

An Evaluation of Non-Linear Audio to Enhance
Immersion within Narrative Driven Games

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Abstract

Context: Non-linear audio can be found in many modern video games, performing a variety of tasks. One area that is relatively unexplored is the use of non-linear audio to affect how a player emotionally connects with the game they are playing.

Aim: To implement and evaluate a set of three non-linear audio techniques within a narrative driven game, and determine the most effective technique to enhance a player's immersion within a narrative driven game.

Method: Three non-linear audio techniques will be researched and then implemented into a narrative driven game. The game will be tested by external participants at two stages along the project, so that the techniques may be altered and improved per feedback from testers, as well as to obtain data to answer the aim of this project.

Results: It is expected that the different techniques will alter the user's immersion within the game, be it to either enhance or detract from the overall experience. Mixed results are expected for the effectiveness of individual techniques, due to the personal preferences and feelings of the external users testing the game.

Conclusion: This project will attempt to demonstrate that non-linear audio can be used as an effective additional method in increasing player immersion, specifically within games where the focus is on narrative rather than gameplay.

1. Introduction

For many, a game's soundtrack and the audio effects present within the game are its defining features, leaving lasting impressions long after a player is finished with the game. Especially in games that lack eye-catching graphics or unique gameplay elements, the audio must be well-crafted and enjoyable, so that the player has something interesting and memorable to recollect back to.

As the video games market expands, expectations as to what these games should contain inevitably also expand. New mechanics must be designed, more efficient graphics be made available, and so forth. Audio is no exception to these expectations, and therefore must also adapt to the ever changing demands of consumers, in order to keep up with all other components of video games.

The most noticeable shift in recent years concerning video game audio is that from using linear audio (audio that has been composed with a defined start and end point within the media) to non-linear audio (audio that is composed without a clear idea of when it might be heard or used within the media) techniques.

While appropriate in other forms of multimedia such as television and film, the use of linear audio within video games is becoming less popular due to the nature of video games themselves. In general, games are fluid; the player decides when things happen in the game. A composer "cannot know in advance what will be happening at any particular moment in a game" (Griffin 1998, p. 3), nor how long that moment will last.

While a composer can still write a linear piece for a title sequence or cut scene, non-linear audio is becoming increasingly necessary to immerse the player as they play through typical gameplay.

Non-linear audio performs a wide variety of tasks in modern games, such as providing information about the player, providing information to the player, or navigating the player through the game.

One genre that is somewhat untouched by non-linear audio is that of narrative driven and 'serious' games. In these games, the focus is on the story and emotions conveyed by the game to the player, rather than the gameplay itself.

Non-linear audio has been used in many situations to communicate meaning to the player, but its use to induce emotions onto a player is relatively unexplored.

Instead of using non-linear audio to compliment gameplay, can it instead be used to compliment narrative, and assist with immersing the player into the story and emotions of the game? Instead of making the player feel as if they are watching a story unfold, is it possible to make the player feel as if they are unfolding the story themselves?

1.1 Research Question

With the points made in the previous section, the project undertook the following research question in the hope to solve the outlined statements:

How can non-linear audio techniques be used to enhance a player's immersion by altering the generated atmosphere and emotions within a narrative driven game?

The aim of this question was to see if the inclusion of non-linear audio techniques was a viable method of adding to a player's immersion within a very narrative heavy experience, where every minute detail could make or break the immersion constructed by the gameplay and narrative.

The above research question lead into a more specific question that would also need to be addressed during the course of the project:

What is the most effective non-linear audio technique to aid immersion within a narrative driven game?

1.2 Aim & Objectives

The project aim is as follows:

- To implement and evaluate a set of non-linear audio techniques within a narrative driven game, and determine the most effective technique to enhance a player's immersion within this style of game.

The project objectives key to achieving the aims and research question are as follows:

1. *Select three suitable non-linear audio techniques to be implemented into the project's narrative driven game*

This is a crucial area of the project: allowing sufficient research into existing technologies provides a solid base upon which first iterations of the techniques can be implemented.

2. *Plan where and how techniques will be implemented within the game*

Implemented techniques must be carefully placed into the game so that they do not detract from the rest of the experience. It must also be decided in what manner the techniques will be tied to gameplay mechanics.

3. *Determine the effectiveness of techniques via participant testing*

The feedback gathered from testing will provide the basis of further technique development between testing stages.

4. Iterate on the techniques to improve overall effectiveness

Technique iteration will allow for techniques to be refined and made more accessible to participants during testing, hopefully enhancing their immersion even more.

5. Analyse and evaluate feedback to ascertain how effective the three non-linear audio techniques were at enhancing player immersion

Analysis of data obtained from participant feedback will be used to answer the research question of the project.

6. To suggest future work that could be done on the project

Once conclusions have been drawn from the last stage of testing, it is important to discuss how further development of the techniques or research in the topic can be accomplished.

2. Literature Review

2.1 Non Linear Audio

Non-linear audio, also known as dynamic audio, is a term that encompasses two distinct categories of audio, known as interactive audio and adaptive audio.

Interactive audio is best described as “sound events occurring in reaction to gameplay, which can respond to the player directly” (Collins, 2007, p. 1). This could be something as simple as footstep audio playing as a player traverses the game world, or something as complex as the audio fading from over-world music to battle music when a player enters the trigger area of an enemy or boss fight.

Adaptive audio, while similar to interactive audio, differs from directly responding to the user in the fact that it “reacts appropriately to - and even anticipates – gameplay” (Whitmore, 2003, p. 1).

As indicated by Todd Fay, “in many ways, it is like interactive audio in that it responds to a particular event. The difference is that instead of responding to feedback from the listener/player, the audio changes according to changes occurring within the game or playback environment” (Fay, Selfon and Fay, 2004, p. 6).

This project will focus on three separate non-linear audio techniques; vertical re-orchestration, stinger-based sequencing and sound property modulation.

2.1.1 Vertical Re-orchestration

Vertical re-orchestration is “the adaptive technique where composers break up a music cue into two or more musical layers” (Sweet, 2016). Simply put, audio can be split up into multiple elements, such as different instruments or different musical functions. These different elements can be faded in and out from the ongoing game audio depending on certain

gameplay aspects. The resulting ebb and flow of audio can help emphasize certain parts of the game, increasing the amount of audio layers present when something important is happening, and fading them away as the gameplay calms down.

A common example of this layering technique can be found in many games. As the player is travelling through an area, a piece of audio themed to that area plays in the background. When the player approaches an enemy, other layers are added in on top of the existing audio to alert the player to the ensuing battle. After the battle has ended, the layers are gradually faded back out and the audio returns to its previous state.

2.1.2 Stinger-Based Sequencing

Stinger-based sequencing revolves around the idea of using short audio cues to signify in-game events. These cues are generally composed of accents and crescendos, and are individual, meaning that they do not connect with other stingers potentially present in the game. Cues may overlap if the events they are tied to trigger quickly enough, but they are designed to act independently of one another.

Stingers have been used in a variety of ways, such as signalling information to the player, telling them something important just occurred or was interacted with. They have also been used to bridge the gap between gameplay and cut scenes, or gameplay and menu screens.

2.1.3 Sound Property Modulation

Finally, sound property modulation is the act of modifying audio properties such as tempo, pitch, volume and direction, to achieve specific effects. These modifications can either be interactive or adaptive in terms of audio categorization. A player may turn themselves in-game and experience sound from a different angle, or the game may speed up the tempo of audio as time to complete the level runs out.

2.2 Creating Immersion

For many videogames, having an immersive experience is a large selling point. But what exactly is meant by immersion? Immersion is often defined as being present when "media contents are perceived as 'real' in the sense that media users experience a sensation of being spatially located in the mediated environment" (Madigan, 2010).

The most common ways of creating immersion are by providing the player with as much sensory information as possible, as well as techniques such as strong narrative and consistent behaviour from game elements. A player is more likely to be immersed if they see something within the game, and also hear an accompanying sound that justifies what they see.

Immersion can be created in a large amount of ways, but the effectiveness of each technique is completely dependent on the person experiencing it. In other words, immersion is subjective, and therefore creating an immersive gameplay experience is a challenging, yet interesting problem.

2.3 Evaluating Immersion

While creating immersion is one problem, analysing and evaluating it is another. Due to the subjective nature of immersion, care must be taken when stating anything specific about the properties and features of immersion.

In the general term, it has been noted that immersion has the following key properties (Jennett et al., 2008, p. 5):

- Lack of awareness of time
- Loss of awareness of the real world
- Involvement and a sense of being in the task environment

These properties distil into three levels of immersion; engagement, engrossment and total immersion. The engagement level deals with the

player learning how to play the game, and putting time and effort into learning the controls.

The second level, engrossment, is when the controls no longer hinder the player, and the game starts to emotionally affect the player. At this level, the player also starts to become less self-aware, and less aware of their surroundings.

In the final level, total immersion, the game is now all that matters to the player. It is uncommon for games to induce this state onto its players, with the first two levels of immersion being more attainable.

The more a developer can convince a player that they are within the game they are playing, the more it can be said that the player is immersed, be it that they spend more time playing the game than they intended to, or to start emotionally connecting and absorbing with the narrative.

2.4 Narrative Driven Games – I am Here

Narrative driven games are games where the underlying plot is more valued and important than other properties such as game mechanics, graphics, audio and so forth. This can be seen in a popular style of game that many narrative games take the form of; the walking simulator.

Walking simulators are exactly what they sound like; the player walks through an interactive story, occasionally making some small gameplay choices are using very simple mechanics to experience more of the game. In these types of games, gameplay mechanics take the back seat as moving and interesting plot lines tell the player a story through the media of a video game.

The narrative driven game chosen for this project was I am Here (Lavalamp Games, 2018), a walking simulator styled game currently in development by a team from Abertay University. In the game, players must step into the shoes of Karen, a successful writer in her earlier days,

as she searches for her missing partner. Players must explore their surroundings to experience memories of Karen's past and discover the struggles she and her partner faced as a gay couple in the 60's.

I am Here relies heavily on using the environment to tell a story to the player, but currently lacks meaningful audio to accompany the narrative experience. It was therefore deemed a perfect fit for the project.

I am Here is being built in the Unreal 4 Engine (Epic Games, 2018), a games development engine that has become increasingly popular in recent years due to its high degree of portability and free nature. Unreal 4 Engine makes use of a node based Visual Scripting system named Blueprints, which allows for quick implementations of semi-complex systems. The Blueprint system can also be tied into C++ classes allowing for programmers to create Blueprints via C++ that can then be expanded upon within the game engine editor by programmers, designers and artists alike.

3. Methodology

3.1 Overview

The practical side of this investigation intended to explore the immersion created by non-linear audio techniques implemented into a narrative driven game. The following steps were followed to successfully achieve this:

- Research three non-linear audio techniques to determine the most appropriate way for them to be implemented into the narrative driven game being used as the basis for the investigation
- Source and/or generate audio that would be used by the non-linear audio techniques
- Implement the three techniques into the narrative driven game
- Test implemented techniques with external users, observing their reactions to gameplay and the three techniques
- Obtain test data via post-gameplay questionnaires

3.2 Practical Work

3.2.1 Technique Planning

Practical work started with planning how the three non-linear audio techniques discussed in the Literature Review would be implemented into the narrative driven game. The three techniques, which are discussed further in the Literature Review, were as follows:

- Vertical Re-Orchestration, the use of multiple audio tracks layered one on top of the other, that are brought in and out depending on various game states
- Stinger-Based Sequencing, the use of short audio cues to signify in-game events or mechanics
- Sound Property Modulation, the act of modifying audio properties such as pitch, volume and direction to achieve specific effects

The game, in its current state, contained six levels, which were as follows:

- Level 1 has the player navigate a brightly lit house. They must first answer a phone call, then interact with a typewriter and finally head to bed to enter the second level.
- Level 2 has the player navigate a darker version of the house. They must interact with a dog bed, then answer another phone call to enter the third level.
- Level 3 has the player returned to the brightly lit house. Here they must interact with a wedding photo to trigger a cut scene that takes them into the fourth level.
- Level 4 has the player return to the darkened house. They must navigate to a brick that was thrown in through a kitchen window. After interacting with the brick, the player must navigate into the corridor and then the living room to trigger entry into the fifth level.
- Level 5 has the player navigate the brightly lit house one final time. They must interact with a key in the garage, then head down into the basement, navigating a small maze made of various shelves and boxes. Once through the maze, the player must interact with a gravestone to enter the final level.
- Level 6 has the player navigate back through the basement, then walk down a seemingly endless corridor. At the end of the corridor, the game ends.

Each technique would be used once, in one of the six levels present within the game. Therefore, there would be three levels with techniques present, and three levels acting as 'blank' control levels. This would allow for observations to be made during testing on how players interacted with the game, and if the introduction of the techniques influenced or altered how they played.

The simplest technique to start with in terms of how it could be implemented into the game was Stinger-Based Sequencing, due to the technique comprising of short audio clips instead of larger pieces of music. The Stinger technique could be used in a multitude of ways, such as bridging gaps at the start and end of cut scenes present within levels,

or upon entering each new level. Whilst good uses of the technique, they would not be appropriate in terms of testing. Cut scenes were either not present in levels, or only occurred once, reducing the possibility that players would notice the technique. As for using Stingers to introduce the players to each new level, this would void the plan of having techniques only present in one level. Players would become accustomed to hearing it play at the start of every level, and the technique would therefore not be as influential as if it was only used in one level.

It was instead decided to use the technique when the player interacted with plot-related objects within the third level of the game. This would provide enough opportunities for the technique to present itself to the player, and would also allow for observations to be made if the presence of the technique influenced how much the player interacted with objects within a level, encouraging them to discover more and immerse themselves in the narrative of the game.

The second technique looked at was Sound Property Modulation. This technique, along with Vertical Re-Orchestration, involved longer pieces of audio that could be approached in a variety of ways. For the Modulation technique, it was decided to use it as an indirect way of guiding the player to an important plot progression object within the level. As the first level already had audio and visual cues for its plot progression objects, the technique was instead chosen to be implemented into the second level. This decision came with the additional benefit of having the first level act as the primary control level, making it possible to observe how each individual player interacted and progressed through a typical level of the game. Within the second level, sound properties would be modulated as the player walked down the central corridor of the level towards the plot progression object, with the audio becoming louder and increasing in pitch as the player nears the object.

For the final technique, Vertical Re-Orchestration, the focus shifted from having the technique attached to some form of gameplay, and rather the use of the technique directly for atmospheric purposes. It was therefore

decided to implement the technique just before the main plot point twist in the fifth level, in an attempt to build up emotions such as tension and anticipation in the player. The technique requires a large area of game space to maximize its effect, so that the various layers that comprise the audio have time to blend into one another. Fortunately, level five of the game contains a basement area with multiple rooms, providing a perfect place to make use of the Vertical Re-Orchestration technique.

3.2.2 Audio Sourcing & Generation

After the three non-linear audio techniques had been researched, the next step was to source suitable audio that would be used to demonstrate the techniques in-game. To keep the scope of the project as small as possible, it was initially planned to source all audio from royalty-free music websites, as manually creating the necessary audio would take up project time, as well as requiring additional skills and software.

At first, this plan appeared to be successful. A cover of Erik Satie's *Gymnopedie No. 3* by Kevin MacLeod from incompetech.com (Kevin MacLeod, 2018) was selected as the source audio for the modulation technique. This particular piece was chosen due to the fact that the music was slow and had a simple melody, meaning that changes in volume and pitch due to modulation would be more easily recognizable within the game. As the quality of the audio was very high, the only adjustment required was to convert the file type to a 16-bit PCM .wav via Audacity (Audacity Team, 2018), a piece of audio editing software. This is the required file type for any audio files being imported into Unreal Engine 4.16 (Epic Games, 2018), which is the game engine the narrative driven game was built in.

For the stinger technique, a short audio track was chosen from freesound.org (Music Technology Group, 2018). The audio consisted of roughly sixteen seconds of harp and percussion, playing four distinct smaller melodies at approximately four second intervals. These smaller melodies would act as the base stinger variations within the game. The

audio was edited slightly within Audacity to ensure the smaller melodies started exactly at the 0,4,8 and 12 second marks. This was done to make the implementation of the technique a lot simpler, and will be discussed further in '3.2.3 Technique Implementation'. After these edits were made, the audio was exported in the correct format, and then imported into the engine.

It was while attempting to source audio for the re-orchestration technique were a major problem with the initial plan was discovered. The technique required three or more audio files that were all individual layers of a single piece of music. None of the royalty-free sites contained any multi-layered audio, and therefore a change of plan was needed for the last audio technique. The only realistic option available given the limited timeframe was to generate some simple audio using composing software.

After some research into various software options, the browser-based soundtrap.com (Soundtrap AB, 2018) was chosen to generate a re-orchestration audio composition. A minute-long piece of music was composed, with three separate layers consisting of a main grand piano track, and a secondary and tertiary string section track.

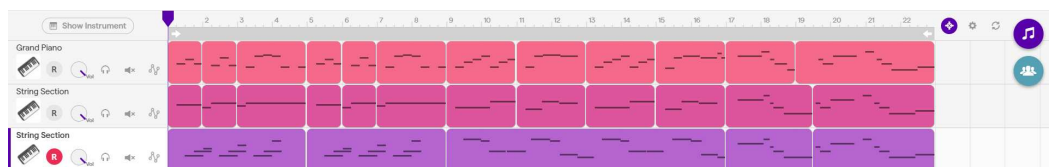


Figure 1 - An overview of the Vertical Re-Orchestration audio composition

Each track was exported from the software individually, taken into Audacity and converted into the correct file format, then imported into the engine.

After some initial testing with the stinger technique, it was decided to replace the stinger audio with a cleaner version, generated via the composing software. A simple single track piece was composed, comprising of four short melodies, each of which was four seconds long.



Figure 2 - An overview of the Stinger-Based Sequencing composition

The track was then exported and loaded into Audacity, where the melody start points were lined up at eight second intervals, and was then exported and loaded into Unreal.

3.2.3 Technique Implementation

With all audio sourced, work could begin on technique implementation. All techniques would be implemented into I am Here, a narrative driven game currently in development by Lavalamp Games using the Unreal 4 Engine. A combination of the Blueprint Visual Scripting system and Sound Cue system was used to handle the base implementation of all three techniques, with individual technique implementations being specific to the level they were implemented into.

Blueprints were chosen to be used over C++ code due to easier prototyping and iteration allowed by Blueprints. While C++ runs faster and is slightly more efficient than when using Blueprints, the complexity and size of the techniques would not have made a noticeable difference if using C++ over Blueprints. Blueprints were also chosen to allow Designers who work on the narrative driven game the project was built into to edit the techniques in the future if required, as Unreal Engine C++ code is not as easily readable or adjustable by non-programmers who are not as familiar with the Engine.

Sound Property Modulation Implementation

Using the imported Modulation audio file discussed in 'Audio Sourcing & Generation', a sound cue asset was generated to act as the audio source for the technique within the game. Looping functionality was enabled on the cue output node, and a continuous modulator was added to the cue just before its output node. The loop would ensure the audio would continue to play until disabled specially via a Blueprint. The continuous modulator contained two custom fields to allow Blueprints to access

volume and pitch properties of the sound cue. These two custom fields were named 'HouseVolume' and 'HousePitch'. The volume field was set within the cue to a default value of zero so that the Modulation audio would not be heard when first entering the level.

This cue was then added as a component to the FirstPersonCharacter Blueprint, which controls a majority of player-based mechanics such as interaction and movement. Adding the cue to the player character in this way ensured that the audio would always be present and accessible wherever required within the game.

As the Modulation technique was only required in the second level, the functionality for this technique was implemented into the Level Blueprint of the second level. Level Blueprints are Blueprints tied to specific levels/maps within a project, able to take references to objects and triggers within the level for use in events and so forth.

Within the Level Blueprint, a node starts playing the Modulation audio file as soon as the player enters the level. A single GetHorizontalDistanceTo node also performs a small calculation that determines the distance the player is from a door at the other end of the level. This distance is stored in a Max Distance float variable, which will be used throughout the level to determine what volume and pitch the Modulation audio should be playing at.

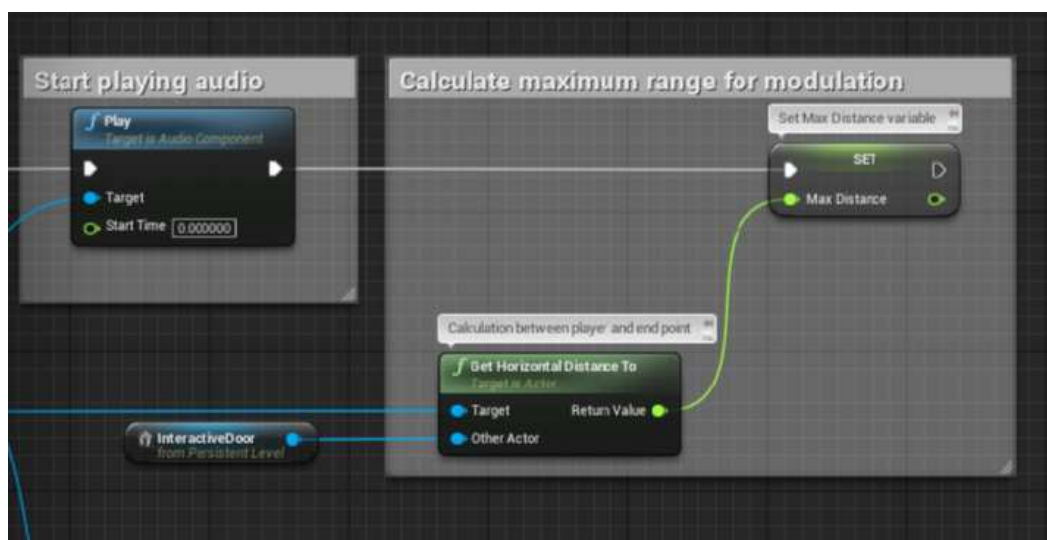


Figure 3 - Modulation Technique Initialisation node overview

The main functionality of the Modulation technique occurs every tick, setting the custom volume and pitch fields of the Modulation audio via a set of calculations and parameter-setting nodes.

First, the player's current distance from the technique end point (the door) is calculated using the same `GetHorizontalDistanceTo` node used at the start of the level. This value is then divided by the Max Distance variable, resulting in a float showing how far the player is away from the end point, with the start point being the furthest possible distance the player can be. For example, if the max distance is 50, and the player's current distance is 45, they have moved a value of 5, and are 0.9 away from the endpoint. The more they move towards the end point, the smaller the value will become. To calculate the current volume percentage at this point, the value is inverted by subtracting the calculated float from 1. Using the previous example, it can be seen that at a distance of 45, the volume of the Modulation audio would be at 0.1 of its maximum volume. This float is then passed to a `SetFloatParameter` node which accesses the sound cue attached to the player and sets the 'HouseVolume' field to the same value as the passed in float value. This results in the volume heard by the player modulating depending on their distance from the end point.

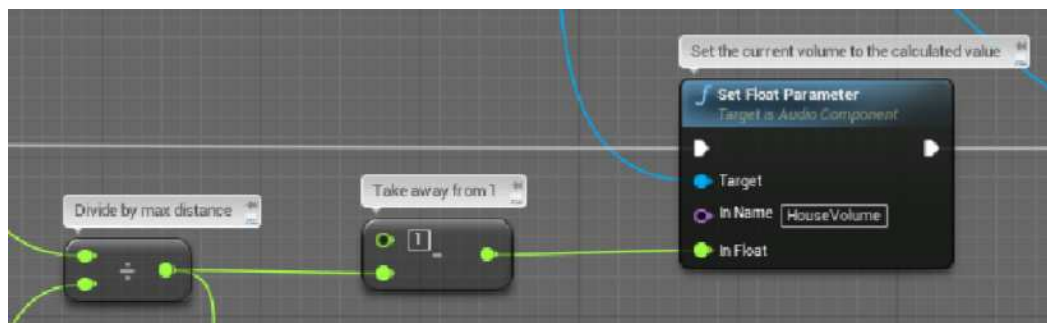


Figure 4 - Volume parameter setting overview

The pitch calculation follows a similar, but slightly more complicated implementation. Initially the pitch calculation was implemented the same way as the volume calculation, but it was soon discovered that this implementation was too precise for pitch modulation. Moving through the corridor would rapidly modulate the pitch in very small increments, with the resulting effect being far from pleasing to the ear. A different

implementation was required that would modulate the pitch in slightly larger increments.

This was achieved via multiplying the fractional distance float by 100, rounding the float to its nearest integer, converting it back into a float and then dividing by 100 to bring it back in range for use with the SetFloatParameter node. By multiplying and dividing by 100, it was ensured the float value would only modulate at 2 decimal point intervals, as opposed to the non-capped decimal point intervals that it was modulating at in the first implementation. This resulted in a far smoother transition between pitches as the player walked up and down the corridor. The pitch float is passed into a SetFloatParameter node which accesses the “HousePitch” field, setting the pitch the player hears depending on their distance from the end point.

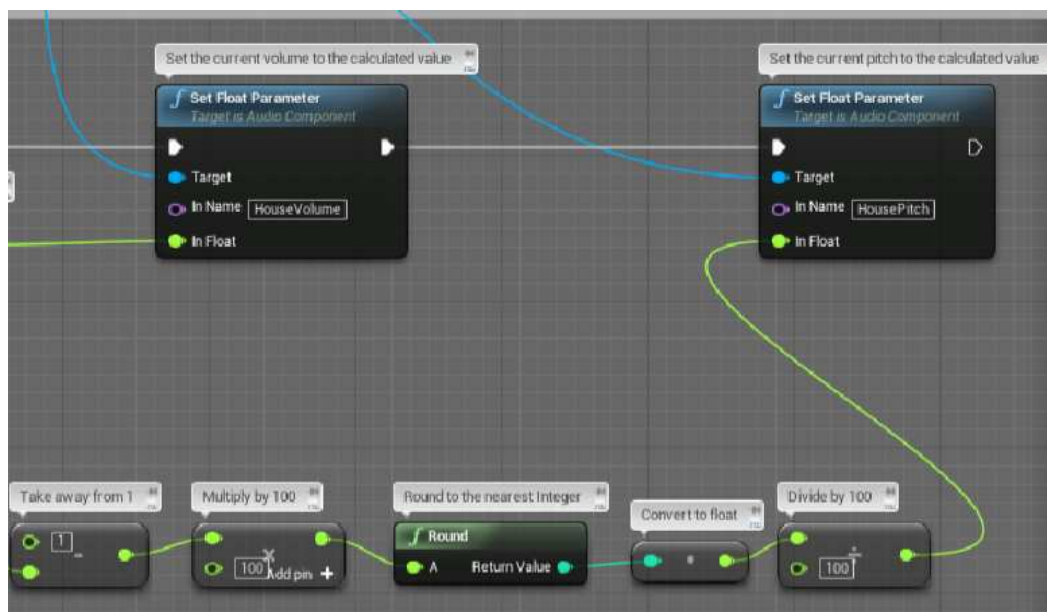


Figure 5 - Pitch parameter calculations and parameter setting overview

The Modulation technique continues until the player enters a trigger box placed just after the technique end point. Upon entering the trigger box, a Fade Boolean is set to true. This Boolean is checked at the start of every tick, and if true, starts fading the audio out instead of modulating the volume and pitch parameters. The volume float is reduced by 0.0025 every tick using the SetFloatParameter node and the ‘HouseVolume’ field. Upon reaching a volume of 0, a Faded Boolean is set to true, signalling the end of the technique.

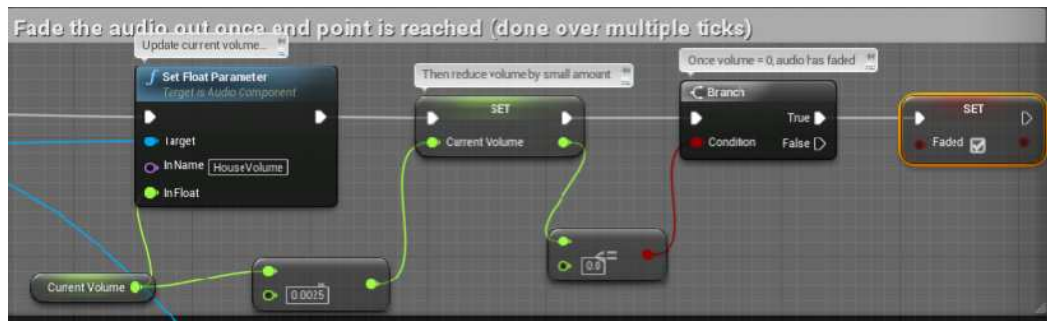


Figure 6 - Modulation audio technique end point overview

Stinger-Based Sequencing Implementation

The sound cue generated for the Stingers required no additional modifications, due to the more simplistic nature of the technique. As the Stingers would only play when the player interacted with certain objects, the cue was attached to the InteractivePickup Blueprint instead of the FirstPersonCharacter Blueprint. This Blueprint handles all interactive objects that can be picked up and inspected by the player.

Within the Blueprint, three simple steps are done to play a Stinger every time the player interacts with a pickup object. First, a check is done on the current level name, ensuring that the Stingers only play in the third level. If this check passes, a random integer between 0 and 2 is generated, then multiplied by 8. This is done so that a value of 0, 8 or 16 is produced, which corresponds to a time in the Stinger audio file where a new Stinger starts. This allows for 3 separate Stingers to be played from only one audio file, minimizing the number of audio files required, as well as minimizing the complexity of the implementation.

After this float is calculated, it is passed in to a FadeIn node. This node starts playing the Stinger audio file at a time matching the float passed in. As soon as the Stinger starts playing, a FadeOut node reduces the volume of the Stinger to 0 over a timeframe of four seconds, which is the length of one Stinger in the audio file. This results in a concise Stinger that can be played just before item interaction begins.

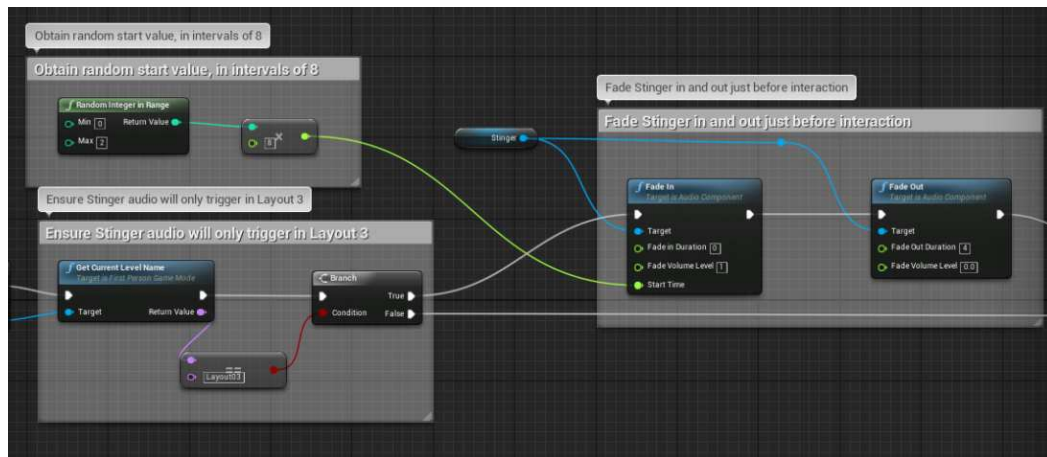


Figure 7 - Stinger technique overview

Vertical Re-Orchestration Implementation

Similar to the previous two techniques, the three imported audio files for the Vertical Re-Orchestration technique were used to generate sound cues. Looping was enabled in the output node, default volume of all cues were set to 1, with the cues then attached to the FirstPersonCharacter Blueprint. No continuous modulators were required with this technique, as the only property that needed changing was volume. As this technique was only present in the fifth level, the Level Blueprint for fifth level was used to implement functionality. During the start of the level, the volume multipliers for the secondary and tertiary layers were set to 0.01 so that they would not be heard upon the technique starting.

When the player enters a trigger box at the start of the basement (the technique start point), a set of three Play nodes start the three layers playing their respective tracks. At this point only the main track can be heard due to the other two tracks having their volume almost muted. Each layer is controlled by a set of coupled trigger boxes placed progressively throughout the basement, and a Timeline to control the volume fade of the layer. A Timeline is a built-in Unreal Engine feature that outputs data over a certain period of time. The time period and output data is determined by curve-like 'tracks' present within the Timeline.

When the play enters the activation trigger for a layer, a check is done to make sure the layer is not already active. If not, it is set active and a Timeline fades the volume for that track from 0.01 to 1 over the course of five seconds.

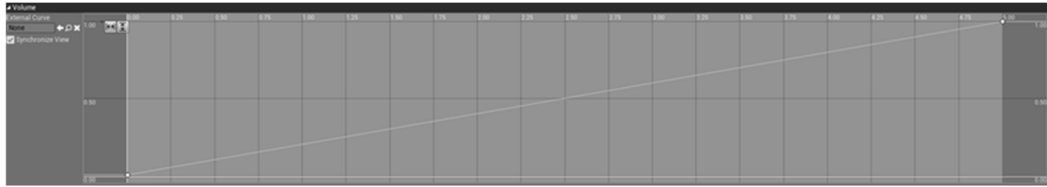


Figure 8 - Vertical Re-Orchestration Timeline fade overview

Similarly, when the player enters the de-activation trigger for a layer, a check is done to make sure the layer is not already inactive. If not, it is set inactive and the same Timeline is used in reverse to fade the track volume from 1 to 0.01.

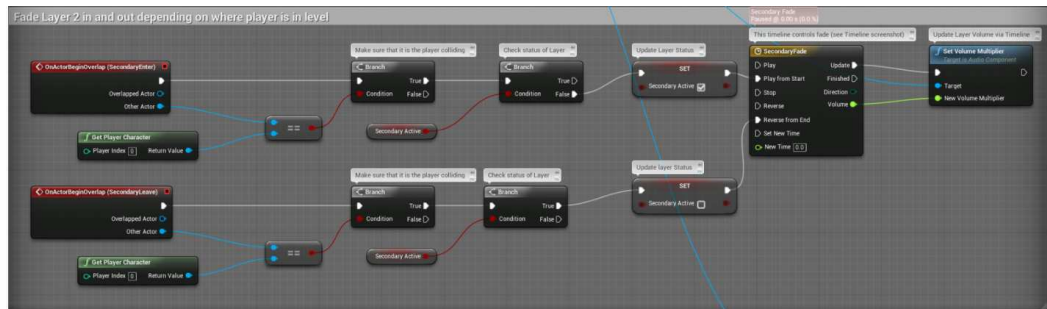


Figure 9 - Vertical Re-Orchestration Layer fade in & out overview

When the player enters a trigger box at the end of the basement (the end of the technique), all three layers are faded out at the same time over a period of three seconds. If the player backtracks at this point, layers can no longer be faded in or restarted.

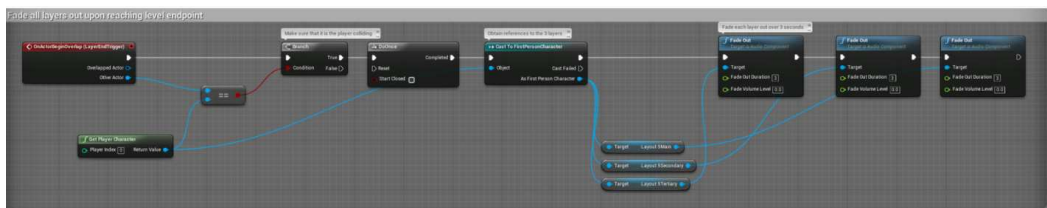


Figure 10 - Vertical Re-Orchestration technique end point overview

3.3 User Testing

3.3.1 User Testing Method

Testing was carried out in two stages, with the first stage acting as a small initial test for properties such as technique volume and placement, whilst the second stage was focused on obtaining more useful data.

Participants took part in two tasks during testing. First, they were instructed to complete a play through of I am Here, taking as long as necessary to make it to the end of the game. Assistance was provided in cases where the participants were unsure of how to proceed through the game, to ensure that they had opportunities to experience all three techniques. During gameplay, observations were made on certain aspects of the participants' behaviour and interactions with the game. After the participants had completed their play through of the game, they were asked to fill out a questionnaire based around what they had experienced in-game. Both parts of testing were equally important in determining how effective the techniques were at immersing players.

3.3.2 Gameplay Observation

After gaining consent to perform testing and being given a short briefing on the project, participants were instructed to play through I am Here as they would typically play through any other game of the walking sim/narrative driven genre. As participants navigated the first level of the game, notes were made on various statistics such as how fast they proceeded through the level, how long they spent in particular parts of the level and how many of the various objects they interacted with. These notes would be used as a reference in later levels with techniques present to see if the presence of techniques affected the statistics, such as Stingers causing the participant to interact with more objects or Modulation influencing the participant to move to a plot-specific area more quickly.

3.3.3 Post-Gameplay Questionnaire

After playing through and completing all six levels of the game, participants were tasked with filling out a questionnaire. The questionnaire (as shown in Appendix I) comprised of three main sections. The first section contained three questions designed to allow for the use of weighted testing. Participants could answer from one through to five, with one being “Not at all” and five being “Very much so”.

The three questions were as follows:

- *Do you enjoy playing narrative driven games?*
- *Do you enjoy playing ‘walking simulator’ style games?*
- *How important do you feel sound is in a game?*

Each question was given a possible weighted score between zero and ten, with the scores for each question summed to provide a total score for the participant. This score would be used to determine the relevancy of the participant in relation to the aims of the project. Participants with larger interests in narrative driven and walking simulator style games, as well as game audio, would receive a higher weighting for questions further along in the questionnaire.

After a small recap of the three techniques and where they were located within the game, participants were then asked to answer eight questions on how the techniques affected various aspects of the game, such as how much the game held the participant’s attention, or how emotionally attached they felt to the game whilst playing. These questions were all based around the numerous ways in which immersion is defined, and it was hoped that the vagueness of the questions would provide more diverse answers instead of asking participants if they simply ‘felt immersed’. Questions were arranged in the same way as the previous section, with participants being able to respond with a numerical response ranging from one to five, again with one being “Not at all” and five being “Very much so”.

The final section of the questionnaire consisted of multiple free text boxes to allow participants to give more detailed information and feedback about certain techniques or the audio in general. Using the answers provided in the second and third sections, combined with the weightings from the first section, a general evaluation could be made on how successful each technique was at creating immersion within the game.

3.3.4 Testing Data Processing

To produce a more accurate evaluation, weighting the responses given by participants according to their interest in narrative driven games, walking simulator style games and games audio was necessary. Each participant received a weighting value based on their answers to the three questions at the start of the questionnaire, which was then used as a multiplier for the eight answers given in the following section. Each of the three initial questions was valued from zero to ten. Lower values corresponded to a less relevant answer, and higher values to a more relevant answer. The weighting of each participant was calculated using the following formula:

$$ParticipantWeighting = \frac{ParticipantTotal}{AverageParticipantTotal}$$

After the calculation of participant weightings, the averages of all participant answers to the second section questions could be calculated using the following formula:

$$AverageValue = \frac{\sum_n^{TotalParticipants} (ParticipantWeighting_n * AnswerValue_n)}{TotalParticipants}$$

Answers to the free text box questions were then qualitatively analysed to determine if there were any recurring issues or agreements amongst participants.

4. Results

4.1 Testing Stage 1

4.1.1 Participant Stage 1 Results & Weighting Values

Participant	Question 1	Question 2	Question 3	Score	Weighting
01	10	2	8	20	1.25
02	4	2	6	12	0.75

Table 1 - Participant Phase 1 Stage 1 Results & Weighting Values

4.1.2 Participant Stage 2 Results & Question Averages

Question 1 – To what extent did the game hold your attention

Participant	Weighting	Main	Modulation	Stingers	Layered
01	1.25	10	6	8	10
02	0.75	4	2	6	8
Average		7.75	4.5	7.25	9.25

Table 2 - Participant Responses Phase 1 Stage 2 Question 1

Question 2 – To what extent did you put effort into playing the game

Participant	Weighting	Main	Modulation	Stingers	Layered
01	1.25	10	2	0	0
02	0.75	2	2	4	6
Average		7	2	1.5	2.25

Table 3 - Participant Responses Phase 1 Stage 2 Question 2

Question 3 - To what extent did you lose track of time whilst playing?

Participant	Weighting	Main	Modulation	Stingers	Layered
01	1.25	10	2	8	6
02	0.75	4	2	4	4
Average		7.75	2	6.5	5.25

Table 4 - Participant Responses Phase 1 Stage 2 Question 3

Question 4 - To what extent did you feel that the game was something you were experiencing, rather than something you were just doing/playing?

Participant	Weighting	Main	Modulation	Stingers	Layered
01	1.25	10	2	2	10
02	0.75	6	2	6	6
Average		8.5	2	3.5	8.5

Table 5 - Participant Responses Phase 1 Stage 2 Question 4

Question 5 - To what extent did you feel as though you were moving through the game according to your own will?

Participant	Weighting	Main	Modulation	Stingers	Layered
01	1.25	2	4	2	2
02	0.75	4	2	4	8
Average		2.75	3.25	2.75	4.25

Table 6 - Participant Responses Phase 1 Stage 2 Question 5

Question 6 - To what extent did you feel emotionally attached to/interested in the game?

Participant	Weighting	Main	Modulation	Stingers	Layered
01	1.25	6	8	8	10
02	0.75	4	2	2	6
Average		5.25	5.75	5.75	8.5

Table 7 - Participant Responses Phase 1 Stage 2 Question 6

Question 7 - To what extent were you interested in seeing how the game's events would progress?

Participant	Weighting	Main	Modulation	Stingers	Layered
01	1.25	2	2	2	2
02	0.75	2	2	2	6
Average		2	2	2	3.5

Table 8 - Participant Responses Phase 1 Stage 2 Question 7

Question 8 - To what extent did you feel immersed within the game?

Participant	Weighting	Main	Modulation	Stingers	Layered
01	1.25	8	4	8	10
02	0.75	2	2	8	8
Average		5.75	3.25	8	9.25

Table 9 - Participant Responses Phase 1 Stage 2 Question 1

4.1.3 Participant Stage 3 Free Text Box Analysis

Free Text Boxes – Vertical Re-Orchestration

Participants felt that the vertical re-orchestration technique enhanced the level due to the build-up and indication that something important was coming. Both participants noted that the volume of the technique was too loud, which ruined the technique slightly.

Free Text Boxes – Stinger Bases Sequencing

Participants agreed that the sound was non-intuitive and detracted from the experience, as it made the game feel more like an actual game rather than a narrative driven experience, due to expecting to hear sound every time an object was picked up.

Free Text Boxes – Sound Property Modulation

Participants were actively unaware of the technique, though did remark that this was not necessarily a bad thing.

Free Text Boxes – Preferred Audio Technique

Participants agreed that the vertical re-orchestration technique in the basement was their preferred audio technique due to the build-up and immersion created by the technique. They also re-iterated that the volume of certain audio cues detracted from the overall experience.

4.2 Testing Stage 2

4.2.1 Participant Stage 1 Results & Weighting Values

Participant	Question 1	Question 2	Question 3	Score	Weighting
03	8	8	10	26	1.04
04	8	8	10	26	1.04
05	10	8	8	26	1.04
06	8	6	8	22	0.88

Table 10 - Participant Phase 2 Stage 1 Results & Weighting Values

4.2.2 Participant Stage 2 Results & Question Averages

Question 1 – To what extent did the game hold your attention?

Participant	Weighting	Main	Modulation	Stingers	Layered
03	1.04	8	10	4	10
04	1.04	6	6	4	8
05	1.04	8	8	0	8
06	0.88	6	2	4	8
Average		7.04	6.68	2.96	8.52

Table 11 - Participant Responses Phase 2 Stage 2 Question 1

Question 2 – To what extent did you put effort into playing the game?

Participant	Weighting	Main	Modulation	Stingers	Layered
03	1.04	8	10	6	10
04	1.04	4	4	4	4
05	1.04	6	0	0	6
06	0.88	6	0	0	0
Average		6	3.64	2.6	5.2

Table 12 - Participant Responses Phase 2 Stage 2 Question 2

Question 3 – To what extent did you lose track of time whilst playing?

Participant	Weighting	Main	Modulation	Stingers	Layered
03	1.04	8	10	4	10
04	1.04	6	6	4	8
05	1.04	8	0	8	0
06	0.88	4	2	4	4
Average		6.6	4.6	5.04	5.56

Table 13 - Participant Responses Phase 2 Stage 2 Question 3

Question 4 – To what extent did you feel that the game was something you were experiencing, rather than something you were just doing/playing?

Participant	Weighting	Main	Modulation	Stingers	Layered
03	1.04	8	10	6	10
04	1.04	8	8	6	8
05	1.04	8	8	8	8
06	0.88	8	2	4	8
Average		8	7.2	6.08	8.52

Table 14 - Participant Responses Phase 2 Stage 2 Question 4

Question 5 - To what extent did you feel as though you were moving through the game according to your own will?

Participant	Weighting	Main	Modulation	Stingers	Layered
03	1.04	10	10	2	10
04	1.04	10	6	6	6
05	1.04	8	8	0	8
06	0.88	8	2	6	8
Average		9.04	6.68	3.4	8

Table 15 - Participant Responses Phase 2 Stage 2 Question 5

Question 6 - To what extent did you feel emotionally attached to/interested in the game?

Participant	Weighting	Main	Modulation	Stingers	Layered
03	1.04	10	10	2	10
04	1.04	6	8	6	8
05	1.04	8	10	0	10
06	0.88	6	2	4	8
Average		7.56	7.72	2.6	9.04

Table 16 - Participant Responses Phase 2 Stage 2 Question 6

Question 7 - To what extent were you interested in seeing how the game's events would progress?

Participant	Weighting	Main	Modulation	Stingers	Layered
03	1.04	8	10	2	10
04	1.04	8	6	6	8
05	1.04	10	10	0	10
06	0.88	6	2	2	6
Average		8.08	7.2	2.52	8.6

Table 17 - Participant Responses Phase 2 Stage 2 Question 7

Question 8 - To what extent did you feel immersed within the game?

Participant	Weighting	Main	Modulation	Stingers	Layered
03	1.04	8	10	2	10
04	1.04	8	8	6	8
05	1.04	8	8	0	8
06	0.88	6	2	2	6
Average		7.56	7.2	2.52	8.08

Table 18 - Participant Responses Phase 2 Stage 2 Question 8

4.2.3 Participant Stage 3 Free Text Box Analysis

Free Text Boxes – Vertical Re-Orchestration

All participants agreed that this technique enhanced the level it was present in, increasing the emotions they were feeling while moving through the basement. Some suggested they would like to see this technique used in other parts of the game.

Free Text Boxes – Stinger Bases Sequencing

The general consensus amongst participants was that this technique detracted from their game experience, stating that it broke immersion due to being too frequent and not adding anything of importance to the experience.

Free Text Boxes – Sound Property Modulation

Participants were split on this technique. Some of the participants said that it assisted in generating a 'spooky' atmosphere, lending itself to the theme of the level, while others mentioned that the technique was uncomfortable to listen to and made the audio stand out too much, which detracted from the game experience.

Free Text Boxes – Preferred Audio Technique

All participants agreed that the vertical re-orchestration technique was their preferred technique, stating that it contributed most to the emotional and immersive aspects of the game. One made the comparison that this technique was effective compared to the Modulation technique due to feeling that the vertical re-orchestration technique was not the focus of the scene, and was more a subtle influence on their feelings.

5. Discussion

As previously discussed, the project had two main phases for development and testing. The first phase consisted mainly of initial implementations and ensuring the techniques were at an acceptable state for wider testing. Results and findings from this first phase were used to improve technique properties and placement during the second phase, where the techniques were then tested with more participants.

Techniques during the first phase were expected to be less effective at enhancing immersion due to them being the first developed iteration, whilst it was expected that feedback on techniques during the second phase would provide more useful to the project as they were more refined.

5.1 Testing Stage 1

5.1.1 Vertical Re-Orchestration

During their play through of the game, both participants were observed to have a visible reaction to the technique, noticing the effect as soon as they entered the basement. They also both took their time proceeding through the basement, when they had rushed through other parts of the game in previous levels. This may indicate that the technique was having a noticeable impact on their investment into their surroundings, one of the components of how immersion is defined.

These statements are reinforced by the participants answers in the second part of the questionnaire, where responses to how the Layered audio affected their various answers performed either at the same level or higher than the other two techniques (Questions 1,4,5,6,7,8). Out of these six questions, four had an average response of 8.5 or higher, signifying that the technique had clearly enhanced the participant's immersion within the game.

Within the Free Text Box responses, both participants made it clear that the Vertical Re-Orchestration technique was their favourite, stating that

the technique created a build-up of emotions as they proceeded through the basement. It was however commented that the technique's volume was too loud, which detracted slightly from the overall experience.

5.1.2 Stinger-Based Sequencing

Both participants noticed the technique, with one of the participants interacting with a single item multiple times. Apart from this, the presence of Stingers did not seem to affect the average number of interactions, as they were interacting with every possible thing in previous levels, and continued this in the level with the Stinger technique present.

Within the questionnaire, Stingers performed better than the Modulation technique in most of the questions, but only outperformed Vertical Re-Orchestration in Question 3, which dealt with participants losing track of time as they played. The average response amongst all eight questions was quite unstable however, going from as low as 1.5 (Question 2) all the way up to a value of 8 (Question 8).

In the Free Text Box responses, participants made it clear that they were not fond of the technique, saying it detracted from the overall experience, and made it feel less like a narrative driven experience and more like a typical game. One participant noted that they did appreciate the technique as it made them feel rewarded for interacting with objects, but that it felt out of place in this type of game, lending to the previous argument.

5.1.3 Sound Property Modulation

Unlike the previous two techniques, both participants did not visibly seem to notice or react to the technique upon entering the level, proceeding down the corridor and diverting into the living room without seemingly being drawn to the other end of the corridor, as was the intention of the technique. One of the participants did eventually visibly notice the technique as they approached the other end of the corridor.

Modulation performed poorly in the questionnaire, scoring low average response values across all eight questions. Surprisingly, the only question it outperformed another technique in was Question 5, which dealt with the participants feeling like they were moving through the game of their own will. This is most likely due to the technique not being as noticeable as it was intended to be, as the technique was meant to indirectly guide the player to the end of the corridor.

In the Free Text Box responses, participants confirmed that they were unaware of the technique. They heard the audio of the technique towards the end of the corridor, noting that they heard it increase in volume as they moved closer to the end of the corridor. They did not however notice the other modulation of pitch. It is hard to say if this is because the rate at which the pitch changed was not appropriate, or if the participants believed it was part of the song used in the technique. Participants mentioned that their unawareness of the technique was not necessarily a bad thing, implying that the technique could maybe have been used as a more general audio effect to build atmosphere in a way similar to the Vertical Re-Orchestration technique.

5.2 Testing Stage 2

For the second phase of testing, the overall volume of all tracks for the Vertical Re-Orchestration technique were lowered by 50%, and the first track was made to fade in rather than start playing immediately at full volume. It was hoped this would improve responses to the technique when introduced to the participant, as remarks in the previous testing phase mentioned that the sudden loud piano music after a very quiet level pulled them out of their immersion.

Stinger fade times and volumes were also slightly adjusted to better assist in separating them from the other game various pieces of audio present within the level.

5.2.1 Vertical Re-Orchestration

Only one of the four participants visibly reacted to the technique, with the other three making their way through the basement without looking around too much. The participant who reacted to the technique appeared to stop at points to listen to the music. None of the participants experimented with the technique by tracing back their steps, all kept moving through the basement in a single direction.

Vertical Re-Orchestration again outperformed the other techniques in terms of average question response values, with all eight questions scoring above a value of 5, and eight out of the ten questions scoring a value above 8. This again showed that participants found this technique highly valuable to the immersion they experienced within the game.

Within the Free Text Box responses, similarly to the first phase of testing, all participants agreed that the Vertical Re-Orchestration technique was their favourite technique of the three, enhancing emotions they experienced as they traversed the basement. Comments from some participants mentioned they enjoyed the technique so much they would not have minded seeing more of the technique in other levels, reiterating the statement of how much this technique impacted their immersion.

5.2.2 Stinger-Based Sequencing

Out of the four participants, two did initially not interact with any objects in the level, almost missing the technique. None of the participants had a visible reaction to the technique, with only one of the participants interacting with a single item multiple times. With the two participants who at first were not aware of the technique, discovering the technique did not seem to encourage them to go back and interact with them. Overall, the Stingers did not seem to appeal to any of the participants.

The opposite from the first phase of testing, the Stinger technique performed poorly in the questionnaire responses, only having a higher average value than the Moderation technique in Question 3, which dealt

with the player losing track of time. Average response values mostly ranged between 2 and 3, with an unexpected high of 6.08 in Question 4, which dealt with the participant feeling the game was something they were experiencing rather than playing.

In the Free Text Box responses, all participants stated that they the Stinger technique detracted from their overall experience. Various comments were made on the technique, such as the frequency that the player experienced the technique made it less subtle and emotionally impacting. It was also commented that it did not add anything of importance to the experience, and was simply telling the player they had interacted with something.

5.2.3 Sound Property Modulation

Two out of the four participants visibly reacted to the technique, and also appeared to experiment with the technique slightly, moving up and down the corridor with intermittent pauses. The presence of the technique did not however influence any of the participants to move directly to the other end of the corridor, as all four participants diverted to explore the living room and kitchen of the level.

Within the questionnaire Modulation performed reasonably well, with six of the questions reaching average values of 6.68 or higher, and four reaching average values of 7.2 or higher. Even though no changes were made to this technique, the technique perform vastly greater than it did in the first testing phase, and is therefore most likely due to the tastes and personalities of the participants.

The consensus was split between participants in the Free Text Box responses, with some of the participants saying that the technique helped develop the atmosphere and feeling of the level, while others noted that the technique was too obvious and detracted from the game experience by making the audio stand out too much.

6. Conclusion

6.1 Research Implications

The project can be deemed an overall success, as three non-linear audio techniques were successfully implemented and then evaluated. All participants found that one or more of the techniques had a positive experience on the overall immersion they experienced within the game. As can be seen in the Discussion section previously, the Vertical Re-Orchestration technique was the clear favourite amongst all participants, with no negative comments (apart from some small volume issues in the first phase of testing) and high scores in the questionnaire responses. Looking at the results from all three techniques, it is clear that the addition of non-linear audio techniques to a narrative driven game enhances immersion experienced by people playing the game. Care must however be taken how and where the techniques are used, as even though the technique may seem suitable, inappropriate use of the techniques could cause them to detract from the overall immersion instead.

6.2 Future Work

6.2.1 Implementation Experimentation

All three techniques were implemented in specific ways. Vertical Re-Orchestration was used to add atmosphere to a certain area, Modulation was used to indirectly guide players and Stingers were used to enhance item interaction. As briefly discussed in 3.2.1 Technique Planning, there are other ways in which these techniques could have been implemented, like using Stingers to start and close cut scenes etc. Implementing the techniques in ways different to the way they had been implemented in this project would provide a wider array of data on how techniques affect player immersion, as the results gained in this project were heavily affected by the game mechanics they were tied to.

Another implementation that could be further looked at is the Sound Property Modulation technique. In this project, the only two properties that

were modified were sound and pitch. In future work, properties such as echo and reverb could be experimented with to see if they could be used to enhance player immersion.

6.2.2 Expanded Testing

In total, only eight participants were sought to test and evaluate the techniques. This number is very low, and also consisted of a very specific demographic, that being game development students within a certain age range, all from Abertay University. This again impacts the results discovered in this project, as they are only really relevant to this demographic. By testing the techniques over a wider demographic, such as age, gaming background, audio background and so forth, more accurate data could be found.

Appendices

Appendix I – Questionnaire

Questionnaire Page 1

Questionnaire No. _____

Date: _____

Please answer the following questions by marking one of the boxes (1 is "Not at all", 5 is "Very much so").

	1	2	3	4	5
1. Do you enjoy playing narrative-driven games?					
2. Do you enjoy playing 'walking simulator' style games?					
3. How important do you feel sound is in a game?					

Throughout the game, certain audio techniques were present to alter the flow, presence and absorption of the game. These techniques were present as follows:

- As you approached the dog bed the first time you entered the 'dark' house
- As you interacted with items upon returning to the 'well-lit' house
- As you approached the brick in the kitchen upon yet again entering the 'dark' house

Please answer the following questions by marking one of the boxes (1 is "Not at all", 5 is "Very much so").

If you felt that the presence of one (or more) of the audio techniques mentioned above affected your answer to a question, please indicate how much it affected your answer by marking one of the boxes (1 is "Not at all", 5 is "Very much so").

	1	2	3	4	5
1. To what extent did the game hold your attention? Did the audio technique present with the dog bed affect this? Did the audio technique present with the item interaction affect this? Did the audio technique present with the brick affect this?					
2. To what extent did you put effort into playing the game? Did the audio technique present with the dog bed affect this? Did the audio technique present with the item interaction affect this? Did the audio technique present with the brick affect this?					
3. To what extent did you lose track of time whilst playing? Did the audio technique present with the dog bed affect this? Did the audio technique present with the item interaction affect this? Did the audio technique present with the brick affect this?					
4. To what extent did you feel that the game was something you were experiencing, rather than something you were just doing/playing? Did the audio technique present with the dog bed affect this? Did the audio technique present with the item interaction affect this? Did the audio technique present with the brick affect this?					
5. To what extent did you feel as though you were moving through the game according to your own will? Did the audio technique present with the dog bed affect this? Did the audio technique present with the item interaction affect this? Did the audio technique present with the brick affect this?					
6. To what extent did you feel emotionally attached to/interested in the game? Did the audio technique present with the dog bed affect this? Did the audio technique present with the item interaction affect this? Did the audio technique present with the brick affect this?					
7. To what extent were you interested in seeing how the game's events would progress? Did the audio technique present with the dog bed affect this? Did the audio technique present with the item interaction affect this? Did the audio technique present with the brick affect this?					
8. To what extent did you feel immersed within the game? Did the audio technique present with the dog bed affect this? Did the audio technique present with the item interaction affect this? Did the audio technique present with the brick affect this?					

What part of the game did you prefer in terms of audio, and why?

Questionnaire Page 2

Did parts of the game without certain audio detract from the experience due to the lack of said audio?

Technique 1 – Vertical Re-Orchestration

This technique was the use of layered audio in the 4th Layout (with the brick in the kitchen)

Do you feel this technique enhanced/detracted from your experience with the game, and why?

(Optional) Any other specific feedback on the use of this technique within the game (volume, range of the technique etc.)

Technique 2 – Stinger-Based Sequencing

This technique was the use of short audio cues in the 3rd Layout (return to well-lit house)

Do you feel this technique enhanced/detracted from your experience with the game, and why?

(Optional) Any other specific feedback on the use of this technique within the game (volume, frequency of the technique etc.)

Questionnaire Page 3

Technique 3 – Sound Property Modulation

This technique was the use of tempo (speed)/pitch (frequency)/volume modification in the 2nd Layout (with dog bed)

Do you feel this technique enhanced/detracted from your experience with the game, and why?

(Optional) Any other specific feedback on the use of this technique within the game (volume, range of the technique etc.)

Out of the three techniques discussed, which did you prefer, and why?

(Optional) Any other general comments or feedback on the use of audio within the game

Appendix II – Sample Answers

Part 1 Sample Answers

Questionnaire No. __6__

Date: 27/04/18

Please answer the following questions by marking one of the boxes (1 is "Not at all", 5 is "Very much so").

	1	2	3	4	5
1. Do you enjoy playing narrative-driven games?				x	
2. Do you enjoy playing 'walking simulator' style games?			x		
3. How important do you feel sound is in a game?				x	

Part 2 Sample Answers

	1	2	3	4	5
1. To what extent did the game hold your attention? Did the audio technique present with the corridor affect this? Did the audio technique present with the item interaction affect this? Did the audio technique present with the basement affect this?	X	X	X	X	
2. To what extent did you put effort into playing the game? Did the audio technique present with the corridor affect this? Did the audio technique present with the item interaction affect this? Did the audio technique present with the basement affect this?			X		
3. To what extent did you lose track of time whilst playing? Did the audio technique present with the corridor affect this? Did the audio technique present with the item interaction affect this? Did the audio technique present with the basement affect this?	X	X X X			
4. To what extent did you feel that the game was something you were experiencing, rather than something you were just doing/playing? Did the audio technique present with the corridor affect this? Did the audio technique present with the item interaction affect this? Did the audio technique present with the basement affect this?	X	X		X X	
5. To what extent did you feel as though you were moving through the game according to your own will? Did the audio technique present with the corridor affect this? Did the audio technique present with the item interaction affect this? Did the audio technique present with the basement affect this?	X		X	X X	
6. To what extent did you feel emotionally attached to/interested in the game? Did the audio technique present with the corridor affect this? Did the audio technique present with the item interaction affect this? Did the audio technique present with the basement affect this?	X	X	X	X	
7. To what extent were you interested in seeing how the game's events would progress? Did the audio technique present with the corridor affect this? Did the audio technique present with the item interaction affect this? Did the audio technique present with the basement affect this?	X X		X X		
8. To what extent did you feel immersed within the game? Did the audio technique present with the corridor affect this? Did the audio technique present with the item interaction affect this? Did the audio technique present with the basement affect this?	X X		X X		

Part 2 Free Text 1 Sample Answers

What part of the game did you prefer in terms of audio, and why?

My preferred game section was the basement, the building music was a nice effect for immersion and made me want to progress further through the basement.

Part 2 Free Text 2 Sample Answers

Did parts of the game without certain audio detract from the experience due to the lack of said audio?

The 5th layout felt quite empty before the basement section without any ambient audio

Part 3 Vertical Re-Orchestration Free Text Sample Answers

Technique 1 – Vertical Re-Orchestration

This technique was the use of layered audio in the 5th Layout (with the basement)

Do you feel this technique enhanced/detracted from your experience with the game, and why?

This technique enhanced the playing experience for me as it immersed the player in the emotions of the scene and encouraged them to progress further

(Optional) Any other specific feedback on the use of this technique within the game (volume, range of the technique etc.)

Part 3 Stinger-Based Sequencing Free Text Sample Answers

Technique 2 – Stinger-Based Sequencing

This technique was the use of short audio cues in the 3rd Layout (return to well-lit house)

Do you feel this technique enhanced/detracted from your experience with the game, and why?

I felt this technique detracted from the experience as the sound was rather immersion breaking and did not add anything of importance to the game.

(Optional) Any other specific feedback on the use of this technique within the game (volume, frequency of the technique etc.)

Part 3 Sound Property Modulation Free Text Sample Answers

Technique 3 – Sound Property Modulation

This technique was the use of pitch (frequency)/volume modification in the 2nd Layout (with the corridor)

Do you feel this technique enhanced/detracted from your experience with the game, and why?

While it didn't detract from the experience I did not feel it enhanced it, partially because the music chosen did not fit with the atmosphere at the time. I actually forgot that this technique had been used until filling out the form.

(Optional) Any other specific feedback on the use of this technique within the game (volume, range of the technique etc.)

Part 3 General Free Text Sample Answers

Out of the three techniques discussed, which did you prefer, and why?

Basement, out of the two techniques I noticed it was the most beneficial to the immersion of the experience.

(Optional) Any other general comments or feedback on the use of audio within the game

Footstep are really loud.

8) Observations - Tester 03 - has played the game before

Layout 2 - Modulation
Didn't visibly react to technique - Passed through layout in normal way - Didn't experiment with technique

Layout 3 - Stingers
Didn't visibly react to technique - Interacted with some items multiple times - After ignoring some pickups in spawn location, after picking up other items, returned to pickup items in spawn location.

Layout 5 - Layers
Didn't visibly react to technique - Didn't experiment with technique - Travelled through basement very quickly

9) Observations - Tester 09 - has played the game before

Layout 2 - Modulation
Visibly reacted to technique - Experimented with the technique a little

Layout 3 - Stingers
Didn't pick up any items nor did not experiment technique

Layout 5 - Layers
Seemed to notice technique - Took their base guy through basement, seemed to listen to technique at points

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