Self-Directed
Level Exploration

An Interactive Qualifying Project
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Abstract

When used in informal learning environments, self-directed exploration can be a great learning tool. By their nature, video games can be designed to effectively facilitate self-directed exploration, and can be a powerful learning tool by providing an engaging setting in which to learn. The goal of this project was to create a game environment that would facilitate self-directed exploration by adapting various learning methods for use in the planning of the prototype game environment. Our team conducted a study through which college students explored the environment and answered a survey to determine whether the team had succeeded on the topic.

Executive Summary

Introduction

Self-directed exploration, in a learning environment, is when people explore and actively engage with concepts to develop their understanding. It can provide a more memorable and rewarding learning experience for people than simply for doing as they're told. One style of education which relies heavily on self-directed exploration is discovery learning, in which "the learner is allowed to explore and become actively engaged with concepts, objects, or the physical environment in order to develop their understanding of it.[1]" In discovery learning, the teacher is a "facilitator," not an "instructor," since their job is to organize a learning environment with the appropriate resources "to encourage the learner's self-directed curiosity and problem-solving skills. [1]"

Structured appropriately, video games can be excellent tools for discovery learning and any other method of teaching which relies on self-directed exploration. In a book written as a guide for video game development, Scott Rogers, an accomplished game developer, discusses methods to organizing a game that encourages exploration of the game environment. A compelling video game that facilitates self-directed exploration will have been organized by game developers to encourage the player's self-directed curiosity and problem solving skills,

much like how teachers in discovery learning perform their duties to organize the learning environment.

This project is part of an ongoing effort to create a video game which will teach musicianship skills in fun and engaging ways, with the goal being for the completed game to be a suitable tool in informal (self-led) learning environments with game mechanics that make it fun and easy to learn. To that end, this project aims to design a 3-dimensional game environment which will support that goal by encouraging self-directed exploration of the game environment. Once the prototype is complete the team will use a survey to determine how well the goal was accomplished, and whether or not the prototype would be suitable for use in an education-oriented game.

Using our research and inspiration from the games Bloodborne[2] and Xenoblade chronicles[3], which facilitate and feature exploration, we tried to ensure our explorable 3-dimensional environment would be ideal for the game's vision of creating a game which teaches musicianship skills. Once we completed that step, we had some college students that are taking music courses, or with an interest in music, play the level see how well our game environment facilitated self-directed exploration. We had 70% of the 20 responses that could find more than two out of six objects that we put in the game, without any hints. We feel we achieved our goal of setting up the environment in a way that led players to explore the game content by themselves.

Background

Discovery learning is a style of education which allows its students to explore subjects and engage them in order to better understand them. In discovery learning a teacher will organize the learning environment to nurture the learner's self-directed curiosity and problem-solving skills. Jean Piaget established the the principles of discovery learning, and stressed that students should be interacting with one another in order to update and review their understanding of concepts. Through that process, the students are learning from their own discoveries instead of experiencing instructional learning.

According to the book *Level Up!: The Guide to Great Video Game Design* [7], written by Scott Rogers, the first step to designing a video game environment is making a map.There's two styles of maps a game developer can choose from: alley maps and island maps. Alley maps keep the player restrained to a fixed path, although there can be branches in that path, like a hallway or alley. These kinds of maps are easy to plan for since player movement is limited in some way and the game developer doesn't have to expect a large disparity in how different players approach certain areas. Conversely, island maps are more complex to plan for since there's typically more freedom to how the player experiences the game. Since island maps are more wide open, things like scripted events require careful planning since players may not be standing or looking where the developers expected. Stringing weenies, the practice of organizing interesting landmarks and objects in a way to draw people in a certain direction, is also important when planning the layout of a map, even in alley maps.

Bloodborne is a game which adheres to the alley design and does an excellent job according to Scott's guidelines to video game design. Early on, the game has excellent weenie placement to draw players in the right directions, using buildings, enemies, sounds, fire, items, and unique looking objects in the environment. The game almost always rewards exploration through branching paths with unique items, shortcuts, special interactions with other characters, and enemies, as Scott suggests.

Xenoblade Chronicles is a good example of a primarily island game that makes excellent use of alleys and does an great job of adhering to Scott's guidelines. The art direction and massive size of the game's setting can be considered a weenie, since there's almost always extraordinarily large landmarks that will pull the player in different directions. Furthermore, experience points, rare enemy encounters (with rare item drops and lots of experience points the reward for victory), and access to various quests are all rewards for exploring in this game.

Methodology

After careful review of our research, we set out to make the level. The team made a map early on which embodied the lessons learned from our research, first focusing on creating an "alley" level. The team later switched to a mixture of "alley" and "island" level designs, with the hopes of using the strengths of both types of levels effectively.

The Team decided to use Unity as the engine to build the level. Compared to other mainstream game engines in the industry, such as Unreal 4, Unity is more beginner friendly and is also less resource-intensive for computers. Since the goal of this project is not building a fantastic AAA game environment, Unity satisfies the demand that the team needs. Within Unity,

the team also decided to use online assets rather than make assets by our own. Since the team was going to use background music in the game, Unity's easy to understand process for importing music was another good reason to use it. In order to give hints for player searching for the instruments, the team made use of the 'gradual change' technique by decreasing or increasing the background music volume depending on how far the player was from the instruments. The team built the game environment, including the island, mountain, grass, water and others, by making use of the "World Creator Professional" tool. This tool is made by BiteTheBytes, a 3D software development company, for Unity. It is very user-friendly and powerful for making terrain. After experimenting with placing different styles of building in the game space, the team decided to use "medieval" and 'steampunk' assets.

The team also used a survey to ascertain the effectiveness of our design. The survey was designed in a way to help the team understand the player's experience with gaming, as well as their tendencies while playing games. This clarification helped the team effectively analyze the comments left by those we surveyed, which included college students taking music courses and with an interest in music. The team asked questions about their prior gaming experience. Next we asked about the map itself and the treasure hunt, including the number of instruments found and difficulty of finding them and exploring the level. Finally the team asked open-ended questions to get more specific information about the opinions of the people who responded.

Results

The team sent out the level and survey to college students who are interested in music, since the theme of the level we designed is music. Of the targeted college students with an

interest in music, the team received 20 responses to the multiple-choice section of the survey, and 8 responses to the open-ended questions section.

The team started out by asking about prior gaming experience for the people questioned. The first question was how often they play video games. This question was to infer skill level and determine how we treat their responses. Only 30% of the people questioned rarely played video games; the rest of the responders appeared to be fairly familiar with video games based on their response to this question. For the second question we asked how much the people questioned explored in a video game when given the opportunity. This helped us understand how accustomed players were to self-directed exploration in video games.

Next we asked about the level itself and the treasure hunt. The team asked how the responders felt about the level size, and half of the people answered "just right" and the other half "too large". For the treasure hunt, the survey results show that the average number of instruments found by players was 2.75 out of 6. Only one of the players found all six instruments; all of them found except one person found at least one instrument. 60% of the players thought the layout of the level was easy to navigate.

Finally, the team asked open-ended questions to get more specifics from the people who responded. Some responses mentioned a desire for more variety in the scenery for the level's size, as well as a feeling that there wasn't enough guidance when the player first spawns into the level. Conversely, other responses appreciated the layout of the level.

Conclusions and Recommendations

Overall, the team feels that it partially succeeded in its goal. The multiple-choice questions seemed to indicate that the level was well-designed according to our goals. However, the free-response questions did highlight some areas that could use improvement, such as lighting, size, variation in scenery, spawn point, and optimization of the level. The team would have felt the goal was accomplished properly if there were fewer or no suggested improvements for the level, as well as if the average number of found instruments were a bit higher. Had those conditions been met, we would have felt the team had successfully encouraged self-directed exploration of the map to a degree we felt was appropriate.

Moving forward, the team feels taking the suggestions from the people surveyed into consideration could be a good starting place for how to improve the prototype. Making better natural pathways, improving lighting, making the scenery more interesting, and focusing the size of the level are all things the team feels should be focused on for future iterations of the level. The team felt the final product would have turned out better if the survey was sent out sooner, tweaks were made, and then the survey was sent out again. With that in mind, the team suggests that a future project try to continuously get feedback and update the level accordingly until it seems that the level can properly encourage self-directed exploration and engagement.

1. Introduction

In education, self-directed exploration is when people find information on their own by observation, consideration (logical thinking), or brainstorming (innovative trying) when presented with a problem. It plays a vital part in education and can provide memorable learning experiences by encouraging a level of engagement that is difficult to achieve when students simply do as they're told. Self-directed exploration is a central concept to the discovery learning method of education. In discovery learning, "the learner is allowed to explore and become actively engaged with concepts, objects, or the physical environment in order to develop their understanding of it.[1]" Teachers "facilitate" by organizing the learning environment "to encourage the learner's self-directed curiosity and problem-solving skills [1]" rather than "instruct" by demonstrating or providing "'correct' answers or procedures. [1]"

Video games can provide excellent informal learning environments by playing a role similar to the role held by teachers in discovery learning. In a book written as a guide for video game development, Scott Rogers, an accomplished game developer, discusses successful video game design. Smart game design, following the guidelines given by Rogers, will have games organized in a way to encourage the player's self-directed curiosity, especially when exploring the game environment, and problem solving skills, much like how teachers in discovery learning perform their duties to organize the learning environment.

While video games can teach real skills and foster a deeper understanding of a subject, there have not been a lot of games which go deeper than the surface level on the subject of music. Most video games in the genre of music focus on the rhythm aspect of music, and don't

foster musicianship skills beyond that point. Games like Guitar Hero [4] and Rock Band [5] have been the pioneers of this type of gameplay for home gaming. Meanwhile, for mobile games, there's a plethora of rhythm tapping games in the market as well. These kinds of games can be enjoyable to play, but someone who plays Guitar Hero will not learn how to play a guitar through the game, nor will they learn how to read or compose music or perform any other music related skills, from these games..

This project is part of an ongoing effort to create a video game which will teach musicianship skills in fun and engaging ways. To that end, this project aims to design a 3-dimensional game environment which will support that goal by encouraging self-directed exploration of the game environment. This will be accomplished by learning about self-directed exploration and various learning methods, as well as game design methods, and implementing that information as we create the game environment.

With our research and inspiration from the games Bloodborne and Xenoblade chronicles, which both facilitate and feature exploration, we tried to ensure our explorable 3-dimensional environment would be ideal for the game's vision of creating a game which teaches musicianship skills. We then had some college students that are taking music courses, or with an interest in music, play the level see how well our game environment facilitated their exploration self-exploration. We had a 70% of 20 responses that could find more than two out of six objects that we put in the game without them any hints, as well as other mixed to favorable responses. We feel the goal of setting up the environment in a way that led players to explore the game content by themselves was partially achieved, and feel that, with improvements, this prototype could be more suitable for the ultimate goal of the project.

2. Background

2.1 Fostering Exploration Toward Learning

The goal of this project was to examine the ways that video game level design may encourage self-directed exploration as informal learning. Our team is building upon a prototype developed through prior IQP research [6] that resulted in the creation of an interactive game, which allows players to compose, perform, and learn about music through fun and interesting quests. In this non-violent role-playing game, players informally learn about music composition and performance, among other musicianship skills that may be applicable outside the game world, by exploring an environment that informally conveys instruction about musicianship. The focus of this project has primarily been on level design as a means to encourage participation, engagement, and self-directed exploration. In this chapter, we describe our review of literature on education techniques which are compatible with video games and level design and the creation of interactive layouts that encourage such exploration.

2.2 Discovery Learning

As discussed in the introduction section, the techniques used for teaching in discovery learning share many similarities to the techniques used in game design. Discovery learning is a method of education where "the learner is allowed to explore and become actively engaged with concepts, objects, or the physical environment in order to develop their understanding of it. [1]"

Teachers don't demonstrate and provide correct answers, they organize the learning environment to encourage the learner's self-directed curiosity and problem-solving skills. This emphasis on the learners makes it a learner-centered approach, since the learner's needs and interests is to be considered when planning for lessons. [1]

Jean Piaget, who had a background in psychology, laid the groundwork for discovery learning. He emphasized the importance of interaction between peers, which would encourage engagement with peers that have different viewpoints. He felt that children were more likely to refine and evaluate their ideas this way, and thus learn through their own discoveries. Conversely, he argued they would be more likely to have their viewpoint and ideas easily swayed, without critical thinking, by teachers. [1]

2.3 Level Design

This project focuses on the design for the first level of the game, the City of Tonic, located in the Ionian Province. The primary resource for understanding level design was *Level Up!: The Guide to Great Video Game Design* [7], by Scott Rogers, who played an active role in the design of games such as the Maximo series, the Drawn to Life series, God of War, Pac-Man World, and Darksiders.

Throughout his chapter on level design, Scott frequently cites the Disneyland Imagineers as a source of inspiration for his perspectives on level design. One of his earliest examples refers to the creation and structure of Disneyland vs. a video game world. "The basic progression of creation is this:

- **Disneyland**: *World* to *land* to *attraction* to *scene*.

- **Video game**: *World* to *level* to *experience* to *moment-to-moment gameplay*."

As he puts it, the world of Disneyland corresponds to a video game world, the "lands" within Disneyland corresponds to video game levels, the attractions in the lands corresponds to video game experiences (encounters, challenges, story points, etc.), and the scenes of an attraction corresponds to moment-to-moment gameplay. The "world" and "experiences" for our game has already been described in the first section of the background, as this project's focus has been on the "level".

The first step to level design includes making a level map. As explained by Scott, there's two types of maps: alleys and islands. Alley maps are useful for game creators because it's easier to anticipate and plan for when and how a player will approach certain points on the map. They're easier to plan for because the player can only travel through the map through the pathways created by the game developer, as though walking through a hallway or alley. As a result, camera trigger zones, dramatic camera movements, scripted events, and traps are easier to execute, while removing or simplifying camera controls for the player. Alleys can be narrow and claustrophobic, or wider and more spacious, but Player movement is restricted when compared to island maps.

Island levels are a bit more complex to plan for, since there's typically more freedom to how the player experiences the game. The camera needs to be more flexible, while scripted events can be difficult to pull off since a player may not be looking in the right direction at the

right time. "*Mario 64* is one of the earliest examples of island level design in which players could choose to climb mountains, explore hills, or swim into underwater grottos in any order they liked." Furthermore, *Just Cause 2, LEGO Batman 2*, and *LA Noire* are video games of the "sandbox" genre, or "huge island playgrounds," which are significantly large examples of an island level.

Mixing of the techniques used in island levels and alley levels are common as well, with island levels frequently including interior locations with excellent alley design, and vice verse. In the examples given by Scott, the *Uncharted* series will frequently alternate between island and alleys from level to level, while the Darksiders and Maximo games will use alleys for their dungeon levels and islands for hubs and battle arenas.

He next discusses a technique called "stringing the weenies," specifically with respect to sandbox levels. "Weenies" refers to architectural landmarks, such as Sleeping Beauty's castle or Space Mountain, used by Disneyland Imagineers to attract the interest of guests, and draw them in their direction. Anything can be a weenie: statues, bridges, a distinct rock or tree, or giant castles or mountains. While he's specifically discussing sandboxes, stringing weenies in a way that players constantly have something to look forward to and keep them progressing how the game developer wants them to, is an important step of level design.

When it comes to actually making a map, scale is the first thing that must be considered. In a top-down map, the scale on graph paper would usually be determined by character being represented by one square, with every other element being drawn in relation to the size of the player. Every one of these other elements should have an icon on the map representing them.

Some things Scott says should be included are: the player's starting point, enemy starting locations, doors, teleporters, gates, puzzle mechanics (switches and levers, etc.), treasure chests and power ups, traps (and other areas of effect), and significant landmarks (statues, pools, pits, etc.).

For a top-down map representing a 3D space, an additional tip Scott suggests is to make any passageway five squares wide (two squares on each side of the player) in order to have room for players to move, combat to happen, and have room for the camera to move. Another tip he has is to use lighting to affect the player's path. Brightening up an area and/or darkening another will drive the player to move more in the direction of the light, since players are more drawn to the light. This can be accomplished simply by making the main path the brightest thing on the screen through use of lighting and colors.

Multiple paths can add variety by giving the players surprises and rewards for exploring when they don't have to. An easy way to improve a level is to use the concept of "fingers." By adding "fingers" off the main path is a simple way to add paths for players to explore. Every path must have a reward for the player though, "even if it's a trash can"[7]. Having secret paths and shortcuts for players to find outside of the main path can be rewarding for the player by making them feel clever, or giving them the ability to move through the level quicker. Verticality is another important step for exploring, and including verticality assists in realizing a concept that's very important to Scott: "If it looks like players can go there, they should be able to!"[7]

One game which has done an excellent job of executing according to Scott's' guidelines is Bloodborne [2]. The game, which is closer to a hallway design than island for its maps, does

an excellent job of guiding players through its levels. It does an excellent job of stringing

weenies via interesting looking buildings, enemies, fire, unique looking objects, items, and

sound.

Figure 2.1: One of the first weenies the player experiences after leaving the tutorial area

[2].

As shown in Figure 2.1, one of the first things the player sees upon leaving the tutorial area of

the game is these towering buildings, which naturally draws the player in that direction, where

the player will find a locked gate and, a short ways away from it, a ladder leading up and around

the gate blocking the path. Later on the player can unlock the gate, rewarding the player for

exploration by unlocking a shortcut to travel through.

Bloodborne rewards exploring down branching paths quite frequently too, either by giving items, meeting unique characters that aren't required for progressing the story, treasure, or having enemies to fight (which earns the player the in-game currency and experience).

Figure 2.2 : A character the player can only meet through exploration [2].

Figure 2.2 Shows a character that can only be discovered by exploring, who can be met after destroying a set of barrels covering a window which the can player drop through to reach a walkway that, among other things, leads to another window covered by barrels, through which the player can finally meet the character. Meeting her is the first step to unlocking a series of quests she'll give the player, which will ultimately open up a covenant the player can join, which unlocks further rewards when player participates in online play. The player also has the option of, if they choose, defeating her to unlock her armor and weapon, which can add a fun and different way to play early on in the game. Either way, this is just one many examples of Bloodborne rewarding players who explore.

Xenoblade Chronicles is an excellent example of a game which uses both alley and island design effectively. The shear size of the environment in the game is the most consistent weenie

used in the game. As shown below in Figure 2.3, the large waterfalls in the background are quite

appealing to the eye. If the player actually swims toward that direction they will encounter an

island just before the waterfalls, with rare items that spawn there, while the player also receives

experience points for discovering the island. As Scott suggests, the player is well rewarded for

exploring in this game. Sometimes rare enemies are the reward for exploration in this game, with

rare drops and large amounts of experience points given for defeating the rare enemies.

Furthermore, some quests, which may shape the lives of the characters giving the quest (a great

way to get the player to care about the quests they take), might lead to the player exploring in

areas they had previously not yet explored, especially when the player does not know the specific

location they need to travel to for that quest. Through these methods, the game really excels at

encouraging the player to explore.

Figure 2.3 : A set of waterfalls in the game's forest region [3].

Figure 2.4 : The region known as Gaur Plains [3]

Figure 2.4 shows a scene the player experiences early in the game, once they exit a cave, walk down a path (with no branches in it) between two high rock walls, obscuring the view in every direction. This is an excellent use of an alley to control the direction the player is looking as they enter a new area, especially since the wide open plains are such a stark contrast from the narrow claustrophobic pathway the player just came from. This kind of transition may be an excellent motivator for some players to explore, especially once the player realizes just how much land there is to explore.

3. Methodology

This project aims to design a 3-dimensional game environment which will encourage self-directed exploration of the game environment by learning about self-directed exploration and various learning methods, as well as game design methods, and implementing that information as we create the game environment. The overall goal is for the video game to be used as an informal learning tool, teaching players real world musicianship skills. By focusing on level design that encourages self-directed exploration, the game can better be utilized as a learning tool for musicianship.

The team made use of several ideas that came up during research, and created the level in Unity based on these. Once the prototype of the level was created, the team had others test the game and fill out a survey. The survey was then used to help the team determine whether or not the level was created in a way that encouraged self-directed exploration, and what could be done to improve on the level.

3.1 Unity

The Team decided to use Unity as the engine to build the level. Compared to other mainstream game engines in the industry, like Unreal 4, Unity is more beginner friendly and is also less resource-intensive for computers. Since the goal of this project is not building a fantastic AAA game environment, Unity satisfies the demand that the team needs. Another reason that Unity was chosen was because of the large library of assets and tools that were

readily available to the team. The availability of third-party tools and resources was another good reason to use Unity.

3.2 Terrain

One of the assets available to us is a very strong toolkit called "World Creator Professional," which is used to build terrain, and can generate Random Seed. We used a seed with mountains in the surrounding area and a generally flat center region. Inside the toolkit, there are some "Terrain Filters" such as "Cross Hills", "Canyon" and etc. We used these filters to make the terrain more realistic. Different textures are applied for different areas. The Terrain is added with "Filter: Zero Edge". This filter can smooth the edge of the terrain to zero, therefore, the edge of the terrain will be lower than the center of the terrain, which can form the terrain to an island shape. "Filter: Desert" is applied to the part that's near the sea level. Above the sea level, the terrain is mixed with "Filter: Smoothing", "Filter: Ridged", trees and grass. "Filter: Smoothing" can smooth out the general slope of the terrain, and so we can have some plane area to put our buildings. :Filter: Ridged" can add ridge details to the terrain, thus we can have some beautiful mountains. "Desert" texture is added near the sea to create a beach, and "Snow" texture on the top of the mountain. The end result is an island which has the appearance of a late Winter, early Spring type of scene.
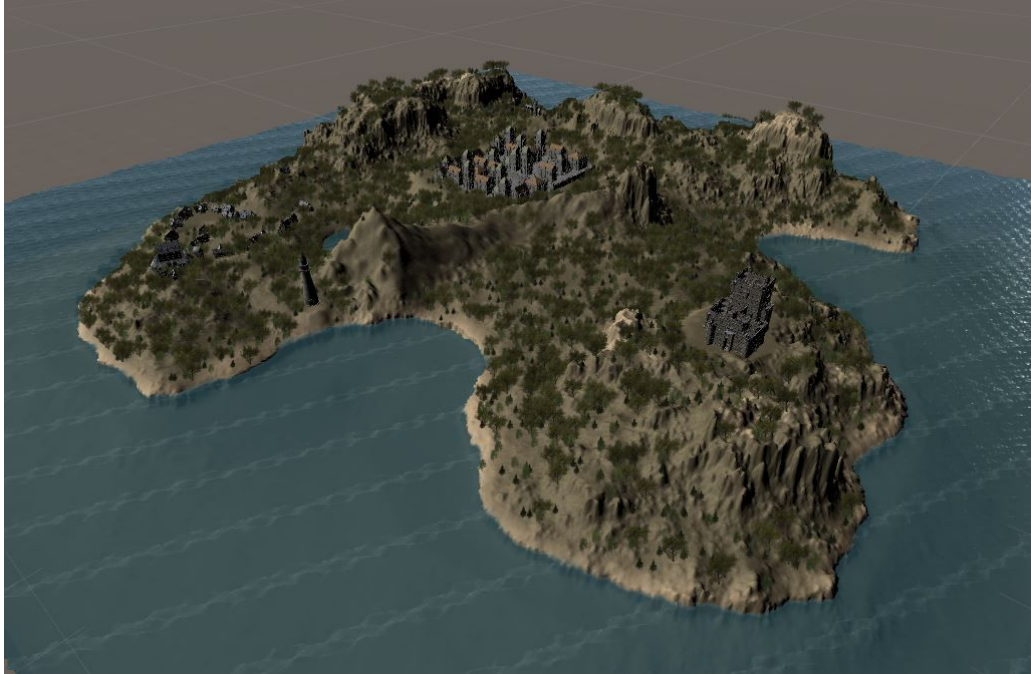
Figure 3.1 : The level created by the team, showing the terrain of the area.

3.3 Level Design

As discussed in the background, the team started off with an early concept map for the
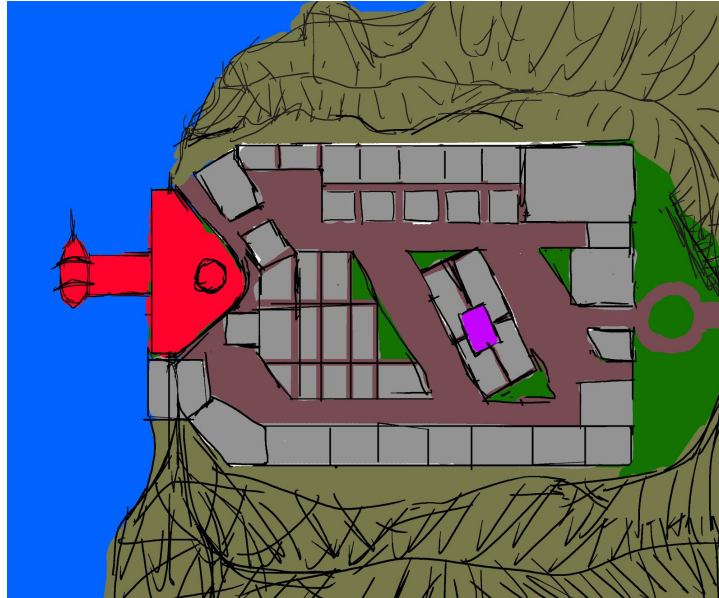
level, shown below in Figure 3.2.

Figure 3.2 : Early map of the city.

The gray in the map represents the buildings of the town, while the dark red color represents the streets and roads, the green represents greenery and can include decorations and statues as well, the purple represents a special building known as the Loft, the red represents the docks and player starting point, the dark yellow represents the terrain, and finally the blue represents the ocean. As can be seen in the early map, there were many roads between buildings, which could be explored for some reward if the player wanted to do so.

Ultimately, expanding upon what the team began here, the team changed to more of an island design for the level, as shown in Figures 3.2 and 3.3. This decision was made because the team felt and island map would be more fun to explore than an alley design. Around this time the team used meshes in our level to ensured that the appearance of the level was appropriate for the Victorian setting. Specifically, we ended up using some mid-century village style and gothic style buildings.

When the player first starts the game, they will be located at the edge of the island, in front of a lighthouse, which is located along the southern edge of the island. There are several reasons for this starting point. First, the team wanted the player to start on the edge of the island in order to give the player a general idea of how big the island is. From this location, the player can see buildings from the other areas of the island, which can give direction to the player, letting them decide which way they might want to go. The placement of the lighthouse in this area seemed natural since lighthouses are typically built close to the shore.

If the player follows the path from the lighthouse, they can find the next area, a mid-century style village (Zone 1) which is placed a short distance from the lighthouse. A path from the village connects to the center area of the island. We placed a small gothic town (Zone 2) in this area of the island. Northwest from the gothic town, there is a gothic church (Zone 4), while a medieval castle (Zone 3) is located to the southeast of the gothic town. The layouts of these towns were constructed similarly to the town shown in our early map.

The level was designed to lead the player from the Lighthouse to the mid-century village (Zone 1), and then to the Gothic Town (Zone 2) which is in the center of the map. The team considers Zone 2 as the capital area of the whole island. From this location at the center of the island, the player can decide which way they want to explore. In this way, the player can reach The Gothic Church and The Medieval Castle by exploring the island. Between these zones, paths are made, and plants were cleared. Through these paths, which are lighter than the surrounding areas, and with the building structures visible throughout the island, we feel we have managed to string the weenies, providing a general guide of where to go for the players, while giving them the freedom to explore how they wish,.

Figure 3.3 : Another angle of the level.

3.4 Treasure Hunt

As part of our measure to determine how well we were able to achieve self-directed

exploration, we placed different music instruments for players to collect throughout the level. In

the map (shown as Figure 3.3), one instrument was placed in Zone 1. Zone 1 is the first area the

player reaches on the island, and the instrument can be found easily just by following the path on

the ground. Through this method the team tried to easily teach the player about the treasure hunt and give them a hint about how the hidden instruments look. Two instruments are placed in Zone 2, which is the Gothic City. The team expected the player to explore the city carefully in order to find these instruments. One instrument was placed in Zone 3, and one instrument was placed in Zone 4. The team tried to position these two instruments so they could be easily noticed by the player if they led themself to Zone 3 and Zone 4. The last instrument was intended to be slightly harder to find, being placed inside a house near the mid-century village. The team expected a player that loves to explore to find this one.

Instruments are all hidden in each area with a green ambient light. The screen will display how many instruments are being collected, and how many in total are in the level on the top left of the screen. For the Treasure Hunt, there is no guide for the player, such as narrative or UI navigation. The instruments will each play music as the player approaches them, in order to give the player some idea about when they're close to the instrument. If the average number of found instruments is higher than 2 and lower than four, with comments that aren't unfavorable for whatever average we get, we feel it will show that we properly guided the players to the instruments.

The team decided on this range instruments because two of the instruments are hidden far away from the starting point (in zones 3 and 4), the team feels that players should explore zone 2 carefully in order to find the two instruments located there, and the last instrument was intended to be pretty hard to find. As such, the team expected only people who really like exploring game environments to get five instruments or more. Conversely, the team expects even people who don't like exploring or don't have a lot of gaming experience to stumble upon at least one of the

instruments, especially in zone 1. The team expects most people we survey would fall somewhere in between those two extremes. As such, an average of 2, 3, or 4 seems like a reasonable range to expect.

3.5 Survey

The project's goal was to first develop a prototype by making use of learning methods and game design guidelines that were learned while researching for the background. Now that the prototype had been completed, the team needed to determine how well the prototype encouraged self-directed exploration. To that end, a survey was created to poll users and hopefully determine whether or not the team adequately accomplished its goals, why or why not the goals were accomplished, and how the prototype could be improved. There were 20 participants in the survey; all of them were fellow students with an interest in music, and were contacted via email. Their interest in music was important, since the target audience for the full game is the same and the environment was designed with that in mind.

The team hoped that the people taking the survey included people with very little experience in games and people with a lot of experience with games. People who play video games frequently can have very insightful opinions and ideas, since they have so much experience. However, many experienced gamer have clearly defined preferences and approaches to playing a video game, and may be predisposed to explore a lot. If a person like that played our level and found a lot of instruments, it wouldn't be clear if they found them because we did a good job encouraging self-directed exploration, or because they were trying to explore their environment regardless of what we did. Meanwhile, inexperienced gamers, or people who have

never played a video game before are good subjects for our survey, since they will not likely be exploring the way they do because they have their previous experiences guiding them. They will be an excellent measuring stick for how well we encourage players to explore, especially since the target audience of the game's final product will include inexperienced gamers.

The team created the executable for the game and uploaded them to Google Drive. The surveys were created in a word document and distributed with the link to the stage as well. The email, shown in the appendixes, included links to the game on Drive, as well as a how-to for the game's startup.

The questions of the survey were created to determine how well we achieve our goal. Because the goal was determining how effective our level design was, most of our questions focused on gauging the quality of the level itself. The first set of questions were asked to determine the player's experience with previous games. The first question in this set was, "How frequently do you play games?" and the second question was, "In the video games you have played, did you try to explore your environment extensively?"

The second set of questions asked about the player's experience playing the game. The first question asked how the player felt about the size of the map, which would show if the size was inconvenient for the player. The second question asked how many instruments the player found, which, as was explained earlier in the methodology, would be an important indicator as to whether the team succeeded or not. The third question in this set asked how difficult it was to find the instruments. The final questions asked how easy the level was to explore. The answer to these last two questions would show if the difficulty was as the team intended.

The final set of questions were all open-ended questions, hoping to get details that can't be expressed in multiple-choice questions and the opinions and suggestions of the people answering the survey. The first question asked about the player's opinion of the level, while the second asked if the layout negatively impacted their ability to find instruments.Question three asked if the level felt immersive. Fourth, the team asked if the player got stuck anywhere, which could expose any problems or bugs in the layout or code. The final question of this set and the whole survey asked if there were any final thoughts or suggestions the player had. With the exception of question four, the team tried to keep these questions a little broad in order to give the person responding the freedom to express what their opinions and ideas that the team may not have expected.

4. Results

The team sent out the level and survey to college students who are interested in music, since the theme of the level we designed is music. The survey included 6 multiple choice questions and 5 open ended questions, for a total of 11 questions. Of the targeted college students with an interest in music, the team received 20 responses to the multiple-choice section of the survey, and 8 responses to the open-ended questions section.

Since the intended target audience for the full game includes people interested in learning about music that may or may not have a lot of experience with games, it was important that the group responding to the survey was made up of the same type of people. Their responses will give the team an idea as to whether or not the design and layout of the environment would be able to encourage engagement in the game's world once everything comes together in the full game.

The team started out by asking about prior gaming experience for the people questioned. Next we asked about the level itself and the treasure hunt, including the number of instruments found and difficulty of finding them and exploring the level. Finally the team asked open-ended questions to get more specifics about the opinions of the people who responded.

4.1 Multiple Choice Questions

4.1.1 Experience with Games

The first question asked how frequently the user played video games. This was to infer skill level and, along with the next question, determine how we treat their responses. As was said at the end of the methodology, we felt the need to separate responses from experienced gamers from responses given by inexperienced gamers. Overall, we were able to tell that we had a total of 14 experienced gamers (people who answered c-e), and a total of 6 inexperienced gamers (people who answered a-b).
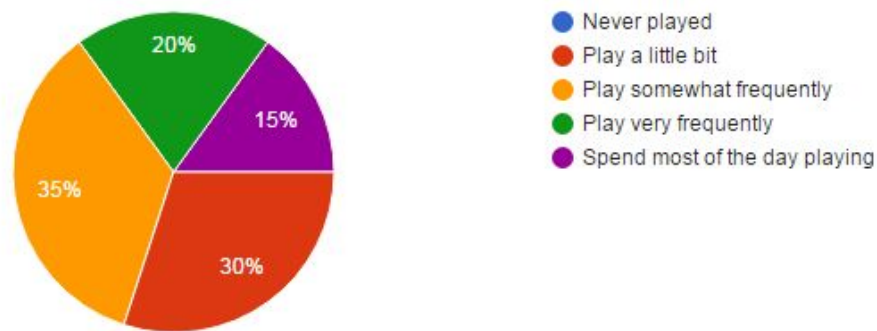

Figure 4.1 : Result for multiple-choice Q1

4.1.2 Approach to Gaming

For the second question, we tried to ascertain how the user played whenever they played video games. Again, like mentioned in the methodology, we felt we needed to know if the user was the type of player to explore regardless of how the game was designed.

One person only ever played games with little to no exploration allowed, 6 people played games which allowed for or encouraged exploration and tended to shy away from exploration, while 6 would occasionally explore when given the opportunity, and 7 explored quite frequently. These responses helped the team understand why each person might be responding the way they did.
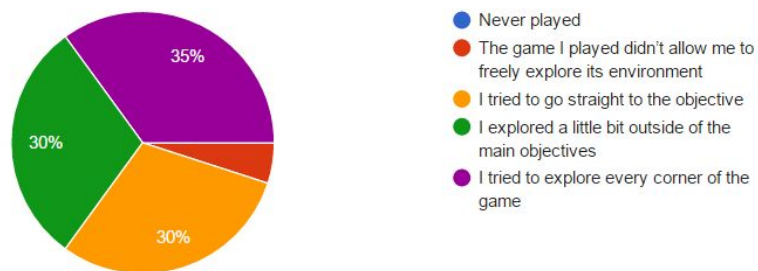

Figure 4.2 : Result for multiple-choice Q2

4.1.3 Level Size

The team asked the users to answer whether they felt the level was too small, too large, or just right. Exactly half of the user responded that the level's size was just right and the other half responded that it was too large.

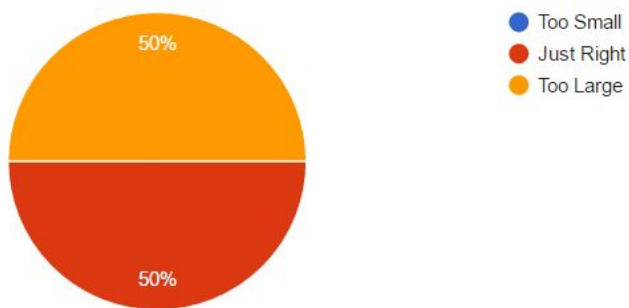How did you feel about the size of the level?

Figure 4.3 : Result for multiple-choice Q3

4.1.4 Finding Instruments and Difficulty of Finding the Instruments

This was one of the most important measuring sticks for us being able to determine how effectively we created the level. Overall it seems that more than half of the players (55%) are able to find 2-4 instruments without any narrative or UI navigation. From these results, the

average number of instruments were found by players was 2.75.
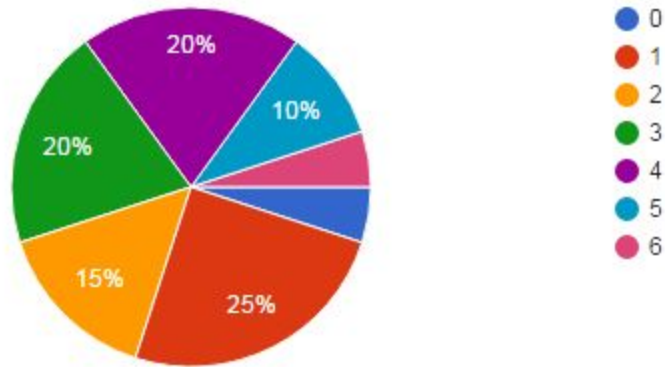
How many instruments were you able to find?

Figure 4.4 : Result for multiple-choice Q4

4.1.5 Difficulty of Exploration

Overall it seems that people felt the level was easy to navigate through, with over half of the players (60%) saying it was easy, and 30% saying it wasn't too easy or difficult. 1 Person thought it was very easy, while 1 person thought it was difficult.

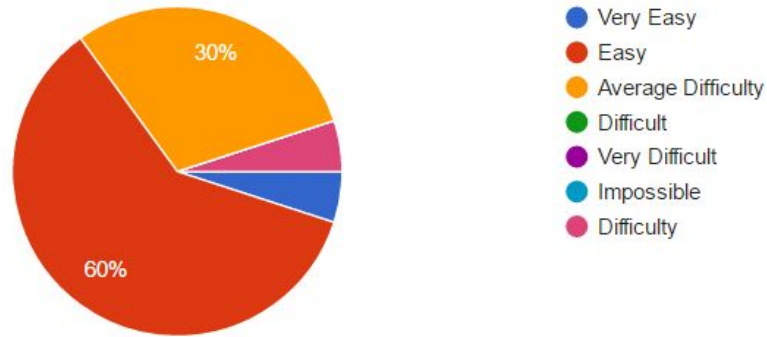Rate the degree to which you feel the layout of the level was easy to navigate through.

Figure 4.5 : Result for multiple-choice Q5

4.2 Open-Ended Questions

The team only received 8 responses to the open-ended section of the survey. These responses are shown in the images below.

4.2.1 General Opinions About the Level

What were your opinions about the layout of the level?

The layout was good, nice variation in depth

It appears that everything was separated into little towns or sections,which seemed neat

I started off at the lighthouse which is nowhere near anything in particular, which leaves me with no guidance as to where I'm supposed to go. Even in an open-ended exploration context there should be clear areas of interest after which the player may decide to explore around.

Layout was fine

Too big for how little scenery variation there is

It ran extremely slow on my computer. i was not able to complete the level. I have an intel graphics card and i7 processor.

Pretty good

Put lights in castle such as candle

Figure 4.6 : Result for open-ended Q1

4.2.2 Level's Effect on Finding the Orbs

Was your ability to find the instruments negatively affected by the layout of the level?

A bit, the instruments were well hideen

Yes and no. It's a large map and the instruments are small, but nothing was in the way of actually finding them.

I did not feel that my ability to find instruments was even a factor - after I found the first two I had this feeling that I would just have to go and scour all corners of the map in order to find all items. Also the level's layout feel homogeneous in that the whole map has basically the same covering with little variation - it causes me to lose interest very quickly, especially when I need to traverse an enormous distance to reach a new location. I recommend that you make the pathways more obvious. Start the player out a good vantage point in the map or already on a clearly marked path facing towards a structure.

Possibly--there were a ton of trees

A little because of lack of landmarks.

It ran extremely slow on my computer. i was not able to complete the level. I have an intel graphics card and i7 processor.

Impossible

Yes

Figure 4.7 : Result for open-ended Q2

4.2.3 How Immersive the Level is

Does the level feel immersive overall? If not, why? What could be done to improve it?

Not yet, the game was extremely choppy which felt unrealistic

Not really, there were just a bunch of empty buildings, and some I couldnt get into. Perhaps adding more decor to the buildings and towns can make it more immersive and remove some trees glitching through buildings, unless that is the intention. Roadways directing the player to different towns or buildings would help a lot as well.

You should direct your attention to improving the intrigue or interest of the game. Immersion improves if you add character to your level - evidence that someone lives in, or has built the structures, some kind of visually recognizable landmark, some areas that show off the fact that this island has life on it.

Not really. There were only 6 objects for a decently sized map. Add more items or make the map smaller?

No, but also it's a game about making music so it doesn't need to be immersive, just have a good UI and make the objective obvious and you're good.

It ran extremely slow on my computer. i was not able to complete the level. I have an intel graphics card and i7 processor.

Yes

Yes!!

Figure 4.8 : Result for open-ended Q3

4.2.4 Asking if the User Got Lost

Did you get lost or stuck anywhere? If so, where?

I didn't have any direction on where to find the instruments

No, if I would eventually find buildings if i ran in one direction

I got stuck after I thought I'd looked at all of the building clusters and the castle, and still had two instruments left. I gave up because I figured that it would take me a very long time to go back to where I'd already looked and

Accidentally jumped in the sea and couldn't get out

I fell in the pond and couldn't get out.

It ran extremely slow on my computer. i was not able to complete the level. I have an intel graphics card and i7 processor.

No

In the castle there were no lights, cant see anything

Figure 4.9: Result for open-ended Q4

4.2.5 Final Thoughts and Suggestions

Do you have any final thoughts or suggestions?

Instead of seemingly aimless wandering to find instruments, maybe include hints or checkpoints

Maybe condense the map?

The normal maps on the stone buildings in the town with the fountain are reversed. My PC was struggling with performance with a TITAN Black, a quad core 4.0 ghz CPU, and 16 gigs of ram, so perhaps there is some optimization you should look into.

For some reason it was pretty laggy on my computer, even though I can run other games on high quality

Make the footstep sound on beat with the music.

It ran extremely slow on my computer. i was not able to complete the level. I have an intel graphics card and i7 processor.

Lightning need to improve

make different views, and angles to choose.

Figure 4.10 : Result for open-ended Q5

5. Conclusions and Recommendations

Overall, the team feels that it was able to achieve an acceptable level of self-directed exploration by implementing characteristics similar to methods used in the discovery learning style of education, and would conclude that the goal has at least partially been accomplished. The team was able to identify similarities in game design practices and a style of education which relies on self-directed exploration. If the average number of found instruments were higher and there were fewer suggestions for improving the level in the survey responses, the team would have felt the goal was accomplished properly.

Based on the players' responses to the survey, it seems that, overall, the team did a decent job of guiding players to the different zones of the map, while making it not too hard or easy to find the instruments. Condensing the map, making some of the paths a little more clearly defined, improving lighting in some locations (specifically the castle), adding more variety to the scenery, and changing the player's starting position are all steps that would improve the user experience, based on the survey responses. Another suggestion was to have the player start in a location which gives the player a better vantage point to view the surrounding region from. Furthermore, there is some optimization that needs to be done on the level, since the game's performance was not that great even though some of the people being surveyed played the game with powerful computers.

Similar to how discovery learning has teachers strive to provide an environment which encourages the learner's self-directed curiosity and problem-solving skills, the game needs to

provide an environment which encourages the player's self-directed exploration. The team feels that a future team could fully accomplish this by following the suggestions given in the survey responses.

Furthermore, in the scope of the game as a whole and complete product, the team believes that Jean Piaget's advice should be followed. Peer interaction can be a great way to learn from others and experience different viewpoints about music that could help the player grow their musicianship skills and knowledge. The team is aware that a previous project focused on the social aspect of the game [6], and feels that a fully-functional social experience would be a great way to encourage self-directed exploration in the game environment. Perhaps a future team could delve into both the exploration of the game environment and social aspect of the game.

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