



# Tutorial 10

## XACT for sound design

### Using the XBox Audio Creation Tool to make SFX .

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#### Overview

The Microsoft XBox Audio Creation Tool XACT began as a development tool to create audio environments for the XBOX game console. Its current version is included as part of Microsoft's XNA development tools and functions for both Xbox 360 and PC. It is designed to allow users to create complex audio environments for game projects and is freely available for download through the XNA development website

<http://msdn.microsoft.com/en-us/xna/default.aspx>

XACT is by no means the only application that offers this functionality but it is the application I have chosen to demonstrate for this tutorial.

While the tool itself is quite useful for developing audio specifically for game projects it can also be utilized for creating sound effects in general. The approach to sound effect construction using XNA is quite different to what most sound designers are used to and will not be suitable for all types of sound design. It does however function very effectively for creating large numbers of sounds of a particular type that are all unique. Essentially if you need to have lots of explosions, crashes or generally chaotic sounds, XACT will allow you to produce an infinite number of completely unique sounds in a short period of time once the initial data has been set up. The initial setup period will of course depend on the parameters you need and your familiarity with the process. This tutorial aims to clarify and illustrate the process to allow users to more easily utilize this useful functionality.

#### Understanding XACT

XACT is not designed to be an audio editing tool, it is an application that allows a sound designer to define sounds and sound data so that they can be used to generate sound events in a game environment in real time. This can result in incredibly diverse and flexible sound environments for use in a game project. XACT can also be used to simulate a multi-track sound editor, but the interface is quite different to standard editors and as such might be less appealing to sound designers. Sounds are not laid out visually as they would be in a sound editor, they are instead defined by a series of data values. The main strength of XACT is that where in a standard editor you would layout a single wave file and place it in a desired position in a linear editing track, XACT allows for each instance of a sound to be created from a group of sound files whose relative position in time when defined by data can have randomness applied to almost all aspects of their behaviour. It is this ability to randomise that makes XACT so useful for game audio implementation and can also be utilized for sound effect creation.

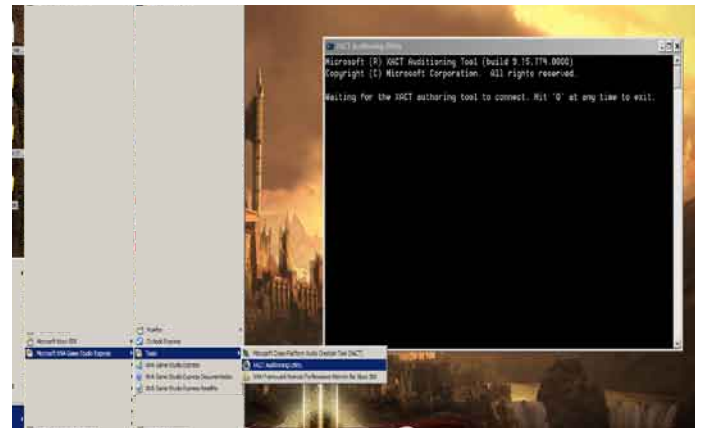


Figure 1. The XACT Auditioning Utility  
This utility must be running in order to hear any sounds produced in XACT

One aspect of XACT that is important to understand is its need to be connected to its auditioning tool. Under the start menu that includes the XACT tool is another application called The XACT Auditioning Utility. This sub program links XACT to the PC so you can hear the sounds it produces. This is because XACT is usually part of a game engine and the process of creating sounds happens in real time. This utility emulates this game engine function and creates the sounds each time you press play. It is like mixing down the various tracks in a multi-track editor every time you press play. This is because there are a lot of elements that go towards creating the sound you hear. As a general rule I start the auditioning utility before I open XACT to avoid forgetting it.

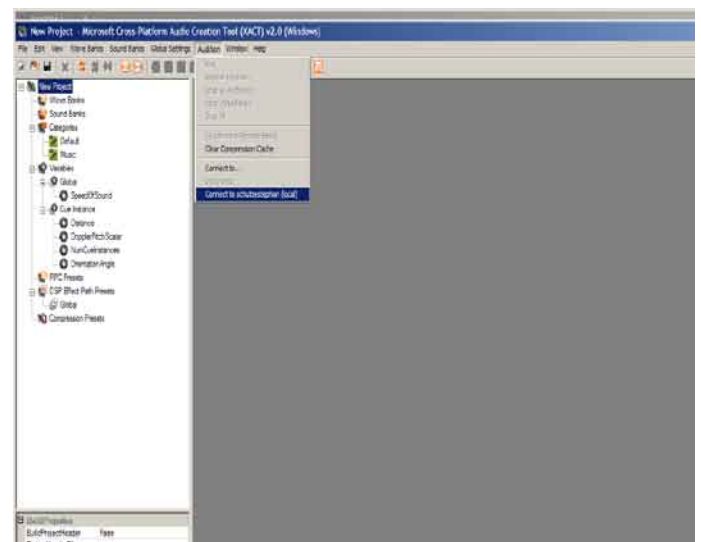
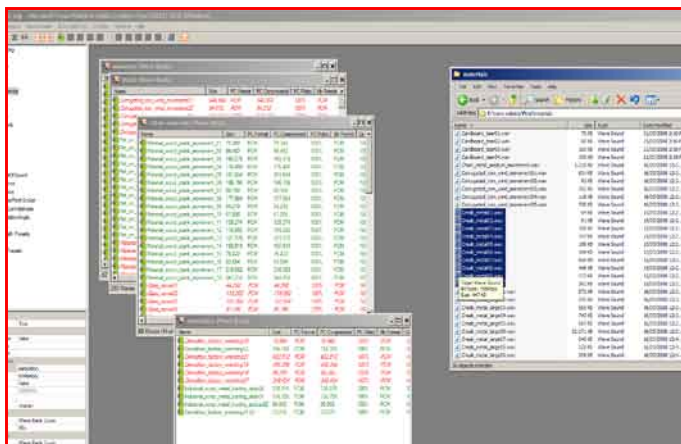


Figure 2. Connecting to the XACT Auditioning Utility  
This function will connect to the utility program running on your PC

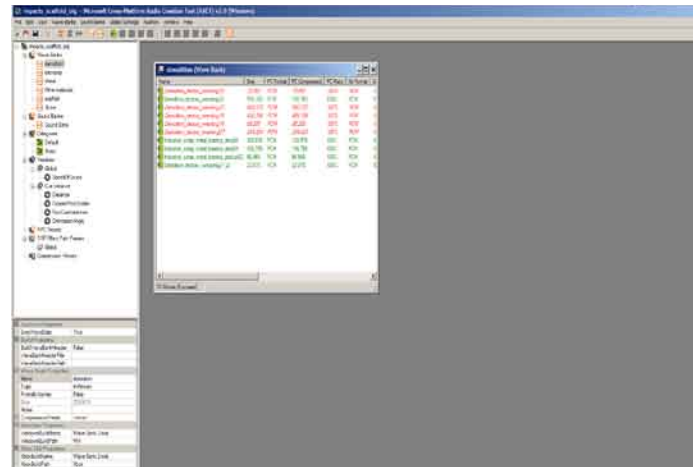
Open both XACT and the auditioning utility now. You will need to connect to the Auditioning Utility for it to function properly. Go to **Auditioning/Connect to...** the tab should indicate the name of your PC. Clicking on this will connect the utility program to XACT and allow you to hear its output sounds. XACT uses a series of sound files and combines them together to create the desired final sound. The raw sound files that XACT uses are stored in Wave Banks. The top left hand side of the interface shows the list of created wave banks. To create a new empty Wave Bank you can either right click on the wave bank list or go to **Wave Banks/Create New Wave Bank** an empty window should pop up in the work area, it will also be added to the wavebank list on the left hand side of the UI. This is your first wave bank; you can rename it by left clicking on the entry in the wave bank list. Wave banks can be named in any way.

To populate a wave bank it needs sound files from a folder somewhere on your computer. Either right click on the wavebank entry in the list or on the wavebank window itself and selecting **Insert Wave File(s)** this will open a standard Windows window and allow navigation to and selection of the wave files you would like to add to the wave bank. You can also drag the wave files directly from another window into the wave bank window.



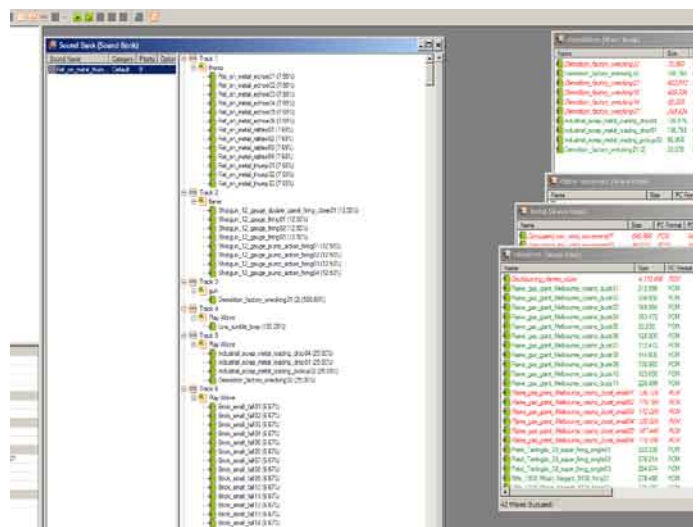
**Figure 3. Populating Wave Banks in XACT**  
The easiest way to add sounds to Wave Banks in XACT is to simply drag and drop them from another folder on your PC

Once sound files are in a wave banks they can be auditioned by selecting them and pressing the play button or the space bar. Note that when a sound is played the icon next to its name in the wave bank will change to indicate it is playing. This may not seem immediately useful, but when complex sound events with lots of sound files are played it can be a very useful tool. In the diagram below some of the sound files are listed in red and some in green. Sounds will be listed in red until they are used in a sound event. Once used they are listed in green. This allows for an instant indication of whether files have been used or not.



**Figure 4. Wave Bank functionality**  
Wave files that have not yet been used in a Sound Bank will be marked in red and will turn green once added to a Sound Bank. When a sound is played all wave files used in that sound will have the icon to the left of their name change to indicate they are currently playing.

The next step is to create a sound bank. This is essentially the same process as creating a wavebank but uses the sound bank tab or list entry. Again a new window will open. In the top left section of this window you can right click and create a new sound. At this stage the sound will not play as there is only an empty sound definition. You must add wave files from the wave banks for it to play. Either right click on the new sound and add a new track, or just directly drag a sound file from the wave bank into the sound window on the right hand side. This will create a new track with the sound automatically in it. Dragging multiple sounds from a wave bank into the sound bank simultaneously will automatically create tracks for each sound instantly creating a multi track sound event. The sounds will all default to playing together at zero of the time line.



**Figure 5. Sound Bank layout**  
Sound events in Sound Banks can be made out of many layers called tracks. Each track can consists of a selection of wave files from which one file is selected each time the sound is played. This functionality is one of the major characteristics of XACTS randomising of sound data

Clicking on a play wave event in the top right section of the sound bank window XACT will display the data in the event properties window. It is this data that defines how sound files are utilized when creating the real time sound effects. Understanding how this data is used by XACT is the main hurdle in understanding XACT.

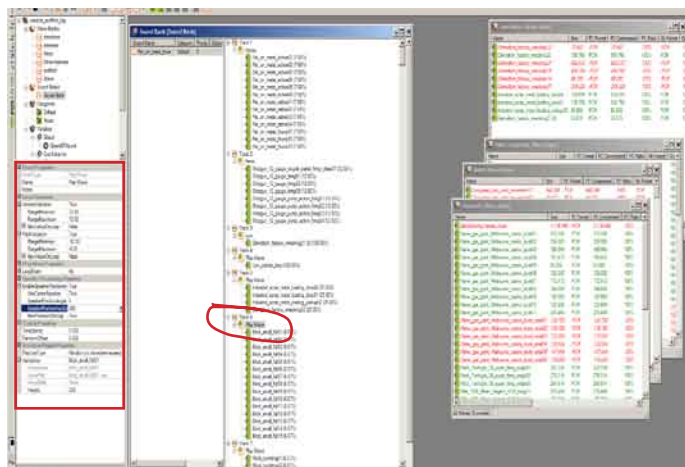


Figure 5. Event Data

The play event and its data are the main components for creating sounds in XACT. The data allows the user to alter a variety of a sound components aspects and control its pitch, volume, time and spatial position. Understanding these elements is the core of understanding XACT

These are the basic functions.

**Event Type: Play Wave** This is the type of event, in this case a simple function of playing the listed wave bank entry with the information provided.

### Volume Variation

When set to False there is no volume variation and the sound will play at a constant volume. When set to True this section expands to allow for extra information. The **RangeMinimum** and **RangeMaximum** values define by how much a sound will vary each time it is triggered. For example, setting the minimum range to -3db and the maximum range to plus 6 db would mean each time the sound is played it would choose a random value between -3db and 6db, so sometimes the sound would play softer than its original value and sometime it would play louder. It is possible to increase or decrease the overall volume of a sound as well as randomising its volume. A minimum value of -9db and a maximum value of -3 db means that the sound will still randomise but it will always be at least -3db at its loudest. This can be useful if one sound in a mix of sounds is too loud. **NewValueOnLoop** will set wether sounds set to be looping randomise each time they loop or only on the first time they are triggered.

### Pitch Variation

The same data values of **RangeMinimum** and **RangeMaximum** are used in this section and function in the same way as the volume variation except they refer to altering pitch. **NewValueOnLoop** also functions in the same way.

### Loop Event

Events can be flagged as looping under this section. An event may be classed as either **Finite** or **Infinite** when looping. If set to **Finite** an extra parameter is displayed allowing for the number of loop times before the event stops to be defined. When multiple wave files are included in a play sound event **NewVariationOnLoop** will force XACT to choose a new wave file each time the loop restarts.

### Speaker positioning

This function allows the user to randomize the location in which the sound is generated. This is designed to randomise a sound source in the 3D space of a computer game. For instance; the sounds of birds in a tree could be randomised so the position that each triggered event occurred in changed slightly within the area of the tree. This would create the illusion that the various bird sounds were coming from different places in the tree and not all from a single point at its centre. **UseCentreSpeaker** defines if the centre front speaker of a 5.1 or 7.1 sound system is utilized. This is because often this speaker is reserved for dialogue only to ensure clarity of dialogue. **SpeakerPositonAngle** defines the position in a radius where the sound will be generated and **SpeakerPositionArcSize** defines how much of a circle will be utilized to randomly position a sound. In a stereo mix this function will randomise where a sound is placed. Without utilizing this function XACT will create mono sounds

A value of 360 will result in the sound being triggered anywhere within the entire radius of the sound source. In this way this function allows for sounds to be completely randomised in space or randomized within a defined area. **NewPositonOnLoop** defines if the position will change each time a loop resets.

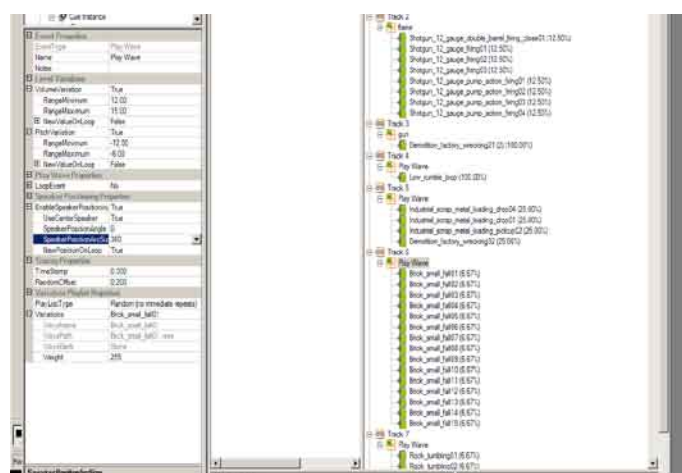


Figure 6. Event Data closeup

Each of the entries in the event data window have a selection of parameters that define how an individual play event functions. Combining multiple play events to create a final sounds can produce excellent results.



## Timing Properties

**TimeStamp** is simply when the wave file will start to play. It defaults to 0.000 which starts at zero seconds. It can be moved to any position that would normally exist on a multi track timeline by defining the desired offset value. I.e.

if you want the sound to play one second after the play button is pressed its timestamp should be set to 1.000.

The **RandomOffset** allows for the randomization of start time up to the value defined. So if 5 seconds is defined, XACT will delay the start of the event randomly by up to 5 seconds.

Combining both **TimeStamp** and **RandomOffset** allows for greater flexibility. Combining a TimeStamp of 1 second and a RandomOffset of 5 seconds will result in the sound being triggered between 1 and 6 seconds. (Waits at least 1 second and then counts randomly up to another 5 seconds).

## Variation Plalist Properties

**PlayListType** defines how multiple waves files under the one track function. **Random(no immediate repeats)** means that XACT will draw a sound randomly from the selection defined, but will not repeat any sounds until all of them have played through once. **Random** will select sounds completely randomly, so sounds may repeat as that is the nature of being random. **Ordered** will result in the sounds playing in the order they are listed and always in that order each time they cycle. **OrderedFromRandom** will randomise the list before playing, but after that will cycle through the list in an ordered fashion. Variations lists all the wave files that make up the track and that will be drawn from to play the track.

Wavename, Wavepath, and wavebank provide information to the files and their location. The final value of **Weight** defines how likely each of the wave sounds are to play when randomly selected. In this way you can increase the weighting of a single or group of sounds so they have a higher chance of being selected to play.

## Method

Using the event properties of a sound bank is the main process in creating effective sounds events. By combining multiple tracks each containing a selection of sound files and then arranging them using the event properties data it is possible to create sounds in a similar way to a linear audio editor. The process is however much slower as each of the events needs to have their data added separately. Unfortunately XACT does not include the functionality to copy and paste events, or event data. In my opinion this is a huge oversight and prevents XACT from being usable as a serious audio tool. It is also one of the main reasons why I do not use it for Game Audio either. I use a different application because XACT is too unwieldy without the most basic functions of cut and paste. Where XACT does become useful is when it is used to define a sound event which then allows the creation of multiple unique copies to be recorded.

The basic concept is this. Any chaotic sound event such as an explosion, a crash, a landslide or structural collapse consists of a large number of individual events combined to create the overall effect. All the elements that go together in constructing an object each contribute to the sound event of it being disassembled. Glass, wood, metal, stone objects all have characteristic sounds when they are broken or impacted upon. To build an explosion sound in a standard sound editor you would take sounds of each of the desired components and place them in a linear editor in an order that simulates how they might be placed in a real world explosion. This is a logical process if you want to create a single explosion sound effect, but if you wish to create lots of explosions then you would need to create the layout in the editor individually for each explosion sound, and ensure you altered the timing of the components to ensure that each sound effect was suitably different. Using XACT, once you have set up the parameters to create an explosion, as long as you provide each track entry with a series of wave files to select from, each time you press play it will create a sound effect that is entirely unique.

## Example

To test this, create a sound bank with a single sound event in it. Add a single wave file to the sound event. (but use a sound that comes from a group of similar sounds) Audition the sound event several times, it should constantly repeat the same sound. Go to the event properties, change both Volume and Pitch variation to true and set the Volume range from -3db to +3db. Set the Pitch Variation from -3 semitones to +3 semitones. Now set the **EnableSpeakerPositioning** to true and set **SpeakerPostionArcSize** to 360. Finally set the **RandomOffset** under Timing Properties to 1.000. These are the most basic settings I regularly use to randomise any sound. All of the values can be shifted to achieve more drastic changes, but these setting provide a good basic level of randomization. Play the sound you have created and listen to how it is generated. It should shift slightly in tone, time and position (position is more noticeable if wearing headphones.) Already there is more variety using only a single sound. Now add 9 more sounds from the same group to the same track as the initial sound.

Now each time the sound is triggered it will randomly select one of the 10 sound files and then randomise the various values according to the data provided.

The previous example utilises only one track and one sound group. When combined with multiple tracks all using the randomising data and laid out appropriately it is possible to create any sound that is creatable in a standard editor except that each time the sound is triggered it is different. With this process a sound designer working on a project that required lots of explosions could generate as many as required very quickly. Further more by defining tracks by material types it is possible to switch off certain elements to create explosions with specific materials. I have created a project that contains over 60 tracks with many different elements stacked together. If glass is not required because a specific object contains no glass, I disable the tracks contain glass sounds. Using this method for each group I can quickly alter the tracks to produce the combination of materials I require and then output as many instances of the sound as I need each one being unique.

Like most new tools the best way to understand how to get the most out of XACT is to work with it and try different combinations of functionality and compare results.

Understanding new tools is often the greatest barrier to being able to gain the greatest benefit from them. XACT's unusual functionality allows it to be used to create audio assets that would otherwise require much more time to create.

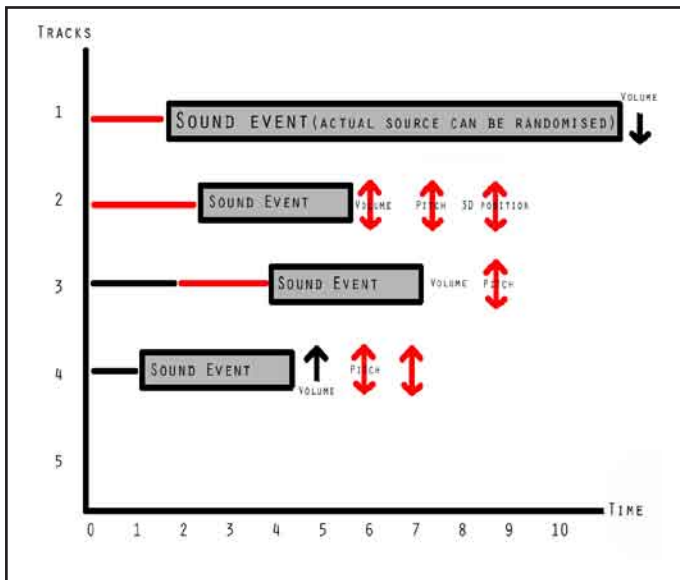


Figure 7. Example of track functionality

The tracks in XACT can function in exactly the same way as a standard linear editor, but can also add randomization. The diagram above illustrates how various sound files would be laid out in a linear editor. The main difference is that with XACT each sound is an event that can consist of multiple sound files. These can be selected randomly or orderly each time a sound is triggered. For each sound event the user can define its parameters. The diagram depicts parameters that have been randomized in red and those that are set in black.

Track 1 is placed randomly up to 2 seconds into the timeline and has a set reduction in volume.

Track 2 is placed randomly up to 2.5 seconds in the timeline and has random volume, pitch and 3D positioning.

Track 3 is placed a set time of 2 seconds into the time line and then randomly up to a further 2 seconds. Its volume is unchanged but its pitch has been randomized.

Track 4 has been placed a set time of 1 second into the time line, has a set increase in volume and has both its pitch and 3D position randomized.

This is an example of the flexibility of this system of sound creation. When triggered the final sound will be generated using the parameters and selectable sound files to create the final sound.