

The Broad Concept of Inevitability:  
A Video Game Soundtrack from the Ground Up

by  
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## **Abstract**

For this honors thesis, I created a video game soundtrack album. I sought to answer the question of “what makes a video game soundtrack,” learned how to expand music into binaural audio, and learned how to use audio middleware. Using these skills, I created a video game soundtrack and implemented it into the middleware program.

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## **Introduction**

Growing up, I played hundreds of video games, ranging from Microsoft's *Minecraft* to Nintendo's *Super Mario Galaxy* and everything in between. Video games have always fascinated me, begging me to look deeper to figure out how they work. This thesis was born from that desire to learn the intricacies of how every piece fits together.

The original idea for the thesis was merely an attempt to learn how the musical bed fits into the overarching soundtrack for any given video game and to learn what separates a video game track from that of film or music. The project itself would then be an attempt to emulate it myself by creating a video game soundtrack to show off the knowledge learned. Though the identity of the project remained the same throughout creation, the purpose became altered as I dove deeper.

## **Research**

I initially limited my research to compositional elements, but as I was in the process of finding information, I decided that I wanted to expand my music into the world of immersive audio in order to learn more and experience more about the technology on the forefront of the game industry. I also realized the best way to show this work off would be actually to implement it into an audio middleware, so I looked into the software side of game implementation. Walking away from all of this, I had a pretty hefty accumulation of information that I was able to use to create my thesis project.

## Composition

When I began my research, the project still had a major focus on composition, so I initially looked for a basic guide to music theory, or perhaps something a little more advanced, to get in the right ballpark. I very quickly learned that music theory is incredibly dense and would take way more time than I had to learn the basics. I also learned that music theory isn't rules to be followed completely and wholly, but more of a set of general guidelines that can largely be ignored in favor of something that just sounds good.

I decided to skip researching theory, and instead I jumped into researching how video game soundtracks fit within the bed of the video game. The brunt of the research boils down to two key points. The first point is simple, as described by Laviers, the audio director for *Dead Space 3*: "if players don't notice, then you're doing your job right." The second point, as described by Gregor Herzfeld in his paper, "Atmospheres at Play: Aesthetical Considerations of Game Music," is that "Music, as the ordered succession of sound, is, in addition to its structural qualities, a vehicle for the transportation of atmospheric values."

In other words, the soundtrack of a video game should not be the focus. It exists to enhance the visual media of the game and support the gameplay, not the other way around. It needs to step back, and it needs to define the atmosphere and environment of the game itself.

In determining how I wanted my soundtrack to sound, I listened to tons of video game soundtracks, including Firaxis's *Civilization 6*, Riot's *League of Legends*, Team Cherry's *Hollow Knight*, and Kingsisle's *Wizard101* among others. I examined how the

tracks operated within the games themselves, and found they all generally aligned with the concept of invisibility and enhancement.

Take, for example, Team Cherry's *Hollow Knight*. When listening to the soundtrack on its own, *Dirtmouth* seems to fit the bill as a background aesthetic, but *Mantis Lords* is way more exciting and intense. On its own, the second track feels memorable and exciting, almost as though it must break the ideas above. It feels like it should take center stage and beg for the player's attention. That is, until the context of the game comes into play. *Mantis Lords* plays during one of the more intense boss fights in the game, where the player is barely clinging to life trying to just get one more hit in before they die. Noticing this similarity in a lot of different tracks from different games with the boss tracks, I discovered that the atmosphere and level of invisibility is flexible to the level of action on screen. In fact, the two are proportional. If a segment of a game is incredibly intense and begs for the player's full involvement, a slow simple background would rip the player out of the experience. Thus, the more intense sections of the game require more intense music. And on the inverse, if a segment of the game is more laid back like *Dirtmouth* is in *Hollow Knight*, then an intense background would rip the player out of the experience. Thus, a simpler and more subtle approach is needed for the music in the slower parts of the game.

## **Immersion**

Audio is designed to enhance the visual media, to help create an experience for the player, from the music to the sound effects. And what better way to help create that experience than binaural audio? My classes here at Middle Tennessee State University



have taught me the basics of what binaural audio is, though a large part of my knowledge has come from my own research.

Basically, binaural audio is how a listener would perceive audio in the natural world. As sounds in nature hit the two ears, there are 4 general things that change the sound. The first two are interaural time and amplitude differences, or the amount of time it takes for the sound to hit one ear and then the other, and the amount of volume lost between when the sound hits one ear and when it hits the other. Combined, these give a stereo image, but it requires two other elements to get a surround image. As sound travels through the air, the air will have a tangible effect on the sound, as will one's head as it gets in the way of the sound. Combined with a very large list of other factors, one has the head related transfer function. This is the effect of the world and one's environment on the sound. The last thing that affects the surround image is the shape of the ear itself. The folds in the ear have naturally evolved to aid in height localization. Basically, when a sound hits one's ears, the folds will affect the sound in such a way that a person's brain will be able to tell the general direction the sound is coming from on the height plane.

Due to a whole ton of advancements within the audio world, 3 of those 4 effects can be mirrored in just two speakers. Using just a pair of headphones and an algorithm, interaural time and amplitude differences and head related transfer function can be programmed into the audio. This is known as binaural audio, an effect which is easily able to be heard in the LovelyVirus youtube video from 2007, *Virtual Barber Shop*.

While doing my research for the project, I repeatedly came across games in virtual reality, using VR headsets to allow the player to experience the world in 3D through their own eyes. VR games take great advantage of binaural audio to increase

further the immersive experience, making the player not only see the game world as though it were real, but also hear it as though it were real as well.

As VR games become more and more popular, and cheaper to acquire, VR and binaural technology has been on the forefront of the game industry for the past couple of years. In an article titled “Binaural and Ambisonic Sounds as the future Standard of Digital Games,” Tomáš Farkaš details the entire history of binaural audio, ending it by saying, “Perfectly immersive sound could be the next standard.” “This feature could mean the next step in the world of digital games, changing the way of working with narrative, gameplay, difficulty, or space.”

## **Middleware**

When a game needs a soundtrack, it typically uses a software known as middleware to allow the game engine to communicate with the audio engine. The big budget studios may use their budget and create their own middleware, giving them full creative control over what they want to accomplish, but most studios will opt to use Wwise, an audio middleware created by Audiokinetic.

Audiokinetic has on its website multiple courses and certifications for use in learning how to use Wwise, including Wwise 201: Interactive Music. The first part of the introduction to the course explains in relative detail how different composers approach games compared to film. As Audiokinetic puts it, “When working with film, the scene plays back the same way the hundredth time as it did the first.” “With video games, there is no timeline, no way to know how long the player will linger or when they may unexpectedly jump into danger, and no way to know the exact moment in which they

defeat their evil nemesis.” Nonlinearity perpetuates throughout the compositions of games, and in my research, I’ve found many different ways games approach the problem.

Take, for example, *Fire Emblem: Three Houses*. Nintendo uses a system it calls “Rain and Thunder.” Essentially, during combat in the game, the player is viewing the map from a top-down view, but during actual attacks, the player zooms in and gets to experience the combat firsthand. In order to differentiate these experiences, Nintendo wanted the zoomed-out soundtrack to be more expressive, as one is watching everything from a distance, and wanted the zoomed in tracks to be less expressive to accommodate for the on-screen action. In doing so, Nintendo created two tracks for each battle: rain and thunder. The rain and thunder mixes are almost exactly the same, typically with only minor differences. The most striking difference is that often the vocals that are present in the rain versions are replaced by horns or just removed altogether in the thunder version. But, in order to have them transition smoothly whenever the player enters combat, the game will actually play both tracks at the same time, keeping one muted at any given time. This means that whenever the player enters combat, the rain version can be muted and the thunder version unmuted, with a simple fade to make them blend properly.

Another example is a game like *Sid Meiers Civilization*. Firaxis uses a system that essentially ignores musical cues and will just play a 3-minute-long track every 4 or so minutes. In the early game, the timing is such that one hears about one track every 5-10 minutes, but due to how congested the game can get in the late game, it will often end a track and immediately start playing a new one with no breaks. All of this is done randomly, by selecting a track that meets the preconditions of the game in that moment. Basically, due to the nature of the strategy game, it doesn’t need musical cues during war

to make battles more aggressive. It can get away with just ambience to keep you thinking about your next turn.

There are many different ways sound can be programmed into the game, and much of it ends up being the case where the developer wants to do something and the sound designer makes it happen. Middleware is made such that if it can be dreamed up, it can be implemented. And if it can't be implemented, Wwise is customizable enough that they can make it be able to be implemented. And if they can't, the studio can easily just develop their own middleware to make it happen. In essence, music can be whatever the developer wants it to be.

### **The Broad Concept of Inevitability**

So, facing all of this, I realized the first step in my creation process was to design a game to work with. If I had a game to go from, I could easily choose the desired approach to the soundtrack. So I sat down, and started brainstorming ideas.

The game is titled *The Broad Concept of Inevitability*. In it, one plays as a character known as the Watcher. The player typically just observes the universe from the safety of the expanse, a place filled with nothing in all directions, that is, until a being known as the Defiler comes to wreak havoc on your universe.

In a small portion of the universe, on a continent there exists some regions. In one age the southern region is an ocean filled with islands unsettled by anything other than monkeys. In the next, it is a harbor filled with the sounds of machinery and commerce. In the last, it is an apocalyptic desert, fully dried up from the wastes of the last age. And in

every single age, terrifying beasts of stone that were summoned by the Defiler have come to destroy everything.

Just north of what is sometimes the harbor exists a city. In one age, it is a vast forest filled with creepy spiders. In the next, it is a city, so full of life, yet so empty of soul. In the last, it has been reclaimed by nature and has been turned into a frozen wasteland, with the spiders coming back in droves. And in every single age, terrifying beasts of frost that were summoned by the Defiler have come to destroy everything.

Just north of what is sometimes the city exists a massive mountain. In one age, the inside of the mountain is a hollow cavern, filled with lush life and underground rivers. In the next, it is an abandoned research laboratory filled with technology and experiments. In the last, the remnants of the laboratory have crumbled into pools of magma clinging to the ancient caverns. In every single age, terrifying beasts of flame that have been summoned by the Defiler have come to destroy everything.

Outside of the inner mountain there stands a fantastical ridge line, filled with floating rocks. In one age, it is an ancestral path for old monks to traverse to arrive to their sacred temple. In the next, it is the ruins of an old temple in a park meant to be preserved. In the last, it is a ridgeline torn apart and fractured, with massive chasms at every step. In every single age, terrifying beasts of wind and storm that have been summoned by the Defiler have come to destroy everything.

The player, as the Watcher, sees this beast come and invade his or her perfect world, ruining the beauty and splendor. So, the player takes up their weapons and fight. They fight through each of the four regions, battling elemental monsters that seek to slow the player down. Eventually, after slaying the Defiler's 4 guardians present within the

regions, the player comes face to face with the Defiler, and slays him down. But as is the name of the game, the Defiler is inevitable, and he comes again to ruin the Watcher's perfect world.

Some of my favorite games have been roguelikes, games in which one plays through the game multiple times. In each game, the world will be different, the objectives different, the gameplay itself different. And at the end, when one wins or loses, they're brought right back to the beginning to have another go, but this time things will be different. So, I wanted to emulate that game style, with a randomly generated world filled with monsters.

Due to the tensions this game would have, I knew immediately that I couldn't take either approach I described above, and that I'd need to do something else. As already described though, if the developer wants something to happen, he can make sure it happens. So, I came up with my idea and I made it happen.

## **Approach**

Given there would be no downtime in regular areas, I needed a system that would allow for a stable amount of tension with variance, so it doesn't get boring. Upon continuing the Wwise 201 course, I figured out exactly how I was going to do it, as the course taught the exact method of implementation I was going to use.

Essentially, the main tracks of my game rely on an A -> Transition -> B repeating system. Every one of the four main tracks has an A segment, half of them have a Transition segment, and all of them have a B segment. It will randomly choose how many times to play the A segment, then it will play a transition and then randomly choose

the number of times to play the B segment. It will then repeat this indefinitely, until the player enters a new area.

However, I needed to make sure there's variance, so the players don't get fatigued by having the exact same thing played repeatedly. The method to solve this I went with is a random generation method. Basically, each time one of the segments is played, for each part of the segment, it will randomly choose a variation. For example, if one of the segments has a piano part, the generation will randomly choose between the piano being muted, the piano playing the harmony, the piano playing the melody, or the piano playing underlying chords. If enough parts are randomly varied, it can be made such that no two loops of the first segment are ever the same.

Combining the two random generation methods, the tracks could be playing for an hour and the player would still find something new in each pass through.

However, this method doesn't work for everything in my game, as I have two other tracks planned. One track is a calmer chilled out track which plays during a rest area. The other is an aggressive boss theme. Due to this, neither of them wants extended variance, and the tracks would rather have something a little more akin to the solution *Sid Meiers Civilization* came up with.

## **The Songs**

I had my approach, and I had my game, so now I needed to determine what exact tracks I'd need. I came up with a list of 6 tracks I needed. A track for each of the four regions in the world, a track for the Expanse, where you start and end each game, and a track for the boss fights.

## Respite

The first area the player starts in is the Expanse, a great blank nothingness from outside the universe. From here, the player will jump into the action, only to return every once and a while during their journey. Games can be intense, so the Expanse would serve as a buffer zone to allow players to take a breath and relax for as long as they want.

Due to the low tensions, I decided to make this track incredibly simple. The whole track is composed of two parts: A flowing synth and a simple bell melody. In addition, both parts are slow, simple, and easy to follow.

Upon going into the studio to mix it out, it was fairly simple. I expanded the synth to fill out the room and made the bells float above everything in a pinpoint location. Everything is supposed to combine together to grant the player a feeling of safety and rest. Making the layer feel at ease.

## Ancient Sand Sea

One of the four regions the player can start their combat in is the Ancient Sand Sea. In some portions of the map, it's a vast ocean with small islands dotted around, and in other portions, it's a Harbor filled with commerce. In other portions still, it's a ruined desert filled with the ruins of an age long past.

As one of the four main regions of the game, I needed the track to have an intensity to it, but I also wanted to play with the concept of loneliness that can come from the vast open ocean or an endless desert. So, I wrote a more subdued part, with longer phrases and simpler rhythms. This section serves as the A section and works really well in all three time periods.



But I also needed the intensity to be present, so I wrote a second section that has a ton of drive to it and a lot of intensity. Due to the more melodic nature of this part, I used it to create my key center and drive home the melodic identity. As one time zone deals with trade and commerce, and another time zone is in a desert, I felt an Arabian feel would work perfectly for the track.

When I went into the studio for mixing, I added an earthquake rumble and changed positioning to make it feel incredibly wide. I made the low end super expansive and tightened the higher end into a few points in space. I wanted to make it feel like a massive empty region, and by making the low end have such a huge rumble, I succeeded in giving it that width.

### Fractured Ground

The next of the four regions is the Fractured Grounds, located deep within the heart of the mountain. It is a spacious cavern that has been infested with fire monsters that burn everything around them. As it is a main area, I needed intensity to keep the game moving.

In all my research and experience with soundtracks for fire areas, they generally tend to have very booming low ends and very muted high ends. So, I decided I wanted a big brass theme to my track, with huge booming tubas and muted trumpets. So, I laid out the foundation and added in a light upper end.

All of this was an attempt to make the player feel hot, like everything in the air around them was scorching. To accentuate that, I added in the sound of a crackling fire and pushed every single instrument closer to a buzzy sharp sound than in the other tracks, giving everything a hard, rough edge.

When I went into the studio, I expanded the lower end to be incredibly booming, but I also did the same to the high end. I wanted the caverns to feel claustrophobic, so even the high end instruments are coming in from all directions. Everything feels hollow and compressed, which is exactly what I wanted it to feel like.

### Perch of the Heavens

In the next of the four regions, the player character gets to run and jump thousands of feet up in the air, maneuvering between floating rocks and evading wind and storm elementals. It's an exciting, exhilarating experience meant to increase the feeling of pure bliss as you catapult through the air. I even designed the region itself in a manner that would lead to as little change between the areas as possible. Sure, one time zone has a holy temple. Sure, in the next, that temple is now ruins. And sure, in the last era it's just a bunch of ruins on the cliffside. But all in all, it's just a great place to jump around and zoom through the area.

So, I knew immediately that I needed this theme to be the most stagnant. Or rather, have the least change. The theme itself takes a backseat to the action, unlike the other areas where the soundtrack is designed to enhance. This theme really is just supposed to get out of the way and let the player do their own thing. So even in the variations I created, it still sounds nearly the same throughout the whole track, with only minor differences so as not to pull the player out of the excitement.

By design, even the individual tracks start melding together with no real discernable moments the player can grab onto. Everything is just a flowing cesspool of noise that sounds vaguely heroic and adventurous, with a nice windy backing to just further drive the experience so far in the sky.

In the studio, I did a similar thing to the Ancient Sand Sea, expanding out the relatively limited low end and pinpointing the high end to a small point to give a sense of direction and excitement. I did do my best to cut as much of the low end as possible to give it a “floaty” sound.

### Spiritual Evergreen

The Spiritual Evergreen is a terrifying region. In two ages it is a frozen wasteland. In the first, it’s an unending forest, and in the last it’s a desolate expanse. In the middle age, it is a great city, but even then it is void of life, everything frozen in by the frost monsters. The frost monsters in the area use the blizzard and limited visibility to their advantage, turning the game into less of an action oriented dungeon crawl and more into a creepy horror survival game. Sure, it’s still action packed and exciting, but this entire area is constantly screaming at you to get out, and I needed the music to enhance and expand upon that.

Most of the track is just a drone with the sound of the creaking woods all around you. Occasionally, drums are played in the distance, or a chime explodes into the sky, though neither has a known source. Every track is soaked in reverb and delay to make it feel unwelcome and murky. In addition, the random chimes and drums are set to come from random directions and are set to be played at random times.

Basically, during the primary segment, everything is murky, random, unpredictable, and creepy. But there’s a secondary segment, one that comes in basically whenever, but very rarely. The B segment is much more intense, to give the player some sense of urgency, but it still feels off-putting. In order to keep the player with no sense of direction or stability, the B segment will randomly shut off. Sometimes they’ll hear the

whole 16 bar section, other times they'll hear 4. It is random every single time, and gives no warning to when it starts or stops.

Every single piece of the track is designed to be off-putting, designed to make the player feel uncomfortable, even in its relative simplicity. Even down to the directional information. Every single sound comes from a different direction, and I made sure that that direction was picked almost at random during mixing. It will always be the same on playback, but at the very least some elements feel like they're coming from the wrong location.

### Battle of the Ages

The final track of the album is the boss track. It plays whenever you fight the boss at the end of each region, and it also plays when you fight the Defiler. In all instances, the player character drags the monster into the Expanse in order to have full reign of the fight. In all instances, it's a hectic fight.

The track makes use of concepts from all 4 region tracks as well as the Respite track. I did this to tie this fight into the whole game and give the player an idea that this track would belong in any of the four regions while also giving the player a sense of finality when it's played during the Defiler fight.

From Respite, Battle of the Ages takes the main melody. The intro to Battle of the Ages is the same key, and includes the exact same interval as the intro to Respite. From there, both tracks largely go different directions, though the exciting part of Battle of the Ages shares a lot of similarities with main melody of Respite. The two tracks do occur in the same locations, so I wanted to make sure they had similar sounds with entirely different purposes.

From the four regions, it took smaller aspects, just individual pieces. From Ancient Sand Sea, I used the same pan flute. It's the exact same instrument, even playing the same part, a simple up and down repeating segment. From Fractured Grounds, I used the trumpet as the main melodic instrument. From Perch of the Heavens, I used a similar lower horn pattern, where it plays for very short bursts at the beginning of each bar. From Spiritual Evergreen, I used the same drone to fill out the low end.

The track is a culmination of the entire game and is designed to make the player feel the tension of a great boss fight, while still making them feel exhilarated and ready to strike. It's designed to push the player forward and stay motivated.

## **Implementation**

After teaching myself Wwise through Adiokinetic's online course and after mixing in the studio, I had a ton of audio files to implement, 137 files to be exact. Though, the process of implementation wasn't long. I created different music objects for the tracks to exist in, routed them up properly and began to approach randomization in both areas.

## **Conclusion**

I set out to answer the question of how the soundtrack ties into a video game, the purpose it plays, and exactly how to accomplish that. Through a lot of research, I came up with a decisive answer. The soundtrack to a video game is designed to enhance the visual element without being overbearing. But what good is an answer without creating something tangible to express that answer?

In my pursuit of creating a tangible object, I expanded my project and learned how to develop into a surround and binaural mix and learned how to implement it into an audio middleware.

When the dust cleared, I had a project I was happy with. It sounds good, and it accomplishes the goals I set out to achieve. Though, I wish I had gone about it differently. If I had devoted more time to the project, I could have not just implemented it into a hypothetical game, but I could have worked within a game engine to create a project able to be played. And with a bit more time, I could have created tracks to accomplish all manners of the game soundtrack, from short stings to a credits theme and a title theme.

This project is just the first step though. The first step of many. As I delve further into the world of video games, I can use the knowledge learned and created in this project to propel my advancement in learning about every other element of a soundtrack, from the environmental cues to the small effects that occur on the graphical interface.

## **Song Files**

Full Album: <https://on.soundcloud.com/hRKMz>

Respice: <https://on.soundcloud.com/BoZ5Z>

A simple theme designed to evoke safety and melancholy. It is played in a blank expanse between games.

Ancient Sand Sea: <https://on.soundcloud.com/yf2LP>

An expressive theme designed to evoke earth and sand. It is played in an oceanic region that has turned into a dry desert.

Fractured Grounds: <https://on.soundcloud.com/4Qmbo>

A booming theme designed to evoke fire and blistering heat. It is played in a cavernous region filled with lava.

Perch of the Heavens: <https://on.soundcloud.com/G9r9S>

An exciting theme designed to evoke wind and adventure. It is played in a mountainous region, shattered, and floating through magical means.

Spiritual Evergreen: <https://on.soundcloud.com/RSrCh>

An unsettling theme designed to evoke ice and terror. It is played in an empty forest region, overcome with the cold.

Battle of the Ages: <https://on.soundcloud.com/2n3Pd>

An exhilarating theme designed to evoke strength and heroism. It is played during the final boss fights.

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