Sound in Simmetry 3d

This tutorial demonstrates how to create sounds in Simmetry, and described the various parameters used to control them.

Concepts

In this tutorial you will learn about:

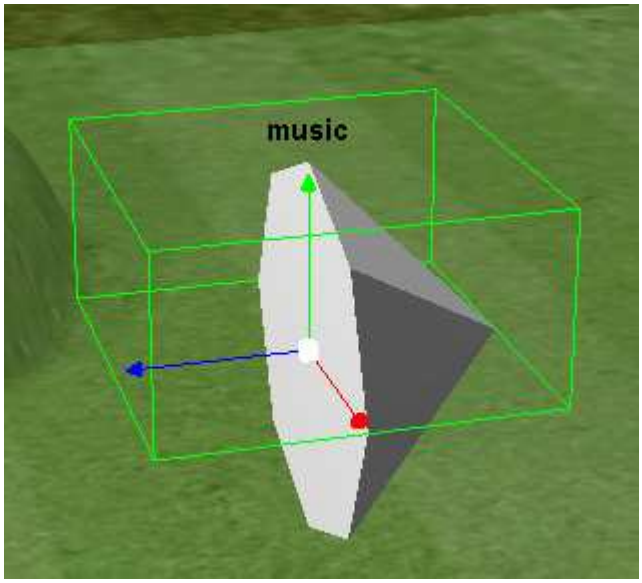
- Creating a sound object
- Inserting a sound object into a design

Prerequisites

- Objects Tutorial
- Animations Tutorial
- Composites Tutorial
- Simulator Tutorial

What are Sound Objects?

Sound objects allow you to place a sound at a particular position in your design so that it is heard when you either play an animation or enter the simulation mode. A sound object could be a music sound track for your animation, a narrative describing a particular walk-though, or could be a realistic sound an object in your design makes for instance a door opening or closing. Because you can add as many sounds as you like to your design there is no reason why you cannot have combinations of the above types.
As already stated the sound has a position in the design; it can also have a configurable direction so that it is audible only from that direction. The listener position is taken to be the position of the camera and therefore moves as the viewer moves through the design. This means that certain sounds can become quieter/noisier as you navigate through the design which can add an extra level of realism to the design.
Sounds have been implemented in Simmetry in a very similar way to mesh objects (and light objects) and indeed you can elect to show a mesh marker at the sound's position when you are designing with them; this helps to show the position and the direction of the sound:



In the same way you can “insert” mesh objects into the design you can “insert” sound objects; this means that you can re-use a particular sound many times at different positions in the design. It also means that you can use the same “tools” to position and rotate them as you do for mesh objects (scaling a sound has no effect). The inserts of sounds also fit into the hierarchy of other inserts so that a sound can be easily “attached” to an object so that when that object is moved so too is the sound. A good example of this could be the engine noise of a car object.
Finally when sounds are moved (or when the listener is moving) the effect of the relative movement is computed which will give rise to the “Doppler Effect” where the pitch of the sound is slightly altered.

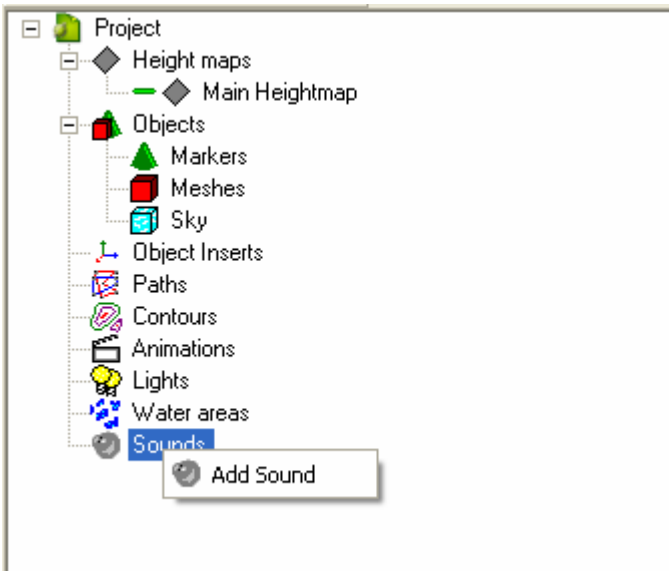
Attenuation

When you move nearer or further away from a sound then it will typically get louder or quieter – the way in which this happens is know as its attenuation. You can set parameters to control how quickly the sound volume falls with respect to the distance from the listener.

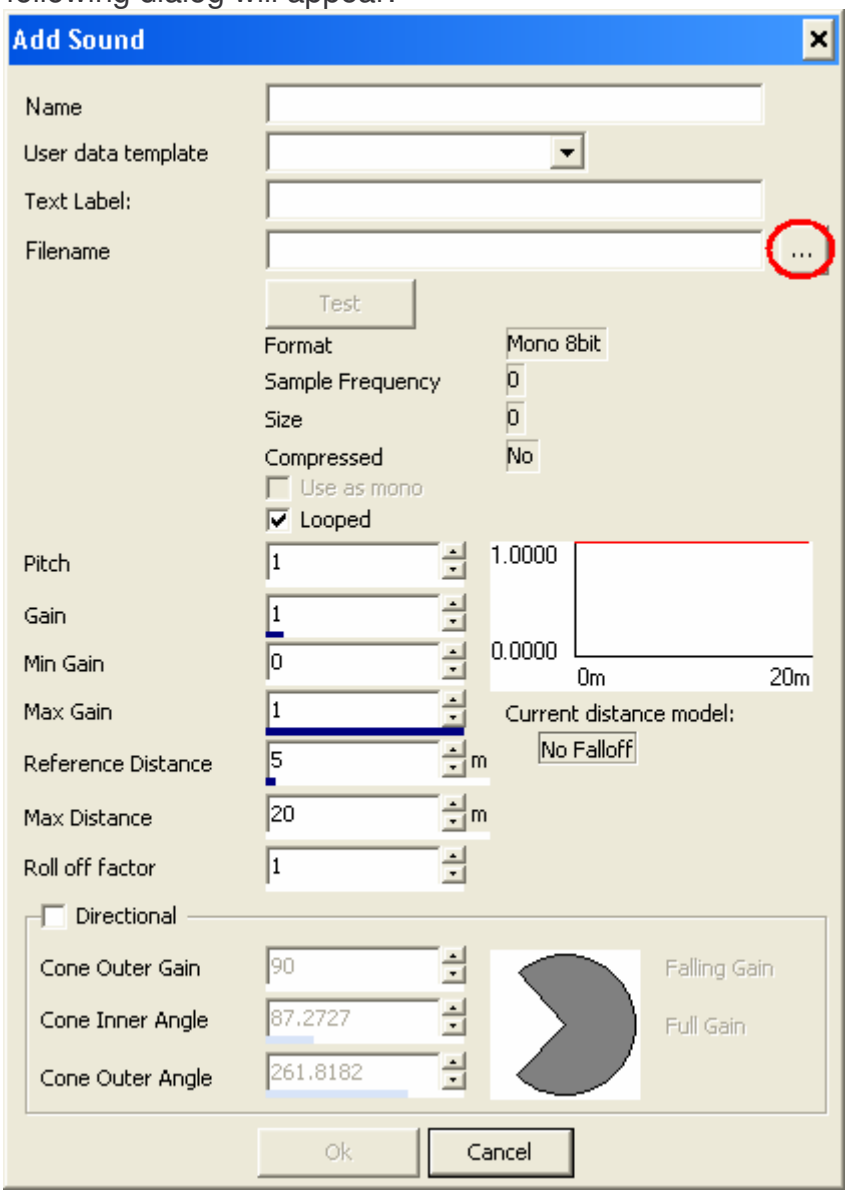
EXERCISE 1

Creating a sound object.

- First we will create a sound which is non-positional and non-directional
- Right click on the “Sounds” node in the project tree, and choose “Add Sound”:

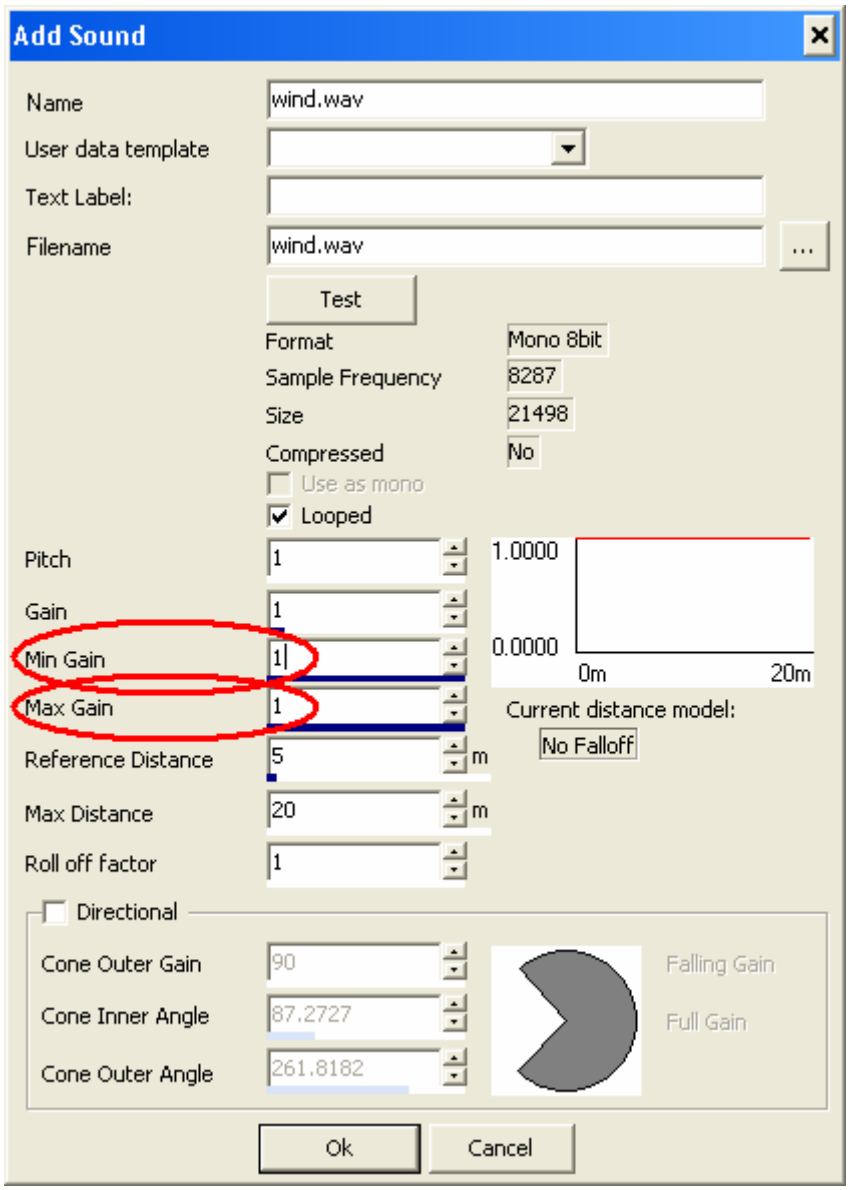


- The following dialog will appear:



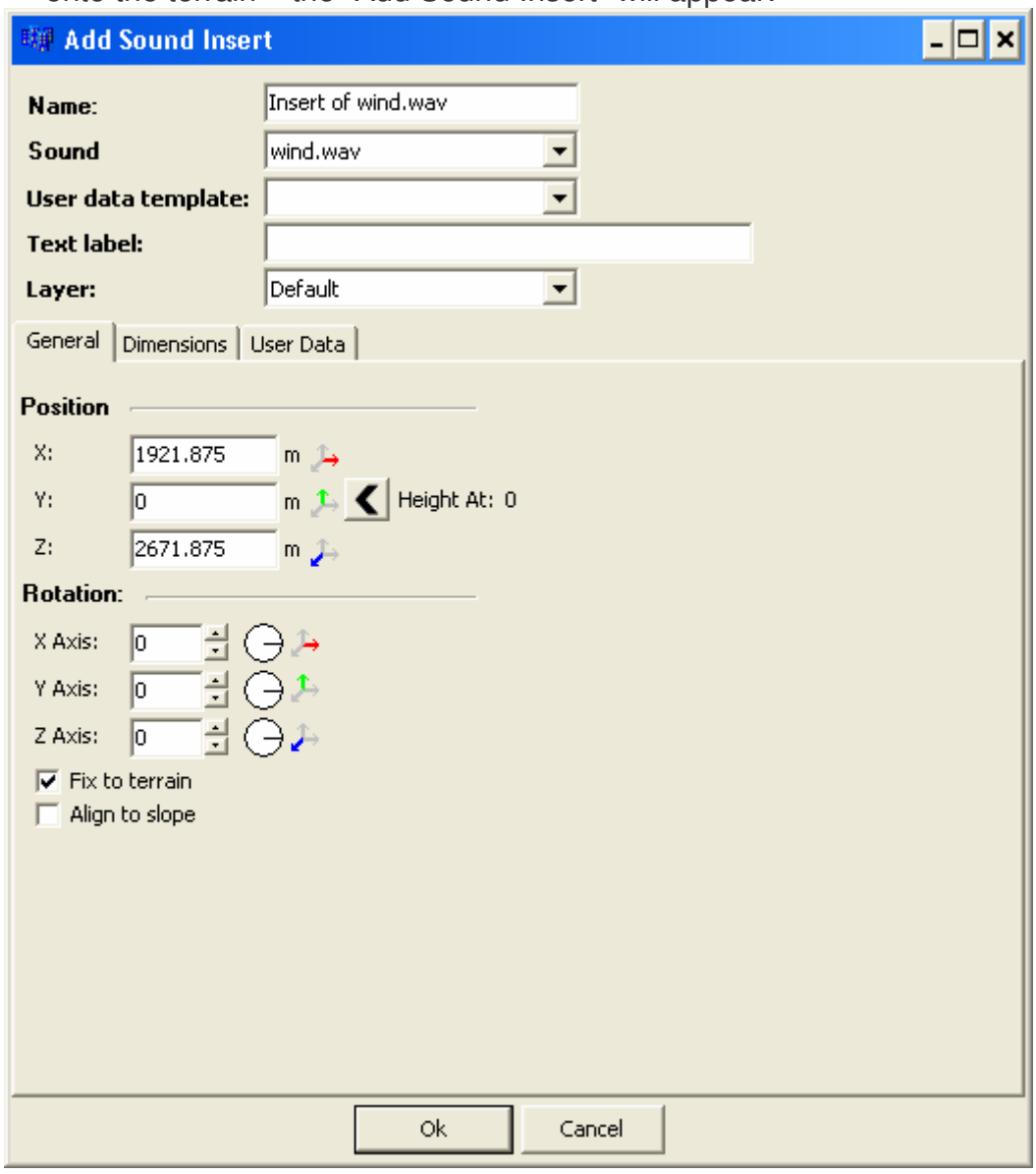
- Press the "…" button and choose the file "sounds\wind1.wav" in the file selection dialog.

- The name of the sound will change to “wind.wav” and the “Test” will become enabled. Press this “Test” button and you should hear the wind noise – (pressing the “Escape” key will stop the sound part way through).
- The parameters on the form affect how you hear the sound and are described in detail in the help, and the exercises in this tutorial will help explain them. The settings as they are shown in the following dialog box above will generate a sound which does not vary directionally or positionally.

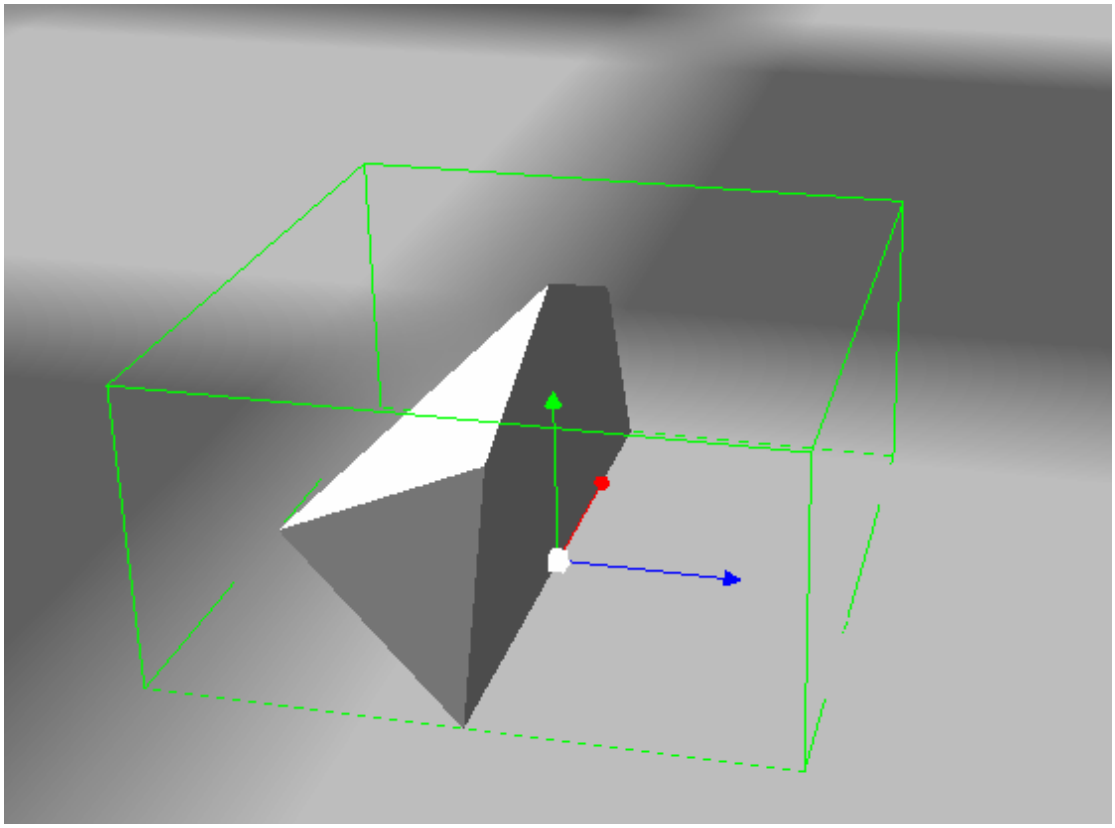


- The max and min gain control the range of the sound’s gain (volume). Thus setting both to 1 will make sure that it remains at constant volume.
- Ok this dialog and you will see this sound in the project tree:

- This sound can now be inserted onto the terrain in the same way you would a mesh object – click on its node in the project tree and drag it onto the terrain – the “Add Sound Insert” will appear:



- Press the Ok button and you will have inserted sound on the terrain:



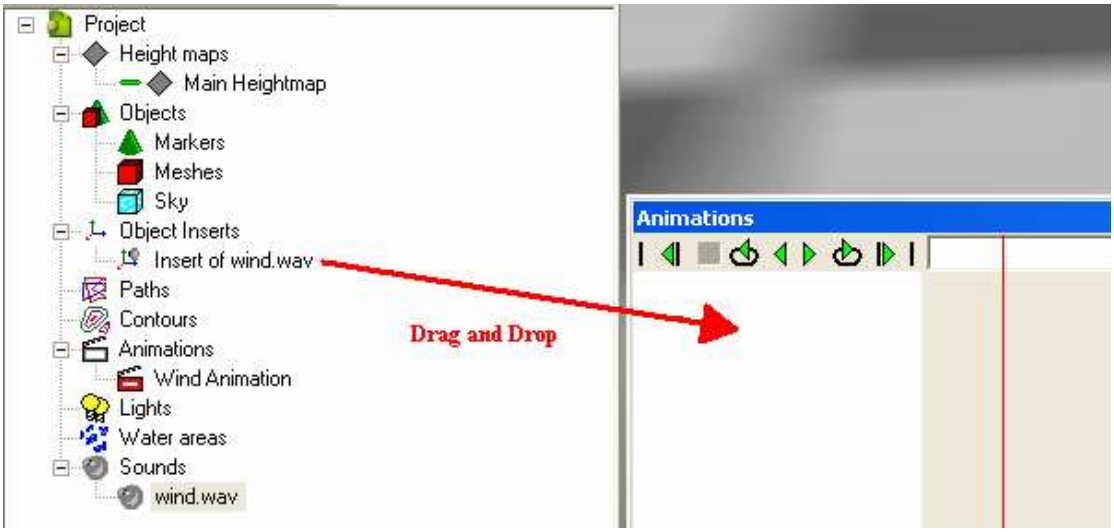
- Experiment with the “Select Object”, “Move” and “Rotate” tools – these let you move the sound and rotate the sound.

EXERCISE 2

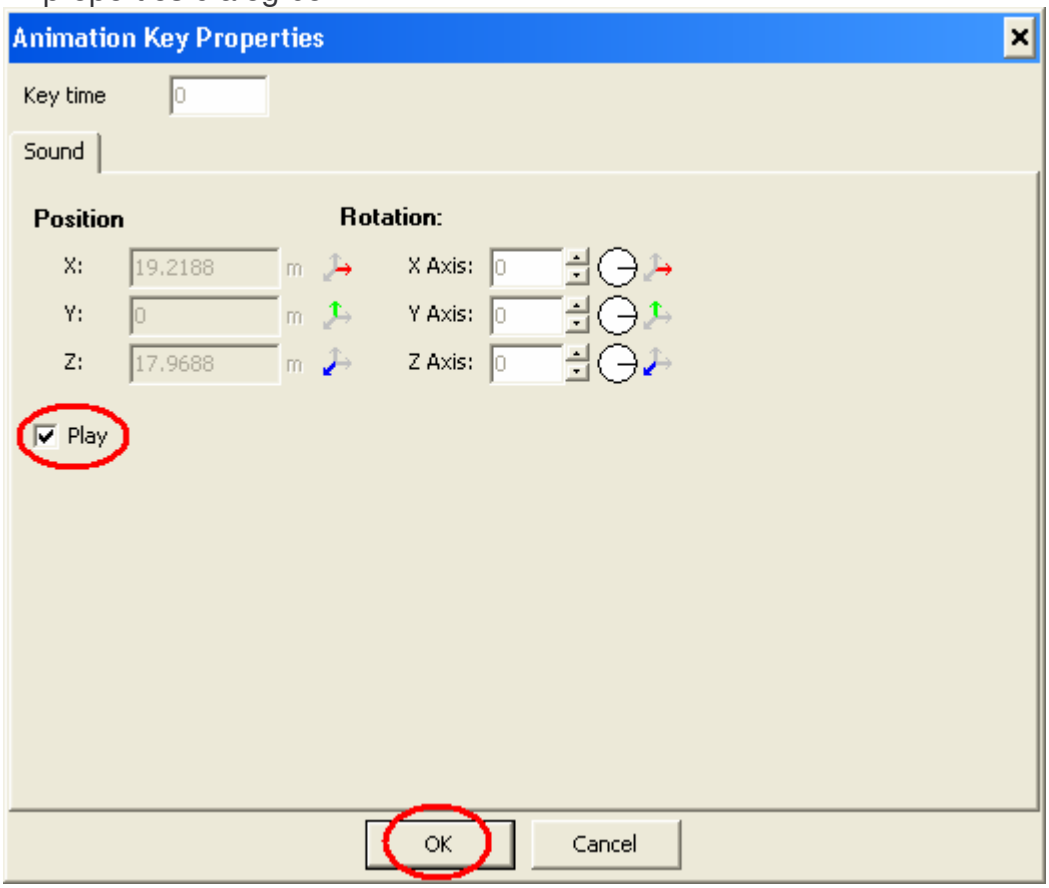
Sounds in animations

In order to hear the sounds in your designs they need to be added to animations. This is done in the same way as you would for object inserts.

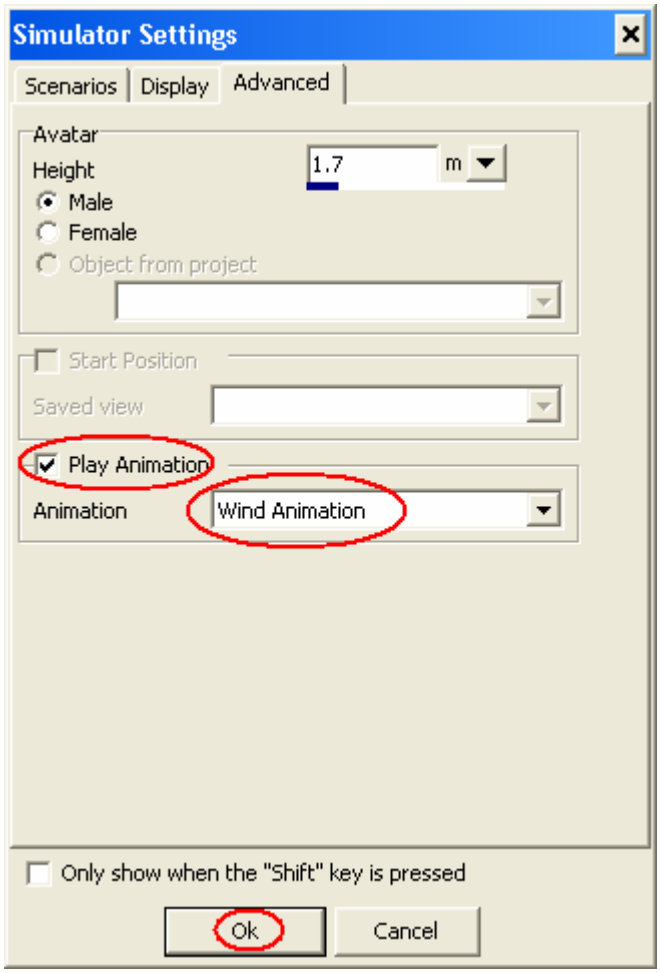
- Continue with the previous project – add a new animation by right clicking on the “Animations” node in the project tree and choose “Add Animation…”.
- Find the insert of the sound in the project tree and drag it onto the animation channels panel:



- This creates a channel for the sound, add a key for time zero (right click on the sound channel and choose “Record Key”). Then right click on the key marker and choose “Properties”. Incidentally holding the shift key down when recording the key will automatically pop up the properties dialog box.



- Check the “Play” checkbox - this will make the sound start playing at this key in the animation.
- You can “Play” the animation now and you will hear the wind sound.
- If you want to hear the wind in the simulator you must choose that animation to play when you start the simulator:

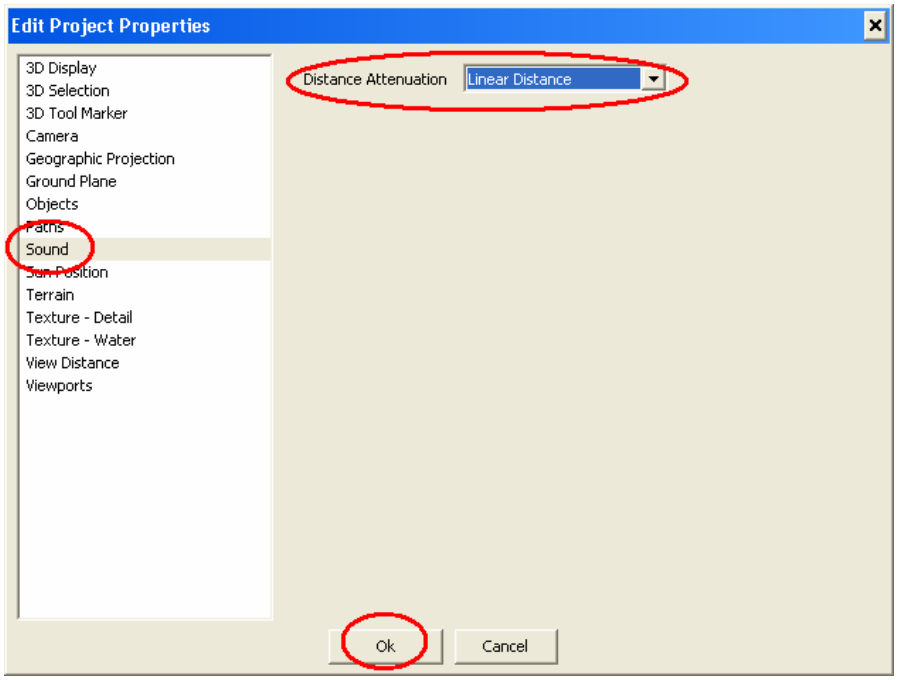


EXERCISE 3

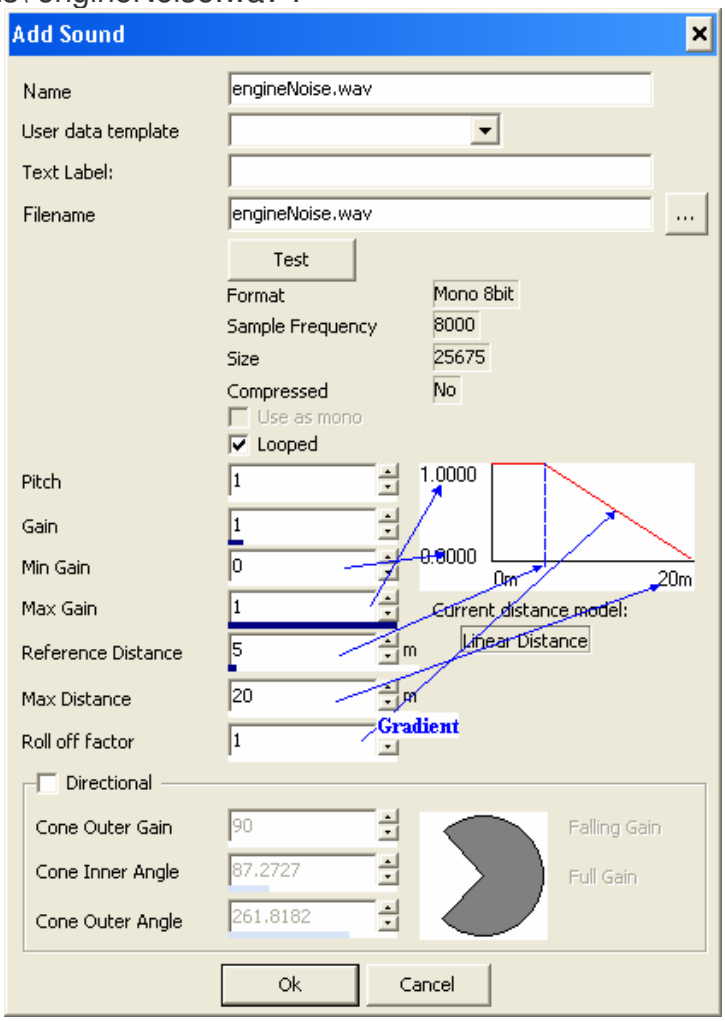
Attenuated Sound

So far the sound as been “ambient” – the same where ever you are viewing the design from. Some sounds should be louder when you get nearer to their source. We shall continue with the same project, but add a new sound which we will make exhibit this property of distance attenuation.

- First we must set the attenuation model in the project – “File|Project Properties…”
- Find the “Sound” page and select “Linear Distance” from the drop down list:



- This makes the sound decay linearly with respect to the distance of the listener from the sound emitter.
- Next do the same as you did in Exercise 1 to add a new sound – “sounds\ engineNoise.wav”:



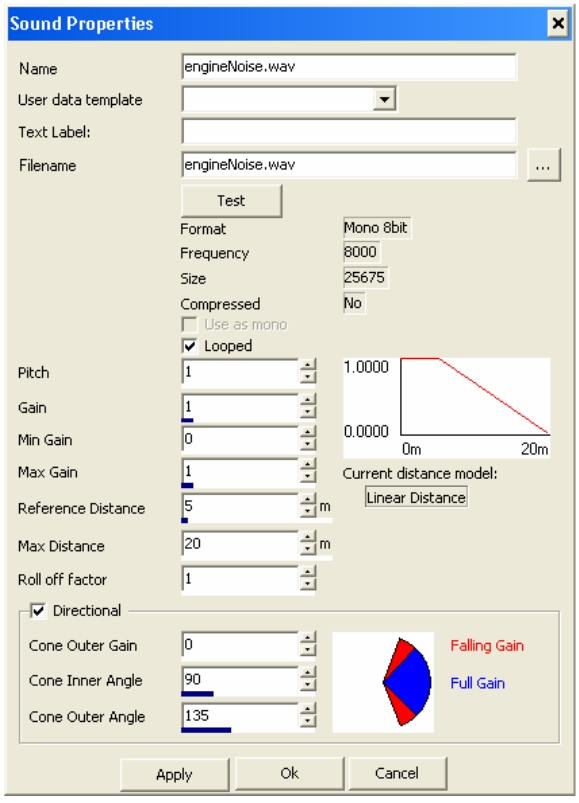
- The graph on the right hand side of the dialog shows the effects of the parameters and makes it both intuitive and easy to set up. The settings shown will have the sound at it's loudest when the listener is between 0 and 5 metres from the sound object; from 5m to 20m the sound will quieten until it is no longer audible.
- Insert the sound into the design (drag and drop onto the terrain)
- Add a channel to the existing animation; record a key and adjust its properties to play the sound (like in exercise 2)
- Now play the animation and experiment with the camera position. You will find the nearer you get to the sound the louder it becomes.
- The other thing to notice is the stereo separation being computed for each sound. As you move the camera to look to either side of the sound object the sound volume will move between the left and right speaker.

EXERCISE 4

Directional Sound

You will have noticed that there is a section in the "Add Sound" dialog to enable the directional nature of the sound

- Right click on the sound node "engineNoise.wav" and choose "Properties":

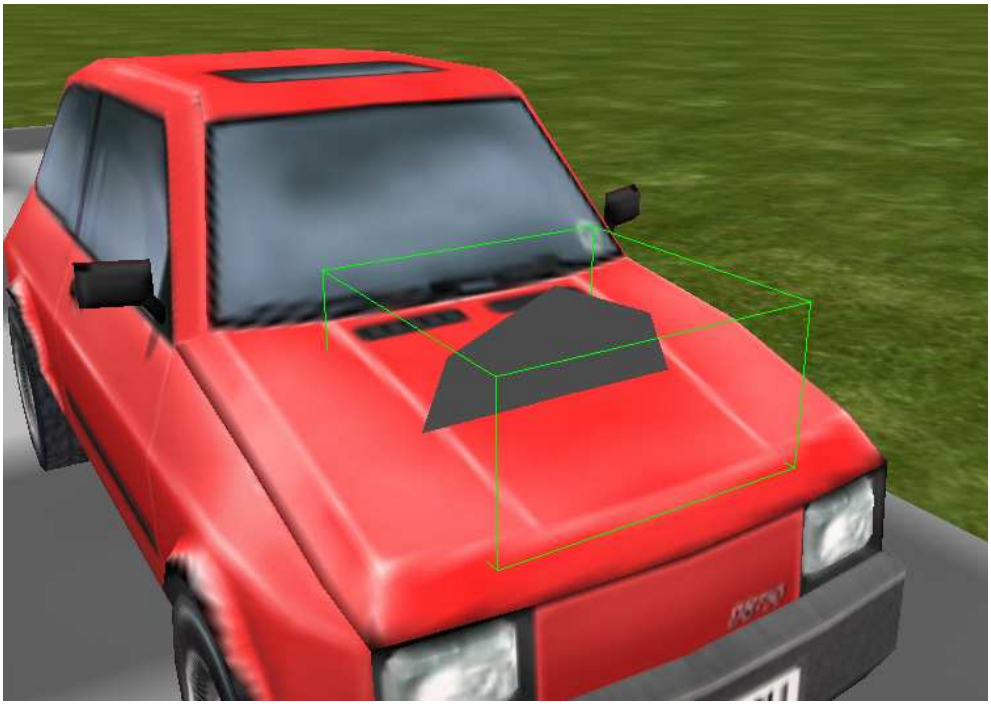


- Check the box marked “Directional”, and adjust the fields to the values shown above. You are setting the “cone” through which the sound will be audible. The diagram on the right shows a section through the cone and helps you envisage the effects of the cone angle parameters. You are in fact defining two cones – the smaller one – the “inner” cone is the one where the sound will be loudest; the other – the “outer” cone is the area where the sound decreases in volume. Outside of both cones the volume is controlled by the field “Cone Outer Gain” - in this case it is set to zero and so the sound will be silent.
- Press the “Ok” button and then play the animation again whilst using the camera tools to move around the sound object – you will find that the sound is silent when listened to from behind the object but audible from in front of it.
- If you wanted the sound to be audible above but not below then you would rotate the sound object through 90 degrees so that it is pointing upwards.

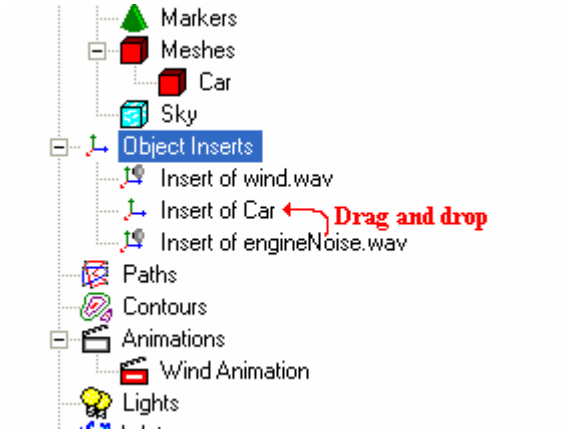
EXERCISE 4

Attaching a sound to an object

- Load project “sound\ex4.s3d”. This is similar to the project you have been working on already but has a car object in it which has been animated to travel round in a circle.
- Insert the “enginenoise.wav” sound (drag and drop from the project tree) and move it so that it is “inside” the car – perhaps just under the bonnet of the car:



- Now make the sound insert a “child” of the car insert by dragging the sound insert node in the project tree onto the insert of the car object:



- Add the sound insert to the animation (drag and drop into the animation channels panel like in exercise 2). Then record a key for it and check the “Play” check box so that the sound starts playing.
- Now Play the animation to see how the sound is moved around with the car, and how the volume of the noise changes as the car moves.
- Finally you may wish to make the sound markers invisible – go to the Sounds menu and choose “Show Sounds”.

Additional Notes

Stereo/Mono sound data

For the hardware sound system to compute the positional and directional nature of sounds it requires them to be in “mono” format (as opposed to “stereo”). This property of the sound is dependant on the file from which the sound is loaded. A stereo sound will be played in stereo as defined from its stereo tracks. If you load a sound file and find that it is in stereo format but you want it to be positional or directional there is an option – “Use as mono” which you can set. This will get the sound hardware to use it as a mono sound and all the positional functionality will work.

Sound Data Files

Two sound file formats are currently supported: .WAV and *.OGG.

*.WAV – these are native windows sound files and are “uncompressed”, which means that the sound sample data is stored directly in the file, which in turn means that they can be quite large and will in turn make the Simmetry project file quite large.

*.OGG – these are Ogg Vorbis sound files and are in a “compressed” format. This means that the sound sample data has been compressed so as to take less room in the file; a considerable size saving is made and using this type of file will reduce the size of the Simmetry project files. A good program for creating these compressed files is available at “http://audacity.sourceforge.net/”

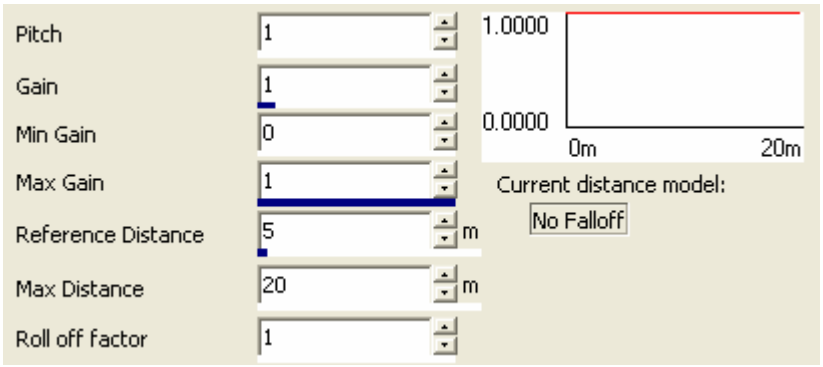
Looped Sounds

Sounds can optionally be “looped”. What this means is that when the sound is played it will continue to the end of the sound and then immediately repeat from the start again. Non-looped sounds will play until the end and then stop.

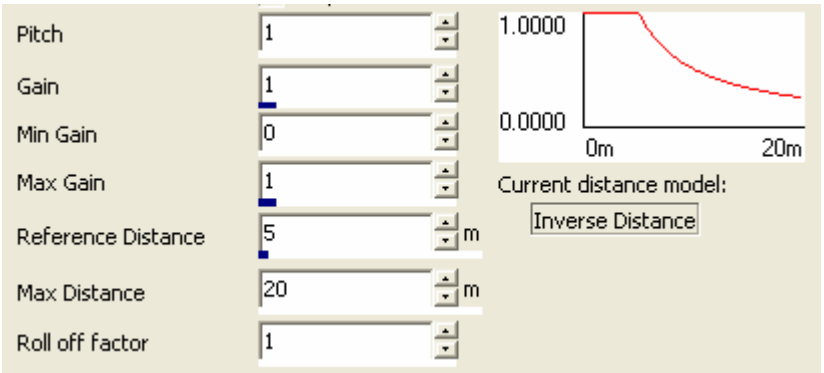
Distance Attenuation Models

The attenuation model must be set per project; this is done through the “Project Properties” dialog, on the “Sounds” page. There are 7 different options; the first is none. There are 3 other basic types which each of these being either clamped or not clamped. Clamped means that the distance between the listener is forced to lie between the “Reference Distance” and the “Maximum Distance” prior to working out the gain.

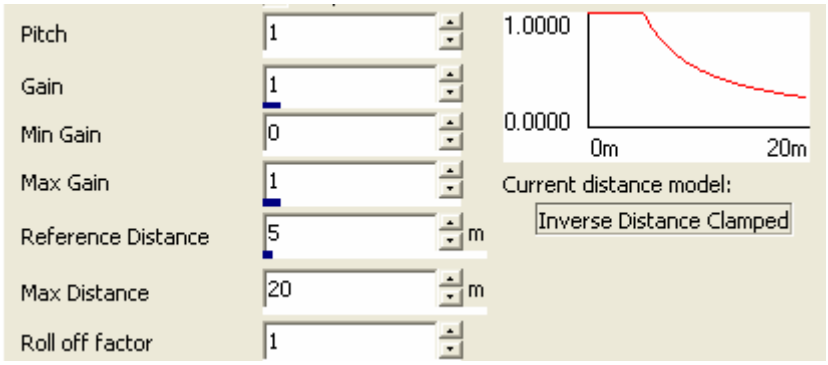
1) None
All sounds will be NOT be attenuated



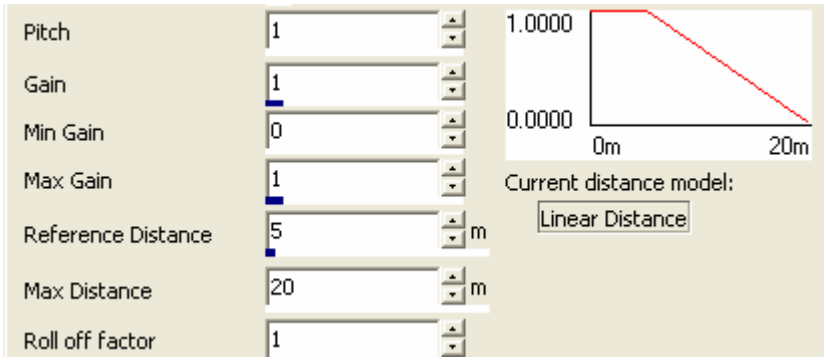
2)Inverse Distance
Non-linear falloff.



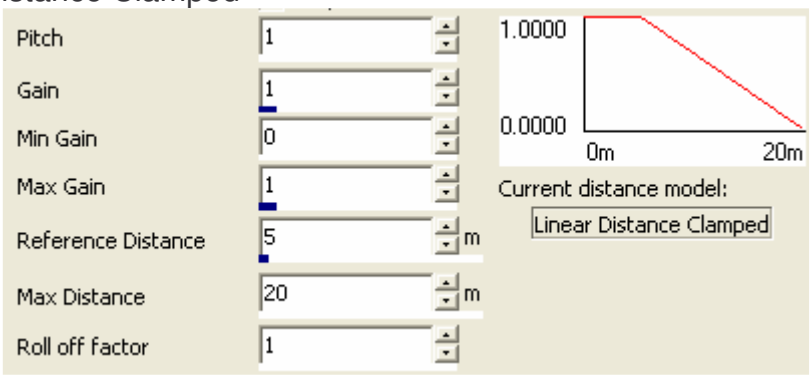
3)Inverse Distance Clamped



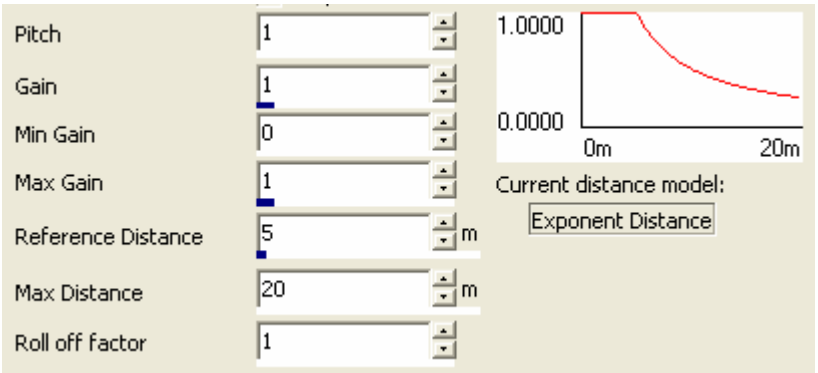
4)Linear Distance
Linear falloff



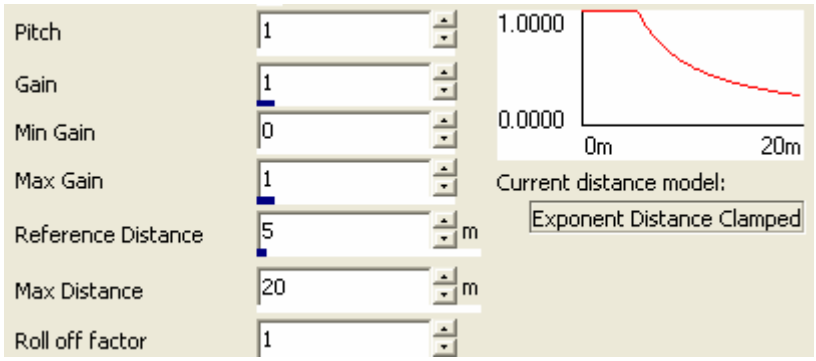
5)Linear Distance Clamped



6)Exponent Distance
Exponential falloff



7)Exponent Distance Clamped


Pitch
1
Gain
1
Min Gain
0
Max Gain
1
Reference Distance
5
m
Max Distance
20
m
Roll off factor
1
1.0000
0.0000
0m
20m
Current distance model:
Exponent Distance Clamped