

Basics of Sound Design for Video Games

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About Me

- BFA in Film Production (Sound Design emphasis), Minor in Music
- Worked for Sony, Avid, NBCUniversal (TV show Grimm)
- Worked on over 35 short films/docs - nominated for Student Academy Award
- Finalist for Cinema Audio Society's Recognition Award for best sound mixing
- Performed / worked in over 80 live theater musicals/shows
- Just finished UCI's Sankofa video game's first level!

Sound Designer Jobs

For our purposes, there are two separate jobs that work with sound while making a video game:

- Sound Designer
- Sound Implementer

The creation and implementation of sounds can be handled by both positions but for our purposes it's easiest to divide the tasks into two separate jobs.

Sound Design

What is Sound Design?

Instead of defining sound design, it's best to talk about what it can do:

- suggest a mood, evoke a feeling
- indicate a geographical locale
- define a character
- mirror or exaggerate how things sound in real life
- clarify the narrative

Although we may not think about the sounds we hear everyday, we recognize them readily and have preconceptions about how things should sound.

Families

- DX = Dialogue - any verbal speech in the game.
- MX = Music - any non-diegetic music.
- SFX = Sound Effects (Hard Effects) - any sound from an real-life object.
- FOL = Foley - any sound effect that the player makes.
- BG = Backgrounds (ambience) - noise from the environment.

Generally every video game should have every type of sound family represented.

Some sounds could fit into multiple categories.

Video Game Exercise 1 - Shadow of the Colossus

Let's watch this gameplay clip and imagine what you think you should hear:



(4:30)

What I thought I should hear:

- DX - player talking to the horse, breathing, grunts
- MX - some kind of epic music (orchestral), slow and steady
- SFX - all the horse sounds (breathing, footsteps on stone/grass/dirt)
- SFX - sound of colossus
- SFX - sound of sword bow being pull / tension on the string
- SFX - sound of rocks falling
- FOL - footsteps of player on stones/dirt
- FOL - rattle of cloth
- BG - light wind in the plains
- cave echoes?

Video Game Exercise 2 - Badlands

Let's watch this gameplay clip and imagine what you think you should hear:



(0:22)

What I thought I should hear:

- DX - maybe some noise from the creature
- MX - slow mystical music, dark and subdued
- FOL - flapping of the creature
- FOL - enlarging/shrinking sounds
- FOL - creature knocking into metal pipes / branches
- FOL - squish of creature “dying”
- SFX - sound of whooshing fans / gears
- BG - jungle sounds (bugs, leaves, wind)

Video Game Exercise 3

Let's watch this gameplay clip and imagine what you think you should hear:



(44:45)

What I thought I should hear:

- DX - breathing, grunts
- MX - some kind of epic music (orchestral), slow and steady
- FOL - sounds of flapping clothing
- FOL - player flying sounds
- FOL - collection of items
- SFX - flying kite fluttering
- SFX - water rising
- SFX - glittering walls
- BG - sandy wind
- SFX - hall echoes?

The Purposes of Sound in Game

In general, sounds tell the player:

1. The state of their actions in the game.

- Points
- Level Up
- Health

2. The environment that they are immersed in.

- Windy, rainy, snowy

3. The mood of the game.

- Hostile, foreboding, adventurous, dangerous, calm, organized

Sounds are the easiest way to connect to your player emotionally.

Where do I need a sound effect?

To determine what does/does not need a sound effect:

- Does it move?
- Does it draw attention to itself?
- Does it tell the player something they can't see visually?
- Could it set a mood?

If the answer is yes to any of these questions, that object needs a sound.

Thematic Expectations

Picking a sound depends on the context. Although there is no “right way” to sound design a game, there are certain expectations for different genres:

- Action-Adventure games: complex big music, big sound effects, a lot of DX
- Mobile games: big music, simple sound effects, some DX
- 8-bit games: simple music, simple sound effects, little DX

You don't have to follow the conventions, but knowing them will allow you to break them in a smart way.

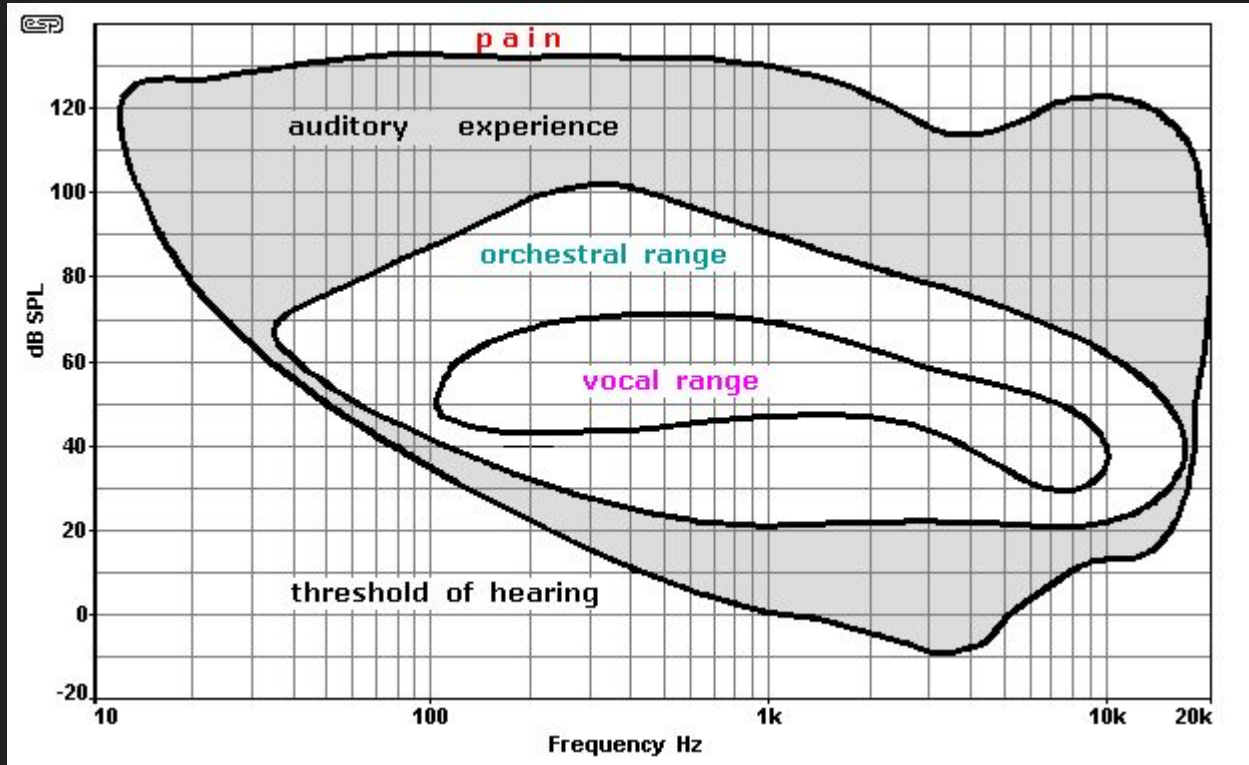
How do I make a sound effect?

Normally the best sounds are the ones that combine the realistic with the fictional:

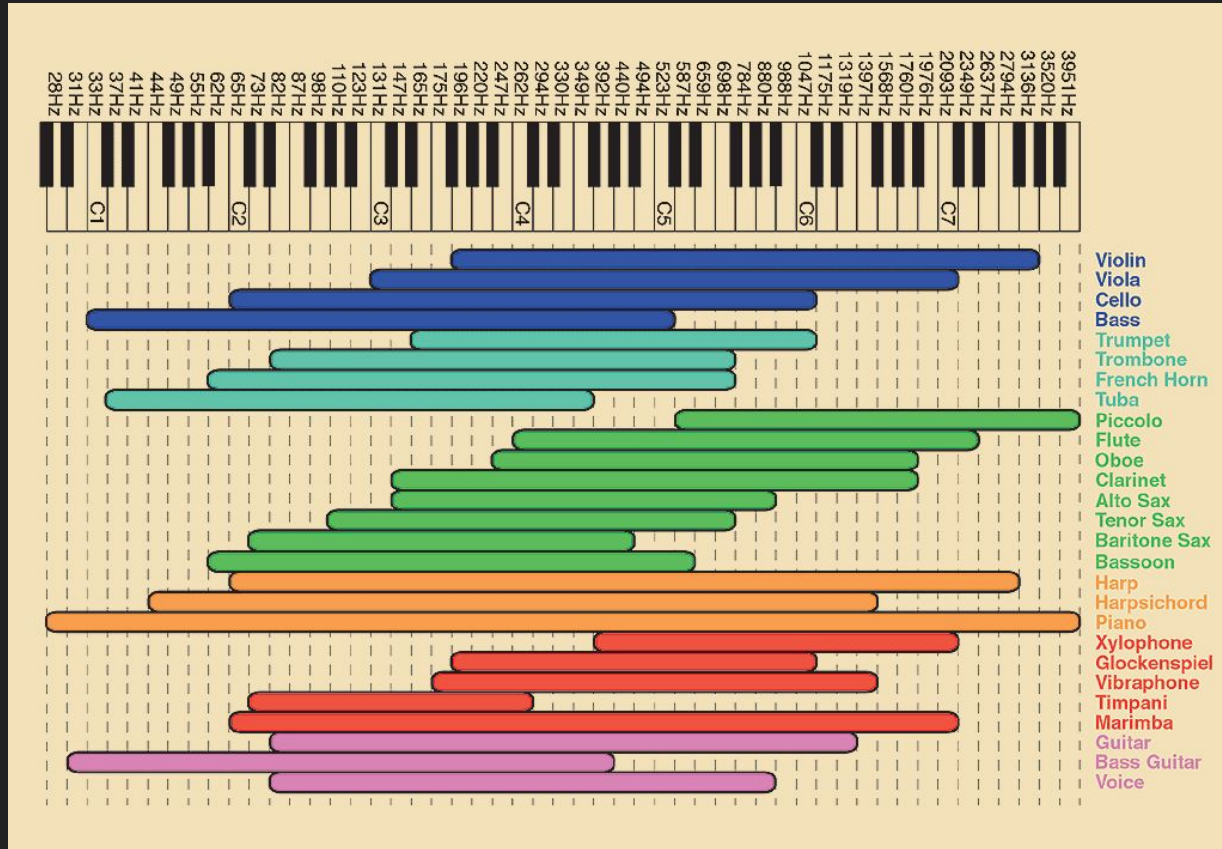
- What is the object made out of?
- Are there expectations on how it should sound?
- What kind of mood should the sound evoke?

To make a sophisticated effect, combine multiple SFX into a new single sound. By combining sounds from different frequencies, you will have a larger sound.

Human Hearing Frequency Spectrum



Orchestral Instruments Frequency Spectrum



Practical Example

Making the sounds of the creation of the universe.

- video example of universe breaking open from an egg

Practical Example

Making the sounds of the creation of the universe.

- Low frequency - low rumble
- Low frequency - canon gunshot
- Mid frequency - egg crack
- Mid frequency - bomb dropping explosion
- High frequency - thunder/lighting

Mono vs Stereo vs 5.1 surround

Sound effects are recorded with various microphone setups. Most of the time they are recorded in:

- Mono = recorded with one microphone
- Stereo = recorded with two microphones
- 5.1 = recorded with six microphones (.1 is the bass channel)

When you are creating your own sounds:

- DX, FOL, SFX should be mono files.
- MX and BGs should be stereo files.

Ensure to use 48k sample rate, 24 bit depth for highest quality

Programs to Use

You can make the sounds in:

- Garageband (Apple only)
- Audacity (Free)
- Reaper
- Cubase
- Sony Acid
- Pro Tools
- Logic

Look for free DAWs (Digital Audio Workstation)

Audio plugins are called VSTs or RTAS

Where do I find sound effects?

<http://www.mediacollege.com/downloads/sound-effects/>

<http://www.flashkit.com/soundfx/>

<http://www.audiomicro.com/>

<https://freesound.org/>

<http://freemusicarchive.org/>

Record them yourselves with your phone!

Implementation

Audio Objects in Games

Three audio objects that you can add in a game:

- Audio Listener (the Camera's ears)
- Audio Sources (Speakers)
- Reverb Zones

The speakers placed across the map to wherever you want a sound to emanate from. From that speaker the sound can be triggered to play at a specific time.

Reverb Zones can add additional effects to how the speakers play the sounds.

The listener doesn't have to be parented to the camera but it normally is.

Visual of Audio Sources (Unity)



Visual of Audio Sources (Unity)



Video Game Exercise 4 - Stalin vs. Martians

Before looking at good implementation, let's look what bad implementation is:



(4:30)

Some of the Bad Implementation Traits

- DX - no character DX (from soldiers)
- MX - has vocals
- MX - too loud
- BG - no ambient BGs whatsoever
- SFX - same russian lines while adding vehicles
- SFX - most SFX repetitive (vehicles moving and firing)
- SFX - chaotic, not responsive to players current actions

Video Game Exercise 5 - Motorbike

Before looking at good implementation, let's look what bad implementation is:



(1:54)

Some of the Bad Implementation Traits

- BG Music - drops out unexpectedly
- BG Music - too loud
- BG - no ambient sounds whatsoever (doesn't distinguish sand/mountain)
- SFX - motorcycle has no variety
- SFX - wood hits no variety
- SFX - no tire skids for dirt vs. metal vs. wood
- SFX - no human breaths/grunts
- SFX - no "level up / success" SFX after finishing level

Video Game Exercise 5 - Ride to Hell: Retribution

Before talking at good implementation, let's look what bad implementation is:



(8:06)

Some of the Bad Implementation Traits

- DX - no breathing, grunts, other character's yells
- MX - too loud
- BG - no ambient sounds
- FOL - no sound of player weapon hitting
- SFX - motorcycles have no variety
- SFX - wood hits no variety
- SFX - no tire skids for slides/spinouts
- SFX - no “level up / success” SFX after finishing level

Implementation Considerations

After designing sounds for an object, you have to decide how to implement the sound to best tell the narrative. When doing so, you'll have to consider:

- Repetition / Variation
- Priority (Mixing Levels)
- Trigger Areas (Optimization)
- 2D vs 3D sounds (Non-diegetic vs. Diegetic)
- 3D Sound settings
- Platform and devices

Repetition / Variation

Most sounds in real life never repeat exactly the same. Unless a sound corresponds to specific game mechanic, it should have many variations.

Example: footsteps

- Provide at least 6 different single footstep sounds per surface
- Randomize the order in which the SFX play
- Randomize the pitch +/- 20% from original source (80%-120% speed)

Variation prevents ear fatigue.

Audio Engine Priority (Mixing Levels)

In Unity and other audio software, you can provide a priority number to tell the audio engine what is most important to hear. It will then mix the audio accordingly:

Unity (0-255)

- DX - 255
- MX - 200
- SFX ~ 128
- BGs ~ 128

When resources are low, then the most important sounds remain audible.

Trigger Areas

Having all the sounds play all the time is expensive resource-wise. Instead use triggers to minimize load and avoid a “wall of noise.”

- SFX sounds should only trigger when player is in that area
- only BG sounds should trigger “On Awake”

Snapshots (Unity only)

- Write code to trigger change in audio mixer to allow certain sounds to play louder than others

Unity has build compression settings for to minimize size of audio files in a build.

2D vs. 3D Audio Sources

For video games, there are two different types of audio sources: 2D and 3D.

2D sounds = (non-diegetic) emanate from player (like wearing headphones)

- Examples: MX, FOL, most BGs, some DX

3D sounds = (diegetic) emanate from speakers placed around the scene

- Examples: SFX, most DX

3D Sound Settings

Each speaker in :

- Output to a specific submaster
- Should have priority level
- Special blend slider changed to “3D” or “1”
- Should have low Max/min levels

To avoid chaos, it's best to have low speaker radius so sounds are contained to specific area in the map.

The screenshot shows the 'Audio Source' settings for a clip named 'basket_lv1.wav'. The settings are as follows:

- AudioClip: basket_lv1.wav
- Output: SFX (Master)
- Mute:
- Bypass Effects:
- Bypass Listener Effects:
- Bypass Reverb Zone:
- Play On Awake:
- Loop:
- Priority: 128 (High/Low)
- Volume: 0.749
- Pitch: 1
- Stereo Pan: 0 (Left/Right)
- Spatial Blend: 1 (2D/3D)
- Reverb Zone Mix: 1

The '3D Sound Settings' section includes:

- Doppler Level: 1
- Spread: 0
- Volume Rolloff: Custom Rolloff
- Min Distance: Controlled by curve
- Max Distance: 20

A graph at the bottom shows the Volume Rolloff curve. The x-axis represents distance (0 to 20) and the y-axis represents volume (0.0 to 1.0). The curve starts at (0, 1.0) and drops to 0.0 at a distance of 20. The legend indicates that the red line represents Volume, the green line represents Spatial, the blue line represents Spread, and the yellow line represents Reverb.

Distance	Volume	Spatial	Spread	Reverb
0	1.0	1.0	0.0	1.0
20	0.0	1.0	0.0	1.0

Platforms Limitations Considerations

Just like having visual constraints with different screen sizes/graphic cards, same constraints with a variety of speaker sizes.

Speaker cone size $\leq 6''$ to fully reproduce fully frequency of human hearing

- Computers: headphones to larger speakers
- Tablets: headphones or small speakers
- Phones: headphones or tiny speakers

Knowing where your game is going to be played will determine how you implement the sounds.



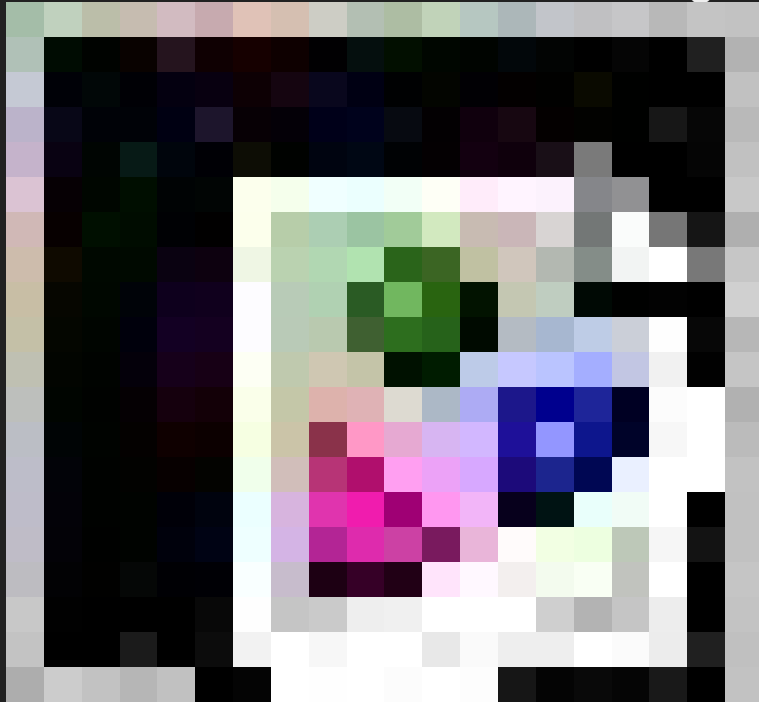
Implementation Software/Plugins

- Wwise (standalone)
- FMOD (standalone)
- Unity Audio Engine (Audio Mixer, Snapshots)
 - Plenty of plugins on Unity Asset Store
- Fabric (Unity plugin)
- Two Big Ears (binaural plugin)
- Hand coded scripts (C# or Javascript)

The program you use doesn't matter. What matters is the intention behind the sound.

Practical Example

Sankofa is a action-adventure game made here at UCI.



Led by : Magda El Zarki and Patricia Seed

Platform: For PC made in Unity 5

Team: over 22 students / professionals

Scope: 2 years (6 months of intensive work)

Sankofa Sound Features

Sankofa is a action-adventure game made here at UCI.

- Submaster Busses
- Reverb Zones

In Conclusion

- Sounds inform the player about their status, surroundings, and progress.
- Combine multiple sounds from different frequencies to make fuller SFX.
- Add variety to SFX to promote realism.
- Centralize your sounds to avoid chaos and over-informing the player.
- Ensure platform can handle sounds to maximize what the user hears.
- Use sound to better tell your story.

Credits

- Jory Prum - Konsoll 2013: Making a great sounding Unity game using Fabric
- Lectures by Dan Pavelin (Chapman University)
- Lectures by Harry Cheney (Chapman University)
- Lectures by Roy Finch (Chapman University)
- Lectures by Michael Kowalski (Chapman University)
- Images from Cornell.edu
- Sankofa game made by UC Irvine

Questions?

Brainstorming Exercise for your Group

Please take this time to gather in your groups and start thinking about how you can incorporate sounds into your game that better tells the story.

- How can sounds help our game?
- Which platform going to use to implement the sounds?
- Who will take the lead with sound designing/implementing the sound?

I'll be coming around to each group to hear your proposals and give additional ideas for your game.