



Auro Panner-Mixer Plug-in User Guide

Plug-in Version 1.0

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1 Introduction

1.1 Auro 3D

Welcome to Auro-3D[®], the next step in sound evolution brought to you by Auro Technologies. Audio reproduction has evolved from a point source or mono, to a single dimension or stereo, to two-dimensional surround sound, i.e. 5.1 or 7.1. To produce true three-dimensional sound, a reproduction system must include a vertical Z axis (top-to-bottom), in addition to the existing X (side-to-side) and Y (front-to-back) planar axes found in current systems. Auro-3D's three-layered approach, namely the Lower, Height and Top layers, completes this evolution by creating a realistic three-dimensional soundscape.

1.1.1 Auro 3D Formats

The Auro-3D 9.1–11.1 formats are based on, and compatible with the 5.1 Standard. They include the following additional channels:

- Auro 9.1: 5.1 + four Height channels, one above each side channel.
- Auro 10.1: 9.1 + Top channel, aka Voice of God.
- Auro 11.1: 10.1 + Height Center

The Auro-3D 11.1b and 13.1 formats are based on, and compatible with the 7.1 Standard. They include the following additional channels:

- Auro 11.1(7+4): 7.1 + four Height channels: 2 above the front speakers, Height Front Left and Height Front Right channels. And 2 above the side surround speakers, Height Back Left and Height Back Right channels.
- Auro 13.1: 11.1b + Height Center channel + Top channel

Auro Technologies developed a plug-in suite for Audiokinetic Wwise to allow three-dimensional sound reproduction in the context of a game.

1.2 Auro Panner-Mixer Plug-in

The Auro-Panner-Mixer Plug-in allows the game audio engine to place sounds, emitted by game objects, around and above the listener utilizing 3D channel configurations as described in section [1.1.1 Auro 3D Formats](#).

Furthermore the plug-in gives the user the possibility to place, for example, stereo or 5.1 tracks in a 3D channel configuration. The plug-in's Panning mode provides a way to achieve cinematic effects. For example, musical content can be elevated to the

height speakers, or simply be positioned towards the rear of the listener to achieve an ambiance.

The Wwise and Sound Engine plug-in consists of two components, which will be explained in the sections 2 and 3:

- Mixer plug-in
- Attachment plug-in

2 The Mixer Plug-in

The Mixer plug-in is inserted in the Mixer slot of an Audio Bus where it accumulates and mixes input audio. The Mixer slot can be found in the Mixer Plug-in tab in the Audio Bus Property Editor as shown in Figure 2.1. When the Mixer Plug-in tab is not available, it can be enabled by clicking on the tab labeled "+", and checking the Mixer Plug-in checkbox.

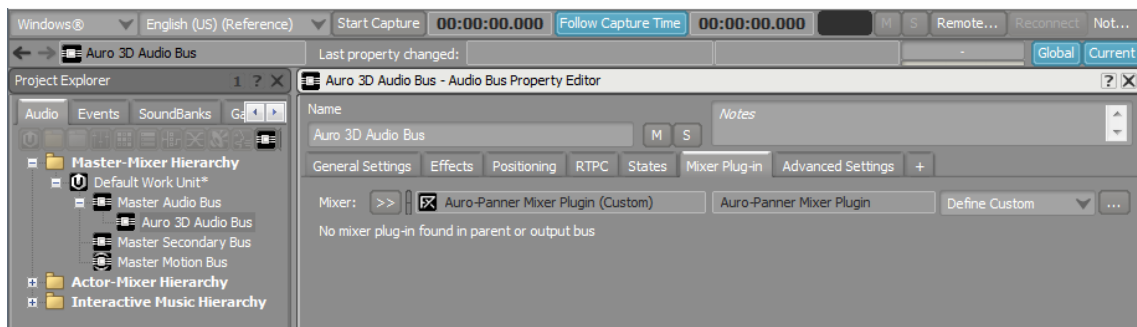


Figure 2.1: Mixer Plug-in tab of an Audio Bus

Select Auro-Panner Mixer Plug-in from the drop down box and click the ellipsis to reveal the Mixer plug-in parameters in Effect Editor window, shown in Figure 2.2.

2.1 Mixer Plug-in Parameters Overview

Enable default spatialization Uses Wwise's spatialization/mixing algorithm in stead of the Auro Panning algorithm.

Panning Law dB Represents the attenuation used when reproducing a signal for which the source position is in the center of 2 adjacent speakers.

When a signal, with equal phase and amplitude, is played on 2 speakers in ideal circumstances the loudness will increase by about 6 dB in comparison to playing the sound on

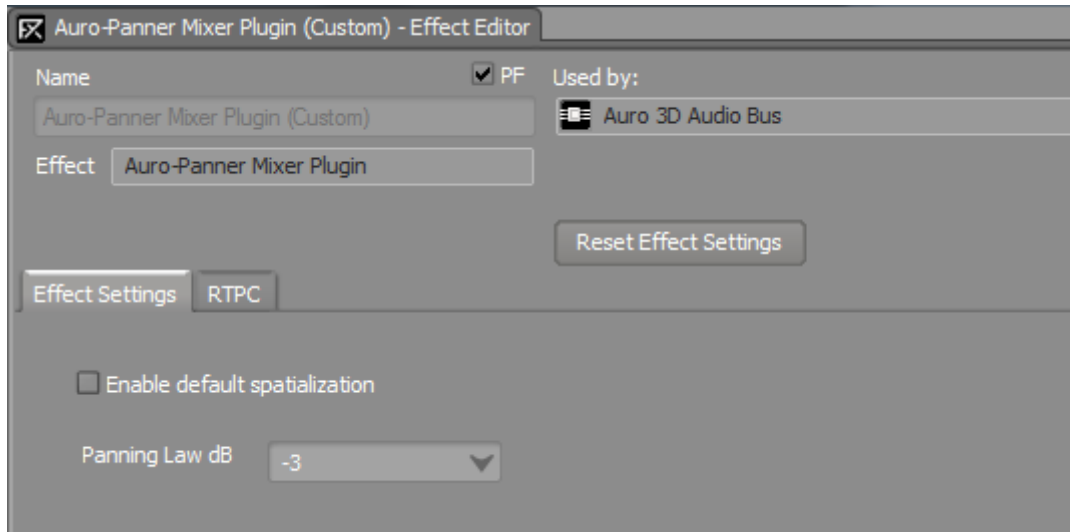


Figure 2.2: Mixer Plug-in parameters

one speaker. +6 dB represents a doubling of amplitude, even so -6 dB represents a halving of amplitude. So to counter the doubling of signal, both signals should be halved in amplitude so their sum equals the original signal. This means that the signal for both speakers should have -6 dB applied to them.

However in real world conditions -6 dB is considered too much and the convention is to use -3 dB.

2.2 Downmix behavior of the Mixer Plug-in

The Mixer plug-in output configuration always utilizes the configuration of its host bus. For example: when to Audio Bus with the Mixer plug-in is in a 7.1 channel configuration, the audio sent from sources with a higher configuration, say 13.1, will be downmixed to 7.1.

2.3 Downmix attenuation

Attenuation is applied for some combinations of input-output configurations to counteract the effects of summing.

In scenarios where the input configuration is higher than mono and the Mixer plug-in host bus is mono, an output attenuation of -6 dB is applied. If stereo inputs are mixed to a stereo bus, an output attenuation of -4.5 dB is applied.

3 The Attachment Plug-in

The Attachment plug-in is responsible for sending audio from single or multi-channel Sound Objects to an Auro-Panner Mixer Plugin's input. The Attachment plug-in part is automatically instantiated when a Sound Object is routed to a mixer bus. A mixer bus can be any bus which has an Auro-Panner-Mixer Plug-in inserted in its mixer plug-in slot.

Note that the Attachment parameters are only available for child objects in the Actor-Mixer-Hierarchy. Audio buses in the Master-Mixer-Hierarchy, such as child audio buses of the mixer bus, are also processed but the attachment parameters and positioning options are not accessible.

3.1 Connecting a Sound Object to a Mixer Bus

Figure 3.1 shows the General Settings tab of the Sound Property Editor of a Sound Object from which audio is sent to the mixer bus, named Auro 3D Audio Bus in this screenshot. Once the Output Bus is set to the mixer bus, all audio from the Sound Object will be sent to the Mixer plug-in, and the Attachment plug-in is instantiated for that Sound Object.

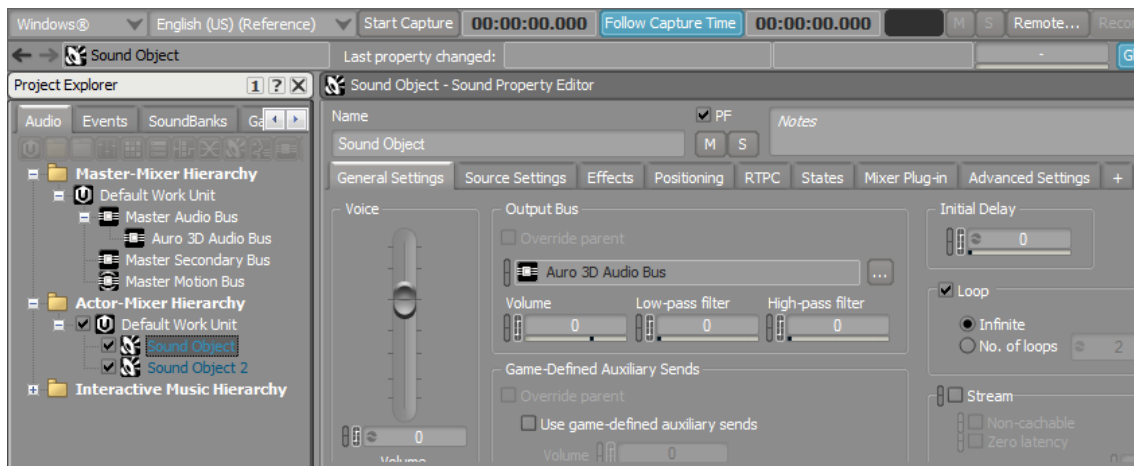


Figure 3.1: Sound Object - Sound Property Editor's General Settings tab

3.2 Attachment Plug-in Parameters Overview

Figure 3.2 shows the Attachment plug-in specific parameters for a Sound Object connected to a mixer bus. These parameters can be found in the Mixer Plug-in tab of the Sound Property editor of that Sound Object.

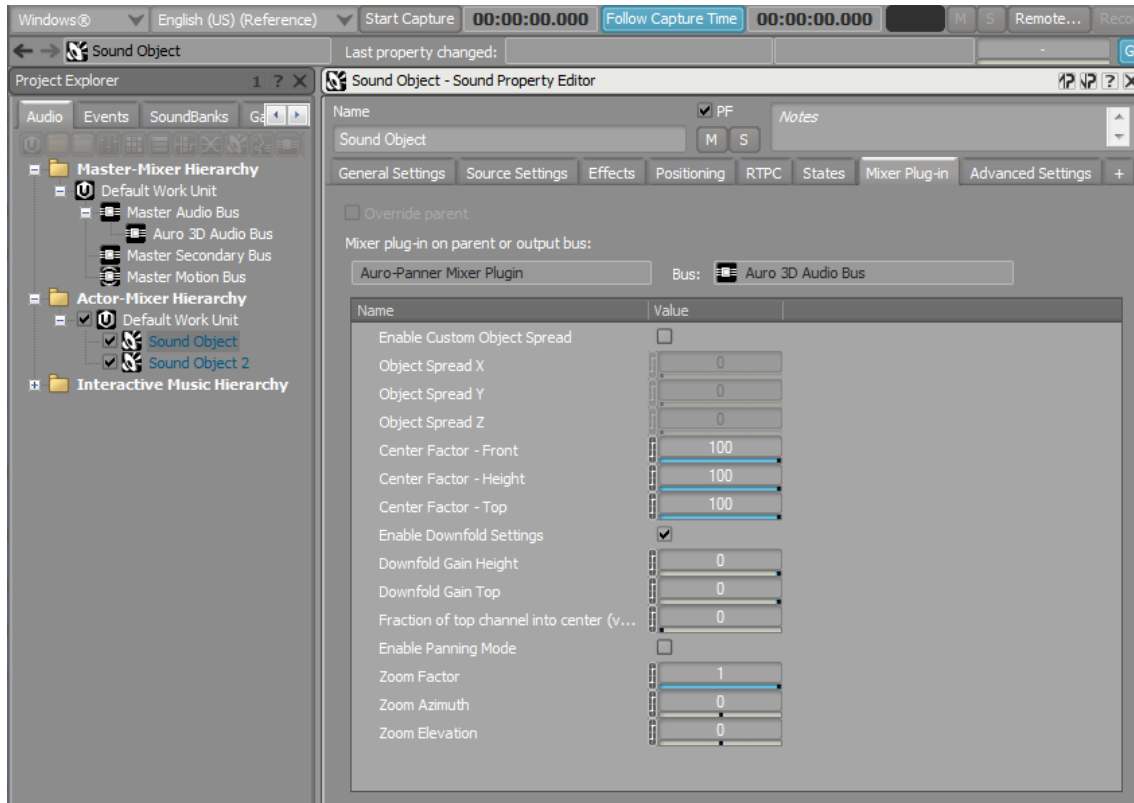


Figure 3.2: Sound Object - Sound Property Editor's Mixer Plug-in tab

Enable Custom Object Spread Enable this setting to select custom spread parameters using the three sliders (Object Spread X, Y, Z) below. Off by default, uses the object spread value as defined in the Attenuation settings when 3D panning is performed, and disables spreading for 2D panning. (see Wwise documentation on how to set attenuation settings).

Object Spread X Defines the amount of spread over the X axis.

Object Spread X = 0 - no spread.

Object Spread X = 100 - maximum spread.

Object Spread Y Defines the amount of spread over the Y axis.

Object Spread Y = 0 - no spread.

Object Spread Y = 100 - maximum spread.

Object Spread Z Defines the amount of spread over the Z axis. This is only enabled for 3D panning; for 2D panning, no spread over the Z axis is applied.

Object Spread Z = 0 - no spread.

Object Spread Z = 100 - maximum spread.

Center Factor - Front Defines whether a centered Sound Object will use the center channel or adjacent Left and Right channels to create the desired image location. The values range from 0–100%

Center Factor - Front = 0% - the entire signal is sent to the L and R channels, none to the C channel.

Center Factor - Front = 100% - the entire signal is sent to the C channel, none to the L or R channels.

Center Factor - Height Defines whether a centered Sound Object, with a positive Z value will use the Height Center channel or adjacent Height Left and Height Right channels to create the desired image location.

Center Factor - Height = 0% - the entire signal is sent to the HL and HR channels, none to the HC channel.

Center Factor - Height = 100% - the entire signal is sent to the HC channel, none to the HL and HR channel.

Center Factor - Top Defines whether a centered Sound Object, with a centered position so that the Top channel is used (i.e. elevation >45 degrees for configurations with a top channel), will use the Top channel or adjacent Height Back Left and Height Back Right channels to create the desired image location.

Center Factor - Top = 0% - the entire signal is sent to the HBL and HBR channels, none to the T channel.

Center Factor - Top = 100% - the entire signal is sent to the T channel, none to the HBL and HBR channels.

Enable Downfold Settings Enable Downfold Gain for Height and Top Layer as set by both sliders below

Downfold Gain Height This setting controls the level of the height layer reproduced by the lower layer when a planar mix is selected in the host bus configuration (e.g. 5.1, 7.1). Adjust the Downfold Gain Height slider to send the desired signal amount from this Attachment plug-in to the planar mix output by the Mixer plug-in.

Downfold Gain Top This setting controls the level of the top layer reproduced by the lower layer when a planar mix is selected in the host bus configuration. Adjust the Downfold Gain Top slider to send the desired signal amount from this attachment plug-in to the planar mix output by the Mixer plug-in.

Fraction of top channel into center (vs. corners) This setting controls the level of the top layer reproduced by the Center channel vs the corner channels by the lower layer when a planar mix is selected in the host bus configuration.

Fraction of top channel into center (vs. corners) = 0 - the entire top layer signal will be downmixed to the corners, none to the C channel.

Fraction of top channel into center (vs. corners) = 1 - the entire top layer signal will be downmixed to the C channel, none to the corners

Enable Panning Mode Enabling this setting will cause the input position to act as an translation offset, rather than angular displacement. This allows elevation of multi-channel audio in the bottom layer to the height layer for example. An alternative use-case might be to move a stereo source up and to the rear. See section [5 Panning Mode](#) for a more detailed explanation.

Zoom Factor The zoom factor can assume values between zero and one. If the zoom factor is one, the source position(s) remain(s) unchanged. A value of zero positions the source(s) in the center speaker, whilst values in between 0 and 1 will result in an interpolated position. See section [6 Zooming](#) for a more detailed explanation.

Zoom Azimuth Angle offset from the front center, applied to zoomed sources.

A positive value represents angular displacement to the right.

A negative value represents angular displacement to the left.

Zoom Elevation Angle offset from the front center, applied to zoomed sources.

A positive value represents angular displacement to the top.

A negative value represents angular displacement to the bottom.

4 Notes on object positioning

The 3D panning capabilities of the Auro-Panner-Mixer plugin-in are only active for 3D panner types. To activate, go to the Sound Property Editor's Positioning tab associated with the Sound Object and set Combo Box to '3D', as shown in Figure [4.1](#). Furthermore the Position Source can be set to User-defined or Game-defined.

User-defined positions can be a great way to test 3D panning in the Wwise Authoring application. And to position multi-channel sounds relative to the listener, such as environment sounds or music (see also section [5 Panning Mode](#)). Click on Edit... to open the Position Editor, as shown in Figure [4.2](#).

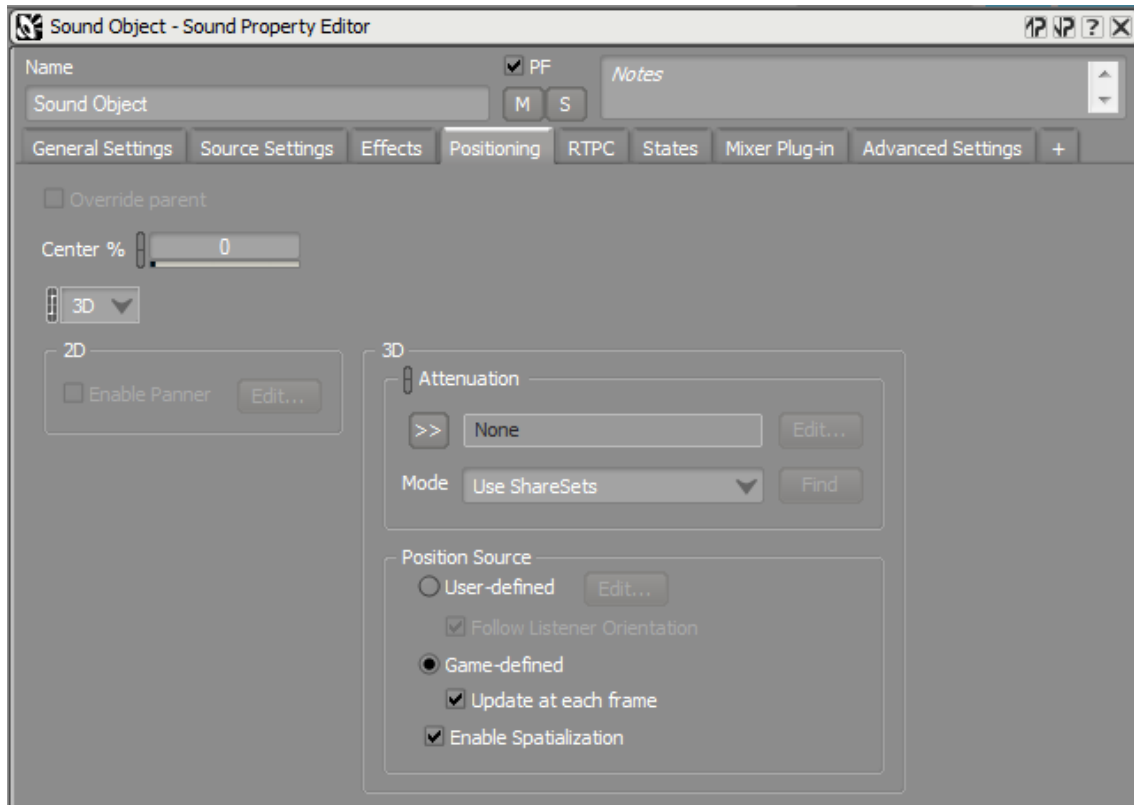


Figure 4.1: Sound Object - Sound Property Editor's Mixer Plug-in tab

Single positions or paths consisting of key frames can be created. X, Y and Z values between -100 and 100 are possible. Note that the Z values below 0 are mapped to 0, as there are no speakers below ear level. Hence coordinates where the Z value is 0 refer to positions on the listeners ear level and 100 refers to the height channel height. Sounds panned to Z=100 will only engage the height speakers and/or top speaker.

5 Panning Mode

The Panning Mode option can be found in the Attachment Plug-in settings, see section [3 The Attachment Plug-in](#).

By default, when Panning Mode is disabled, a source is rotated around the listener by an angle associated with the position of that source relative to the listener position and orientation. This mode (i.e. the absence of Panning Mode) is most useful for associating mono sounds with the position of a sound emitting object in game. However it can also be used with multi-channel input. For example, when a stereo source is displaced in such a way that its position represents an azimuth angle of 90 degrees (clockwise) for the listener, the left and right channel source will be rotated around the listener by 90 degrees. The new

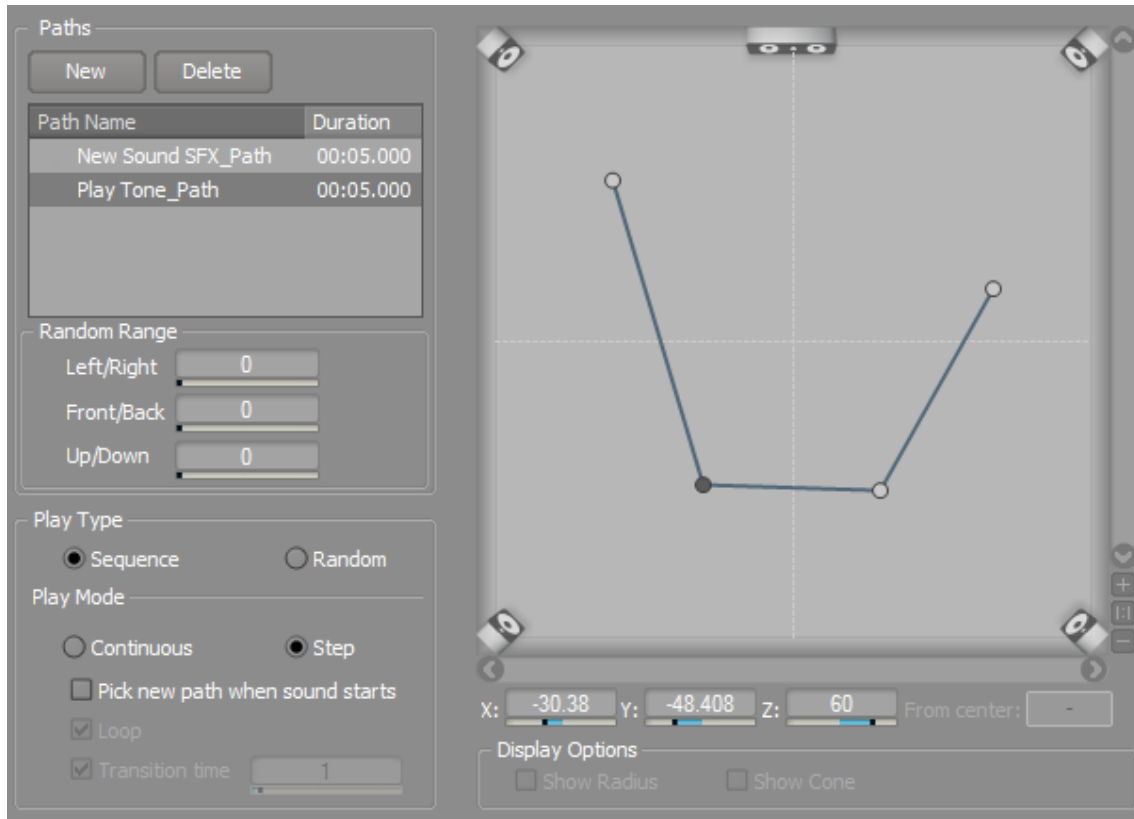


Figure 4.2: Sound Object - Position Editor (3D User-defined)

locations for the left and right channels of the stereo source will then become, respectively, the front right channel and the back right channel.

If the Panning Mode option in the attachment properties is enabled, the sources will be translated in a linear fashion. In Panning Mode, the source position represents a linear offset for each source channel. This mode is not very useful with game-defined positions, but rather with user-defined positions, which are relative to the listener position and orientation. Also note that user-defined source positions are limited to a box from -100 to 100 on the X and Y axis and from 0 to 100 on the Z axis (negative Z values are discarded and mapped to 0). For that reason the X and Y coordinates are scaled by a factor 2 to be able to translate the source channels to all possible target channels. For example, a stereo source with user-defined position ($x = 0, y = -50, z = 0$) will translate the front left channel and front right channel halfway to the back, i.e. right next to the listener. In 7.1 based configurations, this new position would be associated with the surround left channel and surround right channel. Similarly, a stereo source with user-defined position ($x = 0, y = -100, z = 0$) will translate the front left channel and front right channel all the way to the back channels, respectively, to the back left channel and back right channel.

Note that a zoom factors smaller than 1 causes the the Panning Mode option to be ignored and sources will be rotated around the listener.

6 Zooming

The zooming feature intends to assist the user to move all source positions associated with a Sound Object from their original position to a user defined position. The term zooming refers to changing a game objects azimuth and elevation angles, which define its angular position. The default value for the zoom factor is 1, where it doesn't affect the angular position. A zoom factor of 0 will result in a source position in the front center speaker right in front of the listener. The Attachment plug-in's parameters Zoom Azimuth and Zoom Elevation represent an angular position offset from the front center. These parameters range from -180 degrees to 180 degrees. The zoom angles are relative to the first listener's orientation.

This way the Zoom Factor can be used to move all sources between their original position and the position given by the zoom angles.

A use case for this feature could be to simulate the transition between spaces of different ambient sound tracks. A multi-track recording containing 3D audio content can be morphed into a single point source.

6.1 Zooming example

An example can be given by the transition from an open space into a cave.

When the listener is located in the open space, objects around and above the listener emit sounds, characteristic to the open space. As the listener moves from the open space in to a cave, all the sources attributed to the open space move to a single position right outside the cave opening. Hence, the Zoom factor could be linked to the distance between listener and cave opening. The zoom angles allow alignment of cave opening and the resulting point source of open space objects.

Once the listener is located in the tunnel all objects in the open space will emit sounds from a single location just outside of the tunnel opening. Simultaneously, audio tracks of cave specific audio (water drops, etc) may take over.

Figure 6.1 illustrates how source angles may change upon entry of the listener in to a cave for instance. The zoom factor would be dependent on the distance of the listener from the cave entry.

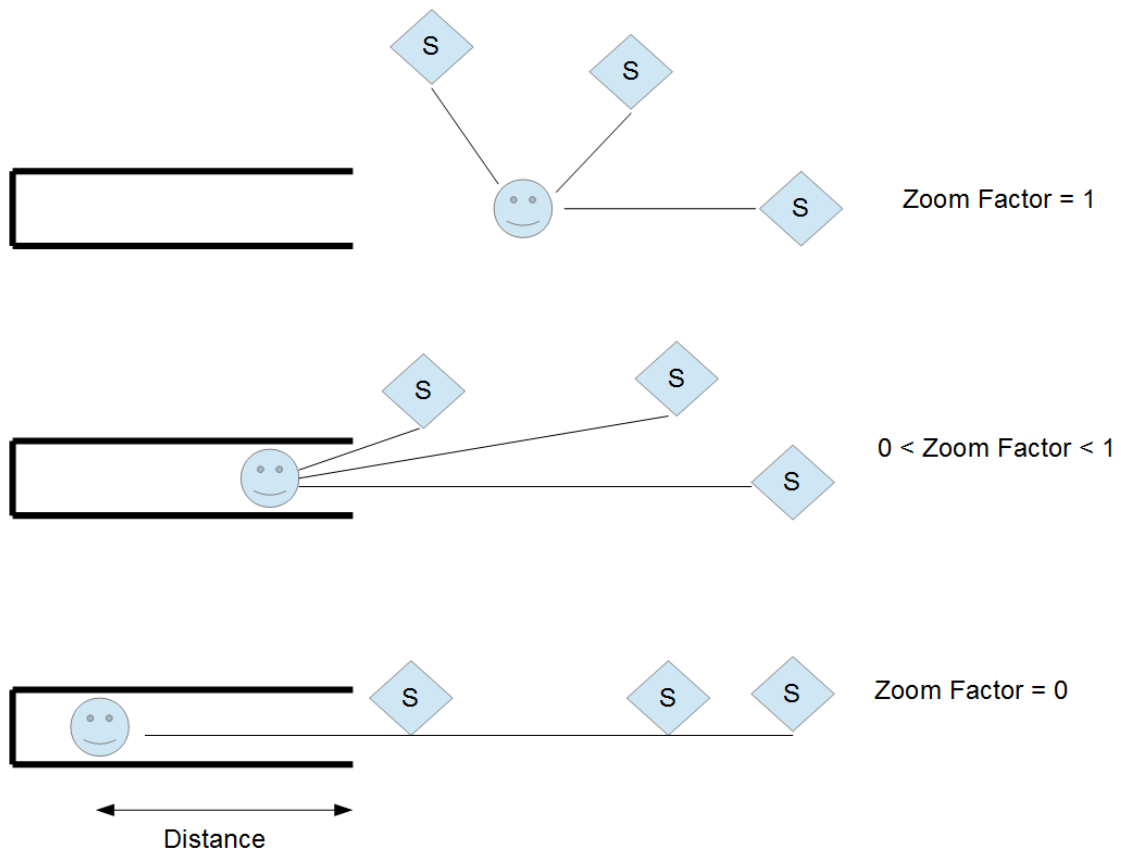


Figure 6.1: Zooming example: going from an open space into a cave

A zoom factors smaller than 1 cause the the Panning Mode option, see section 5 [Panning Mode](#), to be ignored and sources will be rotated around the listener.

Adjusted Zoom Azimuth and Zoom Elevation to the cave entry orientation. The zoom angles are relative to the first listener's orientation. The following illustration shows how Zoom Angles serve the alignment of the cave entry.