



EAX Quality Assurance

A Guide to Testing Positional Audio
and EAX

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EAX Quality Assurance

A Guide to Testing Positional Audio and EAX

Introduction

We have prepared this document specifically for Quality Assurance groups who want to learn about positional audio in games, EAX, and how to eliminate the most common audio-related bugs found in games today.

QA groups have a myriad of challenges facing them during their testing process. This guide intends to make game audio testing easier by giving the tester some questions to ask before testing a game, which will enable them to focus their attention to certain features. The guide will also give the tester examples of common problems they might encounter while testing their game.

This guide will empower the tester with information about the different audio API's, versions and features of EAX, and definitions of those features. We hope that, with all this information, we can bring the user the soundest game possible.

Positional Audio APIs

This is a brief overview of the major API's used in games. For more information, see the websites listed.

Direct X

DirectSound3D is part of Microsoft's DirectX SDK, a programming interface for Windows PCs. The DirectX homepage on the web can be found at <http://msdn.microsoft.com/directx>. The entire DirectX SDK is updated regularly. DirectSound3D positional audio was introduced in DirectX v.3, with hardware acceleration being catered for from version 5. The latest release at the time of writing, version 9a, was released in March 2003.

OpenAL

OpenAL is an Open Source audio API, with support currently available for Windows (9x, NT4, 2000, XP) Linux, and MacOS (8, 9, X). OpenAL is vendor neutral. Employees of Loki Entertainment and Creative Labs developed the initial versions. They are now accelerated libraries available from Creative Labs and Nvidia. The organization's website (<http://www.openal.org>) contains lots of useful information including the OpenAL Specification and Reference document. A programmer's guide, SDK's, and additional information can be found at <http://developer.creative.com> in the Games/OpenAL section.

Middleware Solutions

Miles

Miles gives game programmers a simple solution to 3D audio. Miles can be found on the PC as well as Playstation 2 and Xbox platforms. Miles gives games support for 2D and 3D digital audio, EAX 1, 2 and 3 and other technologies. See <http://www.radgametools.com> for more information.

fmod

fmod is a cross-platform audio engine that gives games support for DirectSound3D as well as EAX 2 and 3. fmod can be found on PC, Linux, and Macintosh. For more information, see <http://www.fmod.org>.

More Information

<http://www.iasig.org>

The IASIG (Interactive Audio Special Interest Group) is involved in making the standards that are the basis for today's audio API

<http://www.audiogang.org>

This is a great audio and design and implementation resource for sound designers.

<http://atc.creative.com>

The Creative ATC is Creative Lab's main research facility. Their website contains several of their white papers on 3D audio and EAX.

Definitions

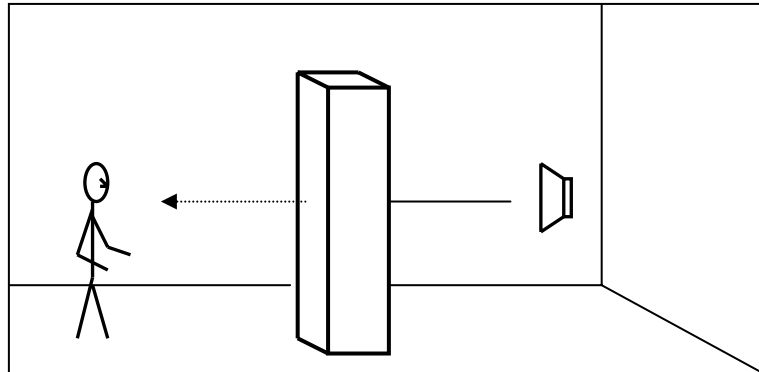
Reverberation

The merging of distinct sound reflections into an overall sonic wash is exactly what happens to sound reflections after the first- and second-order reflections. As each reflection loses specularly, the overall effect is a sound tail that provides information about the general quality of the room, not its specific components. This sound tail is most commonly called reverberation.

The length and the loudness of the reverberation tell the brain quite a bit about room size and the reflective quality of the walls. The more reflective the walls are and the larger the room, the longer the reverberation lasts. The more reflective the walls are and the smaller the room, the louder the reverberation.

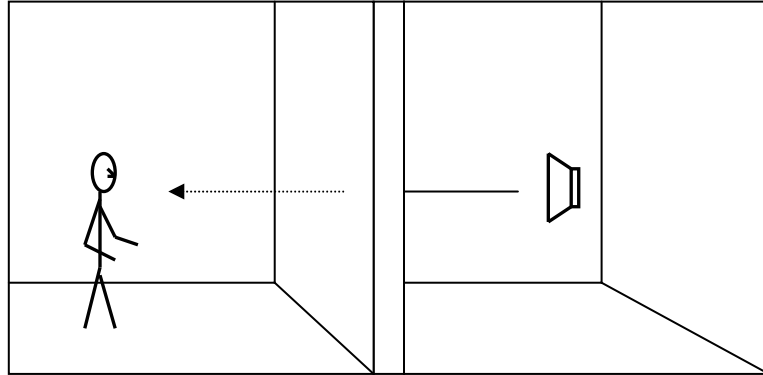
Obstruction

When an object in a room separates sound from listener, obstruction occurs. In this example, the direct-path sound is muffled through a partially transmissive obstacle or medium. If you cannot see the source, the audio should be obstructed (unless the source is not in the same room.)



Occlusion

Occlusion: When a full wall separates the sound source from the listener, it occludes the sound.



Morphing

Morphing simulates a continuous and seamless audio transition from one environment to another by blending reverberation parameters of the two separate environments.

Questions to Ask

The following questions will put you on the fast track to deciding what you need to test in your game.

What audio API is my game using?

Is my game using OpenAL, DirectX or a custom 3D audio API?

Are we using a custom audio engine?

Are we using a custom audio engine or one provided to us by a 3rd party (ex. Miles)?

What version of EAX is my game using?

EAX 1, 2, or 3?

What features of EAX is my game using?

My game is using EAX 2. Is it using Occlusion and Obstruction?

How does the API deal with older cards that do not support newer versions of EAX?

Does my game use EAX Unified or have its own fallback mechanism?

Creative's Environmental Audio eXtensions

These are the major features of each version of EAX. For more information on EAX, visit <http://eax.creative.com>

EAX 1

EAX 1 included 26 reverb presets such as bathroom, parking lot and cave. Reverb levels and volumes were editable.

EAX 2

EAX 2 gave users the ability to create their own reverb presets. Occlusion and Obstruction were added as well.

EAX 3

EAX 3 gave users the ability to pan and steer reverbs and reflections. EAX reverb model is completely editable now allowing users to morph one reverb into another.

EAX Unified

EAX Unified allows a programmer to write a game for higher versions of EAX that maybe a user does not have. It does this by mapping higher version EAX calls to the lower available EAX version based on the hardware the user has.

Testing Positional Audio

It is highly recommended that you use a variety of speaker sets to test your game. Headphones are fine to listen to discrete sounds, but when testing 3D audio, it is best to use a 4, 5 or 6.1 speaker configuration.

Test 1: Multi-speaker

In your game, find a non-moving but constant sound. An example would be a parked car with the engine running. Stand in front of the sound and slowly rotate your avatar 360 degrees. The desired effect is the sound moving around you. Make sure that you have at least a 4.1 speaker setup and try to isolate the sound in each speaker. That way, you can detect if the 3D audio spatializer is working properly.

Test 2: Listener's Vertical Axis

Find a static sound and stand directly in front of it. When you look down, the audio will sound normal. When you look up, it should sound slightly muffled. Then, while looking up and down, rotate your character 360 degrees and (as above) insure the sound moves around you properly. An example of the listener's vertical axis being broken is if you look down the sound gets muffled.

Test 3: Speaker Switch

Select 5.1 in the Creative Surround Mixer Speaker Application and close the window. Start your game, play for a bit and exit out. Open up the speaker application again and verify that the speaker application still shows that you are using a 5.1 speaker set.

In the speaker application, if there is a box marked "Synchronize with control panel," make sure it is checked. This feature of the mixer application blocks applications and games from changing your selected speaker configuration.

Test 4: Multiplayer

If your game has multiplayer capabilities, have another tester log on. Use the other player as a source for sounds and make sure that the audio is placed correctly in 3D. This is a great test for the 3D audio since the listener (you) and the source can be moving at the same time, which will really stress the 3D audio engine.

Test 5: Volume Rolloff

Find a stationary source and make sure the sound volume drops naturally as you move away from that source. This will insure that the distance levels are all properly set in your 3D audio engine

Test 6: Voice Management

When playing your game, find an area that has many sounds playing. A battle with 15 or more players/bots in the same room would be a good example. Make sure that there are no sounds dropping off or missing.

Testing EAX

Test 1: Avatar Reverb

When playing your game, listen for reverb in your avatar's own sounds. Sounds such as footsteps and weapons coming from your avatar are sometimes overlooked. If this is working, you should hear reverb coming from your footsteps as you enter a cave or some other interior environment.

Test 2: Morphing

When moving from one environment to another, listen closely for a smooth transition. The reverb change should sound natural and smooth – not abrupt. Things that can go wrong: reverb trail cutting off, stuttering, or audio artifacts (popping) when reverbs switch

Test 3: Occlusion

When separated from a sound by a wall, the sound should naturally muffle as the wall blocks the direct path of the audio. The source should also have the same reverb as the listener.

Test 3: Obstruction

When separated from a sound by an object like a stack of boxes, the sound should slightly muffle as the object obstructs the sound. The source should also have the same reverb as the listener.

Test 4: EAX Unified

If your game supports EAX Unified, then you need to make sure that the EAX 4.0/3.0 reverbs will work on a card, like the Live!, that only supports EAX 2.0. We recommend that you listen for inconsistencies in the reverb amounts and keep in mind there are new features in EAX that the older boards just cannot do.

Test 5: Windows 2000 Hardware Acceleration

After installing your sound card, or updating your audio drivers, ensure that audio acceleration is set to "full acceleration" in dxdiag.exe. Dxdiag saves the setting after a reboot, so the best way to ensure the setting is changed properly is to set it at max acceleration, close the application and reboot your machine. You must do this each time you install any audio driver or update your audio driver in Windows 2000.

EAX Compatibility Chart

| | SoundBlaster Live! | SoundBlaster Audigy | SoundBlaster Audigy2 | nForce | Philips, MAudio, Turtle Beach, Hercules |
|--------------|--------------------|---------------------|----------------------|--------|---|
| EAX 1 | X | X | X | X | X |
| EAX 2 | X | X | X | X | X |
| EAX 3 | | X | X | | |

Sound Card Info

The Sound Blaster Audigy, Audigy Platinum, and Audigy Platinum EX products have the exact same cards. The differences are in the connectors and accessories.

The Sound Blaster Audigy2, Audigy2 Platinum, and Audigy2 Platinum EX products have the exact same cards. The differences are in the connectors and accessories.

Games to Play

All work and no play make Jack a dull boy, right? Check out these games for some of the best implementations of EAX.

Tom Clancy's Splinter Cell uses EAX 3 with EAX Unified fallback support. Features of EAX 3 used are reverb and obstruction.

Jedi Knight 2 uses EAX 3 via OpenAL. EAX 3 features used are reverb, morphing and occlusion.

Unreal Tournament 2003 uses EAX 3 via OpenAL. EAX 3 features used are reverb and occlusion.

Thief 2 uses EAX 2. EAX 2 features used are reverb and occlusion.