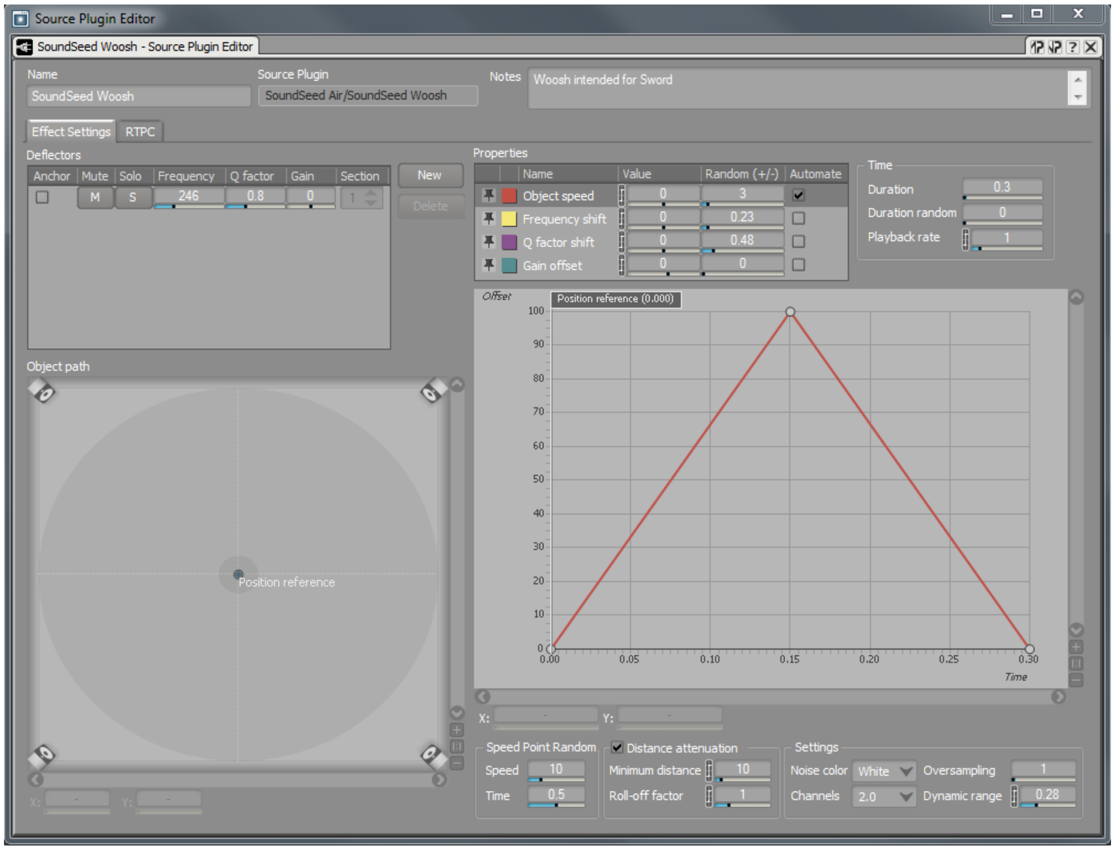


Whoosh Source plug-in Add Source Selector button (>>)

The Source Plug-in Editor can be accessed in the Contents Editor by double-clicking the plug-in icon.



Whoosh Source plug-in icon


Source Plugin Editor

SoundSeed Woosh - Source Plugin Editor

Name: SoundSeed Woosh
Source Plugin: SoundSeed Air/SoundSeed Woosh
Notes: Woosh intended for Sword

Effect Settings | RTPC

Deflectors

Anchor	Mute	Solo	Frequency	Q factor	Gain	Section
☐	M	S	246	0.8	0	1

Properties

Name	Value	Random (+/-)	Automate
🟥 Object speed	0	3	✓
🟨 Frequency shift	0	0.23	☐
🟪 Q factor shift	0	0.48	☐
🟦 Gain offset	0	0	☐

Time

Duration	0.3
Duration random	0
Playback rate	1

Speed Point Random: Speed 10, Time 0.5

✓ Distance attenuation: Minimum distance 10, Roll-off factor 1

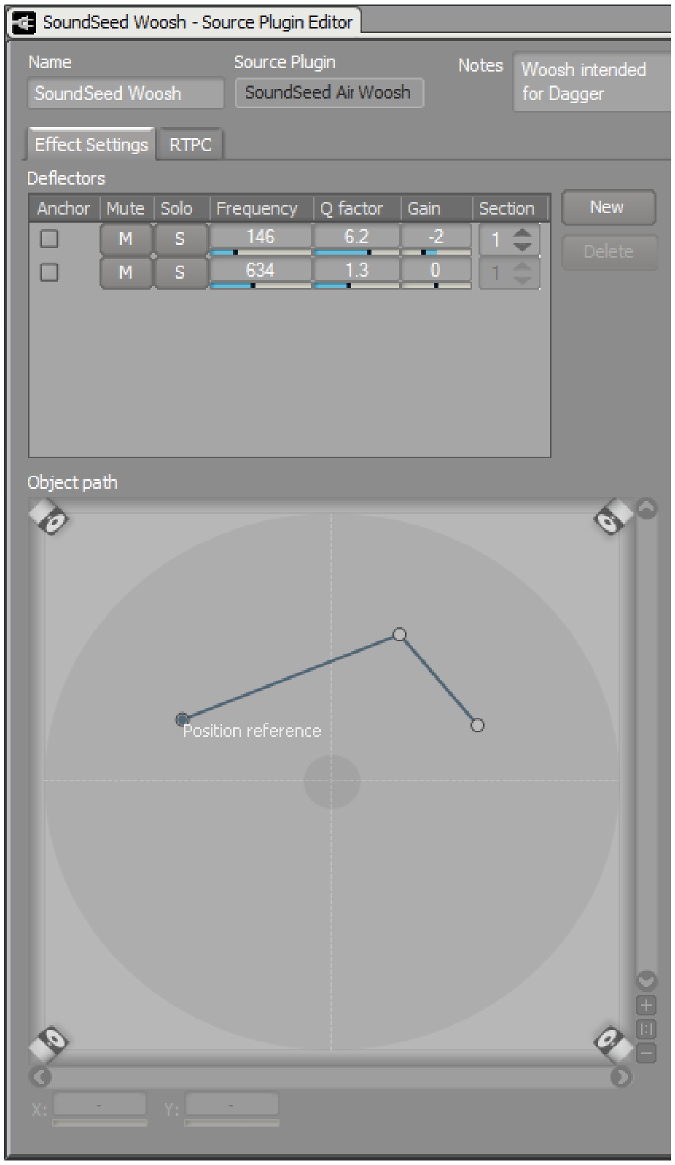
Settings: Noise color White, Channels 2.0, Oversampling 1, Dynamic range 0.28

Authoring Whoosh sounds in the source plug-in editor

Whooshes are a combination of one or many deflectors representing an object and its traveling path. Deflector settings are used to determine the shape of the object, while anchor defines whether the object is spinning or not.

- Frequency: Represents the size of the object.
- Q: Is used to simulate deflector surface type. (regular [high Q]/round or irregular [low Q])
- Gain: Control of the amplitude.

The object path is comprised of points in a path and defines the movement direction of the object through space.



Name: SoundSeed Woosh

Source Plugin: SoundSeed Air Woosh

Notes: Woosh intended for Dagger

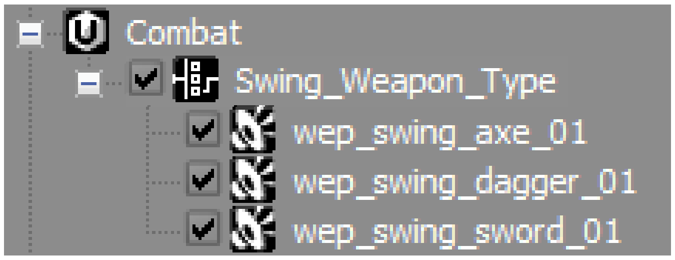
Deflectors

Anchor	Mute	Solo	Frequency	Q factor	Gain	Section
☐	M	S	146	6.2	-2	1
☐	M	S	634	1.3	0	1

Deflector properties and object path

Any number of points can be connected to produce the desired travel path, which appropriately pans based on speaker setup and the number of channels specified in the Settings.

For the weapon swings, we'll be using the two channel setting in conjunction with a path that traces an arc in front of the player from left to right. For the sake of the example, we'll create Whoosh models for sword, axe, and dagger weapon types.

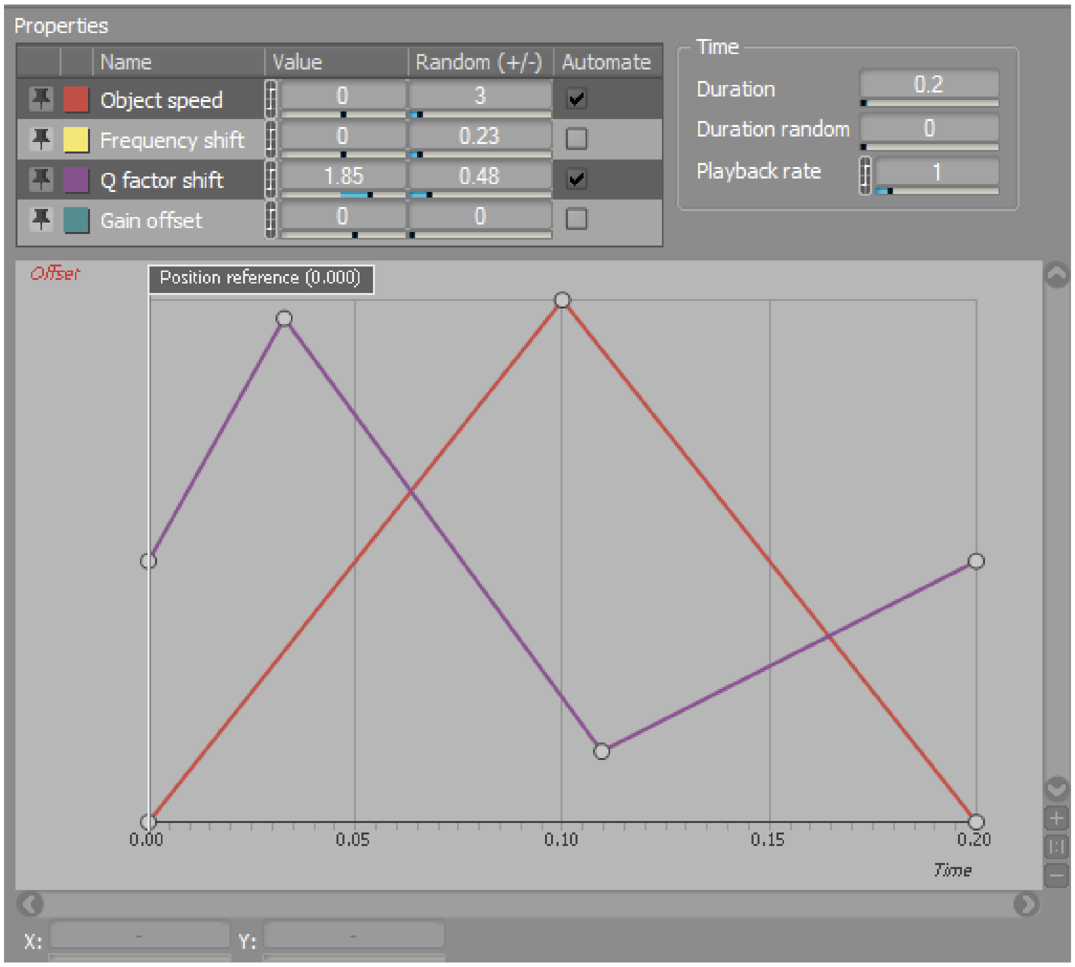


Prepared Whoosh sounds for use by weapon swings

Designer Note

Not just reserved for short duration swings, coupling a circular path with a long time duration can add additional movement sound as a special effect. Due to the generative nature, the simulation and resulting sound will be different every time. Adding a randomized multichannel Whoosh element as part of a spell casting effect could be used to further wrap the player in a swirling maelstrom of sound, without having an impact on the memory budget.

Similar to SoundSeed Wind, properties that control the object's movement can be fixed, randomized, or parametrized via RTPC. The added ability to create automated curves for properties allows you to add further movement and controlled randomness to help sculpt whoosh sounds.



Name	Value	Random (+/-)	Automate
🟥 Object speed	0	3	✓
🟨 Frequency shift	0	0.23	☐
🟪 Q factor shift	1.85	0.48	✓
🟦 Gain offset	0	0	☐

Time	
Duration	0.2
Duration random	0
Playback rate	1

Whoosh properties, automation curves, and time settings

Ignoring all of the memory saving benefits of generative sound design, there is an incredible amount of creativity encapsulated in the SoundSeed suite of plug-ins. By taking a common sound design tool and making it available as part of a game audio authoring application, generative synthesis at runtime can help bridge the gap between design and implementation. Add to this the ability to affect properties in real time using game parameters and you have a winning combination of dynamic flexibility and memory efficiency.

By establishing the weapon swing sounds within a single swing Sound SFX , the need for content variation has been removed by leveraging the features in Whoosh.

Understanding Impact

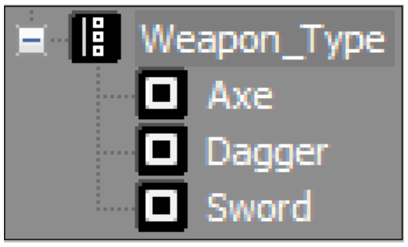
With the beginnings of a weapon swinging in place, we'll move on to the finer details involved with impact sounds and the bashing of bad guy skulls. Object impacts are often handled with either a composite sound (meant to convey the emotional intent of the impact) or by creating a multi-layered system (aimed at recreating the sound of reality). The first decision about which direction to take lies in the type of game, and what will best support the style and expectation of the player.

In a system that relies on a minimum of variation, it may be enough to simply play a group of randomized audio files for an impact - for any weapon, on any surface. Taken a step further, the weapon type could be used to determine the impact sound and play, regardless of surface type. Still further, each weapon type could have a different impact sound on each surface type in the game, making a sword impact on stone sound different than dirt or an axe impact on wood.

Regardless of whether you choose to represent object interactions abstractly or by embracing a model that skews closer to reality, the Wwise authoring application can accommodate your decision.

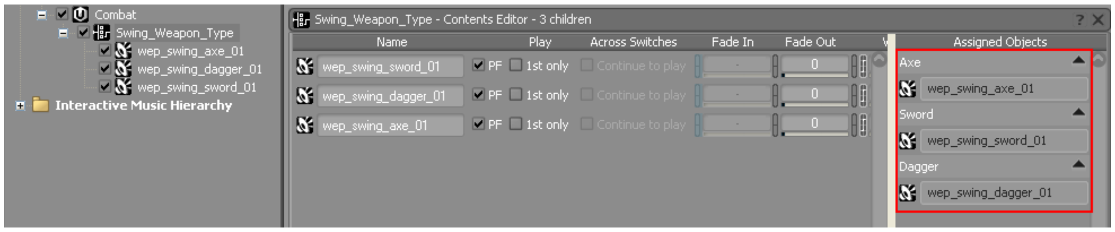
Defining Weapon Type

In the continued pursuit of randomness and variation, we are going to build a system that utilizes switches in a similar fashion to the previous footstep and movement examples. Instead of focusing on character and step type, we'll use weapon type in conjunction with an expanded list of surface types to allow for an increased level of detail.



Weapon_Type switch group and switches

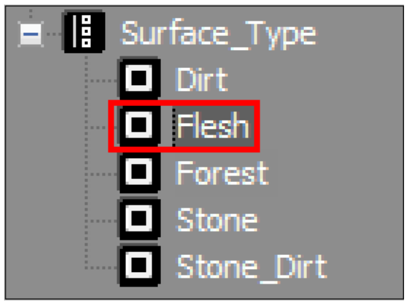
This switch group will change based on the weapon type being wielded by either the player or NPC and will be assigned a unique sound object for each type. Now that there is an established switch group for weapon type, it can be used to implement the swings created in the previous section by parenting them within a switch container, setting the switch group, and assigning the objects.



Weapon type switch group with assigned swing sounds

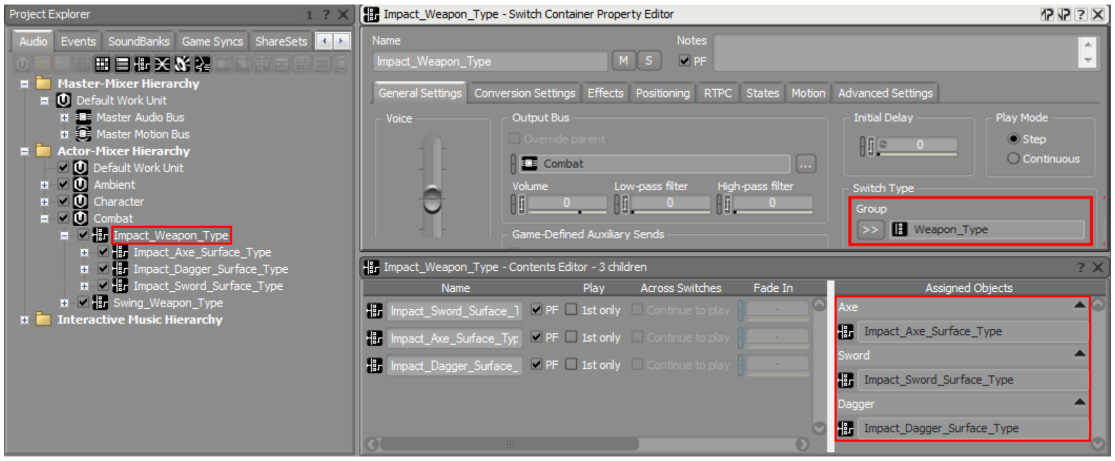
Weapon Impact System

It should be assumed that throughout countless battles our hero will inevitably taste the sting of a blade. In order to add further detail to the impact system, we'll add a switch for flesh to the surface material switch group.

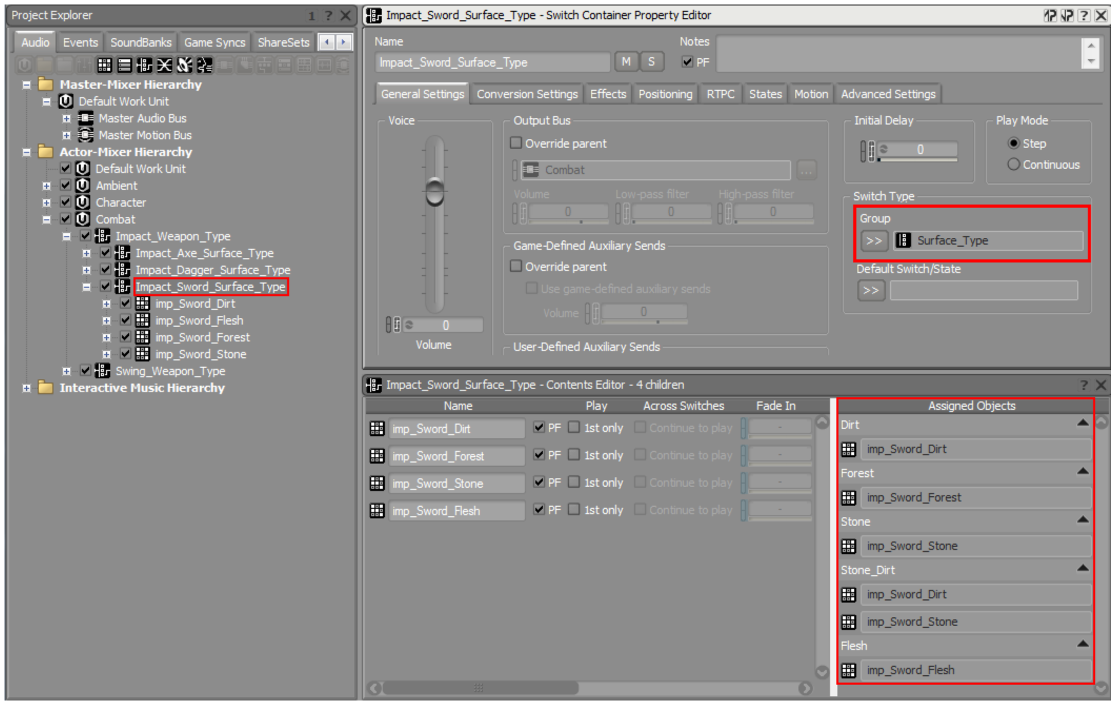


Switch for new surface type

Once switches have been defined in the game and material settings have been set, the properties of the game object being requested will drive the switches and play the appropriately assigned sound for the combination of weapon and material type.



Assigned weapon type objects



Project Explorer

Audio | Events | SoundBanks | Game Syncs | ShareSets

- Master-Mixer Hierarchy
  - Default Work Unit
    - Master Audio Bus
    - Master Motion Bus
- Actor-Mixer Hierarchy
  - Default Work Unit
  - Ambient
  - Character
  - Combat
    - Impact_Weapon_Type
      - Impact_Axe_Surface_Type
      - Impact_Dagger_Surface_Type
      - Impact_Sword_Surface_Type
        - imp_Sword_Dirt
        - imp_Sword_Flesh
        - imp_Sword_Forest
        - imp_Sword_Stone
    - Swing_Weapon_Type
- Interactive Music Hierarchy

Impact_Sword_Surface_Type - Switch Container Property Editor

Name: Impact_Sword_Surface_Type

General Settings | Conversion Settings | Effects | Positioning | RTPC | States | Motion | Advanced Settings

Voice Volume: 0

Output Bus: Override parent; Combat

Initial Delay: 0

Play Mode: Step [✓], Continuous

Switch Type: Group >> Surface_Type

Default Switch/State: >>

Game-Defined Auxiliary Sends: Override parent; Use game-defined auxiliary sends

User-Defined Auxiliary Sends

Impact_Sword_Surface_Type - Contents Editor - 4 children

Name	Play	Across Switches	Fade In
imp_Sword_Dirt	PF	1st only	Continue to play
imp_Sword_Forest	PF	1st only	Continue to play
imp_Sword_Stone	PF	1st only	Continue to play
imp_Sword_Flesh	PF	1st only	Continue to play

Assigned Objects

- Dirt
  - imp_Sword_Dirt
- Forest
  - imp_Sword_Forest
- Stone
  - imp_Sword_Stone
- Stone_Dirt
  - imp_Sword_Dirt
  - imp_Sword_Stone
- Flesh
  - imp_Sword_Flesh

Assigned surface type objects

With the escalating number of surface materials in today's games, you could continue adding detail to the sound for as long as the memory budget allows. By utilizing the previously mentioned technique [Character 2.2] for sharing different surface material content between switches, you can help extend the content while increasing detail. With thoughtful sound design and well designed systems, you can overcome many limitations through the creative use of implementation.

Attenuations for Player vs. NPC

Now that we have a fully switching impact system that can be used for any defined weapon in the game, it's important to begin establishing and subscribing attenuations to ensure that the sound appropriately falls-off over distance. While we've already discussed simple attenuations in the Ambient chapter, they'll be put to further use in helping to define the attenuations of combat sounds.

High Alert

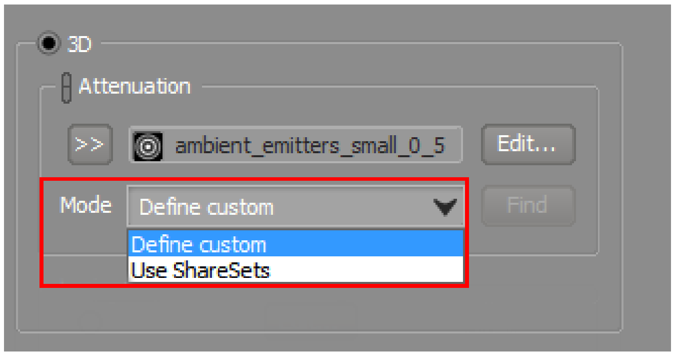
Before the battle has even begun, there is an opportunity to alert the player of an enemy's presence by allowing their idle sound and footsteps to be heard outside of the range where they would attack. Using sound to inform the player of approaching danger can help heighten awareness and prepare for the pending struggle. It starts with knowing at what distance an enemy will attack, and continues with an attenuation that allows the player to hear movement before combat begins. Let's assume that an enemy will engage the player within 15 game units. By extending the movement sounds' max distance for the attenuation to 20 game units, we can make sure the player has time to equip appropriately for the oncoming altercation.

Listener Considerations

In most cases the listener is positioned at either the player or camera, or at some (possibly parametrized) interpolation between the two. The sound changes based on the proximity of the listener to the NPC, and the attenuation provides the falloff properties. This scenario is widely used in 3D games and well understood in game audio. However, choosing where to implement the listener in the game may require special considerations for player sounds.

While some situations may benefit from being played back in 2D on the player (such as surround magic effects), there are potential pitfalls that could cause undesirable results, specifically, in the common scenario where the camera moves through the world to highlight action taking place elsewhere in the environment. If a sound playing from the position of the player is set to 2D when this happens, the sound will persist even though the player is no longer part of the visual scene. In this way it’s usually safest to continue treating the player attenuations in the same way we’ve begun with NPCs, as 3D sounds.

While you may start out sharing several of the same attenuations, a unique attenuation ShareSet can always be applied at any level of the hierarchy. Additionally, you can create a custom attenuation that will apply only to a single object. Changing the mode of a sound objects attenuation from Use ShareSets to Define Custom applies a unique instance of the attenuation that is not shared (or sharable) with any other sound object.



Taking an attenuation ShareSet and defining custom properties for a sound object

While defining custom attenuations can be a good solution as an exception to the rule, there is more power and transparency to creating ShareSets which are all managed in one place.

Once you're gotten the feel for the way sound propagates in the game, you'll find yourself instinctively using attenuation ShareSets you've created for new sounds. By establishing well defined and flexible attenuations, a distance falloff model can be created that suits the game.

Combat Summary

In the Combat chapter we’ve been working on establishing swings and impact based on weapon type. Along the way we looked into the functionality of SoundSeed Whoosh to replace the traditional audio file variation model with a powerful synthesis toolset. We also continued investigating the use of attenuations in conjunction with listener positioning and how they can work together to positively affect gameplay and help define propagation models.

Throughout this chapter we have:

- Discussed the aesthetic choices involved in designing the sound of different weapon types and implementations.
- Discussed the use of generative weapon swings using SoundSeed Whoosh to replace content based variations.
- Exposed different implementation techniques for impact sounds.

Stepped through the process of:

- Creating swing sounds for different weapon types using SoundSeed Whoosh.
- Creating a switching system for weapon swings based on weapon type.
- Creating a switching system for weapon impacts based on weapon and surface type.

We've also touched on:

- Scaling complexities of material based impact detection.
- Using different attenuations for the player vs. NPC.
- Considerations when choosing the position for the listener.

Throughout this section we have created the following objects:

- Swing Sound SFX objects for sword, axe, and dagger authored with SoundSeed Whoosh.
- A weapon swing switch system based on weapon type.
- A weapon impact switch system used to determine impacts based on weapon and surface type.

Combat Additional Resources

Video Tutorial - SoundSeed Introduction

Video Tutorial - SoundSeed Air Whoosh Overview

Chapter 4. Making Magic

Overview

Whether casting spells to fend off a grue attack, getting blasted by dark wizards, or summoning succubus from the nether realms, the rules of magic have been handed down from generation to generation by sorcerers older than time itself. You can experiment with sound in the Wwise authoring application to deploy your sonic alchemy and unleash a powerful torrent of audio mayhem.

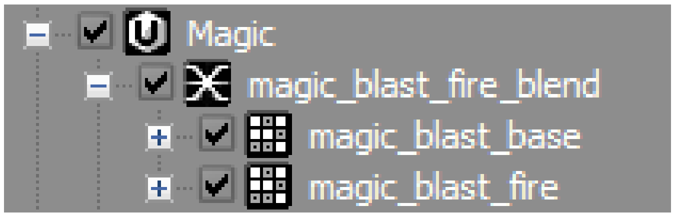
This chapter will take you through the process of:

- Summing and Layering with the Blend Container.
- Using effects.
- Using Real-time Parameter Control (RTPC).
- Leveraging blend tracks as part of a distance based perspective model.
- Using Modulator Envelopes and LFOs to diversify properties of a sound.
- Creating a synthetic element using Wwise Synth One.

The approach for creating unique magic effects begins with inspiration. From there, audio files and synthesis define the sound palette for the eventual effect. You can seriously up the creativity quotient in your effects by taking individual sound element variations, or layers of sound, and recombining them using blend containers. Then draw on parameters from the game to add dynamic variability.

Summing and Layering with Blend Containers

As discussed in the Ambient chapter, a blend container simultaneously plays the sum of its contents. By taking individual sound element variations, or layers of sound design, and recombining them using the blend container, startling new effects and composites can be achieved that help extend the content. This is especially true when coupled with randomized properties or additional effects available at any level of the Actor-Mixer Hierarchy.



The Magic blend container is comprised of multiple random containers

Creating Distance-Based Blend Tracks

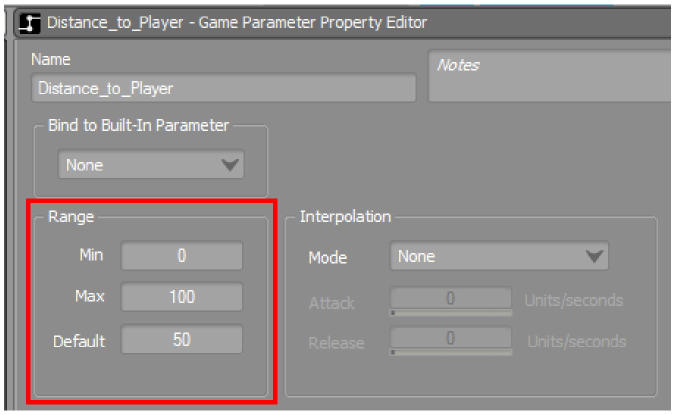
Another way to use blend tracks is to create a complex distance-based blend to diversify perspectives or, simply put, to change the sound content based on distance. This technique can be quite effective when implementing ranged weapons, moving objects, or in this case, magic effects.

We'll be creating a blend container that changes the sound of magic impact blasts near the player, and from a far off distance perspective. When the magic blast event is triggered, the perspective (or combination of perspectives) is played based on the blast game object's distance to the player. So, the content will have more high frequency detail and sense of danger at a close distance from the player and a slightly low pass filtered and reverberant sound when far away.

Magic effects are often associated with particle or visual effects within a game environment. While many particle effects are comprised of different techniques that contribute to the resulting visual effect, there is usually a point of origin, referred to as the game object that travels as the center of the effect in 3D space and can be used to attach sounds. Using the distance to player as part of a dynamic effect can help give a sense of movement to the sound and increase the dramatic effect by lending a positionally significant modifier.

Setting up a Game Parameter

We can get information about the game object's proximity to the player from the game engine and use it through a new game parameter called Distance_to_Player throughout the project.


Distance_to_Player - Game Parameter Property Editor

Name: Distance_to_Player

Notes

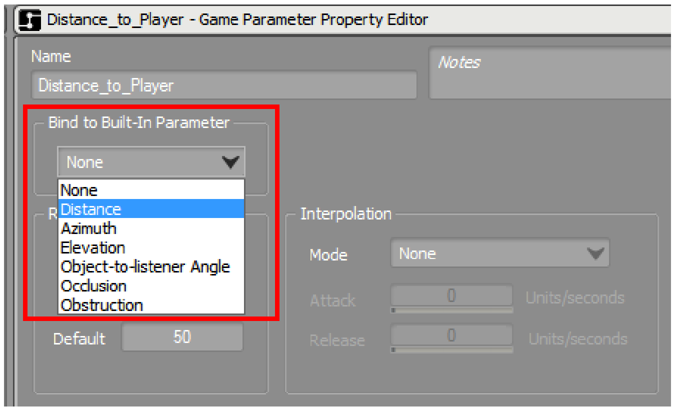
Bind to Built-In Parameter: None

Range
Min: 0
Max: 100
Default: 50

Interpolation
Mode: None
Attack: 0 Units/seconds
Release: 0 Units/seconds

Setting up the Distance_to_Player game parameter

It's easy to get distance info and other values directly from the Wwise audio engine. You can subscribe to a built-in value for the distance between the listener and the game object from a list of built-in values calculated inside of the audio engine using the "Bind to Built-In-Parameter" drop-down menu.



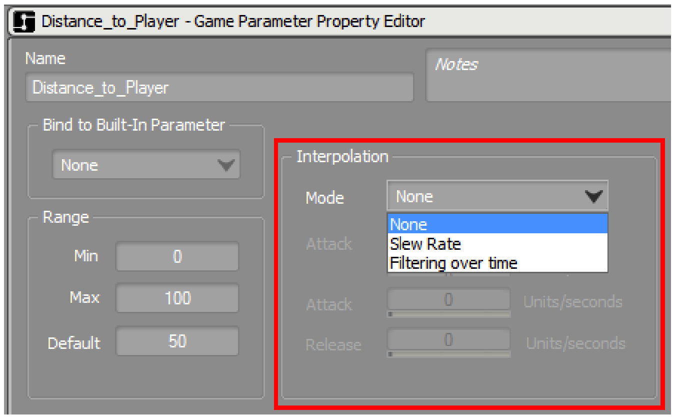
Binding the Built-In Distance value to the Distance_to_Player Game Parameter

The following built-in parameters are calculated by the audio engine and are available to be bound to game parameters:

- Distance - Distance to game object.
- Azimuth - Horizontal angle.
- Elevation - Vertical angle.
- Object-to-listener Angle - Angle between object's orientation and the listener.
- Occlusion - As set by the game on the game object.
- Obstruction - As set by the game on the game object.

Interpolation can be used to apply a kind of "smoothing" to the values sent by the audio engine. The modes (other than None) let you modify the rate (in Units) or time (in seconds) when target values go upward (Attack) or downward (Release). Adding an Interpolation Mode helps keep values from the game engine from "jumping" or "stepping" too quickly which may cause, for example, a voice volume to abruptly increase in volume. The Interpolation properties allow for controlled transitions between Game Parameter values sent from the game or from within the Wwise audio engine.

In this example, the behavior of the Distance_to_Player game parameter is modified using the Interpolation properties available in the Game Parameter Property Editor.


Distance_to_Player - Game Parameter Property Editor

Name: Distance_to_Player

Notes

Bind to Built-In Parameter: None

Range

Min: 0

Max: 100

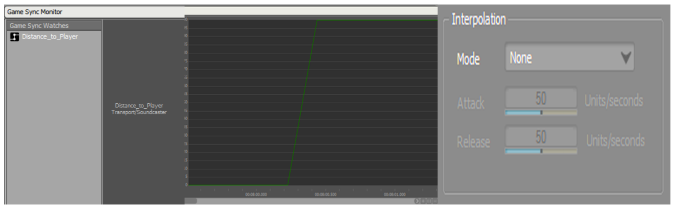
Default: 50

Interpolation

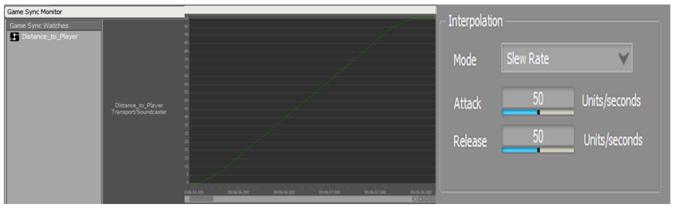
Mode: None

Setting the Game Parameter Interpolation Mode

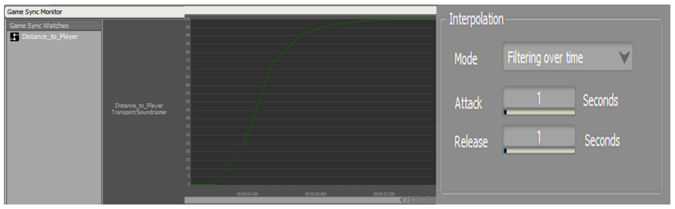
Interpolation Modes can be set using the Mode drop-down list and include:



- **Interpolation Mode - None:** Jump straight to the target value.



- **Interpolation Mode - Slew Rate:** Limit the game parameter variation rate to the specified Attack and Release rate. (Units)



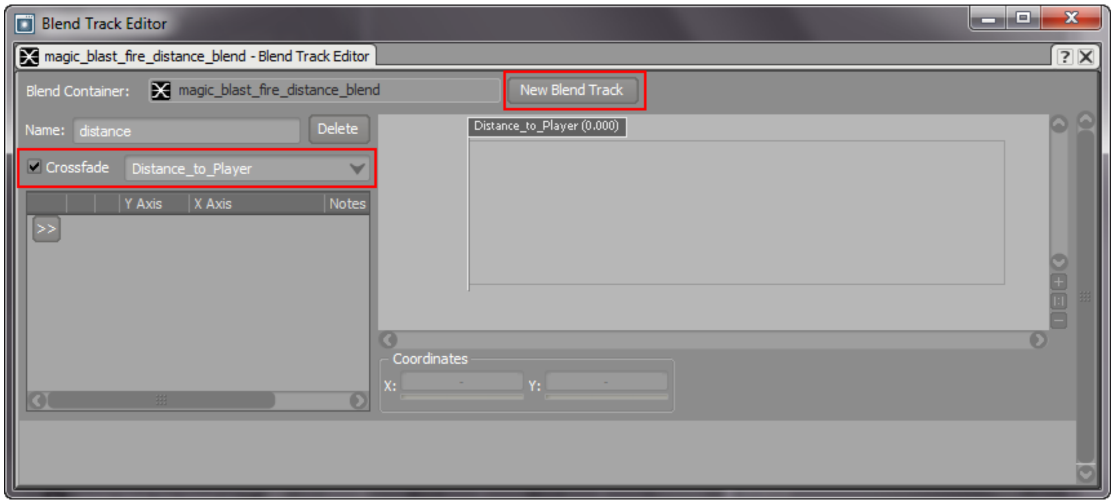
- **Interpolation Mode - Filtering Over time:** Filter the game parameter current value to target 99.5% of the target value within the specific Attack/Release time. (Seconds)

The Interpolation Mode for the Distance_to_Player Game Parameter will be set to "Slew Rate" with a Attack (in Units) of 50 and Release (in Units) of 50 to produce the desired effect.

Crossfading Between Containers on a Blend Track

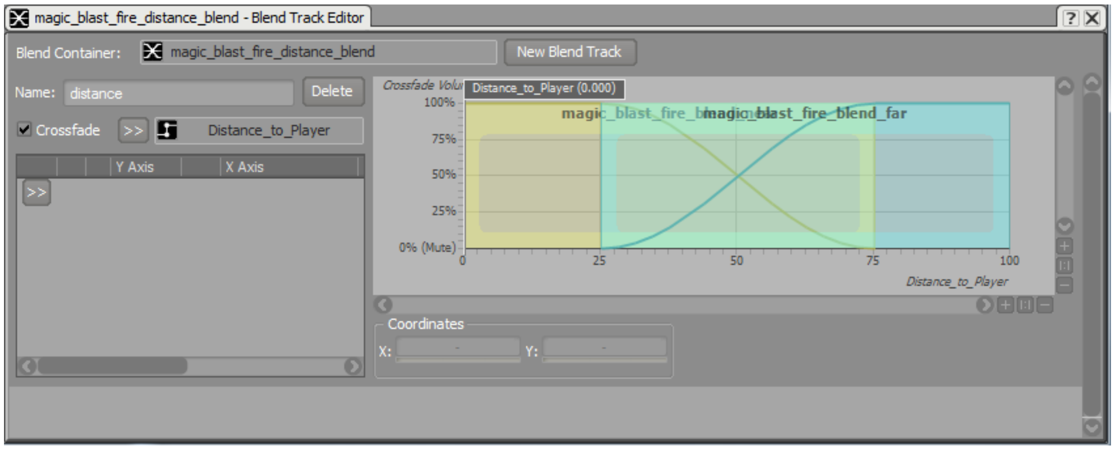
Now that there is a way to track how far an object is from the player, we can use this information to drive the Crossfade between various containers on a blend track inside of a blend container we have named magic_blast_fire_distance_blend.

As we did for the blend containers created for the ambient system, a new blend track will be created with a Crossfade enabled based on the new game parameter for Distance_to_Player.


Blend Track Editor
magic_blast_fire_distance_blend - Blend Track Editor
Blend Container: magic_blast_fire_distance_blend
New Blend Track
Name: distance
Delete
Crossfade Distance_to_Player
Y Axis
X Axis
Notes
Distance_to_Player (0.000)
Coordinates
X:
Y:

Creating a new blend track with Crossfade enabled based on the Distance_to_Player game parameter

Randomized containers can then be added to the assigned objects area in the distance blend track. As previously mentioned, the order of these containers in the assigned objects section is reflected in their positioning on the blend track.


magic_blast_fire_distance_blend - Blend Track Editor
Blend Container: magic_blast_fire_distance_blend
New Blend Track
Name: distance
Delete
Crossfade Distance_to_Player
Y Axis
X Axis
Crossfade Volu
Distance_to_Player (0.000)
magic_blast_fire_b
magic_blast_fire_blend_far
100%
75%
50%
25%
0% (Mute)
0
25
50
75
100
Distance_to_Player
Coordinates
X:
Y:

Adding containers to the blend track in the correct order

After the information is passed successfully from the game, the Distance_to_Player game parameter controls the Crossfade between containers, playing only the container (or containers) beneath the game parameter cursor.

- When the game object plays the magic blast event within 0-25 units from the player, the magic_blast_fire_blend_near is heard alone.
- When the game object plays the magic blast event within 25-75 units from the player, a blend of both perspectives is heard.
- When the game object plays the magic blast event within 75-100 units from the player the magic_blast_fire_blend_far is heard alone.

Designer Note

While similar distance-based blending can be done using multiple attenuations, there are workflow benefits to managing these within blend tracks.

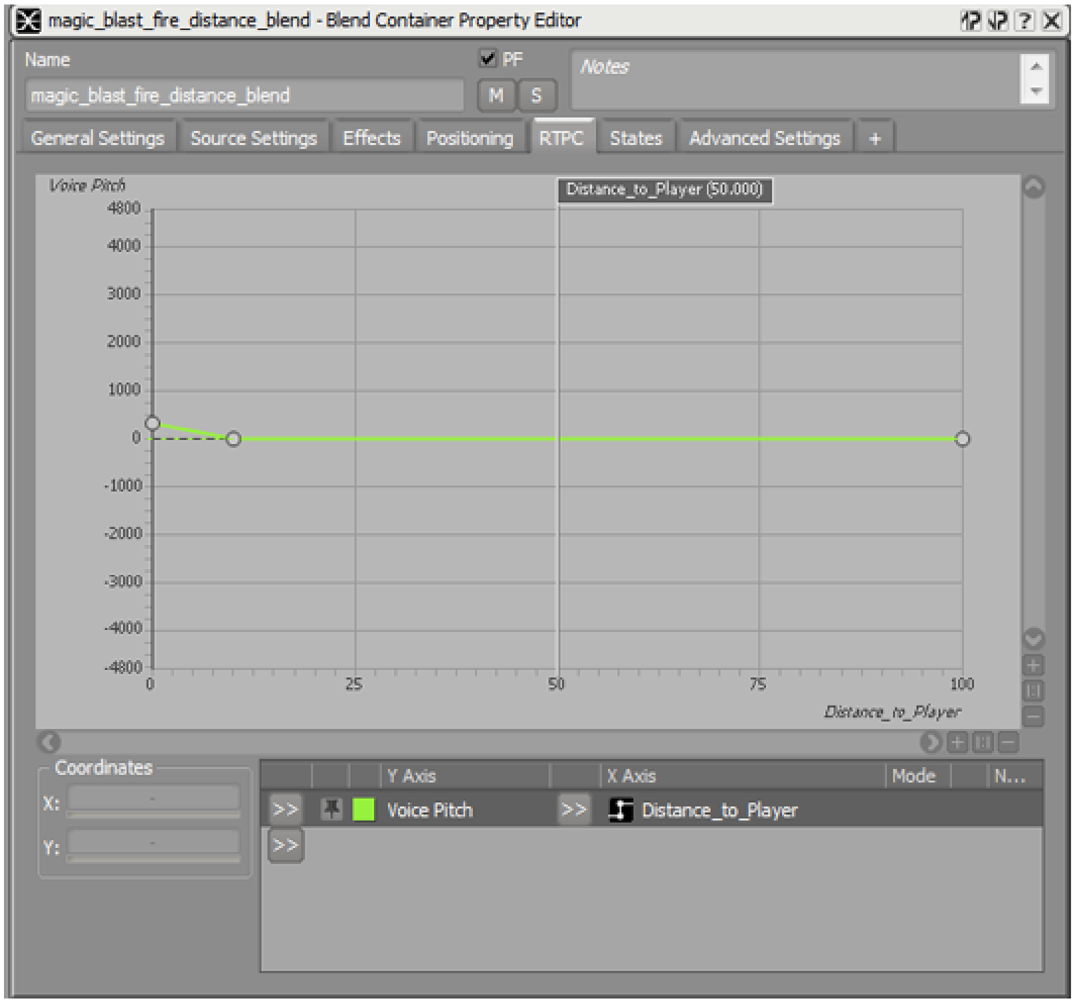
Section Summary

We have successfully implemented magic blasts that change between audio content dependent on the location and distance of the game object from the player. This technique is best used when there is a need to represent different perspectives or levels of detail at the content level. While simple filtering can also be applied to help change the tone of the resulting sound, you can add richer levels of detail by designing the content appropriately.

Real-Time Parameter Control (RTPC)

To push magic effects further into dynamic territory, you can employ Real Time Parameter Control (RTPC) for any sound object in the Actor-Mixer hierarchy or any audio bus in the Master-Mixer hierarchy. RTPC can be accessed in the Property Editor for any sound object, and new modifiers can be added using the Selector button.

Using the magic_blast_fire_distance_blend, a pitch curve can be added using the Distance_to_Player game parameter as part of the object's RTPC. The distance curve value can be used to dynamically affect the sound of the magic blast by modifying pitch based on the magic blast's proximity to the listener. Similar results can be obtained using RTPC within the blend track.



RTPC using the Distance_to_Player game parameter to control the amount of pitch

RTPC further modifies properties of a sound object by opening dynamic possibilities for making your content change based on information from the game. In this example, we have taken and modified the magic blast, pitching it up as it approaches the player. This gives the approach of the magic blast an immediacy that is reflected by its pitch.

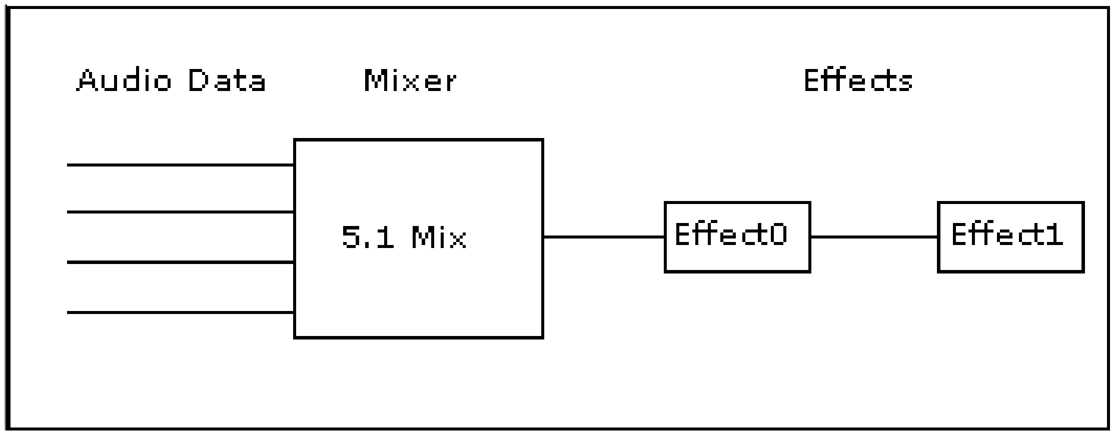
Using Real-Time Effects

In addition to the unique features within the blend container, Wwise ships with a suite of DSP Effects that can be used to modify content after it's been imported, enabling additional sound design possibilities from within the authoring application.

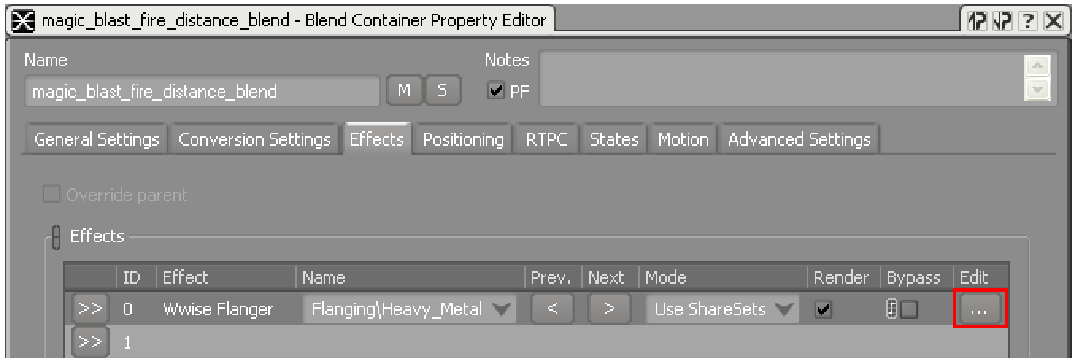
Available in the Property Editor of every audio object, and additionally within the Master-Mixer hierarchy, these effects can be added to modify sounds using fixed settings or dynamically at runtime using game parameters.

Designer Note

When effects are applied to a bus, all incoming audio data is sub-mixed before the effect is applied. If a chain of effects is applied, the effects are applied in the order in which they appear in the list.



RTPC for effects can be found in the Effect Editor after clicking the Edit button for an enabled effect.

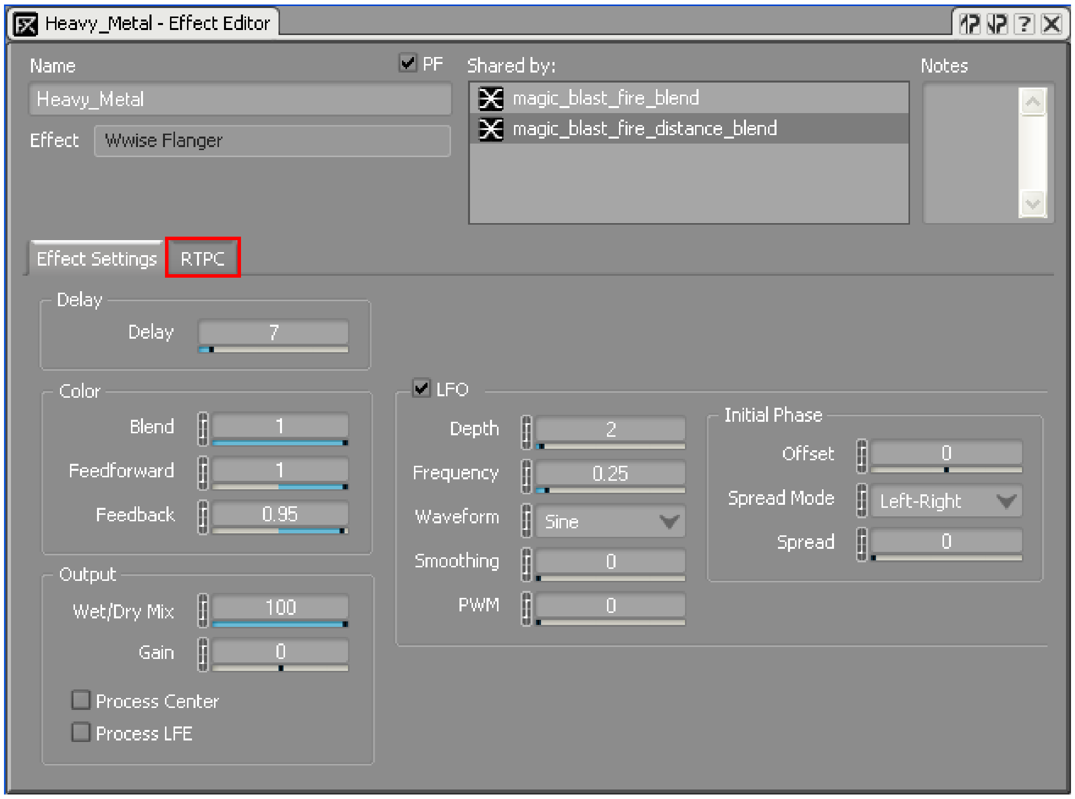


Name: magic_blast_fire_distance_blend
Notes: ✓ PF

ID	Effect	Name	Prev.	Next	Mode	Render	Bypass	Edit
0	Wwise Flanger	Flanging\Heavy_Metal	<	>	Use ShareSets	✓		...
1								

The Edit button is used to access the effect editor

The Effects Editor displays all of the settings of an enabled effect, including access to any properties that can use RTPC.



Name: Heavy_Metal
PF ✓
Effect: Wwise Flanger
Shared by: magic_blast_fire_blend; magic_blast_fire_distance_blend
Notes

Delay
Delay: 7

Color
Blend: 1
Feedforward: 1
Feedback: 0.95

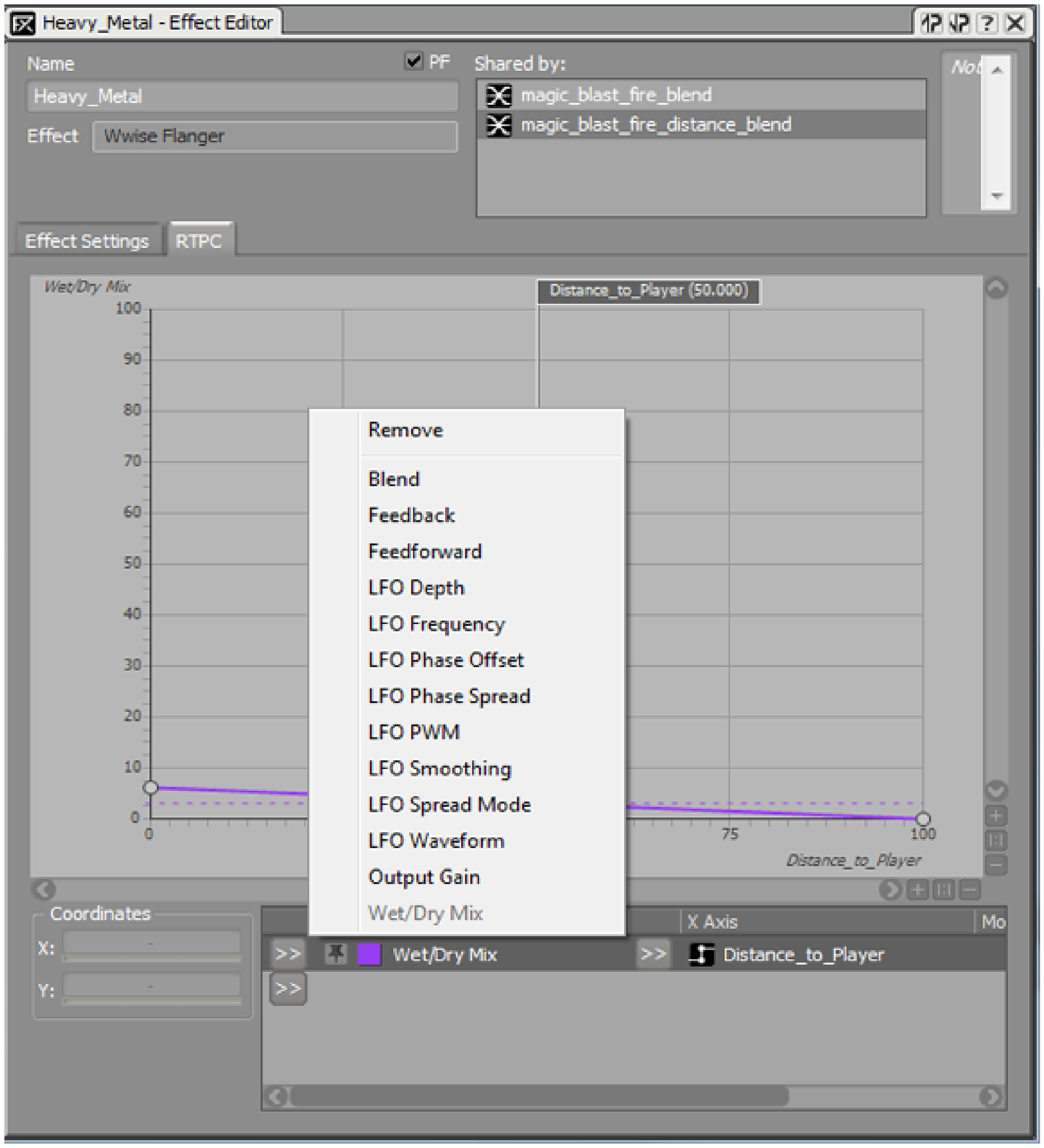
Output
Wet/Dry Mix: 100
Gain: 0
☐ Process Center
☐ Process LFE

✓ LFO
Depth: 2
Frequency: 0.25
Waveform: Sine
Smoothing: 0
PWM: 0

Initial Phase
Offset: 0
Spread Mode: Left-Right
Spread: 0

The effects settings panel and access to the RTPC tab

From the RTPC tab, you can create relationships between effects settings and game parameters to produce unique effects driven by information coming from the game.



RTPC settings added to the Distance_to_Player game parameter

Using game parameters in conjunction with DSP effect settings opens up a whole new world of dynamic content manipulation. You can use the game parameters in conjunction with effects in the following ways:

- Add a slight flange to a rushing river sound to make it sound eerie, only from a distance.
- Add stereo delay to all vocalizations when the player is about to die in combat, based on health.
- Add tremolo to an air conditioner fan loop that changes,based on the rotation speed of the fan.

Whether you're designing iconic spellcasting sounds that need to be instantly recognizable or gaining diversity through recombination, the power of real-time parameter control and dynamic DSP effects can create special effects that are only possible within the environment of an interactive game world.

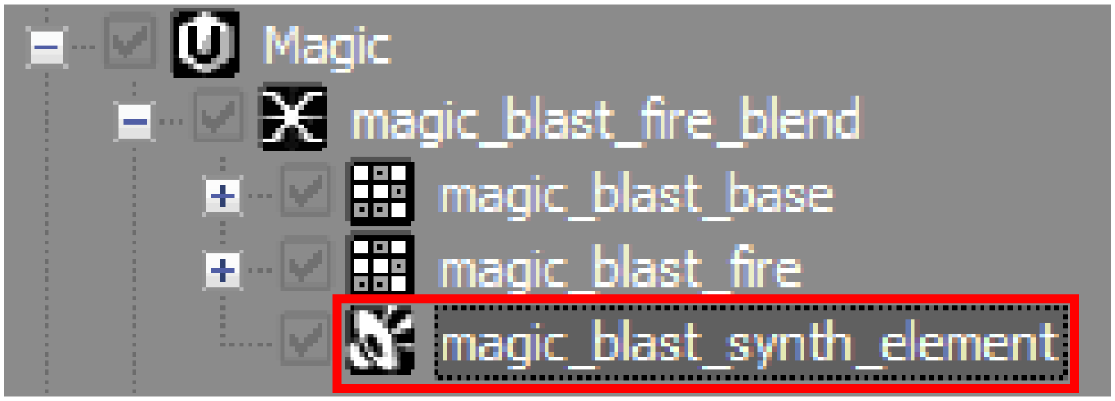
Unleashing Dynamic Synthesis

Another way to replace, augment, or supplement audio files is with the Wwise Synth One plug-in. Synthesis provides a flexible and dynamic audio platform that doesn't depend on system memory (RAM); it uses CPU to generate sounds at runtime instead. Chances are good that you're already using synthesis as part of your sound design process within a DAW. With the power of Wwise Synth One, synthesis can become a part of your pipeline within the Wwise authoring environment.

Game Parameters, MIDI Messages, Modulator LFO, and Modulator Envelope can be added as part of any Sound Object, Audio Bus, or Aux Bus RTPC and then used to modify properties of Wwise Synth One, SoundSeed Whoosh, SoundSeed Air, or any DSP plug-in. Being able to manipulate sound using synthesis at runtime gives you greater flexibility to modify properties using parameters from the game or from within the Wwise authoring environment.

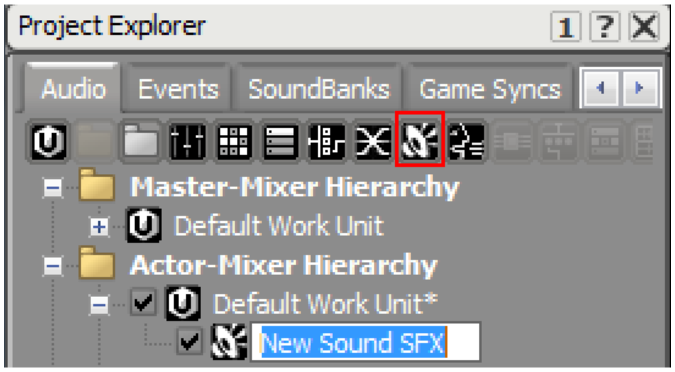
Wwise Synth One

We'll begin by creating a magic_blast_synth_element that contains the Wwise Synth One plug-in as part of the magic_blast_fire_blend created in Section 3.



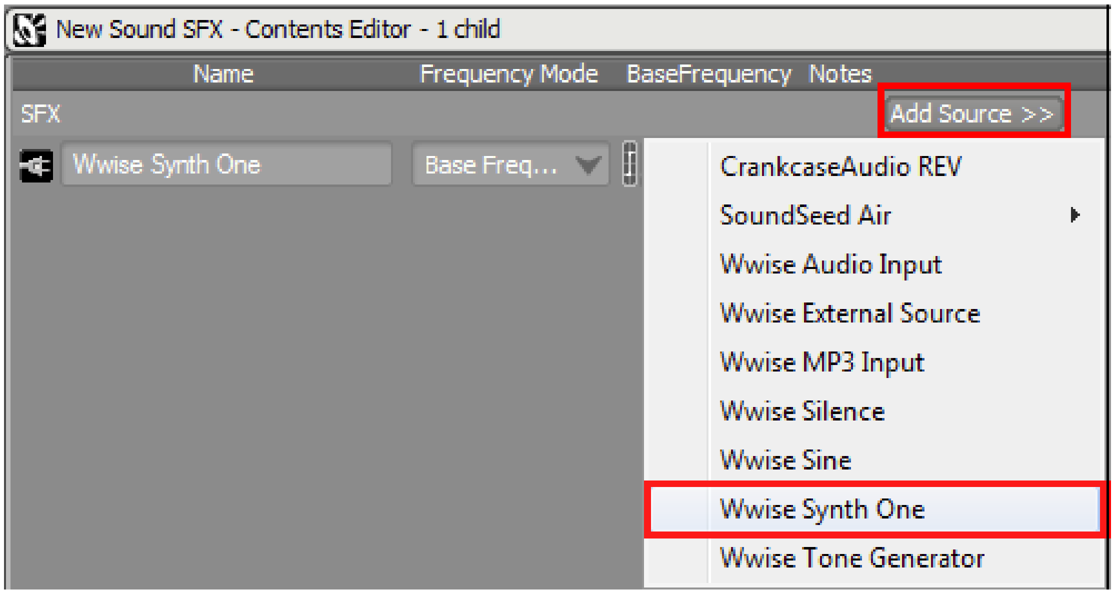
Sound SFX containing the Wwise Synth One plug-in inside the magic_blast_fire_blend

The Wwise Synth One plug-in can be added as an input source to a Sound SFX (or Sound Voice) in the same way that the Silence plug-in was added in Chapter 1. To begin, add a Sound SFX object to the default work unit by clicking the Sound SFX icon in the Project Explorer toolbar. A new Sound SFX is created. Alternately, Sound SFX can be created from the contextual menu or by using shortcut keys.



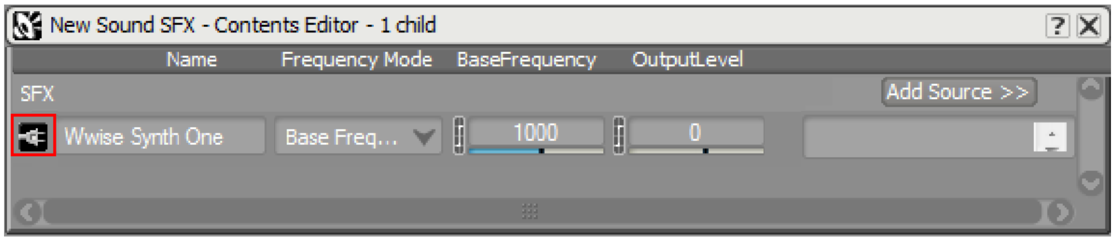
Creating a Sound SFX from the Project Explorer toolbar

After double-clicking to select the new Sound SFX, you can add the Wwise Synth One plug-in using the Add Source menu in the Contents Editor.

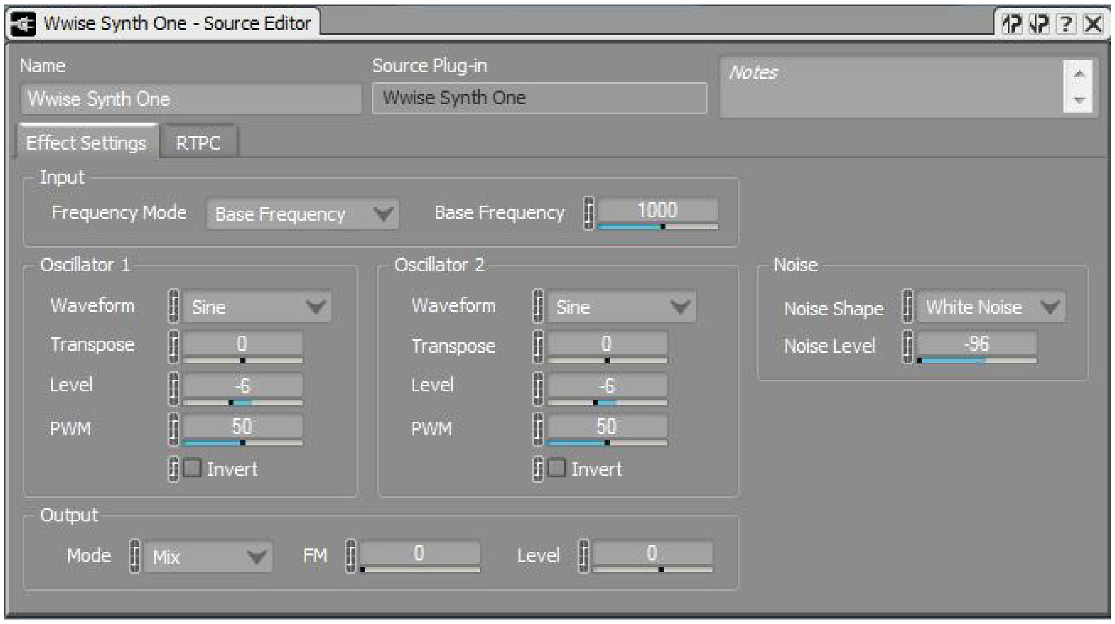


Creating a Wwise Synth One source plug-in for a sound object

The Source Editor can be accessed in the Contents Editor by double-clicking the plug-in icon.



Wwise Synth One plug-in icon



Wwise Synth One - Source Editor

Name: Wwise Synth One
Source Plug-in: Wwise Synth One
Notes

Effect Settings | RTPC

Input
Frequency Mode: Base Frequency
Base Frequency: 1000

Oscillator 1		Oscillator 2		Noise	
Waveform	Sine	Waveform	Sine	Noise Shape	White Noise
Transpose	0	Transpose	0	Noise Level	-96
Level	-6	Level	-6		
PWM	50	PWM	50		
Invert	☐	Invert	☐		

Output
Mode: Mix
FM: 0
Level: 0

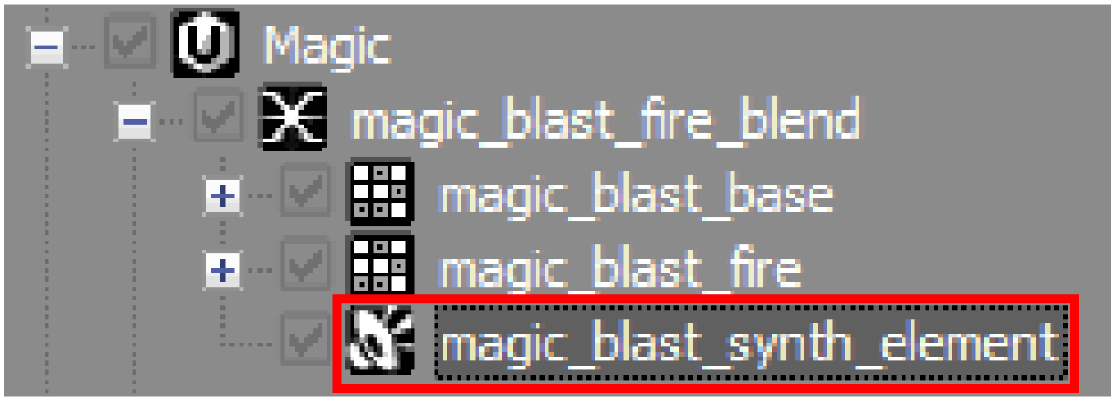
Wwise Synth One - Source Editor

Designer Note

Features of the Wwise Synth One plug-in are described in Chapter 8 - MIDI & Synthesis

We'll begin by creating an additional synthetic element for the magic_blast_fire_blend Blend Container that will play in addition to the audio files already established earlier in this chapter. This element adds to the synthetic characteristics of the sound and is modified using a Modulator Envelope on the Output Level property of the Wwise Synth One plug-in. Additionally, Modulator LFOs and the Distance_to_Player Game Parameter will be used to modify various properties of the Wwise Synth One plug-in in conjunction with a Modulator Envelope.

Now add the magic_blast_synth_element that contains the Wwise Synth One plug-in inside the magic_blast_fire_blend created in Section 3.

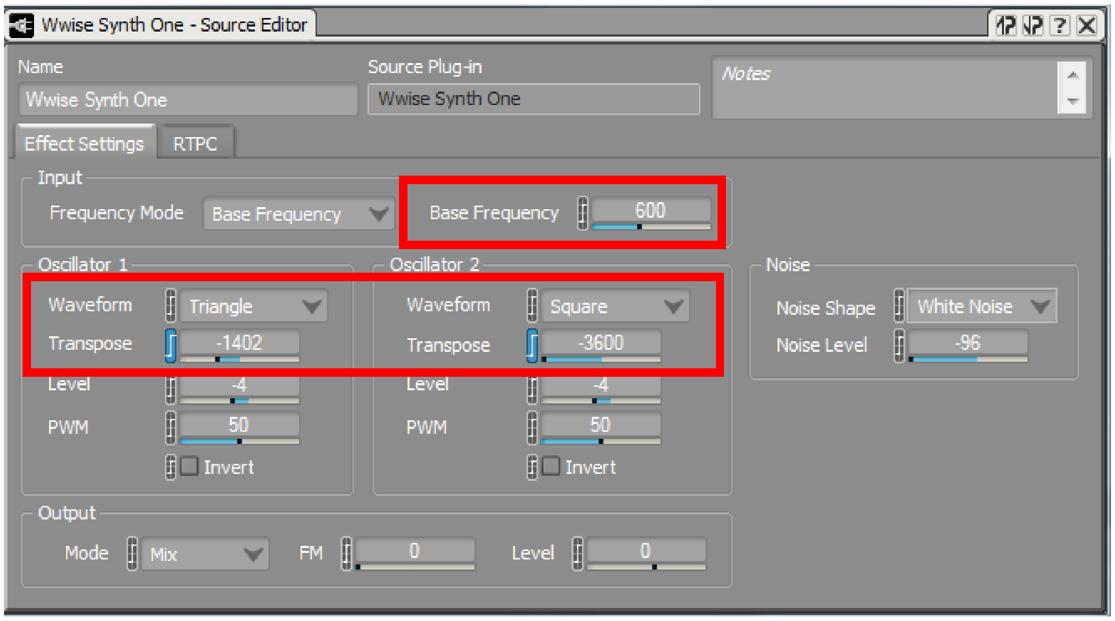


Sound SFX containing the Wwise Synth One plug-in inside the magic_blast_fire_blend

The magic_blast_synth_element will start out with a low base frequency and a combination of Triangle and Square waveforms. Each Oscillator is then further transposed and modified using the Distance_to_Player Game Parameter to increase the transposition as the magical blast gets closer to the player.

Designer Note

You can find more information on Game Parameters in Chapter 1: Setting the Ambient Stage - Introduction of a Day and Night Cycle Establishing a Game Parameter.



Name: Wwise Synth One
Source Plug-in: Wwise Synth One
Frequency Mode: Base Frequency
Base Frequency: 600

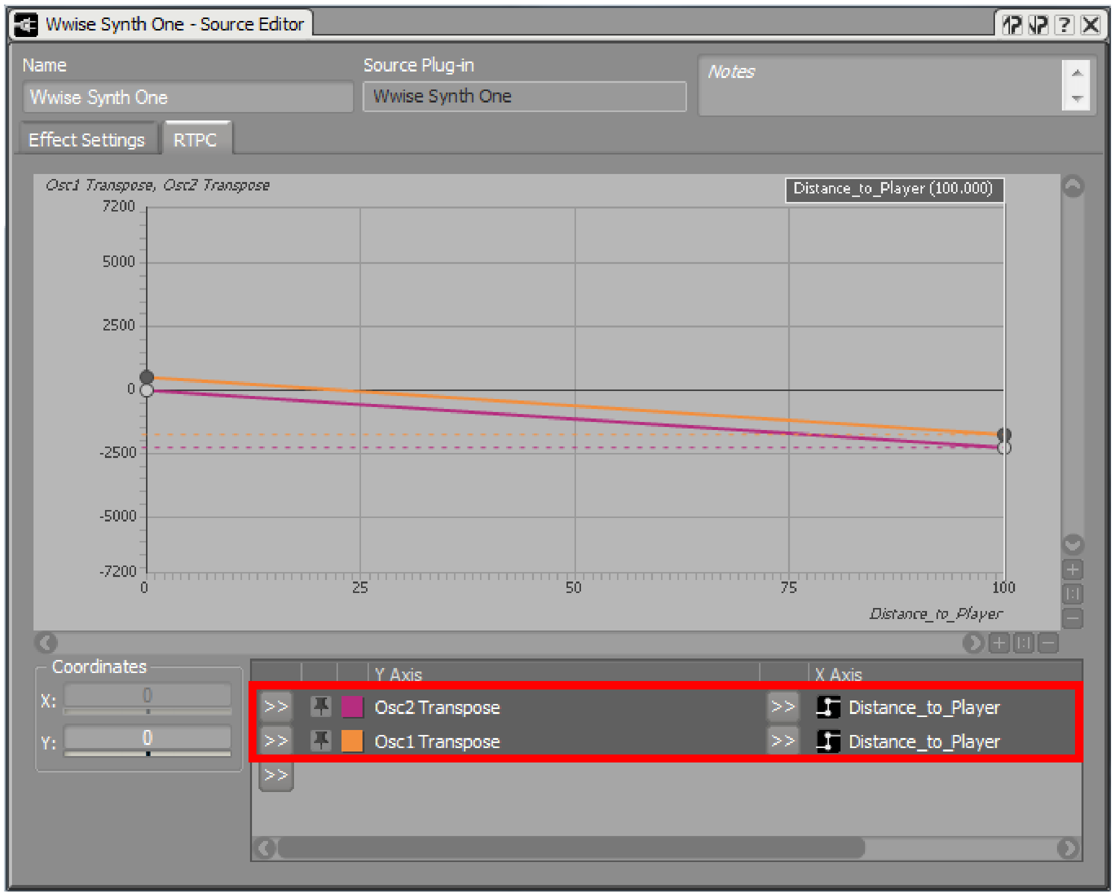
Oscillator 1
Waveform: Triangle
Transpose: -1402
Level: -4
PWM: 50
Invert

Oscillator 2
Waveform: Square
Transpose: -3600
Level: -4
PWM: 50
Invert

Noise Shape: White Noise
Noise Level: -96

Mode: Mix
FM: 0
Level: 0

Wwise Synth One Base Frequency and Waveform properties



Wwise Synth One Oscillator 1 & Oscillator 2 Transpose property RTPC

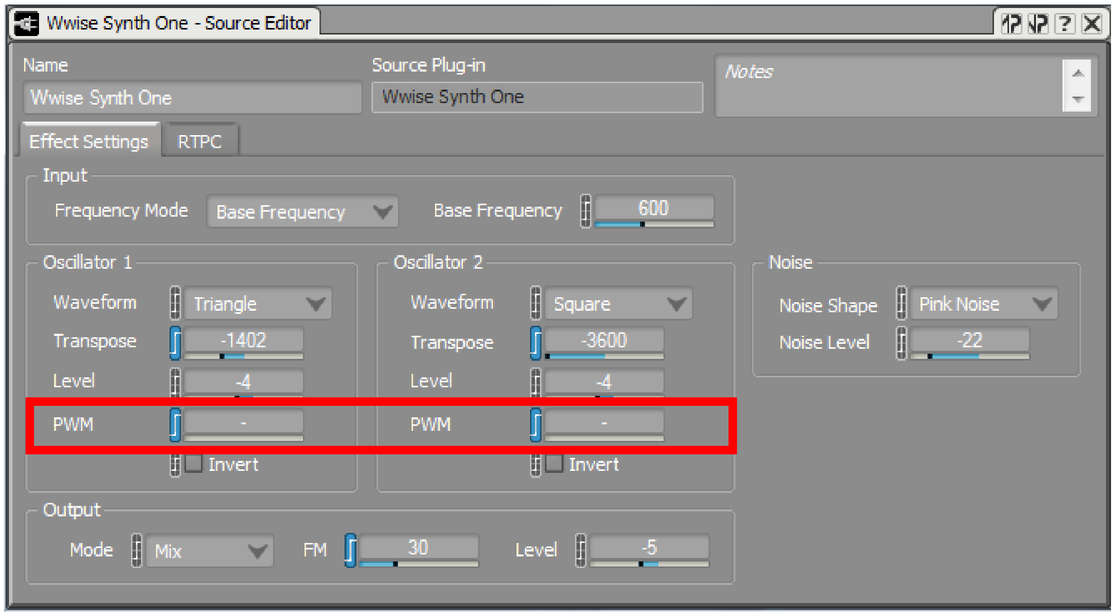
Modulators

Parameterizing properties throughout a Wwise project can become a powerful tool for dynamic creation. Imagine modifying the pitch of the amb_tree_rustle ambient emitter loop by randomizing the properties of a Low Frequency Oscillator (LFO) or varying the length of an audio file by applying an Envelope with a randomized decay time to the voice volume. In addition to Game Parameters, there are a suite of Modulators that can be used to modify an object's properties. These include: LFOs, Envelopes, and MIDI Messages.

Modulator LFO

The Modulator LFOs (Low Frequency Oscillator) can be used to create a modulation of property values over time. When added to an RTPC, a Modulator LFO modifies the values of a property between a range of values. Additionally, the values of the LFO properties can be further parameterized or randomized to achieve a high-level of variability.

To diversify the synth for the purpose of the magic_blast_fire_blend element, a Modulator LFO added as an RTPC to each Oscillators PWM (Pulse Wave Modulation) property gives the sound extra "movement" and vibration.


Wwise Synth One - Source Editor

Name: Wwise Synth One
Source Plug-in: Wwise Synth One
Notes

Effect Settings | RTPC

Input
Frequency Mode: Base Frequency
Base Frequency: 600

Oscillator 1
Waveform: Triangle
Transpose: -1402
Level: -4
PWM: -
Invert

Oscillator 2
Waveform: Square
Transpose: -3600
Level: -4
PWM: -
Invert

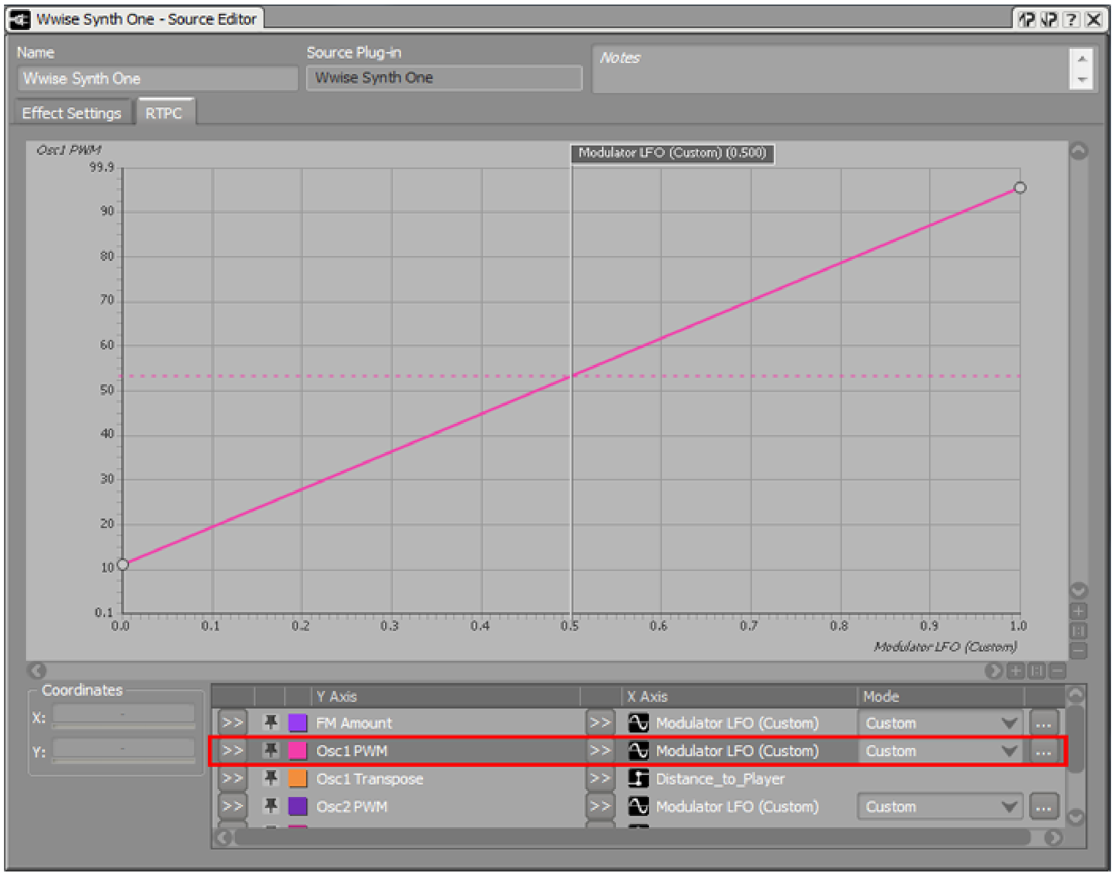
Noise
Noise Shape: Pink Noise
Noise Level: -22

Output
Mode: Mix
FM: 30
Level: -5

Wwise Synth One PWM (Pulse Wave Modulation) properties attached to LFO (settings can be edited in the RTPC tab)

Designer Note

In Wwise, some properties are additive (Voice Volume, Voice Pitch, and so on...), and some are exclusive. When adding an LFO on the additive properties, the LFO modulation is added to the current value of the property. When adding an LFO on the exclusive properties, the LFO modulation replaces the current value of the property. Properties modified by an LFO are represented by a dashed line ("-") in the Property field.



Name: Wwise Synth One

Source Plug-in: Wwise Synth One

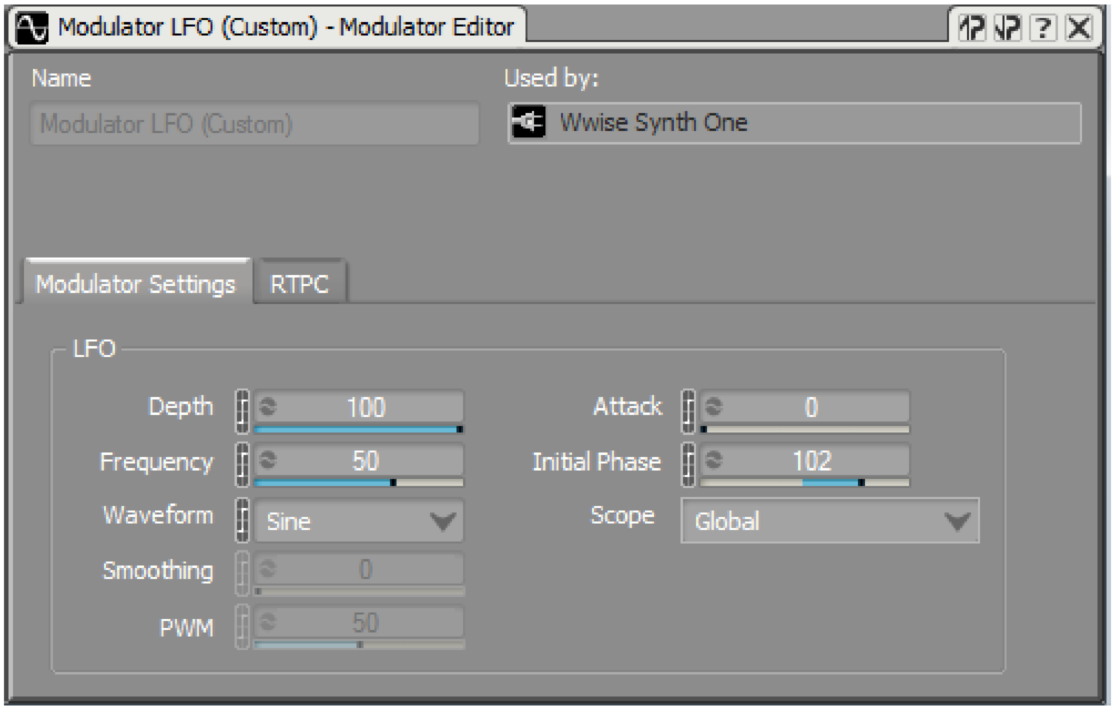
Y Axis	X Axis	Mode
FM Amount	Modulator LFO (Custom)	Custom
Osc1 PWM	Modulator LFO (Custom)	Custom
Osc1 Transpose	Distance_to_Player	
Osc2 PWM	Modulator LFO (Custom)	Custom

Wwise Synth One Oscillator 1 showing the effective range of the PWM property modulated by the LFO.

LFOs (Low Frequency Oscillator) are used to create modulation of property values over time. The minimum and maximum RTPC values of the LFO Envelope in the Sound Property Editor affect the base and top of the LFO (nil and peak values). Swapping the min and max values effectively phase reverse the LFO.

The Modulator Editor can be access by double-clicking the Modulator LFO in the RTPC dialog or by clicking the [...] button.

Accessing the Modulator Editor by double-clicking the Modulator LFO in the RTPC dialog or by clicking the [...] button.


Modulator LFO (Custom) - Modulator Editor

Name: Modulator LFO (Custom)

Used by: Wwise Synth One

Depth: 100

Frequency: 50

Waveform: Sine

Smoothing: 0

PWM: 50

Attack: 0

Initial Phase: 102

Scope: Global

Modulator LFO Modulator Editor

The properties of the Modulator LFO are:

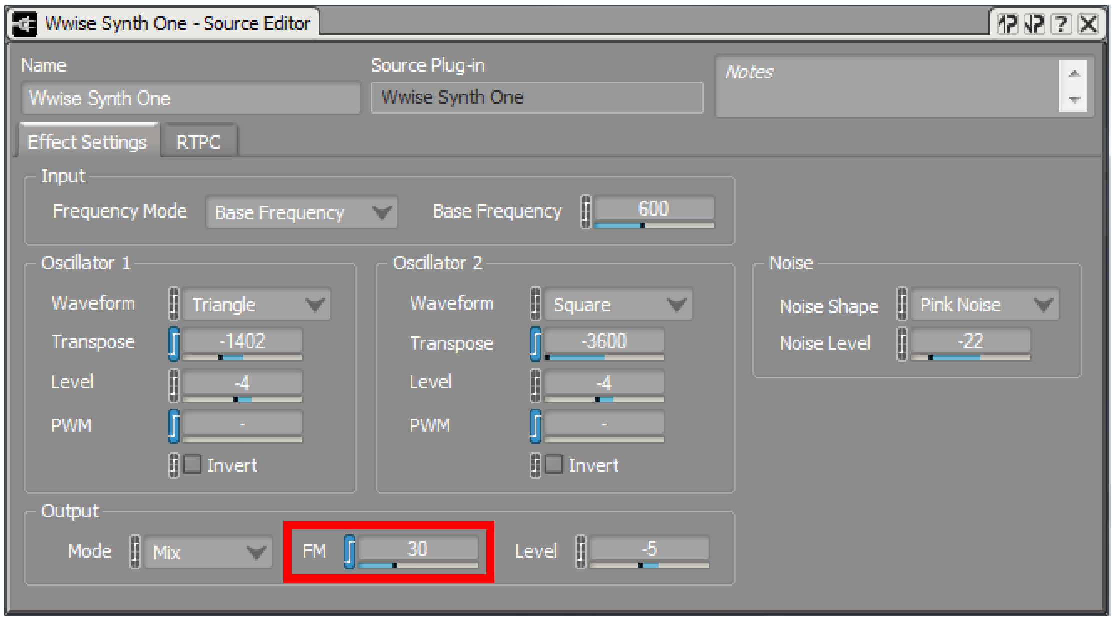
- **Depth**
  - The amplitude variation of the oscillator (in percentage). Maximum amplitude is 1.0.
    - Default value: 100
- **Frequency**
  - The number of cycles per second (in Hz).
    - Default value: 1
- **Waveform**
  - The shape of the modulator (sine, triangle, square, sawtooth).
    - Default value: Sine
- **Smoothing**
  - Low-pass filter over the waveform to smooth hard edges (in percentage).
    - Default value: 0
- **PWM (Pulse Width Modulation)**
  - The width of the pulse wave, only applies to the Square waveform (in percentage).
    - Default value: 50
- **Attack**
  - The time it takes for the oscillator to reach full amplitude (in seconds).
    - Default value: 0

- **Initial Phase**
  - The initial phase of the oscillator waveform (in degrees).
    - Default value: 0
- **Scope**
  - Controls how LFOs are created:
    - **Voice:** An instance of an LFO is created for every voice of the synth when used in MIDI context.
    - **Note/ Event:** An instance of an LFO is created for every playing instance of the synth when used in MIDI context.
    - **Game Object:** An instance of LFO is created for each game object instance in relation to the game engine.
    - **Global:** A single LFO is created for the whole project and used globally by all instances.
  - Default value: Voice

Designer Note

Additional information for working with LFOs can be found in the Wwise Help Document: Wwise Help > Interacting with the Game > Working with RTPCs > Working with LFOs

Additionally, Frequency Modulation (FM) between the two Oscillators is used to "soften" the sound and helps it blend better with the sample based components of the magic_blast_fire_blend.



Name: Wwise Synth One
Source Plug-in: Wwise Synth One

Frequency Mode: Base Frequency
Base Frequency: 600

Oscillator 1 — Waveform: Triangle; Transpose: -1402; Level: -4; PWM: -; Invert

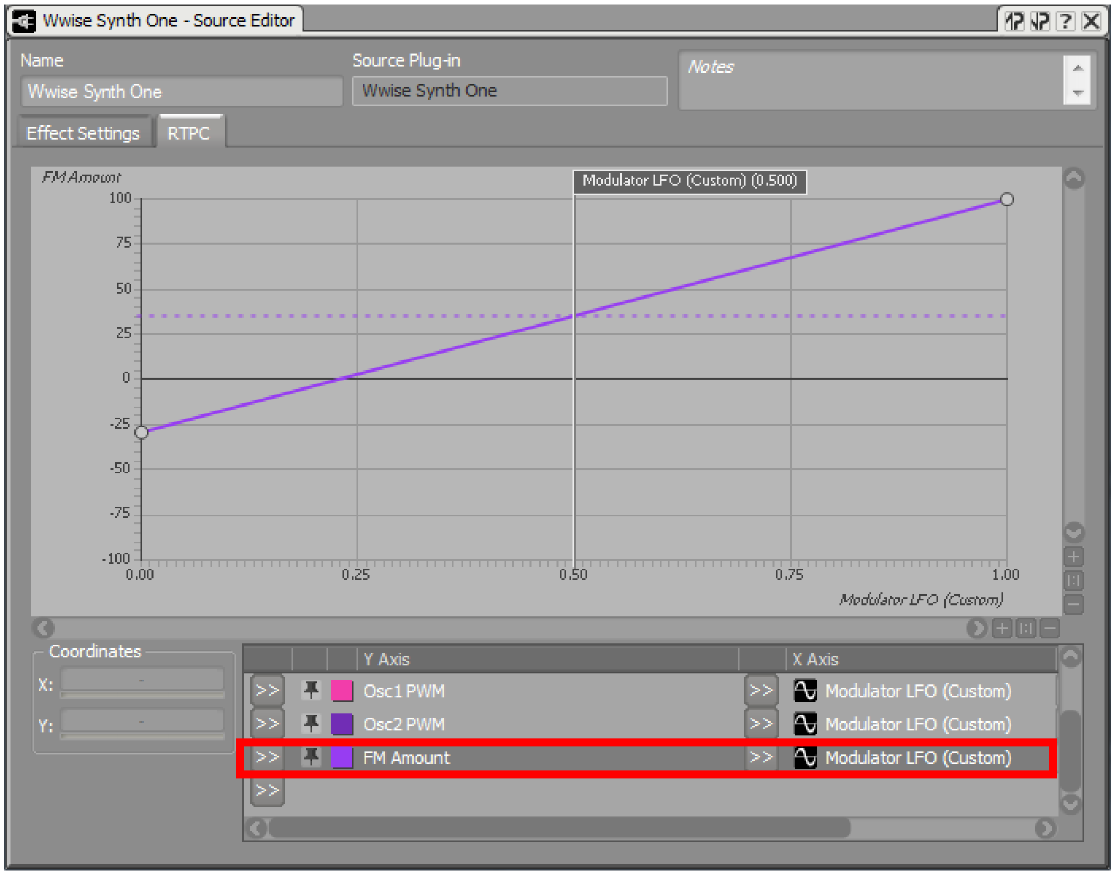
Oscillator 2 — Waveform: Square; Transpose: -3600; Level: -4; PWM: -; Invert

Noise — Noise Shape: Pink Noise; Noise Level: -22

Output — Mode: Mix; FM: 30; Level: -5

Wwise Synth One FM (Frequency Modulation) property

The "FM Amount" property is further modified by an LFO Modulator.



Name: Wwise Synth One
Source Plug-in: Wwise Synth One
Notes

		Y Axis		X Axis
>>	🟪	Osc1 PWM	>>	Modulator LFO (Custom)
>>	🟪	Osc2 PWM	>>	Modulator LFO (Custom)
>>	🟪	FM Amount	>>	Modulator LFO (Custom)
>>				

Wwise Synth One FM Amount property RTPC

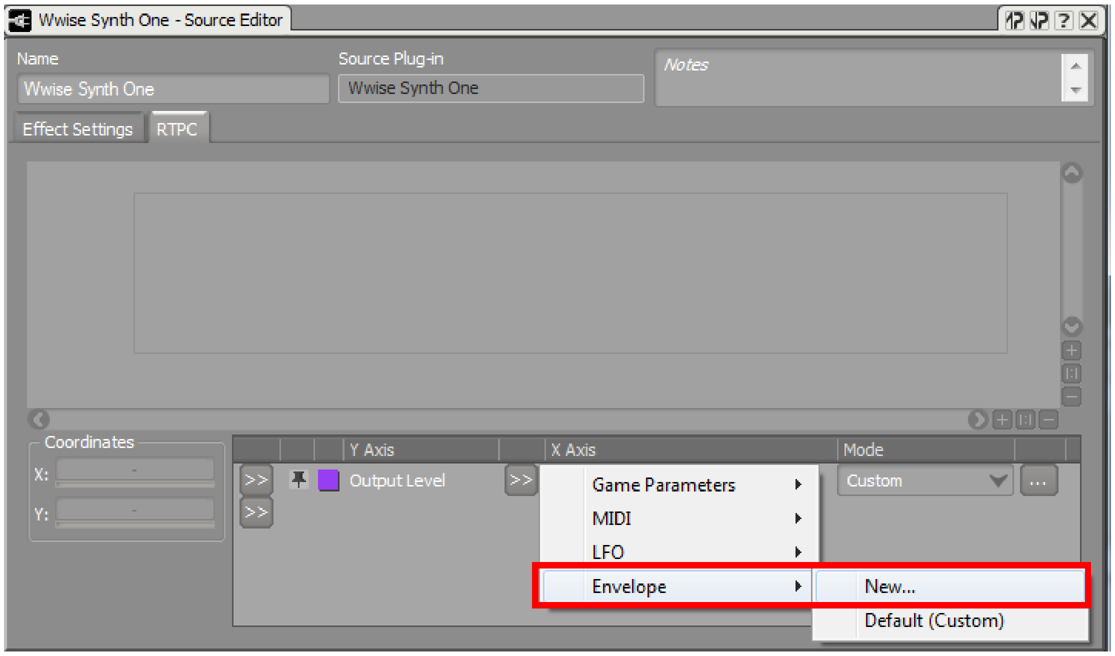
Designer Note

LFO objects can be created as Custom or ShareSet. Custom objects are stored in-place, directly inside the object that has it. ShareSets are stored in a separate work-unit and can be re-used across objects.

Modulation Envelope

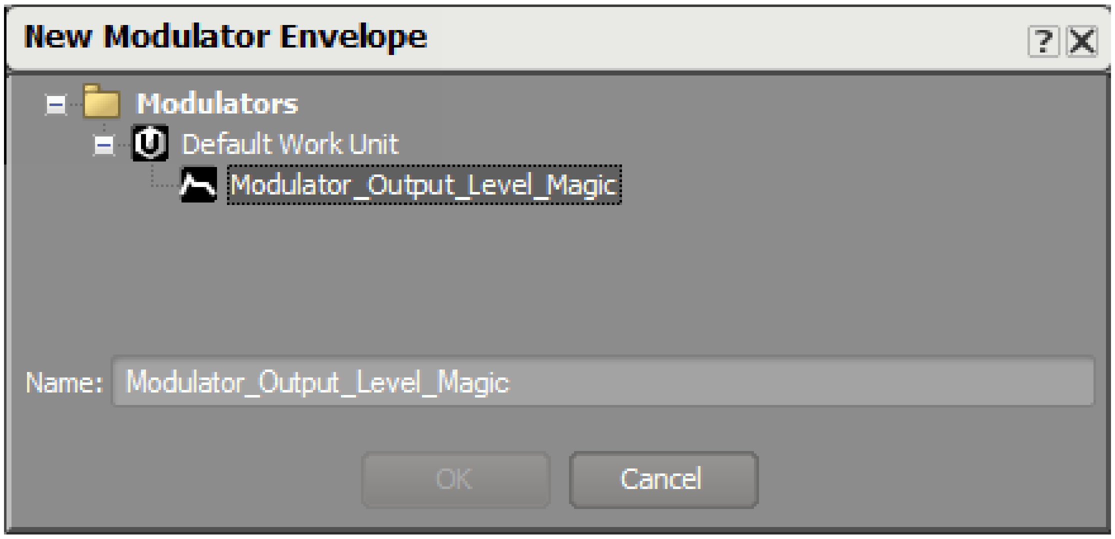
You can control the amplitude envelope of the Wwise Synth One by adding an Output Level RTPC modified by a Modulator Envelope. The Modulator Envelope provides properties to modify the Attack, Decay, Sustain, Release (ADSR) in addition to Attack Curve, Sustain Time. You can also use the Modulator Envelope to stop playback with the envelope. Many of the properties of the Modulator can be randomized and modified by RTPC.

From the RTPC Tab for the magic_blast_synth_element, use the Selector to add the Output Level parameter which will be modified by a new Modulator Envelope ShareSet.



Adding a Modulator Envelope to the Output Level RTPC

By default, the mode for the newly created Modulator Envelope is set to *ShareSet*.

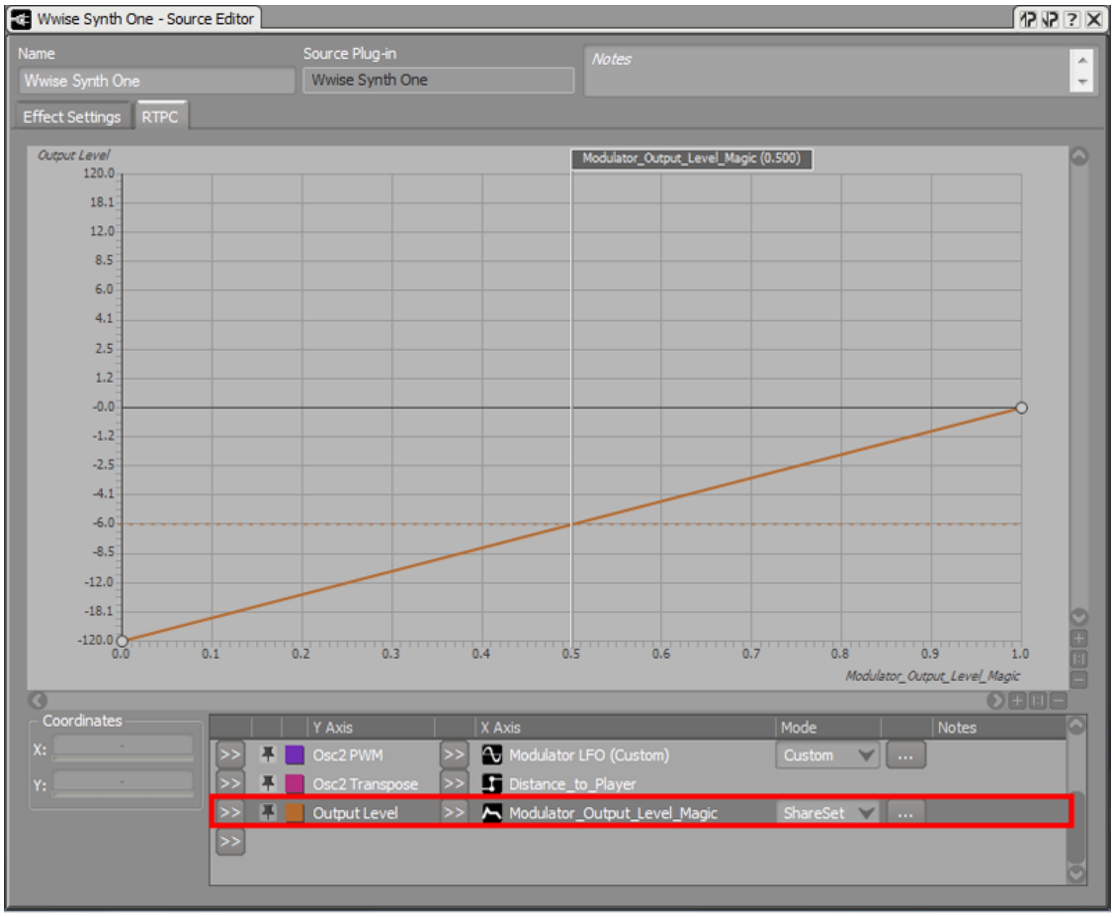


Name: Modulator_Output_Level_Magic

Creating a new Modulator Envelope ShareSet named Modulator_Output_Level_Magic

Designer Note

Envelope objects can be created as Custom or ShareSet. Custom objects are stored in-place, directly inside the object that has it. ShareSets are stored in a separate work-unit and can be re-used across objects.



Name: Wwise Synth One

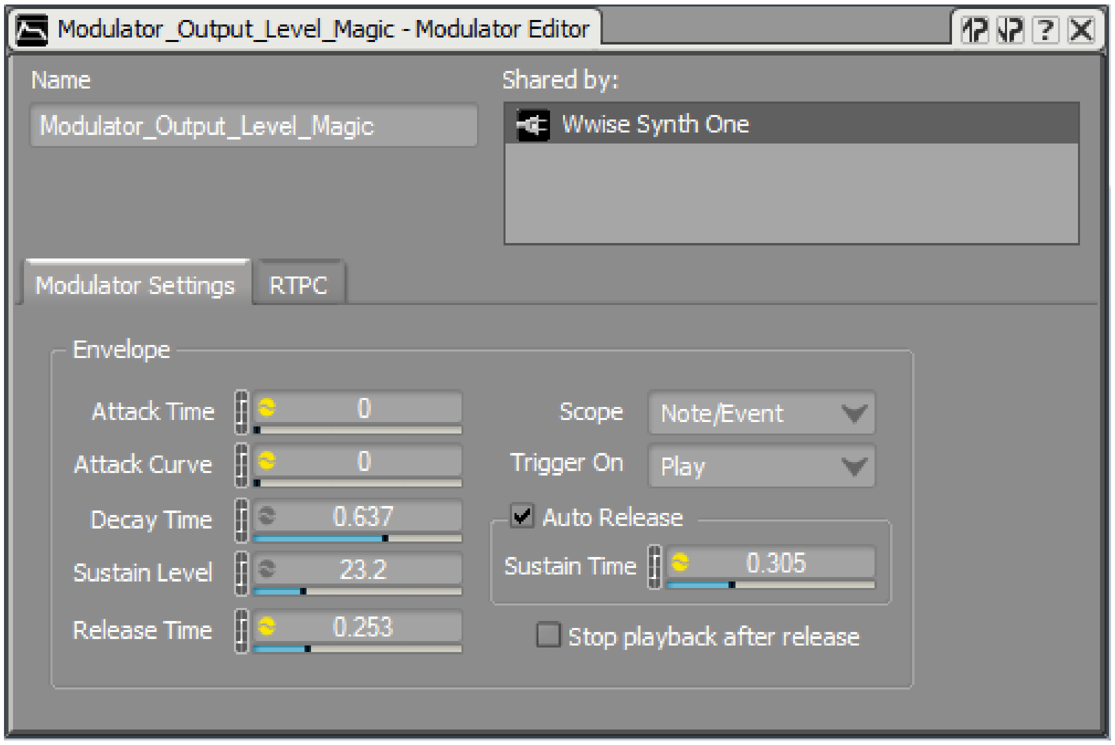
Source Plug-in: Wwise Synth One

Notes

Y Axis	X Axis	Mode	Notes
Osc2 PWM	Modulator LFO (Custom)	Custom	...
Osc2 Transpose	Distance_to_Player		
Output Level	Modulator_Output_Level_Magic	ShareSet	...

Modulator Envelope Mode set to ShareSet

The minimum and maximum RTPC values of Modulator Envelope in the Sound Property Editor affect the base and top of the ADSR envelope (nil and peak values). Swapping the min and max values reverses the ADSR.


Modulator_Output_Level_Magic - Modulator Editor

Name: Modulator_Output_Level_Magic

Shared by: Wwise Synth One

Modulator Settings | RTPC

Envelope

Attack Time: 0

Attack Curve: 0

Decay Time: 0.637

Sustain Level: 23.2

Release Time: 0.253

Scope: Note/Event

Trigger On: Play

[✓] Auto Release

Sustain Time: 0.305

[ ] Stop playback after release

Editing the Envelope Modulator

The properties available to the Modulator Envelope are:

- **Attack Time**
  - Defines the time taken for initial run-up of level from nil to peak, beginning when the key is first pressed (in seconds).
    - Default value: 0.2
- **Attack Curve**
  - Adjusts the Attack Curve from its linear default slope (50%) to either:
    - an exponential-style envelope (0%) where the rate of change starts slow and then increases
    - a logarithmic envelope (100%) where the rate of change starts fast, then decreases
      - Default value: 50
- **Decay Time**
  - Defines the time taken for the subsequent run down from the attack level to the designated sustain level (in seconds).
    - Default value: 0.2
- **Sustain Level**
  - Defines the level during the main sequence of the sound's duration, until the key is released (in percentage of the range).
    - Default value: 100
- **Release Time**

    - Defines the time taken for the level to decay from the sustain level to zero after the key is released (in seconds).
        - Default value: 0.5
- **Scope**
    - Controls how Envelopes are created:
        - **Voice:** An instance of an Envelopes is created for every voice of the synth when used in MIDI context.
        - **Note/ Event:** An instance of an Envelopes is created for every playing instance of the synth when used in MIDI context.
    - Default value: Note/Event
- **Trigger On**
    - The actions/MIDI events that may trigger the envelope (that is, enter the attack phase):
        - **Play:** either a play action or a MIDI note event
        - **Note-Off:** only a MIDI note-off event
    - Default value: Play
- **Auto Release**
    - Determines if the envelope requires an action/MIDI event to exit the sustain phase and enter the release phase. If set, the envelope exits the sustain phase after Sustain Time. If not set, the envelope exits the sustain phase following a certain condition:
        - The envelope may be released by the game via a **Release Envelope** event.
        - An envelope may also enter the release phase via a MIDI note-off event, provided the envelope was triggered by a MIDI note-on event.
        - Default value: False
- **Sustain Time**
    - Defines the time which the envelope will remain in Sustain before the Release is applied (in seconds).
        - Default value: 0
- **Stop Playback After Release**
    - If set, the playback of the associated sound is terminated after the release phase is complete.
        - Default value: false

Modulator Envelope Properties can be accessed using the Modulator Editor:

Designer Note

Additional information for working with Envelopes can be found in the Wwise Help Document: Wwise Help > Interacting with the Game > Working with RTPCs > Working with Envelopes

The combined power of synthesis, modulation, and parameterization is at its best when used in conjunction with the dynamics of gameplay. With so many options to modify and affect the properties of sound within the project, it is important to understand the impact these can have on your platform's memory and CPU performance.

A modulator's processing time depends on its RTPC usage. For most properties, a modulator is evaluated once per audio sample. However, for the property voice volume, the associated modulator is evaluated at every frame. Use modulators selectively as they can consume a significant amount of a platform's memory and CPU. Always work within the constraints of your target platform.

Magic Summary

The creative sound design process for magic and spell casting effects begins deep within your own imagination. From there it extends from sound, to the microphone, eventually ending up in the sound library where it can be assembled in a digital audio workstation as the basis for the creation of fantastical effects. A further step in this process is how the content is prepared for the eventual implementation. Creatively combining, recombining, and dynamically manipulating sounds within the authoring application using game parameters is a working methodology that leverages the inherent interactivity of games as a medium. Coupled with the power of synthesis, LFO, and Envelopes, the potential for the dynamic interaction between gameplay and game sound can make a sound designer's dreams come true.

Throughout this chapter we have:

- Learned about summing and layering with the blend container.
- Changed perspectives based on distance using RTPC.
- Discussed the application and modification of effects.
- Created a Wwise Synth One element.

Stepped through the process of:

- Recombining sounds using the blend container.
- Using effects.
- Employing Real Time Parameter Control (RTPC).
- Leveraging blend tracks as part of a distance based perspective model.
- Creating a Modulator Envelope ShareSet.

Also touched on:

- Effects chain ordering.
- Audio bus sub-mixing of effects.
- Modulator LFOs.

Throughout this section we have created the following objects:

- A blend container called magic_blast_fire_distance_blend that uses a distance game parameter to Crossfade between different perspectives of magic blast sounds.
- A Wwise Synth One element that augments the audio content in magic_blast_fire_blend.

Magic Additional Resources

Wwise Help > Using Sounds and Motion to Enhance Gameplay > Defining Object Playback Behaviors > **Defining the Contents and Behavior of the Blend Container**

Wwise Help > Wwise Reference > Actor-Mixer Objects > **Blend Containers**

Video Tutorial - Creating Dynamic Sounds Using RTPCs

Wwise Help > Interacting with the Game > Working with RTPCs > **Working with LFOs**

Wwise Help > Interacting with the Game > Working with RTPCs > **Working with Envelopes**

Wwise Help > Wwise Source/Effect Plug-ins > Wwise Synth One > **Wwise Synth One Plug-in**

Chapter 5. Dialogue Decisions and Language Lessons

Overview

A single shriek of terror resonates through the forest, shaking dead leaves from the branches of trees and setting birds to flight. What follows is an exchange of inhuman grunts and growls followed by a plea for help.

From simple conversational interactions, to a fully branching multi-language epic storytelling device, the art of dialogue production has become an exercise in asset management and system integration of the highest order. With the escalating line counts of modern console titles, voice over can quickly become a high quality headache without a comprehensive localization strategy.

This chapter will take you through the process of:

- Getting started with voice.
- Preparation for Multi-Language support.
- Dynamic dialogue.
- Positioning and Panning.

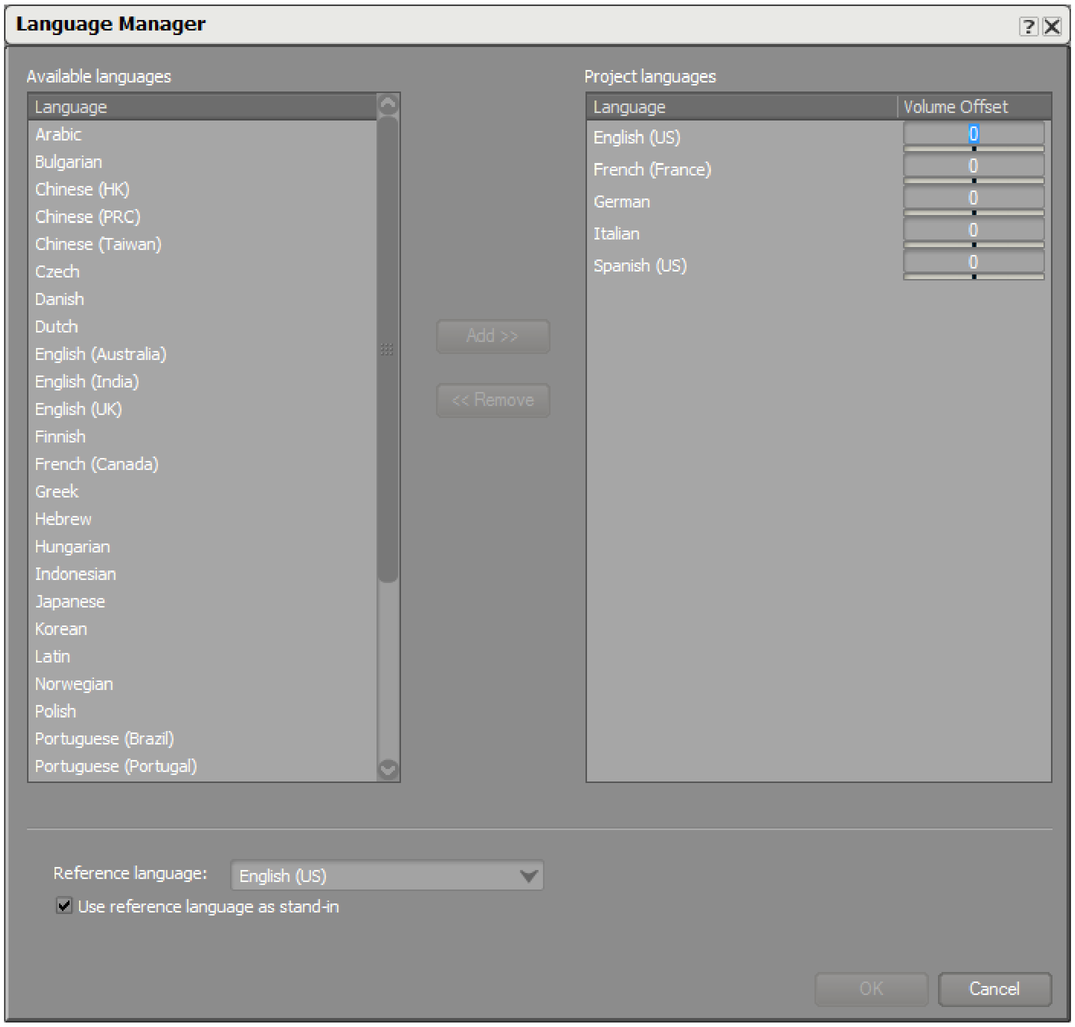
Getting Started with Dialogue and Non-Verbal Vocalizations

When working with dialogue you need to distinguish between spoken and non-verbal dialogue. Spoken dialogue usually needs to be localized in different languages whereas non-verbal dialogue represents the palette of emotional vocalizations not usually translated. In the case of non-localized audio files, variations can be added directly to a sound object, organized within the Actor-Mixer hierarchy, and added to events just like any other sound effect. To handle these dialogue considerations, the process for importing Voice assets into the project differs from music and sound effects. The fundamental difference being the opportunity to determine project languages in preparation for localization.

First you need to define the game project languages in the Language Manager located in Wwise>Project>Languages menu. You also need to define the reference language used throughout the project.

The reference language for the project is used in various situations:

- **Importing language files** - when you are importing an audio file, the import conversion settings of the reference file are used.
- **Converting language files** - when you are converting a language file, the conversion settings of the reference language can be selected.
- **Before language files are available** - when certain language sources are not ready, the reference language can be used in their place.



Available languages

Language
Arabic
Bulgarian
Chinese (HK)
Chinese (PRC)
Chinese (Taiwan)
Czech
Danish
Dutch
English (Australia)
English (India)
English (UK)
Finnish
French (Canada)
Greek
Hebrew
Hungarian
Indonesian
Japanese
Korean
Latin
Norwegian
Polish
Portuguese (Brazil)
Portuguese (Portugal)

Project languages

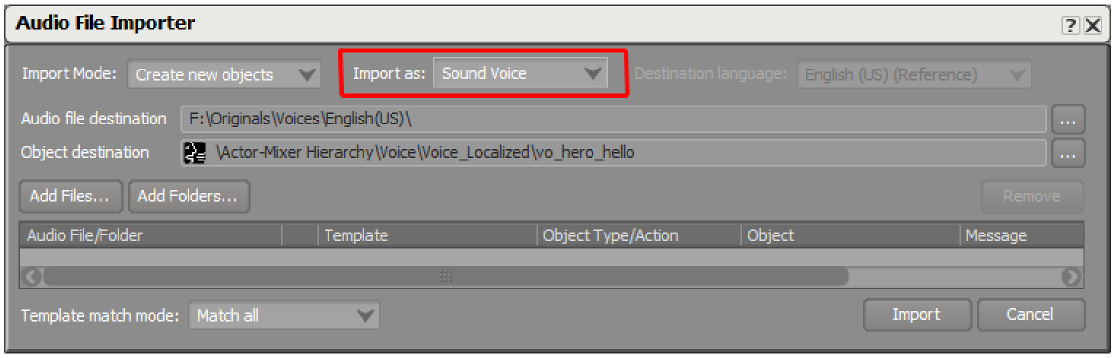
Language	Volume Offset
English (US)	0
French (France)	0
German	0
Italian	0
Spanish (US)	0

Reference language: English (US)

☑ Use reference language as stand-in

Defining project languages in the Language Manager

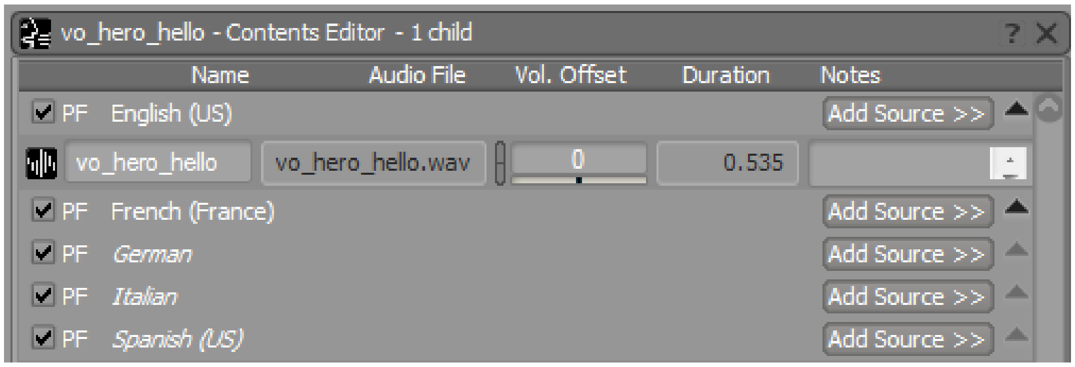
After you have selected the languages, localized voice files can be imported either through the Project menu, or by simply dragging and dropping files into the Project window. Selecting Import as Sound Voice prepares the object for localization based on project languages established in the Language Manager.



Import Mode: Create new objects
Import as: Sound Voice
Destination language: English (US) (Reference)
Audio file destination: F:\Originals\Voices\English(US)\
Object destination: \Actor-Mixer Hierarchy\Voice\Voice_Localized\vo_hero_hello
Template match mode: Match all

Importing dialogue as a Sound Voice in the Audio File Importer

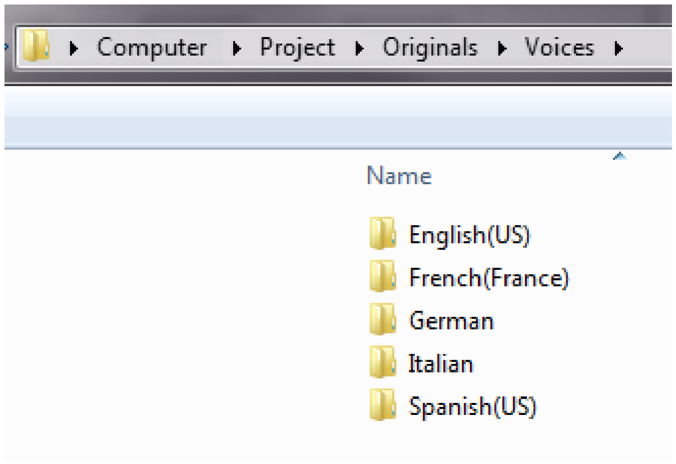
After a Sound Voice has been imported in the reference language, additional localized files can be added.



	Name	Audio File	Vol. Offset	Duration	Notes
PF	English (US)				Add Source >>
	vo_hero_hello	vo_hero_hello.wav	0	0.535	
PF	French (France)				Add Source >>
PF	German				Add Source >>
PF	Italian				Add Source >>
PF	Spanish (US)				Add Source >>

Adding an audio source for English language

A copy of the source audio files are then added to the project based on language. By default these files are copied to the Originals/Voice location within the project directory.



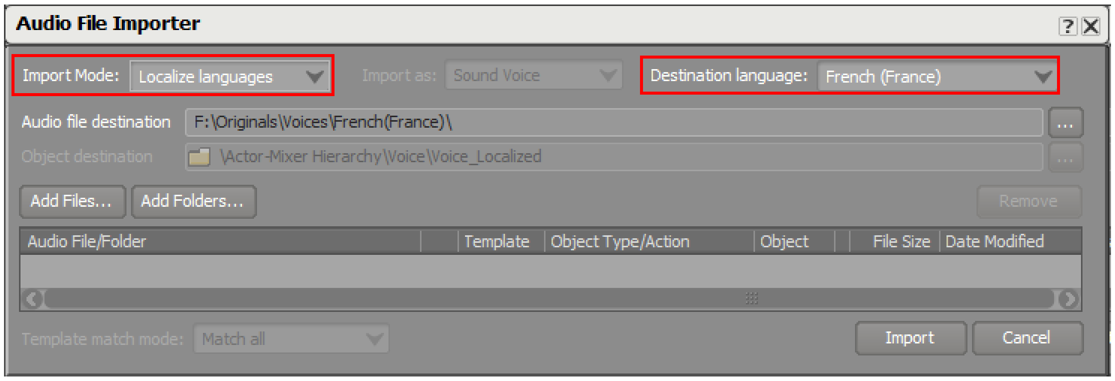
English(US)
French(France)
German
Italian
Spanish(US)

The folder hierarchy for copied Originals in the project Voices file folder

Adding Additional Languages

When localized language files are ready, they can be imported directly into the project using the Audio File Importer.

To begin the process, first change the import mode to Localize Languages and set the appropriate Destination language for localization.

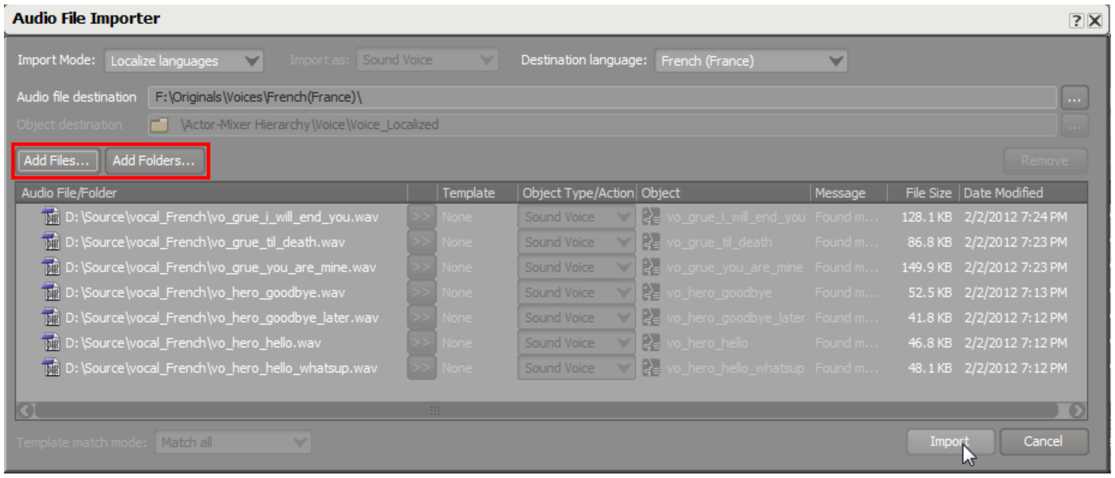


Audio File Importer

Import Mode: Localize languages
Import as: Sound Voice
Destination language: French (France)
Audio file destination: F:\Originals\Voices\French(France)\
Object destination: \Actor-Mixer Hierarchy\Voice\Voice_Localized
Template match mode: Match all

Preparing to import localized voice files using the audio file importer

You can then select files or folders to be imported in the Destination language using either the Add Files or Add Folders button.



Audio File Importer

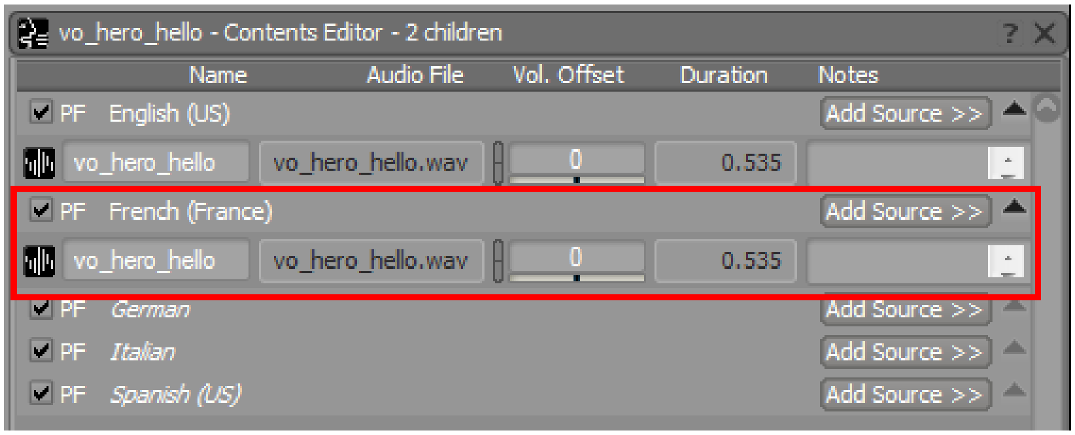
Import Mode: Localize languages
Import as: Sound Voice
Destination language: French (France)
Audio file destination: F:\Originals\Voices\French(France)\
Object destination: \Actor-Mixer Hierarchy\Voice\Voice_Localized

Audio File/Folder	Template	Object Type/Action	Object	Message	File Size	Date Modified
D: \Source\vocal_French\vo_grue_i_will_end_you.wav	None	Sound Voice	vo_grue_i_will_end_you	Found m...	128.1 KB	2/2/2012 7:24 PM
D: \Source\vocal_French\vo_grue_til_death.wav	None	Sound Voice	vo_grue_til_death	Found m...	86.8 KB	2/2/2012 7:23 PM
D: \Source\vocal_French\vo_grue_you_are_mine.wav	None	Sound Voice	vo_grue_you_are_mine	Found m...	149.9 KB	2/2/2012 7:23 PM
D: \Source\vocal_French\vo_hero_goodbye.wav	None	Sound Voice	vo_hero_goodbye	Found m...	52.5 KB	2/2/2012 7:13 PM
D: \Source\vocal_French\vo_hero_goodbye_later.wav	None	Sound Voice	vo_hero_goodbye_later	Found m...	41.8 KB	2/2/2012 7:12 PM
D: \Source\vocal_French\vo_hero_hello.wav	None	Sound Voice	vo_hero_hello	Found m...	46.8 KB	2/2/2012 7:12 PM
D: \Source\vocal_French\vo_hero_hello_whatsup.wav	None	Sound Voice	vo_hero_hello_whatsup	Found m...	48.1 KB	2/2/2012 7:12 PM

Template match mode: Match all

Adding localized files to already existing voice objects

Once imported, the localized files appear in the Contents Editor for the associated Sound Voice object.



Name	Audio File	Vol. Offset	Duration	Notes
PF English (US)				Add Source >>
vo_hero_hello	vo_hero_hello.wav	0	0.535	
PF French (France)				Add Source >>
vo_hero_hello	vo_hero_hello.wav	0	0.535	
PF *German*				Add Source >>
PF *Italian*				Add Source >>
PF *Spanish (US)*				Add Source >>

Localized dialogue added to an existing Sound Voice

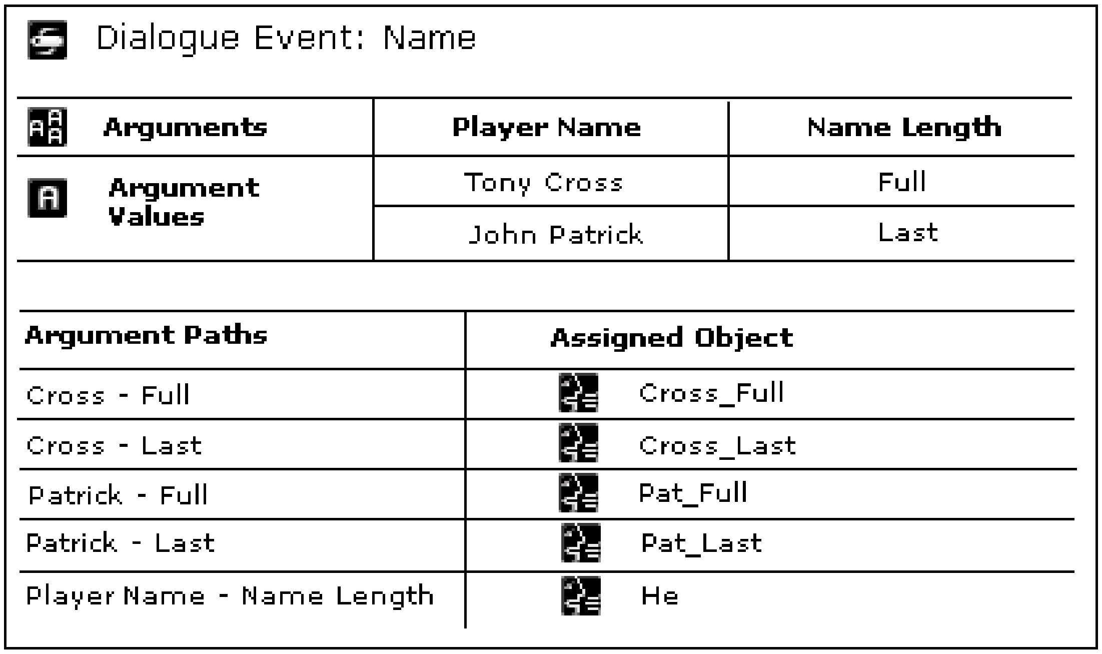
Dynamic Dialogue

There comes a point in every quest when the path splits, and a decision must be made about how to proceed. The art of branching dialogue relies on the player choosing from a list of possible interactions in order to move the conversation forward. In addition to the potential outcome, you may want to carry forward the history of past responses to characters during previous conversations.

At the center of Wwise's Dynamic dialogue system is the dialogue event, which is a set of rules or conditions that determines which piece of dialogue to play. The dialogue event allows you to re-create a variety of different scenarios, conditions, or outcomes that exist in your game. To ensure that you cover every situation, Wwise also allows you to create default or fallback conditions.

All these conditions are defined using a series of arguments and argument values. These arguments and argument values are combined to create argument paths, which define the particular conditions or outcomes in the game. Each path is then associated with a specific sound object in Wwise. As the game is played and dialogue events are called, the game verifies the existing conditions against the paths defined in the dialogue event. The argument paths that match the current situation in game along with the mode, probability, and weighting of each path determine which piece of dialogue is played, if any.

For example, the following dialogue event contains the arguments related to the names of each player in a sports game. The values of each argument are combined to create the different paths or conditions that may exist. In this particular example, the commentator can use either the player's last name or full name.



Dialogue Event: Name

Arguments	Player Name	Name Length
Argument Values	Tony Cross	Full
	John Patrick	Last

Argument Paths	Assigned Object
Cross - Full	Cross_Full
Cross - Last	Cross_Last
Patrick - Full	Pat_Full
Patrick - Last	Pat_Last
Player Name - Name Length	He

To deal with situations where there are no argument values that match the current situation in game, you can create a path with a default or fallback argument value. These fallback paths contain one or more arguments instead of argument values and are usually associated with a more general sound object. In the previous example, the fallback argument path is associated with the sound object "he" instead of one of the player's names.

After you have re-created all the conditions in the dialogue event, it can be integrated into the game engine. When the dialogue events are called by the game, the sound engine resolves the dialogue event by returning the audio object that corresponds to the matching argument path. The sound engine can then decide whether to insert the audio object into a dynamic sequence for playback. The relationship between returning an audio object and inserting it into a dynamic sequence does not have to be 1:1. This means that for each resolved dialogue event, a returned audio object can be added to the dynamic sequence as many times, as necessary.

Since the game engine uses the dialogue event name, you can create the events, integrate them into the game and then build and fine-tune the contents of each event without ever having to re-integrate them into the game again. This gives you a great deal of flexibility to add or remove argument values, and to experiment with different sounds, all without additional programming.

For more information on dynamic dialogue:

Wwise Help > Interacting with the Game > Working with Arguments > **Overview**

Wwise Help > Interacting with the Game > Managing Dynamic Dialogue > **Understanding the Dynamic Dialogue System**

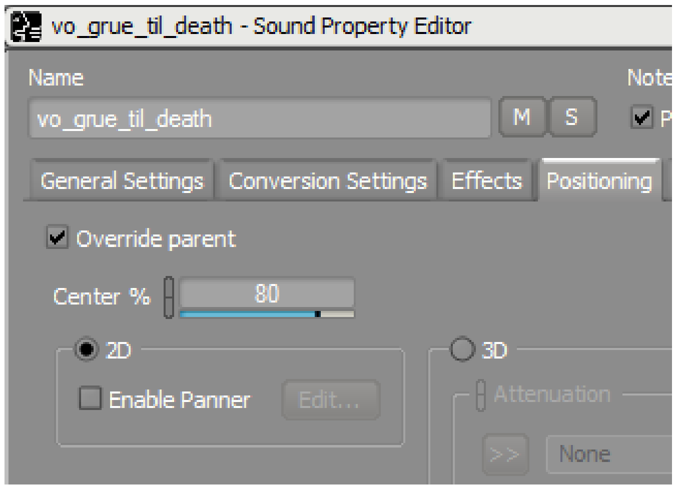
Wwise Help > Interacting with the Game > Managing Dynamic Dialogue > **Dialogue Events Tips and Best Practices**

Wwise Help > Interacting with the Game > Managing Dynamic Dialogue > **Creating Dialogue Events**

Cinematic Dialogue Placement

Several examples are helpful to have a clear picture of how dialogue should be handled positionally in games. Linear media, such as film and television, can help guide the way we present dialogue for the screen, but doesn't accommodate the entire scope of concerns when it comes to handling interactions that are presented dynamically.

With cinematic conversations usually anchored in the front speakers during sections of the game where control is taken from the player, setting the position of dialogue during these sequences to 2D will appropriately manage their placement. By default, 2D objects are only played through the front left/right speakers for sound objects without any propagation behaviors. Adding a percentage of the center channel allows for an additional level of control.



Override parent: ✓
Center %: 80
2D: ●
3D: ○

Cinematic dialogue set to 2D with 80% center channel volume

In situations where the player is present during the delivery of gameplay dialogue and able to move throughout the world, it may be necessary to play the dialogue positionally in 3D. Simply subscribing an attenuation to a Sound Voice with the game object at the location of the character speaking the line will apply the specified volume reduction based on the defined attenuation. This case allows for situations where you are free to move about while dialogue is spoken by characters positioned in the game world.

Adding realism to positioned in-game dialogue doesn't have to end with volume attenuation. As described in the campfire example in the Ambient chapter, most voices could benefit from the addition of a spread across adjacent speakers at close distance. Taking the implementation a step further, the addition of cone attenuation could be used to focus the direction of the sound controlled by the orientation of the game object, or in this case the mouth of the character speaking. Applying a cone attenuation allows for the attenuation and filtering of the sound as the listener moves outside of, or behind, the oriented game object. This simulates the obstruction of the character's head on the spoken line of dialogue.

Programmer Note

The OrientationFront vector defines the direction that the listener's head is facing. It should be orthogonal to the OrientationTop vector, which defines the incline of the listener's head. For a human listener, one could think of the OrientationFront vector as the listener's nose (going away from the face), while the OrientationTop vector would be orthogonal to it, going between the listener's eyes and away from the chin.

Introducing additional techniques for simulating realism with dialogue are worth investigating, but knowing whether the dialogue being delivered is critical to the game play can quickly determine how much realism can be used. If, for instance, it's important that the player hear the secret to subduing the dragon, then realism should not get in the way of delivering the dialogue by obstructing it with filters or volume attenuation. Ideally every conversation in the game needs to be built along the fine line between realism and storytelling to deliver, coupled with game play, an immersive conversational experience to the player.

Voice Summary

As games continue to grow into their role as a storytelling medium, there are few devices available greater than the human voice in its ability to convey emotion and establish character. Whether you're dealing with non-verbal communications or building complex trees of conversational outcomes, there exists a suite of tools designed for the express purpose of integrating dialogue within the flow of gameplay in Wwise.

Throughout this chapter we have:

- Discussed getting started with voice.
- Differentiated between verbal and non-verbal vocalizations.
- Established a methodology for localizing dialogue.
- Discussed the role of dialogue positioning in different scenarios.

Stepped through the process of:

- Importing sound voice objects for English language dialogue files.
- Importing localized language dialogue files using the Audio File Importer.
- Adjusting the percentage of center channel contribution for 2D positioned sounds.

We've also touched on:

- Using arguments to creating branching dialogue.

Throughout this section we have created the following objects:

- Spoken dialogue sound voices in the English language and localized in French.

Voice Additional Resources

Wwise Help > Interacting with the Game > **Managing Dynamic Dialogue**

Wwise Knowledge Base - Does Wwise provide support for integrating a lip-sync solution?

Wwise Knowledge Base - Importing a large number of files in Wwise

Video Tutorial - Managing Voices and Language Localizations

Chapter 6. Unlocking the User Interface

Overview

The User Interface is often the hub around which the game world is created. Creating a solid experience with sound begins with the ability to understand the interface flow and how sound can be used to reinforce the aesthetic, without breaking immersion.

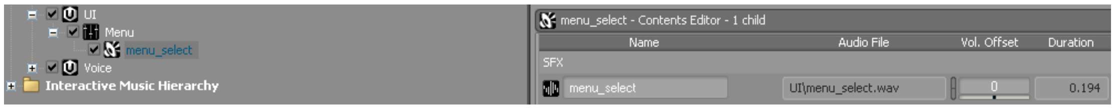
This chapter will take you through the process of:

- Creating simple menu events.
- 2D positioning and panning.
- Creating complex events.

From the simple playback of exactly the right sounds, to the complex negotiation that happens when pressing pause, the User Interface is a case study in the solutions and techniques available within the Wwise authoring application.

Creating a Simple Menu Select Sound

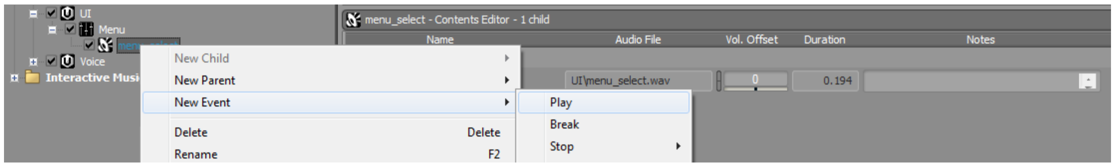
Let's create a Sound SFX for a menu_select sound which will be played whenever a menu selection is confirmed. Start first by importing the menu_select file, either using the audio file importer or by dragging and dropping from the source folder into the default work unit.



menu_select sound object

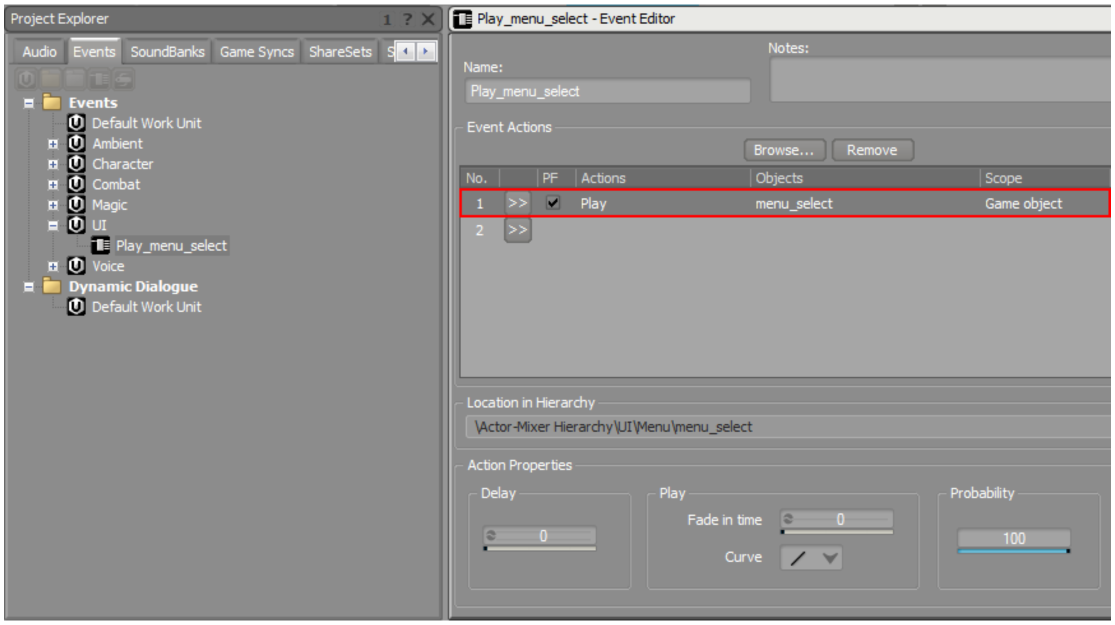
Creating a Simple Menu Select Event

By selecting the Sound SFX and entering the contextual menu we can immediately create a play event for this sound:



Creating a play event from the contextual menu of a sound object

This results in the following event:



Name: Play_menu_select

Event Actions

No.		PF	Actions	Objects	Scope
1	>>	✓	Play	menu_select	Game object
2	>>				

Location in Hierarchy: \Actor-Mixer Hierarchy\UI\Menu\menu_select

Action Properties: Delay 0; Play: Fade in time 0, Curve; Probability 100

Play_menu_select event

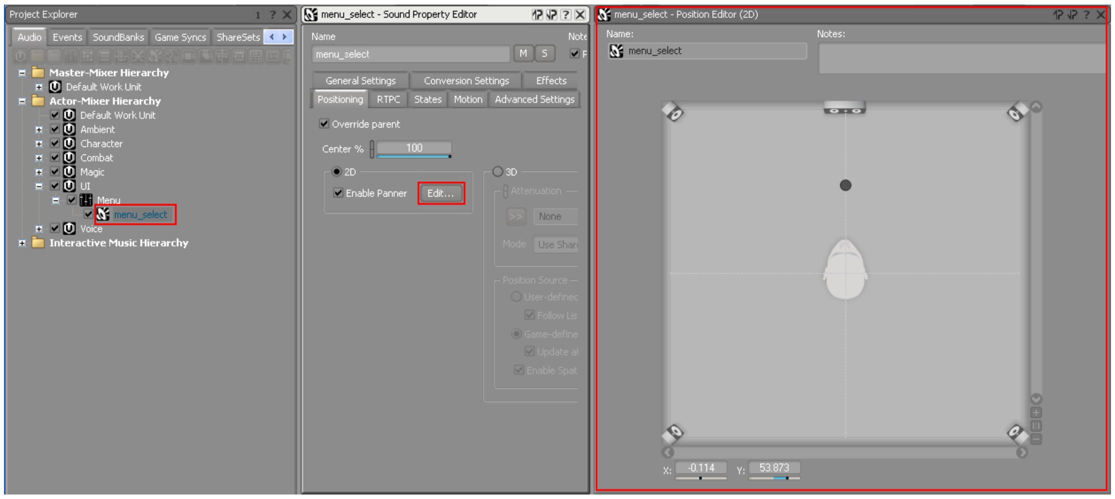
The event name Play_menu_select can now be passed to the programmer who will post the event for each time an item in the menu is selected.

Programmer Note

Events are triggered by calling AK::SoundEngine::PostEvent()

Defining 2D Sound Positioning

With most visual aspects of the menu displayed on a two-dimensional plane, it's common to also ignore 3D positioning for a sound object and instead manually control the positioning in 2D. Wwise enables direct control over 2D positioning of a sound object from the positioning tab in the Project Explorer.



2D Position editor

By switching the positioning to 2D you gain control over the sound's position through the use of the 2D panner interface and also via a percentage parameter for the center channel that sends a contribution of the sound to the center speaker.

Programmer Note

Usually, UI events are triggered from a global game object (a game object without positioning info)

Of primary concern when scoring for the user experience is the feel and aesthetic of the sound itself. While there is always room to use advanced techniques to achieve certain effects, the role of sounds that help to provide feedback to the user are usually much more difficult to design than they are to implement.

The Complex Negotiation of Pause

While the playback of discrete sounds may end up being quite simple, there is often a complex series of interactions that need to take place during the transition from gameplay to the menu. It is expected that at any point during gameplay that the pause button can be pressed, allowing for the swift transition from in-game to in-menu actions.

For this to appear seamless from the sound perspective, several things should happen:

- Music playing in-game should be muted, paused, or allowed to play through the menu.
- In-Game sound effects should be paused, stopped, or muted.
- In-Game ambient sound should be muted, paused, or allowed to play through the menu.
- Non-critical dialogue should be paused or stopped.
- Critical dialogue should be either paused or restarted.
- Menu music or ambient sound could be played.

At first glance, this list of actions may seem outside the scope of what would normally be available to the sound designer; however, the event system allows for these decisions to be controlled and manipulated from within the authoring application. Wwise events can apply actions to the different structures within your project hierarchy. Each event can contain one action or a series of actions. The actions you select will specify whether the Wwise objects will play, pause, stop, and so on.

A complete list of event actions can be found in the help documentation:

Wwise Help > Wwise Reference > Events > **Event Editor**

Wwise Help > Where to Begin? > Wwise Fundamentals > Understanding Events > **Action Events**

Wwise Help > Interacting with the Game > Managing Events > Overview > **Types of Event Actions**

Pause - Defining the Scenario

Let's take a scenario where we specifically want to:

- Pause all music, ambient, sound, and voice.
- Play a transitional sound effect.
- Loop a piece of menu specific music.

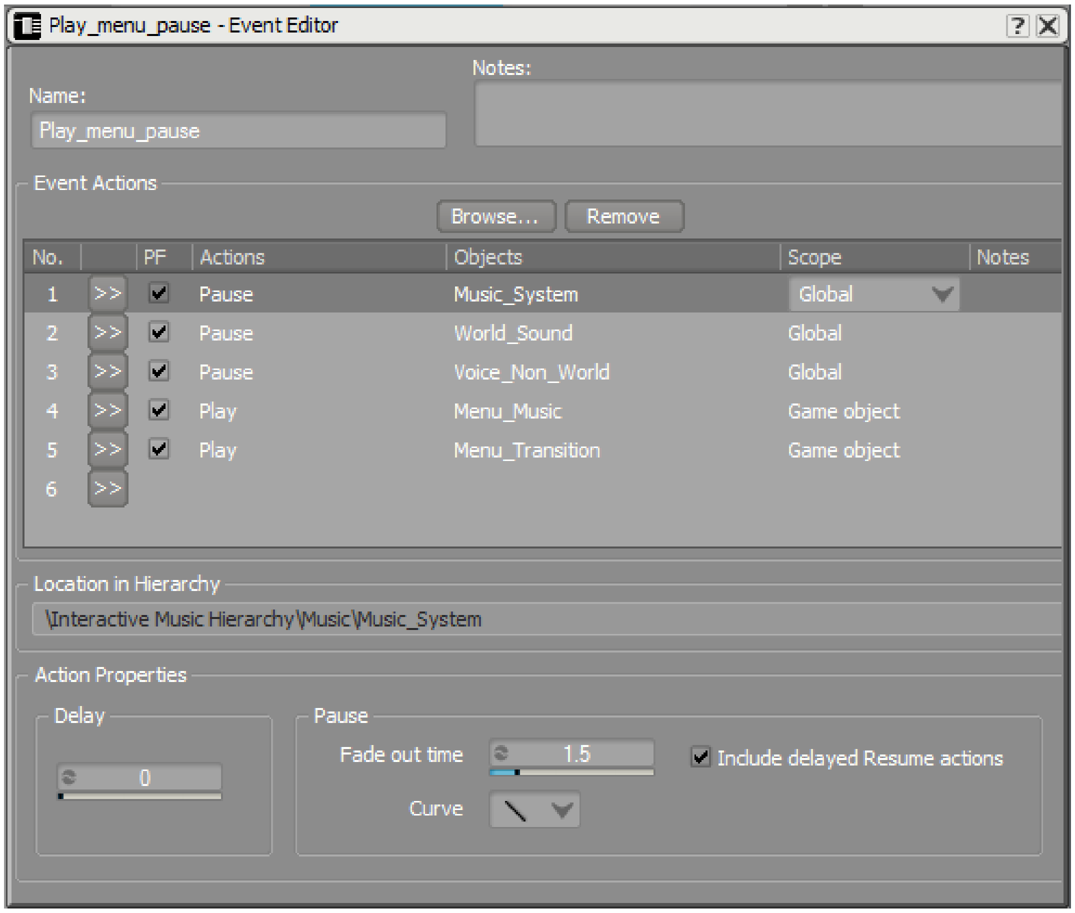
Designer Note

In the case of multi-player or persistent worlds that carry on while one user is paused, there is also the ability to mute the audio.

Ideally, from a simplified perspective and likely that of the programmer, only two events need to be communicated: Pause Audio and Resume Audio. The sound behavior that happens when each of these is posted by the programmer can be specifically determined by the sound designer. To make things easy in the example, we are going to pause based on busses contained in the Master-Mixer Hierarchy.

Pausing the Game

The following event shows each level of the mix hierarchy using the pause action with each object receiving a 1.5 second fade out:



Name: Play_menu_pause

Notes:

Event Actions

No.		PF	Actions	Objects	Scope	Notes
1	>>	✓	Pause	Music_System	Global	
2	>>	✓	Pause	World_Sound	Global	
3	>>	✓	Pause	Voice_Non_World	Global	
4	>>	✓	Play	Menu_Music	Game object	
5	>>	✓	Play	Menu_Transition	Game object	
6	>>					

Location in Hierarchy: \Interactive Music Hierarchy\Music\Music_System

Action Properties

Delay: 0

Pause: Fade out time 1.5; Curve

✓ Include delayed Resume actions

Pause event showing event actions

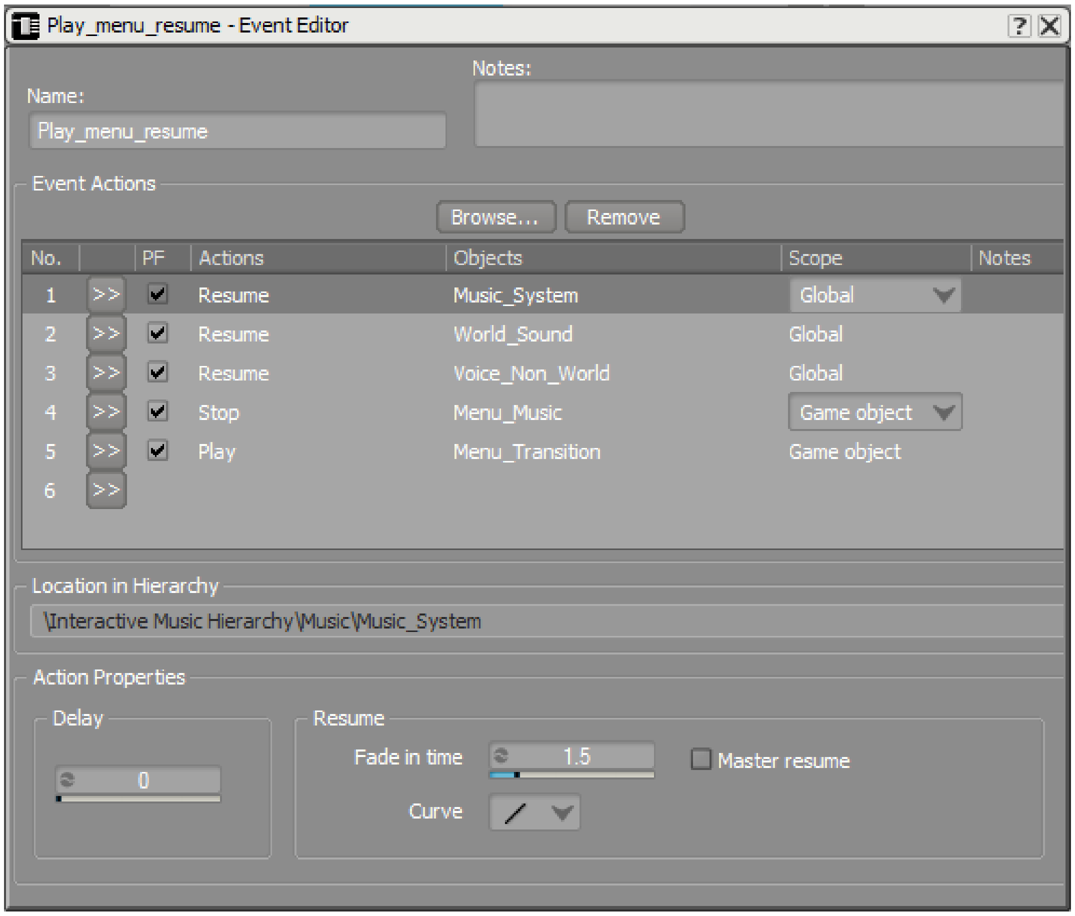
Event Action	Object	Location

Pause	Music_System	(Interactive Music)
Pause	World_Sound	(Master Audio Bus)
Pause	Voice_Non_World	(Master Audio Bus)
Play	Menu_Music	(Interactive Music)
Play	Menu_Transition	(Actor-Mixer)

Additionally, the menu_music and menu_transition use the play action simultaneously.

Resuming the Game

When we resume the game, we only need to use the resume action on the paused busses of the Master-Mixer hierarchy in order to continue playing everything back from the point at which they were paused. Simultaneously we will use the stop action on menu_music with a 1.5 second fade out, and play the menu_transition sound again:


Play_menu_resume - Event Editor

Name: Play_menu_resume

Notes:

Event Actions

No.		PF	Actions	Objects	Scope	Notes
1	>>	✓	Resume	Music_System	Global	
2	>>	✓	Resume	World_Sound	Global	
3	>>	✓	Resume	Voice_Non_World	Global	
4	>>	✓	Stop	Menu_Music	Game object	
5	>>	✓	Play	Menu_Transition	Game object	
6	>>					

Location in Hierarchy: \Interactive Music Hierarchy\Music\Music_System

Action Properties

Delay: 0

Resume: Fade in time 1.5; Curve; Master resume ☐

Resume event showing event actions

Event Action	**Object**	**Location**
Resume	Music_System	(Interactive Music)
Resume	World_Sound	(Master Audio Bus)
Resume	Voice_Non_World	(Master Audio Bus)
Stop	Menu_Music	(Interactive Music)
Play	Menu_Transition	(Actor-Mixer)

The important take away from this example is that with just two Wwise events you can control all of the sound for the game. Using event actions, the audio experience for transitioning from gameplay to pause and back again can be authored according to the desires of the sound designer.

User Interface Summary

Implementing the sound in your user interface can be as simple or complex as necessary in order to support the feel and aesthetic. Simply put, the sound should serve as an extension of the experience; whether navigating through or transitioning between gameplay and the menu system, everything should support the artistic scope. Wwise puts the decisions into the hands of the sound designer by allowing for the finer details of interaction to be managed through the event system.

Throughout this chapter we have:

- Reviewed importing sound files.
- Discussed the role of User Interface sounds to support game aesthetic.
- Outlined some of the complexities inherent with pausing and resuming.

Stepped through the process of:

- Creating a simple Event for menu selection.
- Defining 2D sounds using the Position Editor.
- Creating pause and resume Events.

Also touched on:

- Different types of Event actions.

Throughout this section we have created the following objects:

- A simple menu select Sound SFX and event.
- Pause and resume events.

User Interface Additional Resources

Wwise Help > Interacting with the Game > Managing Events > Overview > **Types of Event Actions**

Wwise Help > Using Sounds and Motion to Enhance Gameplay > **Defining Positioning for Sound and Motion**

Video Tutorial - Creating Events

Chapter 7. Adventures in Music

Overview

Heroic journeys are usually accompanied by the thundering of trumpets and fanfare, but several hours of steadily looping brass wouldn't scale across a single piece of music. Interactive and dynamic music in games continues to evolve as an art form in its own right. Complex techniques such as authoring sync points, defining time signatures, and preserving the musical entry and exit points can now be specified from within the authoring application to create a complex fabric of composition created specifically for the medium of games. With such potential comes the ability to tailor the music to support gameplay and the player experience.

The first consideration when choosing an implementation strategy for a music system begins with matching the emotional scope and intent of the game with appropriate music. By nature, systems are adaptable and varied, but the basic thematic intent should create a seamless blend between the game and its implementation. Once the mood has been established, it's time to begin thinking about how to support gameplay and then how to shape compositional elements into building blocks that will become the emotional river running throughout the game.

This chapter will take you through the process of:

- Starting with the Interactive Music Hierarchy.
- Preparing the Content.
- The Horizontal Approach.
- The Vertical Approach.
- Switching Between Music Types.
- Defining Interactive Music Transitions.

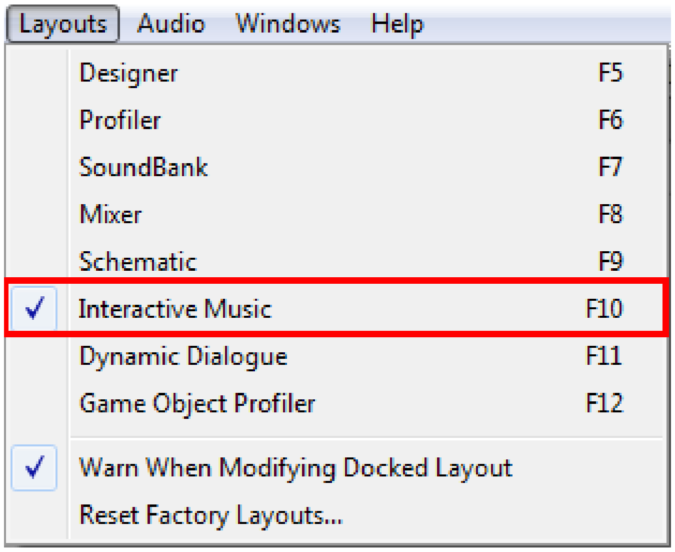
Starting With the Interactive Music Hierarchy

What is the Music Engine?

The music engine is the high-level engine that handles complex, high-level scheduling of music segments of the interactive music hierarchy. The fundamental difference between the Interactive Music and the Actor-Mixer hierarchies is the use of tempo and time signature to rule the behaviors of the different music containers.

Audio files added to the Interactive Music hierarchy are imported as Music Segments and can also be added as tracks within a music segment. Segments can then be added to Music Playlists Container or Music Switch Container in order to add additional functionality.

To view the music specific functionality of containers in the Interactive Music hierarchy, the Layout must be changed to Interactive Music.



Changing to the Interactive Music layout

Preparing the Content

Before beginning the integration of music content into the project, the content must first be prepared for the type of system that's going to be used. Throughout this section we'll walk through two ways of presenting dynamic music that will end up working together to provide an emotional backdrop to the hero's quest. By leveraging both a Horizontal approach (where the volume of time-synced music layers reacts to gameplay) and a Vertical approach (which adds diversity to a looping section of music through randomization) we'll create a simple music system that changes based on player interaction with the game.

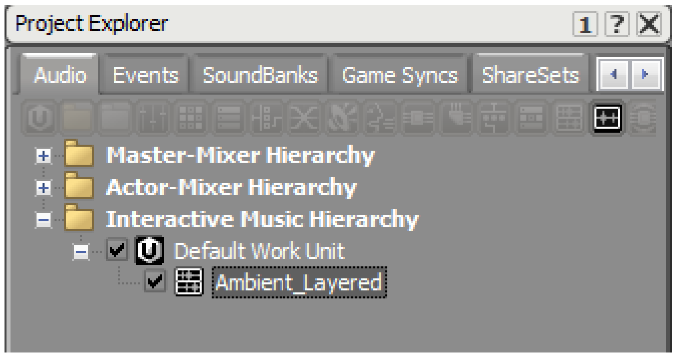
The Horizontal Approach

During a walk through the forest, the music helps to set a serious and foreboding tone as we quest to adventures unknown and dangers hidden just beyond sight. In an attempt to keep the music fresh, varied, and dynamic, the introduction of a horizontal layering approach modified based on the players proximity to danger will be instituted. This parameter is passed from the game engine based on the player distance to an enemy or location and is used to increase the musical intensity during gameplay.

The musical content for the horizontal implementation has been prepared as ten tracks of layered audio that is intended to play back in sync within a single music segment.

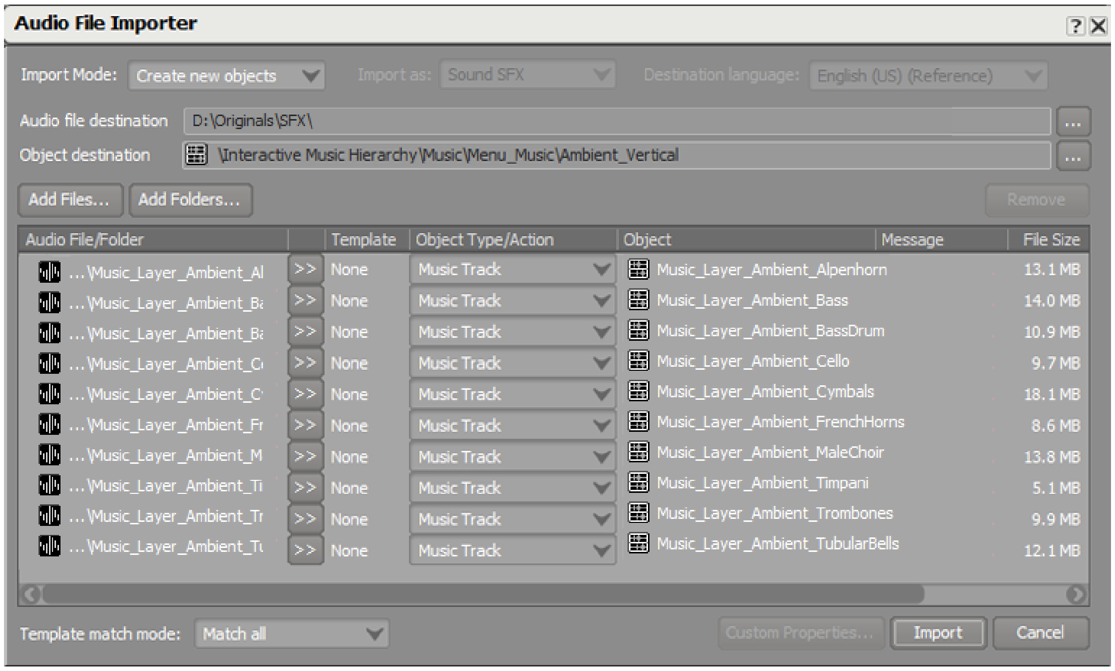
Creating the Ambient Music Segment

Adding a child Music Segment to the Default work unit in the Interactive Music hierarchy called Ambient_Horizontal will begin the process of establishing the ambient music system.



Creating the Ambient Horizontal segment for the horizontal music system

The music files can now be imported as tracks in the segment by either using the Audio File Importer for the segment or dragging and dropping it over the Music Segment.


Audio File Importer

Import Mode: Create new objects Import as: Sound SFX Destination language: English (US) (Reference)

Audio file destination: D:\Originals\SFX\

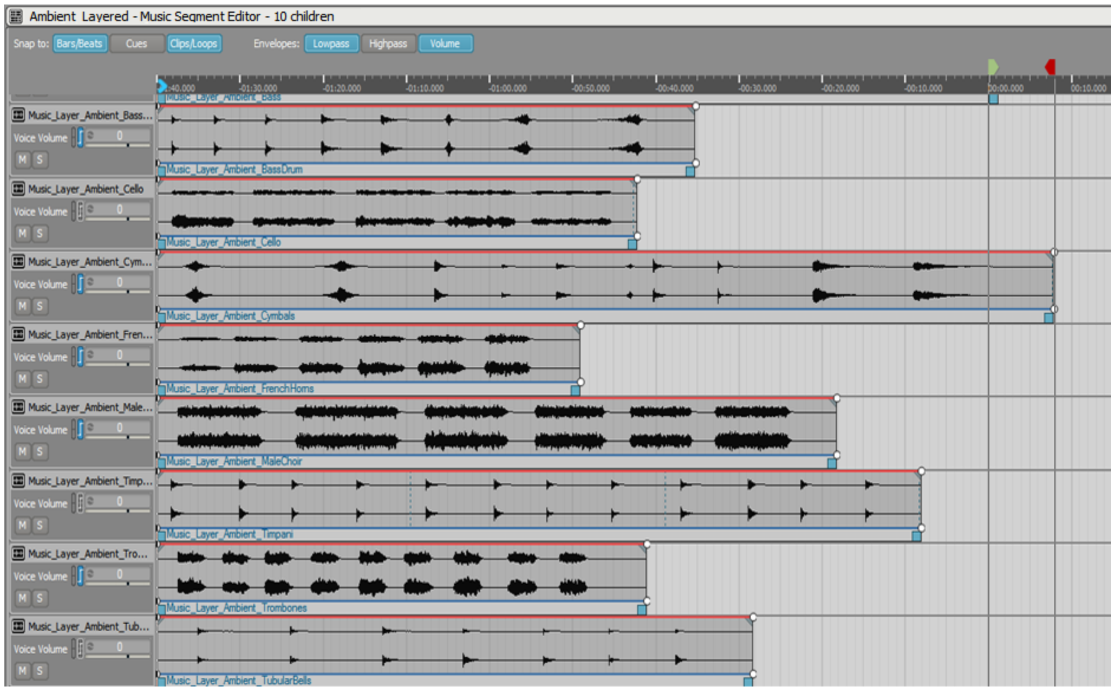
Object destination: \Interactive Music Hierarchy\Music\Menu_Music\Ambient_Vertical

Audio File/Folder		Template	Object Type/Action	Object	Message	File Size
...\Music_Layer_Ambient_Al	>>	None	Music Track	Music_Layer_Ambient_Alpenhorn		13.1 MB
...\Music_Layer_Ambient_Ba	>>	None	Music Track	Music_Layer_Ambient_Bass		14.0 MB
...\Music_Layer_Ambient_Ba	>>	None	Music Track	Music_Layer_Ambient_BassDrum		10.9 MB
...\Music_Layer_Ambient_Ce	>>	None	Music Track	Music_Layer_Ambient_Cello		9.7 MB
...\Music_Layer_Ambient_Cy	>>	None	Music Track	Music_Layer_Ambient_Cymbals		18.1 MB
...\Music_Layer_Ambient_Fr	>>	None	Music Track	Music_Layer_Ambient_FrenchHorns		8.6 MB
...\Music_Layer_Ambient_M	>>	None	Music Track	Music_Layer_Ambient_MaleChoir		13.8 MB
...\Music_Layer_Ambient_Ti	>>	None	Music Track	Music_Layer_Ambient_Timpani		5.1 MB
...\Music_Layer_Ambient_Tr	>>	None	Music Track	Music_Layer_Ambient_Trombones		9.9 MB
...\Music_Layer_Ambient_Tu	>>	None	Music Track	Music_Layer_Ambient_TubularBells		12.1 MB

Template match mode: Match all

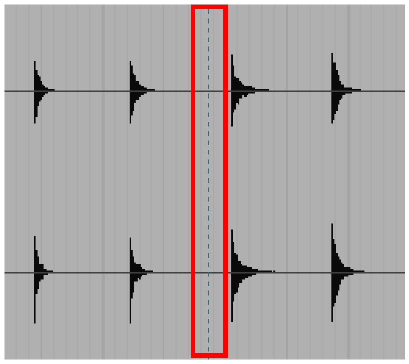
Importing Music Tracks to a segment using the Audio File Importer

Once files have been added as tracks to the segment, you can access them through the Music Segment Editor, where tracks can be arranged and edited within the Music Segment.


Ambient_Layered - Music Segment Editor - 10 children
Snap to: Bars/Beats Cues Clips/Loops
Envelopes: Lowpass Highpass Volume
Music_Layer_Ambient_Bass...
Music_Layer_Ambient_Cello
Music_Layer_Ambient_Cym...
Music_Layer_Ambient_Fren...
Music_Layer_Ambient_Male...
Music_Layer_Ambient_Timp...
Music_Layer_Ambient_Tro...
Music_Layer_Ambient_Tub...
Voice Volume
M S
Music_Layer_Ambient_BassDrum
Music_Layer_Ambient_Cello
Music_Layer_Ambient_Cymbals
Music_Layer_Ambient_FrenchHorns
Music_Layer_Ambient_MaleChoir
Music_Layer_Ambient_Timpani
Music_Layer_Ambient_Trombones
Music_Layer_Ambient_TubularBells

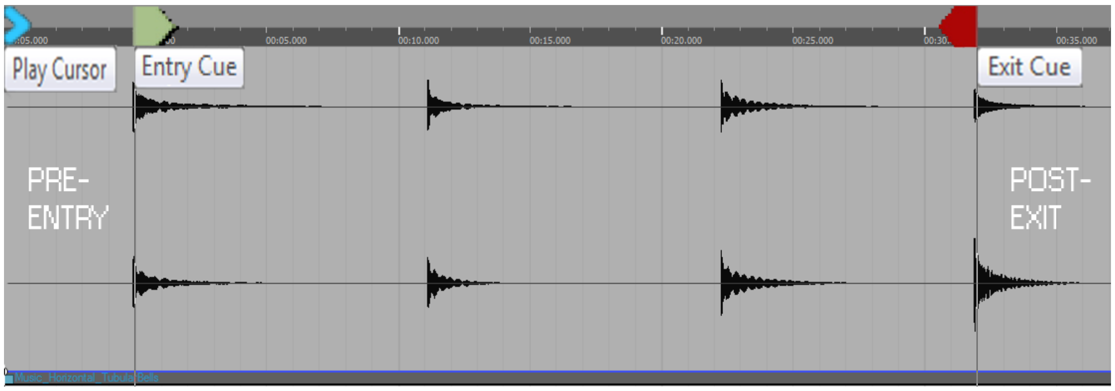
Editing tracks in the Music Segment Editor

The basic component of a track is called a clip, a rectangular area representing a single .wav file. You can adjust when a clip plays by dragging it left or right along its track. You can move clips from one track to another by dragging them up or down. You can also overlap clips on a single track. You can make a clip shorter by dragging one of its handles inwards, or extend it by dragging the handle outwards. When you extend a clip, it repeats itself. Each repeat is called a loop. Loop points can be identified by a vertical dashed line in the clip.



Loop points represented by a vertical dashed line in the clip

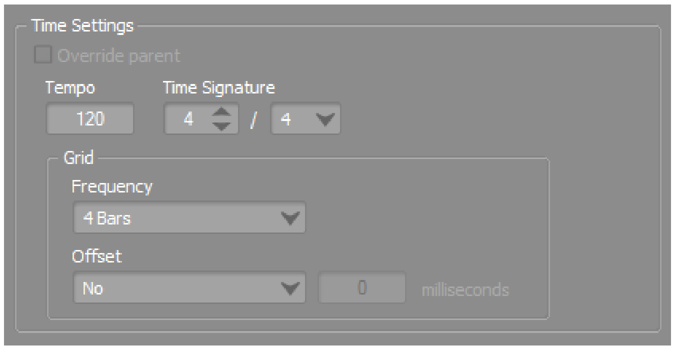
Cues and cursors are also part of the Music Segment Editor. Cues are markers appended to segments to indicate key points, such as its entry and exit points.



Adjusting Entry and Exit cues in the Music Segment Editor

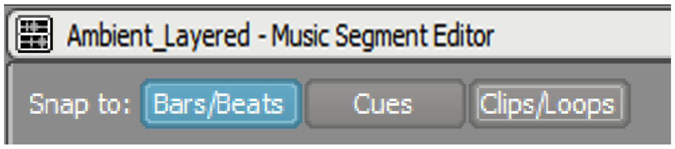
You can also create custom cues to indicate when property changes or transitions should occur, or when stingers should be played. The play cursor moves along as you play a segment, but you can also move it to control where playback begins. The end cursor marks the end of the segment.

The time settings for a segment, which is inherited by any tracks held within a segment, can be specified under the general settings tab. Segments can inherit the time settings of their parent containers, as well as override them for further timing control.


Time Settings
Override parent
Tempo: 120
Time Signature: 4 / 4
Grid
Frequency: 4 Bars
Offset: No 0 milliseconds

Settings for Tempo, Time Signature, or Grid based measurement

The tempo for this multi-layered music is 120 BPM with a 4/4 time signature. Once the time settings have been defined for a segment and its tracks, the ability to use the Snap to functionality in the Music Segment Editor gives a more precise level of control when adjusting clips, cursors, or cue markers.

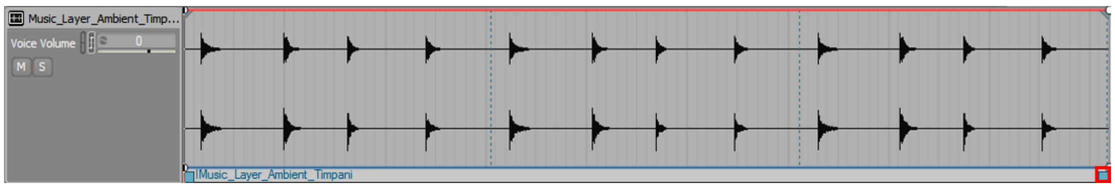

Ambient_Layered - Music Segment Editor

Setting the Snap to functionality in the Music Segment Editor

Grooming the Tracks

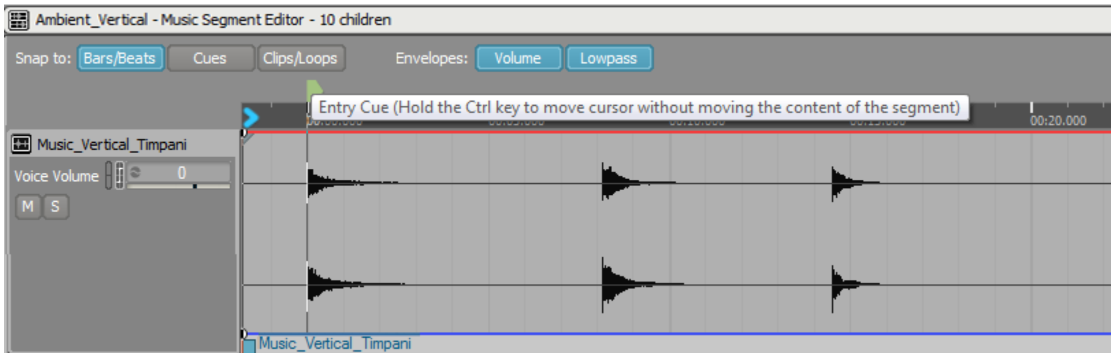
We can now add and adjust any cues or clip handles in order to prepare this ambient segment for use throughout the rest of the music system.

First, there are several percussion tracks (timpani, bass drum, and tubular bells) which can be extended (looped) to match the duration of the cymbals track. This can be accomplished by clicking and dragging on the blue clip handle at the bottom right of each track and matching the approximate length of the target track duration.



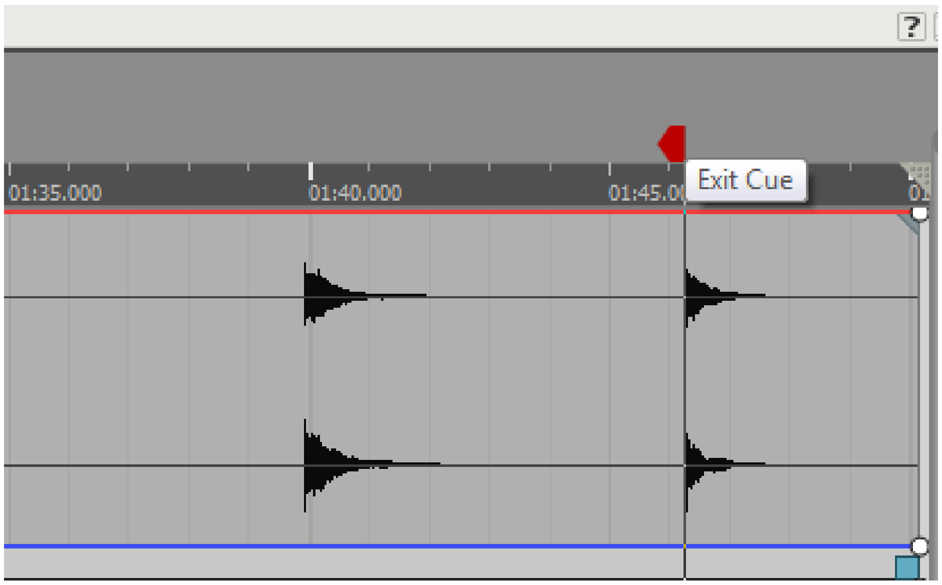
Using the clip handle to loop and extend the duration of a track

Next, adjust the entry cue to the first beat of the timpani by holding the Ctrl key and moving the cursor without moving the segment. This defines the entry cue of the segment and will ensure that any music transitioning to the ambient music segment will start on beat. The area to the left of the entry cue is the pre-entry area of a segment. The pre-entry area may or may not be played in game, depending on transition settings.


Ambient_Vertical - Music Segment Editor - 10 children
Snap to: Bars/Beats Cues Clips/Loops
Envelopes: Volume Lowpass
Entry Cue (Hold the Ctrl key to move cursor without moving the content of the segment)
00:20.000
Music_Vertical_Timpani
Voice Volume 0
M S
Music_Vertical_Timpani

Entry cue moved to the first beat of the timpani

Next, adjust the exit cue by dragging the exit cue cursor to the last beat of the timpani. This defines the exit cue of the segment. The area to the right of the exit cue is the post-exit area of a segment. The post-exit area may or may not be played in game, depending on transition settings.

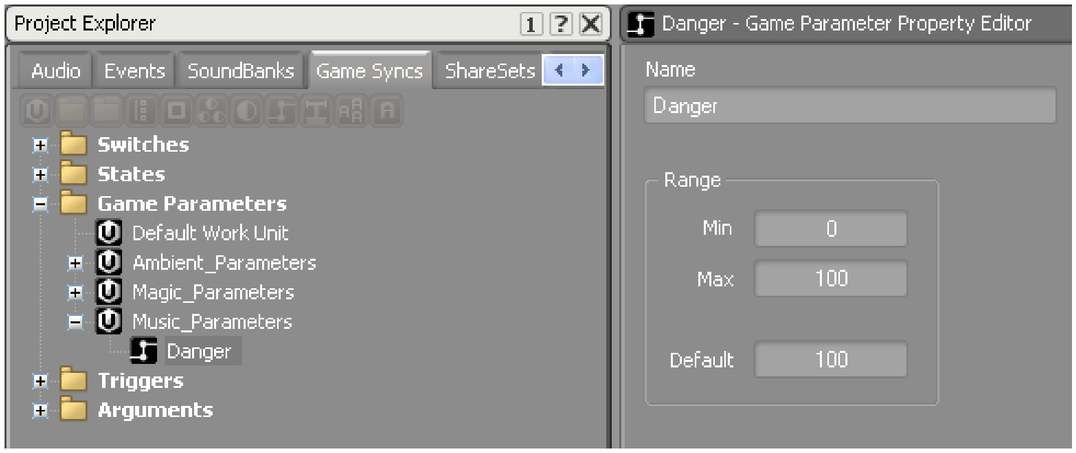


Positioning the exit cue

Dynamic Danger

Now that entry and exit points have been established and a final duration for the ambient music has been set, it's time to set up volume based dynamics driven by potential danger. While the implementation of danger on the game side might include a value attached to each deadly forest creature which would then be passed to the audio engine, this feature can be auditioned directly within the authoring application.

The process begins with the creation of a game parameter called Danger in the game syncs tab of the Project Explorer.



Name: Danger

Min: 0
Max: 100
Default: 100

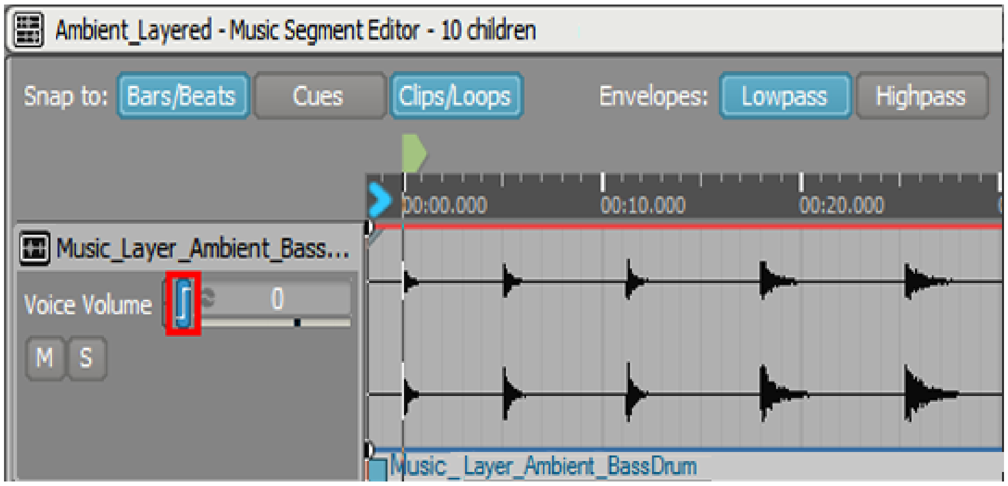
Creating a Danger parameter to be used by the ambient music system

The Danger parameter will be used in conjunction with a volume RTPC for several tracks in the ambient system. Additional track properties are also configurable using RTPC such as: States, Effects, and Positioning as well as setting different busses, priorities, and limiting.

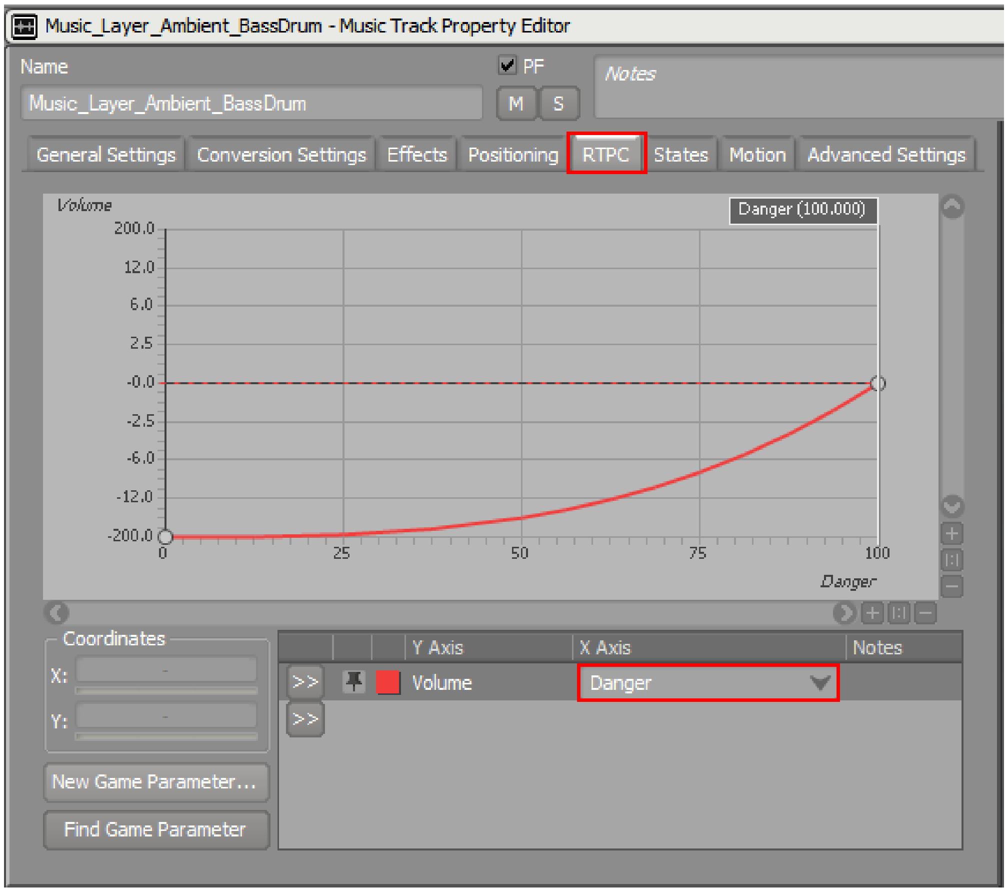
Adding RTPC to Tracks

The intention in the multi-layered ambient system is to drive intensity by using volume in conjunction with several key tracks within the segment, specifically: Bass Drum, Cymbals, French Horn, Male Choir, and Trombones.

Double clicking the RTPC icon for the Bass Drum track opens up the RTPC tab for the track, where volume can then be added and associated with the Danger game parameter.

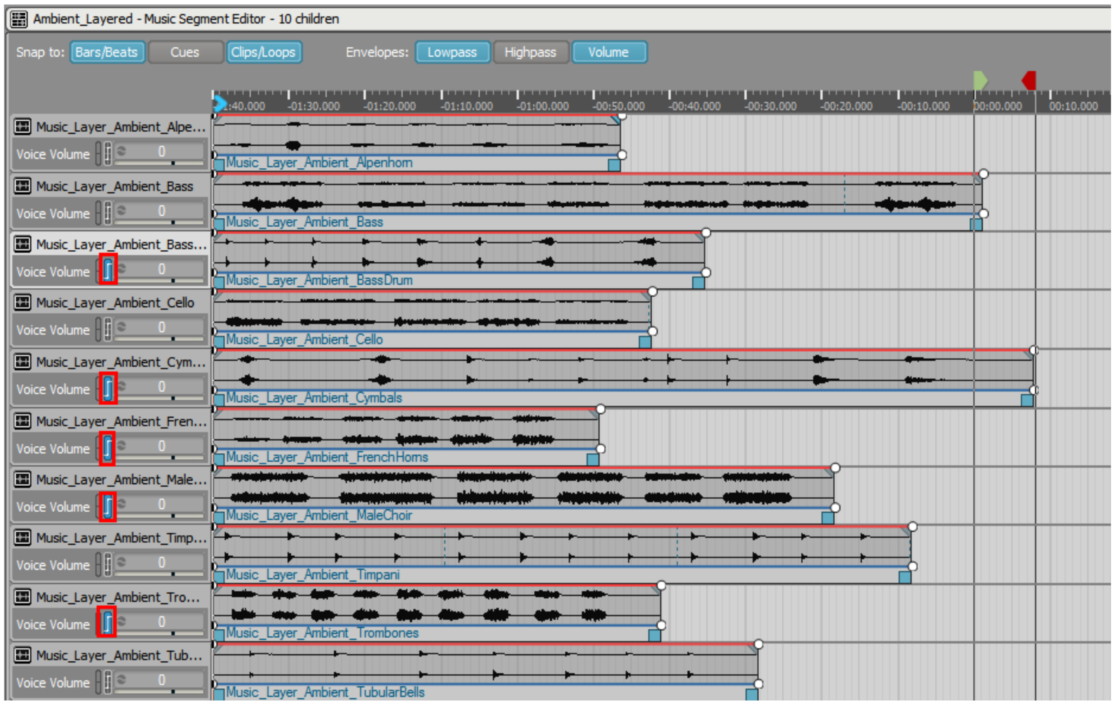

Ambient_Layered - Music Segment Editor - 10 children
Snap to:
Bars/Beats
Cues
Clips/Loops
Envelopes:
Lowpass
Highpass
00:00.000
00:10.000
00:20.000
Music_Layer_Ambient_Bass...
Voice Volume
0
M
S
Music_Layer_Ambient_BassDrum

Accessing the property editor via the RTPC icon



Adding volume adjustment in conjunction with the Danger game parameter for the Bass Drum track

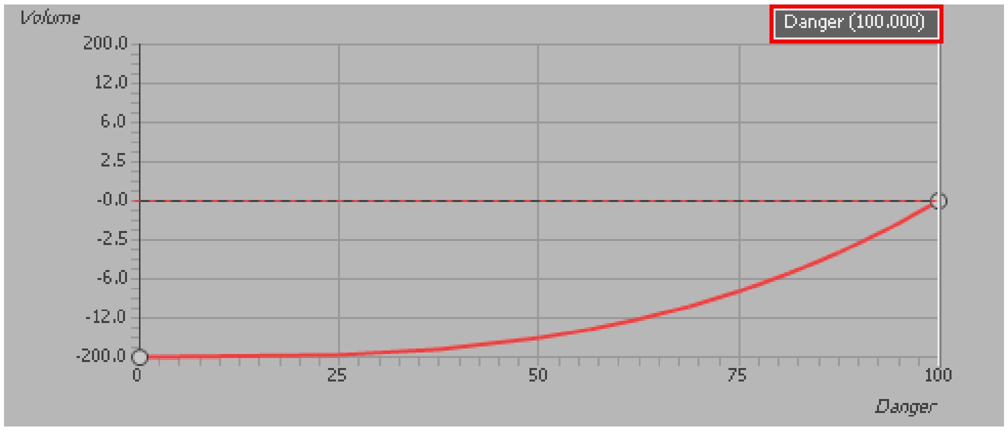
These same changes can be applied to additional tracks so that as the Danger parameter increases, additional instruments fade up and reveal layers of musical intensity.


Ambient_Layered - Music Segment Editor - 10 children
Snap to: Bars/Beats Cues Clips/Loops
Envelopes: Lowpass Highpass Volume
Music_Layer_Ambient_Alpe...
Music_Layer_Ambient_Bass
Music_Layer_Ambient_Bass...
Music_Layer_Ambient_Cello
Music_Layer_Ambient_Cym...
Music_Layer_Ambient_Fren...
Music_Layer_Ambient_Male...
Music_Layer_Ambient_Timp...
Music_Layer_Ambient_Tro...
Music_Layer_Ambient_Tub...
Voice Volume
Music_Layer_Ambient_Alpenhorn
Music_Layer_Ambient_Bass
Music_Layer_Ambient_BassDrum
Music_Layer_Ambient_Cello
Music_Layer_Ambient_Cymbals
Music_Layer_Ambient_FrenchHorns
Music_Layer_Ambient_MaleChoir
Music_Layer_Ambient_Timpani
Music_Layer_Ambient_Trombones
Music_Layer_Ambient_TubularBells

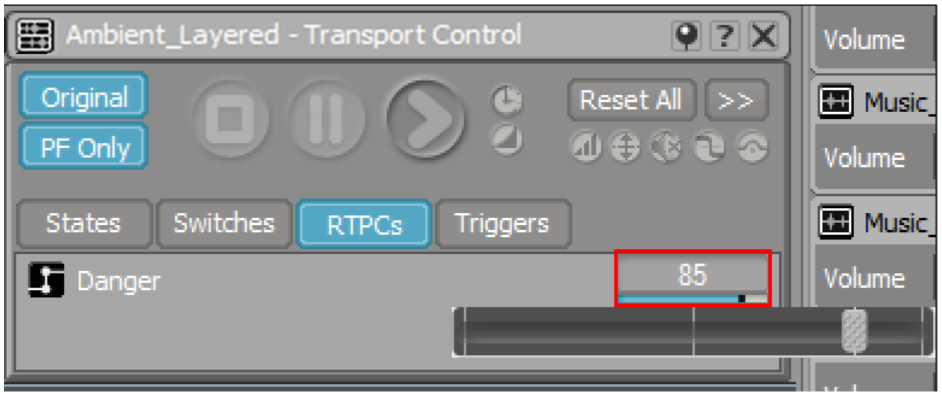
Completed ambient music system showing tracks with RTPC enabled

Auditioning RTPC

Auditioning changes can be done either using the game parameter cursor in the RTPC view or through the RTPC tab in the Transport Control.



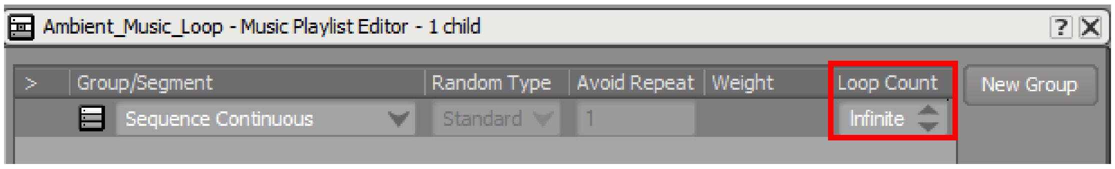
Auditioning RTPC with the game parameter cursor



Auditioning RTPC from the Transport Control

Looping a Music Segment

Looping a Music Segment within the Interactive-Music hierarchy can be done by parenting the segment in a playlist container and managing its looping properties within its group. Once it's been added, the properties for looping can be found in the default group loop count. Clicking the down arrow changes the loop count to infinite, ensuring that the group will continue to play the segment until it is stopped by the audio system.



Setting the loop count to infinite playback

Designer Note

Do not confuse looping segments with looping audio clips inside segments. An indepth look at the difference between approaches can be found in the Wwise Knowledge Base: Looping and streaming of audio clips and interactive music .

Section Summary

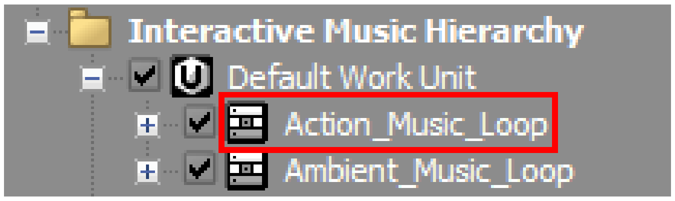
Throughout this section we have worked to create a dynamic loop of music that responds to the level of danger present in the game. Through the use of layering and real time parameter control, in conjunction with volume adjustment, this looping section of exploration music now reflects the hero's journey.

The Vertical Approach

With a dynamic horizontal system in place to handle music during the exploratory section of gameplay, there must also come a time when the battle begins. In the case of the triumphant hero, the vertical approach will increase intensity level through the use of an action specific piece of music. In order to introduce a bit of randomness into the loop, the action music will be broken into two sections with variations, and a bridging segment within the playlist. We'll build these within the Music Playlist Container using groups.

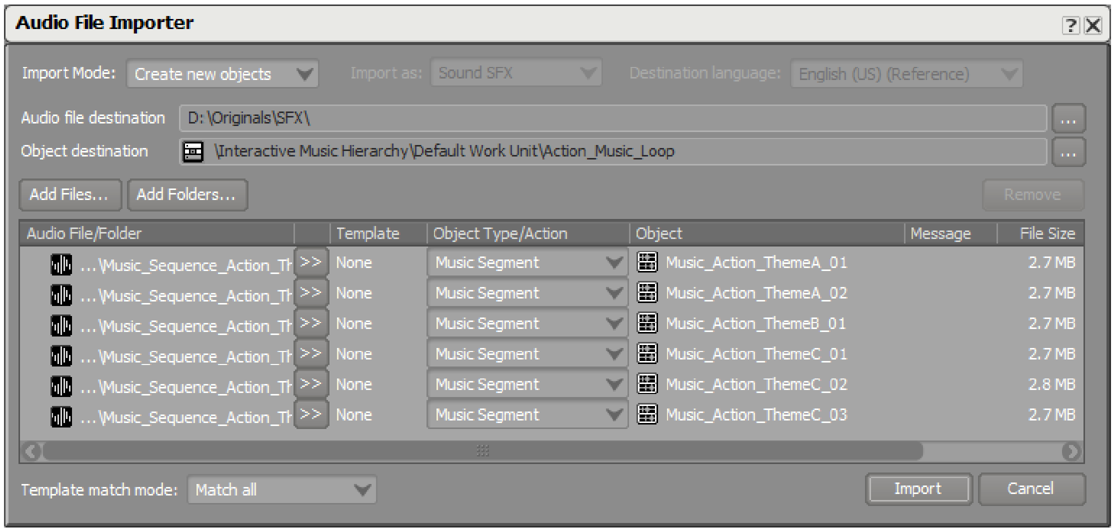
Groups and Behaviors

The first step in the process begins with the creation of a Music Playlist Container that will represent the looping action music in the system.



Creating the action music loop playlist

Next, import the wav files that will be used. By default these will be added to the Music Playlist Container as segments that can be further arranged within the Music Playlist Editor.



Audio File Importer

Import Mode: Create new objects   Import as: Sound SFX   Destination language: English (US) (Reference)

Audio file destination: D:\Originals\SFX\

Object destination: \Interactive Music Hierarchy\Default Work Unit\Action_Music_Loop

Audio File/Folder		Template	Object Type/Action	Object	Message	File Size
...\Music_Sequence_Action_Th	>>	None	Music Segment	Music_Action_ThemeA_01		2.7 MB
...\Music_Sequence_Action_Th	>>	None	Music Segment	Music_Action_ThemeA_02		2.7 MB
...\Music_Sequence_Action_Th	>>	None	Music Segment	Music_Action_ThemeB_01		2.7 MB
...\Music_Sequence_Action_Th	>>	None	Music Segment	Music_Action_ThemeC_01		2.7 MB
...\Music_Sequence_Action_Th	>>	None	Music Segment	Music_Action_ThemeC_02		2.8 MB
...\Music_Sequence_Action_Th	>>	None	Music Segment	Music_Action_ThemeC_03		2.7 MB

Template match mode: Match all

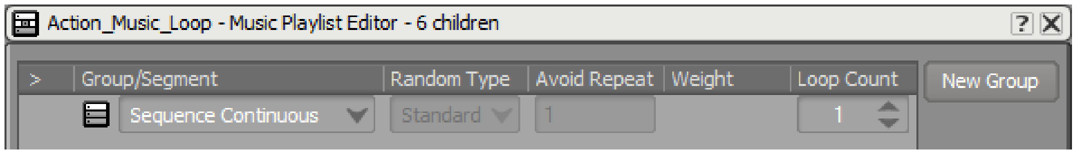
Adding the action music wav files to the Music Playlist Container

Now that action music segments have been added to the project, they need to be dragged and dropped into the Music Playlist Container. Once added, they can be assembled into groups for further arranging. The playlist determines which objects will be played in what order when the playlist container is called by the game engine.

The four types of groups and segments available are:

- **Sequence continuous**: Plays all music objects in the group in sequential order each time the group is played.
- **Sequence step**: Plays only one music object in the group each time the group is played. The next time the group is played, the next music object in the group is played.
- **Random continuous**: Plays all music objects in the group one after the other in random order each time the group is played.
- **Random step**: Plays only one music object in the group selected randomly each time the group is played.

Additional randomization types, weighting, and repetition variables can be accessed in the Music Playlist Editor.


Action_Music_Loop - Music Playlist Editor - 6 children

>	Group/Segment	Random Type	Avoid Repeat	Weight	Loop Count
	Sequence Continuous	Standard	1		1

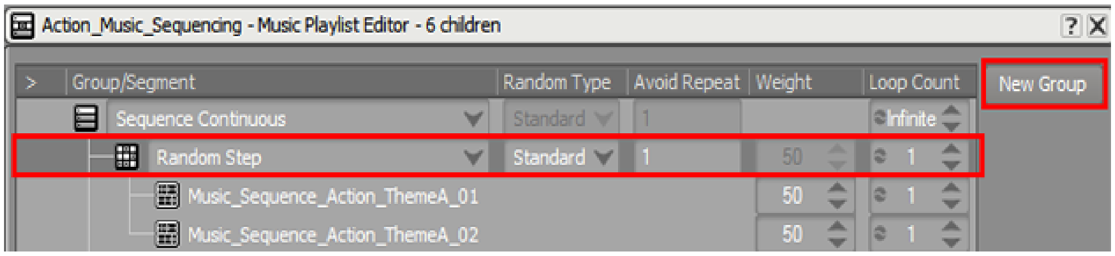
Variables for grouping segments and playback properties in the Music Playlist Editor

Sequencing Groups in the Music Playlist Editor

The action music files are broken into 3 different themes: A, B, C.

Themes can be arranged together by creating groups in the Music Playlist Container. In this case, taking the two Action Theme A variations, the only Action Theme B variation, and the three Action Theme C variations and sequencing them to create a varied action loop.

Start by creating a new group that will play as a random step and drag in the two Action Theme A variations.



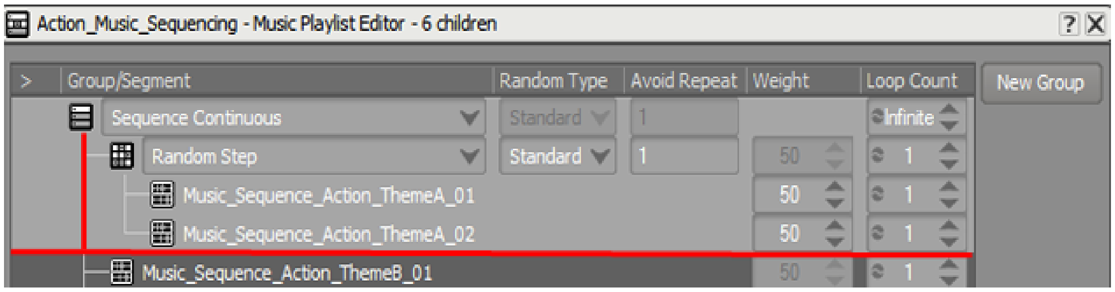
Action_Music_Sequencing - Music Playlist Editor - 6 children

New Group

> Group/Segment	Random Type	Avoid Repeat	Weight	Loop Count
Sequence Continuous	Standard	1		Infinite
Random Step	Standard	1	50	1
Music_Sequence_Action_ThemeA_01			50	1
Music_Sequence_Action_ThemeA_02			50	1

Creating a new continuous random group for Action Theme A

Next, use the Action Theme B segment as a bridge between the two randomized groups created with the Action Theme A and C segments. Action Theme B can be dragged in and positioned within the parent sequence continuous group using the red indicator as a guide to its positioning.



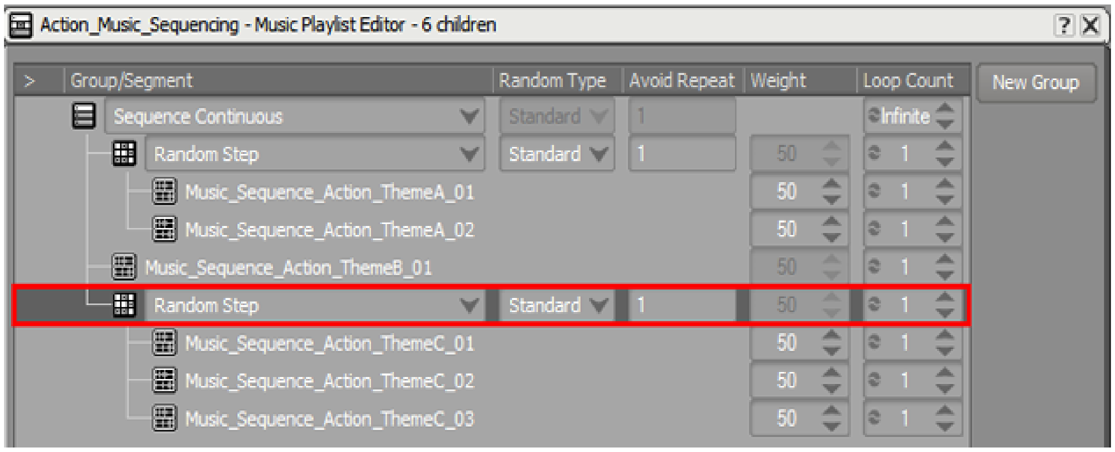
Action_Music_Sequencing - Music Playlist Editor - 6 children

New Group

> Group/Segment	Random Type	Avoid Repeat	Weight	Loop Count
Sequence Continuous	Standard	1		Infinite
Random Step	Standard	1	50	1
Music_Sequence_Action_ThemeA_01			50	1
Music_Sequence_Action_ThemeA_02			50	1
Music_Sequence_Action_ThemeB_01			50	1

Arranging Action Theme B in sequence with the Action Theme A random group

Finally, Action Theme C will play as a random step for one of the three variations within its own group.



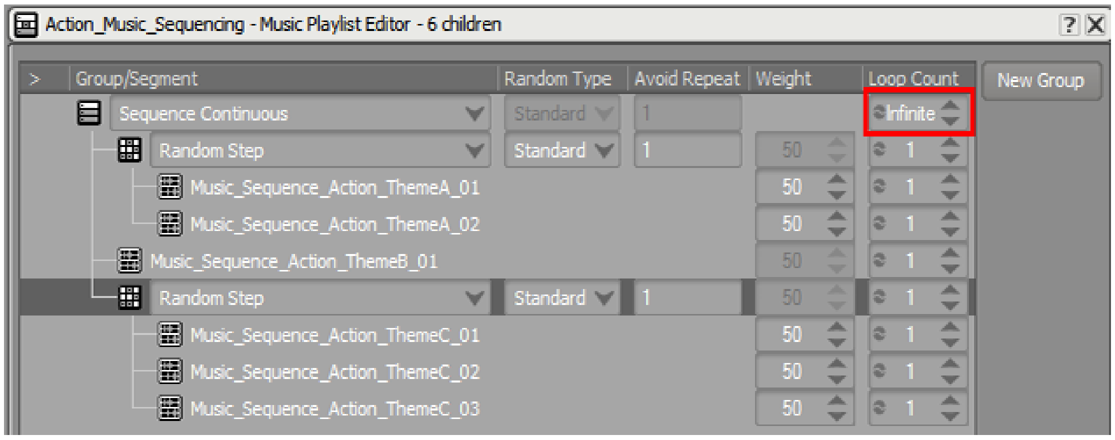
Action_Music_Sequencing - Music Playlist Editor - 6 children

New Group

> Group/Segment	Random Type	Avoid Repeat	Weight	Loop Count
Sequence Continuous	Standard	1		Infinite
Random Step	Standard	1	50	1
Music_Sequence_Action_ThemeA_01			50	1
Music_Sequence_Action_ThemeA_02			50	1
Music_Sequence_Action_ThemeB_01			50	1
Random Step	Standard	1	50	1
Music_Sequence_Action_ThemeC_01			50	1
Music_Sequence_Action_ThemeC_02			50	1
Music_Sequence_Action_ThemeC_03			50	1

Creating a new random step group for Action Theme C and arranging it in sequence

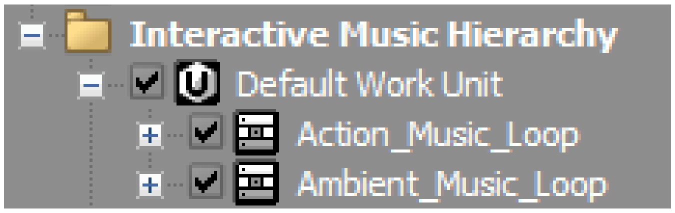
Setting the parent sequence container to loop count infinite will cause the sequence to repeat itself until a change is called by the audio engine.


Action_Music_Sequencing - Music Playlist Editor - 6 children

Group/Segment	Random Type	Avoid Repeat	Weight	Loop Count
Sequence Continuous	Standard	1		Infinite
Random Step	Standard	1	50	1
Music_Sequence_Action_ThemeA_01			50	1
Music_Sequence_Action_ThemeA_02			50	1
Music_Sequence_Action_ThemeB_01			50	1
Random Step	Standard	1	50	1
Music_Sequence_Action_ThemeC_01			50	1
Music_Sequence_Action_ThemeC_02			50	1
Music_Sequence_Action_ThemeC_03			50	1

Setting the playlist container loop count to Infinite

There should now be two playlists containers: one for ambient music and another for action music.


Interactive Music Hierarchy
Default Work Unit
Action_Music_Loop
Ambient_Music_Loop

Playlist containers for ambient and action music

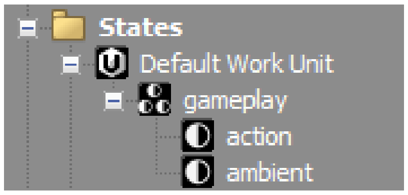
Section Summary

Here we have tackled the creation of looping action music that is randomly assembled using playlists of segments. The added sequencing of different segment types helps to give definition, progression, and drama to the unfolding music.

Using States to Switch Between Music Types

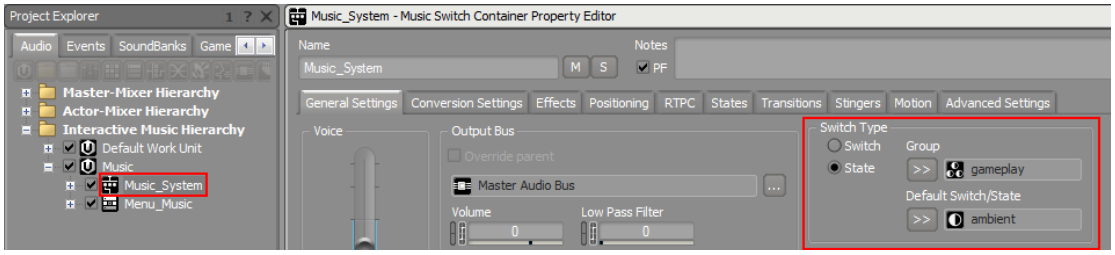
Now that different types of music have been established for different scenarios, the next step is to integrate them so they can react to changes in gameplay. This can be done by introducing States (or game states) that can be used to switch between music containers, in addition to affecting other aspects of sound or music.

The process of creating a music switching system begins by defining states that will be communicated from the game and used to switch between different types of music, in this case: action and ambient music. States represent changes in the game that affect the properties of existing sounds, music, or motion on a global scale. The music switch container operates on the same fundamental principal as the switch container in the Actor-Mixer hierarchy. The addition of time and tempo functionality allows for musical transitions when switching between containers.



Creating gameplay states to switch between music types

Parenting the already existing ambient and action music loop playlists in a music switch container allows for the application of the newly created gameplay state group.



Name: Music_System

Output Bus: Master Audio Bus

Volume: 0

Low Pass Filter: 0

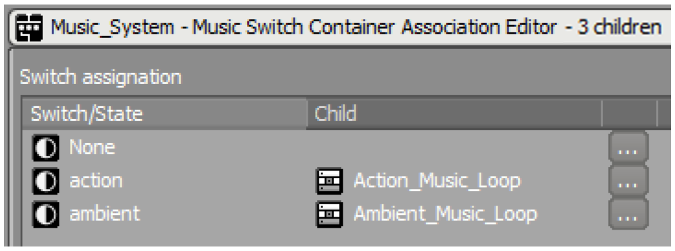
Switch Type: ○ Switch ● State

Group: gameplay

Default Switch/State: ambient

Creating a music switch container using the gameplay state with a default state of ambient

Music playlist containers can now be assigned to each of the states in the Music Switch Container Association Editor either by dragging and dropping them from the hierarchy or using the Selection button.



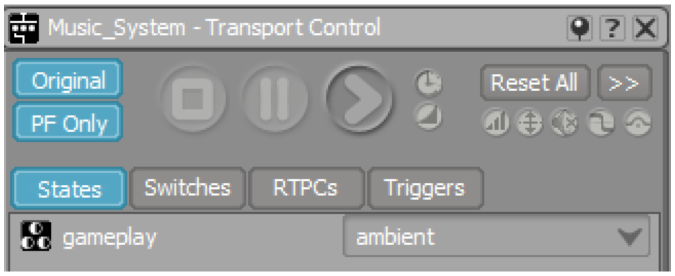
Music_System - Music Switch Container Association Editor - 3 children

Switch assignation

Switch/State	Child
None	
action	Action_Music_Loop
ambient	Ambient_Music_Loop

Assigning music playlist containers to states in the music switch container association editor

Now that the simple assignment of music playlist containers to states has been established, the default transition between music types can be auditioned via states in the transport control.



gameplay: ambient

Auditioning music changes based on states

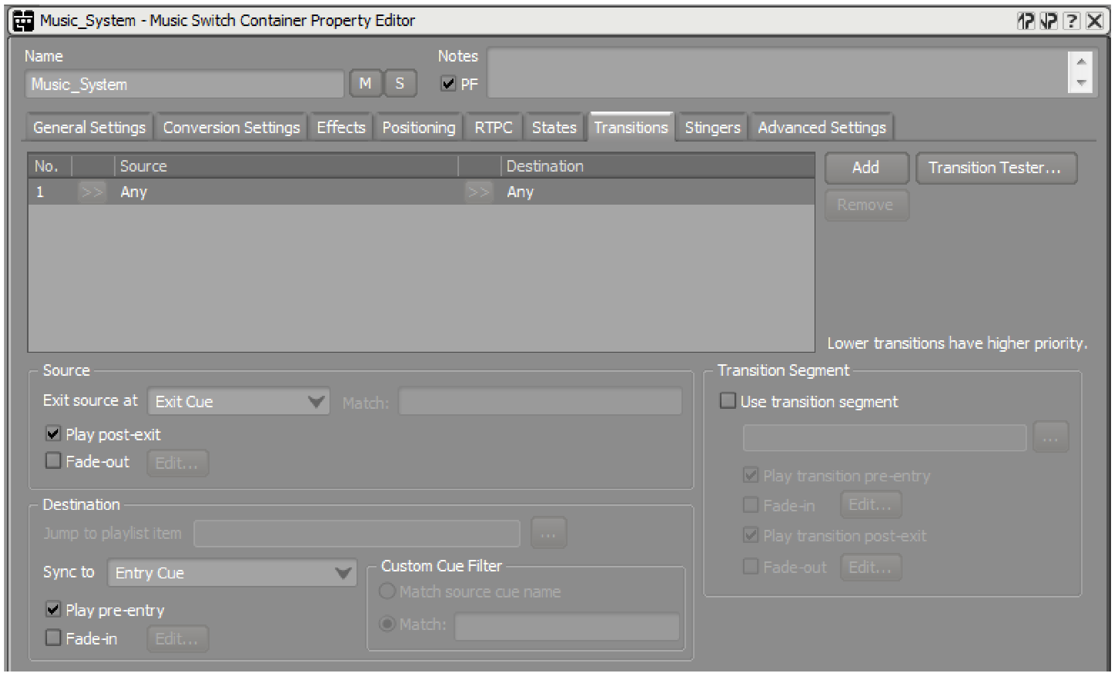
Defining Interactive Music Transitions

In order to gain more control over the way music segments and music playlist containers transition, the music switch container provides the ability to author specific transition behavior.

The Transitions tab is where you define the transitions between music objects within either music playlist or music switch containers. A transition is a musical behavior you can define to be used when switching from the music object currently playing to another. Each transition has a source and a destination. An additional segment, called a transition segment, can be used as a musical bridge between the source and destination.

The Transitions tab contains the Transition Matrix, which allows you to create a set of rules that define how each object transitions to every other object within the container. You can create explicit rules for each object, or more general rules that apply to more than one object. The default Any to Any transition rule applies to all remaining undefined transitions.

The list of transitions is displayed in the Transitions tab in descending order. When a transition is needed, Wwise begins searching at the bottom of the list until it finds one that applies to the situation at hand. If no matching transition is found, Wwise uses the default Any to Any transition.



Name: Music_System

No.	Source	Destination
1	Any	Any

Lower transitions have higher priority.

Source: Exit source at: Exit Cue; [✓] Play post-exit; [ ] Fade-out

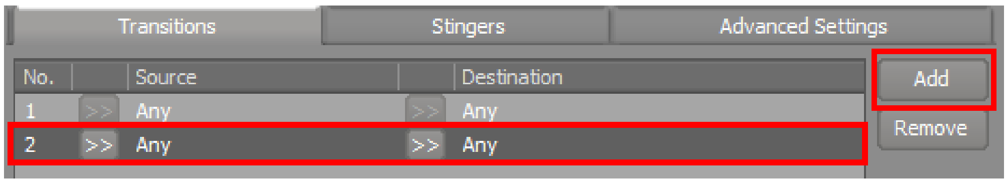
Destination: Sync to: Entry Cue; [✓] Play pre-entry; [ ] Fade-in

The Transitions tab and Transition Matrix

Authoring Transitions

We'll begin by adding explicit transition segments in order to move musically from the ambient loop, to the action loop, and back again. This can be accomplished by adding a new transition to the transition matrix and defining its behavior, starting with the transition from the Ambient Music Loop playlist to the Action Music Loop playlist.

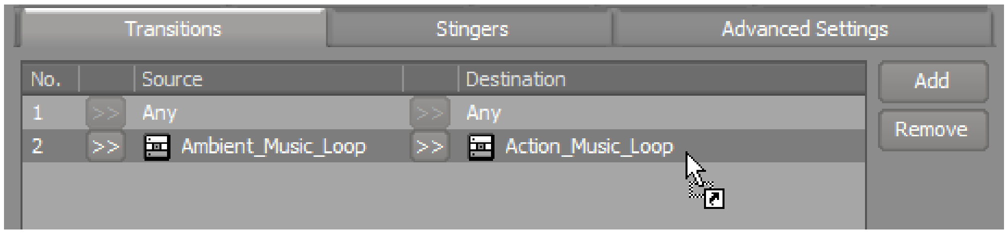
First add a new transition using the Add button.



No.		Source		Destination
1	>>	Any	>>	Any
2	>>	Any	>>	Any

Adding a new transition to the transition matrix

Next drag and drop the source and destination music objects, in this case the Ambient Music Loop playlist (Source) and the Action Music Loop playlist (Destination).



No.		Source		Destination
1	>>	Any	>>	Any
2	>>	Ambient_Music_Loop	>>	Action_Music_Loop

Dragging and Dropping music objects to the transition matrix

Defining Transition Behavior

Transition behavior between the source and destination can now be authored, specifically: exiting the source, entering the destination, and the specifying of any transitional segment.

By default, a transition is a simple change from one music object to another. The real power of transitions appears when you customize the source and destination to make a unique musical passage. By setting source and destination properties, you can make a transition between objects sound both smooth and musical.

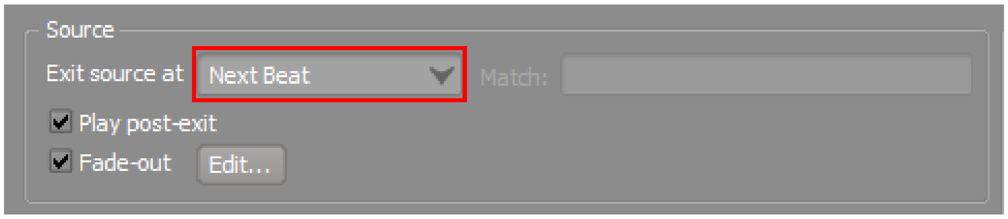
To give you additional control and flexibility over the transitions between objects, you can choose from a number of different exit and entry points for the source and destination respectively.

There are many potential options associated with exiting the source:

- **Immediate**: The source stops playing immediately.
- **Next Grid**: The source stops playing at the next grid interval. The grid is an arbitrary method by which music objects can be virtually partitioned.
- **Next Bar**: The source stops playing at the next bar.
- **Next Beat**: The source stops playing at the next beat.
- **Next Cue**: The source stops playing at the next cue, whether it be a custom cue or the exit cue.
- **Next Custom Cue**: The source stops playing at the next custom cue. If the current music segment doesn't contain a custom cue, Wwise continues to the next segment until it finds a custom cue.
- **Exit Cue**: The source stops playing at the exit cue.

Transitioning from Ambient to Action Music

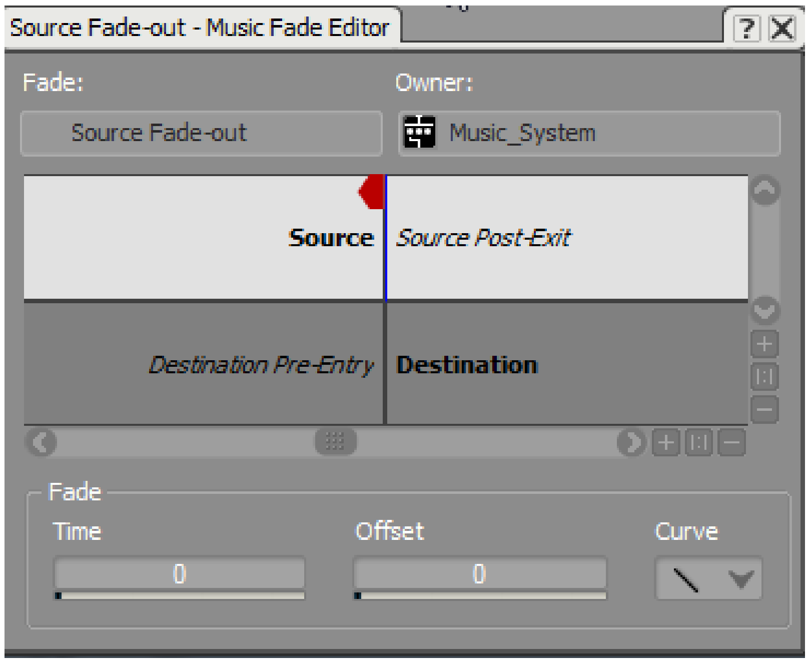
Transitioning at the next beat will suit the purpose of moving quickly from ambient to action music and so specifying Next Beat in the Exit Source window will accomplish this.


Source
Exit source at: Next Beat
Match:
☑ Play post-exit
☑ Fade-out

Defining the source exit source

By default the source transition is set to play the post-exit of the source during the transition, however, the post-exit of a source will only play if that source exits at its exit cue, or fades out at or beyond its exit cue. Otherwise, the post-exit will never play during a transition.

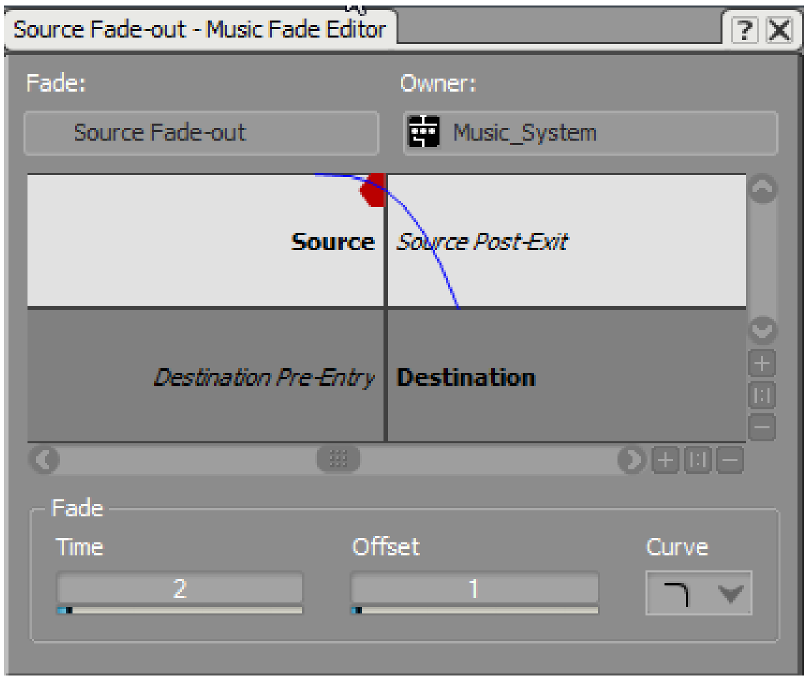
In this transition we also want to end playing with a fade-out. This can be accomplished by selecting Fade-out and pressing edit to enter the Music Fade Editor.



Adding a source fade-out in the music fade editor

The Music Fade Editor is where you can define the properties of each individual fade used when transitioning from one music object to another. This includes fade-ins for destination objects, fade-outs for source objects, and fade-ins and fade-outs for transition segments. You can define the length and offset of each fade, as well as the curve shape to further customize the transition.

For the example, it has been determined that a two second fade with a one second offset using a steep convex curve will allow the ambient music to fade quickly out and sound natural as it transitions to the action music playlist.


Source Fade-out - Music Fade Editor

Fade: Source Fade-out

Owner: Music_System

Fade

Time: 2

Offset: 1

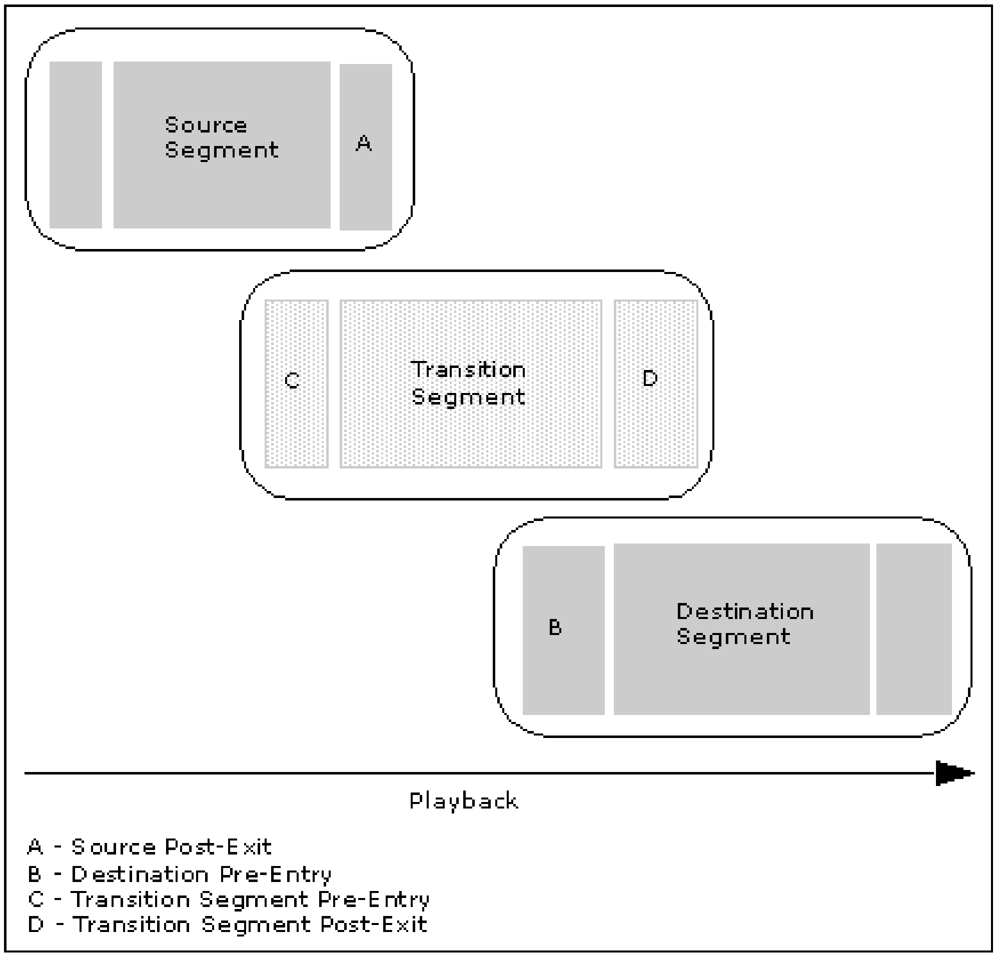
Specifying the fade settings for the ambient to action music transition

Auditioning the transitions can be done in the same way as outlined previously.

Transitioning from Action to Ambient Music

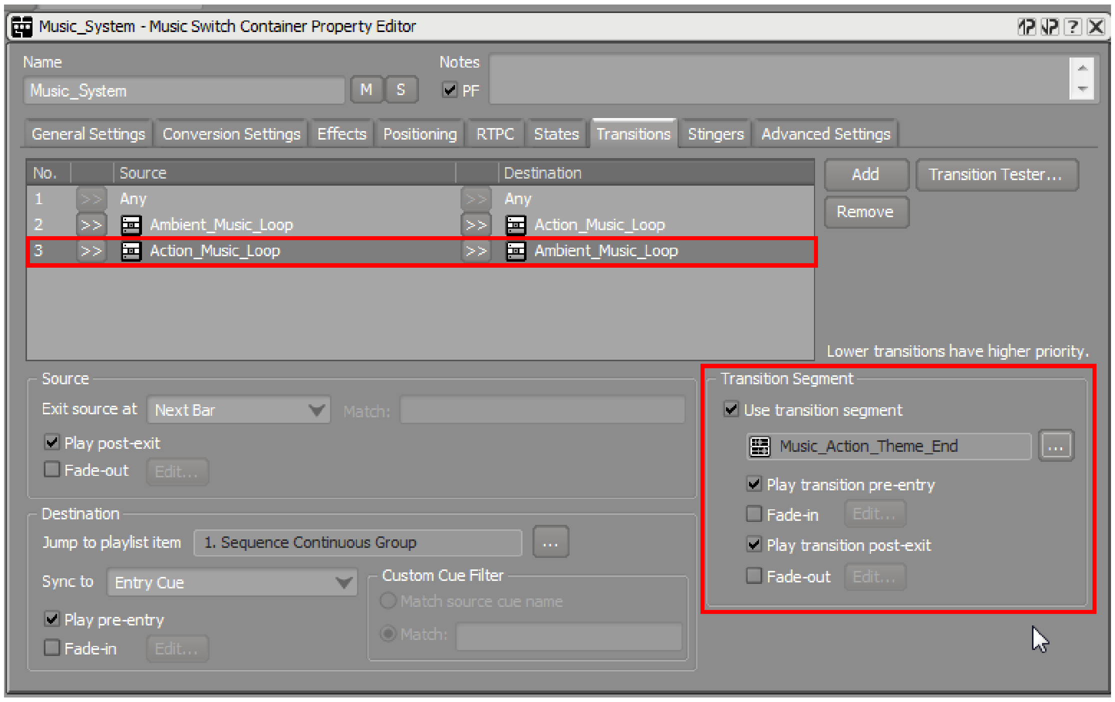
Handling the transition from the action music to ambient requires special handling because of the looping nature of the action playlist, and also in order to capitalize on the dramatic intent signaled by the end of the action music.

At times, a transition sounds better if another piece of music plays over the end of the source and the beginning of the destination. This bridging piece of music is called a transition segment, and you can use one for any transition in Wwise. The following illustration shows how a transition segment is played between the source and destination of a music transition.


Source Segment
A
C
Transition Segment
D
B
Destination Segment
Playback
A - Source Post-Exit
B - Destination Pre-Entry
C - Transition Segment Pre-Entry
D - Transition Segment Post-Exit

You can also use any combination of the pre-entry and post exit areas of the source, destination, and transition segments to create even more seamless transitions.

In order to bridge the transition from the Action Music Loop playlist (Source) back to the Ambient Music Loop playlist (Destination) the addition of the Action Theme End must be used as a transition segment as part of a new transition in the transition matrix.



Music_System - Music Switch Container Property Editor

Name: Music_System

Notes

☑ PF

General Settings | Conversion Settings | Effects | Positioning | RTPC | States | Transitions | Stingers | Advanced Settings

No.	Source	Destination
1	Any	Any
2	Ambient_Music_Loop	Action_Music_Loop
3	Action_Music_Loop	Ambient_Music_Loop

Lower transitions have higher priority.

Source

Exit source at: Next Bar

☑ Play post-exit

☐ Fade-out

Destination

Jump to playlist item: 1. Sequence Continuous Group

Sync to: Entry Cue

☑ Play pre-entry

☐ Fade-in

Custom Cue Filter

Match source cue name

Match:

Transition Segment

☑ Use transition segment

Music_Action_Theme_End

☑ Play transition pre-entry

☐ Fade-in

☑ Play transition post-exit

☐ Fade-out

Specifying a transition segment between the Action Music Loop playlist (Source) and the Ambient Music Loop playlist (Destination)

Section Summary

Handling the delicate relationship and transitioning between music playlist containers and segments is one of the cornerstones of providing a seamless musical experience to the player. With the introduction of switching based on game state and the inclusion of a transition segment serving as a bridge between action and ambient loops, the music is allowed to naturally progress and respond to the game.

Music Summary

This chapter illustrates a very simple state based music system that operates both horizontally and vertically, based on intensity, and vertically, based on game state. The use of tempo based transitions helps keep the music in-sync across state changes, while the amount of Danger dynamically controls the volume of different ambient music tracks. The combination of these techniques results in a musical soundtrack that is customized to the player's experience.

Throughout this chapter we have:

- Discussed the role of interactive and dynamic music in games.
- Discussed the use of different types of implementation strategies.
- Talked about preparing music content for integration.
- Compared the Interactive Music hierarchy with the Actor Music hierarchy.
- Established the use of music segments, music playlist containers, and music switch containers.

Stepped through the process of:

- Creating a music implementation based on the Horizontal Approach using RTPC to control the dynamics of the ambient music:
  - Creating music segments.
  - Adjusting track lengths.
  - Looping music tracks.
  - Adding music segments to music playlist containers.
  - Looping a playlist.
  - Creating game parameters.
  - Modifying music track volume based on RTPC.
- Creating a music implementation based on the Vertical Approach using a playlist to randomly recombine action music segments.
- Switching between music based on state:
  - Defining the transition matrix between source and destination.
  - Defining transition behavior.
  - Setting variables for exiting a source.
  - Using the music fade editor.
  - Defining a transition segment.

We've also touched on:

- Working in the Interactive Music Layout.

Throughout this section we have created the following objects:

- A music system switch container that switches between ambient and action music based on game state.

- A looping ambient music playlist container which includes an ambient music segment and ten tracks of music with volume RTPC based on the danger game parameter.
- A game parameter used to simulate danger.
- A playlist container which includes music segments that are randomized to create a seamless loop of action music.
- An action music theme ending used as a transition segment when switching from the action to ambient state.

Music Additional Resources

Wwise Knowledge Base - Advanced settings playback limits and interactive music

Wwise Knowledge Base - Looping and streaming of audio clips and interactive music

Wwise Knowledge Base - Understanding the Interactive Music Engine

Wwise Knowledge Base - Interleaved Streaming in Interactive Music

Wwise Knowledge Base - Using States with the Interactive Music Hierarchy

Video Tutorial - Creating Interactive Music Structures

Video Tutorial - Defining Interactive Music Transitions

Video Tutorial - Creating Stingers

Game Sound Design - Making Music Interactive: Elaboration of the Feature Set in Wwise

Game Sound Design - Dynamic Music Creation Using Wwise

Chapter 8. Adventures in MIDI

Overview

The hero lies in wait for the winds of change to blow their favorable tidings across the wind-swept field of battle. He seeks knowledge from the oracle, the all-knowing eye of history, brimming with stories of the old days - tales of long-forgotten alchemy and strategies that could help reclaim his position as the rightful heir to the throne. Equipped with an understanding of these ancient ways, there can be no failure- he has the tools at hand and the power of the past to create the ultimate good.

A comprehensive pipeline to utilize MIDI (Musical Instrument Digital Interface) in conjunction with synthesis and sound samples is a powerful combination. The standardized MIDI format is at the heart of every modern DAW (Digital Audio Workstation) and serves as an interoperable format that communicates note, velocity, and other control information for playback. This data can be mapped to sound samples or synthesizers within Wwise to create efficient workflows for music or sound design. The power and flexibility of MIDI is well documented as part of a DAW workflow and the benefit of this format is available within Wwise.

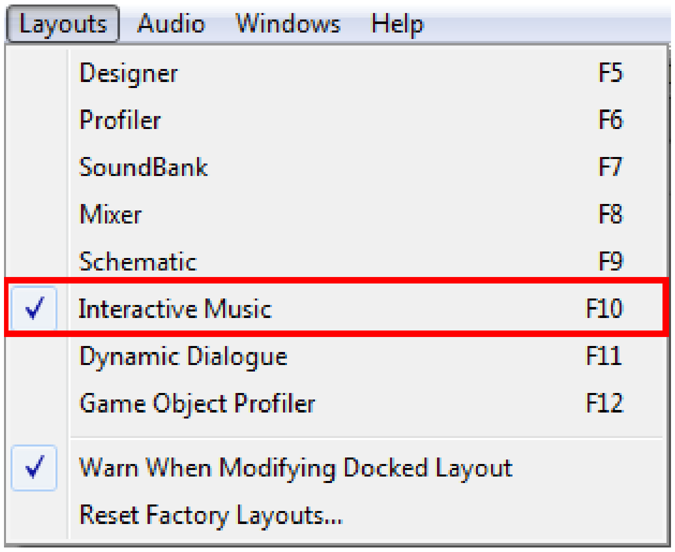
This chapter will take you through the process of:

- Importing MIDI Files
- Adding MIDI Files to a Music Track
- Making Modifications to the MIDI Target
- Adjusting the MIDI Clip Tempo
- Understanding Wwise Synth One - Features & Functionality

Importing MIDI Files

Importing MIDI files can be achieved using the same processes outlined in Chapter 1 (Setting the Ambient Stage: Building the Foundation - Importing Audio Files). MIDI files added to the Interactive Music hierarchy are imported as Music Segments and can also be added as tracks within any existing music segment. The MIDI file includes all of the messages that specify notation, pitch, velocity, and other control information. After the MIDI file has been established in the Wwise Project, it can be replaced or edited like any audio file.

To view the music specific functionality of containers in the Interactive Music hierarchy, you need to switch to the Interactive Music layout.

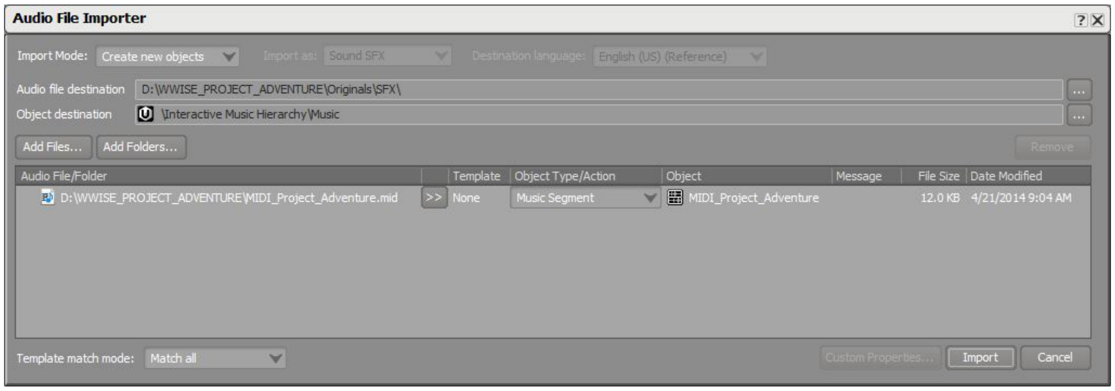


Switching to the Interactive Music Layout

MIDI Files can be imported in any of the following configurations:

- One MIDI file containing all tracks, with each track assigned to a unique MIDI Channel (1-16)
- One MIDI file for each track, with each track assigned to a unique MIDI Channel (1-16)
- One MIDI file for each track, with each track assigned to the same MIDI Channel (1)

MIDI files can be imported as Music Segments or as tracks within an existing Music Segment by either using the Audio File Importer or by dragging and dropping them into the Interactive Music Hierarchy. After files have been added as tracks to the segment, they can be accessed through the Music Segment Editor like any other music track.



Audio File Importer

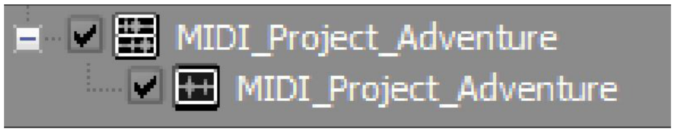
Import Mode: Create new objects
Import as: Sound SFX
Destination language: English (US) (Reference)
Audio file destination: D:\WWISE_PROJECT_ADVENTURE\Originals\SFX\
Object destination: \Interactive Music Hierarchy\Music

Audio File/Folder		Template	Object Type/Action	Object	Message	File Size	Date Modified
D:\WWISE_PROJECT_ADVENTURE\MIDI_Project_Adventure.mid	>>	None	Music Segment	MIDI_Project_Adventure		12.0 KB	4/21/2014 9:04 AM

Template match mode: Match all

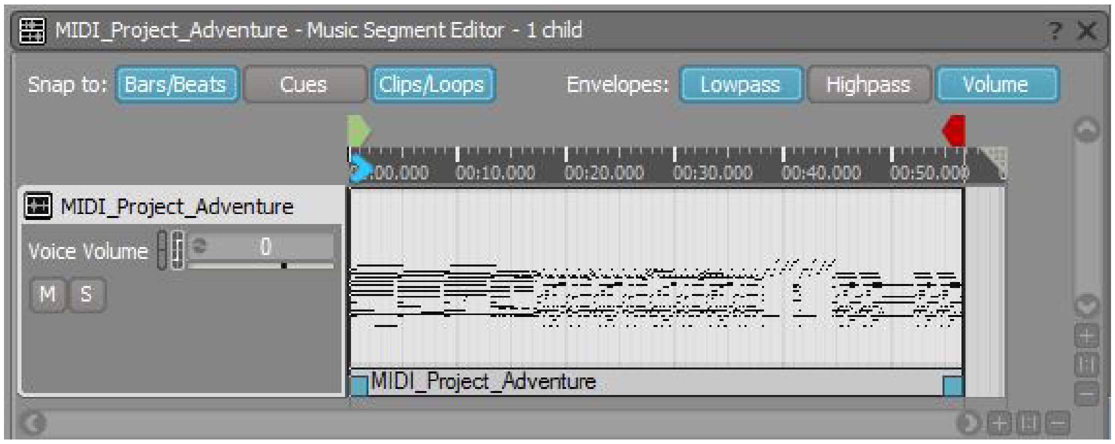
The Audio File Importer showing a single MIDI file to be imported as a Music Segment

Alternately, you can drag and drop MIDI files from folders directly into the Wwise Interactive Music Hierarchy.



Imported MIDI_Project_Adventure .mid file

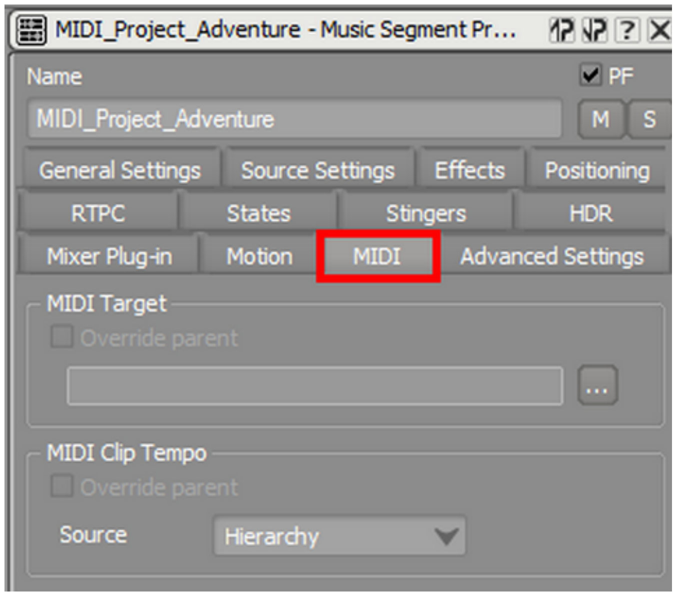
After MIDI files have been added as tracks to the segment, you can access them through the Music Segment Editor, where any combination of audio and MIDI tracks can be arranged and edited within the Music Segment.



Editing tracks in the Music Segment Editor

MIDI Tracks within a Music Segment exhibit the same behavior and functionality as an audio file, with one exception: audio properties are not modifiable in the Music Segment. Since MIDI is a data representation only, the audio properties are a part of the MIDI Target or "Instrument".

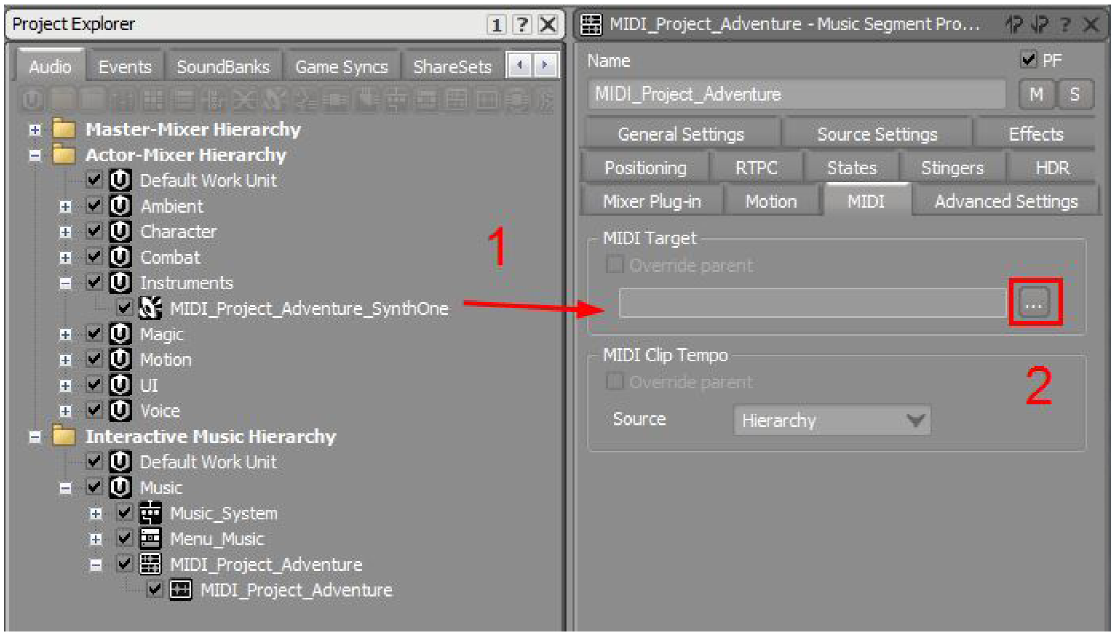
The MIDI Target and MIDI Clip Tempo can be defined for either the Music Segment (Parent) or Music Track (Child) in the MIDI tab in the Music Segment Property Editor or Music Track Editor.



The MIDI tab in the Music Segment Property Editor

The MIDI Target is specified as the Sound Object through which all MIDI events are routed. This property can target a specific Sound Object or a Blend Container including multiple Sound Objects, each with their own individual MIDI properties.

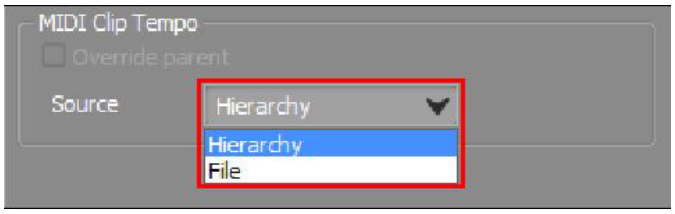
The MIDI Target can be assigned to a Music Segment or Music Track by navigating to a Sound Object through the Project Explorer - Browser or by dragging and dropping a Sound Object from the Actor-Mixer Hierarchy onto the MIDI Target field.



Assigning the MIDI Target using drag and drop (1) or using the Project Explorer - Browser (2)

A MIDI Clip can use either the Tempo specified in the MIDI file to control its tempo or it can use the tempo set for the Music Segment.

The MIDI Clip Tempo can either use tempo information from the General Settings tempo specifications for the Music Track hierarchy or tempo from the (MIDI) file.



Assigning the MIDI Clip Tempo Source

There are some caveats to using MIDI Clip tempo information within the Wwise Music System:

- Transition scheduling between segments is always done using the tempo set for the segment and is never influenced by tempo events indicated in the MIDI clips/files.
- Triggers are scheduled to play on the beat, bar, grid of the music segment and not based on the tempo of the MIDI clips/files.
- MIDI files/clips can be exported with one or more tempo changes and, if the option 'file' is selected, the clip will listen to these tempo changes to play back the MIDI notes and CC on time.

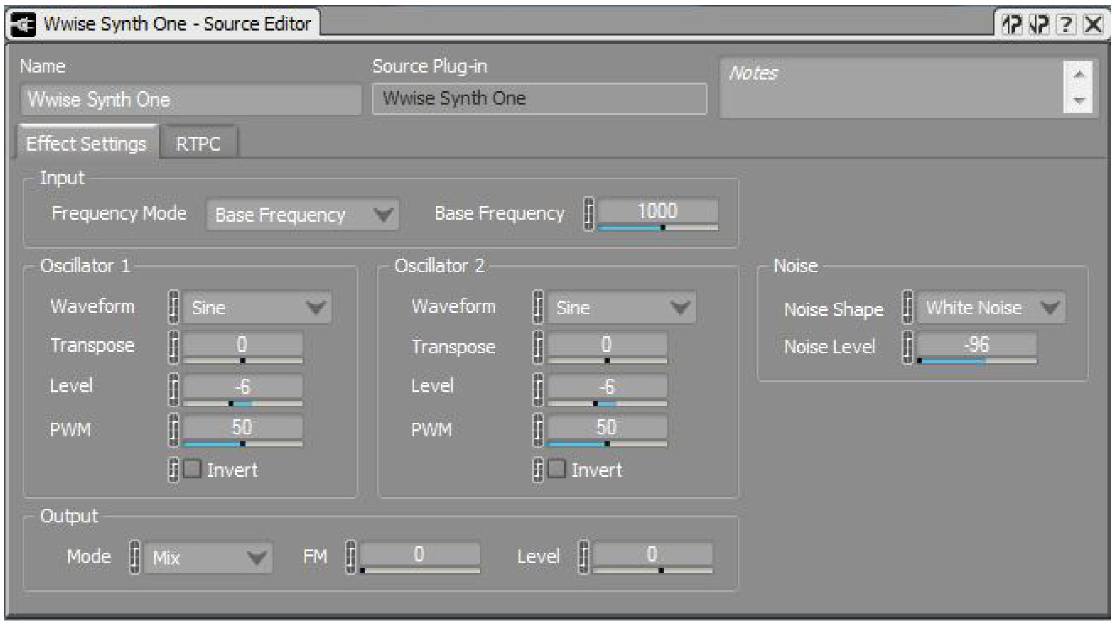
- These MIDI file/clip-based tempo changes do not influence the tempo of the Segment; thus MIDI clip and segment transitions can easily become out of sync.

Section Summary

In this section we have imported a MIDI file and described the track-specific MIDI functionality. The MIDI file is the currency of communication between a composition created within a DAW and its eventual presentation in the game.

Setting up Wwise Synth One

Before we begin working with MIDI in the Interactive Music Hierarchy, let's take a look at the synthesizer functionality of the Wwise Synth One source plug-in.



Wwise Synth One - Source Editor

Name: Wwise Synth One
Source Plug-in: Wwise Synth One
Notes

Effect Settings | RTPC

Input
Frequency Mode: Base Frequency
Base Frequency: 1000

Oscillator 1
Waveform: Sine
Transpose: 0
Level: -6
PWM: 50
Invert

Oscillator 2
Waveform: Sine
Transpose: 0
Level: -6
PWM: 50
Invert

Noise
Noise Shape: White Noise
Noise Level: -96

Output
Mode: Mix
FM: 0
Level: 0

Source Editor - Wwise Synth One

- **Input**
  - **Frequency Mode** - The source of the input frequency used by the oscillators.
    - Base Frequency - Frequency is obtained from the Base Frequency property.
    - Midi Note - Frequency is obtained from received MIDI note events.
  - **Base Frequency**
    - 20-20000 Hz - Input frequency for oscillators in Hz.
- **2 Oscillators**
  - **4 Waveform Types** - Available for each Oscillator.
    - Sine
    - Triangle
    - Square
    - Sawtooth
  - **Transpose**: The Pitch of the Oscillator
    - -3600 to +3600 cents - Transposition of input frequency, in cents.
  - **Level** - Output level of Oscillator, in dB, applied before the Oscillators are combined.
  - **PWM** (Pulse Width Modulation) - A technique that conforms the width of the pulse based on the modulator signal.

    - **Invert** - Inverts the Output of the Oscillator.
- **Output** - How the Oscillator outputs are combined
    - **Mode**
        - Mix: the samples are added
        - Ring: the samples are multiplied
    - **FM** (Frequency Modulation) - This value determines how much of Oscillator 2's output is used to generate oscillator 1's output.
        - 20-20000 Hz
    - **Level** (Volume) - Level applied to the final signal (combined Oscillator outputs mixed with noise generator output).
- **Noise**
    - **Noise Shape** - The type of noise generated.
        - White Noise
        - Pink Noise
    - **Noise Level** (Volume): Level applied to the output of the noise module, in dB. The level is applied before the output of the noise module is mixed with the combined Oscillator outputs.

Adventures in Synthesis

The MIDI Project Adventure uses four instruments that were recreated using the functionality of the Wwise Synth One plug-in. These instruments include: two lead square wave synths, a bass synth comprised of a combination of sine and sawtooth waveforms, and a percussion synth utilizing white noise. Experimentation is the key when working with synthesis, and often the best sounding synths are the result of the creative exploration within the limitations of a feature set.

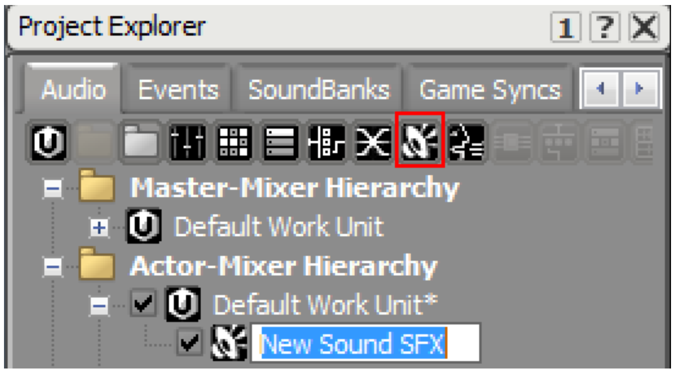
Here are some things to keep in mind when designing your synths:

- **RTPC**: Real Time Parameter Control can be used in conjunction with a Game Parameter set by the game or internally from Wwise as part of a Wwise Meter effect plug-in to output a game parameter to modify properties of the synth.
- **Modulator Envelope**: Modulator Envelopes can be used to control the Attack, Decay, Sustain, Release and other Envelope behaviors of any property that can be modified using RTPC.
- **Modulator LFO**: Modulator LFOs can be used to modify the properties of Wwise Synth One as a RTPC which can produce wildly varied dynamics.

Designer Note

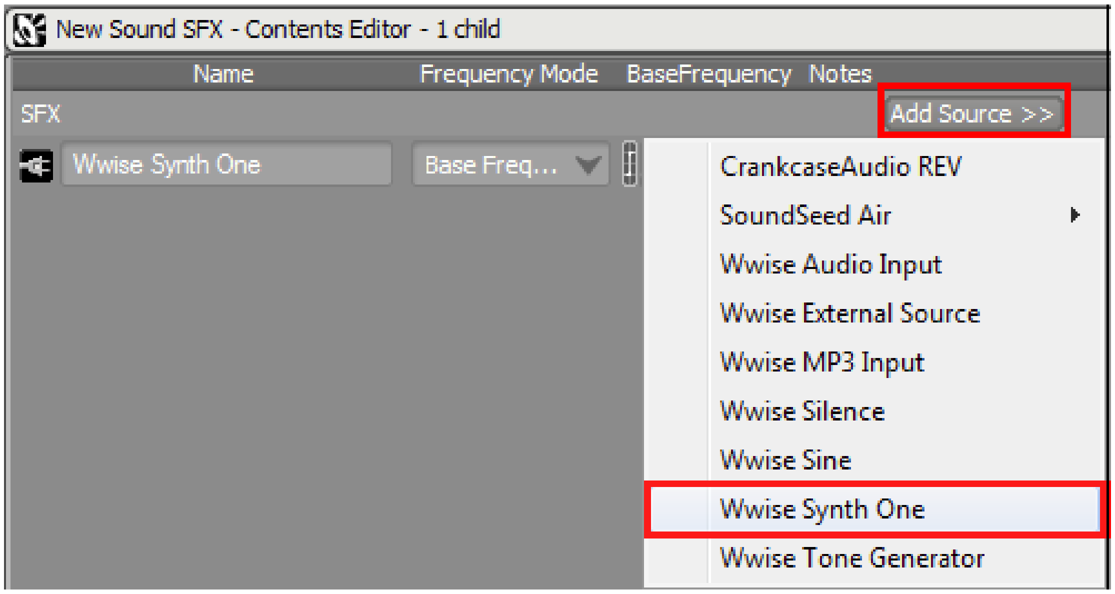
For more information on Modulator LFOs and Modulator Envelopes, see the 'Modulators' section in the Making Magic chapter.

The Wwise Synth One plug-in can be added as an input source to a Sound SFX in the same way that the Silence plug-in was added in Chapter 1. To being add Sound SFX object to the default work unit by clicking the Sound SFX icon in the Project Explorer toolbar, a new Sound SFX is created. Alternately, Sound SFX can be created from the contextual menu or by using shortcut keys.



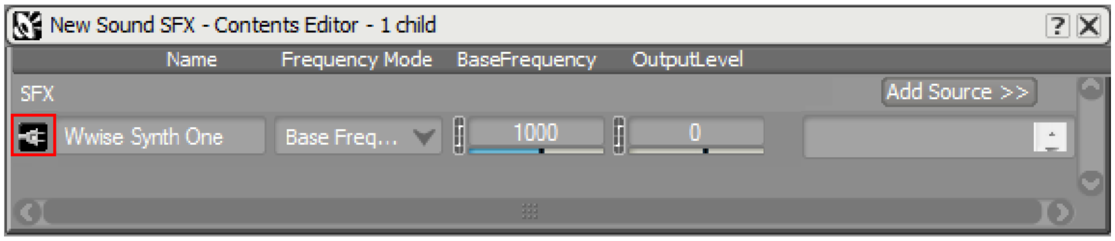
Creating a Sound SFX from the Project Explorer toolbar

After double-clicking to select the new Sound SFX, you can add the Wwise Synth One plug-in from the Add Source menu in the Contents Editor.



Creating a Wwise Synth One source plug-in for a sound object

The Source Editor can be accessed in the Contents Editor by double-clicking the plug-in icon.

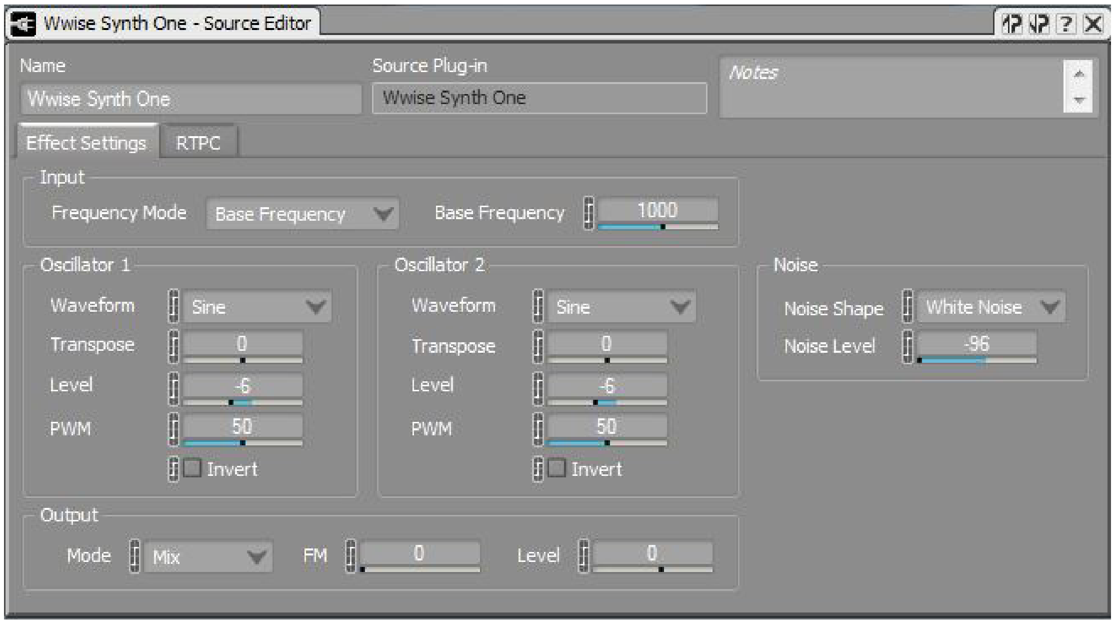

New Sound SFX - Contents Editor - 1 child

Name | Frequency Mode | BaseFrequency | OutputLevel

SFX — Add Source >>

Wwise Synth One | Base Freq... | 1000 | 0

Source plug-in icon for Wwise Synth One


Wwise Synth One - Source Editor

Name: Wwise Synth One
Source Plug-in: Wwise Synth One
Notes

Effect Settings | RTPC

Input
Frequency Mode: Base Frequency
Base Frequency: 1000

Oscillator 1
Waveform: Sine
Transpose: 0
Level: -6
PWM: 50
Invert

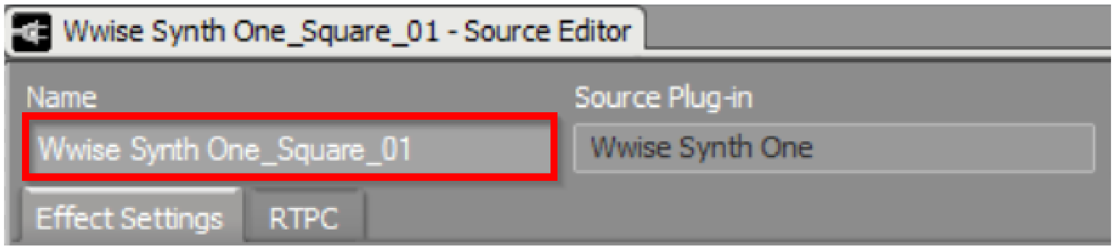
Oscillator 2
Waveform: Sine
Transpose: 0
Level: -6
PWM: 50
Invert

Noise
Noise Shape: White Noise
Noise Level: -96

Output
Mode: Mix
FM: 0
Level: 0

Wwise Synth One - Source Editor

The name of the Wwise Synth One source plug-in can now be renamed in the Source Editor to reflect its intended use.


Wwise Synth One_Square_01 - Source Editor

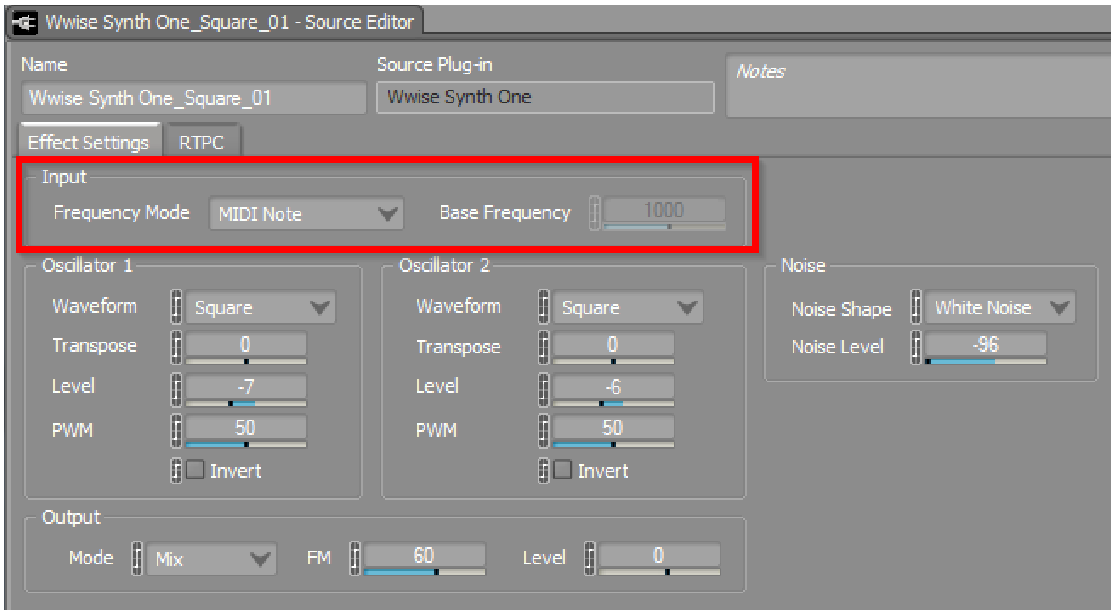
Name: Wwise Synth One_Square_01
Source Plug-in: Wwise Synth One

Effect Settings | RTPC

Renaming the Wwise Synth One plug-in in the Source Editor

The synth can be auditioned by selecting the Sound Object in the Actor-Mixer hierarchy and pressing 'Play' (or Spacebar).

By default, the Input Frequency Mode is set to Base Frequency and uses the Base Frequency property value in Hz as an input for the Oscillators. To use the Wwise Synth One plug-in in conjunction with a MIDI file, the Input must be set to MIDI Note.


Wwise Synth One_Square_01 - Source Editor

Name: Wwise Synth One_Square_01
Source Plug-in: Wwise Synth One
Notes

Effect Settings | RTPC

Input
Frequency Mode: MIDI Note
Base Frequency: 1000

Oscillator 1
Waveform: Square
Transpose: 0
Level: -7
PWM: 50
Invert

Oscillator 2
Waveform: Square
Transpose: 0
Level: -6
PWM: 50
Invert

Noise
Noise Shape: White Noise
Noise Level: -96

Output
Mode: Mix
FM: 60
Level: 0

Setting the Input Frequency Mode to MIDI Note in the Source Editor

Without much effort, a basic instance of the Wwise Synth One plug-in can be ready for use in conjunction with a MIDI file (or files).

Section Summary

The process and methodology of synthesis is a well-established part of creative music making. The inclusion of Wwise Synth One as part of the runtime functionality of the Wwise audio engine opens up a wide-range of capabilities to harness the power of realtime sound synthesis. The ability to modify properties dynamically unlocks a veritable treasure-trove of interactive possibilities.

Connecting MIDI & Sound

The compositional task has its underpinnings in the graphical representation of notes and behaviors. Whether on manuscript (staff) paper, a "piano roll", or beneath the surface of a DAW as MIDI notes, the notation serves as a mechanism to communicate the intended performance to be played back by performers or their mechanical/ digital equivalent. Operating below the surface of most computer-based composition tools, MIDI has provided a consistent and standardized way to represent a composer's musical intention. Wwise acts as an interpretor for this intention and can be used to play back and participate in the interaction between the composition and the "game as performer" modifying properties of the composition in realtime.

A MIDI file from a DAW must be exported with special considerations for use in the Wwise Authoring Application. Specifically, any tempo and MIDI channel configurations should be assigned in correlation to their expected use. Wwise will, by default, use the tempo and MIDI channel assignments exported in the MIDI file to control these aspects.

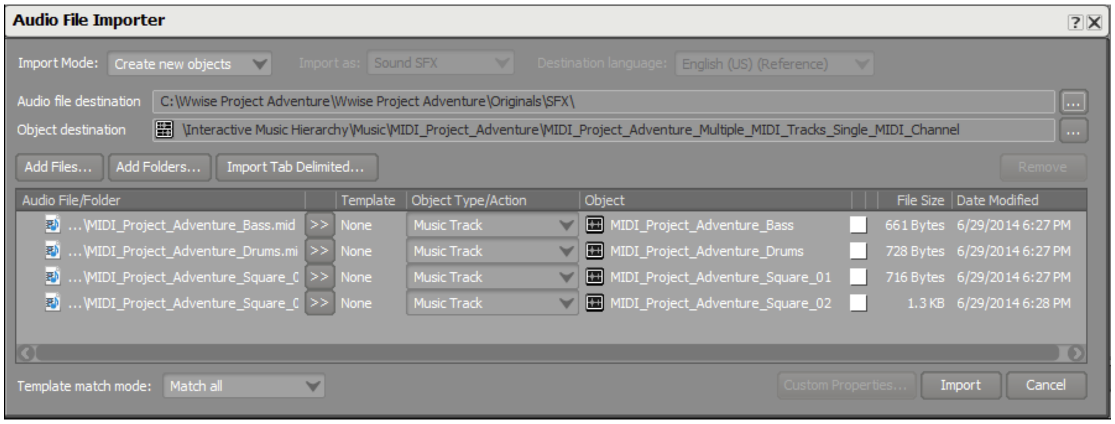
Importing the Individual MIDI Tracks

The instrument tracks have been exported from a DAW as four individual files which represent the different instruments:

- MIDI_Project_Adventure_Square_01.mid
- MIDI_Project_Adventure_Square_02.mid
- MIDI_Project_Adventure_Bass.mid
- MIDI_Project_Adventure_Drums.mid

Each file has been output at a tempo of 140BPM, all channels (Omni), and full Velocity.

MIDI files can be imported as Music Segments or as tracks within an existing Music Segment by either using the Audio File Importer or by dragging and dropping them into the Interactive Music Hierarchy. After files have been added as tracks to the segment, they can be accessed through the Music Segment Editor like any other music track.



Audio File Importer

Import Mode: Create new objects | Import as: Sound SFX | Destination language: English (US) (Reference)

Audio file destination: C:\Wwise Project Adventure\Wwise Project Adventure\Originals\SFX\

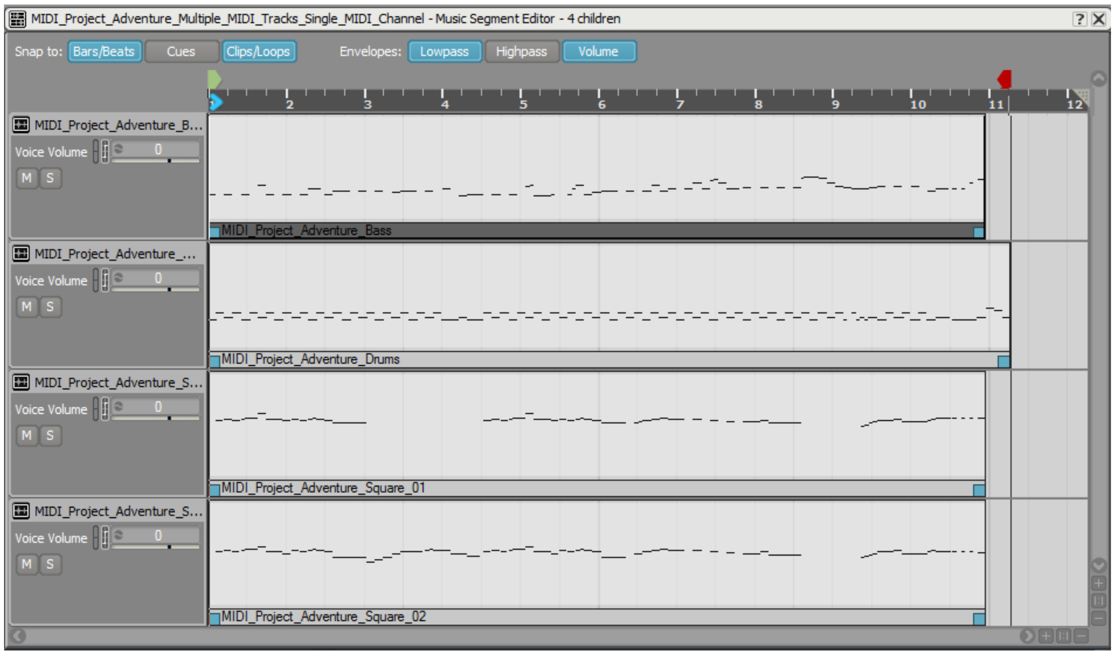
Object destination: \Interactive Music Hierarchy\Music\MIDI_Project_Adventure\MIDI_Project_Adventure_Multiple_MIDI_Tracks_Single_MIDI_Channel

Audio File/Folder		Template	Object Type/Action	Object		File Size	Date Modified
...\MIDI_Project_Adventure_Bass.mid	>>	None	Music Track	MIDI_Project_Adventure_Bass		661 Bytes	6/29/2014 6:27 PM
...\MIDI_Project_Adventure_Drums.mi	>>	None	Music Track	MIDI_Project_Adventure_Drums		728 Bytes	6/29/2014 6:27 PM
...\MIDI_Project_Adventure_Square_C	>>	None	Music Track	MIDI_Project_Adventure_Square_01		716 Bytes	6/29/2014 6:27 PM
...\MIDI_Project_Adventure_Square_C	>>	None	Music Track	MIDI_Project_Adventure_Square_02		1.3 KB	6/29/2014 6:28 PM

Template match mode: Match all

The Audio File Importer showing multiple MIDI files to be imported as Music Tracks

After MIDI files have been added as tracks to the segment, you can access them through the Music Segment Editor, where any combination of audio and MIDI tracks can be arranged and edited within the Music Segment.



MIDI_Project_Adventure_Multiple_MIDI_Tracks_Single_MIDI_Channel - Music Segment Editor - 4 children

Snap to:
Bars/Beats
Cues
Clips/Loops
Envelopes:
Lowpass
Highpass
Volume
2
3
4
5
6
7
8
9
10
11
12
MIDI_Project_Adventure_B...
MIDI_Project_Adventure_...
MIDI_Project_Adventure_S...
MIDI_Project_Adventure_S...
Voice Volume
0
M
S
MIDI_Project_Adventure_Bass
MIDI_Project_Adventure_Drums
MIDI_Project_Adventure_Square_01
MIDI_Project_Adventure_Square_02

Editing tracks in the Music Segment Editor

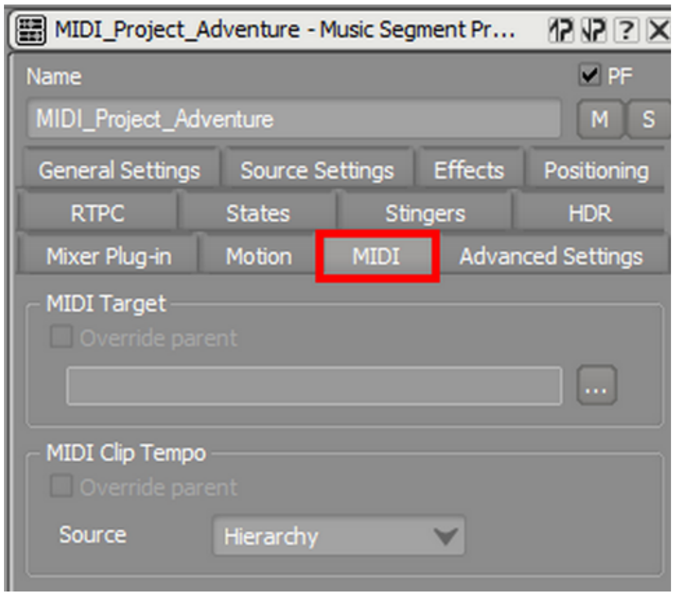
MIDI Tracks within a Music Segment exhibit the same behavior and functionality as an audio file. (as explained in Chapter 7. Adventures in Music - The Layered Approach - Creating the Ambient Music Segment)

Each track needs to be associated with a Sound Object that is used to play back information communicated from the MIDI file.

Music Segment MIDI Properties

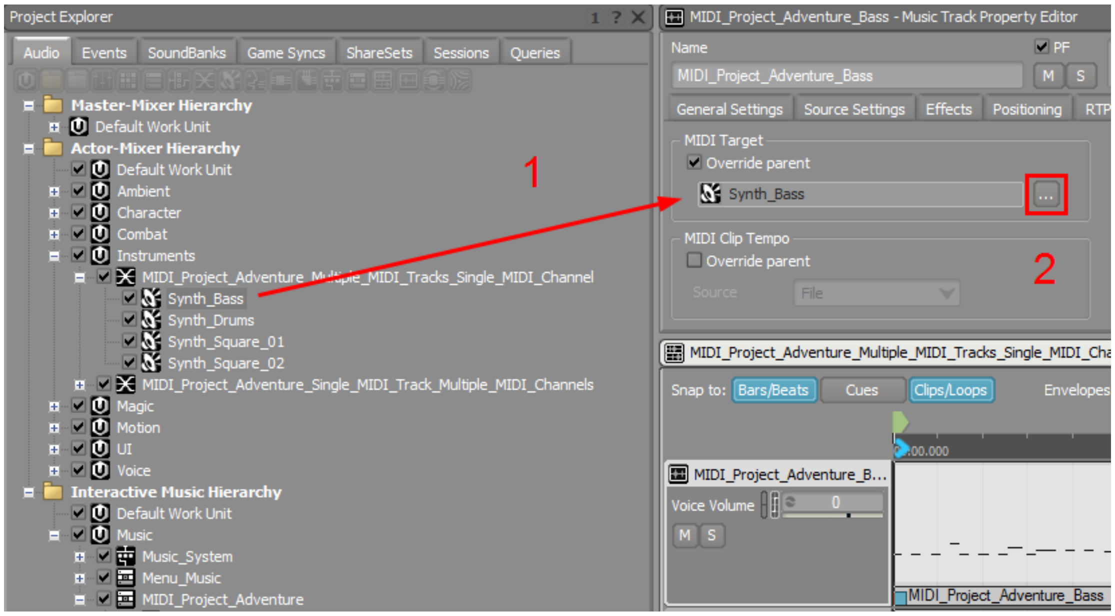
The MIDI Target and MIDI Clip Tempo can be defined for either the Music Segment (Parent) or Music Track (Child) in the MIDI tab in Music Segment Property Editor or Music Track Editor.

The MIDI Target is specified as the Sound Object through which all MIDI Events are routed. This property can target a specific Sound Object or a Blend Container including multiple Sound Objects, each with their own individual MIDI properties.



The MIDI tab in the Music Segment Property Editor

The MIDI Target can be assigned to a Music Segment or Music Track by navigating to a Sound Object through the Project Explorer - Browser or by dragging and dropping a Sound Object from the Actor-Mixer Hierarchy onto the MIDI Target field.



Assigning the MIDI Target using drag and drop (1) or using the Project Explorer - Browser (2)

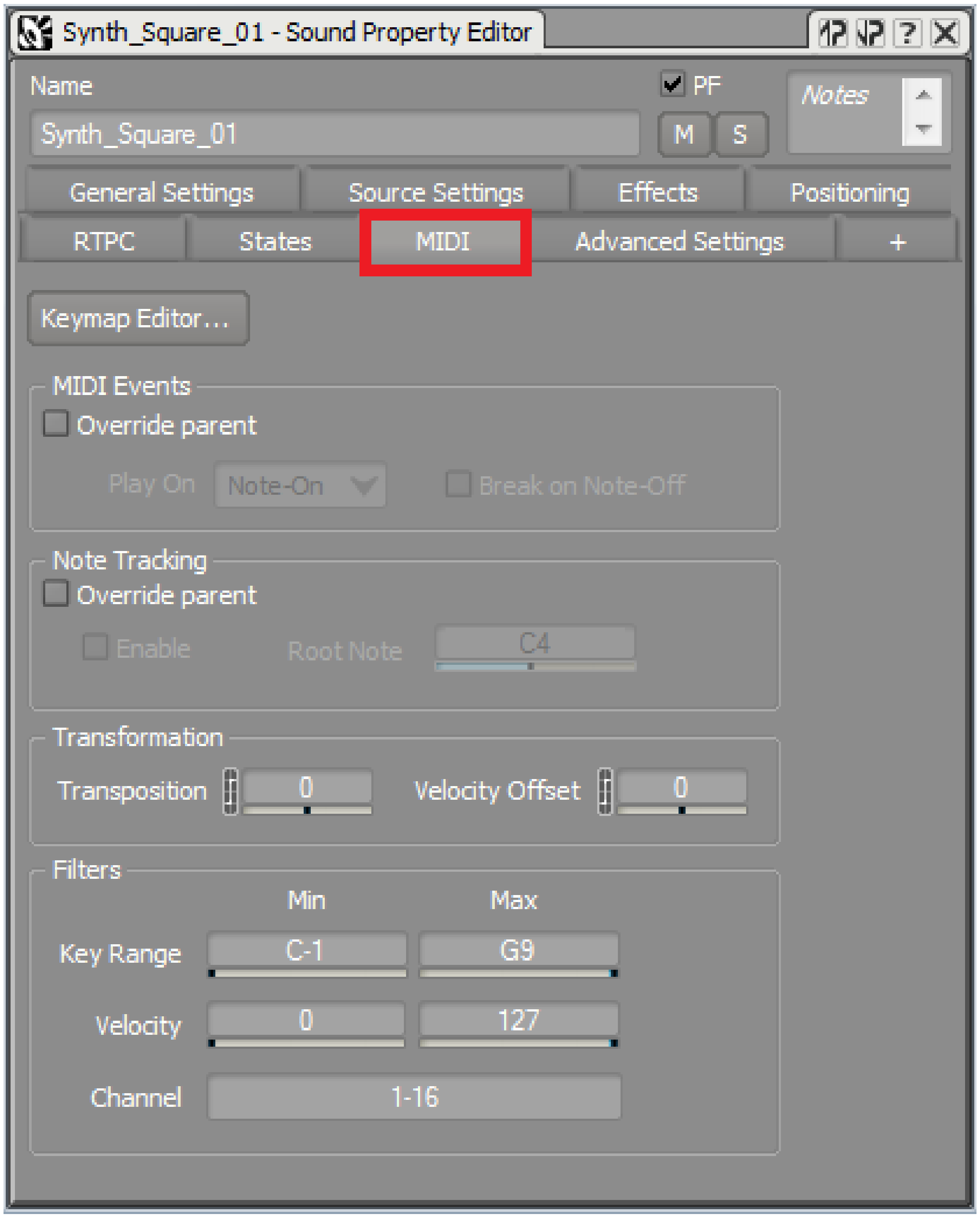
Wwise can use the Tempo map to control the tempo (exported as part of the MIDI file) or use the tempo specification set for the sound object in the Interactive Music Hierarchy.

The imported MIDI tracks use the MIDI Clip Tempo information from the (MIDI) file to control their tempo.

The composition can now be auditioned by selecting the Music Segment in the Interactive Music hierarchy and pressing 'Play' (or Spacebar).

Sound Object MIDI Properties

Additional MIDI properties are located in the MIDI Tab for the parent Sound Object. These properties can be used to: control the behavior of incoming MIDI Events, transform the transposition or velocity offset of MIDI data before it is executed, or filter incoming MIDI data. These techniques can be particularly useful when building instruments comprised of multiple samples, synthesizers, or any combination to be targeted by a MIDI file.


Synth_Square_01 - Sound Property Editor

Name: Synth_Square_01

PF ✓

Notes

MIDI Events
- Override parent ☐
- Play On: Note-On
- Break on Note-Off ☐

Note Tracking
- Override parent ☐
- Enable ☐
- Root Note: C4

Transformation
- Transposition: 0
- Velocity Offset: 0

Filters

	Min	Max
Key Range	C-1	G9
Velocity	0	127
Channel	1-16	

Sound Object properties in the MIDI Tab of the Sound Property Editor

Sound Object MIDI Properties include:

- **Keymap Editor** - Inspects the object in the MIDI Keymap Editor.
- **MIDI Events**

  - **Override parent** - Determines whether the MIDI events controls are inherited from the parent or defined at the current level in the hierarchy. When this option is not selected, the MIDI Events controls are unavailable.

    If the object is a top-level object, this option is unavailable.
  - **Play On** - Determines what type of MIDI note event will cause the object to play.
    - **Note-On** - Plays the object on Note-On.
    - **Note-Off** - Plays the object on Note-Off.
  - **Break On Note-Off** - If Play On is set to Note-On, this property determines whether the playing object stops looping upon reception of a note-off. If so, the playback of looped sounds or continuous containers is stopped, while allowing the current object(s) to finish playing.
- **Note Tracking**:
  - **Override parent** - Determines whether the Note Tracking controls are inherited from the parent or defined at the current level in the hierarchy. When this option is not selected, the Note Tracking controls are unavailable. If the object is a top-level object, this option is unavailable.
  - **Enable** - If selected, the node's playback is pitch-shifted. The amount of pitch-shifting is determined by the note of the received MIDI event and the value of Root Note.
    - Default Value: false
  - **Root Note** - The root note of the node's sound. This value is used in conjunction with a received MIDI note to determine the pitch-shifting of the node's sound.
    - Default Value: C4
- **Transformation**:
  - **Transposition** - The offset applied to the MIDI event's note. The transposition is applied before the Key Range filters.
    - Default Value: 0
  - **Velocity Offset** - The offset applied to the MIDI event's note velocity. This applies to MIDI note events only. The offset is applied before the Velocity filters.
    - Default Value: 0
- **Filters**
  - **Key Range** - Filter applied to received MIDI note event's note. A received MIDI note event is ignored if its note is not within the Min-Max range.
    - Default Min: C-1 Default Max: G9

    Note: The mapping of numerical MIDI notes to octaves is specified via the user preferences; refer to: Wwise Help > Wwise Reference > Projects > User Preferences for more details.

- **Velocity** - Filter applied to received MIDI note event's velocity. A received MIDI note event is ignored if its velocity is not within the Min-Max range.
  - Default Min: 0 Default Max: 127
- **Channel** - Filter applied to received MIDI note event's channel. A received MIDI note event is ignored if its channel is not in the filter.
  - Default: 1-16

Section Summary

As another feature in the expanding Wwise Authoring Application, MIDI can be employed as the right technique for the right situation. Leveraging small sample-sets, synthesis, and the power and flexibility of MIDI can help balance out the use of resources across resident memory (size on disk or RAM) and processing (CPU). Depending on the constraints of your target platform and the desired aesthetic, MIDI can be a powerful ally towards maximizing resources and creating a dynamic audio experience.

MIDI Summary

Like a hero fallen from grace, the return of MIDI comes with the knowledge of past battles and the remembrance of the way it used to be. Some of this knowledge can be immediately put to use navigating through the dawning of a new era for MIDI; experience with: creating sample-sets, MIDI channel assignment, velocity, and MIDI Events. Harnessing the inherent efficiency, dynamism, and flexibility of MIDI heralds the return of a well tested methodology. However, some parts of MIDI still hold negative connotations that need to be minimized; "bad" sounding, difficult workflow, and general prejudice work against the fundamental structure that MIDI makes available.

Throughout this chapter we have:

- Imported MIDI Files
- Added MIDI Files to a Music Track
- Made Modifications to the MIDI Target
- Adjusted the MIDI Clip Tempo
- Looked at the synthesizer functionality of the Wwise Synth One
- Talked about preparing music content for integration.

Stepped through the process of:

- Importing MIDI files.
- Setting up the Wwise Synth One plug-in.
- Creating a multitrack composition comprised of:
  - Four MIDI tracks representing different instruments.
  - Four Wwise Synth One synths representing different instruments.

We've also touched on:

- Advanced functionality of the MIDI format.

Throughout this section we have created the following objects:

- A Music Segment containing a MIDI file with individual channels, each targeting instances of Wwise Synth One which represent the different instruments.
- A Music Segment containing four individual MIDI files, each targeting instances of Wwise Synth One which represent the different instruments.

Music Additional Resources

Wwise Knowledge Base - Advanced settings playback limits and interactive music

Wwise Knowledge Base - Looping and streaming of audio clips and interactive music

Wwise Knowledge Base - Understanding the Interactive Music Engine

Wwise Knowledge Base - Interleaved Streaming in Interactive Music

Wwise Knowledge Base - Using States with the Interactive Music Hierarchy

Video Tutorial - Creating Interactive Music Structures

Video Tutorial - Defining Interactive Music Transitions

Video Tutorial - Creating Stingers

Game Sound Design - Making Music Interactive: Elaboration of the Feature Set in Wwise

Game Sound Design - Dynamic Music Creation Using Wwise

Chapter 9. Mastering the Mix

Overview

Heading into the final mix is not unlike entering into battle with a fire breathing dragon. By the time you arrive at the scene of the last stand against the bloodthirsty creature, you've hopefully equipped yourself with the every skill and weapon in your arsenal in order to belay the beast into submission. As the signal flow winds its way through the labyrinth of routing possibilities, you know you have the flexibility to reshape the audio path and the power to commandeer the ultimate mix.

From a single instance of a sound played back by an audio engine, to the potentially massive pile-up of sounds happening in a single frame, the race is on to make sure that the right sounds are heard throughout the game. Whereas the Mix title has been appropriated from the music and film world where it represents a time locked and non-interactive representation of sound, its use in game audio tends to be a bit more nebulous. Using a combination of dynamic mix-related methodologies and available techniques to balance the final sound output has become one of this generation's greatest challenges.

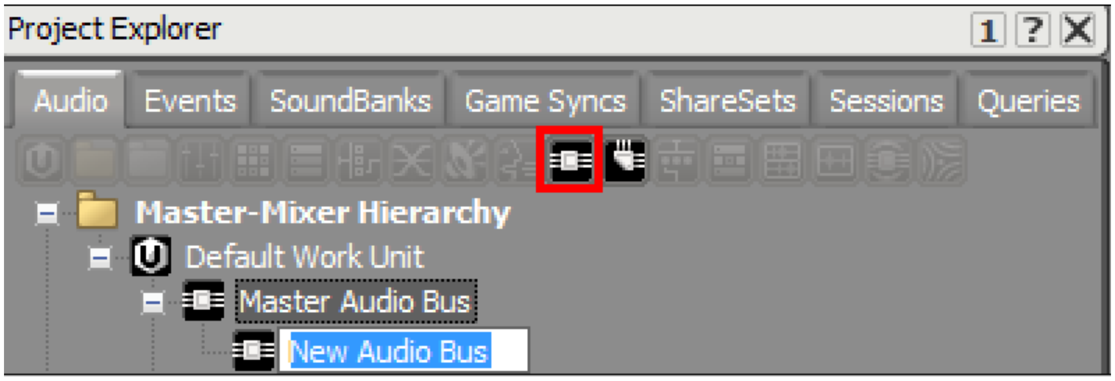
This chapter takes you through the process of:

- Routing with Audio Busses.
- Routing with Auxiliary Busses
- Using Auxiliary Sends.
- States and Mix Snapshots.
- Auto-ducking vs. Side-chaining.
- Mixing with RTPC.
- Using effects in the Master-Mixer.
- Environmental reverb.
- Reorganizing the Master-Mixer.
- Visualizing the mixing desk.
- Mixing techniques for attenuations.

Routing with Audio Busses

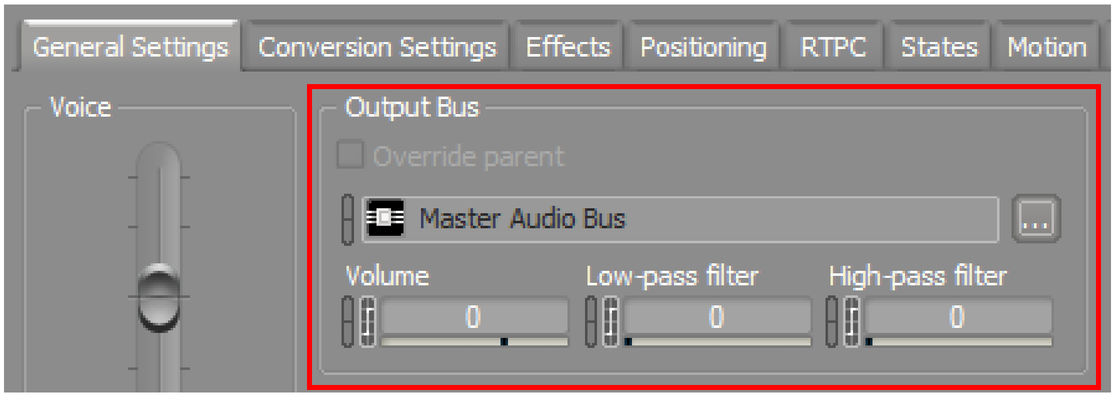
Anyone who has worked with hardware or software mixers in the past can appreciate the Master-Mixer hierarchy in Wwise with its customizable interface for routing audio signals from sound objects throughout the project. You can establish a comprehensive and flexible representation of the signal flow by adding and organizing audio and auxiliary busses.

Fundamentally, audio busses are a way to balance volumes, add effects, apply RTPC, and state-based changes. Audio busses can be added to the Master-Mixer hierarchy by selecting an existing audio bus and then clicking the audio bus icon in the Project Explorer toolbar. A new audio bus is created as a child of the selected audio bus.



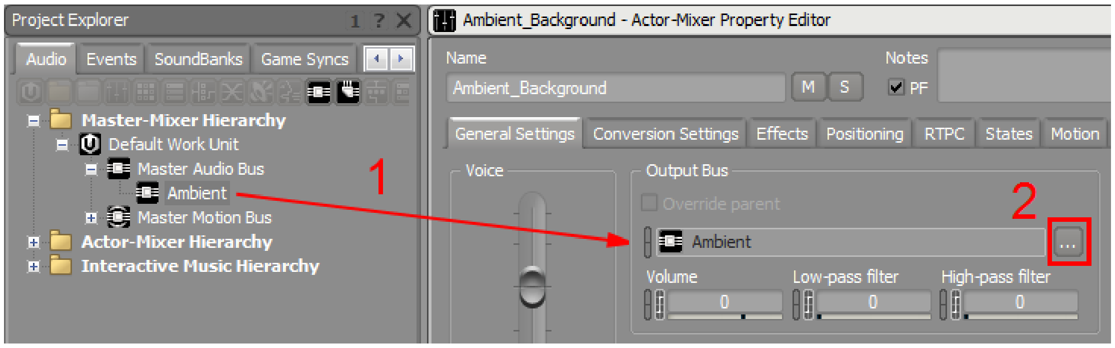
Creating an audio bus from the Project Explorer toolbar

After an audio bus has been created, it can be assigned to any sound object via the General Settings tab in the Property Editor. Audio busses can be assigned to a sound object by either navigating to the Bus through the Project Explorer - Browser, or by simply dragging and dropping an audio bus from the Master-Mixer onto the Audio Output Bus field.



Audio output bus and settings in the Property Editor

Audio busses can be configured and reconfigured to suit the developing needs of any project. Dragging and dropping audio busses within the Master-Mixer hierarchy also maintains any assignments for routing that have been established for a sound object.



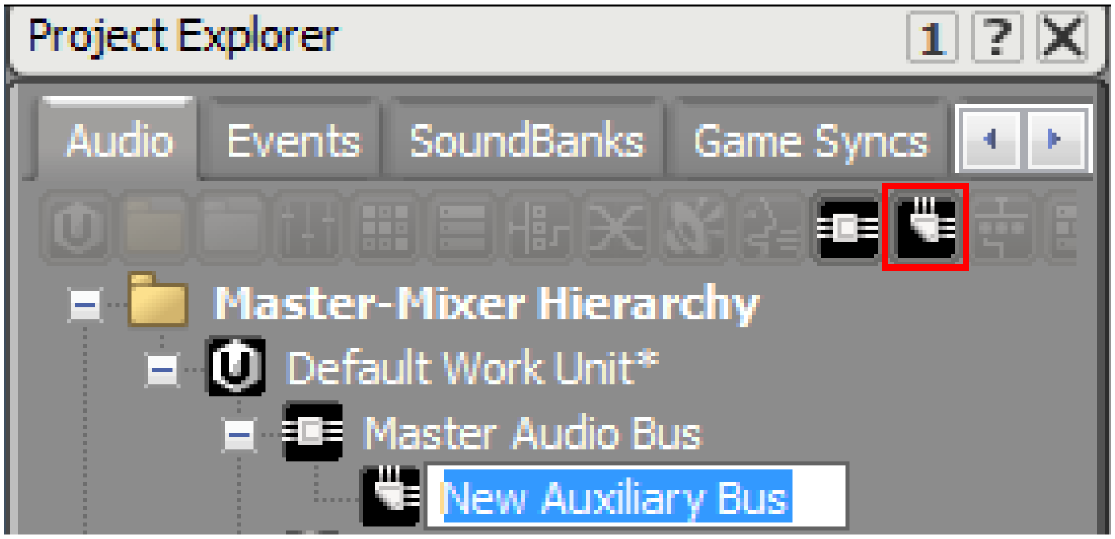
Assigning the audio output bus of a sound object using drag and drop (1) or using the Project Explorer - Browser (2)

In the previous image, once the “Ambient” audio output bus has been assigned, any sound output from the “Ambient_Background” Actor-Mixer is routed through the “Ambient” audio bus. The output bus volume and audio output bus low pass filter settings control the amount of volume or low pass filter from the sound object that is passed to the audio output bus. Furthermore, the properties set for the audio bus in the Master-Mixer hierarchy govern the final output.

Routing with Auxiliary Busses

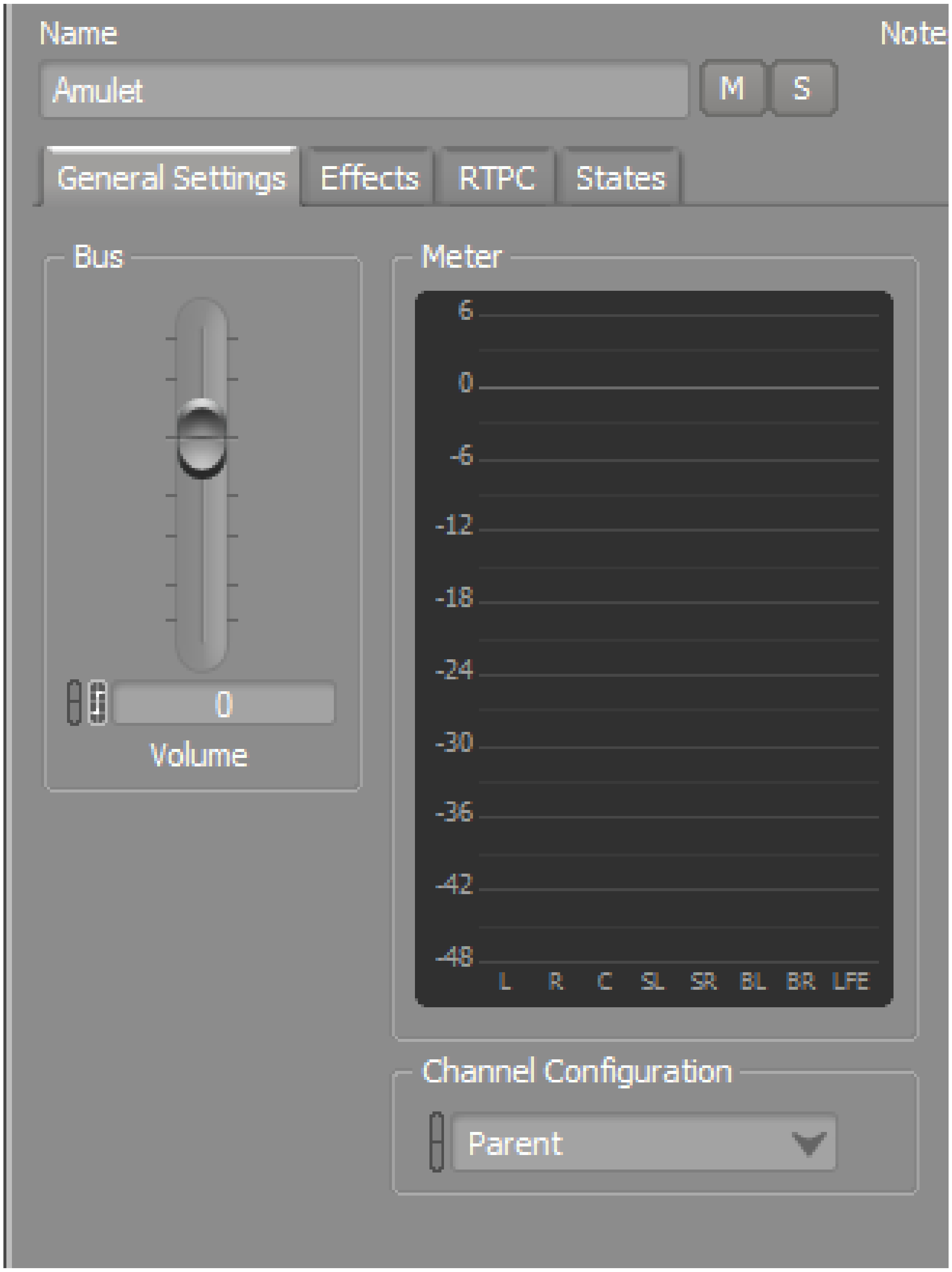
An auxiliary bus is organized within the Master-Mixer hierarchy in the same way as a standard audio bus. Each auxiliary bus can manage up to four effects which can be enabled or disabled programmatically or with game parameters. Auxiliary busses can also be positioned within the Master-Mixer hierarchy as children of other audio or auxiliary busses, allowing for more than four effects in a series.

The process begins by adding an auxiliary bus to the Master-Mixer hierarchy by selecting an existing audio or auxiliary bus and then clicking the auxiliary bus icon in the Project Explorer toolbar. A new auxiliary bus is created as a child of the selected audio or auxiliary bus.



Creating an auxiliary bus from the Project Explorer toolbar

Each auxiliary bus includes metering and allows you to set volume, add effects, RTPC, as well as apply changes based on state.



Name: Amulet

General Settings

Volume: 0

Channel Configuration: Parent

General Settings tab of the auxiliary bus in the Property Editor

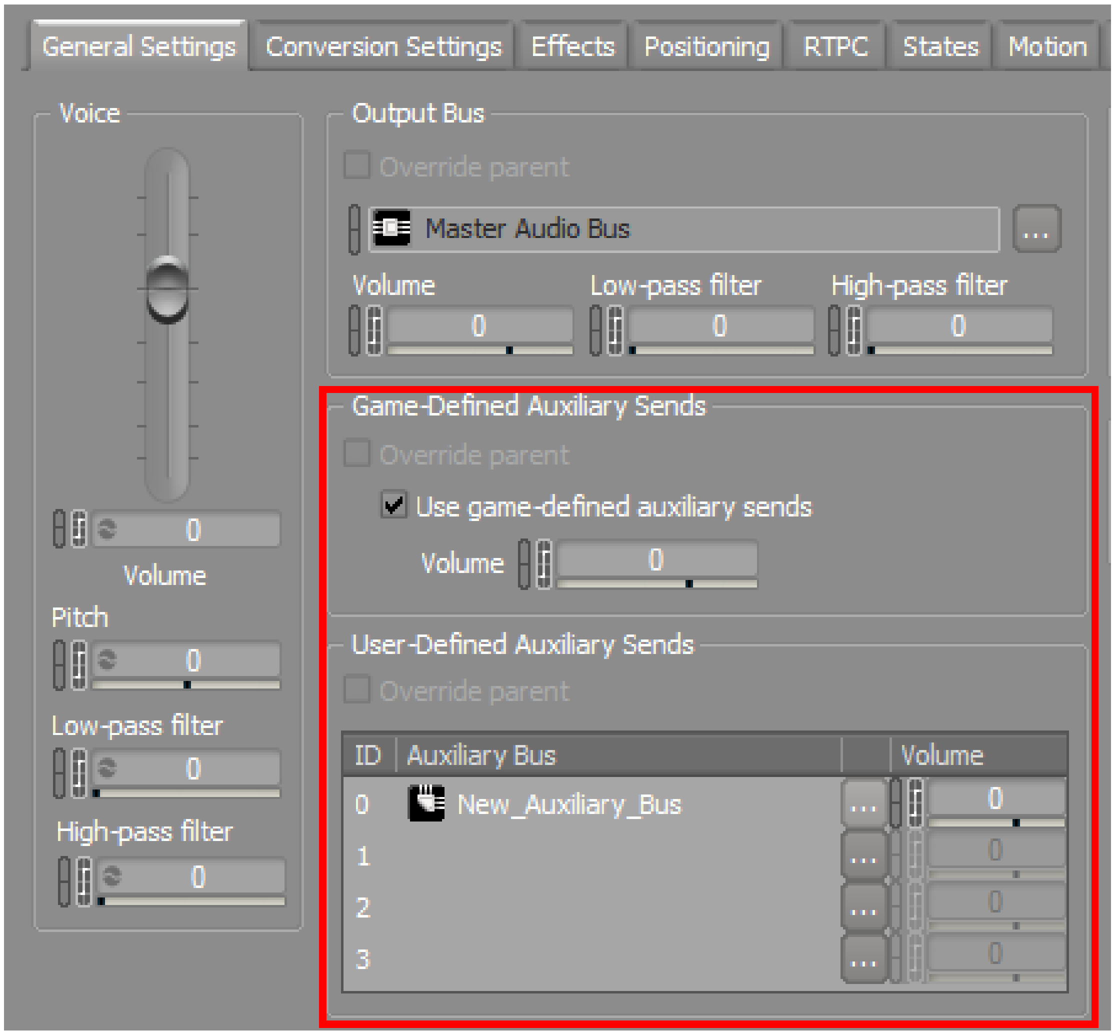
Using Auxiliary Sends

Traditionally, auxiliary sends are used to route an audio signal to a set of effects that are then applied to any audio signal as a whole. In other words, an auxiliary send is a convenient way to route the output of a sound object in the Actor-Mixer hierarchy to an auxiliary bus within the Master-Mixer Hierarchy.

There are two types of auxiliary sends in Wwise:

- User-defined auxiliary sends
- Game-defined auxiliary sends

A sound object can use one or both types of auxiliary send from the General Settings tab in the Property Editor. The different types of auxiliary send behave in exactly the same way. Sends from a sound object can be mixed and matched between the two types within the authoring application.



Voice: Volume 0; Pitch 0; Low-pass filter 0; High-pass filter 0

Output Bus: Override parent [ ]; Master Audio Bus; Volume 0; Low-pass filter 0; High-pass filter 0

Game-Defined Auxiliary Sends: Override parent [ ]; Use game-defined auxiliary sends [✓]; Volume 0

User-Defined Auxiliary Sends: Override parent [ ]

ID	Auxiliary Bus	Volume
0	New_Auxiliary_Bus	0
1		0
2		0
3		0

Defining auxiliary sends in the General Settings tab of the Property Editor

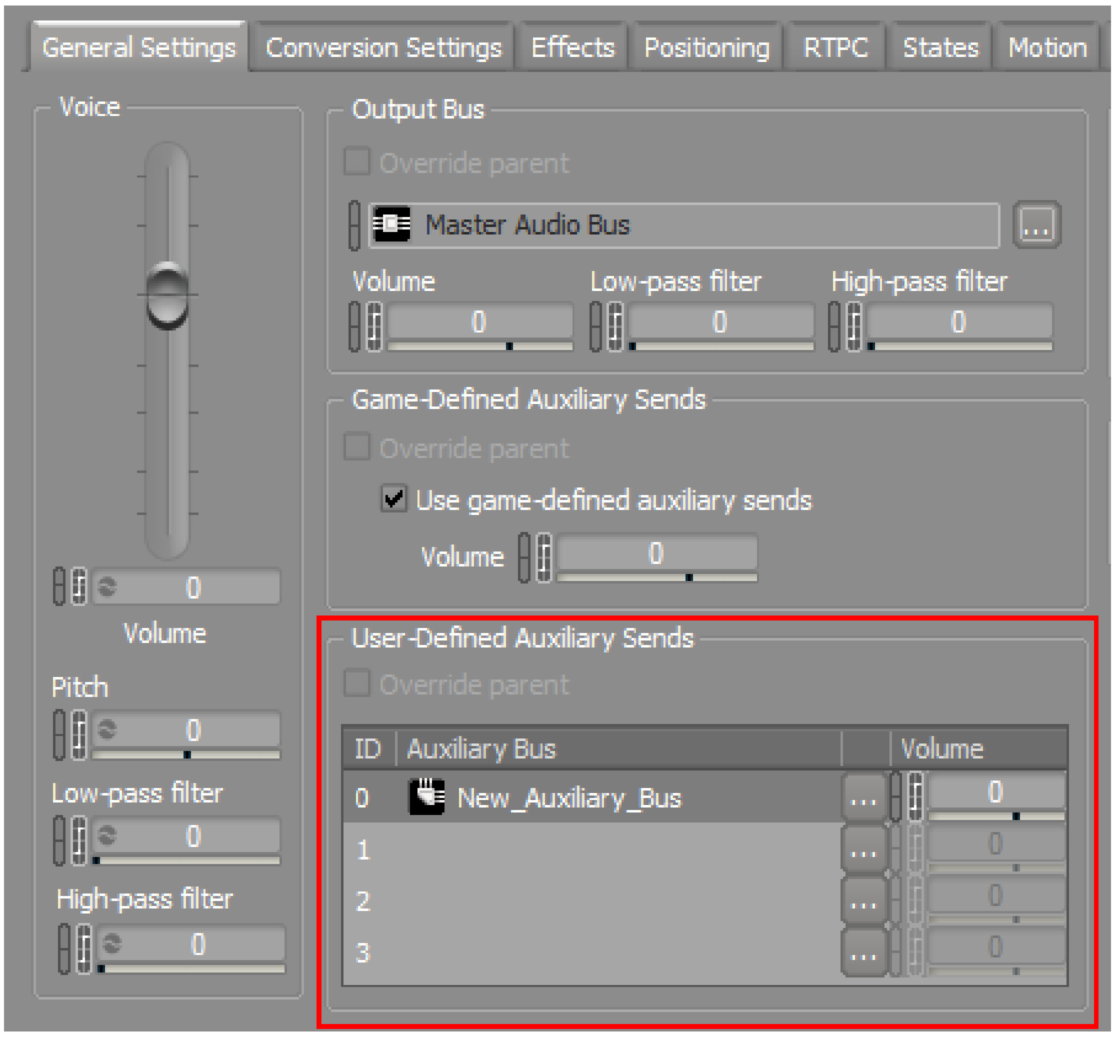
The auxiliary send is controlled in two different ways:

- User-defined: Per sound object in Wwise.
- Game-defined: Per game object using the SDK API.

The send volume related to an auxiliary bus within the Master-Mixer hierarchy is independent of the audio output bus volume and routing. This allows for the creative application of effects and other interactive mixing techniques.

User-Defined Auxiliary Sends

Up to four user-defined auxiliary busses can be assigned to any sound object in the Actor-Mixer hierarchy. The send volume is the level or amplitude of the audio signal that is sent to an auxiliary bus that can also be parameterized using RTPC. User-defined auxiliary busses are assigned in the General Settings tab of the Property Editor.



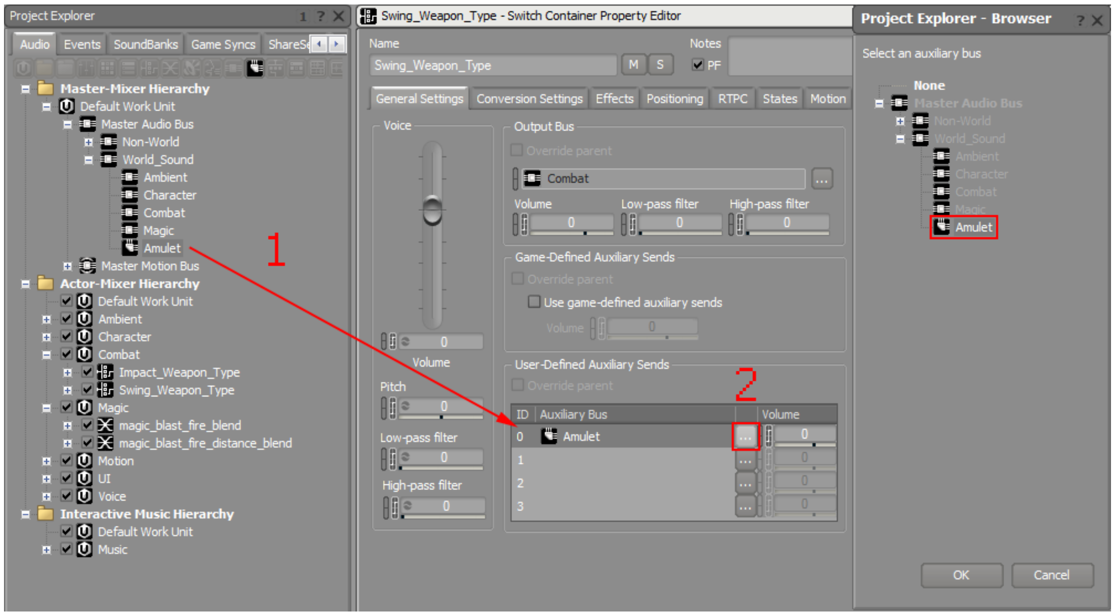
ID	Auxiliary Bus	Volume
0	New_Auxiliary_Bus	0
1		0
2		0
3		0

User-defined auxiliary sends in the Property Editor

In this example we will create a user-defined auxiliary send that is used to apply a magical effect to certain sound types in the project when our hero is in danger. The auxiliary bus will contain a chain of effects that utilize the "Danger" game parameter to adjust various properties. Modifying the sound of weapon swings and magic will be used as an indicator of danger and will enhance the dynamic aspects of battle.

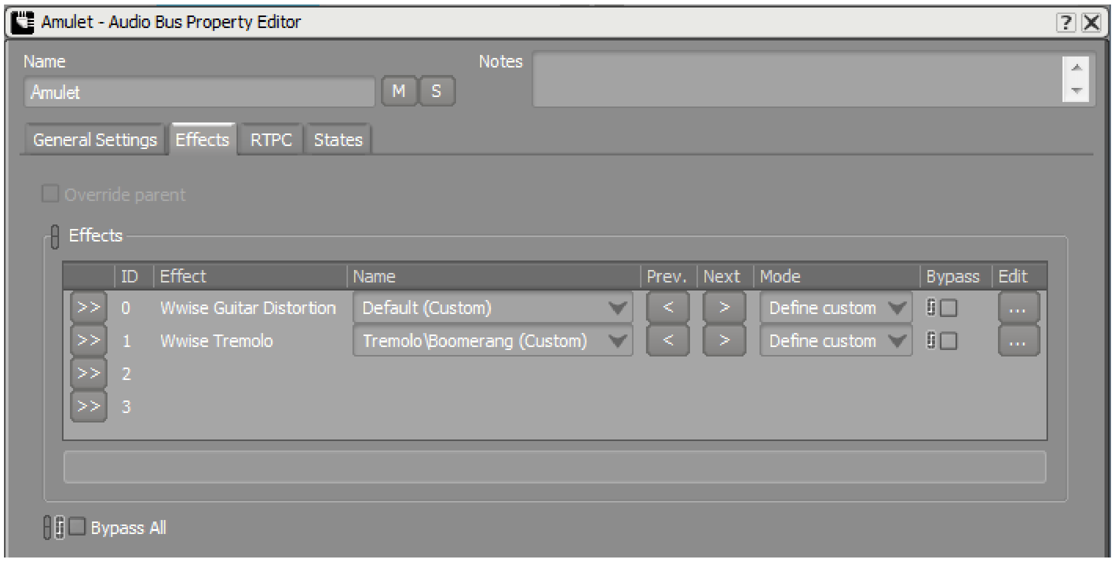
The source of our hero’s power stems from an ancient amulet, and so we will name the newly created auxiliary bus “Amulet”. In this example we’ll be routing the output of the “Swing_Weapon_Type” switch container and of the “magic_blast_fire_distance_blend” blend container to the Amulet auxiliary bus.

Any existing auxiliary bus can be assigned to sound objects by either navigating to the bus through the Project Explorer - Browser, or by simply dragging and dropping the auxiliary bus from the Master-Mixer hierarchy onto the “Auxiliary Bus” field in the User-Defined Auxiliary Sends section of the Property Editor.



Assigning the auxiliary bus of a sound object using drag and drop (1) or using the Project Explorer - Browser (2)

Once a sound object routes a signal to an auxiliary bus, the send volume can be adjusted. Adding and adjusting effects can now be applied to the “Amulet” auxiliary bus to communicate a sense of magical change when our hero is in danger. In this example, a custom “Wwise Guitar Distortion” has been added as the first effect and has been set to increase the wet/dry mix based on the "Danger" game parameter. Additionally a “Wwise Tremolo” has been added as the second effect, with the LFO depth controlled by the "Danger" game parameter.


Amulet - Audio Bus Property Editor

Name: Amulet

Notes

General Settings | Effects | RTPC | States

Override parent

Effects

	ID	Effect	Name	Prev.	Next	Mode	Bypass	Edit
>>	0	Wwise Guitar Distortion	Default (Custom)	<	>	Define custom	☐	...
>>	1	Wwise Tremolo	Tremolo\Boomerang (Custom)	<	>	Define custom	☐	...
>>	2							
>>	3							

☐ Bypass All

A chain of effects on the "Amulet" auxiliary bus

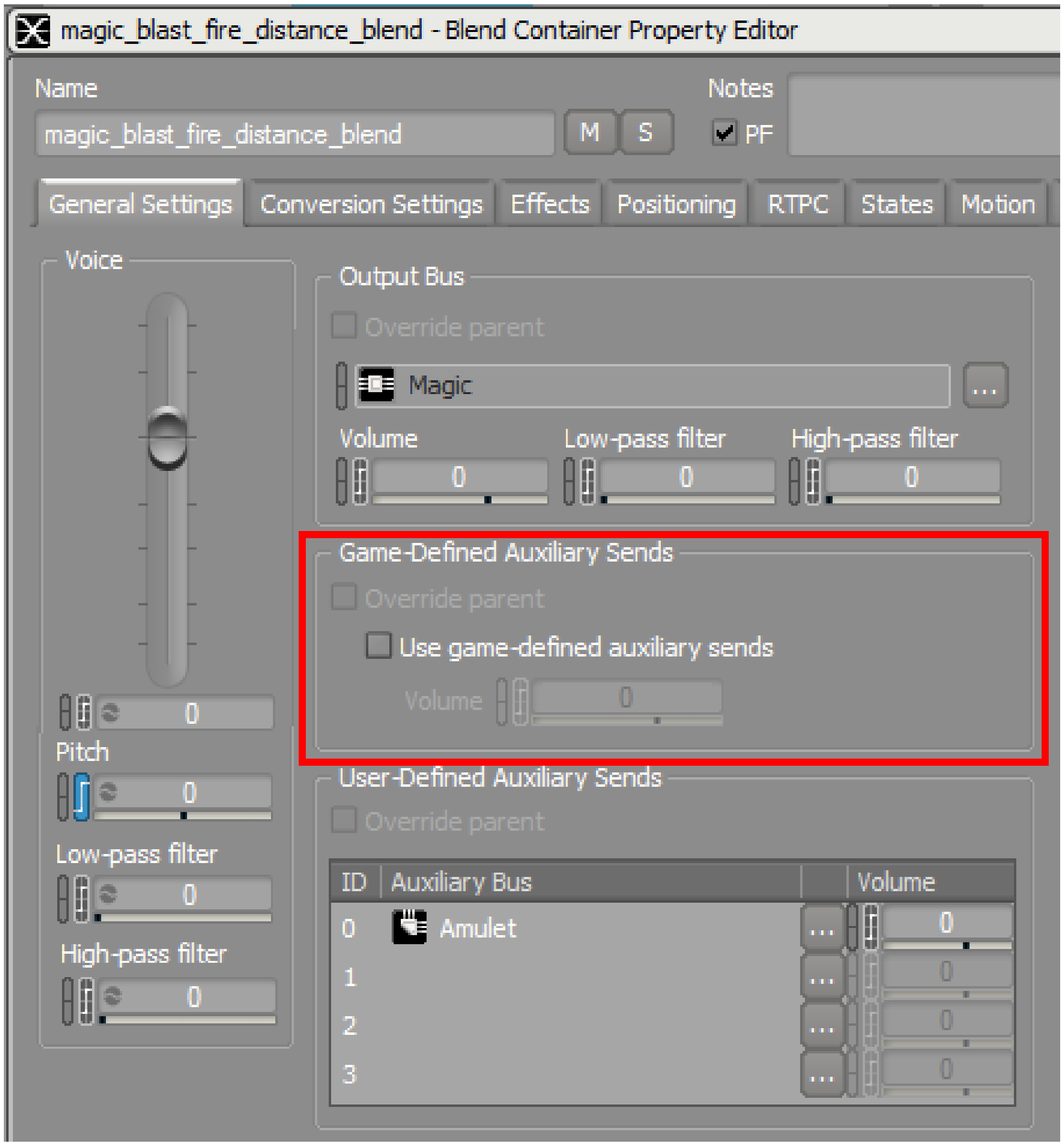
Designer Note

The user-defined auxiliary bus routing cannot be changed at runtime, but the game can use the SetBusEffect() and SetActorMixerEffect() functions to set different effects ShareSets to the auxiliary bus. This method allows for the application of environment acoustics in your game, but with a finer granularity (per audio object and additionally per game object).

By controlling auxiliary sends you can apply creative and runtime-conscious special effects throughout the project.

Game-Defined Auxiliary Sends

In addition to setting user-defined auxiliary busses, up to four game-defined auxiliary busses can be set by the game engine or managed programmatically outside of the authoring application for each game object. Auxiliary busses defined by the game can be used for reverbs, game-state dependant effects, interactive mixing, or any other game-defined usage. Additionally, the sound designer has control from the user interface to enable and offset the game-defined auxiliary send volumes on a per sound basis from the General Settings tab in the Property Editor.



Enabling game-defined auxiliary sends in the Property Editor

Game objects can be routed to a combination of game-defined and user-defined auxiliary busses for a total of eight independent auxiliary targets (four game-defined and four user-defined).

Designer Note

The final send volume is the combination of the game-defined auxiliary send volume from the UI and the SetGameObjectAuxSendValues() SDK function set by a programmer.

States and Mix Snapshots

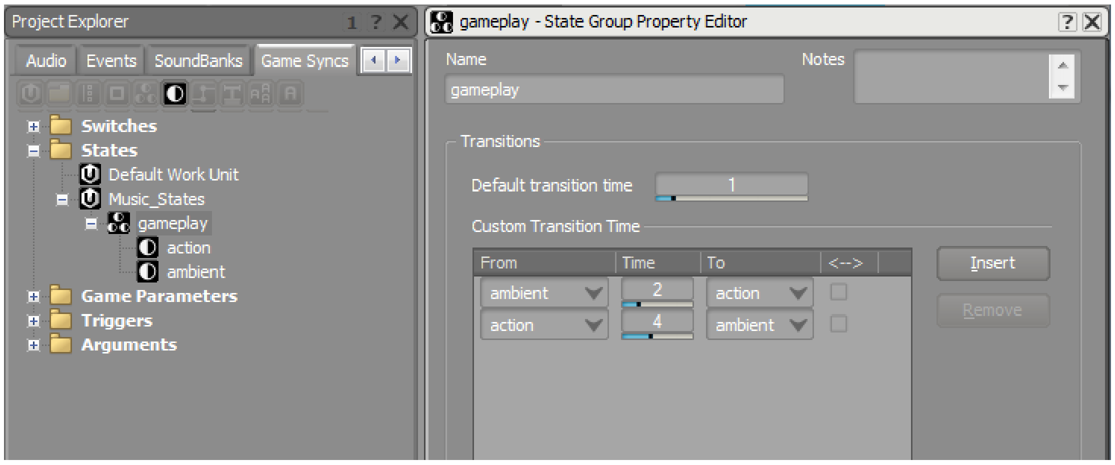
Another powerful practice for manipulating an interactive mix is by using states, or in this context, mix snapshots. States can be directly related to, and commonly referred as, game states such as: combat, stealth, idle. They can also be used to define spaces such as a forest, hallway, or dungeon and, furthermore, can be abstracted to define any circumstance under which you may want to change the sound of the game. States are usually defined in the game engine and triggered within Wwise, where you can combine multiple states simultaneously.

Designer Note

When an object is registered to multiple states, a single property can be affected by multiple value changes. In this scenario, each change of value is added up together. For example, when two states in two different state groups have a volume change of -6 dB, and both become active simultaneously, the resulting volume will be -12 dB.

Due to the non-linear progression and randomness inherent in most games, it is often desirable to plan for a mix that can respond to events in the game dynamically as opposed to a static mix that does not change based on circumstances within the game. By using state changes to modify the properties of different mix busses, you can create a system for dynamically mixing the game. In a sense, it is like programming an artificial intelligence that is able to make changes to the mix in accordance with the rules specified by the sound designer.

States are defined in the game syncs tab of the Project Explorer and include settings for defining a default transition time or custom transitions based on changes between specific states.



Name: gameplay

Notes:

Transitions

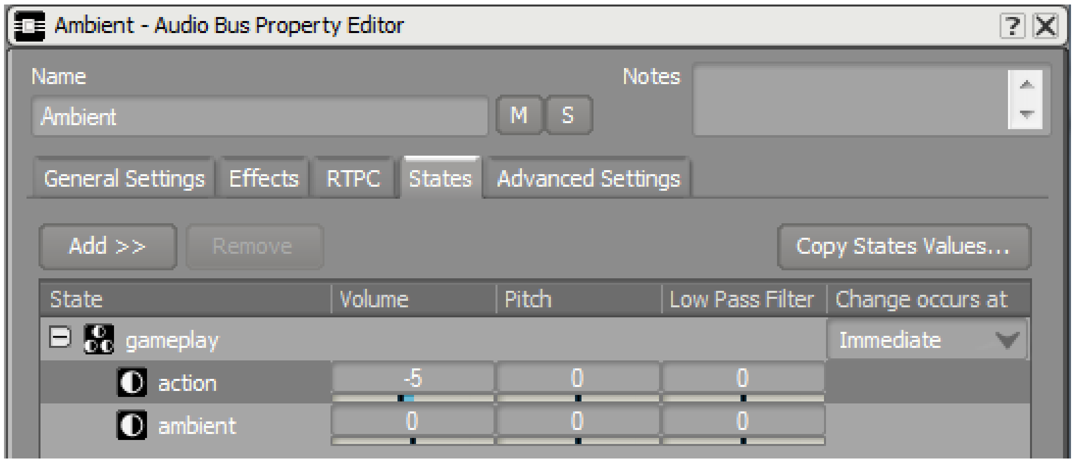
Default transition time: 1

Custom Transition Time

From	Time	To	<-->
ambient	2	action	☐
action	4	ambient	☐

Defining states and setting default and custom transition times

Once states have been established, properties that can be affected by state changes are available for any audio object or audio bus by adding a state in the States tab.



State	Volume	Pitch	Low Pass Filter	Change occurs at
gameplay				Immediate
action	-5	0	0	
ambient	0	0	0	

State based volume reduction of the ambient bus when in the action state

For more information on states:

Wwise Help > Interacting with the Game > **Working with States**

Wwise Knowledge Base - Using Multiple States to Affect Sounds

Wwise Knowledge base - Creating a Temporary Loss of Hearing Effect

Auto-Ducking vs. Side-Chaining

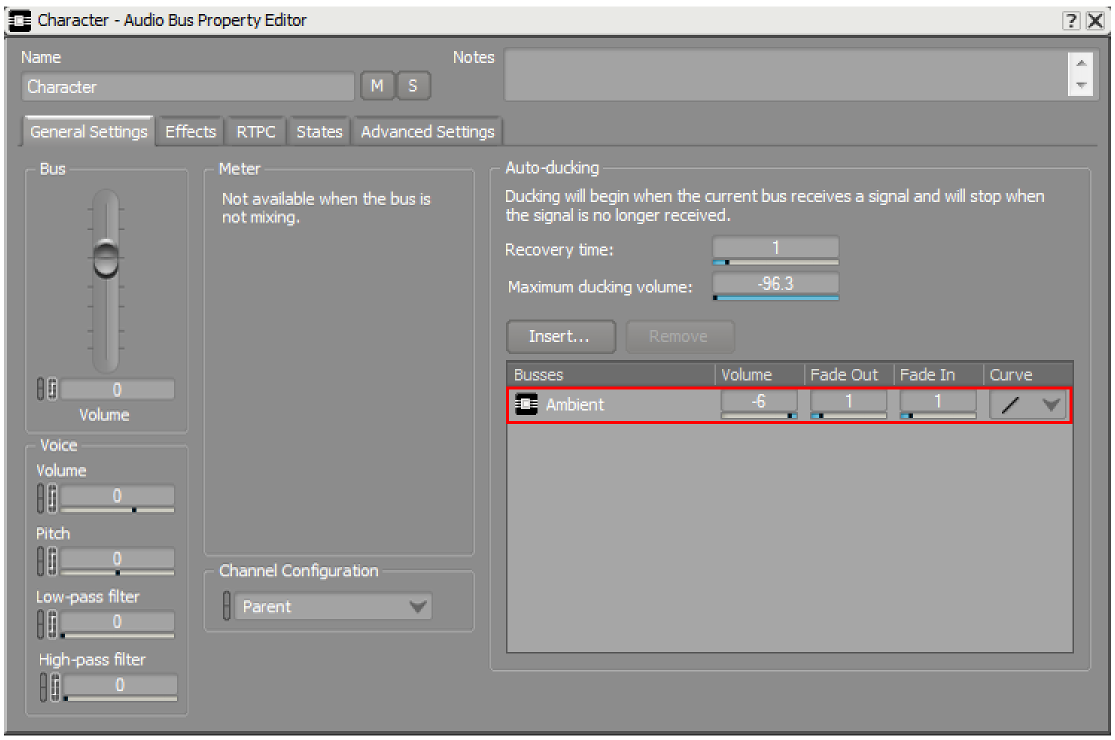
While mix states give explicitly defined control over properties, you can also automate volume reduction based on an incoming signal from another audio bus. This process is often referred to as ducking.

Designer Note

Ducking allows you to automatically lower the volume level of all objects passing through one bus in order for another simultaneous bus to have more prominence.

Auto-Ducking

Wwise allows for Auto-ducking through the General Setting tab on any audio bus. Simply insert any other bus into the Auto-ducking window and define the volume attenuation and fade in/out properties.


Character - Audio Bus Property Editor

Name: Character

Notes:

General Settings | Effects | RTPC | States | Advanced Settings

Bus — Volume: 0

Voice — Volume: 0; Pitch: 0; Low-pass filter: 0; High-pass filter: 0

Meter — Not available when the bus is not mixing.

Channel Configuration: Parent

Auto-ducking — Ducking will begin when the current bus receives a signal and will stop when the signal is no longer received.

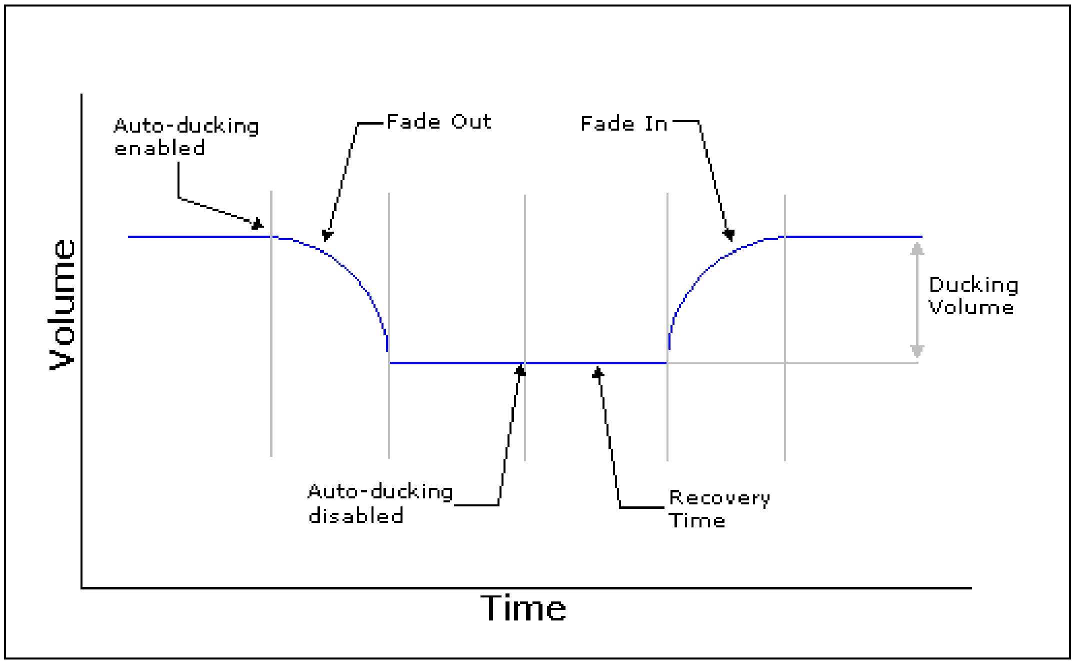
Recovery time: 1

Maximum ducking volume: -96.3

Busses	Volume	Fade Out	Fade In	Curve
Ambient	-6	1	1	/

Character audio bus automatically ducking Ambient audio bus by -6 dB over a period of one second using a linear curve

Auto-ducking begins when the selected bus receives any signal and applies the set attenuation to any inserted busses for the duration of a signal, including silence.



Side-Chaining

Another approach to ducking is through the use of Side-Chaining. Side-chaining consists of monitoring the level of an audio signal and using it to manipulate another audio signal. A concrete example of side-chaining occurs in radio broadcasting where a DJ's voice automatically ducks the music volume.

When using Side-Chaining as part of mixing, you are essentially taking volume information from input signal with the Wwise Meter effect and using it to affect other parts of the mix.

Designer Note

More information about side-chaining:

http://www.audiokinetic.com/download/documents/Wwise_SideChaining_Tutorial.pdf

Mixing with RTPC

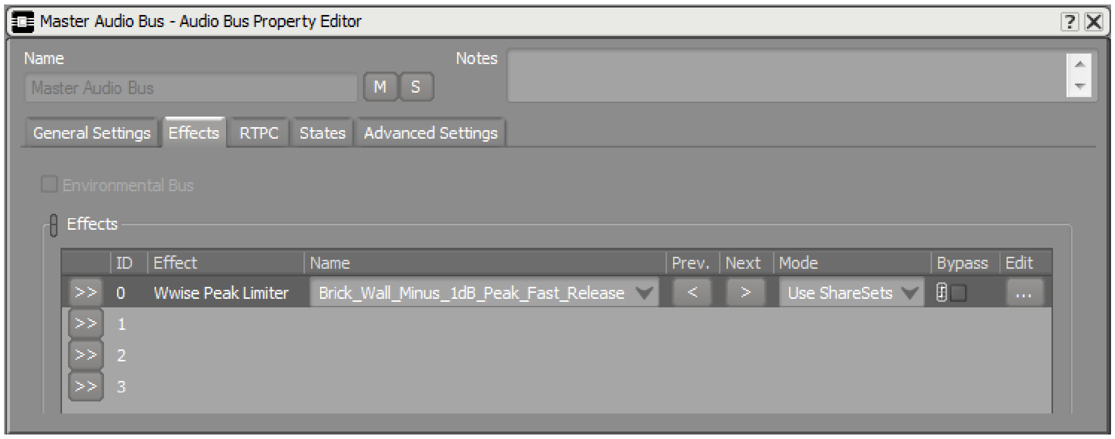
Real Time Parameter Control (RTPC) can also be leveraged to provide dynamic mixing opportunities using parameters from the game to drive volume changes throughout the project. A common parameter driven mix technique is to apply a low pass filter to the in-game environmental mix as the player’s health decreases. This can easily be accomplished with a health game parameter used as an RTPC on one or many audio busses.

Remember that Danger game parameter we created in order to increase the intensity for the horizontal music system? The same game parameter could be used to reduce the volume of sounds or audio busses that demand less attention during combat. Things like ambience or character movement sounds could have an RTPC curve applied to reduce their volume in the mix and make way for the sounds of combat.

Having multiple ways to interact with the different aspects of the mix means that when difficulties arise there will be several ways to approach a solution. Mixing with RTPC is another effective tool in the toolbox of interactive and dynamic mixing.

Using Effects in the Master-Mixer

The use of common DSP is well defined by decades of linear music and sound production. EQ, Delay, Distortion, Compression, among others have found common use in most Digital Audio Workstations for decades, but have only recently (within the last 10 years) become efficient enough to use at runtime in order to affect the mix. It's not just the use of fixed settings that makes this area of growth so exciting, but the dynamic and interactive nature of manipulating DSP using parameters from the game to produce special effects that would be impossible to achieve using other techniques.



Name: Master Audio Bus

	ID	Effect	Name	Prev.	Next	Mode	Bypass	Edit
>>	0	Wwise Peak Limiter	Brick_Wall_Minus_1dB_Peak_Fast_Release	<	>	Use ShareSets		...
>>	1							
>>	2							
>>	3							

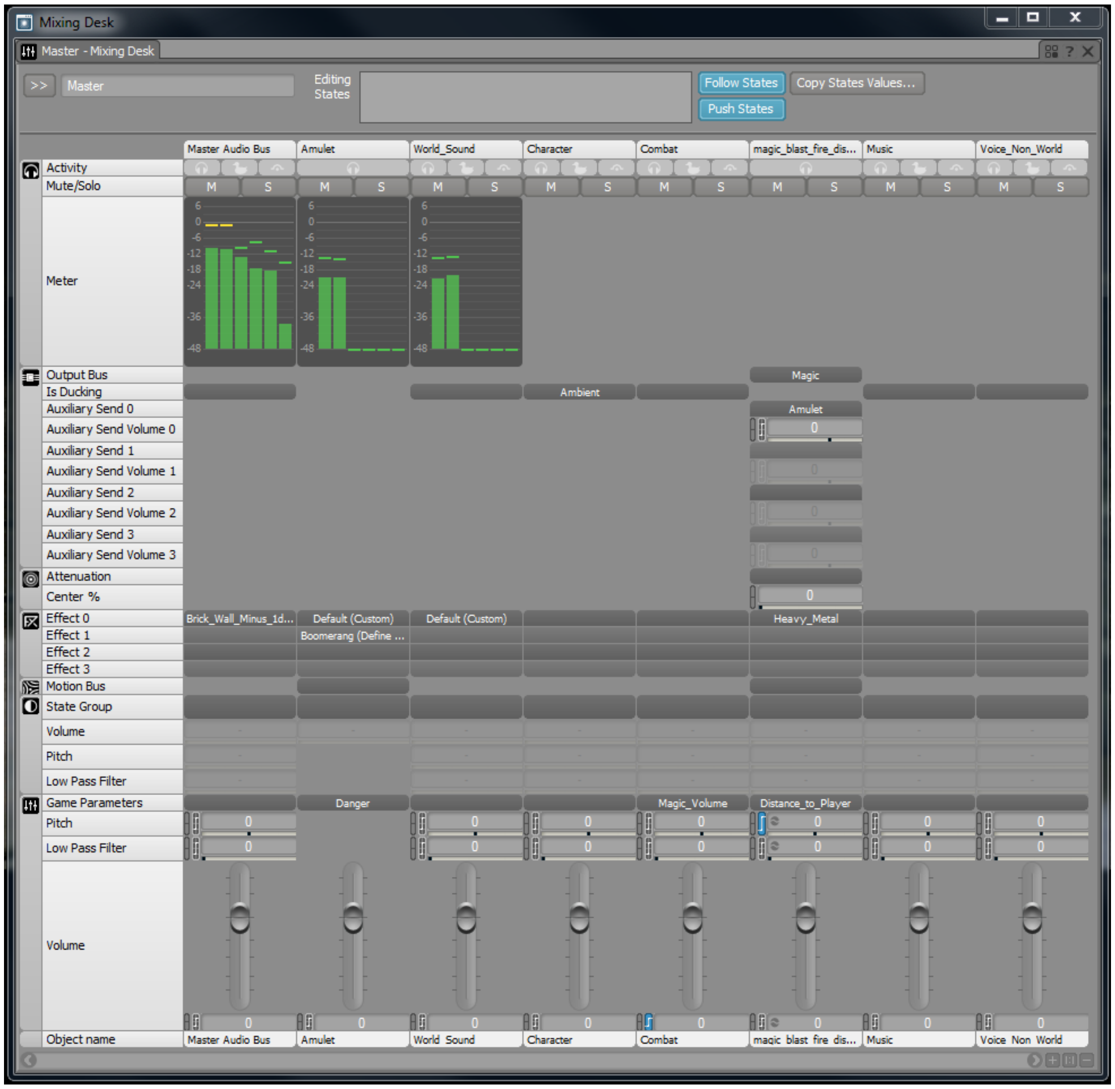
Applying a limiter to the Master Audio Bus

Effects used at runtime will always use up CPU power, but being aware of the different costs can help you use them more efficiently. If an effect (or effects) are applied to only a few mono instances of a sound object, it is more efficient to apply these at the Actor-Mixer level. If many simultaneous sounds need to be processed by a given effect, it would be more efficient to apply the effect(s) on an audio bus that will be mixed before applying the effect (in stereo or 5.1 depending on the speaker configuration).

Visualizing the Mixing Desk

The Mixing Desk is a flexible and powerful interface that groups a variety of properties into one view, allowing you to fine-tune the audio mix in real time. You can add any sound object, audio or auxiliary bus to the Mixing Desk, and then define routing, apply effect and attenuation ShareSets, edit state properties, and modify the properties of individual objects and busses.

After your audio and motion are integrated into the game, you can connect Wwise to the game and profile information in real time as the game is being played. Adjustments and mixing decisions can be made in real time in game directly from the authoring application. Activity of each object within the Mixing Desk can also be viewed, including when a voice is playing, if a bus is being ducked, and whether effects are being bypassed either manually or programmatically. Each audio object can also be muted or soloed, allowing you to adjust the individual objects within the audio mix.



Visualizing the mix using the Mixing Desk view

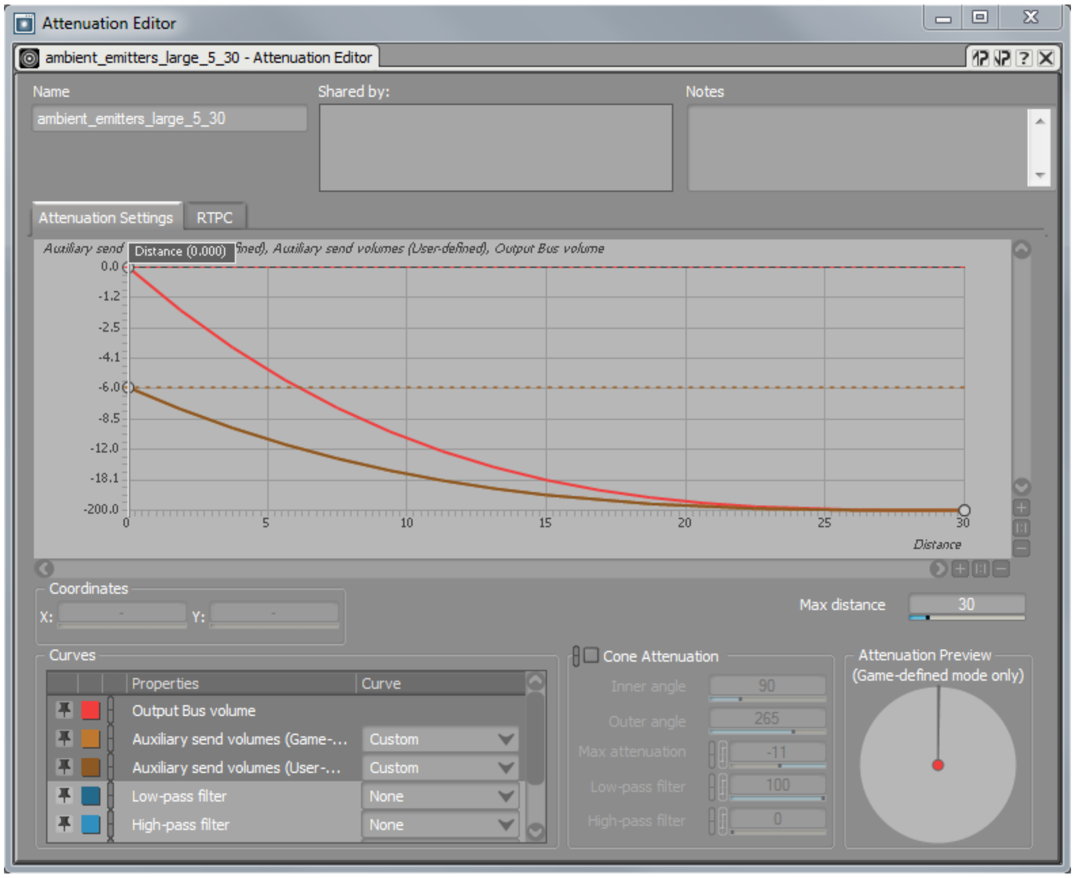
A context menu is also available for each property setting in the mixer strip. These menus contain a set of commands specifically related to the selected property. For example, when you right-click one of the Effect slots (0-3), you can edit the properties of the inserted effect, set a new effect, bypass the effect, and so on. To access the contextual menus, simply right-click the individual property settings in the mixer strip.

The Mixing Desk setup is saved within a Mixing Session ShareSet. This allows you to create different mixing sessions for different components of the game. It also means that you can set up a mixing session and then continue to fine-tune the audio mix at a later time.

Mixing Techniques for Attenuations

The use of attenuations to balance the resulting mix is one of the best contributors to a natural sounding game. Simple things like extending the maximum distance while changing the curve depth or shape can have a tremendous effect, allowing the sounds to be heard from greater distance at a lesser volume. Alternately, reducing the maximum distance can help to clean up an overactive mix and gain some clarity between elements.

Additionally, the auxiliary send volumes of an attenuation are directly related to the amount of signal sent to both game and user-defined busses. Ensuring the correct balance between the output bus volume and the game/user-defined send volumes for a sound or group of sounds can help reveal detail and definition in the mix.



Name: ambient_emitters_large_5_30

Shared by:

Notes

Max distance: 30

Curves

Properties	Curve
🟥 Output Bus volume	
🟧 Auxiliary send volumes (Game-…	Custom
🟫 Auxiliary send volumes (User-…	Custom
🟦 Low-pass filter	None
🟦 High-pass filter	None

☐ Cone Attenuation

Inner angle	90
Outer angle	265
Max attenuation	-11
Low-pass filter	100
High-pass filter	0

Adding a custom auxiliary send volumes curve to an attenuation

Mix Summary

A sound designer equipped with the tools to enable a comprehensive dynamic mix can rest easier when the time comes to complete the game's final mix. With tools modeled after those commonly used in the linear world, and further imbued with the ability to react interactively, a doorway to the next level in dynamic mixing is opened.

Throughout this chapter we have:

- Discussed signal-flow and routing using audio busses.
- Established the use of user-defined auxiliary sends.
- Established the use of game-defined auxiliary sends.
- Discussed the use of states as mix snapshots.
- Compared auto-ducking with side-chaining.
- Mixed with RTPC.
- Discussed the benefits of using effects in the Master-Mixer.
- Shown ways to visualize the mix using the Mixing Desk.
- Illustrated techniques for mixing with attenuations.

Stepped through the process of:

- Creating audio busses.
- Creating auxiliary busses.
- Setting up states.
- Applying auto-ducking to audio busses in the Master-Mixer.

Also touched on:

- The relationship between wet and dry reverb volumes in the attenuation editor.

Throughout this section we have created the following objects:

- An "Amulet" auxiliary bus used to affect magic and weapon swing sounds based on the "Danger" game parameter.

Mixing Additional Resources:

Video Tutorial - Mixing Desk

Video Tutorial - Dynamic mixing using States

Video Tutorial - Wwise Side-Chaining

Wwise Knowledge Base - Advanced settings: usage and dynamic mixing techniques

Wwise Knowledge Base - Wwise Side-Chaining Tutorial

Wwise Knowledge Base - Playback Limit and Priority: Use Case Scenarios

Wwise Knowledge Base - Using Multiple States to Affect Sounds

Wwise Knowledge base - Creating a Temporary Loss of Hearing Effect

Wwise Help > Interacting with the Game > **Working with States**

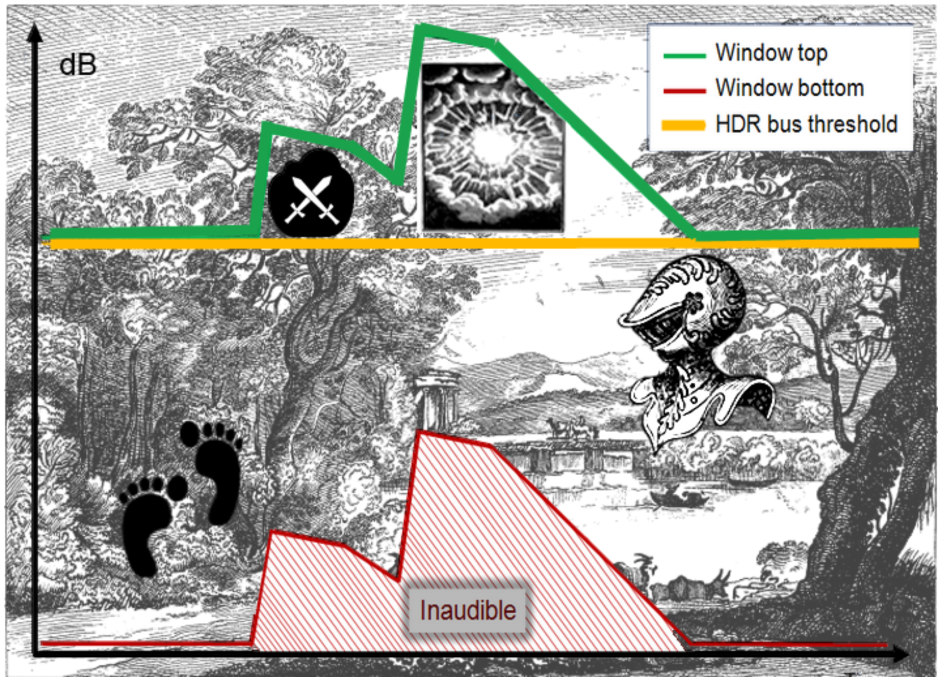
Chapter 10. HDR Audio Wwizardry

Overview

High atop the misty mountain peak, the wizened Wwizard stares out across the battle raging across the valley. The maelstrom churns below as the loudest sounds of cold steel-on-steel impact, blasts of magical power, and the release of catapults drift up from the ensuing assault. As each one of these moments takes precedence, the soundscape clears to reveal and accentuate the madness unfolding. Whether we are conscious of it or not, a finely tuned mechanism is at work assigning relevance to the loudness of what we hear and shaping the way we inherently experience the world through sound. So how can the idea of prioritizing loud sounds fit with today's gaming?

High Dynamic Range (HDR) is a new mixing paradigm available within Wwise to augment the already existing suite of dynamic mixing tools. HDR allows for authoring a system that responds to the dynamic loudness of sounds by giving priority to sounds that are authored the loudest. With this relativistic mixing system, the clarity of intention from the authoring perspective is ensured to make appropriate space in the mix for "important" sounds to be heard.

Think back to the scene that we just described. As the sounds of battle ensue, you instinctively focus on the loudest sounds (combat) and quieter sounds (footsteps) are ignored. In an HDR system, these loud sounds represent the top of a user-defined "window" that moves dynamically to ensure that the loudest sounds are in focus. As this window moves upward, sounds below the window bottom are removed from the mix. When one side emerges triumphant in the battle below and eyes turn toward the misty mountain top, the sound of horse hooves pounding the earth swell with renewed amplitude, becoming the loudest, and most threatening focus. As the HDR window threshold returns to its rest position, the original amplitude of the horses is represented.



An illustration of the HDR window shifting in response to increasing loudness of sounds over time.

This chapter takes you through the process of:

- Implementing HDR Audio in Wwise.
- Setting up an HDR Audio Mix.
- Setting up the HDR Audio Dynamic Range Window.
- Enabling HDR Audio in the Master-Mixer Hierarchy.
- Setting up HDR Audio Dynamics Properties.
- Using HDR Audio in the Actor-Mixer Hierarchy.
- Enabling Envelope Tracking.
- Editing a Waveform Envelope.
- Enabling Source Normalization.
- Using Make-up Gain.
- Using the Voice Monitor to Understand HDR Audio.
- Opening the Voice Monitor View.
- Auditioning Sounds in the Soundcaster.
- Capturing Data from Wwise.

Implementing HDR Audio in Wwise

HDR in Wwise can be enabled for any parent Audio Bus in the in the Master-Mixer Hierarchy. Once enabled, the Audio Bus acts as a converter between Sound Object volumes at the input of the HDR bus and full (device) scale at the output of the same bus. All sounds that are routed to it are handled relative to each other within the HDR bus, with the output of quieter sounds constantly modified according to the properties of the system.

The controls of an HDR bus are similar to that of an audio compressor. The properties of Threshold, Ratio, and Release Time are used to modify the behavior of the project-specified dynamic range window. At run-time, the authored system dynamically maps this wide range of levels to a volume range that is more suited to your sound system's output.

In real life, the audible dynamic range, defined by the loudest possible sound and the threshold of human hearing, is several times wider than the dynamic range offered by speakers at game play levels. The role of the Wwise HDR system is to collapse or "compress" this real life dynamic range into roughly 40 dB (70 dB SPL for TV/Music listening minus 30 dB SPL for the room noise level).

The process is a sort of behavioral compression. It affects your mix by making soft sounds inaudible as soon as loud sounds play, and then making them audible again when the soft sounds play alone. The relative levels of sounds between one another remain intact and add clarity to the mix by playing fewer sounds.

Designer Note

In prior literature, HDR audio systems are presented as having SPL values directly assigned to each individual sound. Wwise removes the notion of SPL, and instead focuses on relative mixing. Hence you will not find a SPL slider anywhere in Wwise; only relative decibel values are used. If you wish to use real-life SPL values into the system, then chose a value that will act as a reference, and perform the necessary subtraction to find the corresponding relative dB level. For example, you may decide that 100 dB SPL is your reference at 0 dB. Then a sound at 80 SPL should have its volume slider set to -20 dB, and a sound at 130 dB SPL should have its volume slider set to +30 dB.

Setting up a HDR Audio Mix

In addition to working with the features available within the authoring application, using the HDR feature allows you to place the loudest sounds front-and-center in the mix. After you have determined the importance of various sound types you can situate them within an evolving mix during production that places them in relative importance to other sounds or sound types throughout the HDR system. The resulting mix adheres to the volumes set for each sound and is constantly balanced by the shifting dynamic range window.

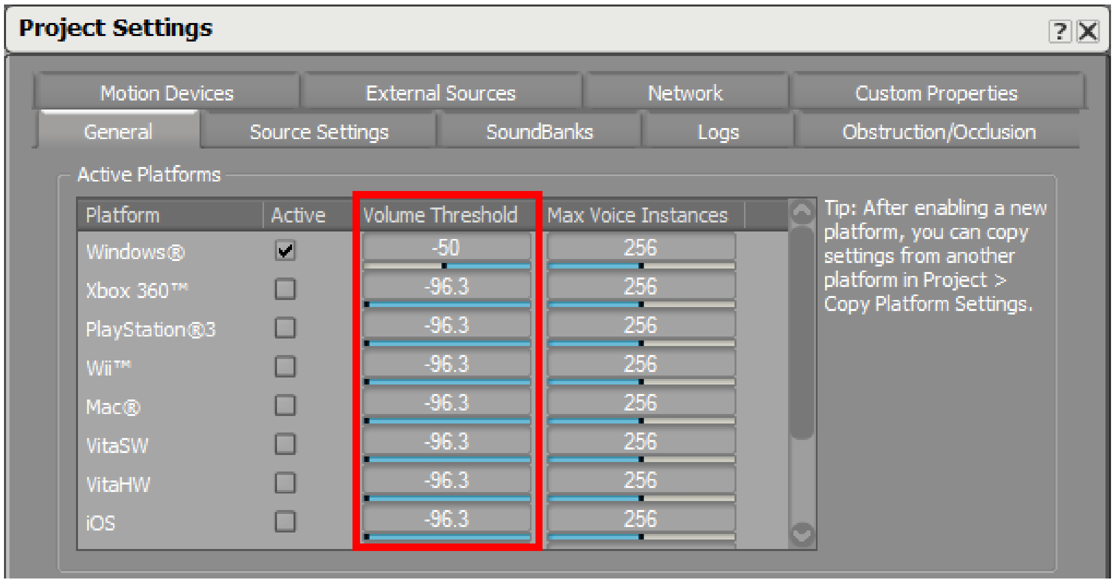
The first step is defining the dynamic range (Volume Threshold) for the project. Then, an Audio Bus is enabled for HDR processing and dynamics properties are adjusted to fine-tune the way the window responds to signals within the system.

Each auxiliary bus includes metering and the ability to set the volume, add effects, RTPC, and apply changes based on state.

Setting up the HDR Audio Dynamic Range Window

Getting set up for HDR in Wwise begins with setting the Volume Threshold (window width) that encapsulates the expected dynamic range for a specific target platform. This Volume Threshold applies to the dynamic range on the output of the HDR system.

To begin setting up an HDR system using the provided Wwise Project Adventure, set the Volume Threshold in the Project Settings to -50 dB:

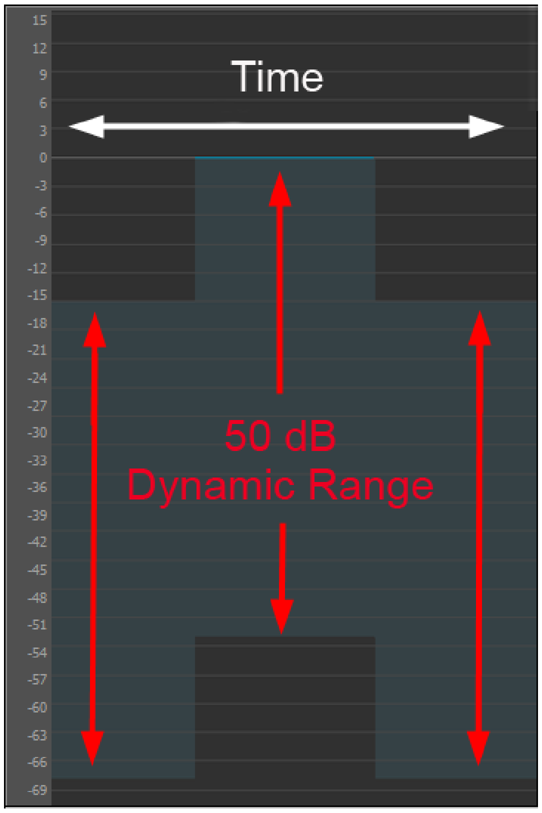


Platform	Active	Volume Threshold	Max Voice Instances
Windows®	✓	-50	256
Xbox 360™	☐	-96.3	256
PlayStation®3	☐	-96.3	256
Wii™	☐	-96.3	256
Mac®	☐	-96.3	256
VitaSW	☐	-96.3	256
VitaHW	☐	-96.3	256
iOS	☐	-96.3	256

Tip: After enabling a new platform, you can copy settings from another platform in Project > Copy Platform Settings.

Setting the Volume Threshold in the Project Settings

The Volume Threshold value from the Project Settings defines the difference between the window top and window bottom. This means that when the amplitude of the loudest sound is played back at HDR bus volume, any sounds below the Volume Threshold (window bottom) set for the platform will either be killed or use their virtual voice settings according to the advanced settings defined in the object properties of each structure. When the window shifts, the dynamic range specified for the window is maintained as it rises and falls adjusting to the loudest sound played back at the HDR bus volume.

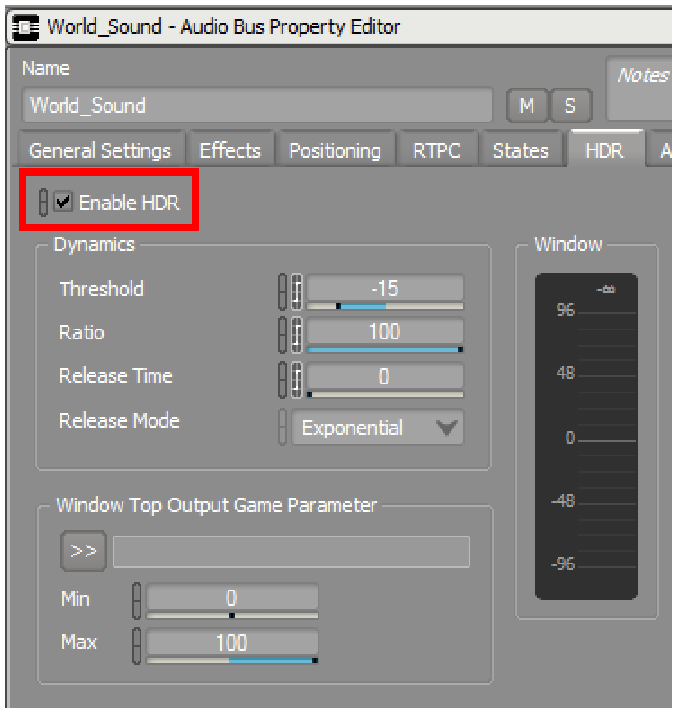


Visualization of a 50 dB Dynamic Range Volume Threshold Window shifting over time.

This Volume Threshold allows sounds that are within the specified volume range to be heard at the output. As the window moves, the volume of sounds that are playing is modified by the value of the loudest sound. This process ensures that sounds that are authored the loudest are heard and quieter sounds (below the window bottom) are removed from the mix.

Enabling HDR Audio in the Master-Mixer Hierarchy

HDR, which can be enabled at any parent level Audio Bus, takes into account any sounds routed through child busses within the hierarchy. While only one bus in a given hierarchy can be set as an HDR Audio Bus, other Audio Busses outside of an HDR-enabled Audio Bus can be used as additional HDR busses.


World_Sound - Audio Bus Property Editor

Name: World_Sound

Enable HDR ✓

Dynamics
Threshold: -15
Ratio: 100
Release Time: 0
Release Mode: Exponential

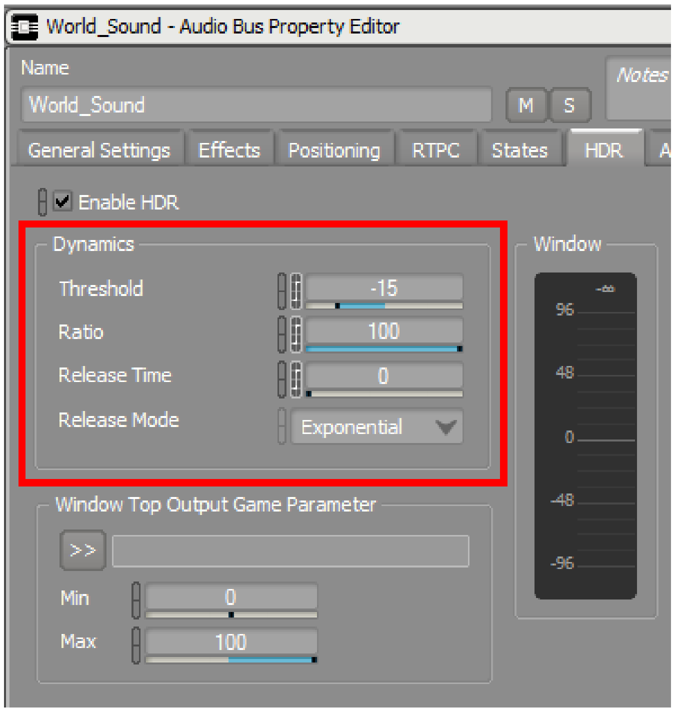
Window Top Output Game Parameter
Min: 0
Max: 100

Enabling HDR in the Master-Mixer Hierarchy

Setting up HDR Audio Dynamics Properties

Dynamics properties govern the way the HDR system reacts when sounds routed to the HDR Audio Bus interact with each other. As sounds with different volumes are passed through the HDR Audio Bus, their amplitude dynamically adjusts the global volume based on familiar properties like Threshold, Ratio, and Release Time.

To test the HDR system using the Wwise Project Adventure, enable HDR on the “World_Sound” Mix Bus and set the Threshold property to -15 dB, leaving the other Dynamics settings at their default values.



Enable HDR ✓

Dynamics

Threshold	-15
Ratio	100
Release Time	0
Release Mode	Exponential

Window Top Output Game Parameter

Min	0
Max	100

Dynamics controls for an HDR enabled bus.

Threshold

The Threshold defines the minimum input level (in dB) above which the HDR window top will engage.

Ratio

This control has a similar behavior to the ratio control in an audio compressor. The HDR window top attenuates peaks that exceed the threshold while reducing the volume of quieter sounds in proportion to the ratio. For example: two sounds, one peaking at 20 dB and the other peaking at 40 dB above threshold, come out at the same level of 0 dBFS, as long as they are not played at the same time. The difference between the two is that the former will result in an attenuation of -20 dB to sounds below threshold, while the latter will result in an attenuation of -40 dB.

At lower ratios, say 4, a sound peaking at +20 dB comes out at +5 dB, while a sound peaking at +40 dB comes out at +10 dB. The attenuation that results on sounds below threshold in these examples is -15 dB and -30 dB respectively. Using lower ratios is therefore useful to gain back "global" dynamic range for sounds above threshold that are otherwise taken away by the HDR system. The drawback is that sounds may peak above threshold, so you need to keep sufficient headroom after the HDR bus to avoid clipping. This can be done by setting the HDR bus volume to a value lower than 0 dB (for example, -10 dB).

Release Time

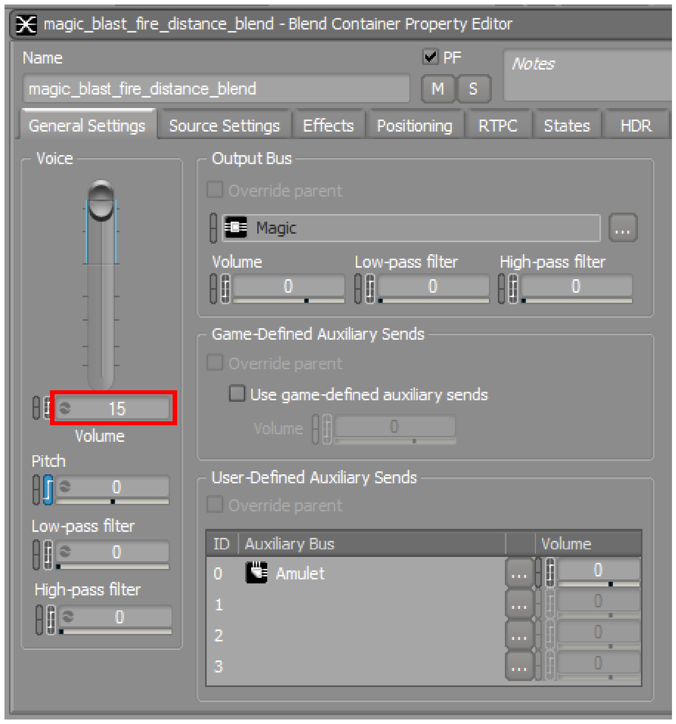
The Release time defines the rate at which the HDR window falls back to rest when the target is below the current value. In Linear Mode, it is the time in seconds it takes to fall by approximately 10 decibels. In Exponential Mode, it is the time in seconds it takes to reach approximately 0.37 (1/e) of the difference between the target and the current value. To know which mode to choose, you need to decide which sounds best based on your source material and game type.

The Use of HDR Audio in the Actor-Mixer Hierarchy

Each Sound Object has additional HDR functionality within the Actor-Mixer Hierarchy. From the HDR Tab in the Property Editor, special considerations can be addressed that affect the way sounds behave when processed within the HDR system.

In the Wwise Project Adventure Actor-Mixer Hierarchy, begin by setting volume values for groups of sounds based on the provided Work Units:

- Ambient: -20 dB
- Character: - 10 dB
- Combat: -5 dB
- Magic: 15 dB



Name: magic_blast_fire_distance_blend

Voice
Volume: 15
Pitch: 0
Low-pass filter: 0
High-pass filter: 0

Output Bus
Override parent
Magic
Volume: 0
Low-pass filter: 0
High-pass filter: 0

Game-Defined Auxiliary Sends
Override parent
Use game-defined auxiliary sends
Volume: 0

User-Defined Auxiliary Sends
Override parent

ID	Auxiliary Bus	Volume
0	Amulet	0
1		0
2		0
3		0

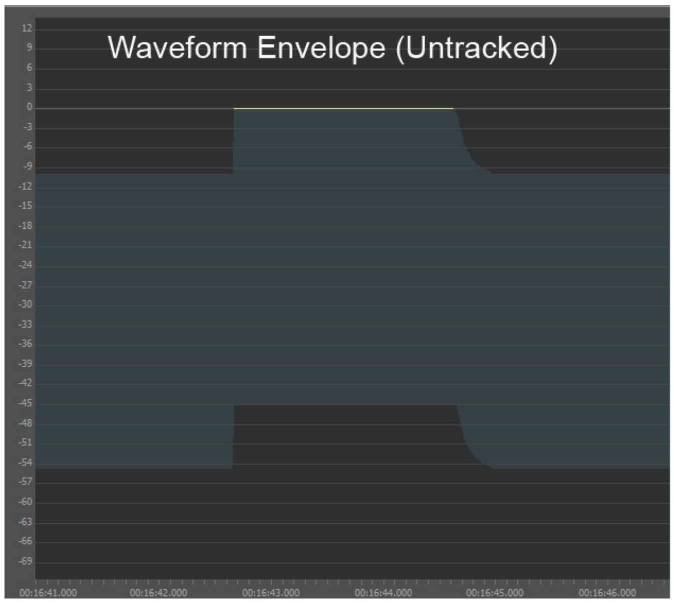
Setting the Volume for the "magic_blast_fire_distance_blend" Blend Container

These values represent a relativistic mix that represents magic sounds as the loudest, followed by: combat, character, and ambient sounds in decreasing amplitude. This simple group-based mix allows you to audition different sound types within the HDR system to see how playback affects each of them.

Enabling Envelope Tracking

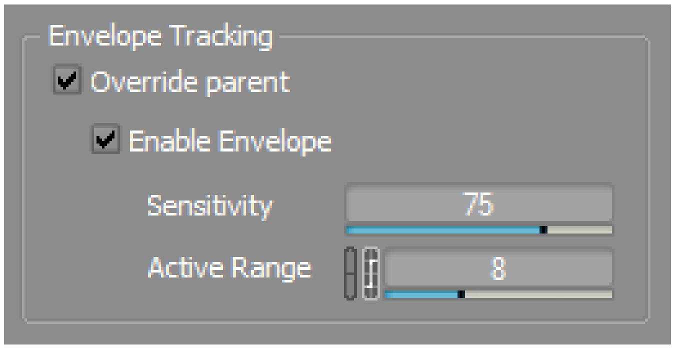
From high atop the mountain, the threshold engages the HDR system as the first magic blast resonates across the battlefield. The volume of the magic blast has been authored as the loudest sound in the project, which swiftly engages the window top and removes footstep sounds from the mix. Regardless of your position during battle, the jolt of the blast signifies danger and all the sounds - nature, footsteps, and fallen soldiers - are removed from your purview while you focus on the magnitude of sound.

As the window top follows the magic blasts envelope, the cold sound of steel-on-steel begins to cascade across the ravaged field of warriors. Authored below the relative volume of a magic blast, each impact rings out with a sharp attack that continues peaking the window top. The ratio property directly relates to the attenuation of sounds below threshold. This leaves ambiance out of the mix as the battle cries rise up towards another assault.



Untracked waveform envelope shifting the HDR window top

When Envelope tracking is enabled, an offline analysis of the waveform automatically calculated by Wwise is used to adjust the window top in relation to the waveform's envelope. This can be very useful for loud sounds that drive the window top over the Volume Threshold. Because the process of tracking the waveform envelope has a small memory cost compared to the default envelope behavior, it is recommended for use with loud sounds or sounds with a long envelope that changes in volume.


Envelope Tracking

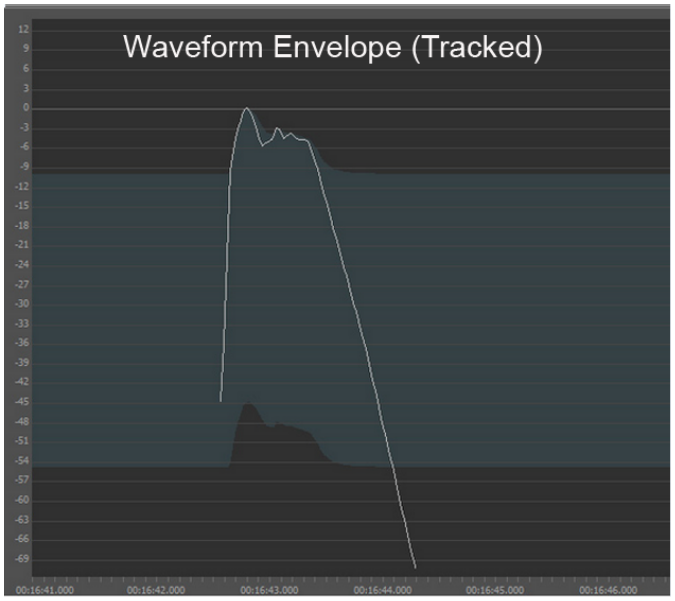
☑ Override parent

☑ Enable Envelope

Sensitivity 75

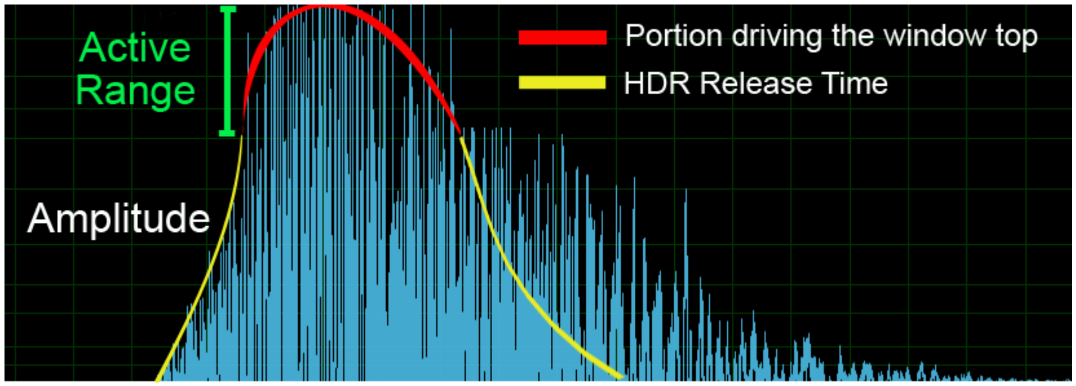
Active Range 8

Envelope Tracking properties for Sensitivity and Active Range.



Tracked waveform envelope shifting the HDR window top.

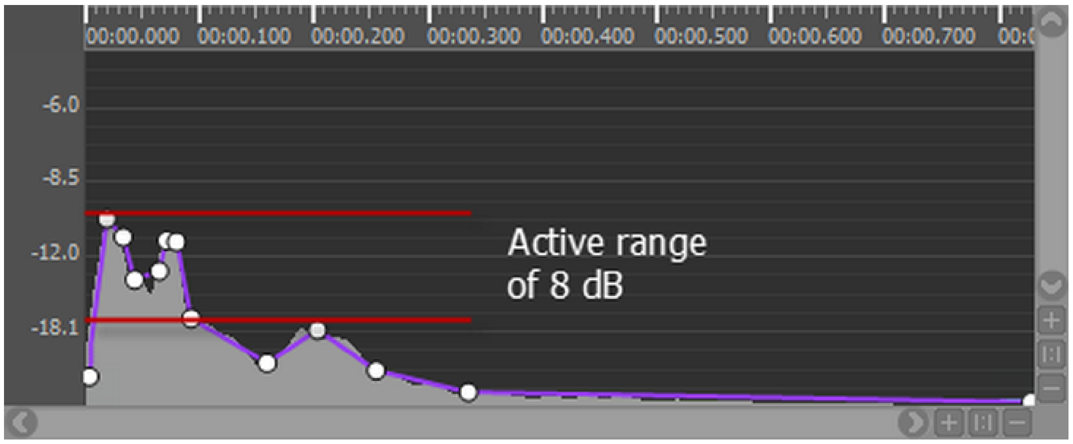
The active range defines the area of a voice from its peak (in decibels) in which the HDR dynamics are active. This region of interest is based on its analyzed envelope: it is "active" as long as the current envelope level is above "peak level" minus "active level". When it is not active, the HDR dynamics ignore the content of the sound and the release time set in the HDR bus is applied.



A chart describing the relationship between the Active Range and HDR Release Time in relation to the envelope of a sound.

Editing a Waveform Envelope

You can further adjust individual waveform envelopes from the Source Editor for specific sound files.

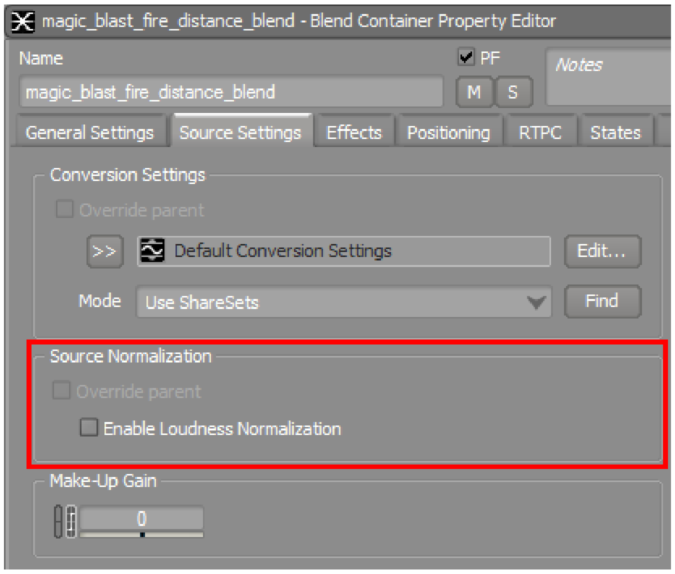


Editing the audio source envelope to isolate the interesting audio signal that should be part of the 8dB active range defined the Object properties HDR tab.

The Envelope Editing Sensitivity value directly relates to the number of data-points in the editor that are represented and tracked when Envelope Tracking is enabled. Reducing the sensitivity reduces the level of detail that is tracked by the HDR system at runtime. Data-points can be modified by manually modifying their position in the Source Editor.

Enabling Source Normalization

Non-destructive Source Normalization can be enabled at either the Parent or overridden at the child level of the Actor-Mixer Hierarchy for any sound or group of sounds. Enabling loudness normalization provides normalization of any sources by applying an automatic gain calculated from the measured loudness of the source recording.



Enabling Loudness Normalization in the Source Setting tab of a Sound Object

To hear the results of Loudness Normalization, enable Loudness Normalization in the Source Settings for Sound Objects contained within these Work Units:

- Ambient
- Character
- Combat
- Magic

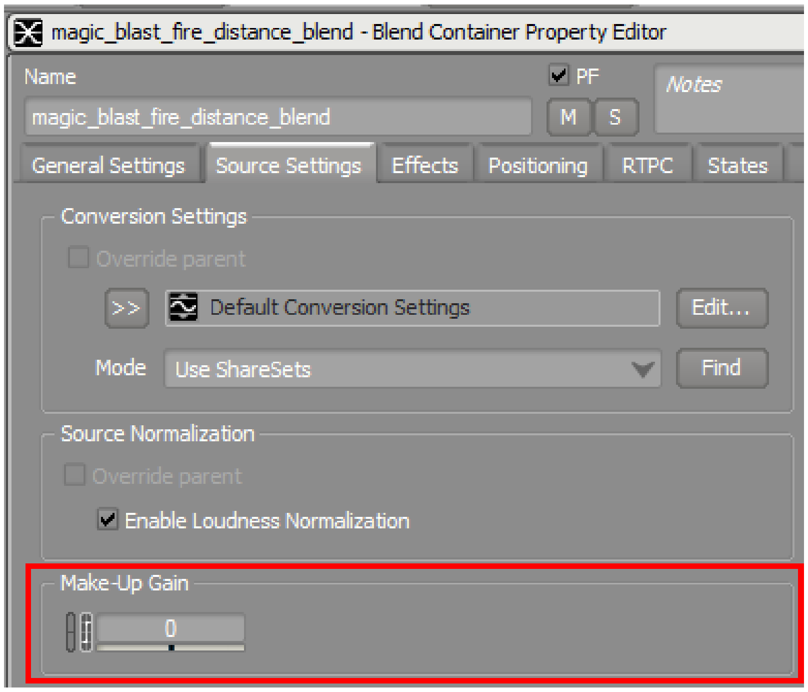
Historically the practice of normalization has varied widely across different development pipelines and audio engine methodologies. Enabling Loudness Normalization as part of your mixing strategy gives you a reliable way to ensure that two sounds playing at the same volume (e.g. -10 dB) will be perceived as playing at exactly at the same level. In this way the sound content is uniformly prepared in a way that inspires confidence during mixing.

Designer Note

Loudness Normalization is applied to source files at a target value of -23dB. Wwise analyzes the wave data, stores its loudness measurement proportional to its RMS value, and then at run-time, applies gain to the sound such that its loudness will be equal to -23 dB. For example, a sound turns out to have a loudness of -35 dB; at run-time, we "normalize it" by applying a gain of +12 dB.

Using Make-up Gain

Make-up Gain defines an amount of gain applied after the HDR processing. This gain does not influence the HDR dynamics, in the way that adjustments made with standard volume sliders do. Make-up Gain can be used to offset sound levels relative to the HDR window. It can also be used to adjust loudness normalization.


magic_blast_fire_distance_blend - Blend Container Property Editor

Name: magic_blast_fire_distance_blend

✓ PF

Conversion Settings

Override parent

Default Conversion Settings

Mode: Use ShareSets

Source Normalization

Override parent

✓ Enable Loudness Normalization

Make-Up Gain: 0

Using Make-Up Gain to offset volume levels for a Sound Object

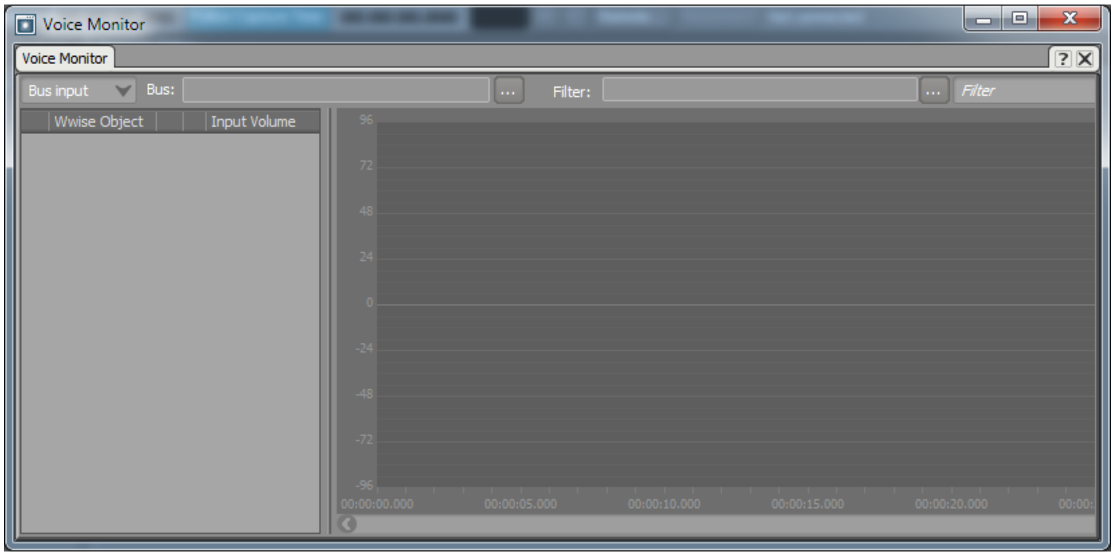
The ability to control the volume of a source without affecting the HDR response is a powerful tool that gives precise control over the mix. The abstraction of volume values becomes a natural process as the mix is iterated during production. Once volumes for sounds are set within the HDR system, this additional volume control ensures that the mix can be fine-tuned without disturbing the overall composition.

Using the Voice Monitor to Understand HDR Audio

Being able to see the effect of the moving window on sounds routed through the HDR bus allows for visualization that helps to clarify the process. Using the Voice Monitor view illustrates the window movement, the volume of sounds, and how the envelope of the loudest sound affects the HDR system.

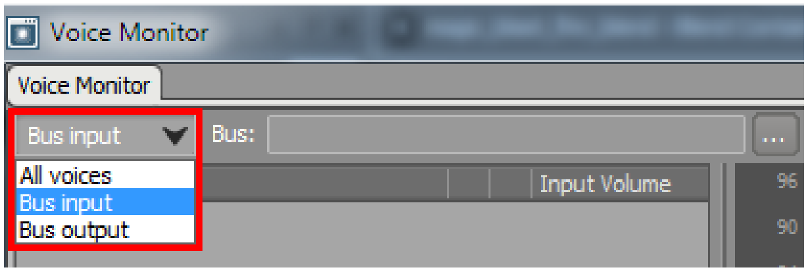
Opening the Voice Monitor View

Begin by opening a Voice Monitor view from the Views Menu in the Menu Bar.



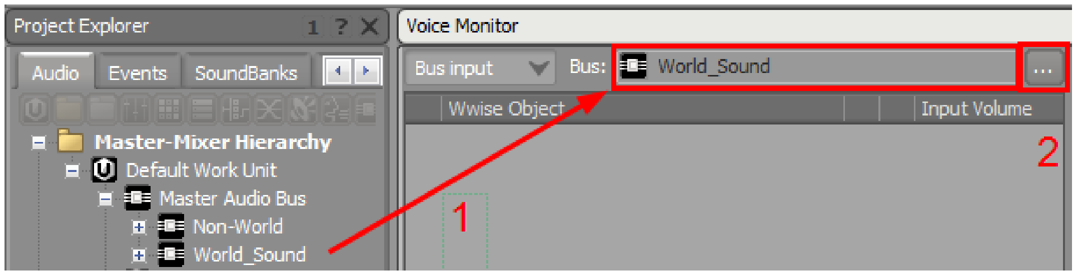
Opening the Voice Monitor View

To see and understand the different behaviors of HDR in action, set the monitoring mode to either: Bus Input, Bus Output, or All voices.



Viewing the different monitoring modes in the Voice Monitor

A HDR Bus can then be assigned to the Voice Monitor using either drag and drop or the Project Explorer Browser.

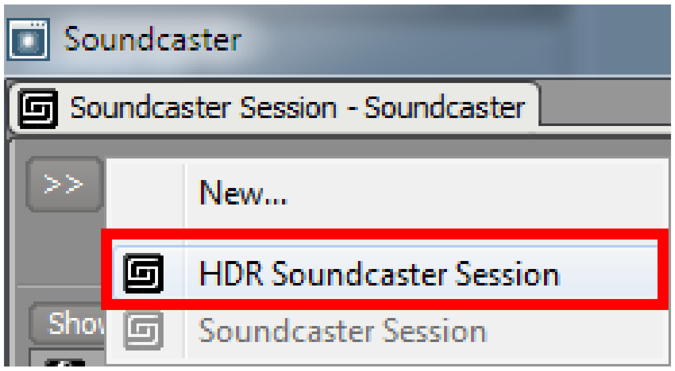


Assigning a mix bus can be done using drag and drop (1) or using the Project Explorer - Browser (2)

After these properties of the Monitor View have been assigned, any audio running through the selected bus is monitored when capturing from the authoring application or from a remotely connected game running on any development platform.

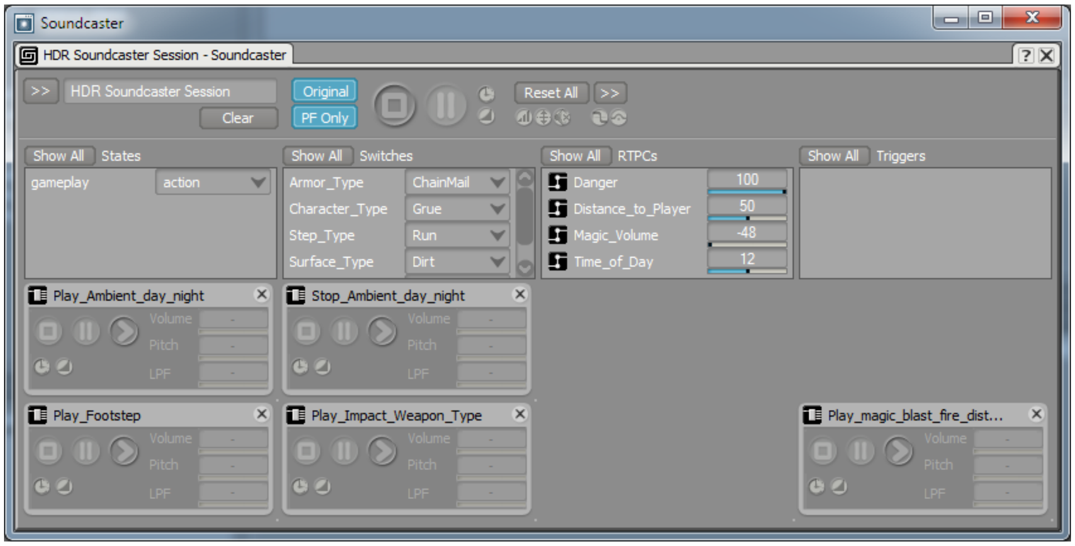
Auditioning Sounds in the Soundcaster

In the Wwise Project Adventure, open the Soundcaster View from the Views Menu and select the default "Soundcaster Session" from the list of sessions:



Selecting the default Soundcaster Session within the Soundcaster

The Soundcaster Session contains a set of Events that can be used to audition sounds within the Project and additional Events can be added to further experiment with the different categories of sound.



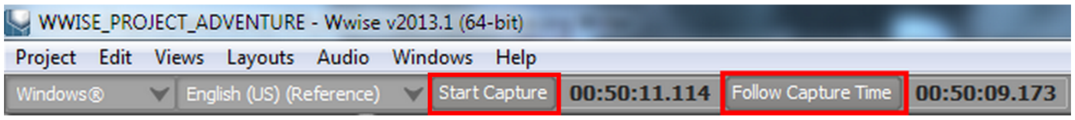
gameplay	action
Armor_Type	ChainMail
Character_Type	Grue
Step_Type	Run
Surface_Type	Dirt
Danger	100
Distance_to_Player	50
Magic_Volume	-48
Time_of_Day	12

Play_Ambient_day_night
Stop_Ambient_day_night
Play_Footstep
Play_Impact_Weapon_Type
Play_magic_blast_fire_dist...

The default Soundcaster Session included in the Wwise Project Adventure

Capturing Data from Wwise

Now that the Soundcaster is ready for auditioning sounds within the HDR system, use Wwise to capture data from the project. To capture data in the authoring application, click Start Capture. Use the Follow Capture Time button to follow along with the capture time to see what happens in real-time.

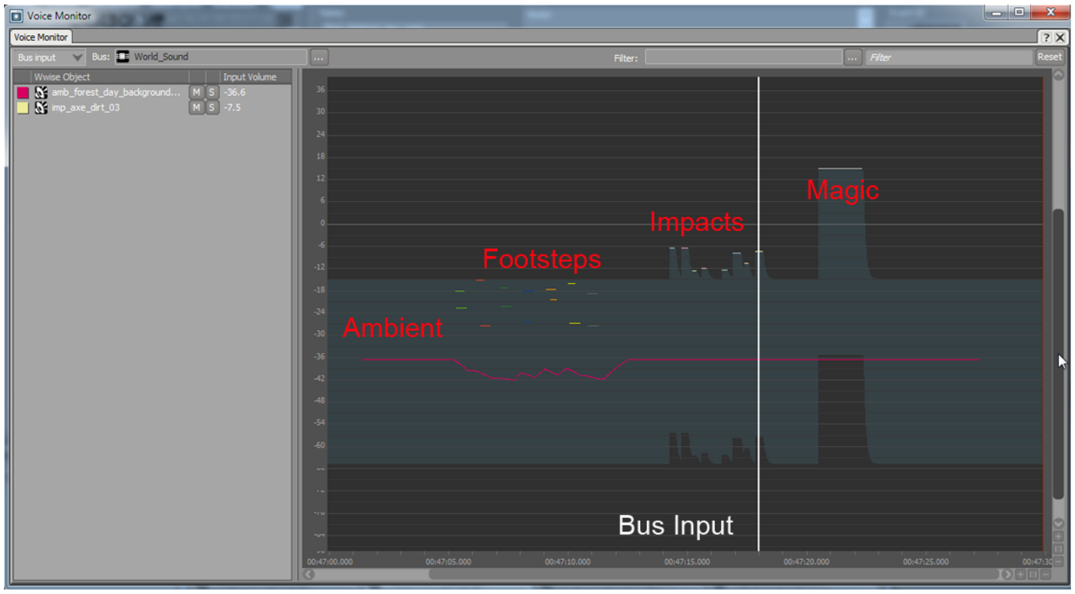


Selecting Start Capture and Follow Capture Time in the Voice Monitor

Once capturing has begun, any sounds passing through the selected bus are displayed according to their current volume. Sounds can be auditioned from the Transport, Soundcaster, or from a locally or remotely connected game running on any development platform.

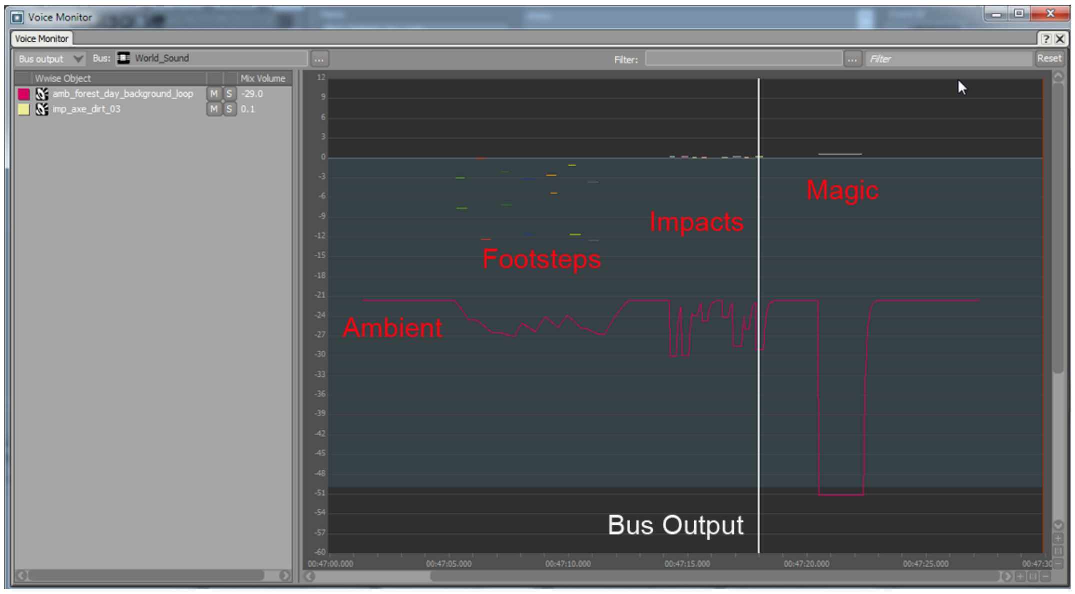
Begin auditioning by selecting the Play icon for the Play_Ambient_day_night Event. From this point, other Events can be auditioned and their effect on the HDR window can be seen represented in the Voice Monitor. It is worth enabling the envelope for the magic sounds to see the difference between settings. Adjusting the HDR Threshold or Ratio will give additional insight into how dynamic range can be modified within the HDR system.

Here's a look at a captured sequence of Events using the Voice Monitor:



Wwise Object			Input Volume
amb_forest_day_background...	M	S	-36.6
imp_axe_dirt_03	M	S	-7.5

Monitoring the Bus Input during a capture using the Voice Monitor



Wwise Object			Mix Volume
amb_forest_day_background_loop	M	S	-29.0
imp_axe_dirt_03	M	S	0.1

Monitoring the Bus Output during a capture using the Voice Monitor

Wwise has implemented an end-to-end solution for authoring and auditioning the HDR system, the results of which can be seen in the Voice Monitor. Being able to test out different values offline within the authoring application and immediately visualize their effect on the mix bring unprecedented clarity to the inner working of the created system. This ability to not only hear the resulting mix but see how sounds affect each other is the key to making optimal mix decisions and knowing how they affect the final output.

HDR Audio Summary

Because HDR is applied selectively to a parent bus within the Master-Mixer hierarchy, it need not be the only technique used for dynamically mixing the game. HDR is one of six mixing techniques within the authoring application that include: set-volume mixing, state-based (snapshot) mixing, auto ducking, RTPC, side-chaining, and high dynamic range mixing. Striking the right balance between different mixing systems allows you to creatively orchestrate your interactive mix and help solve mix-related problems, create customized mixing solutions, and address any project needs that may arise during production.

Throughout this chapter we have:

- Described the theory behind High Dynamic Range audio within Wwise.
- Given background for the application of HDR using the Wwise Project Adventure as an example.
- Provided an fictitious scenario which illustrates the fundamentals of HDR audio.

Stepped through the process of:

- Setting up the HDR Audio Dynamic Range Window.
- Enabling HDR Audio in the Master-Mixer Hierarchy.
- Setting up the HDR Audio Dynamics Properties.
- Enabling HDR Audio in the Actor-Mixer Hierarchy.
- Enabling Envelope Tracking.
- Editing a Waveform Envelope.
- Enabling Source Normalization.
- Using Make-up Gain
- Using the Voice Monitor to Understand HDR Audio.
- Capturing Data from Wwise to view HDR Audio in the Voice Monitor.

Also touched on:

- A fictitious scenario illustrating the fundamentals of HDR audio.

Throughout this section we have created the following objects:

- The Project Settings Volume Threshold
- Master-Mixer “World_Sound” Audio Bus
- Volume and Loudness Normalization for Sound Objects within the following Work Units:
  - Ambient
  - Character
  - Combat
  - Magic

Chapter 11. Getting Set Up for Adventure

Overview

Like any well planned adventure, being prepared for the trials and tribulations you'll face along the way starts with what you bring with you. A well thought out plan of attack can make for smooth travel along the road to development.

This chapter will take you through the process of:

- Work Unit management
- Grouping objects in the Actor-Mixer hierarchy
- Project settings
- Workgroup settings
- Audio file locations
- Default conversion settings
- Obstruction and Occlusion
- Language Manager
- Platform Selector
- Customizing Layouts
- Motion
- SoundBank and SoundBank generation
- Conversion settings
- Integrity Report
- Using the file packager
- Preparing for downloadable content (DLC)

When building a hierarchy there are a couple of key considerations to keep in mind.

Work Unit Management

Establishing a Naming Convention Early

Establishing a naming convention for work units, sound objects, and audio files can help identify the type of asset and possibly its orientation within the project at-a-glance. In larger projects, being able to visually distinguish different types of assets based on naming alone can really speed up the workflow. Throughout this project we've attempted to adopt a naming standard that is consistent and transparent.

Logical Grouping of Work Units

While it's easy to begin dragging and dropping .wav files directly into the Actor-Mixer hierarchy, when planning for a larger project you and your project would benefit from some additional thought on the matter. A simple hierarchy may consist of a single work unit that encompasses all of the game objects. Alternately you might choose to have a work unit for each type of sound, for example: Ambiance, Characters, Combat, UI, Voice, etc. These work units can contain Game Objects of any type and can be further organized within folders or actor-mixers.

Creating Work Units with Sharing in Mind

It's important to note that work units represent individual files within the Wwise project folder. These files are readable via a text editor and contain the information, properties, and relationships specified within the tool. Hierarchies of nested work units can now be created in Wwise and organized in physical folders and subfolders. If work units are present in a subfolder for a specific category (ex: Actor-Mixer hierarchy), they will be loaded with the project. This results in a finer granularity of files available for source control which simplifies development in a multi-user environment.

Designer Note

When working with a large audio team, it is often necessary to create enough work units to allow for a single person to work exclusively with a given work unit for a duration of time. If you are using the integrated Wwise Source Control solution, it is important to make sure you create a hierarchy that will work well with the file permissions established by the programmer.

Grouping Objects in the Actor-Mixer Hierarchy

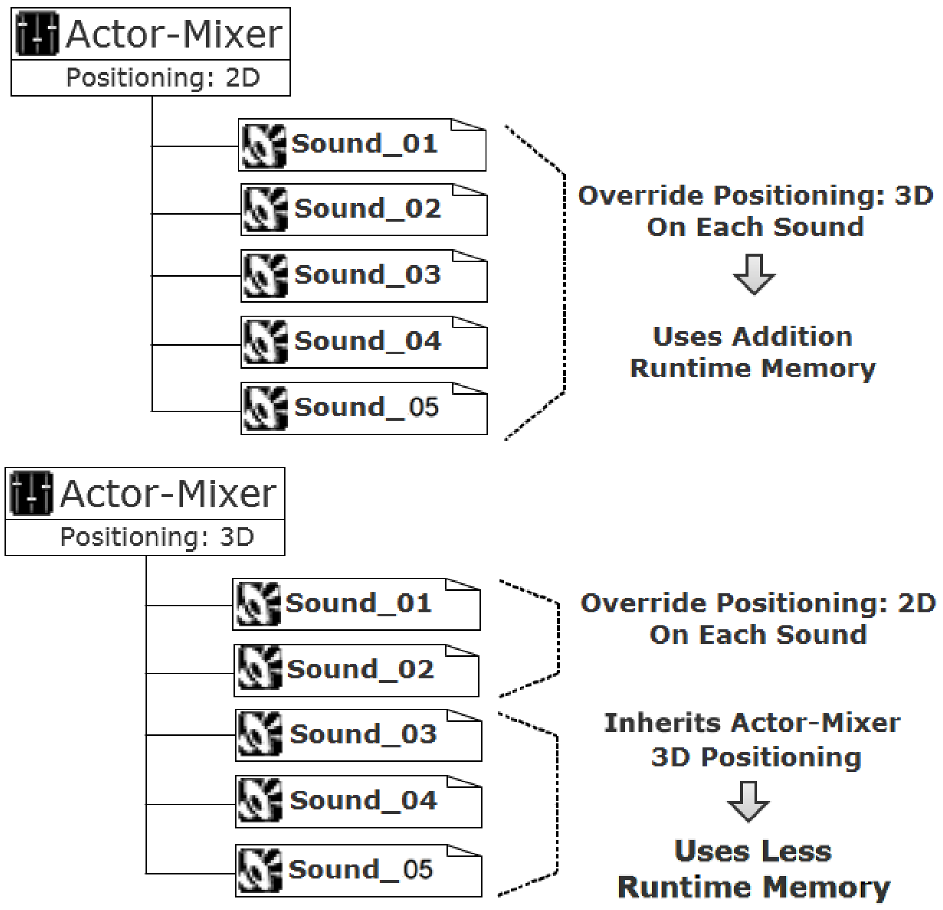
The actor-mixer is the ultimate memory and CPU saver because some of the actor-mixer’s properties, such as positioning and RTPCs, are shared by all of its child objects. When considering how to organize different sound objects, think about grouping within actor-mixers to:

- Share property settings so they are processed only once.
- Limit overrides to avoid processing the overrides for each object.

To optimize memory usage, consider grouping objects into actor-mixers to share the following properties:

- Positioning
- RTPCs
- States
- Randomizers

Let's say you have an actor-mixer containing 10 sounds and you want to set the sound positioning to 3D. You could set the sounds individually to 3D by using the override parent option for each sound. However, doing it this way uses 10 times more memory at run time than if you had set the actor-mixer positioning properties to 3D. Now if you wanted some of the sounds to be 2D, you would still be optimizing memory if you set the actor-mixer's positioning to 3D game-defined. In this case you would override the actor-mixer and apply 2D to the specific sounds because 2D sounds do not require additional memory.



Illustrating the memory saving benefits of hierarchy property inheritance

While the actor-mixer is usually your best choice, in certain situations, you can decide to apply properties in containers to optimize memory consumption. If, you are only applying positioning to specific objects within a container, for example, footstep sounds in a random container, you could save memory by applying the positioning properties to the container and not to the parent actor-mixer. If, however, you want all the objects in the structure to share the positioning properties, you would apply these at the actor-mixer level.

Setting the Audio Channel Configuration

System Default Channel Configuration

- From the menu bar, click **Audio** > **System Default Channel Configuration**
- By default, Wwise use the speaker setup configuration from the windows control panel. Select this option to choose value selected in the Windows control panel.

Stereo Channel Configuration (Speakers)

- From the menu bar, click **Audio** > **Stereo Channel Configuration (Speakers)**
- For more information on panning rules (speakers, headphones), refer to Speakers vs Headphones Panning Rules in the next section.

Stereo Channel Configuration (Headphones)

- From the menu bar, click **Audio** > **Stereo Channel Configuration (Headphones)**
- For more information on panning rules (speakers, headphones), refer to Speakers vs Headphones Panning Rules in the next section.

5.1 Channel Configuration

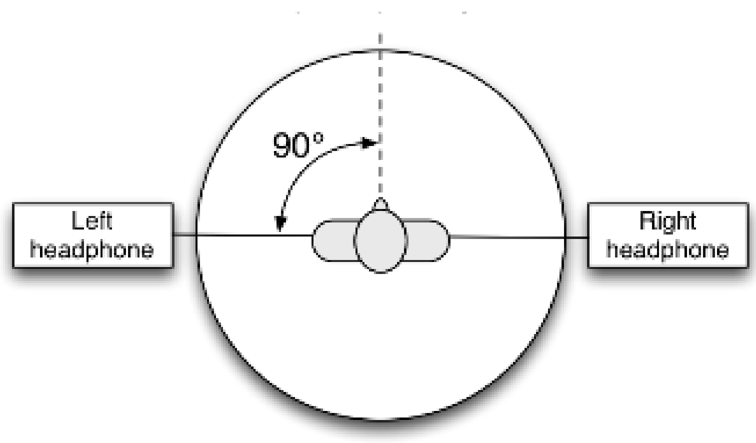
- From the menu bar, click **Audio**> **5.1 Channel Configuration**

Designer Note

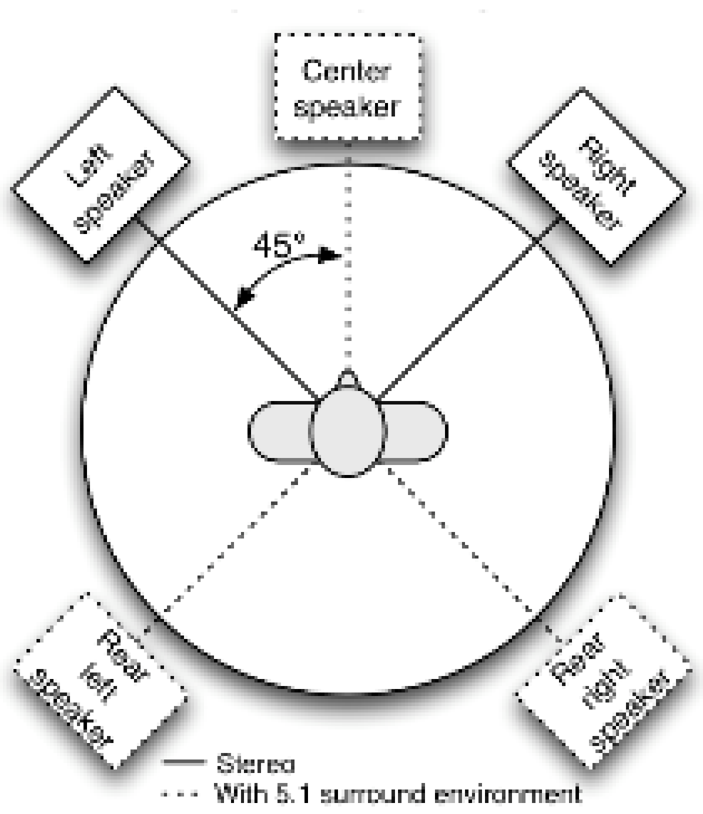
You can select 5.1 Channels Configuration while Windows control panel is set to stereo. Be aware, that this might force directsound to downmix from 5.1 to stereo.

Speakers vs Headphones Panning Rules

In Wwise there are two different panning rules: Headphones and Speakers. By default, all platforms use the speaker panning rule with the exception of the handheld consoles that use the headphone panning rule. The difference in between the two modes is subtle but helps to provide a realistic and accurate audio experience depending on your listening set-up. This setting can be auditioned in Wwise but also can also be set in the game at run-time.



Headphone Panning Rule



Loudspeaker Panning Rule

To audition the two modes:

- From the menu bar, click **Audio** > **Stereo Channel Configuration** (**Speakers**)
- From the menu bar, click **Audio** > **Stereo Channel Configuration** (**Headphones**)

Programmer Note

You can also set the panning rule in the game, please refer to AK::SoundEngine::SetPanningRule in the sound engine documentation.

Creating Simulations with the Soundcaster

At any point in the development process you might find it helpful to build a simulation using the Wwise objects and events you have been working on. To accomplish this, Wwise has created a simulation environment called the Soundcaster where you can play back sound, music, and motion structures asynchronously. This means you can control what plays and when. This can be very handy for testing events, mixing in real time, and so on. The Soundcaster is a powerful tool that can be used for:

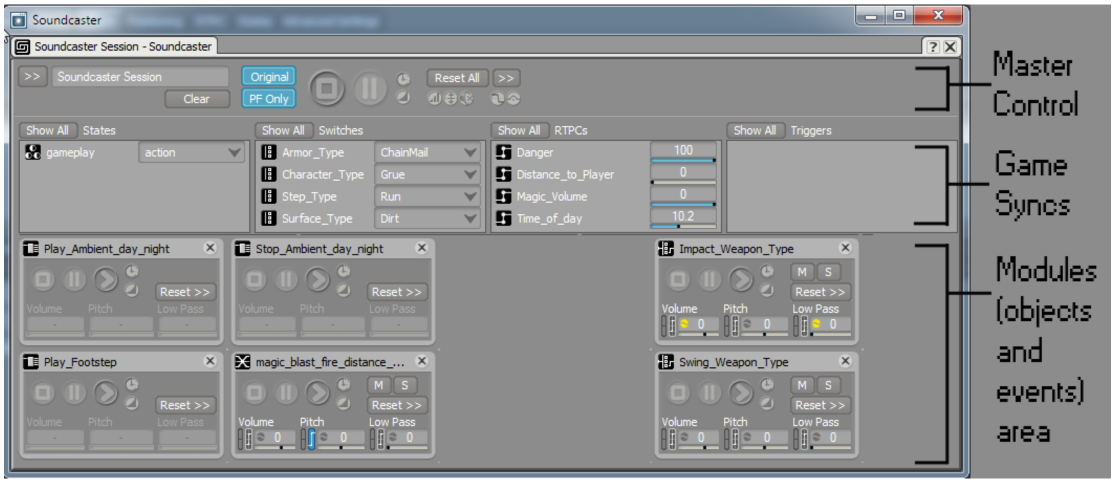
- Prototyping and experimenting.
- Developing a proof of concept.
- Auditioning sounds, music, and motion simultaneously.

Since you can simulate in Wwise alone or by remotely connecting to a game, the Soundcaster provides you with many different uses for your simulation. For any simulation you can choose to:

- Selectively audition the audio or motion for each platform.
- Audition pre-converted audio files.
- Profile your audio and/or motion as it is playing back.
- Mix and test your audio and motion in Wwise by manually simulating the game action.
- Profile your audio and motion in game and in Wwise.
- Experiment with the sounds, music, and motion objects associated with a game object.
- Mix and test your sounds, music, and motion in game.

The Soundcaster consists of three areas:

- Master controls
- Game syncs
- Objects and events



Soundcaster showing the three main areas of simulation interaction

Using the different areas of the Soundcaster, you can work with its mixing and playback functionalities when you build your simulation.

For more information on using the Soundcaster:

Wwise Help > Finishing Your Project > **Creating Simulations**

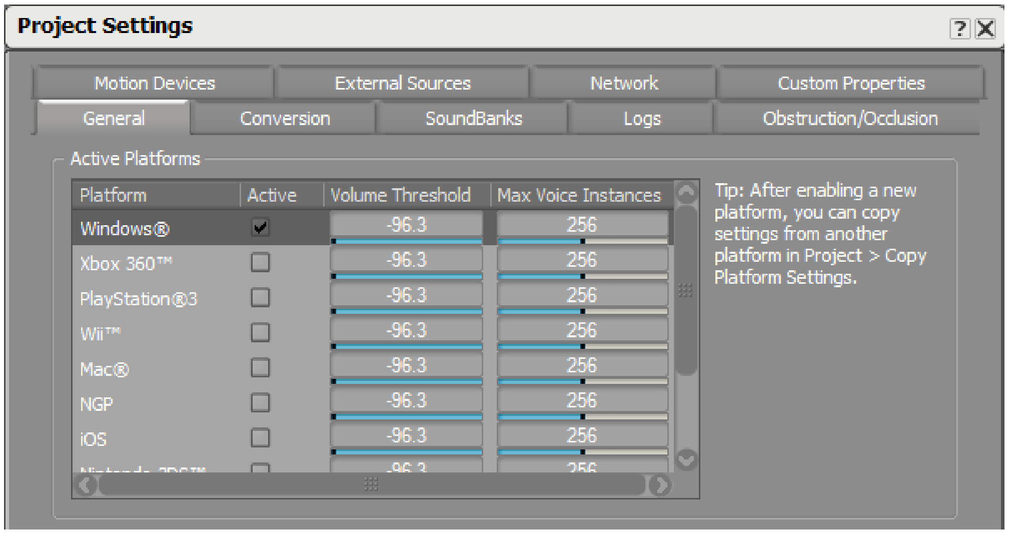
Video Tutorial - Wwise Quick Tip - Transport and Soundcaster

Project Settings

There are several aspects of the Project Settings that define the default behavior for sound throughout the project.

Project Settings - General Tab

Through the general tab you can activate development platforms, set the volume threshold, and set the maximum voice instances for each platform.



Platform	Active	Volume Threshold	Max Voice Instances
Windows®	✓	-96.3	256
Xbox 360™	☐	-96.3	256
PlayStation®3	☐	-96.3	256
Wii™	☐	-96.3	256
Mac®	☐	-96.3	256
NGP	☐	-96.3	256
iOS	☐	-96.3	256

Tip: After enabling a new platform, you can copy settings from another platform in Project > Copy Platform Settings.

Defining active platforms and managing platform settings

Volume Threshold:

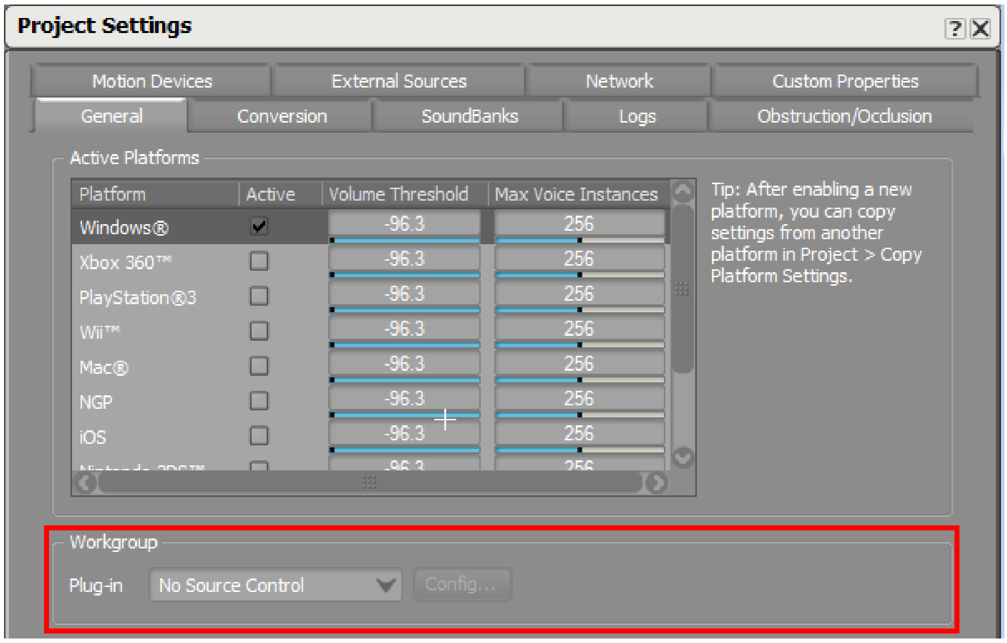
The volume threshold is the default volume level below which voices are managed by behaviors defined on the Advanced Settings tab of the Property Editor, essentially determining the volume when voices will either be killed or sent to virtual voice.

Max Voice Instances:

This value defines the maximum number of simultaneous voices that can be active at the same time in the entire project. Virtual voices do not count as active voices. Over this limit, voices with the lowest priority will adopt their virtual behavior. If priorities are equal, older sounds will be considered having a higher priority.

Workgroup Plug-in Configuration

The Workgroup plug-in allows you to specify a source control solution and specify the settings. In your project development environment, you may already be using a source control system, such as Perforce or Subversion, to effectively manage your assets and other types of project files.



Project Settings

Active Platforms

Platform	Active	Volume Threshold	Max Voice Instances
Windows®	✓	-96.3	256
Xbox 360™	☐	-96.3	256
PlayStation®3	☐	-96.3	256
Wii™	☐	-96.3	256
Mac®	☐	-96.3	256
NGP	☐	-96.3	256
iOS	☐	-96.3	256

Tip: After enabling a new platform, you can copy settings from another platform in Project > Copy Platform Settings.

Workgroup

Plug-in: No Source Control

Specifying a source control plug-in for managing project files from Wwise

The following files within the project can be managed by a source control system:

- **Wwise project file** - the .wproj file.
- **Wwise work units** - the .wwu files, including the Default work units.
- **Originals folder** - the folder that contains the original sound files that were imported into Wwise.
- **Generated SoundBanks** - the SoundBank files generated for each platform and language.

Designer Note

The .cache folder located in the project directory is a local working folder for Wwise. The contents of the .cache folder should not be added to a source control system because it may cause unexpected behaviors in Wwise.

Throughout the development of your game, you can view the status of your project file (.wproj), work unit files (.wwu), and audio files in the File Manager. If you are using Perforce, Subversion, or another Workgroup plug-in, you will be able to perform source control functions directly in Wwise. All Wwise project files, including the individual work units, are XML-based, which means you can use your source control system to easily manage these files as well.

Designer Note

For more information about using a Workgroup plug-in in Wwise, refer to "Managing Project Files Using a Workgroup Plug-in" in the help documentation.

When you are working as part of a workgroup and are using a source control system to manage the files in your project, you should always be aware that others are working on the same project and that there may be merge conflicts that need to be resolved. This is why it is important to sync and merge your work often and to communicate frequently with your team members about the work you are doing.

Designer Note

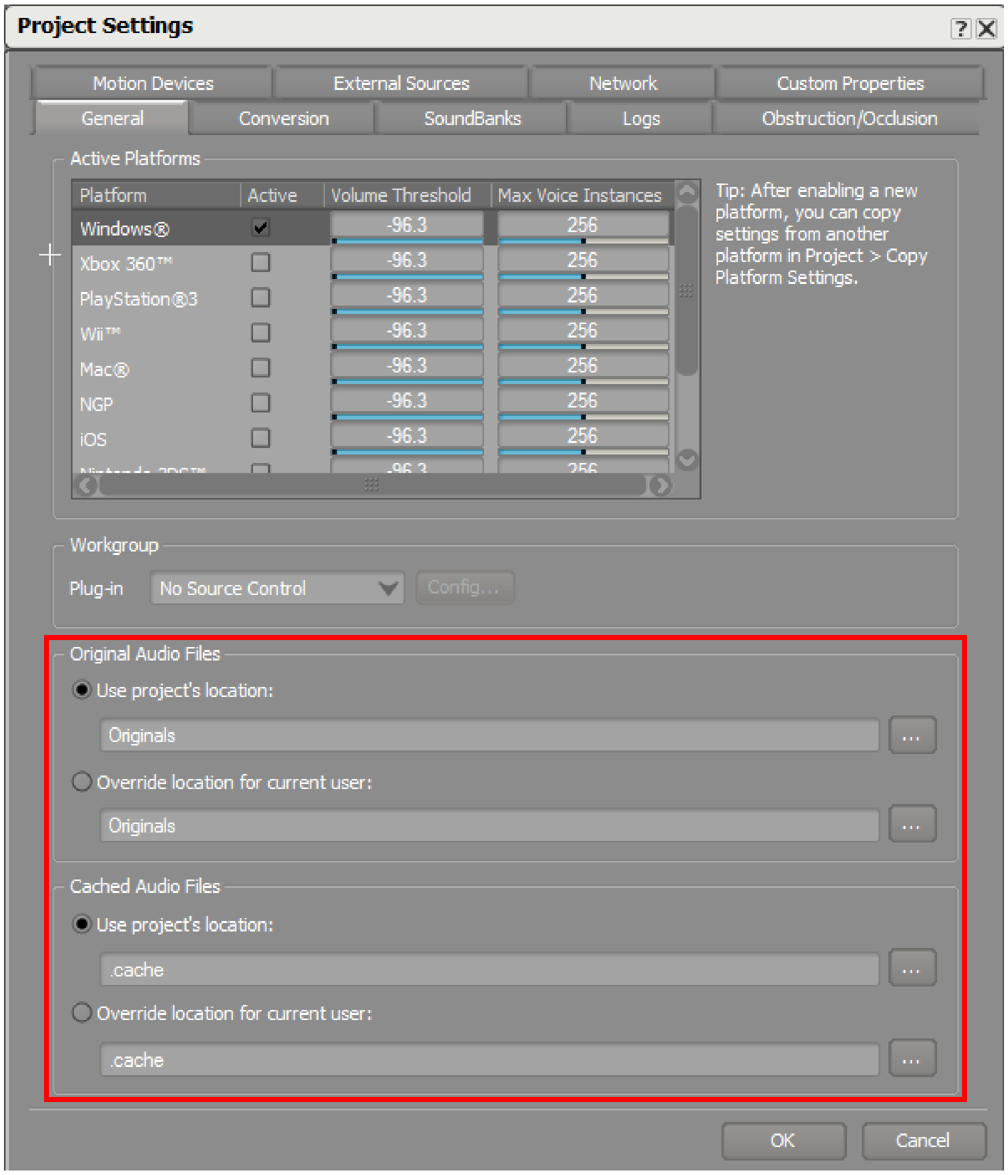
For a complete list of best practices, refer to “Workgroup Tips & Best Practices” in the help documentation.

For more information on workgroups:

Video Tutorial - Workgroup management in Wwise using Perforce

Audio File Locations

A custom location for original and cached audio files can be set for the project as well as an override location for the current user.



Project Settings

Active Platforms

Platform	Active	Volume Threshold	Max Voice Instances
Windows®	✓	-96.3	256
Xbox 360™	☐	-96.3	256
PlayStation®3	☐	-96.3	256
Wii™	☐	-96.3	256
Mac®	☐	-96.3	256
NGP	☐	-96.3	256
iOS	☐	-96.3	256

Tip: After enabling a new platform, you can copy settings from another platform in Project > Copy Platform Settings.

Workgroup

Plug-in: No Source Control

Original Audio Files

(●) Use project's location: Originals

( ) Override location for current user: Originals

Cached Audio Files

(●) Use project's location: .cache

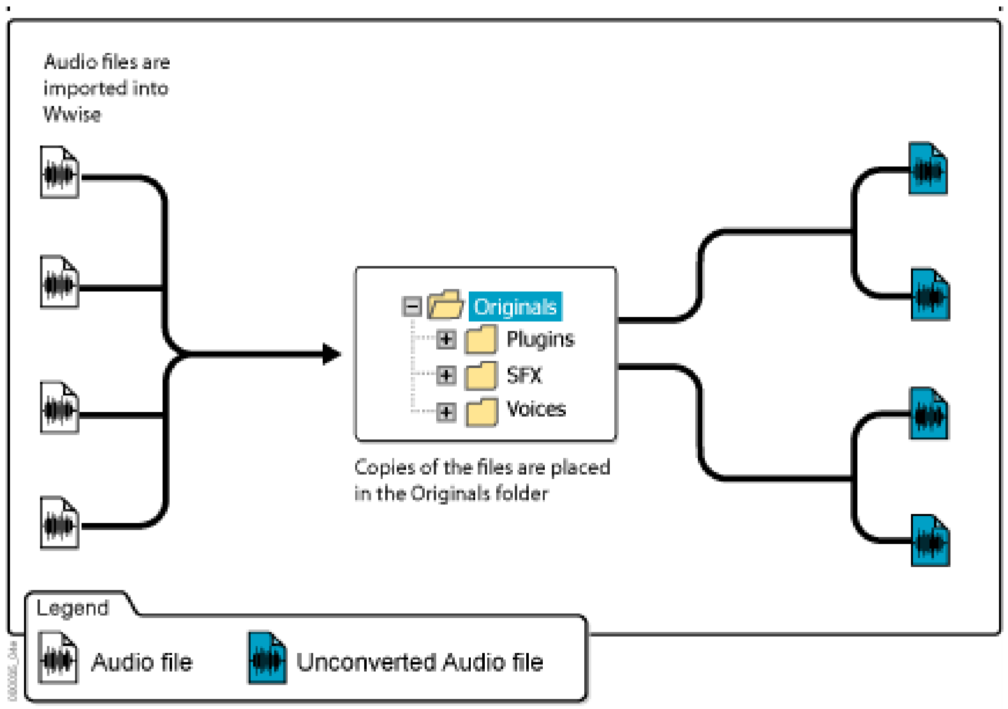
( ) Override location for current user: .cache

Defining locations for original audio files used by the project

Overriding the user location can be useful in the following types of situations:

- You temporarily do not have access to the Originals/Cached folder.
- You do not have permission to alter the contents of the Originals/Cached folder.
- You need to create a temporary location for the Originals/Cached folder without changing the location of the project's Originals/Cached folder.

When you import a file into the project, a copy of the original asset is stored in the Originals project folder. Since these assets are usually shared by several people on the team, this folder can be located anywhere on the network and can easily be managed by a source control system.


Audio files are imported into Wwise
Originals
Plugins
SFX
Voices
Copies of the files are placed in the Originals folder
Legend
Audio file
Unconverted Audio file

The asset versions created for the various game platforms are stored locally in each user's project cache folder. This allows each user to manage their own platform versions and to experiment with different conversion settings.

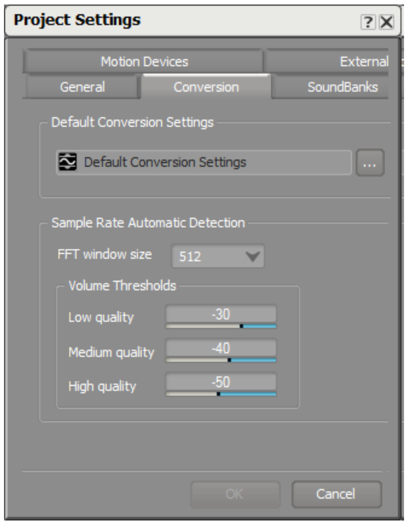
The project's cache folder contains intermediate data generated by Wwise during audio file conversion and SoundBank generation. Its location is initially set to '.cache/' inside the project's directory when a new project is created.

Both types of files can be played back in Wwise. The original pre-converted files will be played back whenever the Original control is activated in the Transport Control or Soundcaster. When the Original control is not active, Wwise will attempt to play the converted file, if one exists.

Designer Note

There are some restrictions to playing converted files in Wwise. When you convert an audio file for a particular platform, it is converted to meet the specific hardware requirements of that platform. As a result, you may not be able to play back these converted files in Wwise when a platform, other than Windows, is selected.

Default Conversion Settings



Default Conversion Settings

Default Conversion Settings

Sample Rate Automatic Detection

FFT window size 512

Volume Thresholds

Low quality -30

Medium quality -40

High quality -50

Default conversion settings

The default conversion settings in Project Settings specifies the name of the ShareSet that will be used as the project's default. When a new object is created, the Default Conversion Settings are used only if the new object is a top-level parent object. If the new object is a child of another object, it will inherit the conversion settings assigned to the parent.

Defining the Sample Rate Automatic Detection Settings

As part of the Project Settings, you can define the size of the Hanning window used by the FFT algorithm as well as the threshold levels for three different quality settings: High, Medium, and Low. These threshold settings are used when you select Auto High, Auto Medium, or Auto Low as the sample rate conversion method.

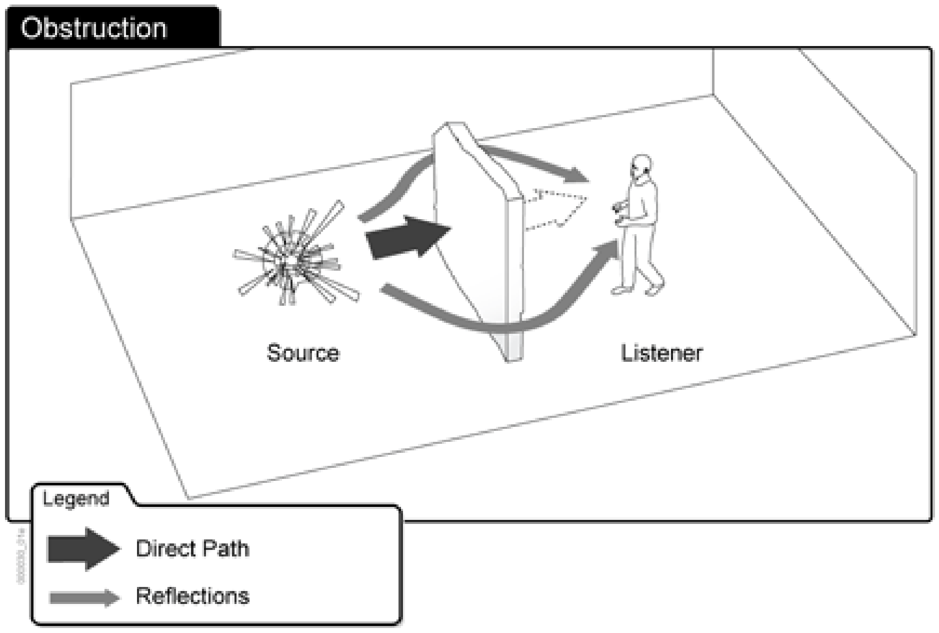
For more information about conversion settings:

Wwise Help > Setting Up Your Projects > Working with Projects > Defining your Project Settings > **Defining the Conversion Settings for Your Project**

Obstruction/ Occlusion

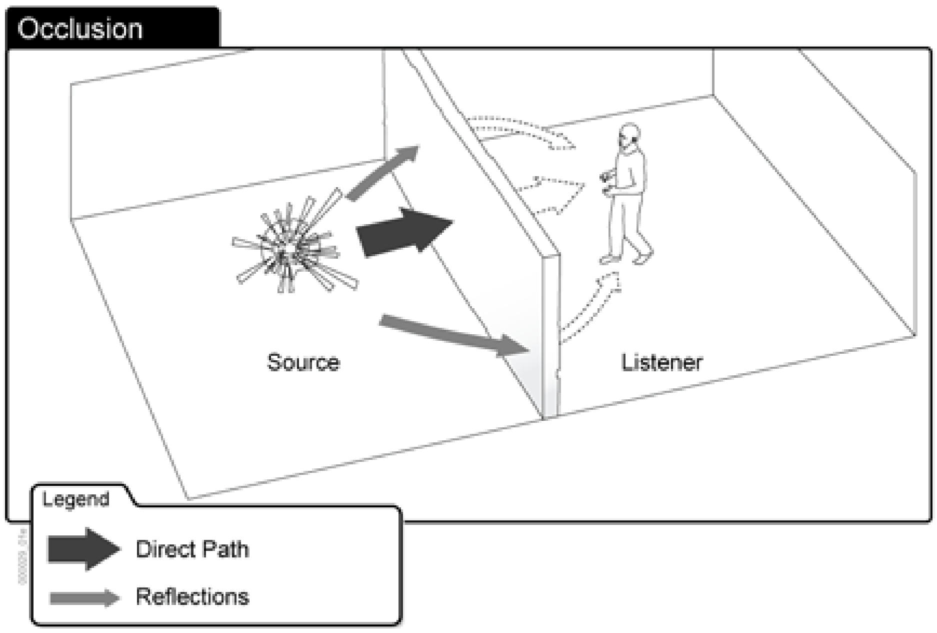
A typical condition of most game environments is having a game object become either obstructed by another object (such as a wall or beam), or occluded in a room where the listener can only hear a few muffled sounds leaking through the walls.

The following diagrams illustrate examples of occlusion and obstruction.



Example of an Obstruction

Obstruction can be modeled by applying a volume control and/or a Low Pass Filter (LPF) affecting only the direct path of the signal. The environmental reflections are unaffected.



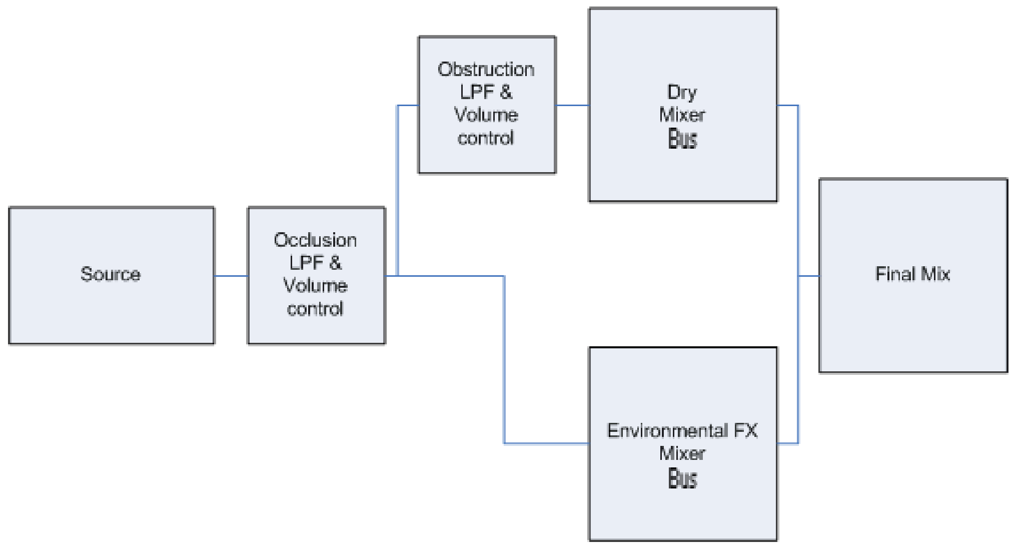
Example of an Occlusion

Occlusion can be modeled by applying a volume control and/or a LPF affecting both the direct path and the environmental reflections of the signal.

Designer Note

Obstructions and occlusions can happen simultaneously and are modeled with the direct path being affected by both the obstruction and occlusion value. However, the reflection path is affected by the occlusion value only.

Here is a diagram of the obstruction/occlusion processing pipeline inside the sound engine:


Source
Occlusion LPF & Volume control
Obstruction LPF & Volume control
Dry Mixer Bus
Environmental FX Mixer Bus
Final Mix

Occlusion Processing Pipeline

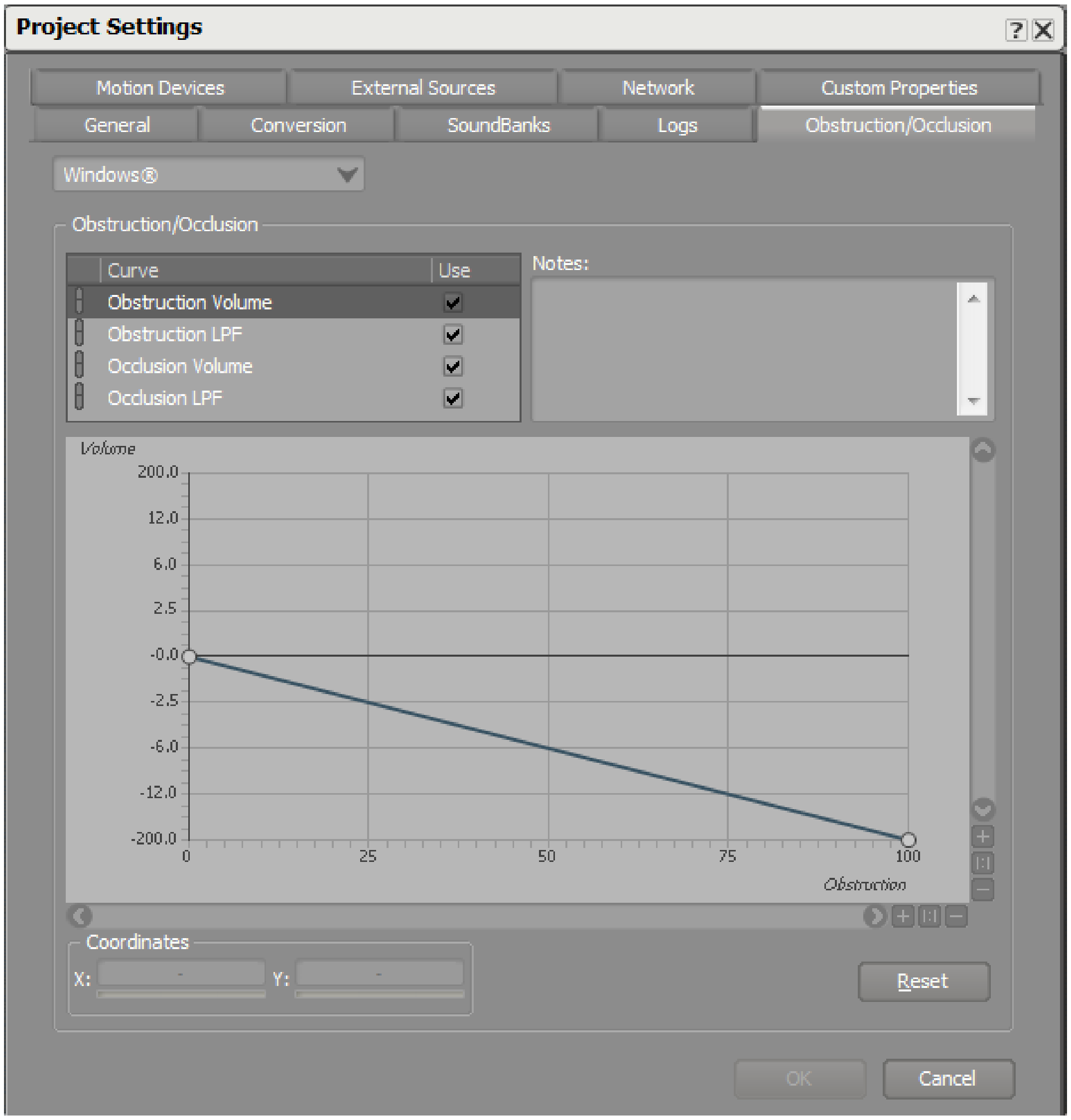
Setting Obstruction and Occlusion

The game engine is responsible for determining the obstruction and occlusion values, which it does using the position of the objects and listeners in relation to the game's geometry.

Programmer Note

The obstruction and occlusion values for each game object affecting each listener must be passed down to the sound engine from the game programmatically.

In the Obstruction/Occlusion tab of the Project Settings dialog box, you can enable and define the default volume and Low Pass Filter (LPF) curves for obstruction and occlusion for each active platform in the project. Sound designers can also enable or disable the usage of any curve to best suit their performance and realism needs.



Obstruction/Occlusion

Curve	Use
Obstruction Volume	✓
Obstruction LPF	✓
Occlusion Volume	✓
Occlusion LPF	✓

Customizing Obstruction and Occlusion Curves in the Project Settings

Using the curve of this snapshot, setting an obstruction value of 1.0f (100%) will produce a volume change of -50dB on the source object.

Designer Note

It is a good practice to always define curves in a linear fashion to minimize CPU and memory usage in the project. Keep curves as simple as possible to begin with and customize only as needed.

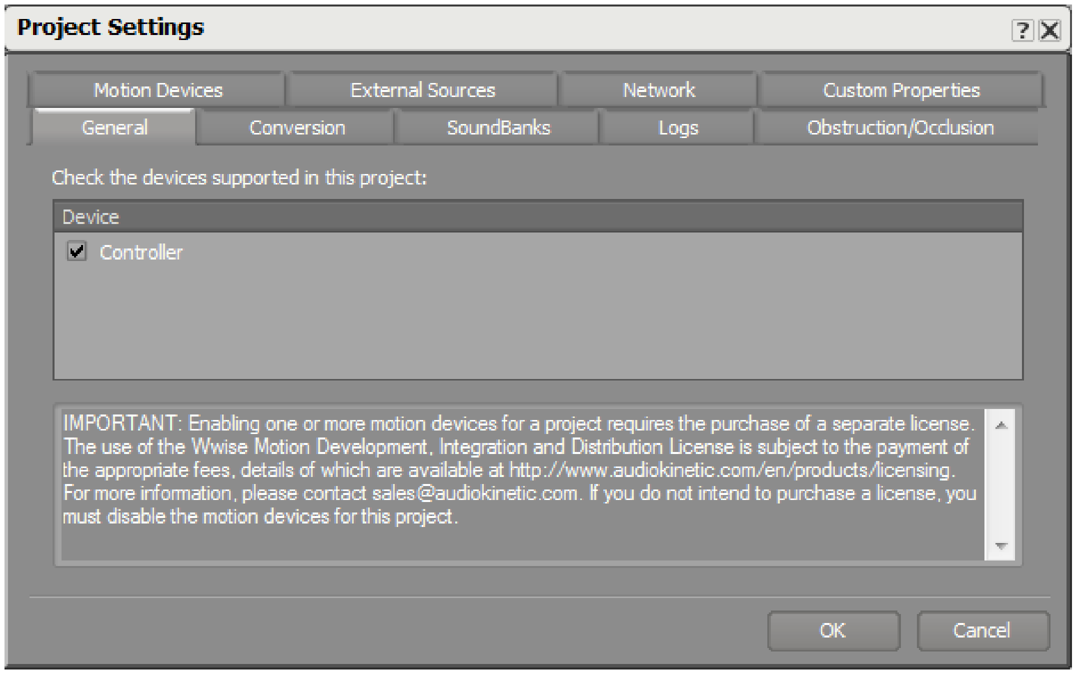
Motion

It begins with an earth shaking rumble as the dragon emerges from an underground lair, followed quickly by the pounding of gargantuan footsteps racing towards the final showdown. With the expectation of a soundtrack to match the intensity of this scenario, it seems a perfect fit for the use sound to drive controller vibration.

Wwise offers a complete pipeline for creating and integrating motion in your game. By implementing a comprehensive pipeline solution for motion, similar to the one that exists for building audio, Wwise allows you to:

- Create sophisticated and realistic motion effects with a very short learning curve.
- Integrate motion easily into a game without significantly affecting the performance of the game or sound engine.
- Use the same features as audio to build and integrate motion.
- Create motion effects for the same type of device on various platforms without additional work.
- Add or remove the motion component easily based on the requirements of your game.

Before creating motion effects in the project, the types of motion devices need to be enabled within the Project Settings in order to create motion effects.



Check the devices supported in this project:

Device
[✓] Controller

IMPORTANT: Enabling one or more motion devices for a project requires the purchase of a separate license. The use of the Wwise Motion Development, Integration and Distribution License is subject to the payment of the appropriate fees, details of which are available at http://www.audiokinetic.com/en/products/licensing. For more information, please contact sales@audiokinetic.com. If you do not intend to purchase a license, you must disable the motion devices for this project.

Enabling motion devices in the Project Settings

After a motion device is enabled, you can do the following in the project:

- Create sources for Motion FX objects using media files or motion generators.
- Include motion data for the selected device within SoundBanks.

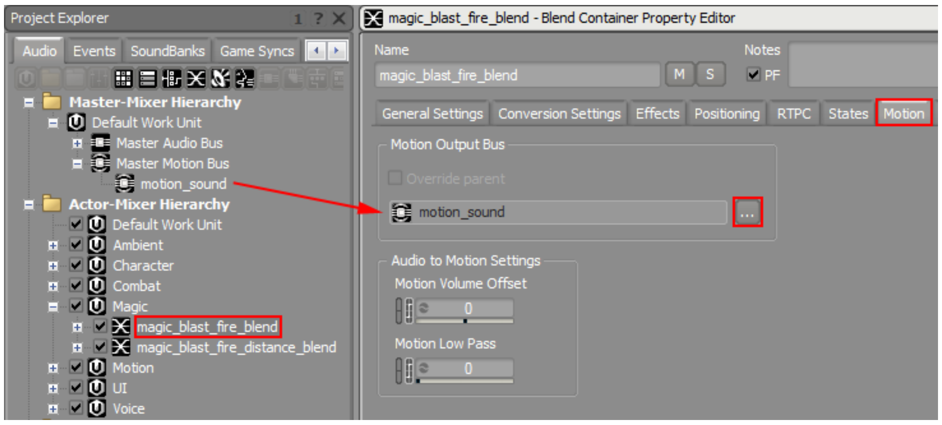
At a very basic level, motion data is generated in Wwise from a source. This source can either be an existing media file, a new media file, or a Motion generator plug-in. After you have decided which motion devices will be supported by the game, you must then decide which method you will use to generate motion.

In Wwise, there are two different methods for creating a motion source:

- Using an existing audio signal.
- Using a Motion FX object.

Generating a Motion Source from an Existing Audio Signal

When you convert an existing audio signal into a motion source, the audio signal is split in two at run-time after both RTPCs and effects have been applied. The split is done so as not to affect the original sound. Since audio has a much larger spectrum than motion, the higher frequencies are filtered out using a low pass filter. The signal is then re-sampled using a much lower sample rate to create the motion source.



Name: magic_blast_fire_blend

Motion Output Bus: motion_sound

Audio to Motion Settings

Motion Volume Offset: 0

Motion Low Pass: 0

Enabling routing to a Motion Bus from an existing sound object

Designer Note

The LFE channel is ignored when generating motion from an existing audio source.

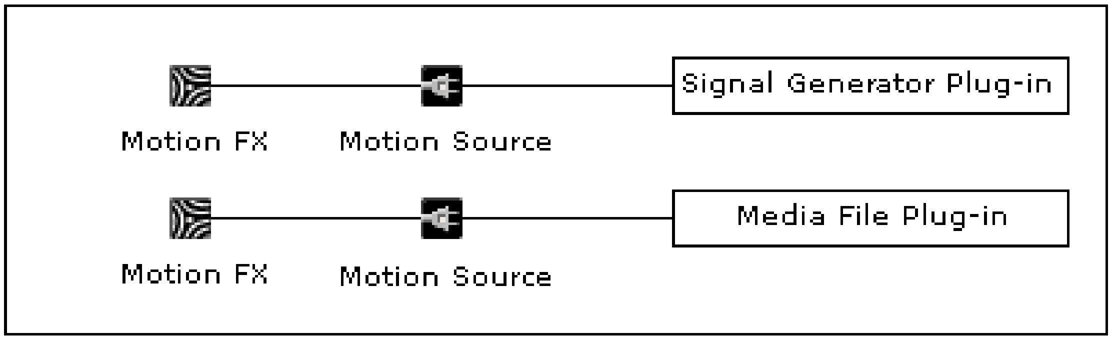
Since the motion source is generated from an existing audio source, the motion is tied to the audio playback in game. This means that the motion source does not require a separate event to be triggered in game. It also means that the motion source is affected by the same properties, behaviors, game syncs, and so on, as the audio object.

Designer Note

You can't generate a motion source from an existing audio source on the Wii platform. To generate motion on the Wii, you have to use Motion FX objects and the Motion Generator plug-in.

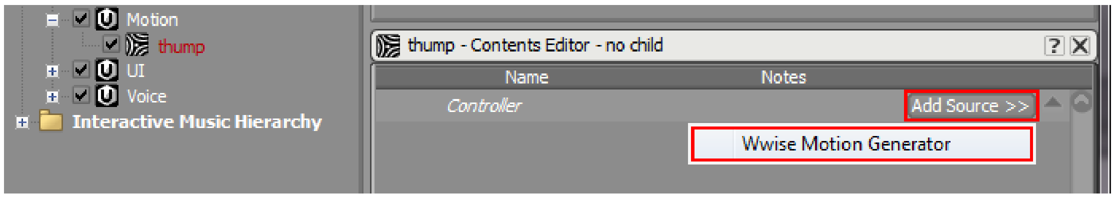
Generating Motion Using a Motion FX Object

Another way to generate motion is by creating special Wwise objects, called Motion FX objects. These objects, like sound objects, contain a source. The motion source can be created from a Motion Generator plug-in.



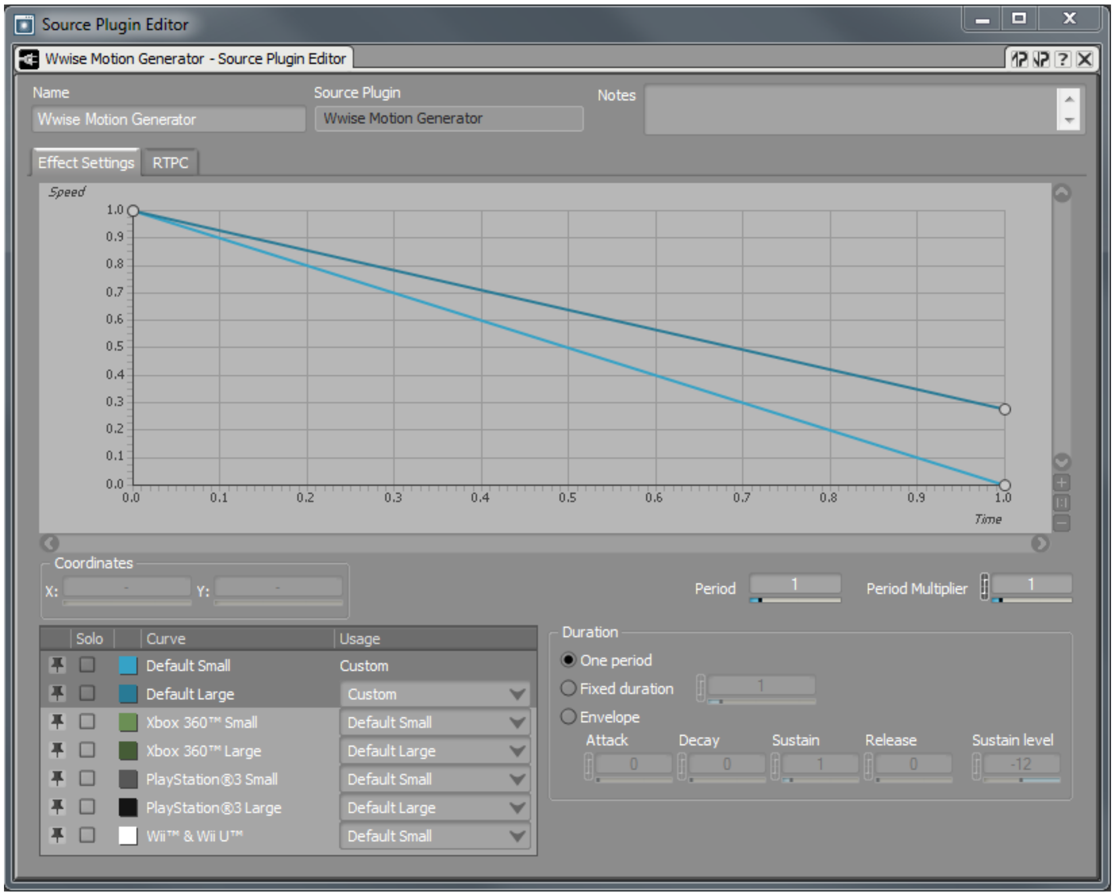
When using Motion FX objects, you can build sophisticated motion structures, using containers and actor-mixers, to define the properties and behaviors of the motion effects. Since these motion effects are not necessarily tied to the audio in the game, they can be triggered at any point in game by their own events.

After enabling the use of Motion FX in the Project Settings, you can begin adding Motion FX objects with a Motion Generator source.



Adding a Motion Generator source to a Motion FX object

The Motion Generator source plug-in gives access to the authoring of motion effects based on duration and speed, in addition to envelope properties. A default setting can be used to define small and large curves for Motion FX, which are inherited for all dual-motor controller types. These default settings can be overridden on a per controller basis in order to fine-tune the motion experience.



Name: Wwise Motion Generator

Source Plugin: Wwise Motion Generator

Notes:

Coordinates X: - Y: -

Period: 1

Period Multiplier: 1

Solo	Curve	Usage
☐	🟦 Default Small	Custom
☐	🟦 Default Large	Custom
☐	🟩 Xbox 360™ Small	Default Small
☐	🟩 Xbox 360™ Large	Default Large
☐	⬛ PlayStation®3 Small	Default Small
☐	⬛ PlayStation®3 Large	Default Large
☐	⬜ Wii™ & Wii U™	Default Small

Duration

● One period

○ Fixed duration 1

○ Envelope

Attack	Decay	Sustain	Release	Sustain level
0	0	1	0	-12

Motion Generator source plug-in editor

Of course, there will be situations where one method will be preferential over another. For a further discussion on the benefits of each of these methods, refer to "Creating Motion for Your Game" in the Wwise help documentation.

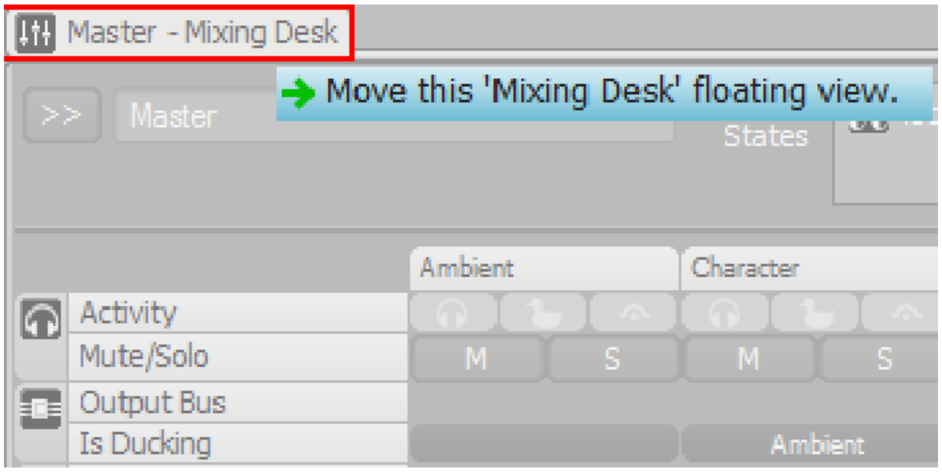
For additional information about Wwise Motion:

Video Tutorial - Wwise Motion

Customizing Layouts

Multiple layout views are available from the menu bar to help you navigate different aspects of the Wwise project workflow. Layouts can be modified by adding or removing any of the views available to streamline your workflow.

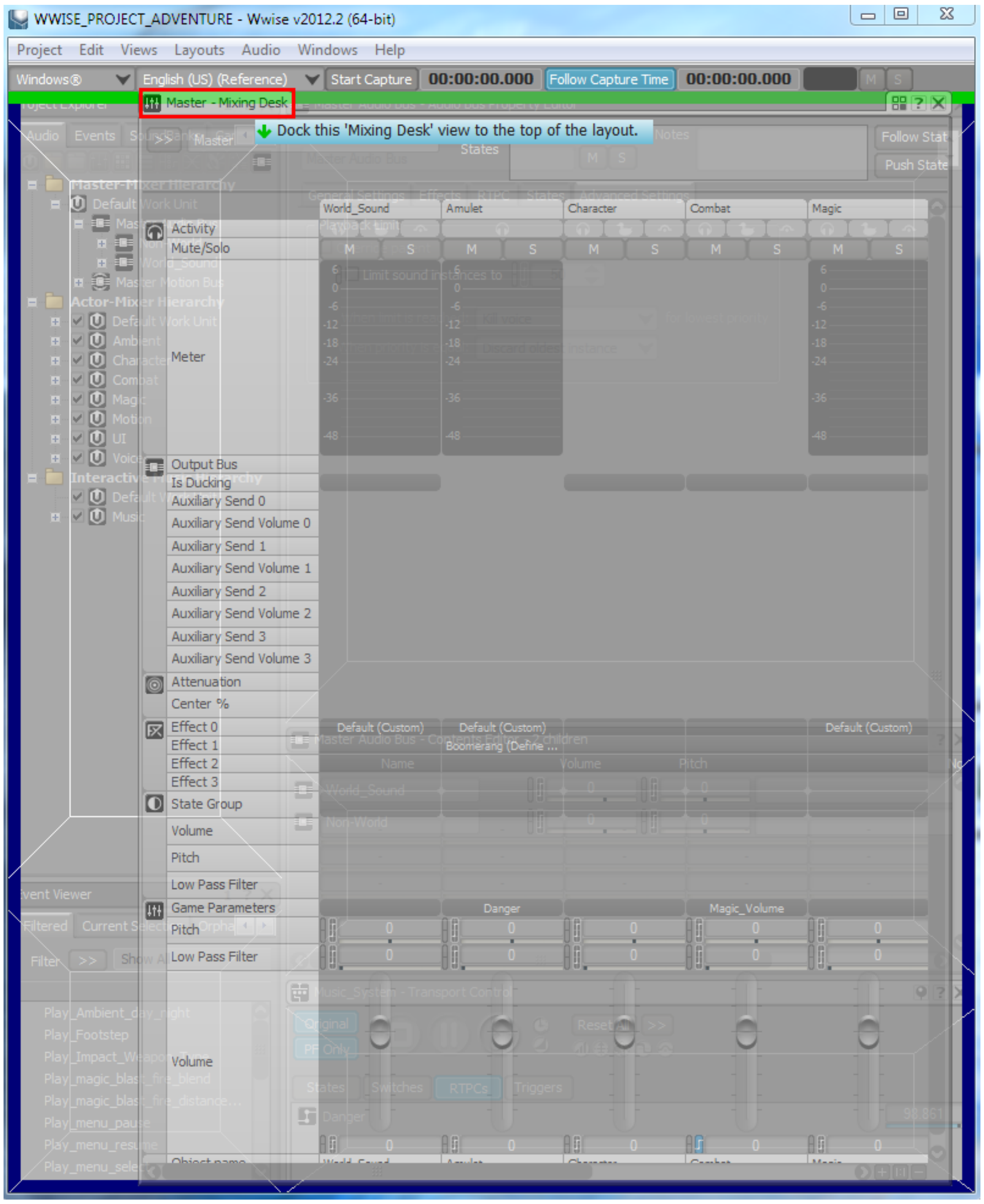
Clicking and dragging on the view's title bar will transform it to a floating view and show possible docking locations.



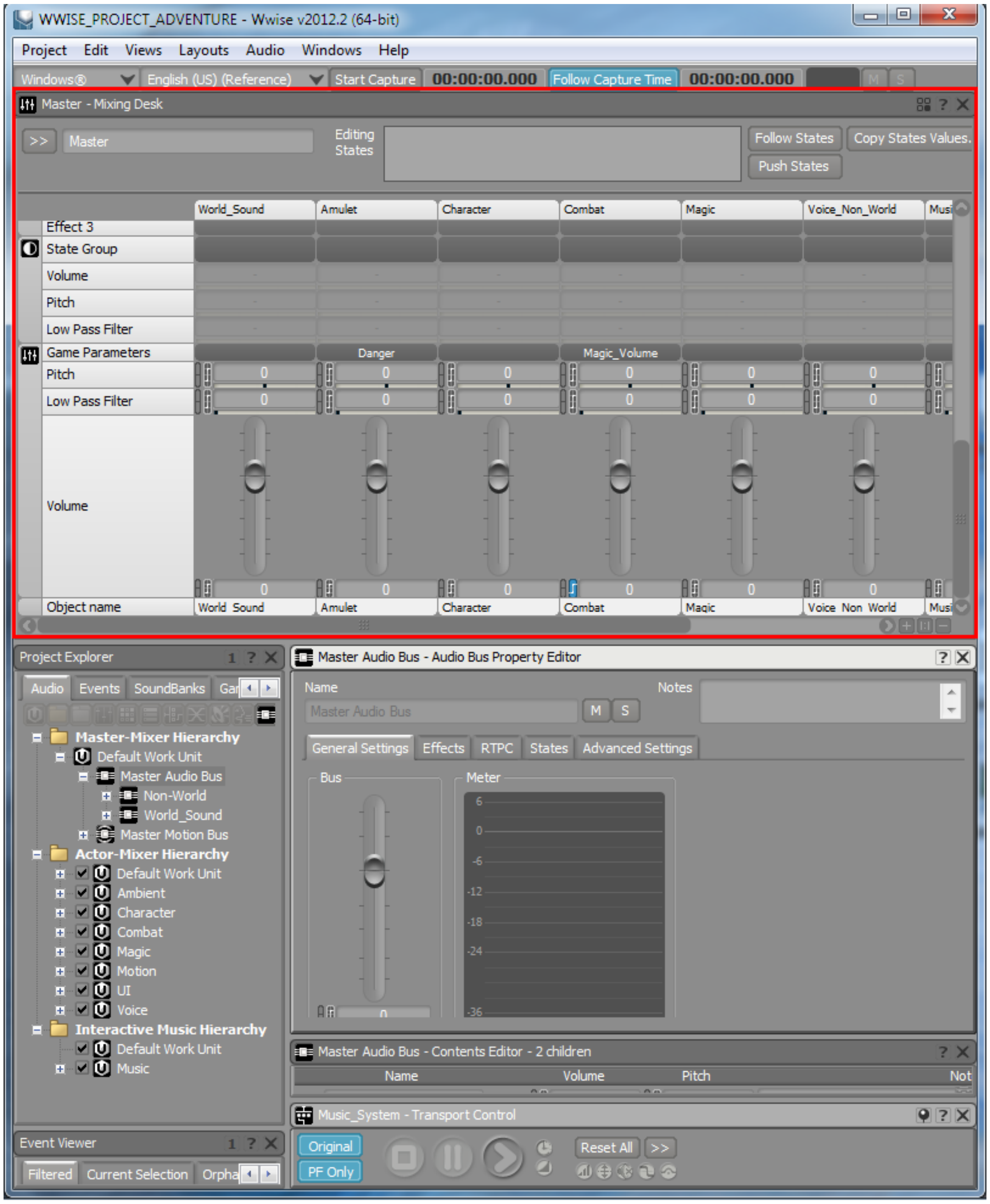
Clicking and dragging the view's title bar in order to move it

Views can be docked on the four sides of both the layout and each individual docked view.

Layout Docking

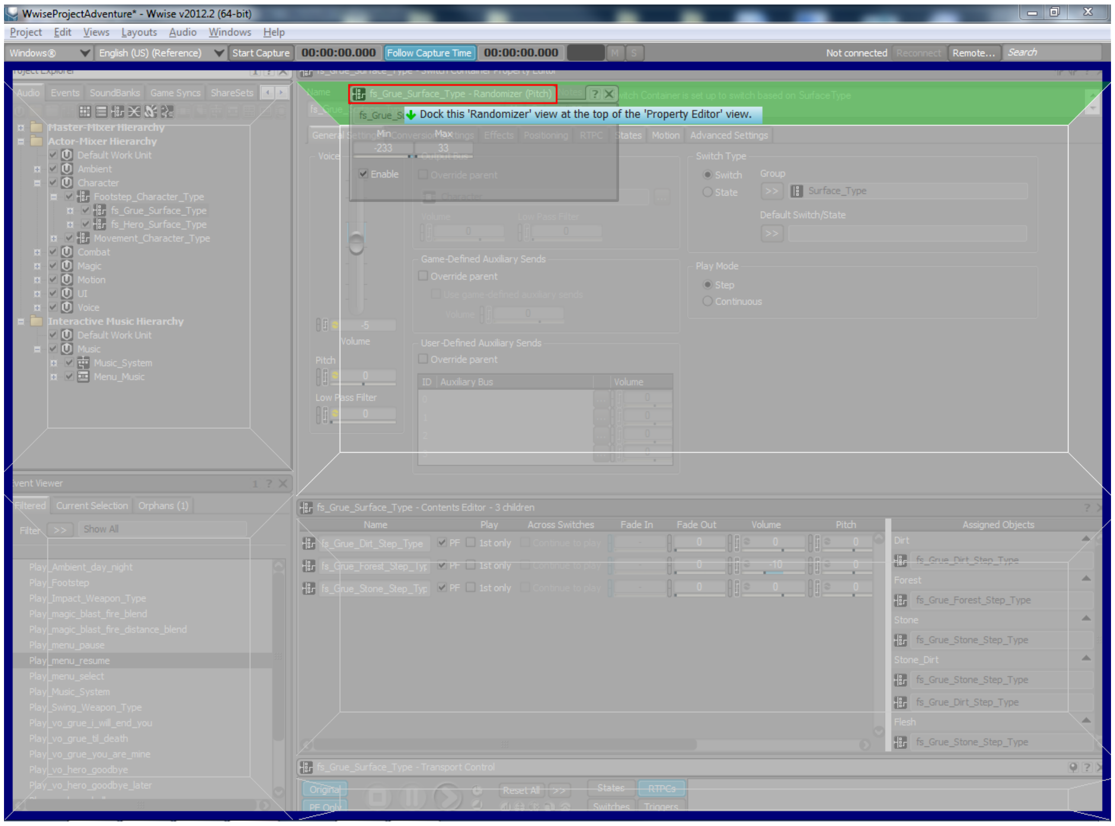


Docking locations in blue, along the border of
the layout window, turn green when hovered over

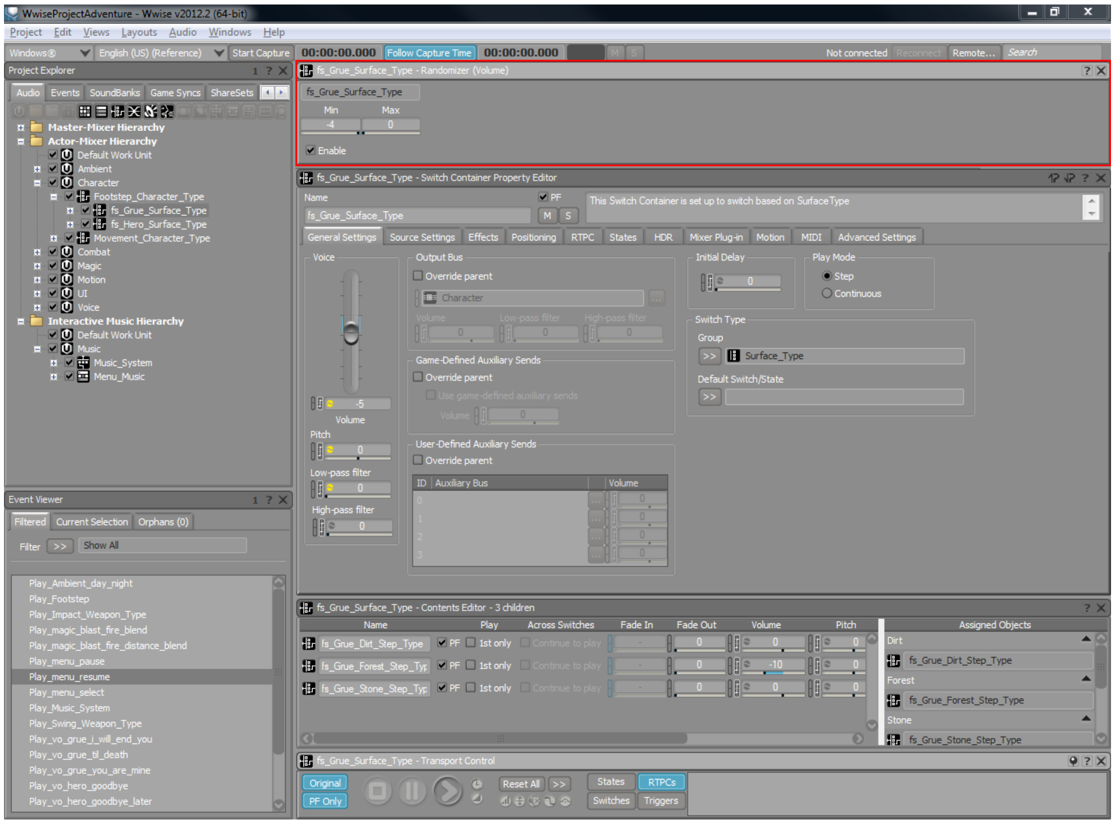


An example of the Mixing Desk view docked at the top of the layout

View Docking

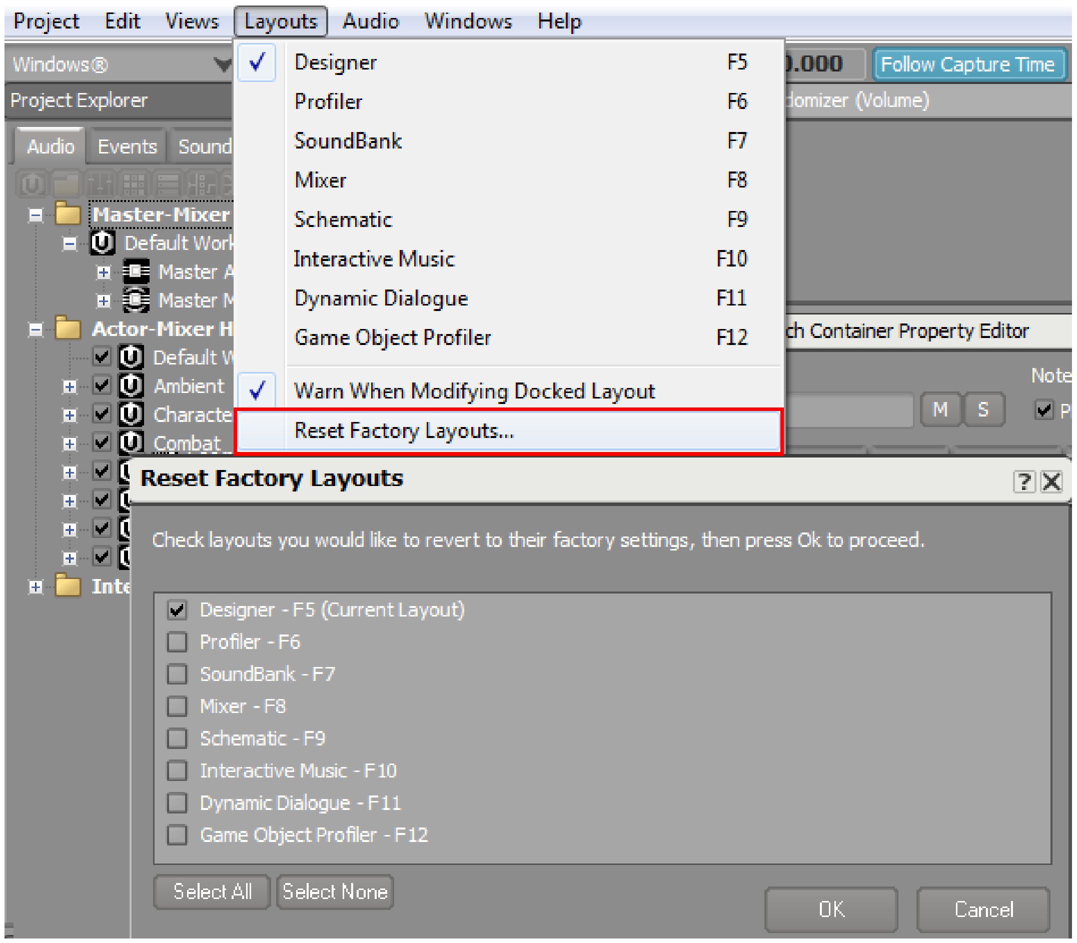

WwiseProjectAdventure* - Wwise v2012.2 (64-bit)
Dock this 'Randomizer' view at the top of the 'Property Editor' view.
fs_Grue_Surface_Type - Randomizer (Pitch)
fs_Grue_Surface_Type - Contents Editor - 3 children
fs_Grue_Surface_Type - Transport Control

Docking locations on the four sides of each docked view turn green when hovered over


WwiseProjectAdventure - Wwise v2012.2 (64-bit)
Project Edit Views Layouts Audio Windows Help
fs_Grue_Surface_Type - Randomizer (Volume)
Min
Max
Enable
fs_Grue_Surface_Type - Switch Container Property Editor
fs_Grue_Surface_Type - Contents Editor - 3 children
fs_Grue_Surface_Type - Transport Control
Project Explorer
Event Viewer

An example of the Randomizer view docked at the top of the Property Editor view

Layouts can be selectively reverted to the default settings at any time from the Layouts menu on the menu bar.



Reset Factory Layouts

Check layouts you would like to revert to their factory settings, then press Ok to proceed.

- [x] Designer - F5 (Current Layout)
- [ ] Profiler - F6
- [ ] SoundBank - F7
- [ ] Mixer - F8
- [ ] Schematic - F9
- [ ] Interactive Music - F10
- [ ] Dynamic Dialogue - F11
- [ ] Game Object Profiler - F12

Resetting the factory layout settings for the Designer layout

Customizing layouts to maximize screen real estate in a multi-monitor setup is a great way to put the views you need in place for a streamlined workflow.

For more information about layouts:

Video Tutorial - Managing Layouts

External Sources

External Sources are a special type of audio source that you can put in a Sound object in Wwise. It indicates that the real sound data will be provided at runtime. This is very useful when managing a large amount of dialogue lines that would otherwise need a Sound and an Event for each, which would then need to be included in SoundBanks. It is also very useful if the dialogue lines are already managed through another system such as an AI-driven speech generator.

Depending on how you manage the dialogue in the project, there may be additional runtime memory savings because the External Source plug-in allows you to play dialogue without having to load many voice assets into memory at any given time.

The External Source plug-in works as follows:

- A Sound Voice 'template' is created in Wwise using the External Source plug-in. This template represents a series of audio files with common properties.
- The External Source plug-in can take full advantage of the power and flexibility of the project hierarchy, by placing it within containers, actor-mixers, applying states, RTPCs, effects, and so on.
- A play event is created that calls the external source.
- The location and conversion settings of the pool of external audio assets that can be used by the External Source plug-in are defined in the External Sources List file. This file is a very simple XML file that contains the location of the external audio assets that need to be converted along with the conversion settings you want to use. The location of this file is defined in the Project Settings dialog box in Wwise.
- At runtime, the game calls the External Source and then associates the template with one of the external audio files. The actual audio file that is played is left entirely up to the programmer. It is important to note that the management of the source audio files is done external to the Wwise sound engine. While this involves more work, it also gives you more flexibility.

Designer Note

Most of the work related to this feature is performed by the audio programmer within the SDK. For more information, refer the Wwise SDK documentation.

SoundBanks and SoundBank Generation

SoundBanks keep all of your audio files and information about how they are played back bundled together in files that can be easily loaded and unloaded with the demands of the game. Regardless of the systems employed on the game side for managing available memory and resources, Wwise SoundBanks can be generated to support most implementations.

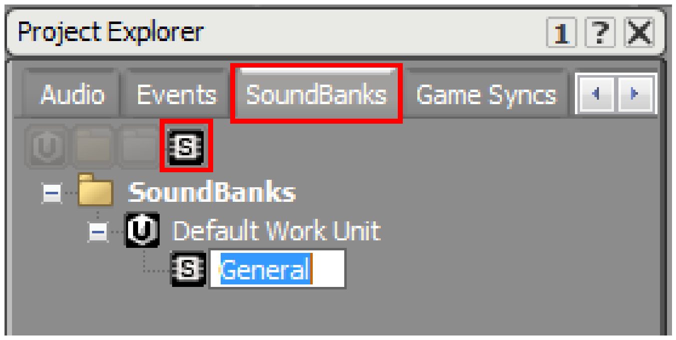
Designer Note

A SoundBank can contain any number of events, Wwise objects, and/or converted media files. At particular points in the game, one or more of these project elements will be loaded into a game's platform memory in anticipation of specific sounds or motion objects being triggered.

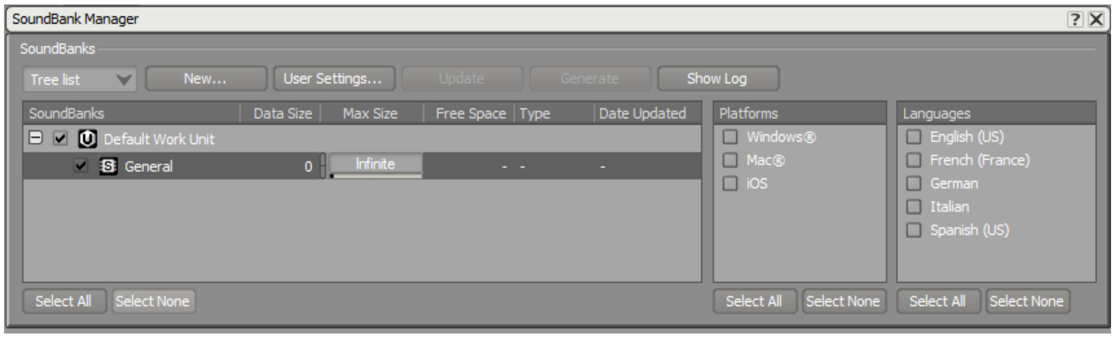
SoundBank creation is better handled through the SoundBank Layout (F7) that gives you access to the SoundBank Manager and SoundBank Editor.

Creating a SoundBank

To begin with, we'll create a new SoundBank called General. Start by selecting the default work unit from the SoundBanks tab in the Project Explorer. This enables you to add a new SoundBank from the Project Explorer toolbar by clicking on the SoundBank icon. Alternately, a SoundBank can be created from the contextual menu for a SoundBank work unit or by using shortcut keys.



Creating a General SoundBank



SoundBanks	Data Size	Max Size	Free Space	Type	Date Updated
Default Work Unit					
General	0	Infinite	-	-	-

Platforms
☐ Windows®
☐ Mac®
☐ iOS

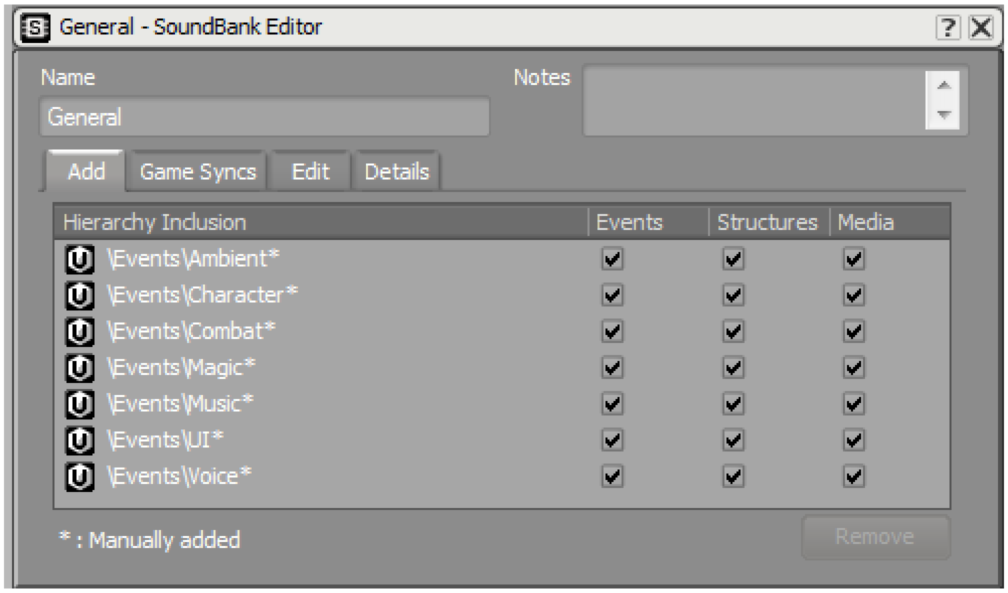
Languages
☐ English (US)
☐ French (France)
☐ German
☐ Italian
☐ Spanish (US)

SoundBank information displayed in the SoundBanks Manager

The SoundBank Manager displays the list of SoundBanks that have been created. It also displays information about each SoundBank, including its current size, the amount of free space left, and the type or contents of the SoundBank. Before generating your SoundBanks, you can update them, define custom user settings, and specify for which platforms and languages the SoundBanks will be generated.

Populating and Managing the Contents of SoundBanks

When you double-click a SoundBank in the SoundBank Manager, information related to the selected SoundBank is automatically displayed in the SoundBank Editor.



Name: General

Notes:

Hierarchy Inclusion	Events	Structures	Media
\Events\Ambient*	✓	✓	✓
\Events\Character*	✓	✓	✓
\Events\Combat*	✓	✓	✓
\Events\Magic*	✓	✓	✓
\Events\Music*	✓	✓	✓
\Events\UI*	✓	✓	✓
\Events\Voice*	✓	✓	✓

* : Manually added

SoundBank Editor showing manually added events

The SoundBank Editor, which is where you populate and manage the contents of your project's SoundBanks, is divided into four different tabs:

SoundBank Editor - Add Tab - displays only the actual events, hierarchies, work units, and folders that were added to the SoundBank. Any corresponding child objects that are also automatically added to the SoundBank are only displayed on the Edit tab. On the Add tab, you determine what types of information and/or media will be included in the SoundBank per hierarchical element.

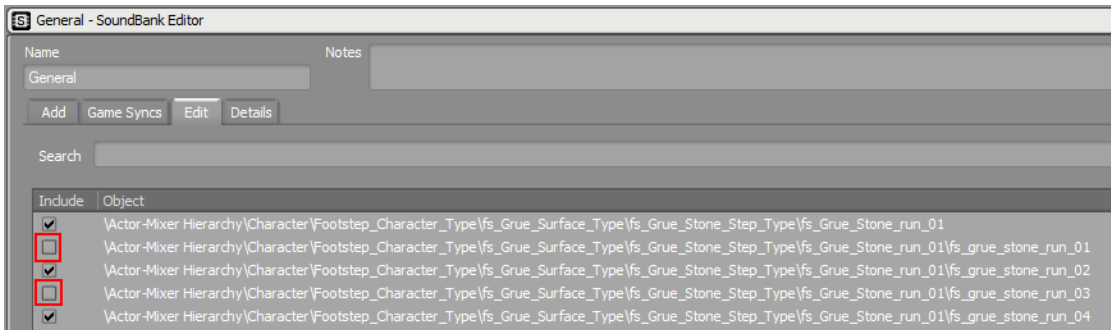
SoundBank Editor - Game Syncs Tab - displays a list of game syncs, except game parameters and arguments, referenced by the events and sound structures that have been included on the Add tab. On this tab, you can filter out sound structures, events, and media files based on their relationship with a particular game sync.

SoundBank Editor - Edit Tab - displays a detailed list of each individual event, object, and media file, including all child objects that are associated with the hierarchical project elements on the Add tab. You can filter the list by language and object type and then deselect any project elements that you want to exclude from the SoundBank.

SoundBank Editor - Details Tab - displays detailed information about all aspects of the SoundBank, including memory size, file size, SFX versus Voice size, as well as the number of missing and replaced files, if any.

Excluding Elements from a SoundBank

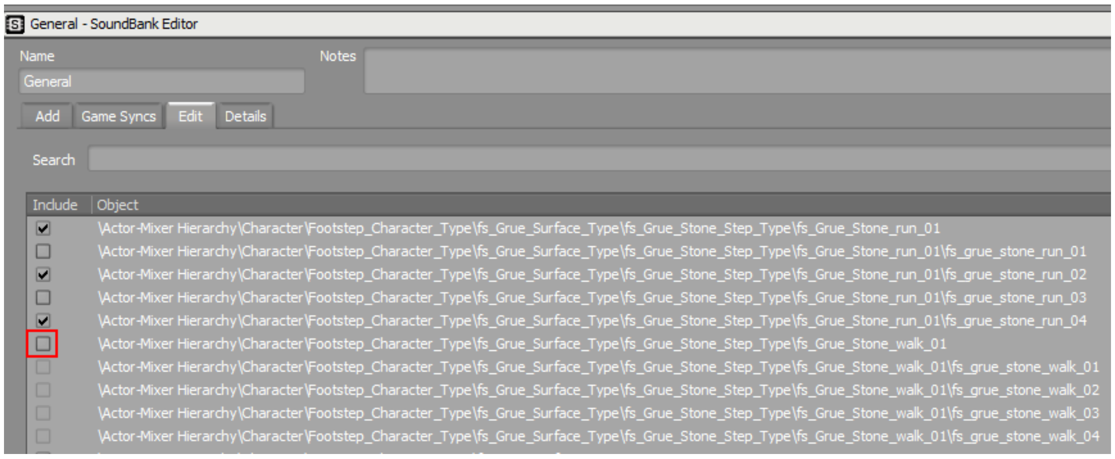
Specific elements within a SoundBank can be selectively excluded by clearing the corresponding check box.



Include	Object
✓	\Actor-Mixer Hierarchy\Character\Footstep_Character_Type\fs_Grue_Surface_Type\fs_Grue_Stone_Step_Type\fs_Grue_Stone_run_01
☐	\Actor-Mixer Hierarchy\Character\Footstep_Character_Type\fs_Grue_Surface_Type\fs_Grue_Stone_Step_Type\fs_Grue_Stone_run_01\fs_grue_stone_run_01
✓	\Actor-Mixer Hierarchy\Character\Footstep_Character_Type\fs_Grue_Surface_Type\fs_Grue_Stone_Step_Type\fs_Grue_Stone_run_01\fs_grue_stone_run_02
☐	\Actor-Mixer Hierarchy\Character\Footstep_Character_Type\fs_Grue_Surface_Type\fs_Grue_Stone_Step_Type\fs_Grue_Stone_run_01\fs_grue_stone_run_03
✓	\Actor-Mixer Hierarchy\Character\Footstep_Character_Type\fs_Grue_Surface_Type\fs_Grue_Stone_Step_Type\fs_Grue_Stone_run_01\fs_grue_stone_run_04

Manually excluding individual sound objects from a SoundBank

Child sound objects can also be removed from the SoundBank by excluding the parent object.



Include	Object
✓	\Actor-Mixer Hierarchy\Character\Footstep_Character_Type\fs_Grue_Surface_Type\fs_Grue_Stone_Step_Type\fs_Grue_Stone_run_01
☐	\Actor-Mixer Hierarchy\Character\Footstep_Character_Type\fs_Grue_Surface_Type\fs_Grue_Stone_Step_Type\fs_Grue_Stone_run_01\fs_grue_stone_run_01
✓	\Actor-Mixer Hierarchy\Character\Footstep_Character_Type\fs_Grue_Surface_Type\fs_Grue_Stone_Step_Type\fs_Grue_Stone_run_01\fs_grue_stone_run_02
☐	\Actor-Mixer Hierarchy\Character\Footstep_Character_Type\fs_Grue_Surface_Type\fs_Grue_Stone_Step_Type\fs_Grue_Stone_run_01\fs_grue_stone_run_03
✓	\Actor-Mixer Hierarchy\Character\Footstep_Character_Type\fs_Grue_Surface_Type\fs_Grue_Stone_Step_Type\fs_Grue_Stone_run_01\fs_grue_stone_run_04
☐	\Actor-Mixer Hierarchy\Character\Footstep_Character_Type\fs_Grue_Surface_Type\fs_Grue_Stone_Step_Type\fs_Grue_Stone_walk_01
☐	\Actor-Mixer Hierarchy\Character\Footstep_Character_Type\fs_Grue_Surface_Type\fs_Grue_Stone_Step_Type\fs_Grue_Stone_walk_01\fs_grue_stone_walk_01
☐	\Actor-Mixer Hierarchy\Character\Footstep_Character_Type\fs_Grue_Surface_Type\fs_Grue_Stone_Step_Type\fs_Grue_Stone_walk_01\fs_grue_stone_walk_02
☐	\Actor-Mixer Hierarchy\Character\Footstep_Character_Type\fs_Grue_Surface_Type\fs_Grue_Stone_Step_Type\fs_Grue_Stone_walk_01\fs_grue_stone_walk_03
☐	\Actor-Mixer Hierarchy\Character\Footstep_Character_Type\fs_Grue_Surface_Type\fs_Grue_Stone_Step_Type\fs_Grue_Stone_walk_01\fs_grue_stone_walk_04

Manually excluding parent and child sound objects from a SoundBank

Once the SoundBanks have been populated they can be generated and used by the game.

A New Approach for SoundBank Management

In an attempt to be as flexible as possible and to meet the requirements of almost any type of game, Wwise has introduced a new approach for managing the SoundBanks in your game. This new approach does not invalidate the usefulness of the original method (explained later in this section), but simply gives you more control and flexibility so that you can better manage the requirements of your games.

The new approach offers three major improvements over the existing traditional method:

- You can populate your SoundBanks with not only events, but also structural content (sounds, containers, actor-mixers, and so on), work units, and folders.
- You can determine what types of information will be included in the bank. This means that you can populate a bank with only media, structural data, event content, or any combination of the three. For example, you may want to create a bank that contains only the media associated with a specific event.
- You can include or exclude specific items from a SoundBank.

The main advantage of this new approach is that it allows media content to be split into multiple memory banks. For example, let's say the music for the entire game is started using one single event. Using the traditional method, you would add the event to the bank, which automatically adds all the corresponding in-memory sounds and pre-fetched media, including the pre-fetch for the song that only plays at the end of the game. Storing all the media in memory for the entirety of the game seems very inefficient. Using the new approach, however, you can better manage your memory by splitting the music media into multiple banks so that it would be loaded only when sounds are likely to be played.

By splitting the media into multiple banks, you can also prioritize the media that is to be loaded. For example, in an environment with limited memory, you will want to load only the most important media. Non-critical media could be stored in a separate bank that would be loaded into memory only when there was enough room. Previously, both critical and non-critical media files were contained in the same bank. If the bank was too large to load into memory, none of the sounds would play, including the critical ones.

The Wwise SDK Bank Management Samples describe the different methods that can be used to generate and integrate the banks in your game. In a single game, you can use one or a combination of the different methods. Since every game is different, the method or methods you choose will depend on the specific requirements of your game. Remember that all solutions will work, but the strategy you choose should take into consideration the memory usage, the I/O access, and the ease of integration in game. Each method has its advantages and drawbacks, so in most situations, it will be a question of balance between memory usage and ease of integration.

Additional SoundBank integration details:

Wwise SDK - Windows > Sound Engine Integration Walkthrough > Integrate Wwise Elements into Your Game > Integrating Banks > **Integration Details - Banks**

Conversion Settings

Conversion settings are managed as ShareSets and created based on the needs of your project and the requirements of each active platform. Many of your choices here can have a big impact on the performance and quality of your audio project. After applying conversion settings ShareSets to the objects in your project, you can go back and adjust your ShareSets at any time to achieve the best possible quality within the constraints of the platform and the game. When you import audio files you can also speed up the process by re-using ShareSets.

For more information about ShareSets:

Wwise Help > Finishing Your Project > Managing Platform and Language Versions > Authoring Across Platforms > Converting Audio Files > **Creating Audio Conversion Settings ShareSets**

Video Tutorial - Conversion Settings ShareSets

The SoundBank Definition File

Outside of the manual generation of SoundBanks, another method that is becoming common is the use of the SoundBanks Definition File as a way to automatically generate SoundBanks based on level, character, object, material or any information from the game. A definition file can be generated automatically by external applications, such as a game level editor, or manually by creating a tab delimited text file that lists all the events in your game, classified by SoundBank. When SoundBanks are generated, Wwise packages all the Actor-Mixers, Containers, Sounds, and so on that are used by the events contained within each SoundBank. If some of the Sounds in a SoundBank are Sound Voices, then a different version of the SoundBank is generated for each language supported by the Wwise project.

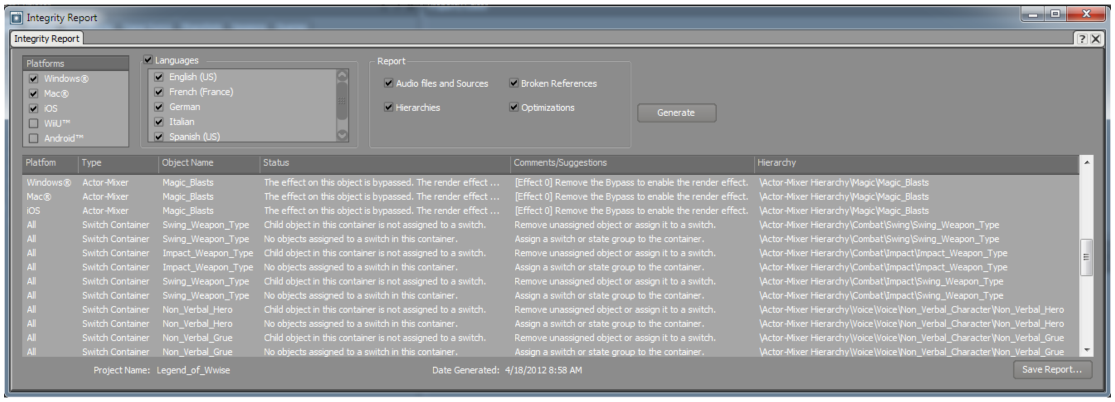
For more information on SoundBanks:

Video Tutorial - Creating and Managing SoundBanks

Video Tutorial - Building SoundBanks

Using the Integrity Report

The Integrity Report serves as a map to the underworld, that is, if the underworld were populated by errors and inconsistencies instead of treasures and foes. The Wwise Integrity Report is where a report can be generated that contains information about the project, including errors and how to resolve them.



Integrity Report

Platforms: ✓ Windows® ✓ Mac® ✓ iOS ☐ WiiU™ ☐ Android™

✓ Languages: ✓ English (US) ✓ French (France) ✓ German ✓ Italian ✓ Spanish (US)

Report: ✓ Audio files and Sources ✓ Broken References ✓ Hierarchies ✓ Optimizations

Platfom	Type	Object Name	Status	Comments/Suggestions	Hierarchy
Windows®	Actor-Mixer	Magic_Blasts	The effect on this object is bypassed. The render effect ...	[Effect 0] Remove the Bypass to enable the render effect.	\Actor-Mixer Hierarchy\Magic\Magic_Blasts
Mac®	Actor-Mixer	Magic_Blasts	The effect on this object is bypassed. The render effect ...	[Effect 0] Remove the Bypass to enable the render effect.	\Actor-Mixer Hierarchy\Magic\Magic_Blasts
iOS	Actor-Mixer	Magic_Blasts	The effect on this object is bypassed. The render effect ...	[Effect 0] Remove the Bypass to enable the render effect.	\Actor-Mixer Hierarchy\Magic\Magic_Blasts
All	Switch Container	Swing_Weapon_Type	Child object in this container is not assigned to a switch.	Remove unassigned object or assign it to a switch.	\Actor-Mixer Hierarchy\Combat\Swing\Swing_Weapon_Type
All	Switch Container	Swing_Weapon_Type	No objects assigned to a switch in this container.	Assign a switch or state group to the container.	\Actor-Mixer Hierarchy\Combat\Swing\Swing_Weapon_Type
All	Switch Container	Impact_Weapon_Type	Child object in this container is not assigned to a switch.	Remove unassigned object or assign it to a switch.	\Actor-Mixer Hierarchy\Combat\Impact\Impact_Weapon_Type
All	Switch Container	Impact_Weapon_Type	No objects assigned to a switch in this container.	Assign a switch or state group to the container.	\Actor-Mixer Hierarchy\Combat\Impact\Impact_Weapon_Type
All	Switch Container	Swing_Weapon_Type	Child object in this container is not assigned to a switch.	Remove unassigned object or assign it to a switch.	\Actor-Mixer Hierarchy\Combat\Impact\Swing_Weapon_Type
All	Switch Container	Swing_Weapon_Type	No objects assigned to a switch in this container.	Assign a switch or state group to the container.	\Actor-Mixer Hierarchy\Combat\Impact\Swing_Weapon_Type
All	Switch Container	Non_Verbal_Hero	Child object in this container is not assigned to a switch.	Remove unassigned object or assign it to a switch.	\Actor-Mixer Hierarchy\Voice\Voice\Non_Verbal_Character\Non_Verbal_Hero
All	Switch Container	Non_Verbal_Hero	No objects assigned to a switch in this container.	Assign a switch or state group to the container.	\Actor-Mixer Hierarchy\Voice\Voice\Non_Verbal_Character\Non_Verbal_Hero
All	Switch Container	Non_Verbal_Grue	Child object in this container is not assigned to a switch.	Remove unassigned object or assign it to a switch.	\Actor-Mixer Hierarchy\Voice\Voice\Non_Verbal_Character\Non_Verbal_Grue
All	Switch Container	Non_Verbal_Grue	No objects assigned to a switch in this container.	Assign a switch or state group to the container.	\Actor-Mixer Hierarchy\Voice\Voice\Non_Verbal_Character\Non_Verbal_Grue

Project Name: Legend_of_Wwise

Date Generated: 4/18/2012 8:58 AM

A view of the Integrity Report listing information, possible errors, and information on resolution.

The Integrity Report lists errors such as:

- Missing media files
- Missing audio or motion sources
- Plug-in problems
- Missing events in SoundBanks

By double-clicking an error in the Error list, you can open a corresponding Wwise dialog box where you can resolve the error, or receive further information about how to handle it.

You can also filter the Integrity Report to display only the types of information that you specify, such as details about the following:

- Platforms
- Languages
- Audio files and sources
- Hierarchies
- References
- Optimizations

Often the integrity report can highlight areas of a project that need additional consideration or a deeper understanding.

Using the File Packager

The File Packager is a stand-alone utility that groups the SoundBanks and/or streamed media files for a Wwise project into one or more file packages to be used for a specific platform. File packages can also help you better manage language versions as well as downloadable content that is made available post release.

File packages can be created that include any of the following:

- SoundBank files only
- Streamed media files only
- SoundBank files and streamed media files

All information about a Wwise project's SoundBanks and streamed media files can be retrieved by importing the SoundBanksInfo.xml file into the File Packager. The SoundBanksInfo.xml file is created automatically by Wwise each time the SoundBanks are generated.

The File Packager can be used to create your file packages manually, or the process can automated by using a command line to run the File Packager as part of SoundBank generation. This command line can be defined at the project level or as a custom SoundBank user setting.

For more information about the File Packager:

Wwise Help > Finishing Your Project > **Managing File Packages**

Wwise Knowledge Base - Using file packages

Wwise Knowledge Base - How do LoadBank/UnloadBank and PrepareEvent work together?

Wwise Knowledge Base - How to avoid duplication of source files when a sound exists in multiple SoundBanks

Video Tutorial - File Packager

Downloadable Content (DLC)

It has become a common development strategy for many games to plan for content that will become available after a game has been released. Often, this strategy is included in the schedule for creating a game and, if properly planned for, can be a seamless experience for adding additional content.

One key aspect of developing content to be distributed after release is: All DLC content must be created using the same Wwise Project that was used for the main release. Also, to ensure compatibility, the same Wwise version must be used for the Main and DLC releases. A basic scenario for managing DLC can be found in the Wwise Knowledge Base and also includes considerations and limitations involved with preparing your project.

It is important to devote time to understand the process involved with preparing for the eventuality of downloadable content. With the right approach, the ability to modify implementation and include additional audio can enable new creative potential after the initial release.

For more information on Downloadable Content:

Wwise Knowledge Base - Downloadable Content Overview

Setup Summary

While the myriad of setup options and considerations can seem overwhelming at a glance, the ability to prepare and modify the project to meet the needs of a particular development methodology ensures that the functionality is available. Understanding the fundamental concepts that run throughout the project can help prepare a road worn veteran for the task at hand. Armed with the tools to forge your own way on the path, a limitless vista of potential awaits.

Throughout this chapter we have discussed:

- Work Unit Management
- Establishing a Naming Convention Early
- Logical Grouping of Work Units
- Creating Work Units with Sharing in Mind
- Grouping Objects in the Actor-Mixer Hierarchy
- Creating Simulations with the Soundcaster
- Project Settings
- Workgroup Plug-in Configuration
- Audio File Locations
- Default Conversion Settings
- Defining the Sample Rate Automatic Detection Settings
- Obstruction/ Occlusion
- Setting Obstruction and Occlusion
- Motion
- Customizing Layouts
- Layout Docking
- View Docking
- External Sources
- SoundBanks and Bank Generation
- A New Approach for SoundBank Management
- Conversion Settings
- The SoundBank Definition File
- Using the Integrity Report
- Using the File Packager
- Downloadable Content (DLC)

Setup Additional Resources

Video Tutorial - Workgroup Management in Wwise Using Perforce

Video Tutorial - Wwise Motion

Video Tutorial - Managing Layouts

Wwise Help > Finishing Your Project > Managing Platform and Language Versions > Authoring Across Platforms > Converting Audio Files > **Creating Audio Conversion Settings ShareSets**

Video Tutorial - Conversion Settings ShareSets

Video Tutorial - Creating and Managing SoundBanks

Video Tutorial - Building SoundBanks

Wwise Knowledge Base - Using file packages

Wwise Knowledge Base - How do LoadBank/UnloadBank and PrepareEvent work together?

Wwise Knowledge Base - How to avoid duplication of source files when a sound exists in multiple SoundBanks

Video Tutorial - File Packager

Wwise Knowledge Base - Downloadable Content Overview

Chapter 12. Workflow Optimization

Overview

Regardless of the game, genre, or platform you're working with, one concern that persists across all developments is the need to fit within the allotted memory and processing budget. Whether working within the tight constraints of mobile platforms, maintaining optimal CPU usage, or making sure the most important sounds get the memory needed for variation, the process of optimization is one that develops organically throughout development. It can be difficult to stay on target while the game is constantly changing, but there are some valuable resources available that can help keep things under control.

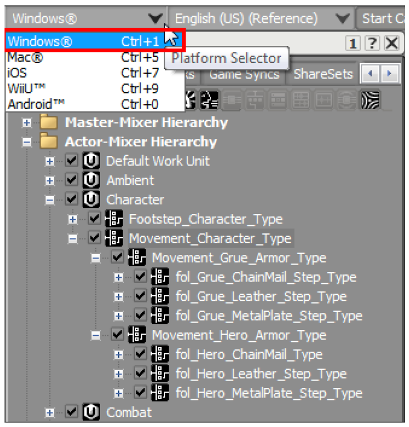
This chapter will take you through the process of:

- Platform Inclusion/ Exclusion
- Linking/ Unlinking properties
- Effects Rendering
- Understanding the Different Types of Profiling in Wwise
- Connecting to the Game
- Capturing Data using the Profiler
- Profiling the Sound In-GameSample rate automatic conversion
- Game Engine integration with SoundFrame
- Integrity Report

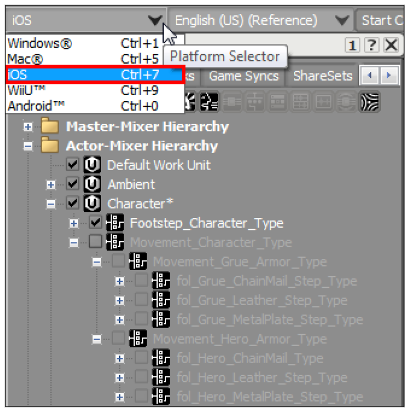
Platform Inclusion / Exclusion

One of the first strategies to make the trimming of sound content a testament to sanity is the ability to include/ exclude sound objects non-destructively from one platform to another. By simply clearing the check box next to a sound object, the parent and any child objects are removed and excluded from the build process depending on the platform.

For instance, removing all of the Movement Sounds from a platform with less memory in order to keep the game within its memory budget is as easy as removing the check from the parent sound object in the hierarchy:



Movement included for the Windows platform



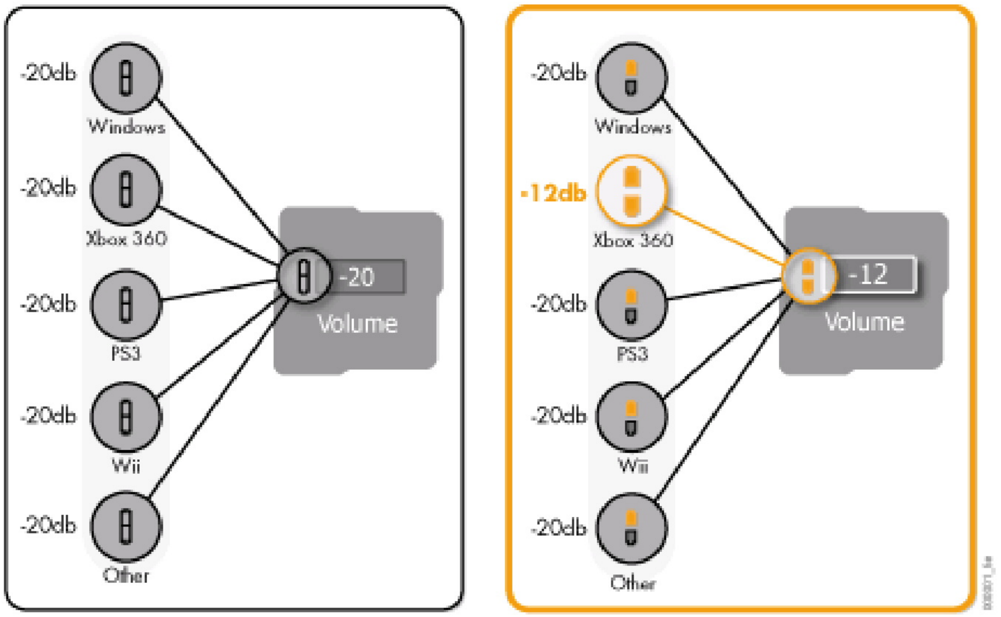
Movement excluded for the iOS platform

If you're working on multiple platforms, you can use this technique to exclude sound objects or variations. Using the platform selector, you can work within each of your target platforms to maintain the necessary requirements.

Linking / Unlinking Properties

By default, all sound and motion properties are set the same across all active platforms. These properties are said to be linked across platforms and can be selectively unlinked for any property on a per platform basis. This streamlines the creation of consistent projects across all platforms. Whether you're unlinking properties in order to apply different mix settings, to remove DSP effects for a specific platform, or any other reason, having a non-destructive workflow that enables this ability is a benefit to any multi-platform development.

Unlinking the properties of a property causes the link indicator to become orange.



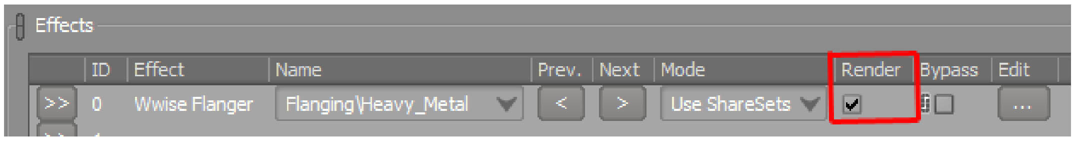
Properties are linked across all active platforms.

Volume is unlinked and customized for "XBox 360" platform, and the remaining platforms are partially unlinked.

When defining the properties for various platforms, you can easily tell if the properties are unlinked on another platform. The link/unlink indicator will be partly orange indicating that it is partially unlinked.

Effects Rendering

Another place where you may be able to gain back valuable resources is in the rendering of any effects that are not actively modified by RTPC. Enabling rendering for an effect applies the effects settings to the audio files during SoundBank generation. While this adds to the overall size of SoundBanks, the reduction in CPU can be beneficial when in short supply.



ID	Effect	Name	Mode	Render	Bypass	Edit
0	Wwise Flanger	Flanging\Heavy_Metal	Use ShareSets	✓		...

Rendering effects

Designer Note

Rendering time-based effects that may extend the duration of the file(s), such as delay, reverb, or time stretch, results in large files being generated in the SoundBank which saves CPU at runtime in exchange for additional memory usage.

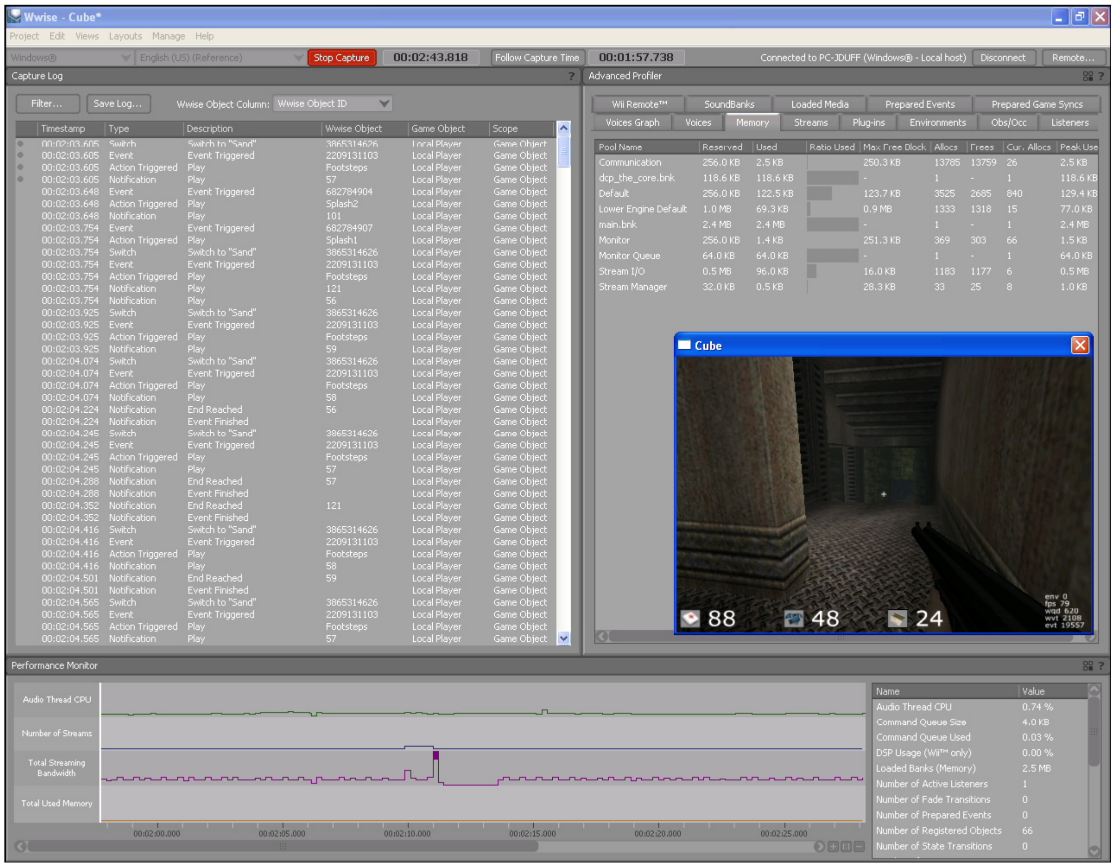
Understanding the Different Types of Profiling in Wwise

The Wwise profiler is at the heart of most resource centered problem solving. There are few things related to the audio engine that you can't ascertain by connecting the running game to the Wwise authoring application and capturing key performance information in real time. The profiler is a consistent barometer for the state of audio in-game and gives access to a deep level of debug opportunities.

In Wwise you can perform two types of profiling:

- Game profiling
- Game object profiling

Game profiling focuses on performance requirements and demands from the point of view of the sound engine and the various components that make up the project. It demonstrates in real time the cumulative effect the sound and motion in the project has on platform performance, and allows you to examine the impact of individual voices.



Timestamp	Type	Description	Wwise Object	Game Object	Scope
00:02:03.605	Switch	Switch to "Sand"	3865314626	Local Player	Game Object
00:02:03.605	Event	Event Triggered	2209131103	Local Player	Game Object
00:02:03.605	Action Triggered	Play	Footsteps	Local Player	Game Object
00:02:03.605	Notification	Play	57	Local Player	Game Object
00:02:03.648	Event	Event Triggered	682784904	Local Player	Game Object
00:02:03.648	Action Triggered	Play	Splash2	Local Player	Game Object
00:02:03.648	Notification	Play	101	Local Player	Game Object
00:02:03.754	Event	Event Triggered	682784907	Local Player	Game Object
00:02:03.754	Action Triggered	Play	Splash1	Local Player	Game Object
00:02:03.754	Switch	Switch to "Sand"	3865314626	Local Player	Game Object
00:02:03.754	Event	Event Triggered	2209131103	Local Player	Game Object
00:02:03.754	Action Triggered	Play	Footsteps	Local Player	Game Object
00:02:03.754	Notification	Play	121	Local Player	Game Object
00:02:03.754	Notification	Play	56	Local Player	Game Object
00:02:03.925	Switch	Switch to "Sand"	3865314626	Local Player	Game Object
00:02:03.925	Event	Event Triggered	2209131103	Local Player	Game Object
00:02:03.925	Action Triggered	Play	Footsteps	Local Player	Game Object
00:02:03.925	Notification	Play	59	Local Player	Game Object
00:02:04.074	Switch	Switch to "Sand"	3865314626	Local Player	Game Object
00:02:04.074	Event	Event Triggered	2209131103	Local Player	Game Object
00:02:04.074	Action Triggered	Play	Footsteps	Local Player	Game Object
00:02:04.074	Notification	Play	58	Local Player	Game Object
00:02:04.224	Notification	End Reached	56	Local Player	Game Object
00:02:04.224	Notification	Event Finished		Local Player	Game Object
00:02:04.245	Switch	Switch to "Sand"	3865314626	Local Player	Game Object
00:02:04.245	Event	Event Triggered	2209131103	Local Player	Game Object
00:02:04.245	Action Triggered	Play	Footsteps	Local Player	Game Object
00:02:04.245	Notification	Play	57	Local Player	Game Object
00:02:04.288	Notification	End Reached	57	Local Player	Game Object
00:02:04.288	Notification	Event Finished		Local Player	Game Object
00:02:04.352	Notification	End Reached	121	Local Player	Game Object
00:02:04.352	Notification	Event Finished		Local Player	Game Object
00:02:04.416	Switch	Switch to "Sand"	3865314626	Local Player	Game Object
00:02:04.416	Event	Event Triggered	2209131103	Local Player	Game Object
00:02:04.416	Action Triggered	Play	Footsteps	Local Player	Game Object
00:02:04.416	Notification	Play	58	Local Player	Game Object
00:02:04.501	Notification	End Reached	59	Local Player	Game Object
00:02:04.501	Notification	Event Finished		Local Player	Game Object
00:02:04.565	Switch	Switch to "Sand"	3865314626	Local Player	Game Object
00:02:04.565	Event	Event Triggered	2209131103	Local Player	Game Object
00:02:04.565	Action Triggered	Play	Footsteps	Local Player	Game Object
00:02:04.565	Notification	Play	57	Local Player	Game Object

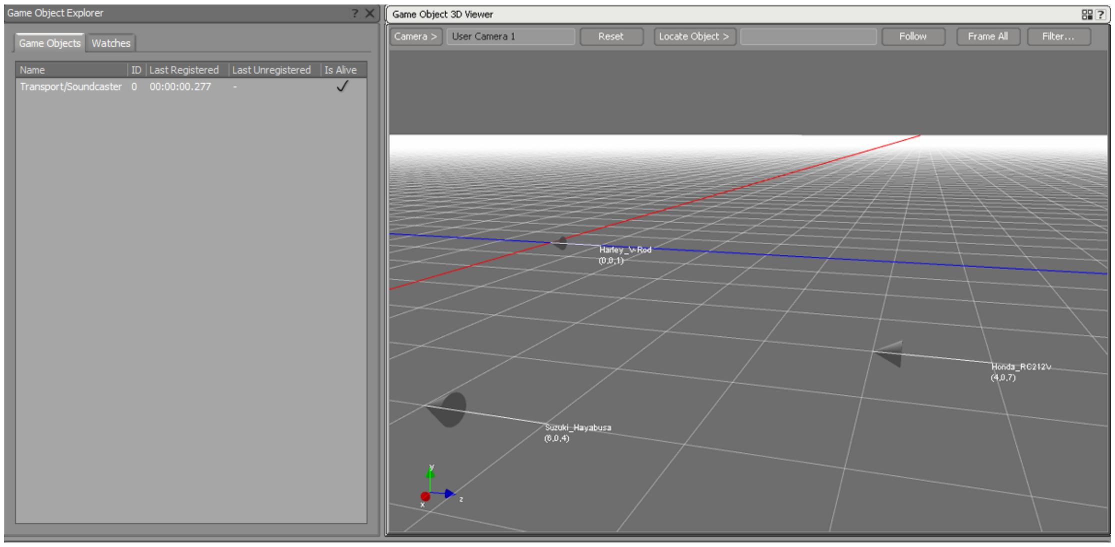
Pool Name	Reserved	Used	Ratio Used	Max Free Block	Allocs	Frees	Cur. Allocs	Peak Use
Communication	256.0 KB	2.5 KB		250.3 KB	13785	13759	26	2.5 KB
dcp_the_core.bnk	118.6 KB	118.6 KB		-	1	-	1	118.6 KB
Default	256.0 KB	122.5 KB		123.7 KB	3525	2685	840	129.4 KB
Lower Engine Default	1.0 MB	69.3 KB		0.9 MB	1333	1318	15	77.0 KB
main.bnk	2.4 MB	2.4 MB		-	1	-	1	2.4 MB
Monitor	256.0 KB	1.4 KB		251.3 KB	369	303	66	1.5 KB
Monitor Queue	64.0 KB	64.0 KB		-	1	-	1	64.0 KB
Stream I/O	0.5 MB	96.0 KB		16.0 KB	1183	1177	6	0.5 MB
Stream Manager	32.0 KB	0.5 KB		28.3 KB	33	25	8	1.0 KB

Name	Value
Audio Thread CPU	0.74 %
Command Queue Size	4.0 KB
Command Queue Used	0.03 %
DSP Usage (Wii™ only)	0.00 %
Loaded Banks (Memory)	2.5 MB
Number of Active Listeners	1
Number of Fade Transitions	0
Number of Prepared Events	0
Number of Registered Objects	66
Number of State Transitions	0

Tracking performance using the Game Profiler with a game currently running

The Game Object Explorer is the starting point for studying game objects and listeners. Within this view, you can see all the registered game objects in your game, as well as control which game objects and listeners will be watched by Wwise. The game objects that you have selected for 'watching' become visible in the Game Sync Monitor, and both game objects and listeners show up in the Game Object 3D Viewer.

Game object profiling also analyzes the output of the sound engine, but from the point of view of individual game objects. Game object profiling tracks game objects so that you can observe their movements and behavior in real time. In this way, you can find out if certain game objects are problematic.



Name	ID	Last Registered	Last Unregistered	Is Alive
Transport/Soundcaster	0	00:00:00.277	-	✓

Tracking individual game objects in the Game Object Explorer 3D viewer

Game objects refer to discrete actors or entities that exist within a game. They are registered or created by the audio programmer for all objects or elements within the game that can emit a sound, such as player characters, non-player characters (NPCs), weapons, vehicles, etc. The game object profiling tools (the Game Object Explorer, Game Object 3D Viewer, and Game Sync Monitor) work together to examine game objects and listeners in a game or simulation.

Connecting to the Game

To begin profiling or simulating sounds or motion fx in- game on a particular platform, you need to first connect to the PC or game console upon which the game runs. You can connect to any Wwise sound engine that is running and available on your local area network.

Designer Note

When profiling, it is recommended that you connect to the Profile build configuration of the Wwise sound engine, even from the Debug build of your game, because the performance of the Debug configuration has not been optimized.

To help you find the PC or game console you are looking for, Wwise automatically searches for all PCs and game consoles on the same subnet of the network that are currently running a version of the Wwise sound engine. You can also connect to consoles or PCs outside your subnet by manually entering the IP address of the platform.

For more information on connecting to the game:

Wwise Help > Finishing Your Project > Profiling > **Connecting to a Local/Remote PC or Game Console**

Capturing Data using the Profiler

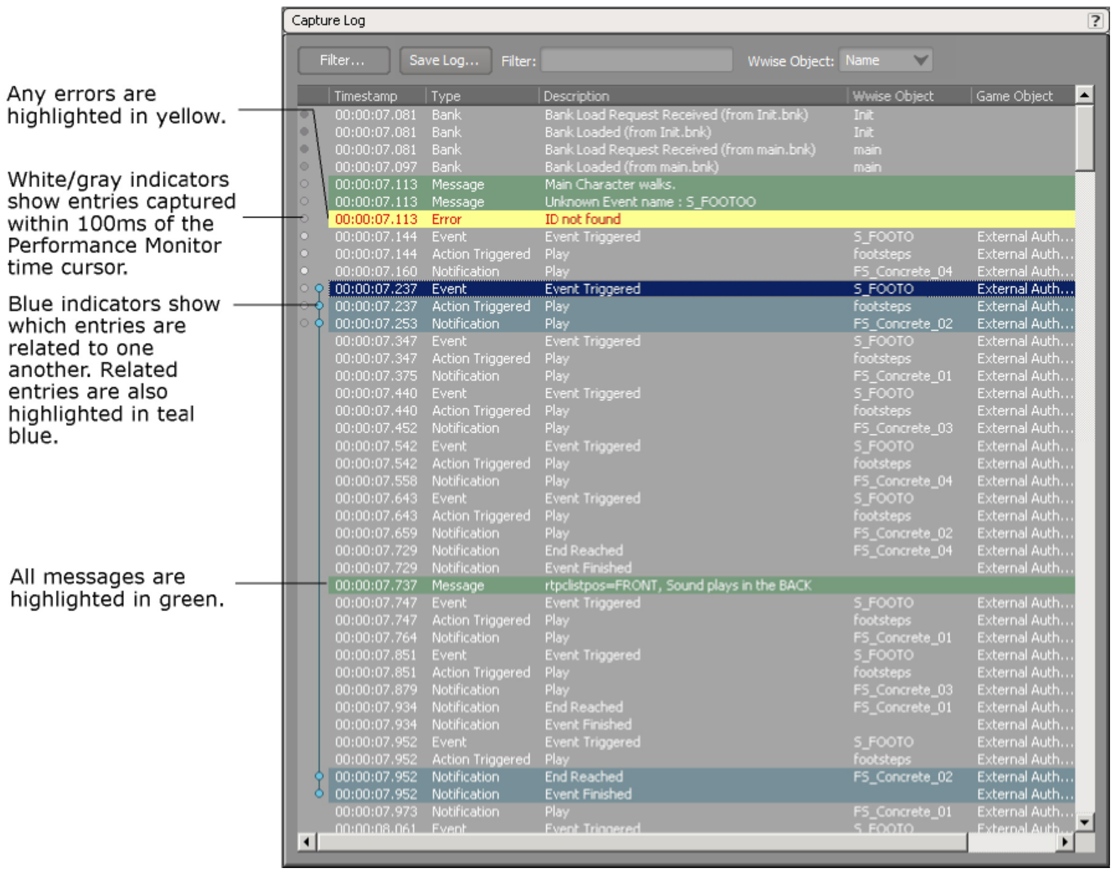
After connecting to a PC or game console, you can begin to profile the audio and motion fx in your game by capturing data directly from the sound engine. All the information coming from the sound engine is displayed in the Capture Log.

An entry is recorded in the Capture Log for the following types of information:

- Notifications
- Properties
- Banks
- Markers
- States
- Errors
- Events
- Switches
- Messages
- Actions
- Prepared Events

You can monitor each of these entries using the Performance Monitor and Advanced Profiler. These views contain detailed information about memory, voice, and effect usage, streaming, SoundBanks, plug-ins, and so on.

Wwise uses the following special indicators and color to help you quickly sort through the many entries that can appear in the Capture Log. The following illustration shows how the different indicators and colors are used in the Capture Log.


Any errors are highlighted in yellow.
White/gray indicators show entries captured within 100ms of the Performance Monitor time cursor.
Blue indicators show which entries are related to one another. Related entries are also highlighted in teal blue.
All messages are highlighted in green.
Capture Log
Filter...
Save Log...
Filter:
Wwise Object:
Name

Timestamp	Type	Description	Wwise Object	Game Object
00:00:07.081	Bank	Bank Load Request Received (from Init.bnk)	Init	
00:00:07.081	Bank	Bank Loaded (from Init.bnk)	Init	
00:00:07.081	Bank	Bank Load Request Received (from main.bnk)	main	
00:00:07.097	Bank	Bank Loaded (from main.bnk)	main	
00:00:07.113	Message	Main Character walks.		
00:00:07.113	Message	Unknown Event name : S_FOOTOO		
00:00:07.113	Error	ID not found		
00:00:07.144	Event	Event Triggered	S_FOOTO	External Auth...
00:00:07.144	Action Triggered	Play	footsteps	External Auth...
00:00:07.160	Notification	Play	FS_Concrete_04	External Auth...
00:00:07.237	Event	Event Triggered	S_FOOTO	External Auth...
00:00:07.237	Action Triggered	Play	footsteps	External Auth...
00:00:07.253	Notification	Play	FS_Concrete_02	External Auth...
00:00:07.347	Event	Event Triggered	S_FOOTO	External Auth...
00:00:07.347	Action Triggered	Play	footsteps	External Auth...
00:00:07.375	Notification	Play	FS_Concrete_01	External Auth...
00:00:07.440	Event	Event Triggered	S_FOOTO	External Auth...
00:00:07.440	Action Triggered	Play	footsteps	External Auth...
00:00:07.452	Notification	Play	FS_Concrete_03	External Auth...
00:00:07.542	Event	Event Triggered	S_FOOTO	External Auth...
00:00:07.542	Action Triggered	Play	footsteps	External Auth...
00:00:07.558	Notification	Play	FS_Concrete_04	External Auth...
00:00:07.643	Event	Event Triggered	S_FOOTO	External Auth...
00:00:07.643	Action Triggered	Play	footsteps	External Auth...
00:00:07.659	Notification	Play	FS_Concrete_02	External Auth...
00:00:07.729	Notification	End Reached	FS_Concrete_04	External Auth...
00:00:07.729	Notification	Event Finished		External Auth...
00:00:07.737	Message	rtpclistpos=FRONT, Sound plays in the BACK		
00:00:07.747	Event	Event Triggered	S_FOOTO	External Auth...
00:00:07.747	Action Triggered	Play	footsteps	External Auth...
00:00:07.764	Notification	Play	FS_Concrete_01	External Auth...
00:00:07.851	Event	Event Triggered	S_FOOTO	External Auth...
00:00:07.851	Action Triggered	Play	footsteps	External Auth...
00:00:07.879	Notification	Play	FS_Concrete_03	External Auth...
00:00:07.934	Notification	End Reached	FS_Concrete_01	External Auth...
00:00:07.934	Notification	Event Finished		External Auth...
00:00:07.952	Event	Event Triggered	S_FOOTO	External Auth...
00:00:07.952	Action Triggered	Play	footsteps	External Auth...
00:00:07.952	Notification	End Reached	FS_Concrete_02	External Auth...
00:00:07.952	Notification	Event Finished		External Auth...
00:00:07.973	Notification	Play	FS_Concrete_01	External Auth...
00:00:08.061	Event	Event Triggered	S_FOOTO	External Auth...

Capture Log showing indicator descriptions

Profiling Sound In-Game

During an epic lower level dungeon raid, the frame rate slows as a burst of sound engulfs the player as a maelstrom of visual effects explodes onscreen. In order to identify the role that sound may have had in the decrease in frame rate, the profiling and game object profiling tools could be used to analyze the performance.

You can use game profiling tools to analyze the following:

- How the many sounds associated with monsters, visual effects, and physics objects use the platform's streaming capabilities.
- How and when background noises such as positional ambient sound fall into virtual voice.
- Which effect plug-ins are applied to the different monster vocalizations and how these affect CPU usage.

You can use game object profiling tools to analyze the following:

- How the attenuation radius of the sounds for each monster interacts with that of each other monster.

- Where game objects such as projectile magic visual effects move relative to one another and to the monsters.
- How an RTPC driving a side-chain affects the playback of sounds associated with combat.

In this way, the game profiling and game object profiling tools can give you a complete view of the game's soundscape in action.

For more information about game profiling:

Wwise Help > Finishing Your Project > **Profiling**

Video Tutorial - Wwise Profiler Overview

Instance Limiting, Prioritization, and Virtual Voices

It's not until the project has been significantly completed that the effects of instance limiting, prioritization, and virtual voice behavior can be heard on the resulting sounds played back during gameplay. Understanding these concerns at the outset, and making preparations throughout development, can save the day at the end of production when resources for implementing a fundamental change can be at a premium.

Playback Limits

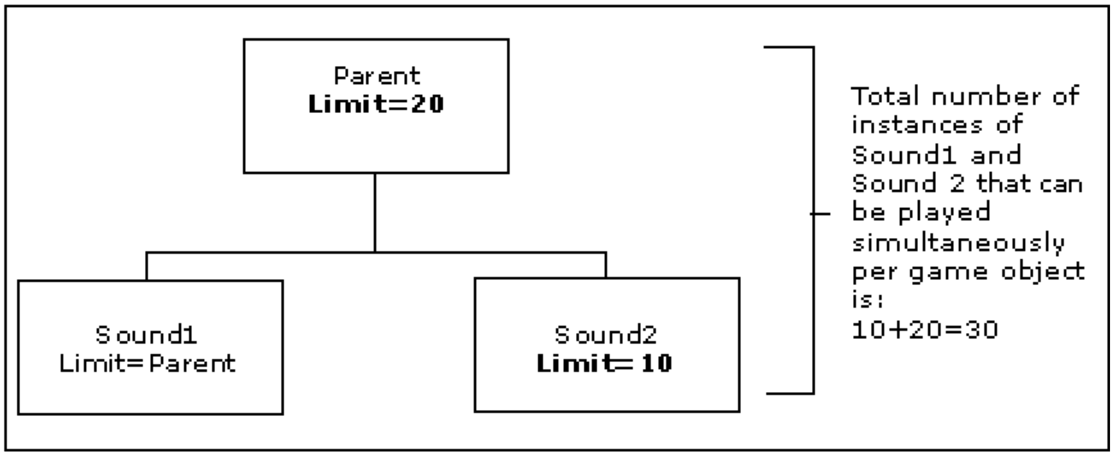
To deal with limited game resources or game-design constraints, you must optimize the sounds, music, and motion objects that are playing at any one point in the game. This can be accomplished using two different methods:

- Limit the number of sound, music, and/or motion instances that can be played per game object.
- Limit the overall number of sound, music, and/or music or motion instances that can pass through a bus.

Setting a Playback Limit per Game Object

When either limit is reached, Wwise uses the priority setting of the object to determine which one to stop and which one to play. If objects have equal priority, there is the option to stop the newest or oldest instance that is playing.

When you set a playback limit at the Actor-Mixer or Interactive Music level, you control the number of instances within the same structure that can be played, per game object. If a child object overrides the playback limit set at the parent level, the total number of instances that can play is equal to the sum of all limits defined within the structure. This means that if, for example, you have a parent with a limit of 20 and a child with a limit of 10, the total possible number of instances is 30.


Parent
Limit=20
Sound1
Limit=Parent
Sound2
Limit=10
Total number of instances of Sound1 and Sound 2 that can be played simultaneously per game object is:
10+20=30

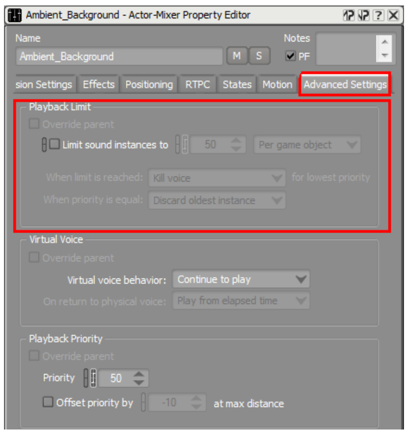
Setting a Playback Limit on an Audio Bus

When you set the playback limit at the Master-Mixer level, the number of sound, music, and/or motion instances that can pass through the bus at any one time is specified. Since the priority of each object has already been specified at the Actor-Mixer or Interactive Music level, there is no playback priority setting for busses.

Global Playback Limit

If the new sound, music, or motion object is not killed or sent to virtual voice at the Actor-Mixer or Interactive Music level, it passes to the second process at the Master-Mixer level. At this level, a global playback limit is used to restrict the total number of voices that can pass through the bus at any one time.

Managing playback limits can be done in the advanced setting of any sound object, actor-mixer, or audio bus in the advanced settings tab of the Property Editor.



Name: Ambient_Background
✓ PF
Override parent
Limit sound instances to 50 Per game object
When limit is reached: Kill voice for lowest priority
When priority is equal: Discard oldest instance
Override parent
Virtual voice behavior: Continue to play
On return to physical voice: Play from elapsed time
Override parent
Priority 50
Offset priority by -10 at max distance

Setting playback limits and behavior in the advanced setting tab

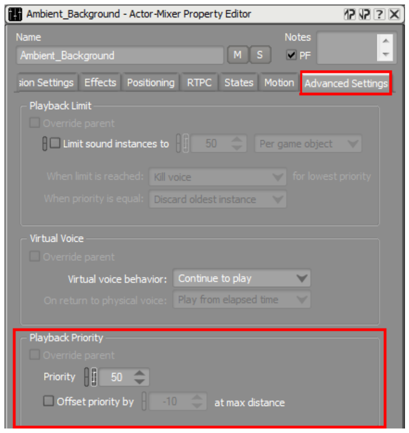
Setting Playback Priority

Priorities define the importance given to the sound or motion object in relation to other objects within the same actor-mixer structure. Establishing general priorities for parent containers early on at the top level of the actor-mixer based on sound type is a step in the right direction. Additionally, identifying critical sounds in need of a higher priority to insure their playback is a matter of knowing the content and, where possible, organizing it appropriately to make things easier towards the end of a project.

Designer Note

You can also alter the playback priority based on the distance the sound or motion object is from the listener. Wwise applies an offset to the priority using the Max distance values defined in the Attenuation Editor. The amount of offset applied will depend on the object's relative position to the listener. Wwise linearly interpolates the offset between the source point, where no offset is applied, and the attenuation max distance, where the full offset value specified is applied.

Managing priorities can be done in the advanced setting of any sound object, actor-mixer, or audio bus in the advanced settings tab of the Property Editor.



Name: Ambient_Background
[✓] PF

Playback Limit
[ ] Override parent
[ ] Limit sound instances to 50 Per game object
When limit is reached: Kill voice for lowest priority
When priority is equal: Discard oldest instance

Virtual Voice
[ ] Override parent
Virtual voice behavior: Continue to play
On return to physical voice: Play from elapsed time

Playback Priority
[ ] Override parent
Priority 50
[ ] Offset priority by -10 at max distance

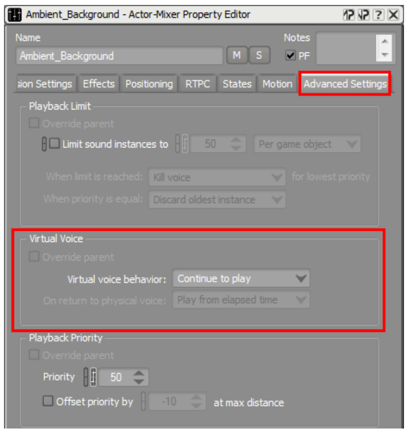
Setting playback priority in the advanced setting tab

Understanding Virtual Voice Behavior

To maintain an optimal level of performance when many sounds are playing simultaneously, sounds below a certain volume level should not take up valuable processing power and memory. Instead of playing these inaudible sounds, the sound engine can queue them in the virtual voice list. Wwise continues to manage and monitor these sounds, but once inside the virtual voice list, they are no longer processed by the sound engine and won't take up one of the hardware's active voices.

When you select the virtual voices feature, sounds move back and forth between the physical and the virtual voice based on their volume levels when they are under threshold, or if their playback limit was exceeded. As the volume reaches the threshold set by the Wwise user in Project Settings, they are added to the virtual voice list and sound processing stops. As volume levels increase, as is the case when sounds move within the max distance radius, the sounds will move from the virtual voice list to the physical voice where they will be processed by the sound engine again.

Managing virtual voice behavior can be done in the advanced setting of any sound object, actor-mixer, or audio bus in the advanced settings tab of the Property Editor.



Name: Ambient_Background
PF ✓

Override parent
Limit sound instances to 50 Per game object
When limit is reached: Kill voice for lowest priority
When priority is equal: Discard oldest instance

Override parent
Virtual voice behavior: Continue to play
On return to physical voice: Play from elapsed time

Override parent
Priority 50
Offset priority by -10 at max distance

Setting virtual voice behavior in the advanced setting tab

There are three options to choose from when determining the move from physical to virtual voice:

- **Continue to play** - Continues playing the object as a physical voice even though it will no longer be heard.
- **Kill voice** - Stops playing the object. No fade out is applied with this option.
- **Send to virtual voice** - Sends the object to the virtual voice list.

When a sound or motion object is sent to the virtual voice list, certain parameters of the object are monitored by the sound engine, but no processing for audio or motion occurs.

When Send to Virtual Voice is set, there are three options that determine the behavior of sounds or motion objects that move from the virtual voice list back to the physical voice.

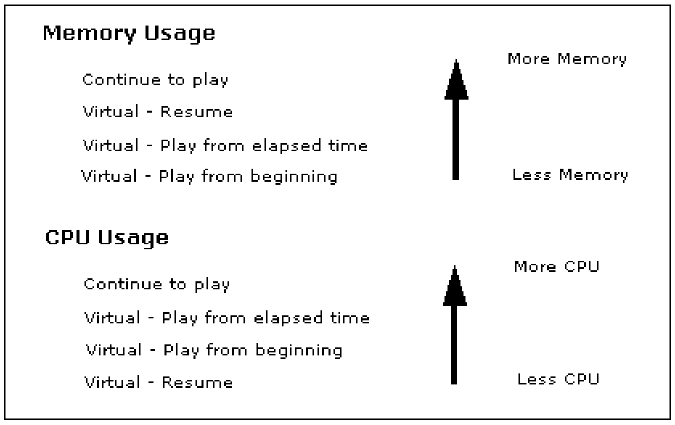
- **Play from beginning** - Plays the object from its beginning. This option resets the object's loop count.
- **Play from elapsed time** - Continues playing the object as if it had never stopped playing.

This option is not sample accurate, so sounds returning to the physical voice may be out of sync with other sounds playing.

- **Resume** - Pauses the object when it moves from the physical voice to the virtual voice list and then resume playback when it moves back to the physical voice.

Each behavior has its own performance characteristics, as demonstrated in the following table:

Behavior	CPU cost	Memory cost
Play from beginning	Medium: Voice stops being serviced when virtual. Some extra operations are done when switching between virtual and physical.	Low: All internal processing buffers are flushed when virtual.
Play from elapsed time	High: Voice needs to be serviced at each buffer when virtual. Some extra operations are done when switching between virtual and physical.	Low: All internal processing buffers are flushed when virtual.
Resume	Low: Voice stops being serviced when virtual. No operations occur when switching.	High: All internal processing buffers are retained when virtual.



Designer Note

Streamed sounds stop consuming I/O bandwidth while they are virtual. When the selected behavior is Play From Beginning or Play from Elapsed Time, the I/O buffer is flushed. This causes a delay before the sound is heard again when the voices switch from virtual to physical.

In short, taking control of instances and priorities can actually change the sound of your game. Special care and handling should be used when defining the properties at every level of both the Actor and Master-Mixer Hierarchies. Restrictively modifying these setting can prevent important sounds from being heard appropriately, in the same way that ignoring the setting can result in unwelcome behavior.

For additional information on Instance Limiting, Prioritization, and Virtual Voices:

Video Tutorial - Voice Management

Wwise Knowledge Base - Tips to reduce memory usage

Wwise Knowledge Base - Playback instance limits (including global limits)

Wwise Knowledge Base - Playback Limit and Priority: Use Case Scenarios

Wwise Knowledge Base - Working with object priority and virtual voices

Wwise Knowledge Base - How does playback limit overriding work?

Wwise Knowledge Base - Virtual voices: What’s calculated and what’s not

Wwise Help > Using Sounds and Motion to Enhance Gameplay > Managing the Priority of Sounds and Motion > **Understanding How Wwise Prioritizes Sounds and Motion Objects**

Bridging the Game Engine Integration Gap

The ability to bridge functionality between game and audio engine authoring applications is one of the most underestimated workflow improvements available to the development team. The interaction between tools that are linked by a shared set of information can be used to drive iteration as part of a sound designer's daily tasks. It is here that the SoundFrame technology aims to bring a suite of solutions to help quickly streamline communication between Wwise and other authoring applications in an intelligent and modular way.

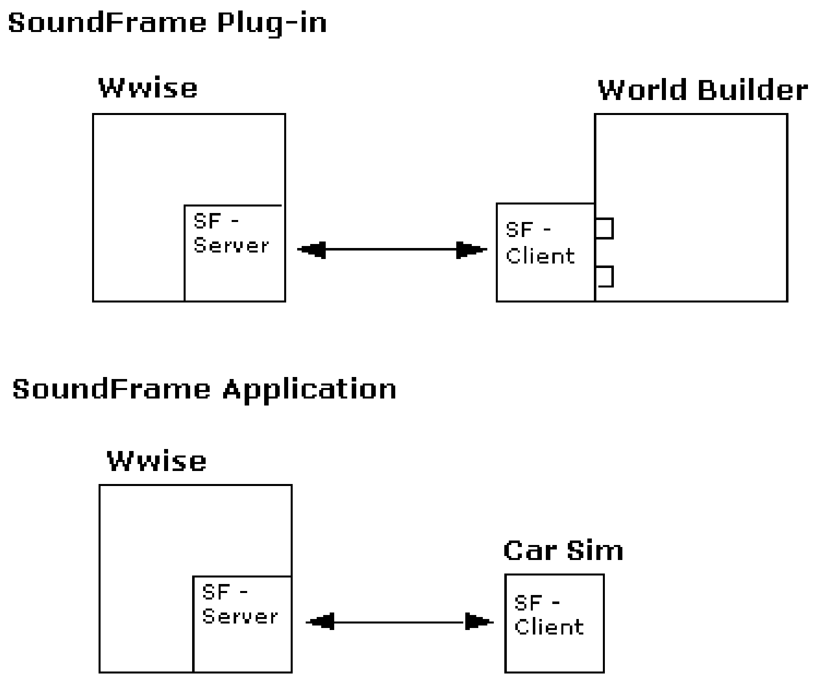
Designer Note

SoundFrame gives you access to most of the Sound Engine API. This allows you to enable event playback as well as modify states, switches, RTPCs, triggers, and environments in the application. This API lets you simulate real game scenarios directly in Wwise without requiring a working game engine or even having to generate SoundBanks.

Using the SoundFrame SDK, you can build plug-ins that can be integrated directly into your world building application, whether it be Unity, Unreal Editor (UnrealEd), Maya®, 3ds Max®, or any internal proprietary tool. This type of plug-in, which is built on top of the communication framework, allows you to perform many Wwise functions directly in your world building application, such as playing events, triggering game sync changes, and modifying positioning properties. You will also be able to integrate events at particular points in the animation, map switches to game textures, visualize attenuation radiuses, and assign environmental reverb to zones, among many other things.

How Does SoundFrame Work?

Applications and plug-ins created with the SoundFrame API work in a similar way to the Soundcaster in Wwise. Like the Soundcaster, you can re-create a variety of game scenarios by triggering events, sounds, and game syncs. The main difference is that the SoundFrame application or plug-in is outside of Wwise. In order for the two applications to communicate with each other, they both need to be installed and running on the same machine. SoundFrame establishes a bi-directional link with Wwise using a client-server type relationship. This type of communication allows you to validate sophisticated game scenarios quickly and efficiently.



When sounds are triggered by a SoundFrame application or plug-in, they are played through Wwise. Since SoundFrame uses Wwise as its sound engine, it is free from any sound engine restrictions. This means that updates can be tested and validated live, which can save you a great deal of time at all stages of the development cycle.

By taking the simulation capabilities of the Soundcaster one step further, the amount and types of audio simulations you can perform using SoundFrame are only limited by your own imagination.

Additional Game Engine Integration Techniques

While the SoundFrame technology provides a framework that can allow rapid development of toolset integration with Wwise, there are those who may wish to approach the task of game engine integration into their own hands. The Wwise XML Schema included with the SDK is provided as a roadmap for deeper integration which may be necessary in the development environment.

Programmer Note

The XML schema for Work Units is available in the Schemas folder in the Wwise installation (ObjectDataSchema.N.xsd - use the one with the highest number). This schema can be used to understand the format of Work Unit files, and it can also be used to validate the XML file generated. Looking at the .WWU files saved by Wwise with simple projects will also allow you to see how information should be organized.

Optimization Summary

Being aware of the many minute details of a Wwise project early on in development can contribute to a positive workflow methodology. By making many small changes over time you can avoid the common pitfalls that occur towards the end of a project. Ideally when you reach milestones within the production that can benefit from optimization, there has already been some thought on how best to manage limited resources. Through a combination of understanding and conscious implementation, the tools to realize great sound for any game are within reach.

Throughout this chapter we have discussed:

- Platform Inclusion / Exclusion
- Linking / Unlinking Properties
- Effects Rendering
- Understanding the Different Types of Profiling in Wwise
- Connecting to the Game
- Capturing Data using the Profiler
- Profiling the Sound In-Game
- Instance Limiting, Prioritization, and Virtual Voices
- Playback Limits
- Setting a Playback Limit Per Game Object
- Global Playback Limit
- Setting Playback Priority
- Understanding Virtual Voice Behavior
- Bridging the Game Engine Integration Gap
- How Does SoundFrame Work?
- Additional Game Engine Integration Techniques

Optimization Additional Resources

Wwise Help > Finishing Your Project > **Profiling**

Video Tutorial - Wwise Profiler Overview

Video Tutorial - Voice Management

Wwise Knowledge Base - Tips to reduce memory usage

Wwise Knowledge Base - Playback instance limits (including global limits)

Wwise Knowledge Base - Playback Limit and Priority: Use Case Scenarios

Wwise Knowledge Base - Working with object priority and virtual voices

Wwise Knowledge Base - How does playback limit overriding work?

Wwise Knowledge Base - Virtual voices: What's calculated and what's not

Wwise Help > Using Sounds and Motion to Enhance Gameplay > Managing the Priority of Sounds and Motion > Understanding How Wwise Prioritizes Sounds and Motion Objects

Chapter 13. Closing

The Real Adventure Begins

The development path is long, winding, and littered with fallen prototypes, past iterations, and a plethora of dead ends. As you head into battle, the best you can hope for is a trusty weapon by your side to help defend yourself against challenges as you progress through the forest of iteration. In game audio, you rely on the combined power of sound design, and the magic of implementation to carry you across the battlefield and to an eventual victory over the forces of evil; or bad sound. Wwise is a formidable ally to have on your side during the challenging task of development. On one hand a gleaming sword of efficiency and simplicity, on the other, a sorcerer's stone of possibility. Let the adventure begin!

Thank You

Special Thanks

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Editor

Judy Lapalme moved swiftly and effortlessly to correct errant punctuation and help streamline clunky sentence structure.

Project Content

All content was created exclusively for use in the accompanying Wwise Project Adventure by Bay Area Sound: Julian Kwasneski (Sound Design) & Jared Emerson-Johnson (Composer).

Continuity Experts (Beta Testers)

Hrishikesh Dani, Luca Fusi, Jack Menhorn, Roel Sanchez, Michael Taylor, and Rob Bridgett.

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Damian Kastbauer is a freelance Technical Sound Designer working to help bridge the gap between noise makers and game developers. Utilizing the functionality of game audio specific implementation authoring applications, his goal is to create dynamic sound interactions that leverage interactive techniques to make good sound content sound great.

He lives in Minneapolis, Minnesota with his sharp-witted and beautiful wife, two glorious daughters, a big hairy dog, and a freaky cat. When not dreaming and talking about ways to bring the beauty of interactive audio to the people, he can be found: spending time with his family, building things with his hands, and making weird noises for fun with effect-pedals.

He can be reached at: damian@lostchocolatelab.com.

Q: Is it: "Lost Chocolate LAB" or "Lost CHOCOLATE Lab"?
A: It depends on how you look at it. I've never lost a Labrador and I don't remember ever having a Laboratory...

Q: You live in Minneapolis, how does that work?
A: A combination of remote source-control enabled work from the home studio with occasional time on-site working directly with developers.

Q: What is the future of game audio?
A: Everyone working together to increase the use of interactive audio to create unique and engaging experiences.