

# Bachelor thesis

## 3D Game Environments

### Controlling Player Experience and Emotion

Using 3D environments to create the emotional experience envisioned  
by the game designers

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## Foreword

This thesis is written as a completion of the bachelor Spill og opplevelsesteknologi at Nord-Trøndelag University College. The subject of this thesis, controlling player experience and emotion through 3D game environments, is something that has piqued the interest of us, the authors of the paper, since a young age.

Like other media, games can stir feelings and emotions within the user. These emotions can be triggered by the story elements, the gameplay that is unfolding, the soundtrack or sound effects, and/or the game environment itself.

A complete game environment consists of many things, and they all need to work together in order to convey the right feeling or experience to the player. In order to do this, the 3D models, animations, textures, materials, sound effects, artificial intelligence, lighting, and visual effects all need to be working towards the same goal, and they must all support each other. The game environment provides a sense of place, and can also support the story being told.

We're very interested in the visual aspects of a 3D game environment - the 3D models, lighting, visual effects, etc. This research paper explores how said 3D environments can affect players, and especially whether they can be designed into stirring the feelings we want the players to feel.

While gathering research for the theory chapter of the thesis we started developing a prototype for a game, which we would later use for testing the assumptions we made after doing research. We spent 14 weeks planning and building the assets for the prototype, 22 weeks developing it, and 4 weeks doing testing and analysis at the end of the development period. All 3D modelling, rigging, animation, texturing, lighting, programming, bug testing, design, and implementation has all been done by the two of us. We have also created all visual assets from scratch. Sound effects used have all been free to use, and not made by us.

We would like to thank Knut Ekker, for his expertise and assistance throughout this year. We would also like to thank Trond Olav Skevik, our supervisor, for all his creative contributions to

the project. A special thanks to Markus Langseth for providing support and technical expertise during the development of our prototype.

## Abstract

By altering the environment, can we control how the player feels? Is the environment important when trying to help the player reach the state of immersion? These questions were part of our main research question, and the very foundation of this thesis. We've gathered theories and claims from numerous sources, and used these theories to design and create playable 3D game environments. During production we focused on creating strong silhouettes, following rules of composition, as well as using color theory, contrasts, and beneficial post-processing effects. Our goal was to create an environment that would stir certain predefined feelings within the players - our test subjects. According to our findings we were able to successfully create and maintain these feelings and impressions within the test subjects, in some cases more strongly than others. Surprisingly, we found that players in the age group 26-35 were more likely to feel the emotions we intended than younger age groups. We were also able to make the players reach a state of immersion in most cases, with the exception of individuals who weren't interested in games in general. The group being more immersed in the game environments turned out to be players who did not play on a daily basis but enjoyed games in general.

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## 1 Introduction

Electronic games – or video- and computer games – have come a long way since they first saw the light of day in 1962, when “Spacewar”, widely acknowledged as the first ever electronic game, was created by Steve Russell. The game was simple in terms of graphics and gameplay, consisting of lone pixels representing stars on a black background. Since then electronic games have evolved into complex and dynamic experiences, with agents controlled by artificial intelligence, orchestrated soundtracks, and massive 3-dimensional worlds.

This extreme advancement in game complexity did not happen overnight. So far it has taken more than 50 years to get to where we are today, and every game created has brought us further into the future. “Zork”, made in 1979, was a text-based adventure game with no graphics whatsoever. 1970s arcade games also had simple graphics due to the restricted memory capabilities, and the individual game elements were separated into bitmaps. Asteroids utilized monochrome vector graphics, which allowed fast moving objects made by sharp lines instead of blurry pixels. These vector graphics later evolved into polygons and 3D-games.

Towards the end of the 1970s the games industry changed from being arcade-oriented to being more focused on home consoles, such as the Atari 2600, Odyssey 100, Odyssey 200, Nintendo Color TV Games, and the Milton-Bradley Microvision. Mid 1980s electronic games developed into using sprites instead, and this new technology was used in both side-scroller games such as Super Mario and open-world games such as The Legend of Zelda. The next generation of home consoles (Super Nintendo Entertainment System and Sega Genesis) paved the way of the 16-bit era. These new systems had more memory, which allowed higher resolution sprites.

During the 1990s there were great advancements made in the technology of the game engines, which introduced 3D-games. The first game to simulate a 3D-world, “Battlezone”, was published in 1980, but this game only simulated depth using vector graphics. When changing from 2D to true 3D, the objects in the game world needed to be viewed from more than one angle. This is why the objects changed from being drawn sprites to being models made out of polygons.



This development of computer game graphics and the transition from 2D to 3D space has piqued the interest of the authors of this paper. More specifically the creation and use of 3D game environments, building a sense of immersion, as well as using the 3D environment to affect the player emotionally.

## 2 Research question

The environment can play a large or minor role in the overall experience of a game. A full game may consist of numerous factors such as game mechanics, environment, sound design, storytelling, etc. There is no answer to which one of these is more important - one can have a good game with great mechanics and hardly any attention paid to the environment, just like one could have a good game with a great environment and very little attention paid to the mechanics of it. What is truly interesting to us is how a great environment can affect the player emotionally. How does one go about creating a good environment, and successfully stir feelings within players that can ultimately increase enjoyment and immersion levels?

### 2.1 Research questions

Using environments to create the emotional experience envisioned by the game designers.

- By altering the environment, can we control how the player feels?
- If we're able to change how the players are feeling – will they be immersed?

## 2.2 Definitions

Definitions of concepts and expressions frequently used in this paper, as well as their meanings.

### 2.2.1 Player's emotional experience

The test subjects participation and observation with the events and visuals in the prototype, and the impressions and feelings left after the fact.

### 2.2.2 Game environment

The surroundings and/or conditions in which the player experiences the game. This is different from the conditions in which the *test subject* experiences the game. This thesis focuses solely on the visual aspects of a game environment, such as the composition of 3D-models, lighting, post-processing effects, textures, and animations.

### 2.2.3 Asset

Any 3D-model, sound effect, texture, or animation made for and usable in the prototype. Also includes asset pieces consisting of several or all of the above.

### 2.2.4 3D-model

A representation of any three-dimensional surface of an object (either inanimate or living).

### 2.2.5 Game

Throughout this thesis a “game” includes video games and computer games.

## 2.3 Exclusions

Aspects of game development or aspects of a game that we will not be focusing on the development of, nor the significance of in this paper.

### 2.3.1 Sound

The study “Time perception, immersion and music in videogames” by Timothy Sanders and Paul Cairns found that music can make a game more or less immersive depending on whether the music is liked or not liked by the players. The study showed both cases that music could set up a situation where immersion was more likely to not occur and where immersion was more likely to occur.

In this research music is going to be used to supplement the scene, but it will not be a part of the elements to test out the research question. In addition, we have decided to use only ambience and effects rather than musical pieces. Sound effects used are simple effects such as the sound of water, flapping of wings, creaking of wood, birds chirping, and wolf howling. All these sound effects are simply used to support the environments already created.

### 2.3.2. Storytelling

Storytelling in games can be an effective way of stirring emotion, but is not relevant to our research question. We are only interested in the visual aspects.

### 2.3.3 Gameplay

Gameplay and mechanics can also be valid and effective ways of providing a game with the depth needed to stir emotions in players, but has also been excluded from the prototype created for this thesis. The implemented gameplay will be very limited, but sufficient for testing the research question.

## 3 Theory

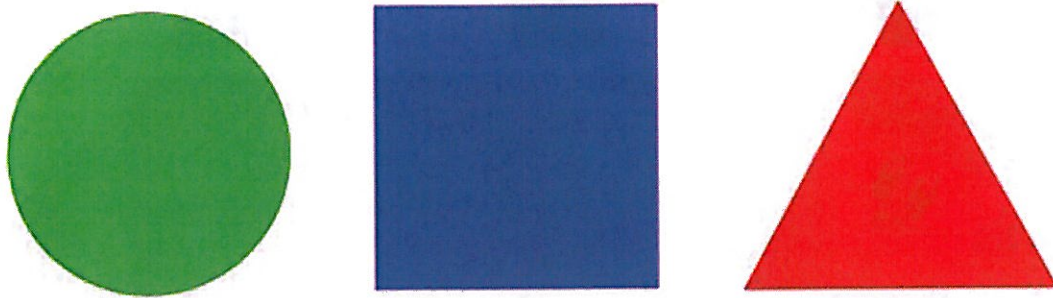
To examine the research question we will have explore the different aspects and techniques in game design. A typical environment in a game is build up by the use of shapes, color, light, movement, particles, and post processing effects. All elements are necessary components to create the entirety that is the game environment. In this chapter we will look at different theories and techniques that can be put to use to control the emotional experience of the player.

### 3.1 Dynamic Composition

Solarski explores a technique he calls “dynamic composition for video games”. Dynamic composition includes four different elements: character shape, character animations, environment shapes, and pathways. Solarski proposes that by adjusting the design using the principles of dynamic composition, the gaming experience will be more varied, richer and more emotionally meaningful for the audience. How to design these four elements rely on the very same design principles that is used in television, for instance perspective, form, and value. In game design, these principles do not only create an illusion of a window into an imagined world, but it also serves the purpose of setting the aesthetic value and application of the visual narratives.

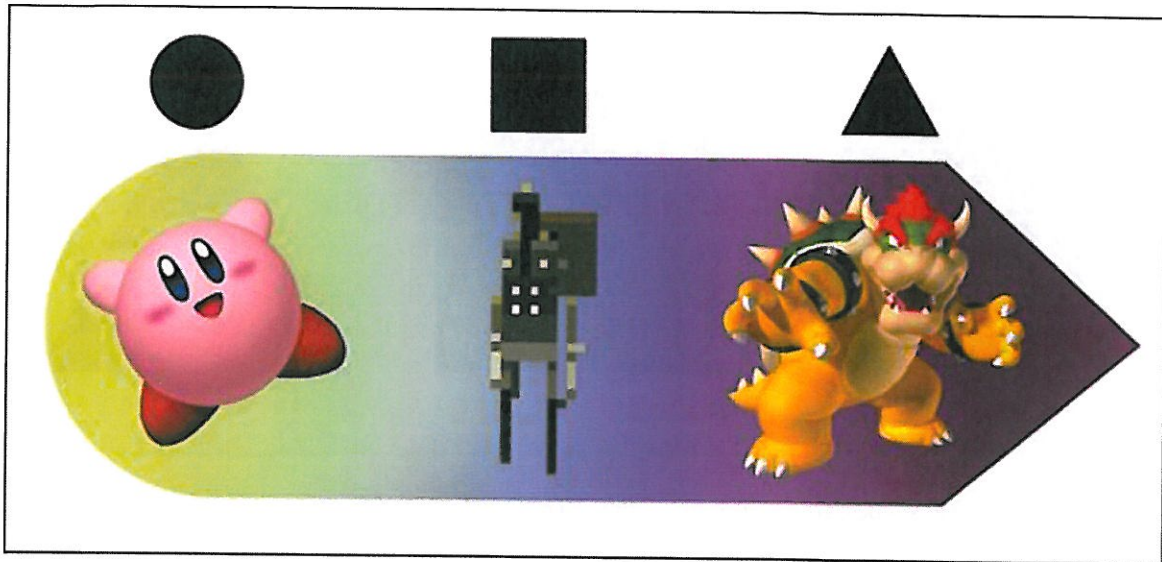
Solarski cites the importance of understanding the traditional art techniques of composition that is used in classical art. There is much to gain regarding better game design by starting the design process with the three base shapes often used in classical art: the circle, the square, and the triangle.





**Figure 3.1.1:** Basic shapes, figure from the article “The Aesthetics of Game Art and Game Design”.

Everyone reacts to art differently because of different life experiences. However, these three shapes have had a consistent meaning throughout art history. We learn to know the shapes already as young children, and we get familiar with these shapes through touch. The circle is soft and easy to move, so psychologically we learn to associate this shape with innocence, youth, energy, and femininity. The square is steady and hard to move, so it will mainly mean maturity, stability, balance, and stubbornness. The triangle is sharp and may hurt, so psychologically this shape will mean aggression, masculinity, and force. These three base shapes are widely used in classical art because of the shapes corresponding aesthetic concepts. For instance the round shape in a classical painting set the mood of a safe and innocent environment, while the sharp edges of the triangle would signal a hostile and unfriendly environment. These shapes can be used in a game to achieve the same effect. Solarski illustrates the effect in the figure 3.1.2 by lining up well known game characters beside each other. Bowser’s sharp edges make him an unpleasant opponent to encounter. We would not be as likely to trust him as the round and happy Kirby to the left.



**Figure 3.1.2:** Well-known game characters, figure from the article “The Aesthetics of Game Art and Game Design”.

Classical art also use these shapes to create lines that will guide the viewer's eyes around the picture. This is a technique the classical artists used to make it easier for the audience to explore the art, but it also makes sure the audience looks at the parts of the painting the way the artist wants them to.



**Figure 3.1.3:** Diana and Her Companions (c. 1655), Johannes Vermeer.



Figure 3.1.3 has a composition that is based on curving lines. The lines will naturally lead your eyes in this curve around the picture. This type of composition also has another effect; because of the round line the impression of a delicate and continuous movement is enhanced, adding to the psychological interpretation that this is a graceful and soft environment.

These three principles can be put to use by the game developers. When merged into the character shape, character animations, environment shape, and pathways, Solarski claims it will enhance the emotional experience of a game.

### 3.1.1 Pathways

Pathways let itself easily reduce to a system of lines. The techniques of composing lines in a classic painting can easily be adapted to a game. The approach one can use is to lay a classical painting flat facing upwards and think of it as a map. Now one can see that the lines in the painting shapes a sort of a map. The same technique can be used when lining out the path/road in a game.

What one sees in classical paintings is that the lines point in the “next” direction the artist wants you to look. So in a 3D-environment one needs to have landmarks that point out the direction for the player. These landmarks need to be shaped and positioned correctly so the player knows where he/she is and where to go next.

The shape of the pathway will also amplify the emotional impression of the game. A narrow and crooked road in a dark forest would be perceived threatening, while a park with leisurely curving shapes would be perceived comfortable.

### 3.1.2 Environment

Environment should include both the surroundings and secondary characters and enemies. The shape of the environment should reflect the shape of the main character, and the main character should be echoed by the environment shape. This makes sure there is a sense of harmony

between the main character and its surroundings. This is important to make it feel like the main character belongs in the particular game world. Creating an enemy with sharp edges and placing it in an environment with circular shapes can be used to create contrast in the game. The enemy would be a threat in the environment.

### 3.1.3 Character shape

Character shape is an important part on the screen if the game does not have a first person camera view. The use of the three base shapes can also be used in designing a main character. Selection of the main characters shape helps forming its personality and its emotional charge. How the character animations and movements are designed will also create an important impression on the player.

In the end, when dealing with dynamic composition it is important to start a new game project by asking the question “what is the emotional experience?”. Otherwise many developers will let the game’s design be led by its style and genre, but this might prove to be less appropriate and fruitful.

## 3.2 Strong silhouettes

A silhouette is often referred to as a black outlined shape - much like a shadow or a drawing of the outline of an object - that is filled with a uniform color. Designing strong silhouettes is a technique usually used in the pre-production period of game development, and when finished it is used as a reference image for a 3D-model. It is a powerful way to quickly produce a large quantity of concepts with lots of variations.

There are several reasons why game designers would want to use strong silhouettes in their design. First off, one wants a key object in the game to stand out from the rest, so it becomes easy for the player to recognize the object from a distance. Another reason is to make the game look unique, so the game itself stands out from the rest. A strong silhouette also makes a recognizable impression in-game - it can be appealing and unique. Designing an environment with strong silhouettes also makes sure the game avoids a generic-looking surrounding.

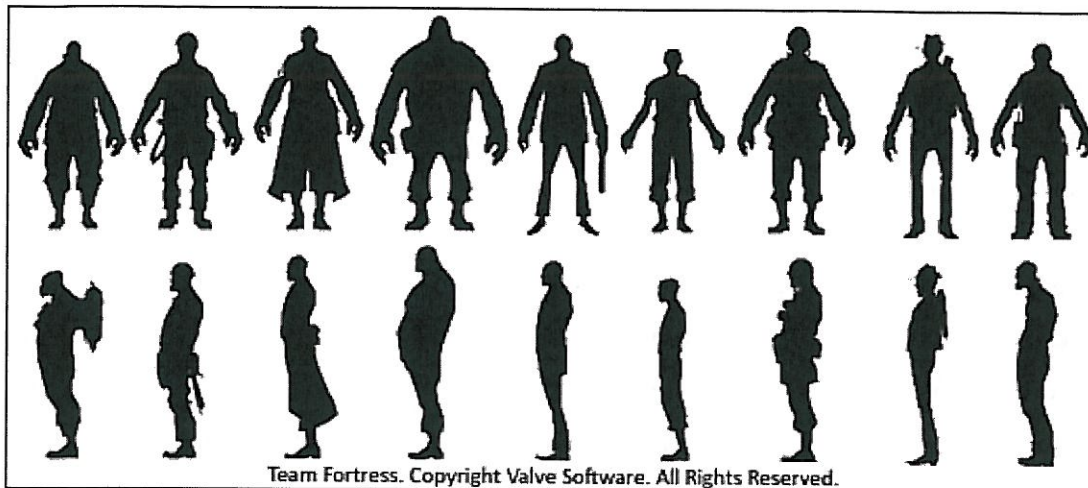


Figure 3.2.1: Picture from the article “Silhouette Design Game Environments”.

Figure 3.2.1 shows how the use of strong silhouettes makes it easy for the player to distinguish between the characters in the game “Team Fortress”. For those who are familiar with this universe the silhouettes is enough information to tell which one of the characters they’re looking at.

Novak and Castillo explore the importance of the silhouette of a 3D-model. Their study states that “silhouette is an excellent technique for generating ideas” and “The strongest silhouettes will translate to the strongest models”. In the game world, it is important to have distinct shapes so that the player will know what he or she is looking at. Players have to see clearly where they are going and recognize elements of the game or they will not be immersed into the world. The lighting and fog in a level can hinder a models’ view, but strong shapes will come through clearly by their silhouettes. The player’s brain will fill in the details of what he or she sees.

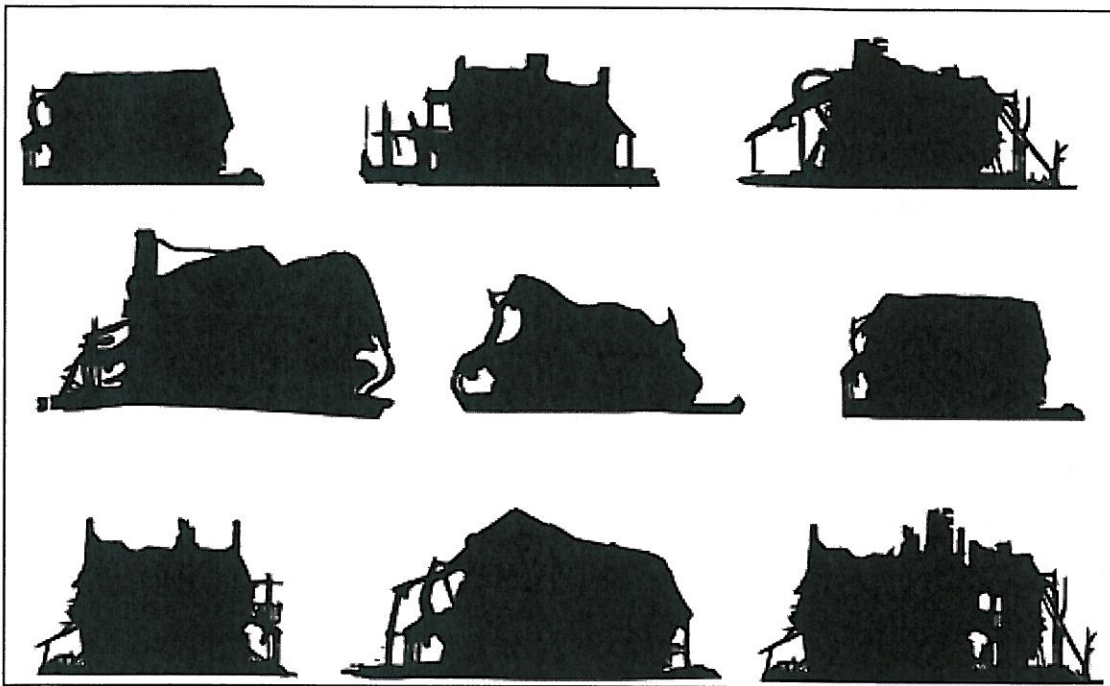
When designing silhouettes one should make sure it contains large shapes, medium shapes, and small detail shapes. The same principles apply for stylized and realistic environment. However, realistic environment require more attention to proportion and authenticity, while the stylistic environment can be pushed and exaggerated.

One way to work with strong silhouettes is to start with a picture of a plain object, then duplicating it a dozen times. The designer can now experiment with the shape by pushing it in



different directions. The goal with this technique is to find a shape that pops from the page and is interesting to look at. After designing for instance 10 different silhouettes the designer usually leaves the drawing for a short amount of time, and when he/she returns it is easier to choose the silhouette that pops the most.

The method described above can be translated to 3D development. Instead of drawing the silhouettes on paper one can design strong silhouettes directly in 3D space. Working in 3D space allows the developer to easily test the silhouettes from different angles. When working with this technique in 3D, it is not necessary to focus on the technical requirements of the model, such as clean topology.



**Figure 3.2.2:** Image from the article “Silhouette Design Game Environments”.

### 3.3 Immersion

According to Cairns and Cheng, immersion is a term that is used in the game industry to promote, review, and describe the game experience. One can say that a game design has successfully incorporated positive user experiences and immersion when a player finds him or herself playing for hours at a time.

Immersion in games is not a simple concept. Sanders and Cairns explain how immersion is understood as a sense of being “in a game”. The player’s thoughts, attention, and goals are all focused on and around the game, and does not attend and/or concern him or herself with anything else.

Brown and Cairns describe this state of immersion as a state that has to be built up in 3 steps. The first level of immersion is “engagement”, and is the lowest level of involvement. To achieve the first level of immersion we will have to look at the access, the player’s preference, and the controls need to be right. For instance, the player won’t even bother to engage with the game if he or she doesn’t like the style of the game. To achieve engagement the player also has to invest time in the game.

The second level of immersion is “engrossment”. After the player has been engaged, he or she will be further involved and become engrossed. The barrier to reach this state has got to do with the game’s construction. Game features like visual quality, interesting tasks, and plot may affect the player’s emotions in such a way that the player is less self-aware and less aware of their surroundings.

Finally, the third level of immersion is “total immersion”, and total immersion is *presence*. In a study performed by Brown and Cairns, the participants described themselves as being cut off from reality, and detached to such an extent that the game was all that mattered. When this level of immersion has been reached the only thing that impacts the player’s thoughts and feelings is the game. To reach this level the player needs empathy and atmosphere, where empathy is the growth of attachment and atmosphere is the development of game construction.

According to Castillo and Novak, the immersion will be broken if not all the art in the game blend well together. If anything stands out in a way that it doesn't belong in the game world, the player will be pulled right out of the immersion.

We see how immersion is important to achieve for a game. In this experiment we do not expect that the player will reach the higher levels of immersion, because of the size of the test scenes and that we are not looking to test a game play. But we still want the player to feel emotional atmosphere in the environment that we are aiming for.

### 3.4 Textures and 3D-models

According to Ahearn, a *shape* (height and width) is simply a two-dimensional, flat outline of a form. Circles, squares, rectangles and triangles are all examples of a shape. Shape is what we first use to draw a picture before we understand such concepts as light, shadow and depth. *Form* is three-dimensional (height, width, and depth), and includes objects such as spheres, cubes, and pyramids. Creating textures for a 3D world is essentially creating 2D art on flat shapes that are later placed on the surface of forms. An example of this is taking a 2D texture and placing it on a 3D object, transforming a cube into a crate.

Everything in the world should have a good sense of unity. If one uses a certain method to create textures, then one should use it consistently with all of the props. If one looks around any given area, one should see repeated use of certain base textures. This natural unity can be replicated by using the same base material textures in the levels. This will help save texture memory as well as unify the art.



### 3.5 Level of detail (LOD)

Luebke explains the different types of LOD.

#### 3.5.1 Discrete LOD

Discrete LOD creates multiple versions of every object. Since distant objects use coarser LODs, the total number of polygons is reduced, and rendering speed increased. Because LODs are computed offline during preprocessing, the simplification process cannot predict from what direction the object will be viewed. The simplification therefore typically reduces detail uniformly across the object. For this reason Discrete LOD is sometimes referred to as view-independent LOD or isotropic LOD.

#### 3.5.2 Continuous LOD

Rather than creating individual LODs during the preprocessing stage, the simplification system creates a data structure encoding a continuous spectrum of detail. The desired level of detail is then extracted from this structure at run-time. A major advantage of this approach is better granularity: since the level of detail for each object is specified exactly rather than selected from a few pre-created options, no more polygons than necessary are used. This frees up more polygons for rendering other objects.

#### 3.5.3 View-dependent LOD

View-dependent LOD extends continuous LOD, using view-dependent simplification criteria to dynamically select the most appropriate level of detail for the current view. A single object can span multiple levels of simplification. For instance, nearby portions of the object may be shown at higher resolution than distant portions, or silhouette regions of the object shown at higher resolution than interior regions. This leads to still better granularity: polygons are allocated where they are most needed within objects, as well as among objects.

*It is also important to think about the level of detail this model needs. If a player will be right next to a wall, it is probably a good idea to put in a few extra polys and give it a good-sized texture. This is because this model will be in the player's face, and if it looks bad, it will ruin the entire look of your level and pull players out of immersion. If that wall were going to be in a hillside above the player's reach, then we can get away with less details. Level of detail (LOD) should always be on your mind as you plan asset creation.*

Jeannie Novak and Travis Castillo on LOD, "Game Level Design", 2008, page 101.

Luebke continues to explain that for games, the metric for which one optimizes is quite simply user perception. The goal is to spend the rendering and CPU budgets on the things the player is focusing his or her attention on, while taking shortcuts to fill the remainder of the screen with convincing support elements.

Another game-specific consideration for LOD is the identification of active or targeted objects in a scene. Depending on the type of game, players commonly interact with only a subset of the objects on screen at a given time. The player may fight one enemy at a time in a combat game, or control only the quarterback during a football play. In cases such as these, the game has a concrete indication of where the user's attention is most likely to be focused, and can bias the selection of LOD based on the likely attentiveness of the viewer.

### **3.6 Lighting**

Birn states that it is important to know the motivation of a light source before adding it, and to know the cause or original source of the light. Birn says there is more to lighting a scene than simply running a simulation of real world parameters. Lighting is also designed to achieve certain visual goals that help a viewer better appreciate a scene.

This statement is supported by El-Nasr. According to El-Nasr lighting design is an important topic of game development. There are many functions that lighting assumes in game environments, including directing attention, establishing good action visibility, evoking emotions, setting atmosphere, and providing depth.

Visual composition - including light placement, angles, colors, camera angles, field of view, movement, and environment textures - has an important impact on how game environments are perceived by players. Film-, theater-, animation-, and game designers have recognized the role that visual composition plays, and its impact on scene communication and perception. Wright identified several functions that visual composition assumes in game environments, including directing a player's focus to important elements in a game by balancing saturation, brightness, and hue of objects in a level. This is important to identify and acknowledge because it is a design element that affects game play and emotional engagement.

Designers have identified several visual design functions or perceptual goals for lighting design. These goals include establishing visibility for important elements in the scene, directing viewer's attention to important scene elements (visual focus), establishing depth, evoking moods, setting atmosphere, as well as providing information such as the time of day and environment setting. Lighting designers must satisfy these goals while maintaining visual continuity, which is important to maintain suspension of disbelief. These are important goals that affect game play at different levels. For example, setting the right mood and atmosphere is important to create the emotional involvement needed for a game. The color of lights in a scene shapes the feel of the entire image. Game designers often use contrast to create mood.

According to El-Nasr, Niedenthal, Knez, Almeida and Zupko, simulated illumination is defined as the method by which virtual 3D game environments are rendered taking into account all lighting information in the scene. Due to the flexibility of game rendering engines and the variety of game styles, we organize simulated illumination exhibited in games into a dimension ranging from more abstract forms of light and colour representation.

While many lighting principles can be borrowed from film and theatre lighting design theories, the interactive nature of games distinguishes them substantially from film and theatre. Game environments are dynamic and unpredictable due to the interactive freedom given to users within the world, thus narrative context, users' positions and perspectives within the game world - crucial parameters to the calculation of lighting - cannot be assumed. Light is understood,



manipulated, and simulated through its most basic characteristics; brightness or luminance, color, hard or soft shadow quality, direction, and variation over time.

El-Nasr explains lighting design techniques used in games. Current techniques in games include ambient lighting (used in games such as the Sims and Sim City), and manual static lighting (used in games such as Half-Life, Unreal Tournament, and Silent Hill), and real-time dynamic lighting (used in games such as Blade of Darkness and Doom 3). To portray shadows and add aesthetic quality to the experience, designers often pre-render or paint shadows into texture maps or player sprites.

### 3.6.1 Ambient lighting

Ambient lighting is a method where objects in a scene are given constant luminance values. In general, ambient lighting presents a fast and simple lighting model. It ensures that all objects are visible. This type of lighting works well with games such as the Sims or Sim City, but it cannot be generalized for use in first person shooters, horror, or action games where realistic and more dramatic lighting is often more appropriate.

### 3.6.2 Manual static lighting

Manual static lighting design is a method where designers carefully plan and predefine the lighting in a scene. They manually set lighting properties, including position, angles, and color, for each individual light in a scene. They then use a global illumination technique to render the level resulting in a light map that is then applied to the level. For aesthetic and atmospheric quality, some designers also use a combination of shadows and colors painted into texture maps.

While manual static lighting design approach provides a successful method for linear media (such as films and theater), it does not provide an adequate solution for interactive environments. Unlike film and theater, interactive 3D environments are unpredictable due to user interaction. Design parameters, including character/object locations and their importance, change unpredictably at runtime. For example, character relationships change depending on users' behaviors and actions, and physical positions of characters change relative to the user's actions.

Therefore, designers cannot script lighting behaviors to accommodate all situations and perform desired perceptual effects.

Most games, including Max Payne, Resident Evil, and Prince of Persia, use strategically placed lights that create a realistic feel by effectively motivating the lighting angles and positions by the major practical sources that exist in the scene, e.g. torches or windows. This kind of lighting, however, seldom portrays the correct visual focus for the scene. In fast paced games, directing viewers' eyes (especially for inexperienced users) to the focus is crucial for engagement. Additionally, in many adventure games, lighting can be employed to visually guide the player through a process or a task by directing his attention to important areas in the scene.

### 3.6.3 Dynamic lighting

Dynamic lighting uses dynamic real-time lighting to enhance emotional involvement and immersion. Doom 3 was one of the first games to extensively use dynamic real-time lighting to enhance emotional involvement and immersion. Designers interplayed among several parameters, including position, orientation, saturation, lightness, and color warmth. An example of a lighting pattern that designers used in Doom 3 was the sudden shift in lightness values from approximately 80% to 0%, and the increase in the affinity of color warmth in certain scenes when specific monsters appear. These changes increase visual tension and heighten emotional engagement.

### 3.7 Color theory

Colors and their meanings in popular culture:

White: purity, innocence, cleanliness, sense of space, and/or neutrality.

Red: love, romance, gentle, warmth, comfort, energy, excitement, intensity, life, and/or blood.

Yellow: happiness, laughter, cheery, warmth, optimism, hunger, intensity, and/or frustration.

Green: neutral, cool, growth, money, health, envy, tranquility, harmony, calmness, and/or fertility.

Orange: happy, energetic, excitement, enthusiasm, and/or sophistication.

Blue: calmness, serenity, cold, uncaring, wisdom, loyalty, truth, and/or focus.

Pink: romance, love, gentle, calming, and/or agitation.

Violet/Purple: royalty, wealth, wisdom, sophistication, exotic, spiritual, prosperity, and/or respect.

Brown: reliability, stability, sadness, warmth, comfort, security, natural, and/or organic.

Black: authority, power, strength, evil, intelligence, and/or death.



**Figure 3.7.1:** “Farbkreis”, by Johannes Itten, 1961.



### 3.8 Contrast

*We speak of contrast when distinct differences can be perceived between two compared effects. Our sense organs can function only by means of comparisons. The eye accepts a line as long when a shorter line is presented for comparison. The same line is taken as short when the line compared with it is longer. Color effects are similarly intensified or weakened by contrast.* Johannes Itten on contrast, “The Elements of Color”, 1970, page 33.

Itten explains that there are seven kinds of color contrasts.

#### 3.8.1 Contrast of hue

Contrast of hue is the simplest of the seven. Some obvious combinations are yellow/red/blue, red/blue/green, blue/yellow/violet, and so on. Just as black-white represents the extreme of light-dark contrast, so yellow/red/blue is the extreme instance of contrast of hue. At least three clearly differentiated hues are required, and Itten claims the effect is always tonic, vigorous and decided. The intensity of contrast of hue diminishes as the hues employed are removed from the three primaries. Thus orange, green, and violet are weaker in character than yellow, red, and blue, and the effect of tertiary colors is still less distinct.

Very interesting studies are obtained if one hue is given the principal role, and others are used in small quantities, merely as accents. Emphasizing one color enhances expressive character.



**Figure 3.8.1.1:** Contrast of hue.

#### 3.8.2 Light-dark contrast

Light-dark contrast is day and night, light and darkness - this polarity is of fundamental significance in human life and nature generally. The effects of black and white are in all respects opposite, with the realm of grays and chromatic colors between them. Light-dark contrast can be found in light-dark composition, colors of equal brilliance, and colors of equal darkness.

According to Itten's color circle, yellow is the lightest and violet is the darkest hue. These two hues have the strongest light-dark contrast.



**Figure 3.8.2.1:** Light-dark contrast.

### 3.8.3 Cold-warm contrast

Red-orange and blue-green are the two poles of cold-warm contrast. Generally the colors yellow, yellow-orange, orange, orange-red, red, and red-violet are considered warm, while yellow-green, green, blue-green, blue, blue-violet and violet are cold. Itten claims this classification can be very misleading, and insists that the hues that intermediate between the blue-green and red-orange may be either cold or warm according as they are contrasted with warmer or colder tones. The cold-warm contrast can be verbalized in a number of other terms: cold and warm, shadow and sun, transparent and opaque, sedative and stimulant, rare and dense, airy and earthy, far and near,

light and heavy, wet and dry.



**Figure 3.8.3.1:** Cold-warm contrast.

### 3.8.4 Complementary contrast

Two colors are called complementary if their pigments, mixed together, yield a neutral gray-black. Physically, light of two complementary colors, mixed together, will yield white. Itten expresses that *“two such colors make a strange pair. They are opposite, they require each other. They incite each other to maximum vividness when adjacent, and they annihilate each other to gray-black when mixed - like fire and water”*. There is always but one color complementary to a given color. Each complementary pair also has its own peculiarities - yellow/violet is complementary and light-dark. Red-orange/blue-green is both complementary and cold-warm.



**Figure 3.8.4.1:** Complementary contrast.

### 3.8.5 Simultaneous contrast

Simultaneous contrast results from the fact that for any given color the eye simultaneously requires the complementary color, and generates it spontaneously if it is not already present. The simultaneously generated complementary occurs as a sensation in the eye of the beholder, and is not objectively present. It cannot be photographed.



**Figure 3.8.5.1:** Simultaneous contrast.

### 3.8.6 Contrast of saturation

Saturation, or quality, relates to the degree of purity of a color. Contrast of saturation is the contrast between pure, intense colors, and dull, diluted colors. This contrast requires only one hue, and is achieved by adding more gray - or reducing purity - of the original hue.



**Figure 3.8.6.1:** Contrast of saturation.

### 3.8.7 Contrast of extension

Contrast of extension involves the relative areas of two or more color patches. It is the contrast between much and little, or great and small. Colors may be assembled in areas of any size, but the quantitative proportion between two or more colors is what is in question. If they are in balance, no one of the colors is used more prominently than the others, but by using one or more colors more prominently we can achieve a contrast of extension.



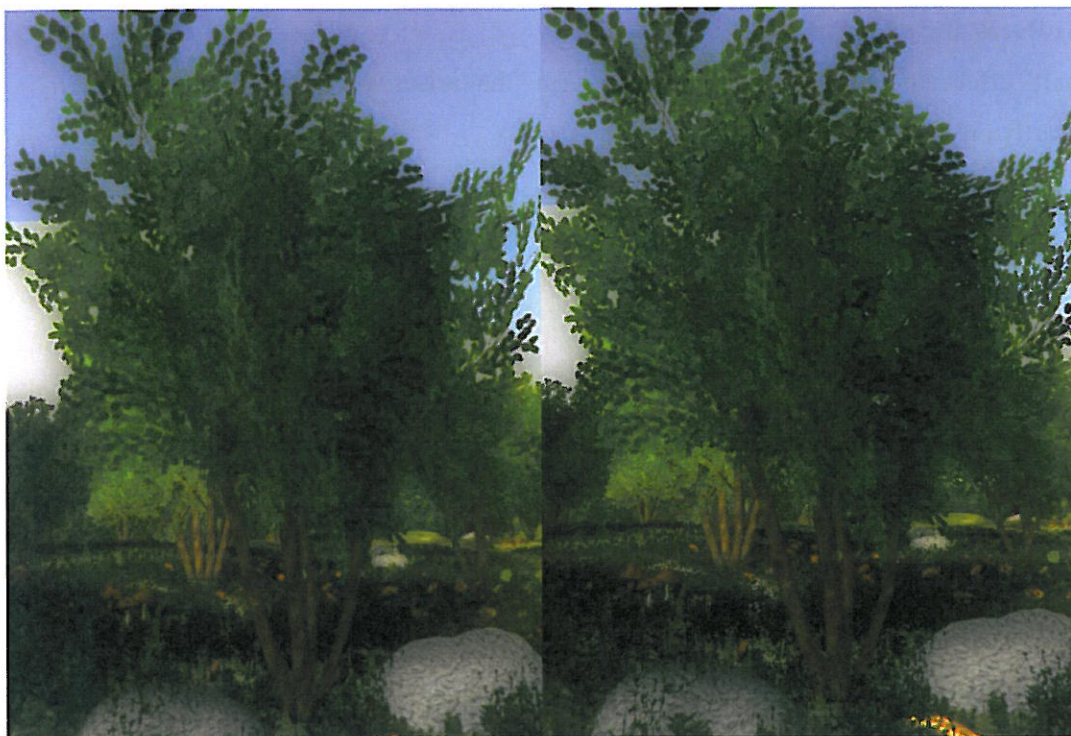
**Figure 3.8.7.1:** Contrast of extension.

## 3.9 Post-processing effects and filters

### 3.9.1 Antialiasing

Antialiasing is a post processing effect designed to give a smoother appearance to graphics. When two areas of different color adjoin in an image, the shape of the pixels can form a very distinctive “staircase” along the boundary. This effect is known as aliasing, and hence anti-aliasing refers to any measure which reduces the effect.





**Figure 3.9.1.1:** Antialiasing, picture taken from the prototype

The image to the left displays anti-aliasing. With this effect both the leaves in the trees as well as the grass on the ground appear denser.

### 3.9.2 Bloom

Blooming is the optical effect where light from a bright source appears to leak into surrounding objects. Bloom is a very distinctive effect that can make a big difference in a scene, and may suggest a magical or dreamlike environment.



**Figure 3.9.2.1:** Bloom, low threshold. Image taken from the prototype

### 3.9.3 Lens flares and sun shafts

A “sun shaft” effect simulates the radial light scattering that arises when a very bright light source is partly obscured.



**Figure 3.9.3.1:** Sun shafts. Image taken from the prototype

### 3.9.4 Motion Blur

Motion blur is a common post-processing effect simulating the fact that for most camera systems light gets accumulated over time. Fast camera or object motion will hence produce blurred images.



**Figure 3.9.4.1:** Motion blur. Image taken from the prototype

Figure 3.9.4.1 shows the effect of motion blur. It effectively enhances fast-moving scenes by leaving “motion trails” of previously rendered frames.



### 3.9.5 Contrast enhance/stretch

Contrast stretch dynamically adjusts the contrast of the image according to the range of brightness levels it contains. This adjustment takes place gradually over a period of time, so the player can be briefly dazzled by bright outdoor lights when emerging from a dark tunnel.



**Figure 3.9.5.1:** Contrast stretch. Image taken from the prototype.

### 3.9.6 Depth of field (DOF)

Depth of field is a common post-processing effect that simulates the properties of a camera lens. In real life, a camera can only focus sharply on an object at a specific distance; objects nearer or farther from the camera will be somewhat out of focus.



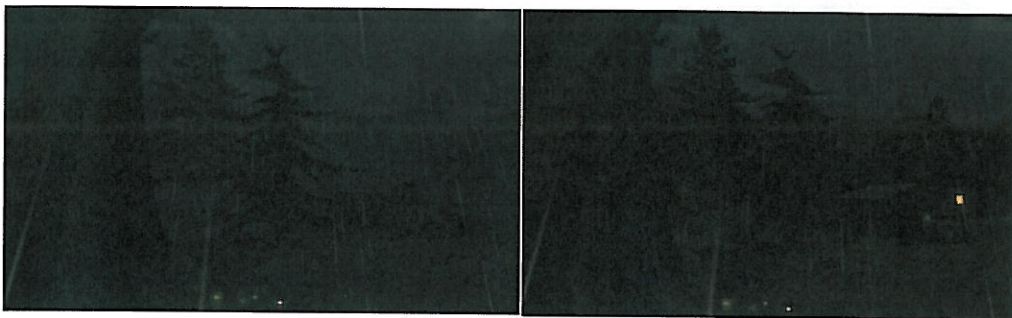
**Figure 3.9.6.1:** Depth of field. Image taken from the prototype.



Figure 3.9.6.1 shows how the camera seemingly focuses on the tree and butterfly in the foreground, and how the background is blurred as a result. The current effect was based on a dynamically changing DOF using a raycast to measure the distance between target of camera and the camera, and then adjusting focal distance and size accordingly.

### 3.9.7 Global fog

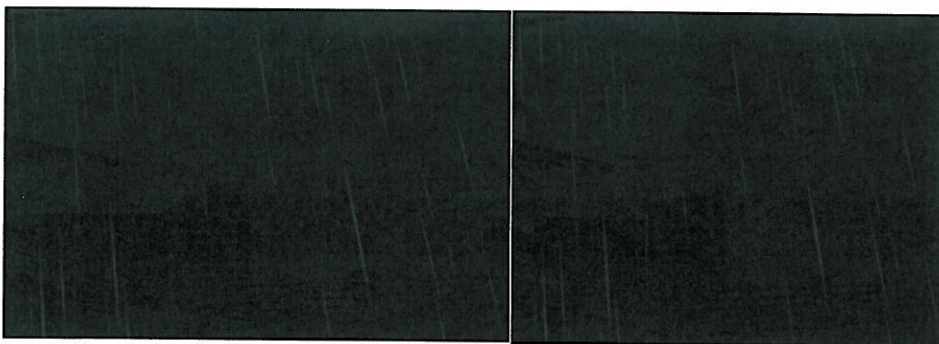
The global fog effect creates camera-based exponential fog. All calculations for this are done in world space, which makes it possible to have both height-based and distance-based fog modes.



**Figure 3.9.7.1:** Global fog. Image taken from the prototype.

### 3.9.8 Ambient obscurance

This approximates ambient occlusion in real-time as an image post-processing effect. It darkens creases, holes, and surfaces that are close to each other. In real life, such areas tend to block out or occlude ambient light, and then appear darker.

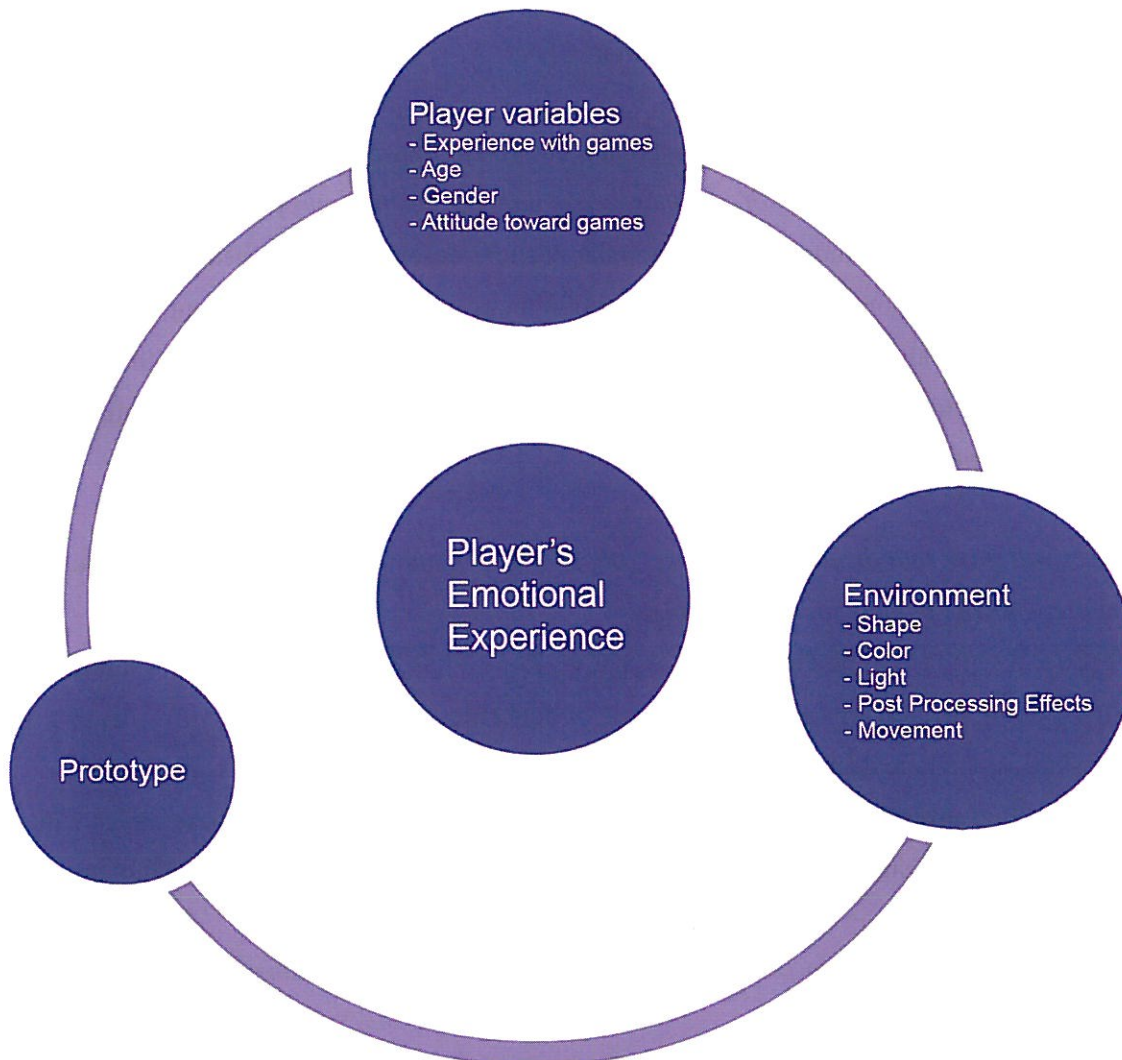


**Figure 3.9.8.1:** Ambient obscurance. Image taken from the prototype.

### 3.10 Research model and assumptions

The research model (figure 3.10.1.1) shows the different aspects of what is important in relation to the research question. It also includes assumptions based on the theory from chapter 3.

#### 3.10.1 Research model



**Figure 3.10.1.1:** Research model

### 3.10.2 Assumptions

*- Test subjects with a lot of prior experience with gaming, or who play games frequently, are more prone to focusing on gameplay rather than environment.*

We believe that test subjects who play games frequently may be more likely to focus on the gameplay and story aspects of a gaming experience than merely observing the aesthetics. This may be because they are used to immediately testing the limits and mechanics of a new game, while new players observe the overall look first.

*- Younger testers (aged 12-20) with a preference for typical first-person shooter games are more prone to focusing on the realism of graphics rather than the aesthetic properties.*

With gaming becoming a more and more popular pastime - especially for tweens and teens - it has come to our attention that this age group's main focus when passing judgement on games is often the level of realism of the graphics, and not the gameplay nor the aesthetics of the game. This has (in our most subjective of observations) appeared to be the case with young fans of the Call of Duty-series.

*- Testers will think that the areas feel more "alive" and dynamic based on movement in the scene (i.e., moving objects such as animals).*

We believe a static environment will feel less alive. Zone 1 has been equipped with a subtle gust of wind rustling the tree tops and grass, a horde of butterflies roaming the area, birds roaming the higher skies, and a lone deer standing idly about. Zone 2 has movement in the way of rain particles falling, strong winds, and wolves roaming the scene. We think all of these things will play a part in the test subjects' experience of the zones, and especially in the way of movement.

*- The test subject's attitude toward games will affect results regarding immersion, playability, and feelings.*

We believe that a subject's prior attitude towards games will play a large role in the test results they provide. An individual with a negative outlook on games and their purposes will most likely be less willing to talk about them or pay attention to them for prolonged periods of time. Due to



this subjective and personal resistance and/or reluctance towards games the subject may be less likely to achieve immersion or engrossment within this prototype.

## 4 Planning and developing the Prototype

We will build a prototype based on the data gathered in chapter 3. We will design the prototype based on the techniques and principles that should - according to theory – give us the emotional gaming experience we are aiming for.

### 4.1 Use of the theory and building the prototype

We will design and create two separate areas where we will aim to create vastly different emotions in the players. These two areas - now called zones - will be used to test and explore our research question, as well as test the collected claims, assertions, and data gathered from numerous sources.

The zones will be crafted using the Unity Editor (game engine), and the individual assets will be made using Autodesk Maya (3D modelling, rigging, animation), and Adobe Photoshop (textures and surfaces).

#### 4.1.1 Zone 1 - Design plans

Keywords for the first zone – Zone 1 – are “*inviting, lush, peaceful, and tranquil*”. All shapes in this zone need to be as inviting and “friendly” as possible, and this must be supported by the colors used, as well as the lighting.

According to Solarski in the chapter dealing with dynamic composition, round and circular shapes are the least connected to stubbornness and aggression. This zone should also avoid sharp edges in general, which excludes square and triangular shapes. With this in mind, geometry should be designed with round edges.

The zone will consist of a large, quite dense deciduous broad-leaf forest. The trees need to have branches that stretch out into a large circular shape, and a recognizable silhouette. It is also

important to make sure the trees in Zone 1 are vastly different from the trees in Zone 2. There will be a path leading through the entire zone, ending at the entrance of a cave. The zone should be populated by butterflies and birds, perhaps even squirrels and deer. In the shadows of the trees there will be large amounts of flowers, perhaps white. There will be a pond somewhere along the path, where the water should be very still for a calming effect.

Round edges and spherical shapes should also be used in the architectural pieces in the zone. To help lead the player through the world using lines and pathways one might want to use fences at some select areas. We want to create houses or a village to make sure the player doesn't feel alone, and also to create some variety in the environment. To avoid too much repetition of surfaces these houses should not be wooden. The fences will be made out of the same material as the trees. Architecture, such as houses, should be made out of warm, round stones.

Colors need to be in the warm specter, and the scene itself should be well-lit, though still maintaining shadows. If the color of the sunlight is to be adjusted, it should be made with a light yellow tint. The zone should stay away from the "warm-cold"-contrast to avoid cold objects altogether. As for post-processing a Bloom-effect would be appropriate to enhance a colorful environment.

#### 4.1.2 Zone 2 - Design plans

Our vision for the second zone – Zone 2 – is to create an environment that reflects the keywords *threatening, uninviting, depressing, grey, cold, and wet*. We want this zone to be a pine forest in an old, mountain-like terrain. In order to create a heavy atmosphere the weather should be characterized by storms and rain, and the forest covered in dense fog. A narrow path should lead the player through the forest. Small cottages and encampments should be placed in different locations to create the impression of a populated world, but it's still a rather harsh environment. There should also be wildlife roaming the forest.

According to Solarski the shape of the triangle is psychologically connected to the feelings of aggression and hostility. We want this to be the main topic for Zone 2. This means that this shape

needs to be used as a basis when designing all the 3D content for this zone. The forest is supposed to be old, and the square is connected to maturity and stability, which is one way to interpret the word “old”. This means that some of the environmental assets should be based on square shapes. With this in mind the forest should be designed based on the sharp edges of the triangle, while the architecture and stone/mountains will be based on the shape of the square. Hostile animals - like wolves and bears - do have softer shapes like the circle. To counteract the friendly impression the circle creates, we will design the animals’ silhouettes to be sharp and pointy to enhance an aggressive impression. The silhouettes of the pine trees should be designed pointy and triangular.

According to Itten’s color theory the blue color is cold, so the colors used in Zone 2 will either have a blue tint or be in the blue color spectrum. The main light source should have a blue tint, as well as the fog. Warm and cold colors are contrasting colors, so to make the atmosphere of the zone seem even colder we will add warm elements through contrast of extension.

The path of the zone should be built in a way that echoes the uninviting and threatening atmosphere. We believe that abrupt turns and poor visibility on the next turn will support the feelings we are aiming for.



#### 4.1.3 Before/after shots



**Figure 4.1.3.1:** Zone 1 with post-processing effects.

Figure 4.1.3.1 shows Zone 1 with post-processing effects in place. Figure 4.1.3.2 has no post-processing effects. Effects have been carefully chosen and tweaked to achieve results based on rules of composition, color, and contrasts. Following effects have been in use: Bloom (low threshold), antialiasing, contrast stretch, motion blur, and sun shafts.



**Figure 4.1.3.2:** Zone 1 with no effects.



**Figure 4.1.3.3:** Zone 2 with post-processing effects.



Figure 4.1.3.3 shows Zone 2 with post-processing effects in place. Figure 4.1.3.4 has no post-processing effects. The following effects have been in use: Bloom (high threshold), antialiasing, ambient obscurance, dynamic depth of field, global fog, and lighting fog.



**Figure 4.1.3.4:** Zone 2 with no effects.

## 4.2 The testing phase

We must test whether we can use these assets, the different effects and color palettes, as well as the guidelines for dynamic composition and strong silhouettes to create areas where the players will feel the emotions we intended as game designers. The areas and the individual assets have been carefully planned and designed based on the claims and theory gathered in chapter 3.

### 4.2.1 General gameplay

The gameplay consists of a 3D world seen from a first person view. We used a standard “First-Person Controller”-asset that ships with Unity for player movement. Input by the test subject would be “WASD” to move, and the mouse to look around. The prototype was created with no further gameplay or mechanics intended. Test subjects are urged to follow a path that will take



them through the zones, simply while observing their surroundings. Invisible colliders are put in place to make sure the test subjects can't divert far from the path.

#### 4.2.2 Zone 1 - Green Forest

Zone 1 is trying to achieve a feeling of peace and tranquility. The test subject is placed at the exit of a cave leading to a lush, green forest. The forest is densely populated by trees, grass, flowers, roots, rocks, and butterflies. This zone has a color palette that reflects previously mentioned claims on contrasts and colors, and how they affect humans. Main colors are warm shades of green and earthy browns. In addition we have used vibrant red, orange, and light blue as contrasts in order to break up the environment.

The terrain, trees, and all other assets have been designed to have very round shapes. There are no sharp edges, and even the mountains in the horizons have round edges. Colors are mostly in the warm-specter of the color wheel.



**Figure 4.2.2.1:** Image taken from Zone 1, after development.

### 4.2.3 Zone 2 - Grey Mountain

During development we have tried to stay as close as possible to the keywords *threatening*, *uninviting*, *depressing*, *grey*, *cold*, and *wet* by using the theory and techniques gathered in chapter 3.

Similar to Zone 1 the player starts in a cave entrance that leads to a narrow road. The road goes through an old pine forest where it is raining heavily with harsh winds, and the forest is covered in a dense fog. Along the road the player passes by houses with glowing windows, as well as glowing mushrooms. After walking for a short while, the player encounters a wolf on the road. The eyes are glowing yellow, and it is standing in an aggressive position looking at the player. As soon as the player gets too close to the wolf, it runs away. When passing a bridge the player can hear a howl from the wolf. About half way through the zone, the player encounters the wolf one more time and the event is repeated.

The lighting in the zone is dim, and the shadows are barely visible. The color of the light has a pale blue tint. To get a decent effect from the fog we had to pick a much darker blue than expected. The color of the glowing windows and mushrooms is very yellow, and we used an emission-shader to get the objects to shine, and a bloom post-processing effect to make the color bleed into the surroundings. To make all the objects look wet, we increased their level of specular.

Regarding strong silhouettes we have chosen to use the technique where we made many iterations of the same model in a 3D program. We explored the technique thoroughly when we designed and developed the pine trees.

Supporting sounds for the zone is a blowing wind, heavy rain, a wolf howl, and wet footsteps. We found the sounds on the webpage [www.freesound.org](http://www.freesound.org).

The particle effect of the rain and the waterfall were borrowed from the website [www.assetstore.unity3d.com](http://www.assetstore.unity3d.com). Some of the textures are borrowed from <http://www.cgtextures.com>.



**Figure 4.2.3.1:** Image taken from Zone 2, after development

### **4.3 Discarded development work**

In this chapter we will look at the work that was done during the development that did not make it into the prototype. Because of different events during production, we ended up with a lot of 3D models and terrain that was discarded.

#### **4.3.1 Discarded and discontinued assets**

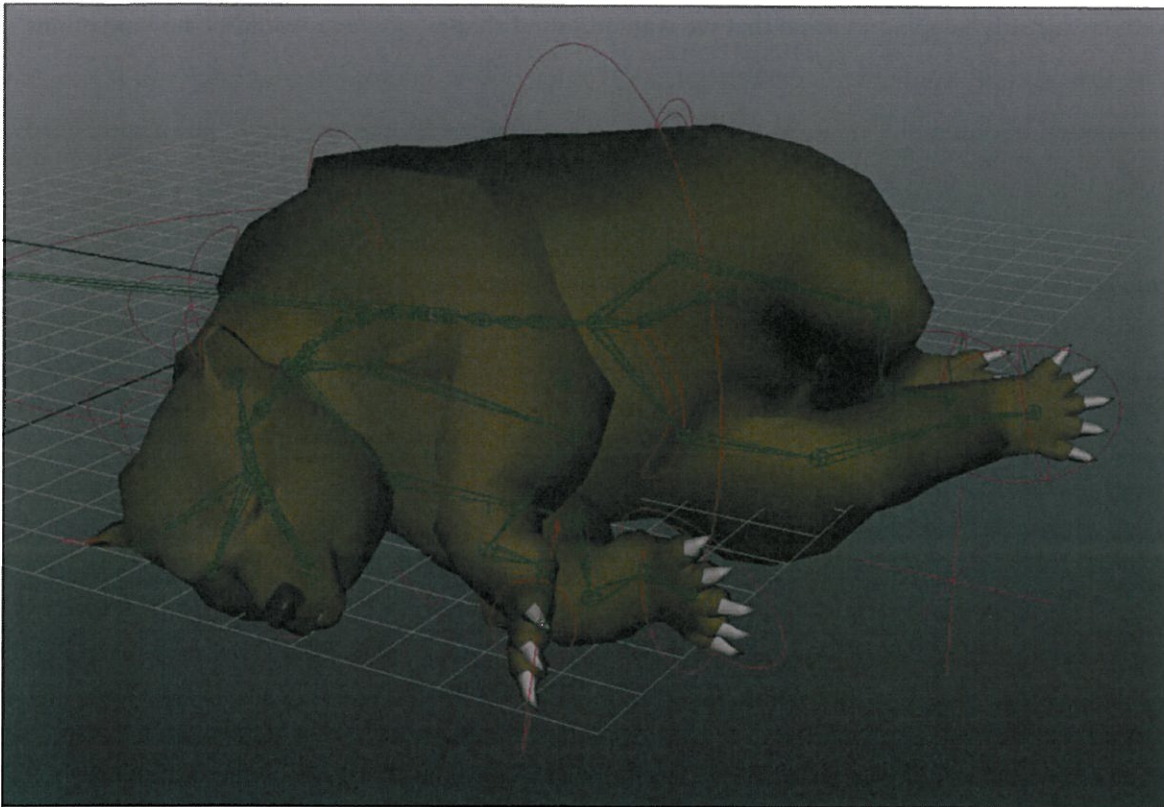
3D-models that were intended to be a part of the prototype which were either discontinued or discarded.





**Figure 4.3.1.1:** A bear that was going to be used in Zone 2 - Grey Mountain.

The planes seen on the bear were going to simulate fur by using a cutout shader. The player was originally going to encounter the bear in a bear den in Zone 2.



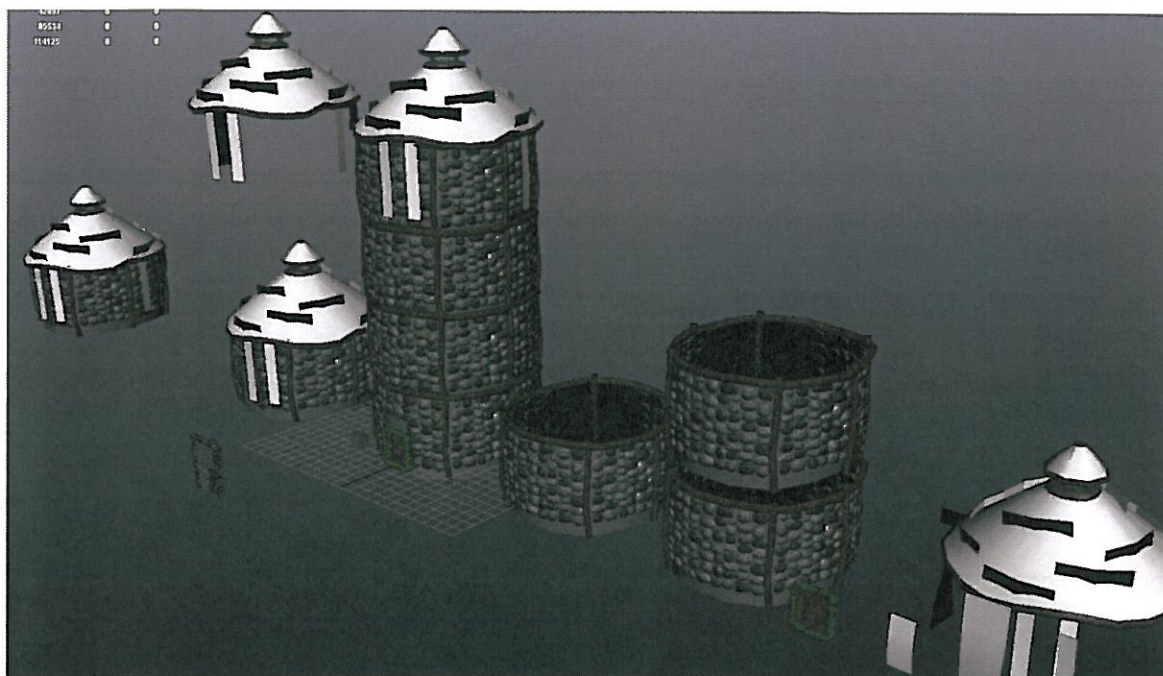
**Figure 4.3.1.2:** A rigged and animated version of the bear.

Upon the encounter in the bear den the bear would be sleeping. A total of 1100 frames of animation were made for this - approx. 44 seconds at 25 fps. It was then discontinued to finish the deer, since the deer would be prove versatile.



**Figure 4.3.1.3:** The image above is the first design attempt of the houses for Zone 1.

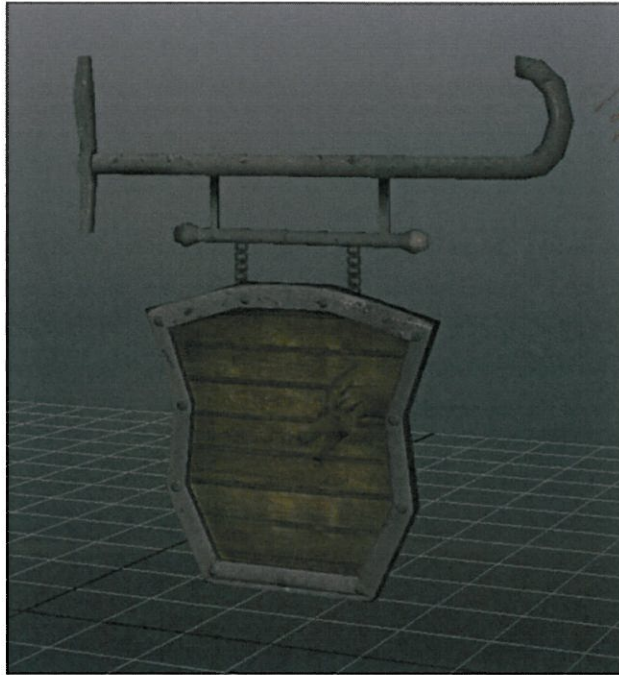
We were already keeping in mind that we wanted round shapes, so there would be no hard edges. With that in mind, we built a “construction set” for the houses, as seen in figure 4.3.1.3. It consisted of building blocks, such as buildings and rooms of varying size, as well as a number of differently designed windows and doors. This would allow many different houses to be assembled quickly from the same blocks. This construction set was discontinued when we realized we wanted to highlight the difference between the two zones in a more obvious way.



**Figure 4.3.1.4** Second attempt at the house construction set.

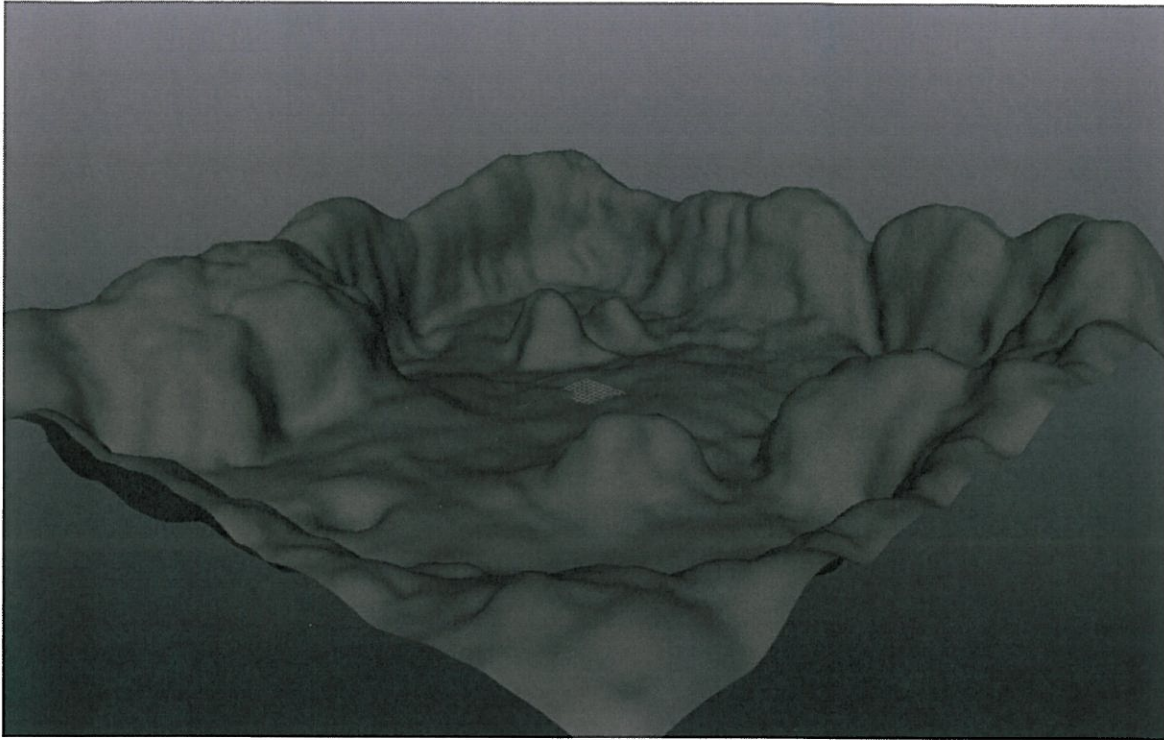
The new construction set consisted of round buildings made of smooth, round rocks and wooden pillars. Out of the houses that were assembled in this new set, only the windmill made it into the final Unity 5 build.





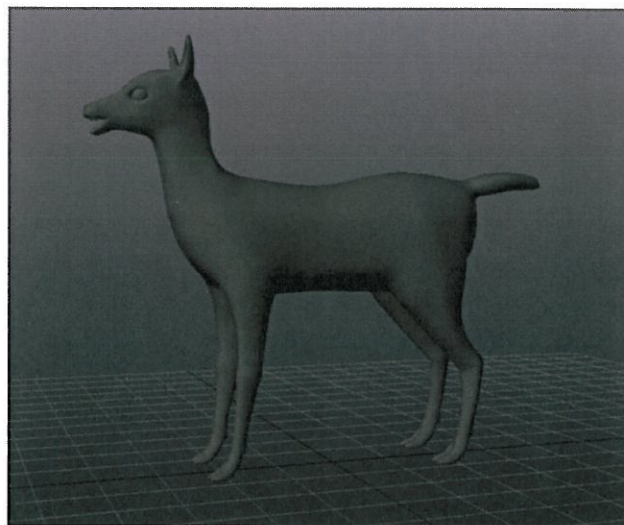
**Figure 4.3.1.5:** Signpost, intended for the village in Zone 1.

Originally Zone 1 was supposed to have a village. Above is the initial design of a sign that was supposed to hang outside an inn. There were also plans of crossing a river to get to the end-cave which transitioned between the zones, so an early design of a bridge was done. This was discontinued as soon as we switched to Unity 5 and the general size of the terrain was reduced drastically.

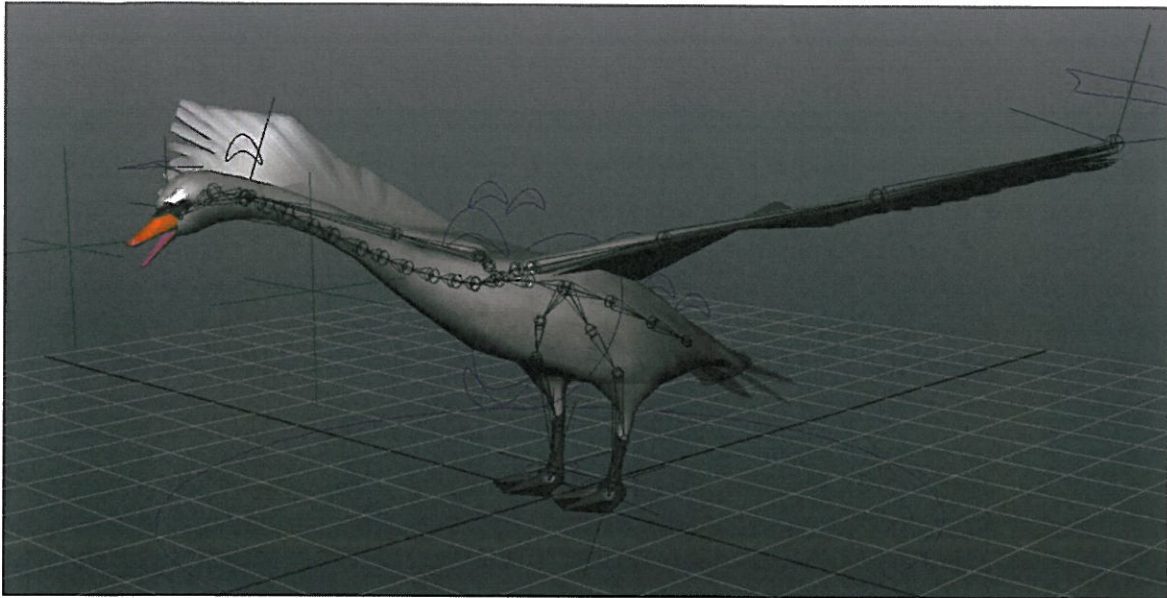


**Figure 4.3.1.6:** The sculpted terrain for Zone 1 in Unity 4.6.

The terrain was sculpted in Autodesk Maya, and then baked and exported as a heightmap. This was put to use in the 4.6 build of Zone 1, but was scrapped once we upgraded to Unity 5. Another sculpted terrain was used for the new build.



**Figure 4.3.1.7:** An early model of a roe deer.



**Figure 4.3.1.8:** Early concept of a swan.

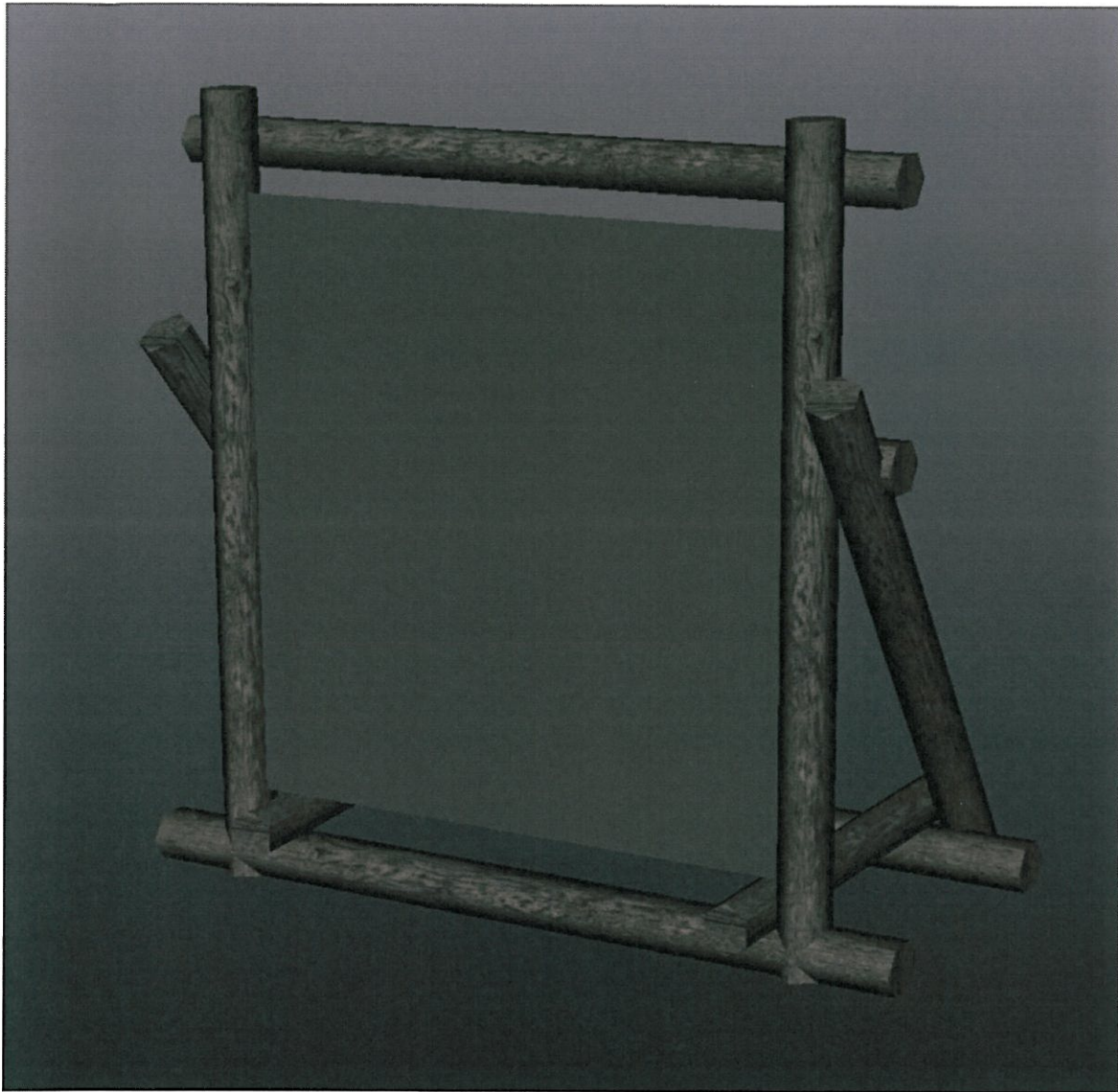
The swan in figure 4.3.1.8 was meant to populate the pond in the 4.6 build of Zone 1. When upgrading to Unity 5 and shrinking down the zones to the most important bits, this swan was discontinued to avoid overpopulating Zone 1. At this point it had already been textured and rigged. A roe deer was supposed to be roaming freely in Zone 1. This was discontinued along with the bear and the swan when we decided to only use the adult Deer, which would potentially fit into both Zone 1 and Zone 2.





**Figure 4.3.1.9:** A dog that was going to be used in Zone 2.

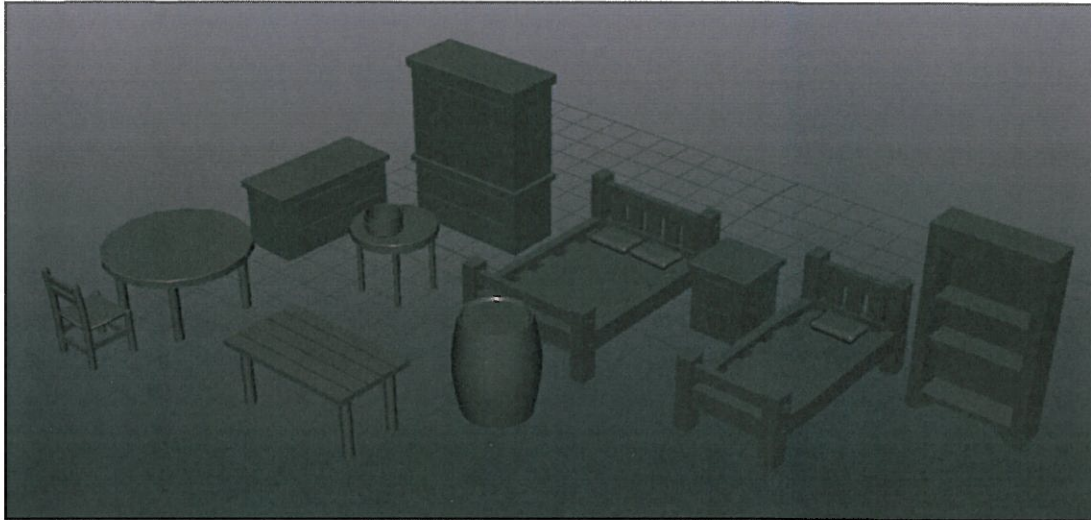
We wanted a dog to be guarding the first house the player meets in Zone 2.



**Figure 4.3.1.10:** A tanning rack that was going to be used in Zone 2.

A tanning rack (figure 4.3.1.10) could originally be found at the campsite in Zone 2.





**Figure 4.3.1.11:** Furniture that was going to be used inside the houses in Zone 2.

We had an idea that the players should be able to walk inside the houses if they wanted to. The furniture displayed in figure 4.3.1.11 was intended for the interiors of said houses.

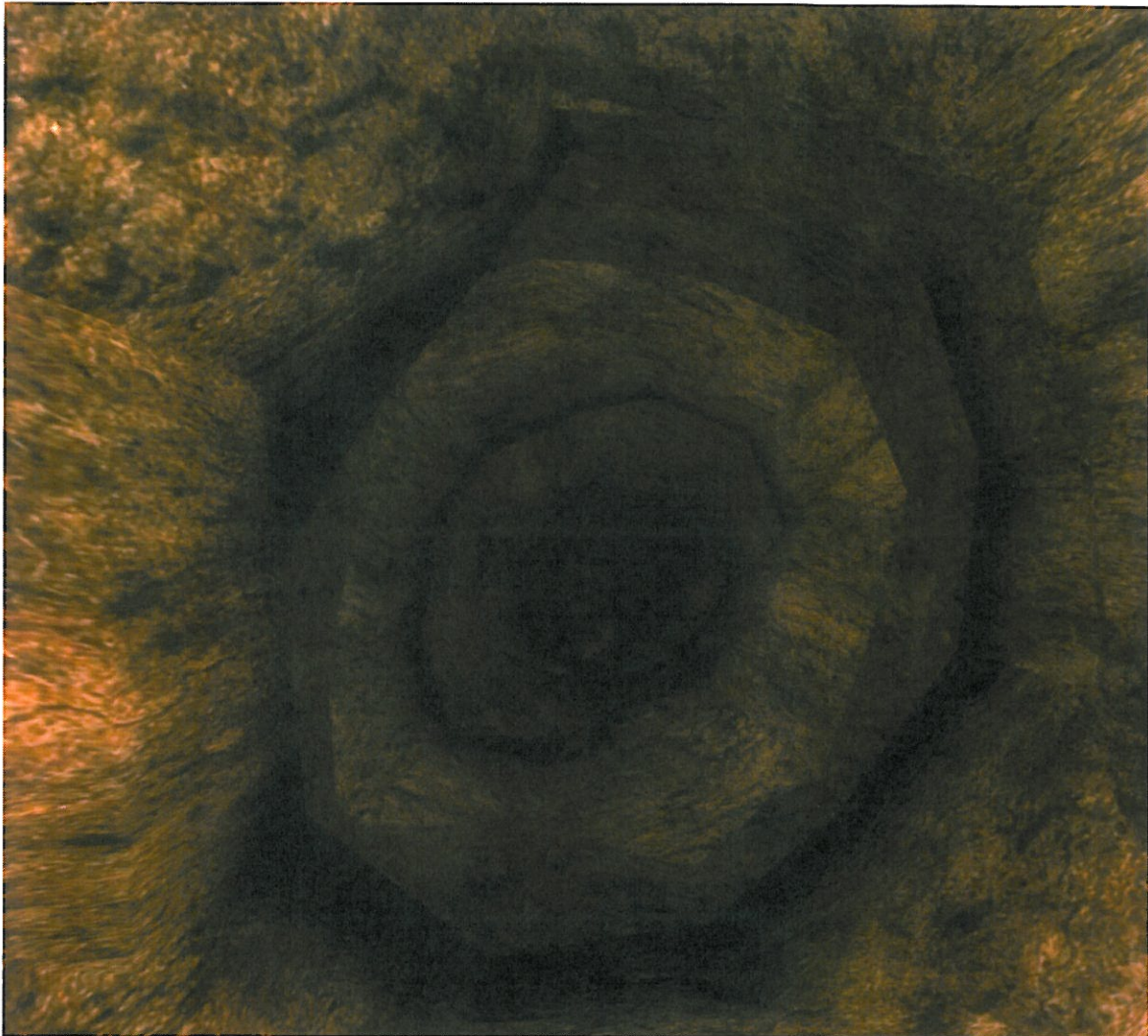


**Figure 4.3.1.12:** Hanging roots that were going to be used as clutter in cave entrances.





**Figure 4.3.1.13:** Roots that were going to be used as clutter along the road in Zone 2..



**Figure 4.3.1.14:** The “Dungeon”.

The dungeon was intended to be a transitional piece between Zone 1 and Zone 2. Considering these zones were supposed to be so vastly different, this dungeon would start out heavily inspired by the design of Zone 1, and progressively become more like Zone 2 as the player got closer to the end of it. In the middle there would be an open area we intended to be “beautiful”. This entire area ended up being scrapped because it added a lot of play time to an already lengthy scene, and



because this area wasn't backed up by much, if any, research on how to do this design.



**Figure 4.3.1.14:** Open area inside the dungeon.

### 4.3.2 Moving from Unity 4.6 to Unity 5

In the middle of the production period Unity Technologies released a new version of their game engine, Unity 5. Starting development of the prototype in Unity 4.6 was the natural choice for us because it was the game engine we had the most experience with. We knew that Unity 5 was under development, but we didn't know if we would get the opportunity to use that version during the prototype development because the release date of the engine was kept secret.



Soon after the launch of Unity 5 we decided to upgrade the prototype. The reason for upgrading in the middle of the development was the new and improved lighting system and shaders in Unity 5. After doing research on the subject we found that this upgraded version would give even better visual results than we first predicted, which would prove very beneficial for our testing. It also meant a lot of extra work rebuilding areas.

#### 4.3.2.1 Zone 1 - Green Forest in Unity 4.6

Before upgrading to Unity 5, most of the areas in Zone 1 were designed and decided. In Unity 4.6 the landscape had been built to be much larger than the terrain of the final Unity 5 build. After some early testing we found that having a test subject walk through an area of such great size was more time-consuming than necessary, and - if anything - only caused the subject to grow restless. We realized we didn't need vast areas of land to test our research question, and downscaled the areas accordingly.

The entire zone was sculpted out in Autodesk Maya, and then baked and exported as a heightmap into the Unity Editor.

Below are images from various points of interest in Zone 1 - the scrapped 4.6 version.



**Figure 4.3.2.1.1:** This is the area the player started off in Zone 1.



**Figure 4.3.2.1.2:** The first point of interest along the path.



**Figure 4.3.2.1.3:** This was the player's general view along the path. The forest was intended to be dense.





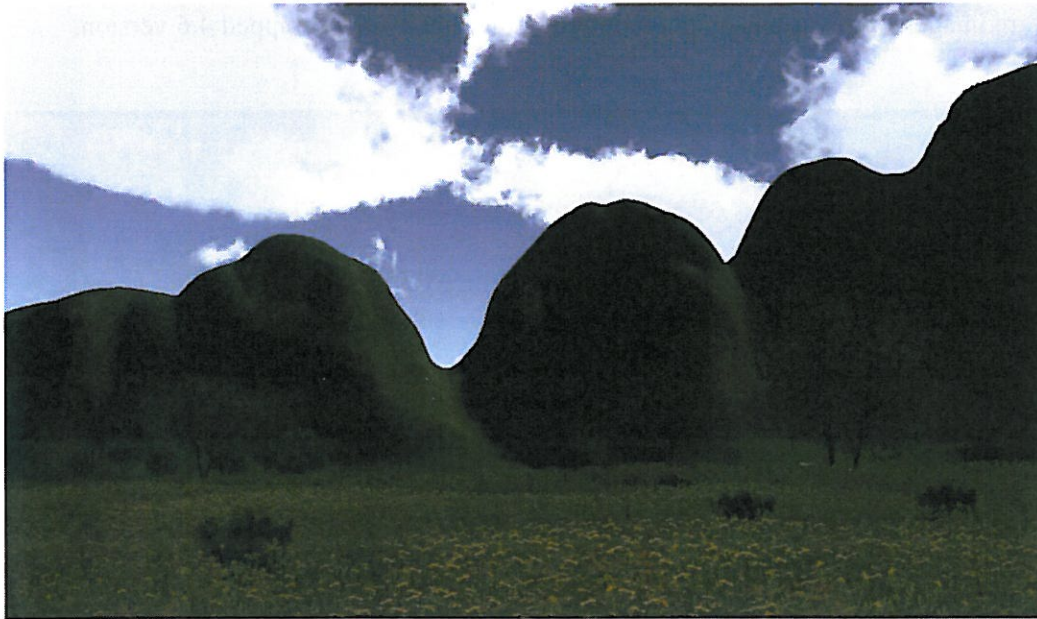
**Figure 4.3.2.1.4:** A medium-sized pond next to the path.

The original plan was to have a pair of swans floating around in the water, surrounded by water lilies. The water lilies made it into the final Unity 5 build, but the swan-model can be found in the discarded-models chapter.



**Figure 4.3.2.1.5:** The player's view of surrounding mountains.





**Figure 4.3.2.1.6:** A field of grass and flowers.

The player would walk through to get to the end cave. The original idea was to have this cave lead through a dungeon, and then to Zone 2 - Grey Mountain. More information about the dungeon can be found in the discarded models section - chapter 4.3.1.

#### 4.3.2.2 Zone 2 - Grey Mountain in Unity 4.6

Before we upgraded to Unity 5, the development of Zone 2 - Grey Mountain had reached the point where a lot of the main areas were hammered out and ready for the finishing touches regarding placement of clutter. Some of the lighting, color scheme, and visual effects were completed. However the zone was very large, and just by following the road it took about 4 minutes to play through. This does not take into account that the test subjects might walk off of the road and look at various points of interest.

Below are images from various points of interests in Zone 2 – the scrapped 4.6 version.



**Figure 4.3.2.2.1:** This is where the player started off in Zone 2.

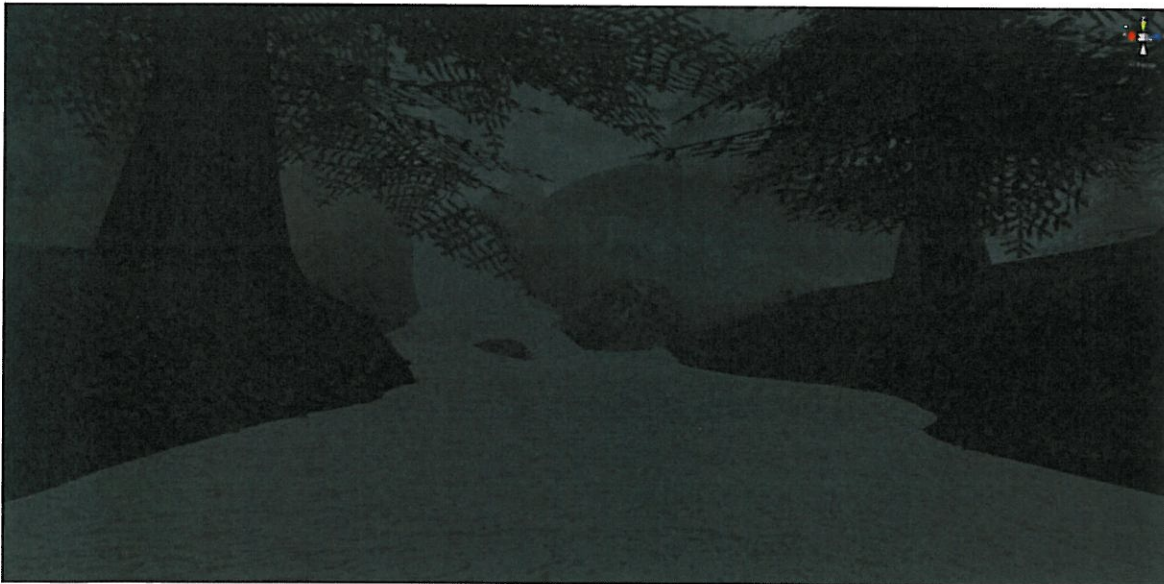


**Figure 4.3.2.2.2:** First place of interest was the “Inn” - a lonely house close to the start.





**Figure 4.3.2.2.3:** A part of the road. The player went uphill in Zone 2.



**Figure 4.3.2.2.4:** There were a lot of rivers in this zone.





**Figure 4.3.2.2.5:** There were also ponds of various sizes.



**Figure 4.3.2.2.6:** The player encountered a wooden bridge on the main road.



**Figure 4.3.2.2.7:** Hidden cave entrance.

If walking off of the main road after passing the wooden bridge, the player could find a cave entrance hidden between some large rocks. This was originally intended to be a bear den.



**Figure 4.3.2.2.8:** Another bridge.



Next point of interest would be found if walking off of the main road after passing the bear den. Then the player would encounter a second and smaller wooden bridge.



**Figure 4.3.2.2.9:** A campsite for hunting and fishing.



**Figure 4.3.2.2.10:** Close to the campsite the player could find a waterfall.





**Figure 4.3.2.2.11:** The village of Zone 2.

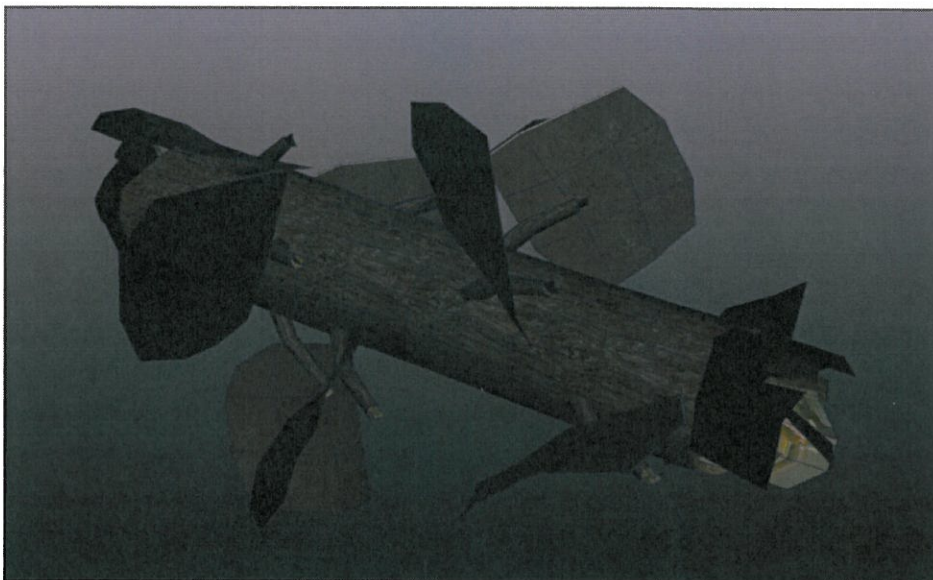


**Figure 4.3.2.2.12:** The last point of interest was a small settlement with various houses.

### 4.3.3 Discarding LOD

The chapter on level of detail discusses how important LOD is for optimization of a game, and how we always need to take the object's silhouette into account when designing the LOD pieces. We also need to think about where the player will be looking. We did not implement LOD as an important part of our prototype since we have been focusing on the composition rather than optimization, but we believe this will be very important in the future. We decided against discarding the chapter on LOD since we have been taking this into account when designing our assets.

When taking into consideration where the player will be looking we decided to only make LOD pieces out of the larger objects the player would want to inspect. As an example, the tree trunk in figure 4.3.3.1. This is the LOD 0, which means it is the version of the model with the most detail, and the highest polycount. Before we discarded LOD we chose to try out the "Discrete LOD"-system, where we've made multiple versions of the objects which will be loaded depending on the player's distance from said object.

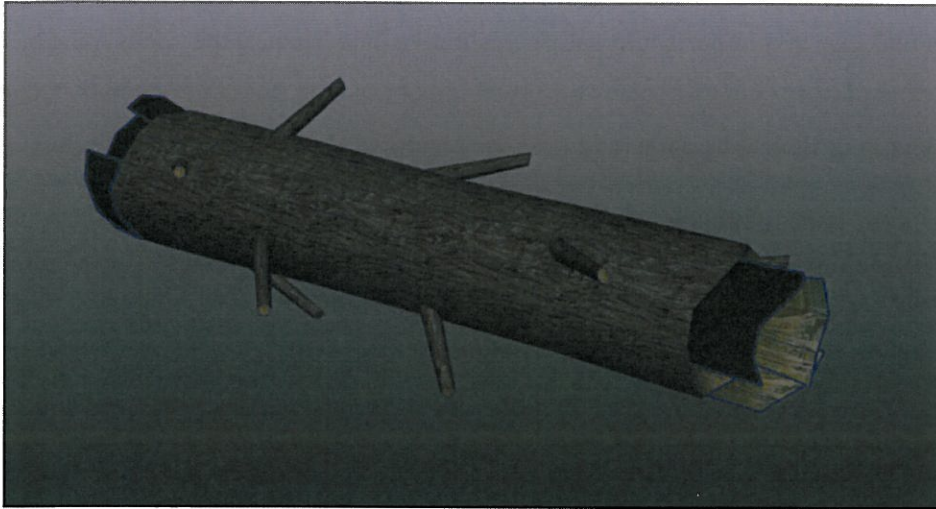


**Figure 4.3.3.1:** LOD 0 of Rotten\_TreeTrunk\_Medium with a polycount of 1302 tris.

Figure 4.3.3.1 shows full object. This screenshot is taken in Autodesk Maya, but when implemented into the Unity Engine we added a shader that allows a cutout-effect for the

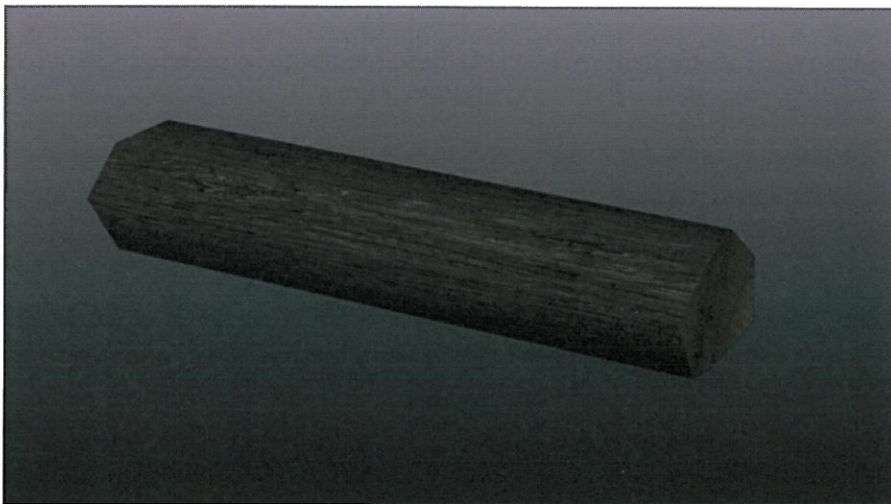


branches and the wood chips. Figure 4.3.3.2 is LOD 1, and shows the same object reduced to 402 tris, down from 1302.



**Figure 4.3.3.2:** LOD 1 of Rotten\_Tree trunk\_Medium with a polycount of 402 tris.

The final LOD (LOD 2 in figure 4.3.3.3) is only a cylinder of 24 tris, but should still work when it is very far away from the player. In addition the object might be occluded by other objects while switching LOD-states, which would help hide the “popping” that might occur. This popping might break immersion for the player, which is why it is important to hide it as effectively as possible.



**Figure 4.3.3.3:** LOD 2 of Rotten\_Tree trunk\_Medium with a polycount of 24 tris.



## 5 Method and data collection

A combination of qualitative data and quantitative data will be gathered to test the research question. In this case it is important to gather qualitative data because the zones must be observed by the players, and this data is observed rather than measured in numbers. Quantitative data and research must also be gathered to see the results of this test on a larger scale.

### 5.1 Data gathering

Qualitative data will appeal more to the human emotional aspects, and will be gathered through semi-structured individual depth interviews. Eligible subjects will be selected to ensure diversity among them. Quantitative data will be based on structured techniques such as online questionnaires, and subjects will be random voluntary participants.

For the data gathering process, two different questionnaires will be used; one for a qualitative in-depth interview, and one for the quantitative data gathering. The questions asked in each questionnaire are looking for the same answers, but the methods for getting them are different.

### 5.2 The quantitative method

The quantitative questionnaire will be available online after playing a demo of the prototype. The quantitative questionnaire focuses its questions on playability of the zones, feelings that were or were not stirred within the subject, player experience, and player immersion. This questionnaire will be available to testers as an online survey, and also users who have finished the online playthrough of the designed zones. The online quantitative survey is quick and anonymous, and the answers are mostly just numeric values and checkboxes.

### 5.3 The qualitative method

The qualitative interviews will be done in person after monitoring the subject during play. The qualitative questionnaire focuses on the overall impression of the zones, the level of immersion, as well as a more in-depth take on the player's feelings during play. The qualitative interview is

very open and free, and the questions allow the testers to answer each question with their own sentences and words instead of pre-built numeric values.

#### **5.4 Questions asked in the quantitative survey**

In the quantitative survey the subjects are not allowed to write their own comments or give answers in full sentences. They would be presented with a number of statements, and choose how true or false this statement was to them.

##### **Subject information**

- Gender
- Age
- How often do you play games?
- Do you enjoy games?

##### **Statements for Zone 1**

- The path was difficult to follow, and I had trouble figuring out where to go
- The zone felt tranquil and happy
- The zone felt safe and calming
- The area I walked through felt dynamic and alive
- The lighting of the area helped support a happy/cheerful mood
- The assets (trees, butterflies, flowers) in the area helped support the overall experience
- I felt immersed throughout the experience
- I felt immersed at some points during the experience
- The sounds/ambience did not break my immersion

##### **Statements for Zone 2**

- The path was difficult to follow, and I had trouble figuring out where to go
- The zone felt depressing
- The zone felt unsafe and threatening
- The area I walked through felt dynamic and alive
- The lighting of the area helped support a sad/low mood
- The assets (trees, houses, rocks) in the area helped support the overall experience
- I felt immersed throughout the experience
- I felt immersed at some points during the experience

- The sounds/ambience used did not break my immersion

### **5.5 Questions asked during the qualitative interview**

The qualitative interview allowed subjects to answer freely to most of the questions. The process of being in the same room as the subject also allowed us to monitor the subject during play.

#### **Subject information**

- Gender
- Age
- How often do you play games?
- Do you enjoy games?

#### **Questions**

- Describe your overall impression of Zone 1.
- Describe your overall impression of Zone 2.
- Describe your level of immersion during play. Was it broken at some point? If yes, when?
- Use 5 words to describe feelings you had when playing each zone.
- Did you have trouble figuring out where to go? If not, why?
- Did the areas feel dynamic and alive? Why/Why not?



## 6 Analysis And Discussion

In this chapter we will have a look at the result of the interviews. The total amount of anonymous responses for the quantitative survey was 41, while the number of qualitative interviews was 5. There were numerous reports of slightly unstable results in the web-build of the prototype, especially for Google Chrome users. Mozilla Firefox users experiences some crashes and fatal errors during play. There is also a distinct difference in the women to men ratio, both in the qualitative interviews and the quantitative survey responses. There is also an uneven ratio between age groups. This must be taken into account when making conclusions.

### 6.1 Interviewed testers

During the qualitative testing we gathered 5 different test subjects to play the prototype while their reactions and movements were being monitored. After the playthrough each subject was interviewed to get an idea of his/her impressions of each zone. At some points during the testing the conditions were not optimal. The room used for testing the last two subjects provided too much daylight, making it difficult to see what was happening on the screen. However, this did not keep the subjects from finishing the prototype.

#### 6.1.1 Background information on the interviewed testers

Subject 1 is a 28 year-old female with little gaming experience. She plays only once a month, but does enjoy games in general. Subject 2 is a 62 year-old male with next to no gaming experience. According to the subject he “plays some Solitaire every day, but doesn’t really play games”, nor does he enjoy computer games in general. Subject 3 is a 32 year-old male who mostly does not play games. He does, however, enjoy them. Subject 4 is a 22 year-old male who plays games every day, and very much enjoys them. Subject 5 is a 21 year-old male who also plays games every day, and enjoys them.

**Table 6.1.2 Describe your overall impression of Zone 1.**

<b>Subject 1</b>	It was very detailed, and bright. Felt like a light summer day.
<b>Subject 2</b>	What to say.. nice landscape. Nice colors.
<b>Subject 3</b>	In the beginning I was a little distracted trying to look at the models from an educator’s point of view. The area looked nice. Very pleasant setting.
<b>Subject 4</b>	Very bright and nice. Calm surroundings.
<b>Subject 5</b>	It was bright, cozy, cheerful, positive, and mystical.

There seems to be a general consensus among all test subjects that Zone 1 is bright and positive, as well as cozy or pleasant. Test subject 4 commented on how it was “calm”, which was one of our main design goals.

**Table 6.1.3 Describe your overall impression of Zone 2.**

<b>Subject 1</b>	Gloomy, frightening, refreshing and creepy.
<b>Subject 2</b>	Well, it was wet.
<b>Subject 3</b>	Dark. I was pretty sure there would be monsters popping out at me. I very much enjoyed the sound, like the wolf howl.
<b>Subject 4</b>	Dark and gloomy. Maybe a little bit scary and dramatic with the glowing mushrooms and glowing eyes on the wolf.
<b>Subject 5</b>	Gloomy, wet, gray, melancholic, scary.

Four out of five subjects stated that we’ve managed to create a very dark, gloomy, and tense atmosphere. Subject 1 thought that Zone 2 was refreshing because of the rain. Subject 2 said that he experienced the rain as a negative aspect, because he didn’t want to get wet. This is not too surprising considering that effects such as rain and fog can be very subjective.

**Table 6.1.4 Describe your level of immersion during play. Was it broken at some point?**

If yes, when?

<b>Subject 1</b>	I was immersed all the time, and very focused.
<b>Subject 2</b>	No, I don't think I experienced that. But maybe that's why I don't like games.
<b>Subject 3</b>	I was immersed enough to feel a little bit frightened when I saw the wolf. And I still recall the settings of both zones, so I guess I was a little bit immersed. I think I'd be more into it if I had someone else to play with.
<b>Subject 4</b>	I was immersed, and that was also because of the sounds.
<b>Subject 5</b>	I was definitely immersed. I liked the butterflies a lot, and the windmill made it very mystical. I also liked the rain, the wind, and the way the sounds indicated a storm building up.

It seems like we have quite successfully managed to make the test subjects immersed in our prototype. Subject 2 is the only participant in the qualitative interview who didn't experience the feeling of immersion. This may confirm one of our assumptions regarding how a person who doesn't like games won't reach the state of immersion. Such a bold statement would need more investigation, but this could definitely point towards interesting future research questions.

**Table 6.1.5 Use 5 words to describe feelings you had when playing each zone.**

<b>Subject 1</b>	The first area I felt happy, energized, optimistic, light and bright. The second area I felt refreshed, but skeptical, anxious and on-guard.
<b>Subject 2</b>	First area was bright, pleasant and nice. Second area was dark and wet.
<b>Subject 3</b>	First area was pleasant, cozy, and quaint. Second area was dreary, a little scary. I also felt analytical and anxious.
<b>Subject 4</b>	First area was happy and light. Second area was gloomy, scary, lost and wild, nightmare-ish.
<b>Subject 5</b>	The first zone was bright, positive, mystical, pretty, and calm. The second was dark, gloomy, negative, tense, scary, and sad.

The results we got were strikingly close to what the theory suggested, for both zones. We did experience some trouble getting the test subjects to describe 5 feelings per zone, and we're



unsure of why this is. It could be because players are not used to being self-conscious while playing, and not used to introspect.

**Table 6.1.6 Did you have trouble figuring out where to go? If not, why?**

<b>Subject 1</b>	I had no trouble following the path. It was made even easier by following the gravel on the road.
<b>Subject 2</b>	No, not really. Following the path was simple enough. It took a while to get used to the controls.
<b>Subject 3</b>	A little. I went down several roads, but somehow I got to the end. I wanted to explore more.
<b>Subject 4</b>	No. There was a path right there.
<b>Subject 5</b>	No. Following the road was very simple.

None of the qualitative test subjects had any major trouble navigating through the zones. We have designed and created the paths in the zones to stand out from the environment. An example would be the path in Zone 1, where the color of the grass around is green, and the color of the path is brown. In addition we placed fences strategically along the paths in both zones.

**Table 6.1.7 Did the areas feel dynamic and alive? Why/Why not?**

<b>Subject 1</b>	Yes. The sunlight coming through the leaves, and the leaves falling from the trees made it seem very alive. Also the rain falling in the second area.
<b>Subject 2</b>	I guess there were animals and such, so there was life there. But I just don't have that feeling of immersion either. Maybe I would feel it if there was music.
<b>Subject 3</b>	With the sounds and everything it did seem pretty alive.
<b>Subject 4</b>	It seemed quite alive. I liked the butterflies flying about in the second area, and the way the trees would bend in the wind in the second area.
<b>Subject 5</b>	The butterflies made it very dynamic and alive. There was also a lot of movement in both zones.

The majority of the qualitative test subjects feel like the areas were alive. The exception is subject 2, but he commented on how this could be because he wasn't too immersed to begin with. Test subjects seem to respond very well to movement in the areas, such as moving trees, falling leaves, and roaming butterflies.

## 6.2 Anonymous testers

Anonymous testers were given the opportunity to play the prototype, and then take our online survey. Testers would provide no identity information except their gender and age, and they knew they would remain anonymous. Unfortunately testers between the ages 18-25 have been overrepresented in this study.

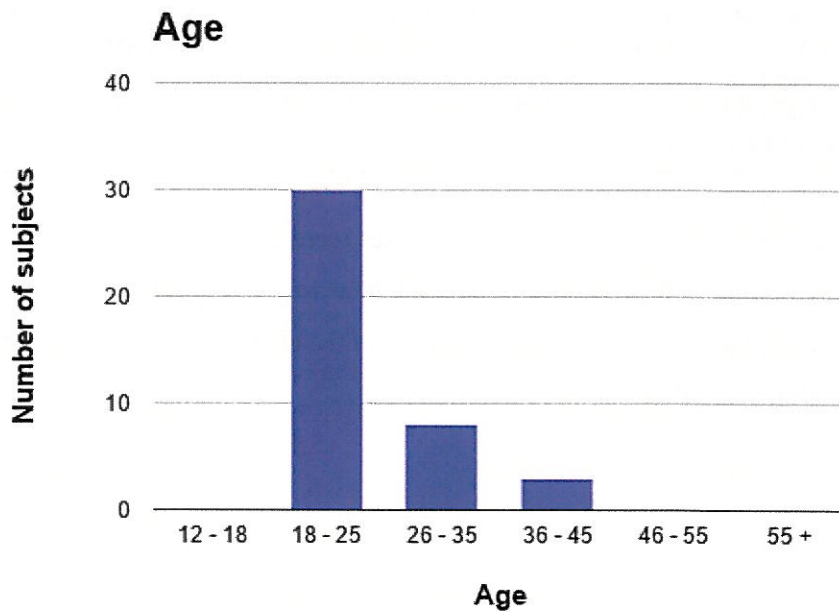


Figure 6.2.1: Age of testers, anonymous survey group



### Gender

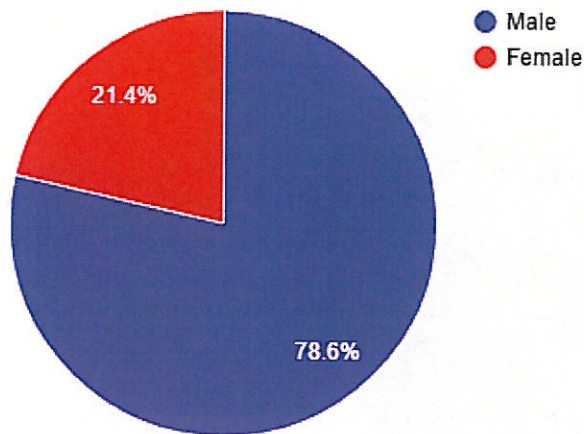


Figure 6.2.2: Gender balance, anonymous survey group

### How often do you play games?

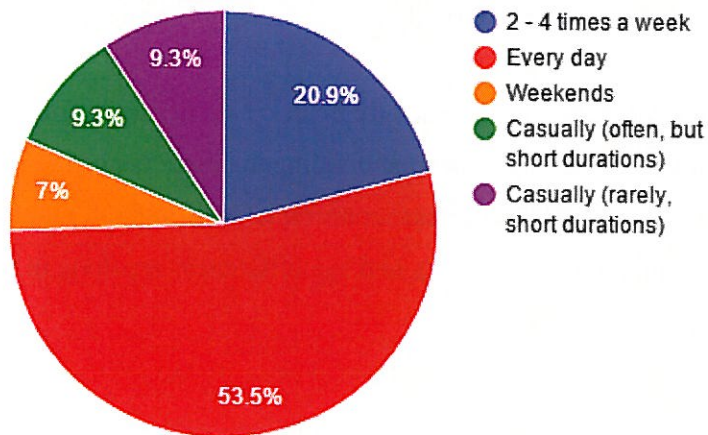
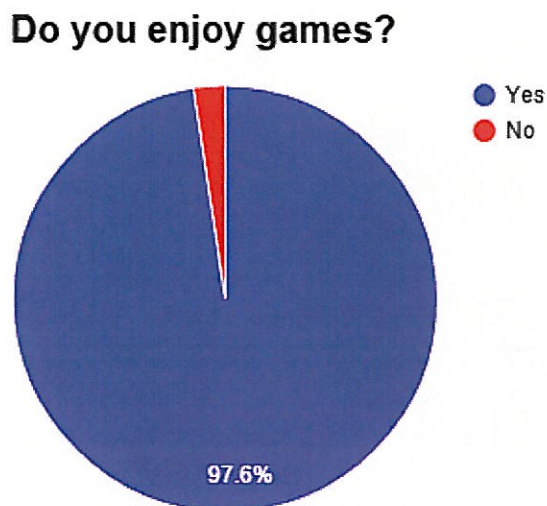


Figure 6.2.3: Gaming habits, anonymous survey group



**Figure 6.2.4:** Participants outlook on games, anonymous survey group

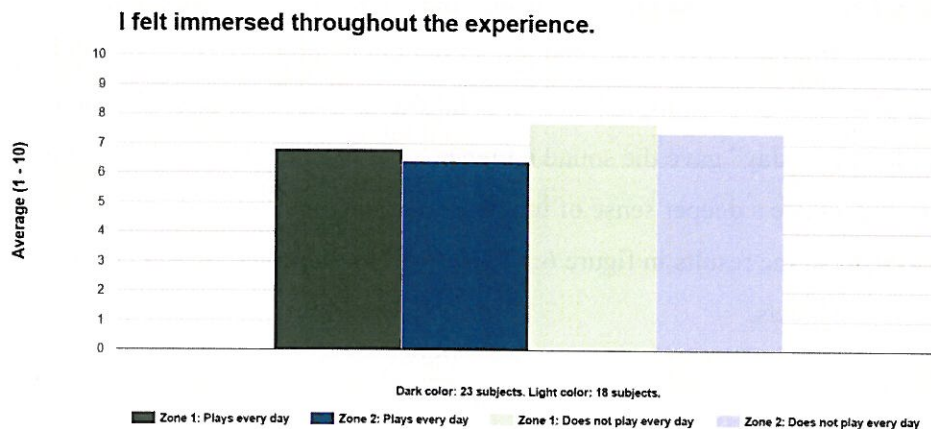
An overwhelming number of participants from the anonymous survey group enjoyed games. This could be because people who enjoy games in general are more willing to freely join a case study where they need to play a game/prototype.

We found that the scores for Zone 1 were generally higher than the scores for Zone 2, but the results are overall positive. As soon as we started dividing the participants into groups we also started discovering tendencies such as different scores on level of immersion, subjective interpretations regarding effects (such as rain), and age differences resulting in varying effectiveness when creating emotion.

### 6.3 Comparison of the surveys

For the quantitative survey we chose to discard the only answer where the test subject does not like games in general, because this individual answered extreme scores all throughout the survey. It seemed to be a very poor representation to what rest of the subjects responded, and contributed to decreasing the overall average score dramatically.

When analyzing the data gathered in the quantitative survey we divided the subjects into two age groups, and two groups representing playing habits to compare results. By looking at the average score between these four groups we found that there is a slight difference as to how they have responded to the environment. We have presented the results of the survey through graphs that show the average score for both groups, “Plays every day” and “Does not play every day” in Zone 1 (green) and Zone 2 (blue), and age groups 18-25 and 26-45. The darker colored columns are the scores of “Plays every day”, while the light colored columns are the scores of “Does not play every day”.

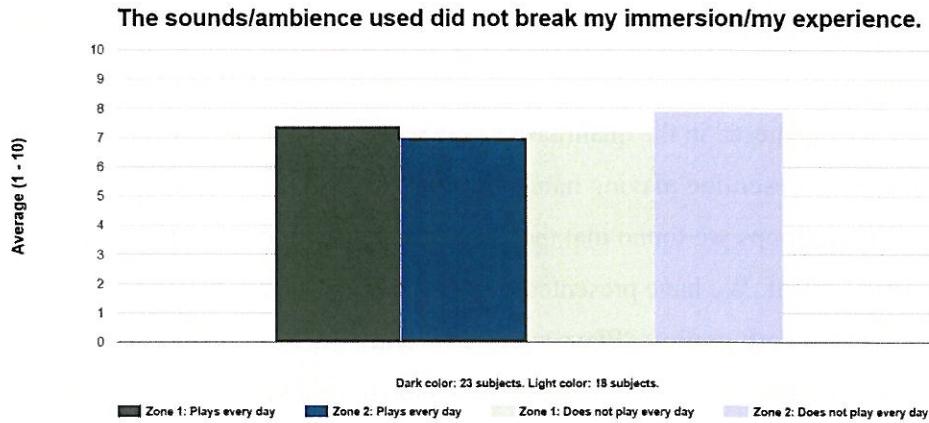


**Figure 6.3.1:** The average score of immersion experienced by the groups “Plays every day” and “Does not play every day”.

Figure 6.3.1 shows that the level of immersion experienced is higher in the group “Does not play every day” than the group “Plays every day”. The prototype does not supply the experience with a lot of gameplay, and we suspected that the more experienced group expected more gameplay to achieve higher levels of immersion than the less experienced group. Another reason might be

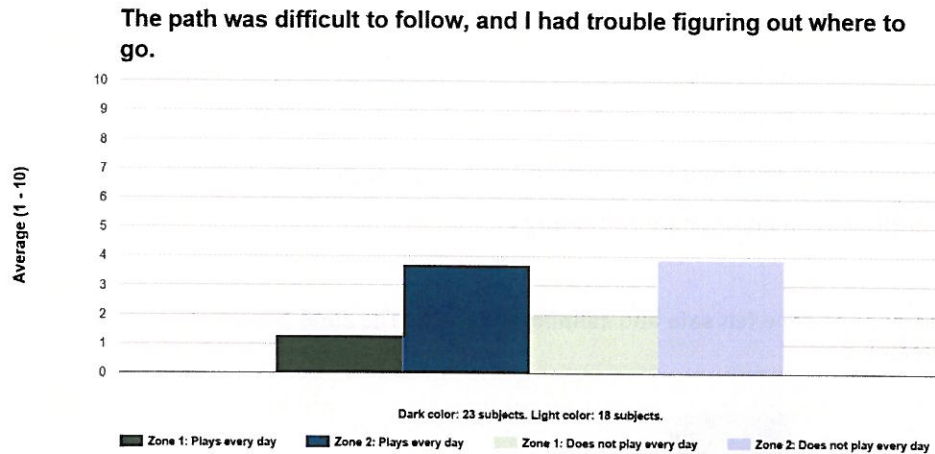


that the more experienced group has greater expectations to the visual quality than the less experienced group.



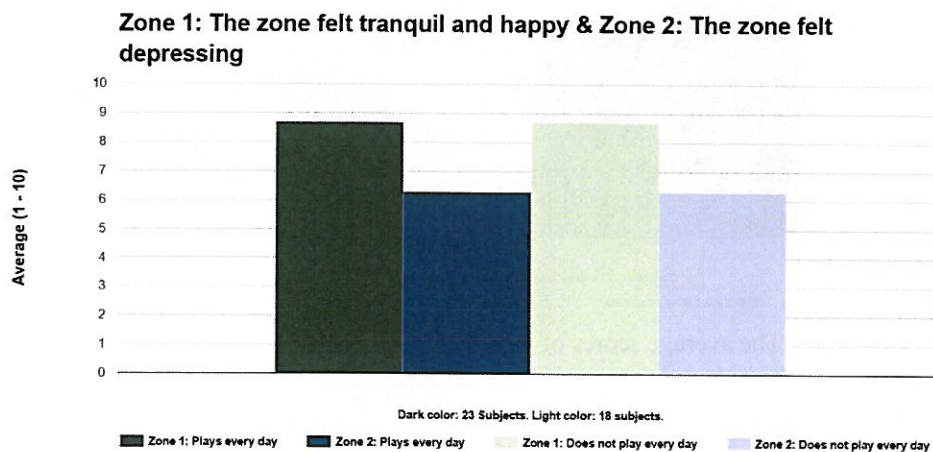
**Figure 6.3.2:** The average score of sound supplementing the experience.

The most important find in the comparison are the different scores when comparing the results for Zone 1 and Zone 2. It is clear that Zone 1 overall stirred the feelings we were aiming for better than Zone 2. Both groups confirm this in every statement, except the last one where the group “Does not play every day” gave the sound a higher score in Zone 2. According to Sanders and Cairns, music may create a deeper sense of immersion when done right, and break it when done wrong. By looking at the results in figure 6.3.2, we believe the sound helped create immersion for the test subjects.



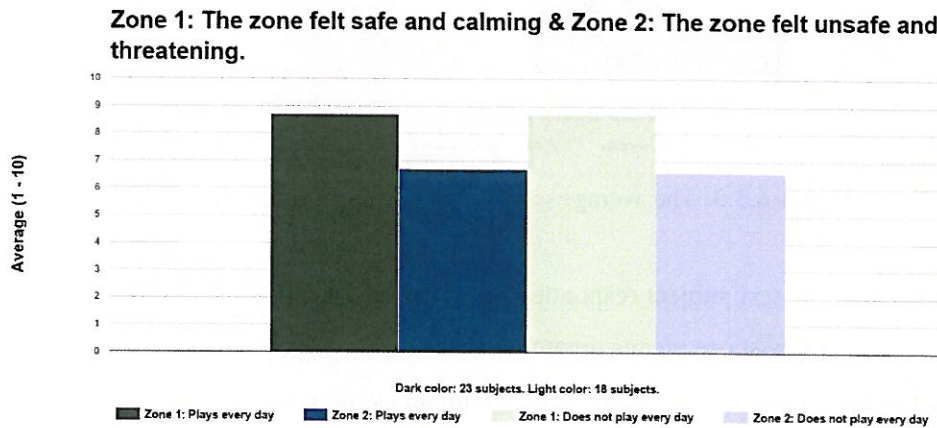
**Figure 6.3.3:** The average scores of navigation through the zones.

Figure 6.3.3 shows how the test subject responded to playability through navigation in the zones we created. In this case a low score means greater success for us. Getting experienced players to navigate Zone 1 has been an overwhelming success with an average score of 1.3. Getting less experienced players to navigate was also a major success with an average score of 2.0. Zone 2 received somewhat higher scores, which might be because of the deliberate crooked turns we added to accentuate a harsh and uninviting environment.

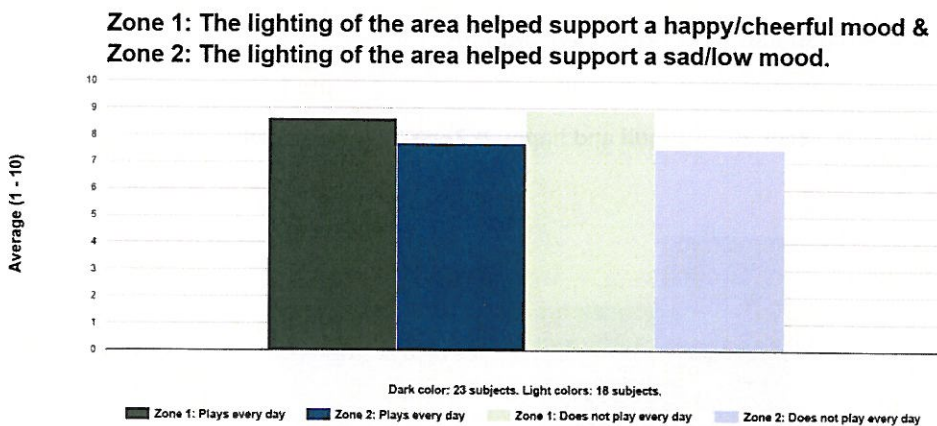


**Figure 6.3.4:** The average scores of intended feelings and impressions.

Figure 6.3.4 shows the difference in emotions that were stirred within players of each zone. The figure shows the average scores, which means Zone 1 overall scored higher when it comes to making the test subjects feel the way we intended. Zone 2 still has scores that are above average (6.1), but Zone 1 ended up having an overall higher average score (8.45). There were no noticeable differences between regular players and non-regular players. Figure 6.3.5 further supports these findings with another set of feelings.



**Figure 6.3.5:** The average scores of further intended feelings and impressions.

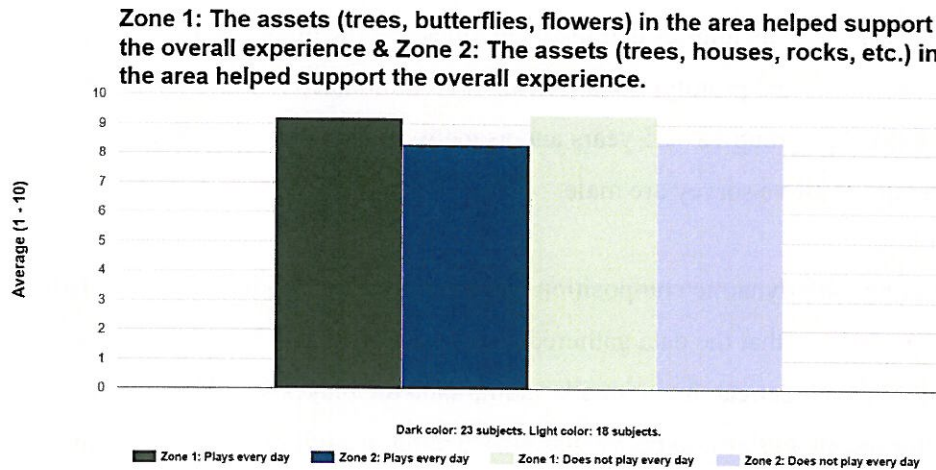


**Figure 6.3.6:** The average scores of how the lighting affected the scene.

According to figure 6.3.6 and 6.3.7 the average scores for the lighting and the assets we created were overwhelmingly positive. This applies to both zones, although Zone 1 was slightly more

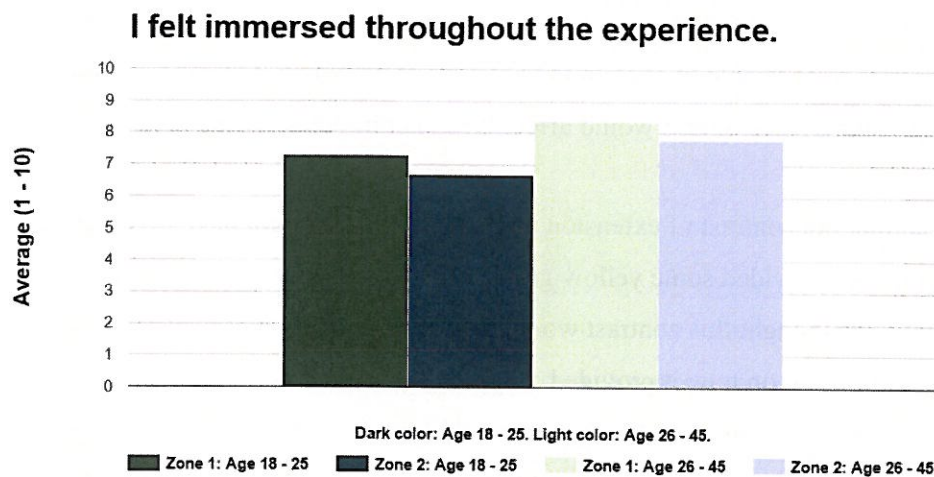


successful. Especially figure 6.3.7 displays overwhelmingly positive results for the assets. This appears to confirm the theory of composition, textures and colors discussed in chapter 3.



**Figure 6.3.7:** The average scores of how the assets supported the experience.

Figure 6.3.8 shows some differences between the age of the test subjects and their level of immersion. It would appear test subjects of age 26 and older were more immersed in the prototype than test subjects in the ages 18 - 25. Immersion scores were mostly positive in general; subjects aged 26 - 45 scoring slightly higher.



**Figure 6.3.8:** Average scores for immersion among age groups.

#### 6.4 End results and discussion

Both the quantitative anonymous survey and the qualitative interview indicated very positive results regarding the research question. The majority of the participants answered our statements with scores of 7 or higher. This implies that the techniques and the theory gathered and used as fundamentals in this thesis and prototype stand firm. We should keep in mind that a total of 30 test subjects are in the age group 18 - 25 years and as many as 78.6 percent of the total participants in the quantitative survey are male.

In the chapter dealing with dynamic composition we saw how all individuals respond differently to art. However, we believe that the data gathered clearly shows us that by using certain techniques the artist/developer can intentionally manipulate the player's feelings by using the environment. After testing our prototype we also realized that we must be very careful when choosing what effects to use because they can negate each other in some cases, as seen in qualitative interview regarding Zone 2.

We noticed that Zone 2 had weaker results than Zone 1. This means that Zone 2 overall received a slightly lower average score than Zone 1, but we still consider the result to be a success. We think the lower scores in Zone 2 could be due to people having different reactions to bad weather. This became quite apparent to us during the interview with qualitative test subject 1. The 28 year old female stated that rain makes her feel very refreshed rather than depressed. Since the quantitative testers were unable to explain their ratings, it would be logical to assume that their own subjective experience of rain would affect the general feeling of the zone.

We also believe adding the contrast of extension and hue in Zone 2 might have been counter-productive. The contrast provided some yellow glowing objects, the mushrooms, and the windows. Originally we thought this contrast would enhance the cold objects and the cold scene, but a few testers commented on how it provided a light in the dark. Another thought on why Zone 2 gave less promising results could be because the heavy use of square-shaped objects drowned the triangular shapes. This could hence counteract the physiological effects of the triangles.

An overwhelming amount of participants responded to the environment in the way we envisioned, but what about the participants who did not experience any sort of immersion? Or the ones who do not feel that any of the statements in the survey were suitable for the zones? In our assumptions we included a statement on how we believe individuals with a negative outlook towards games would not be likely to achieve immersion or engrossment within the prototype. Out of 47 total participants in both the qualitative and quantitative data gathering, only 2 of them had a negative outlook on games. One of the subjects was from the qualitative interview, and the other from the quantitative survey. The interviewed test subject explained that his relationship with computers has always been strictly professional, and he also gets nauseous when there's a lot of movement on the screen. This is one of the reasons why he does not enjoy games. He did however think that Zone 1 had a pretty landscape with nice colors, and that it was light, cozy and nice. He also acknowledged that Zone 2 appears dark, wet, and cold, but the "mushrooms were cozy". As for the anonymous survey we have no data that gives us any indications to why the test subject did not experience immersion, nor experience any of the feelings we intended. The only clue is that the subject does not like games in the first place.

Contrary to our assumptions, experienced players were not more difficult to control or impress. This was a surprising find, but also a very interesting one. We achieved mostly equal results when trying to stir feelings within the subjects, but participants who didn't play games every day were more susceptible to getting immersed.

We assumed the younger age group would be more critical to the graphical realism of our prototype. This assumption originally applied to testers between the ages 12-18, which we ended up having none of. The current younger age group consists of subjects aged 18-25, but our findings show that the assumption was partly correct. This age group was older than we predicted, but subjects aged 18-25 were more critical to the visuals than the age group 26-45, in addition to being less immersed. This supports our assumption, and could potentially lead to future research on the matter. We thought this tendency would be apparent in test subject of younger age, but it could prove to be a reaction in far older subjects than we predicted.



According to our assumptions, the test subject would experience the areas as being more “alive and dynamic” based on movement in the scene, such as animals. This was confirmed through a qualitative interview with at least one test subject. Because of the structured nature of the quantitative survey we are not able to discern why the test subjects thought the zones felt alive, but it could be logical to assume they had a similar experience as the qualitative test subject.

We also assumed that the experienced players would focus on quality of the gameplay rather than the environment. We did not find any direct evidence to support this statement, but the results in the quantitative statements suggest that the more experienced players did not achieve as much immersion as the less experienced group. According to Brown and Cairns, reaching the immersion level “engrossment” – the second level of immersion – require an interesting task or occupation. The prototype offers only walking and observing as gameplay for the player, and might cause the more experienced players to notice the lack of further tasks sooner than the non-experienced players.

## 7 Conclusions and Implications

A game environment is a complex composition of many ingredients. By using the theories and claims we gathered from numerous sources, we were able to create two zones with vastly different environments. More importantly, we were able to create two zones that stirred completely different emotions in our test subjects. We were able to confirm that we can indeed use the environment to control and manipulate the player’s emotional experience the way we envisioned, and we were able to get the players immersed in these zones.

After reading the findings of our sources we learned that people interpret art in different ways based on their mood and past experiences, and this was confirmed in our own results. We also learned that combining two or more techniques or effects that were originally appropriate according to theory, might together potentially create an unexpected and wrongful impression.

Before we started testing we assumed that a test subject's feelings towards games in general would influence both the results we would get, as well as the subject's own ability to reach the state of immersion. This may have been confirmed to some extent through our testing, but it is difficult to make a ruling on this. We had far too few test subjects on the matter to reach a certain conclusion, but we believe it is definitely worth looking into in the future. We had difficulties finding "non-gamer" test subjects who were willing to play through our prototype, thus resulting in "gamers" as an overrepresented group.

An idea for further study would be to assess whether people can't reach the state of immersion because they don't enjoy games, or whether people don't enjoy games because they're not capable of immersion with the medium. It would also have been interesting to do the data gathering differently - perhaps testing two large groups of subjects after gathering feedback. This way we would test one group first, take their scores and feedback into consideration, and then changing some key elements of the prototype according to the results we got. After testing the second group with our new build (perhaps with improved lighting or tweaked effects), we might get a much greater understanding of these selected elements' effect on the players. Arguably, this could potentially lead us closer to reaching the emotional experience envisioned as game designers.

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## 9 Appendix

Notes from the qualitative interviews

Raw data from the qualitative survey

Average score between the groups “Plays every day” and “Does not play every day”

Average scores between the age-groups 18 - 25 and 26 - 45

## 9.1 Notes from the qualitative interviews

### Subject 1

Female, 28

#### **How often do you play games?**

Once a month

#### **Do you enjoy games?**

Yes

#### **Describe your overall impression of Zone 1.**

It was very detailed, and bright. Felt like a light summer day.

#### **Describe your overall impression of Zone 2.**

Gloomy, frightening, refreshing, creepy

#### **Describe your level of immersion during play. Was it broken at some point? If yes, when?**

I was immersed all the time, and very focused.

#### **Use 5 words to describe feelings you had when playing each zone.**

**Zone 1:** Happy, energized, optimistic, light, bright

**Zone 2:** Refreshed, skeptical, anxious, dark, on-guard

#### **Did you have trouble figuring out where to go? If not, why?**

No trouble following the path. It was made even easier by following the gravel on the road.

#### **Did the areas feel dynamic and alive? Why/why not?**

Yes. The sunlight coming through the leaves, and leaves falling from the trees made it seem very alive. Also the rain falling in the second area.

## Subject 1 - Behavioural notes

**Dialogue:**

“Oh, cool roots” - Upon seeing roots on the ground in Zone 1

“Oh!” - Upon seeing the deer

“This was so pretty”

“Wow, such nice details” - Upon straying slightly from the path in Zone 1

“Is this where I’m supposed to go?” - Standing outside the cave at the end of Zone 1

“Oh!” - Upon seeing the wolf

“Creepy” - When noticing the wolf in Zone 2

**Actions:**

Stopped to look at surroundings in the beginning of the zone (1).

Noticed the deer as well.

Test subject wanted to be able to run in Zone 2.

Noticed the wolf, and stopped to observe cautiously.

Also noticed the second wolf, and was on-guard.



## Subject 2

Male, 62 years old

### **How often do you play games?**

I usually play some Solitaire every day, but I don't really play games.

### **Do you enjoy games?**

No. I like Solitaire, but I don't enjoy computer games in general.

### **Describe your overall impression of Zone 1.**

What to say.. nice landscape. Nice colors.

### **Describe your overall impression of Zone 2.**

Well, it was wet. There was too much movement on the screen. I became dizzy because of the rain.

### **Describe your level of immersion during play. Was it broken at some point? If yes, when?**

No, I don't think I experienced that. But maybe that's why I don't like games.

### **Use 5 words to describe feelings you had when playing each zone.**

**Zone 1:** Bright, pleasant, nice colors.

**Zone 2:** Dark, wet, cold.

### **Did you have trouble figuring out where to go? If not, why?**

No, not really. Following the path was simple enough. It took a while to get used to the controls.

### **Did the areas feel dynamic and alive? Why/why not?**

I guess there were animals and such, so there was life there. But I don't think I have that feeling of immersion. Maybe I would feel it if there was music.

## Subject 2 - Behavioural notes

### Dialogue:

- “Mhm...” - When testing the controllers.
- “It’s raining. I don’t want to get wet.”
- “Glowing mushrooms”
- “Hey, kitty” - Upon seeing the wolf.
- “I’m getting dizzy” - A comment on the controllers.

### Actions:

- Missed the deer.
- Tried to enter the windmill.
- Tried to look around a bit, but is not used to the controls.
- Missed the first wolf.
- Noticed the second, but had no noticeable reaction.

## Subject 3

Male, 32 years old

### **How often do you play games?**

Rarely. Used to play a lot of Counter-Strike when I was 18, but I stopped because I never had my own computer to play games on. I tried Minecraft once, and then I played for 4 days straight.

### **Do you enjoy games?**

Yes, I like games.

### **Describe your overall impression of Zone 1.**

In the beginning I was a little distracted trying to look at the models from an educator's point of view. The zone looked nice. Very pleasant setting.

### **Describe your overall impression of Zone 2.**

Dark. I was pretty sure there was going to be monsters popping out at me. I very much enjoyed the sound, like the wolf howl.

### **Describe your level of immersion during play. Was it broken at some point? If yes, when?**

I was immersed enough to feel a little bit frightened when I saw the wolf. And I still recall the settings of both zones, so I guess I was a little bit immersed. I think I'd be more into it if I had someone else to play with.

### **Use 5 words to describe feelings you had when playing each zone.**

**Zone 1:** Pleasant, cozy, quaint, feels like summer

**Zone 2:** Dreary, a little scary, analytical, anxious, cozy (the houses in zone 2)

### **Did you have trouble figuring out where to go? If not, why?**

A little. I went down several roads, but I got to the end. I wanted to explore more.

### **Did the areas feel dynamic and alive? Why/why not?**

With the sounds and everything it did seem pretty alive.





## Subject 3 - Behavioural notes

### Dialogue:

“This looks pleasant”.

“Hmmmmm..”

“Maybe I should go for a swim?”

“This was nice.”

“That was an elk. Or a reindeer”.

“Where to go? I’ll go this way.”

“Hmmm...”

“Mushrooms!”

“So I’m going in there now? Do I have to?”

“No, no, no..”

“Ooooooh, nice.”

“Shit. It ran away. That’s good.”

“I bet there’s gonna be a monster popping out here soon.”

“I feel like I should have a weapon”

“No. Go away. Eugh. No. Go away.” - Upon seeing the second wolf in the middle of the road.

“A wolf!”

“Oh!”

“Do I have to go in there?”

### Actions:

Missed the deer.

Missed the windmill.

Looked around at everything.

## Subject 4

Male, 22 years old

### How often do you play games?

Every day

### Do you enjoy games?

Yes, very much so.

### Describe your overall impression of Zone 1.

Very bright and nice, calm surroundings.

### Describe your overall impression of Zone 2.

Dark and gloomy. Maybe a little bit scary and dramatic with the glowing mushrooms and the glowing eyes on the wolf.

### Describe your level of immersion during play. Was it broken at some point? If yes, when?

I was immersed, and that was also because of the sounds.

### Use 5 words to describe feelings you had when playing each zone.

Zone 1: Happy, light

Zone 2: Gloomy, scary, lost and wild, nightmare-ish.

### Did you have trouble figuring out where to go? If not, why?

No. There was a path right there.

### Did the areas feel dynamic and alive? Why/why not?

It seemed quite alive. I liked the butterflies flying about in the first area, and the way the trees would bend in the wind in the second area.

## Subject 4 - Behavioural notes

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**Dialogue:**

None.

**Actions:**

Noticed the deer.

Inspected the windmill.

Spent quite a bit of time looking at the assets.

Inspected the village in Zone 2.

## Subject 5

Male, 21 years old

**How often do you play games?**

Every day

**Do you enjoy games?**

Yes.

**Describe your overall impression of Zone 1.**

Bright, cozy, cheerful, positive, mystical.

**Describe your overall impression of Zone 2.**

Gloomy, wet, gray, melancholic, scary.

**Describe your level of immersion during play. Was it broken at some point? If yes, when?**

I was definitely immersed. I liked the butterflies a lot, and the slowly-rotating windmill made it very mystical. I also liked the rain, the wind, and the way the sounds indicated a storm building up.

**Use 5 words to describe feelings you had when playing each zone.**

**Zone 1:** Bright, positive, mystical, pretty, calm

**Zone 2:** Dark, gloomy, negative, tense, scary, sad

**Did you have trouble figuring out where to go? If not, why?**

No, following the road was very simple.

**Did the areas feel dynamic and alive? Why/why not?**

The butterflies made it very dynamic and alive. There was a lot of movement in the zones.

## Subject 5 - Behavioural notes

**Dialogue:**

None.

**Actions:**

Looked at the butterflies.

Noticed the deer.

Inspected the windmill explored the surroundings.

Noticed both wolves, and proceeded with caution.

Inspected the village in Zone 2.



9.2 Average score between the groups “Plays every day” and “Does not play every day”

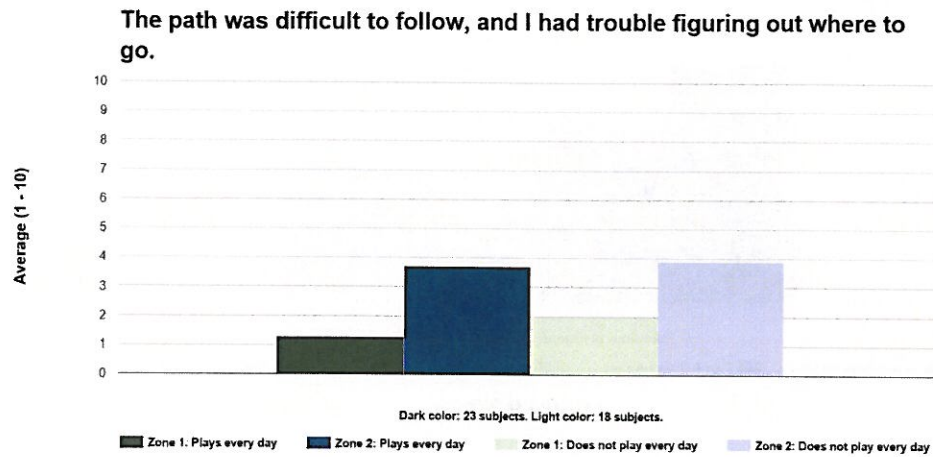


Figure 9.2.1

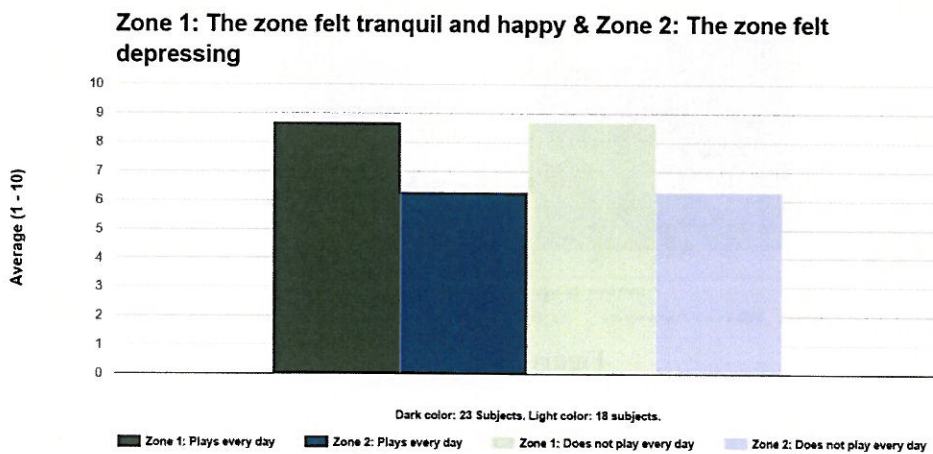


Figure 9.2.2

**Zone 1: The zone felt safe and calming & Zone 2: The zone felt unsafe and threatening.**

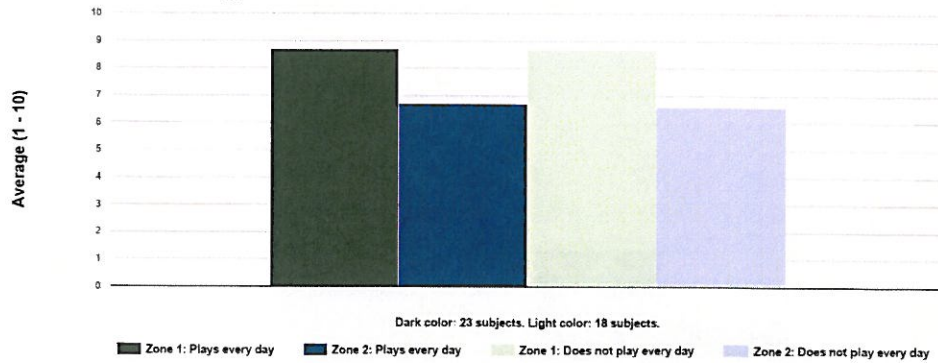


Figure 9.2.3

**The area I walked through felt dynamic and alive.**

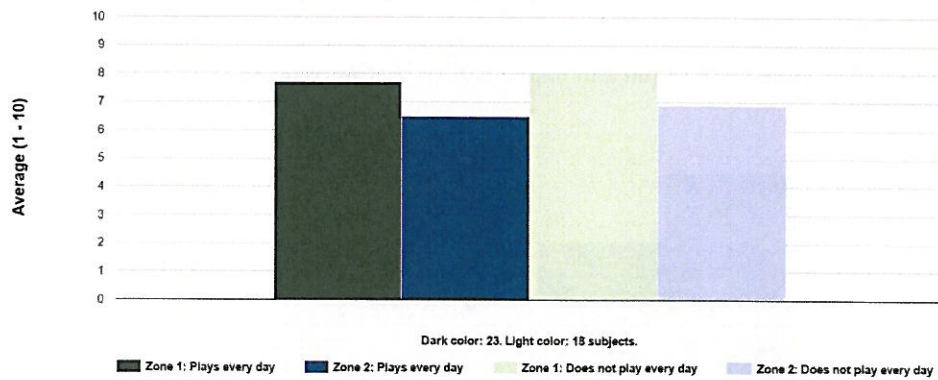


Figure 9.2.4

**Zone 1: The lighting of the area helped support a happy/cheerful mood & Zone 2: The lighting of the area helped support a sad/low mood.**

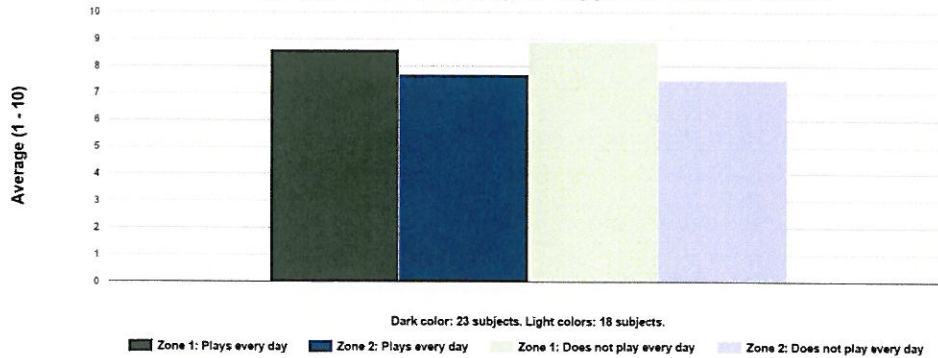


Figure 9.2.4

**Zone 1: The assets (trees, butterflies, flowers) in the area helped support the overall experience & Zone 2: The assets (trees, houses, rocks, etc.) in the area helped support the overall experience.**

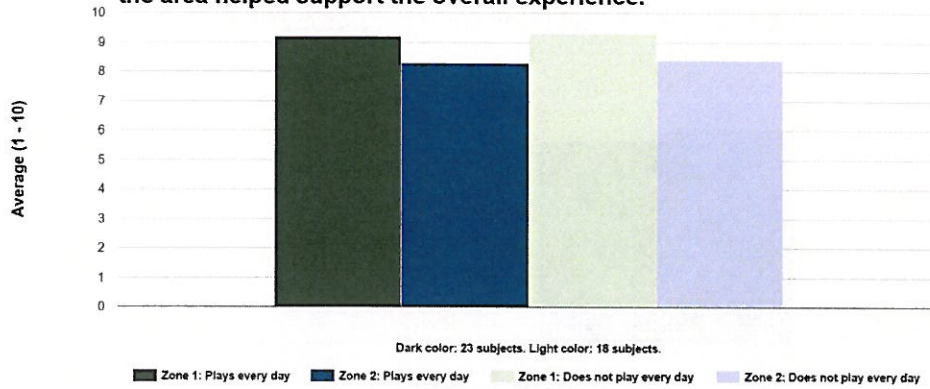


Figure 9.2.5

**I felt immersed throughout the experience.**

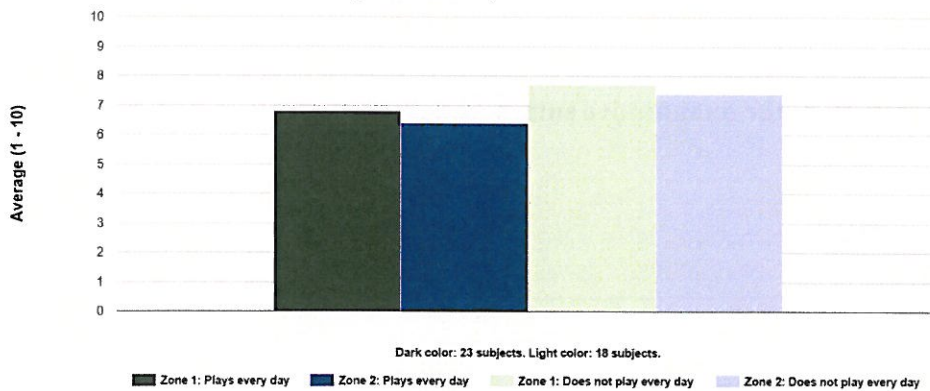


Figure 9.2.6

**I felt immersed at some points during the experience.**

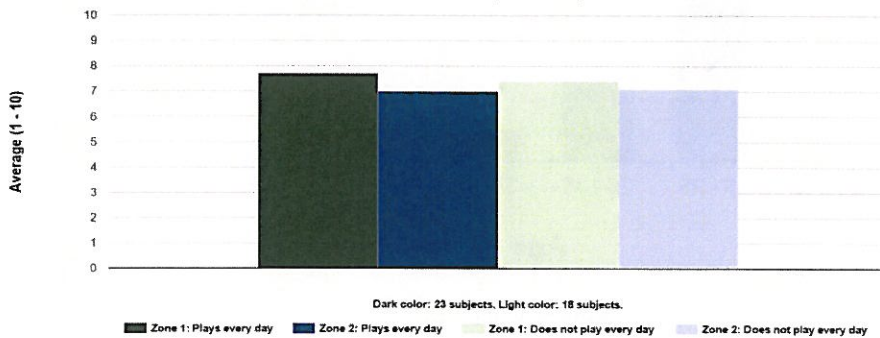


Figure 9.2.7



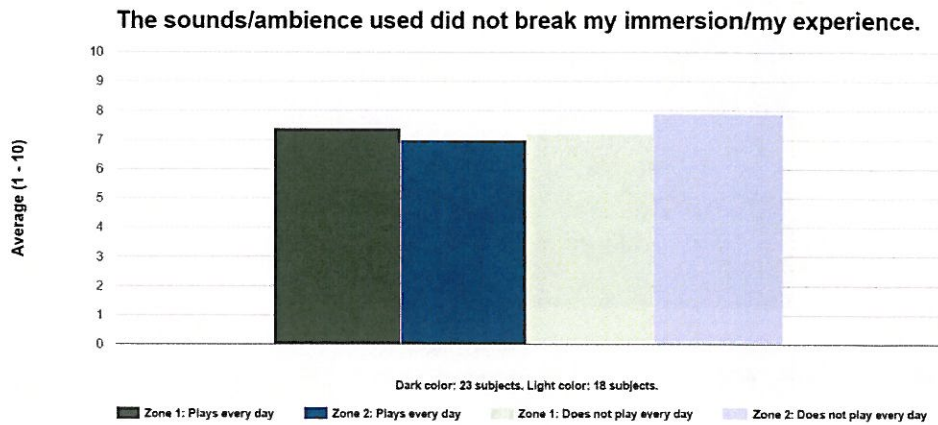


Figure 9.2.8

### 9.3 Raw data results from the quantitative survey

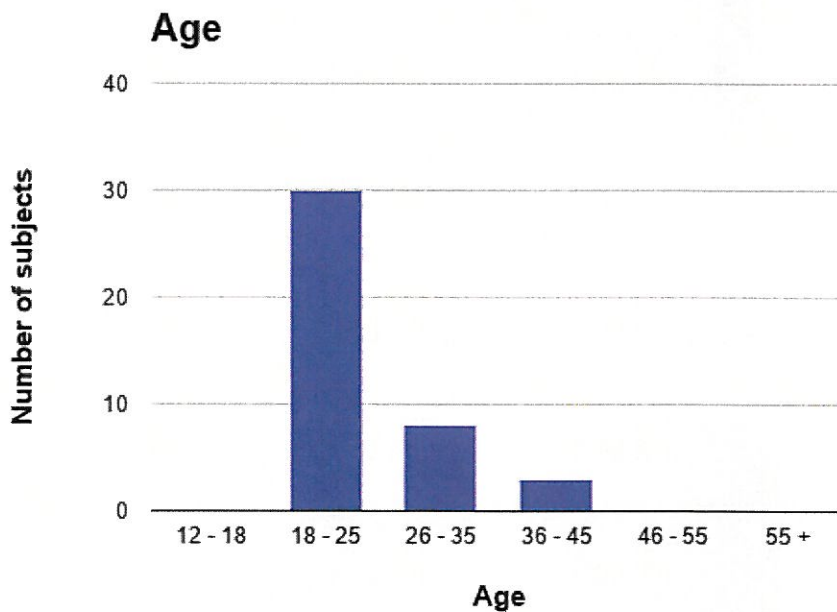


Figure 9.3.1

### Gender

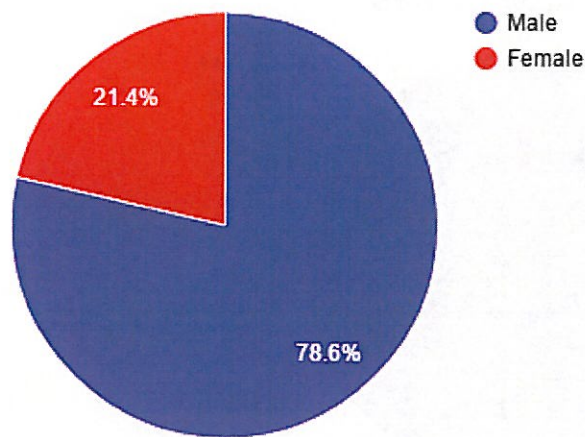


Figure 9.3.2: Gender balance, anonymous survey group

### How often do you play games?

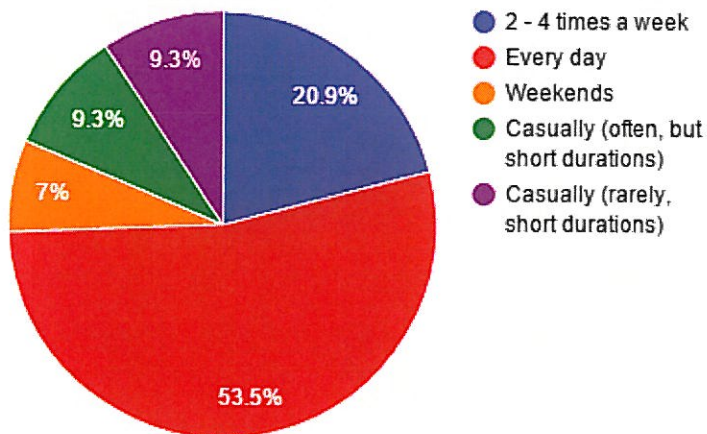
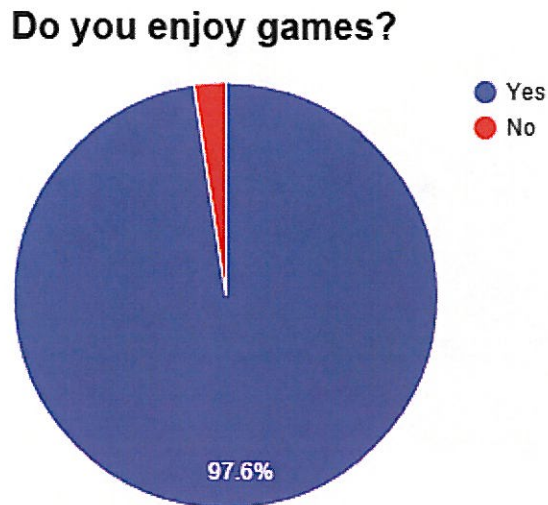


Figure 9.3.4: Gaming habits, anonymous survey group



**Figure 9.3.5:** Participants outlook on games, anonymous survey group

An overwhelming number of participants from the anonymous survey group enjoyed games. This could be because people who enjoy games in general are more willing to freely join a case study where they need to play a game/prototype.



**Zone 1: The path was difficult to follow,  
and I had trouble figuring out where to  
go.**

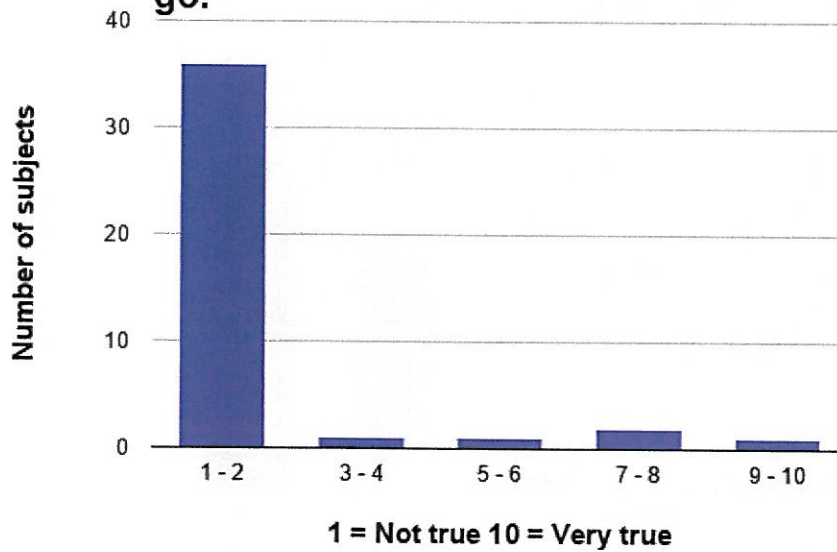


Figure 9.3.6: First statement for Zone 1. Ranging from 1 (not true) - 10 (very true).

**Zone 1: The zone felt tranquil and  
happy.**

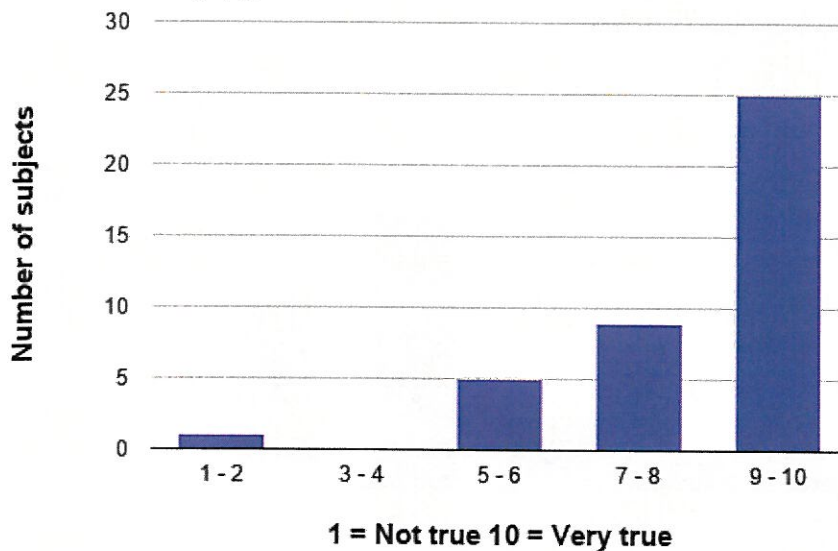


Figure 9.3.7: Second statement for Zone 1. Ranging from 1 (not true) - 10 (very true).

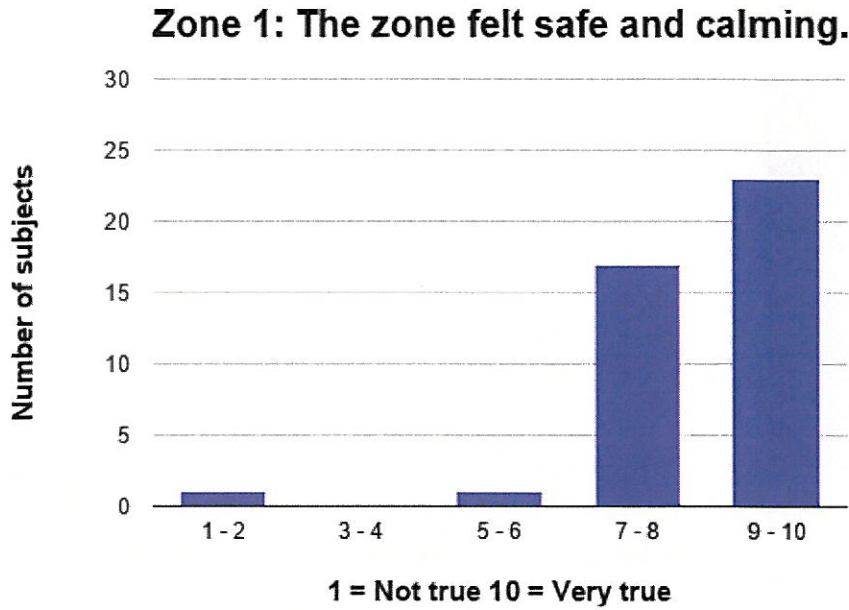


Figure 9.3.8: Third statement for Zone 1. Ranging from 1 (not true) - 10 (very true).

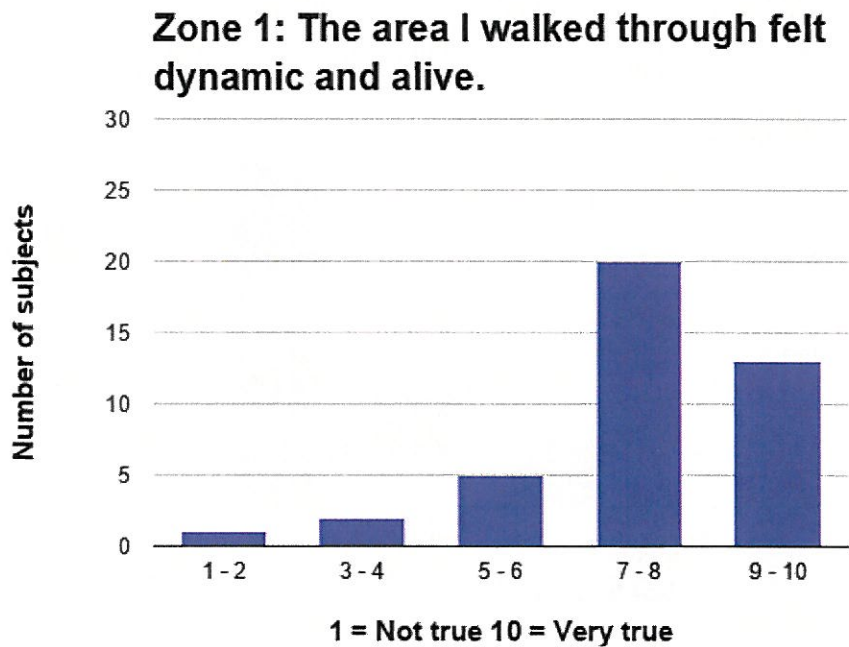


Figure 9.3.9: Fourth statement for Zone 1. Ranging from 1 (not true) - 10 (very true).

**Zone 1: The lighting of the area helped support a happy/cheerful mood.**

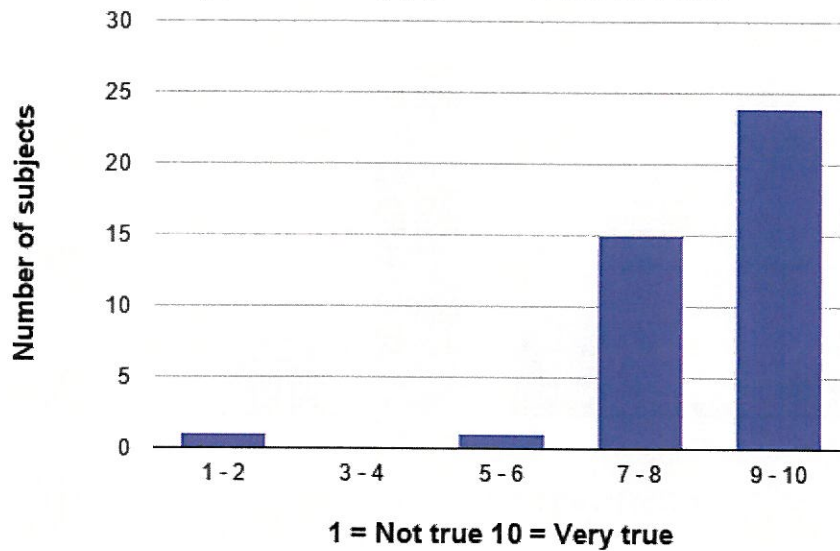


Figure 9.3.10: Fifth statement for Zone 1. Ranging from 1 (not true) - 10 (very true).

**Zone 1: The assets (trees, butterflies, flowers) in the area helped support the overall experience.**

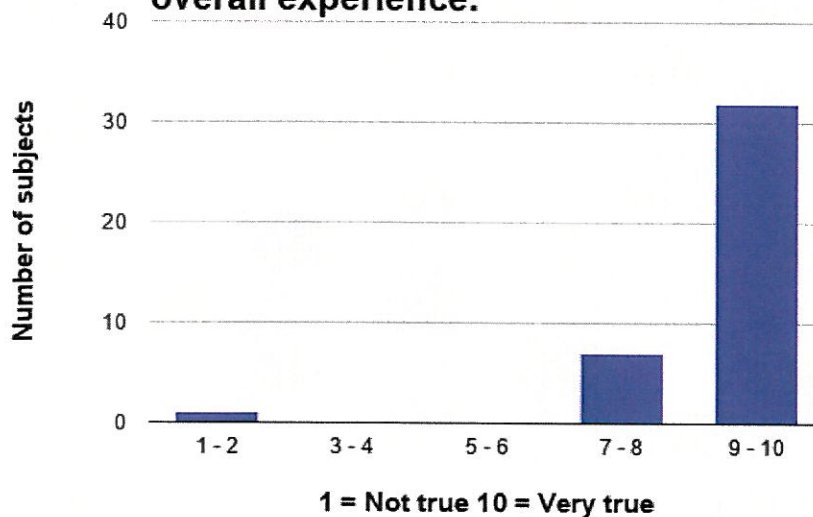


Figure 9.3.11: Sixth statement for Zone 1. Ranging from 1 (not true) - 10 (very true).



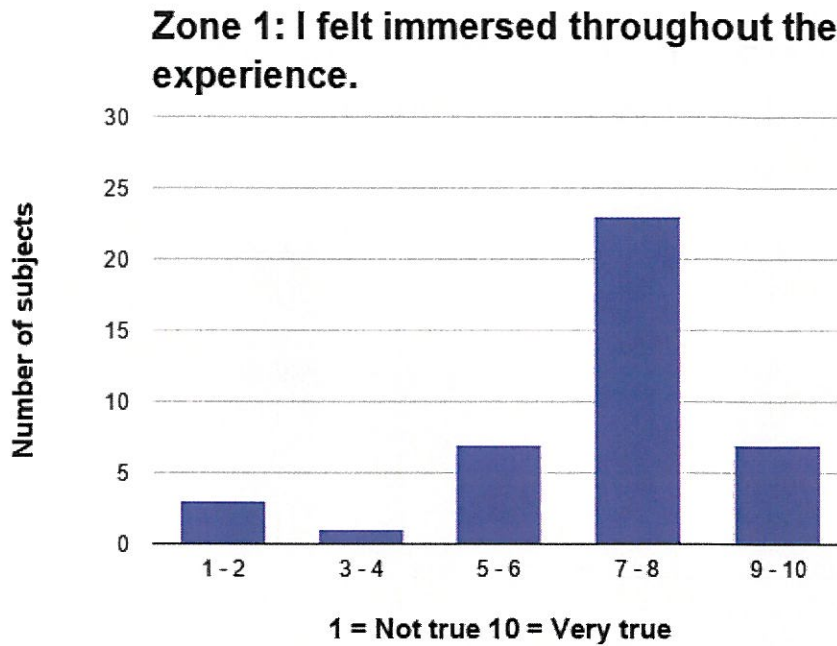


Figure 9.3.12: Seventh statement for Zone 1. Ranging from 1 (not true) - 10 (very true).

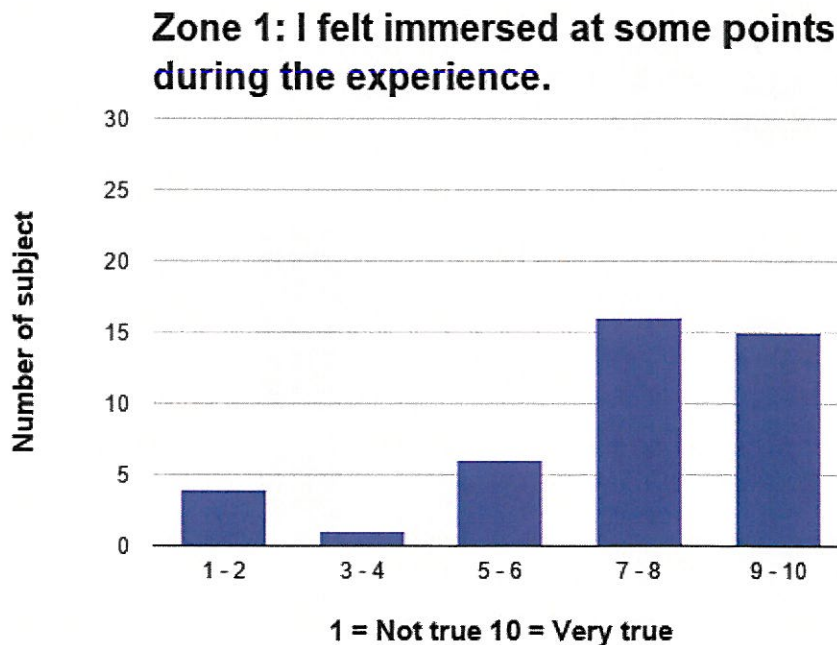


Figure 9.3.13: Eighth statement for Zone 1. Ranging from 1 (not true) - 10 (very true).

**Zone 1: The sounds/ambience used did not break my immersion/my experience.**

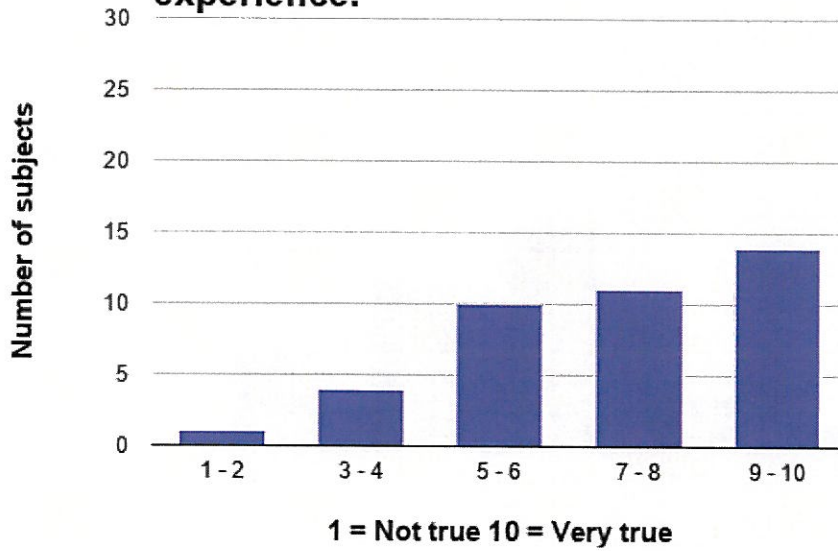


Figure 9.3.14: Ninth and final statement for Zone 1. Ranging from 1 (not true) - 10 (very true).

**Zone 2: The path was difficult to follow, and I had trouble figuring out where to go.**

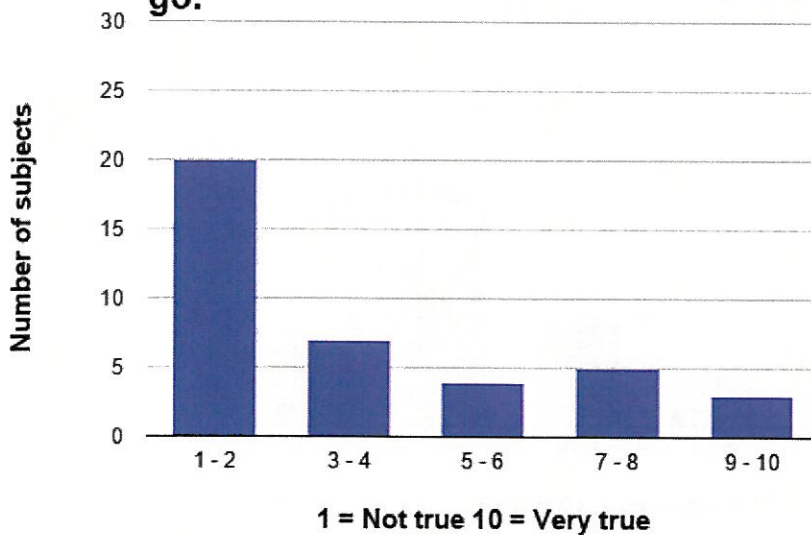


Figure 9.3.15: First statement for Zone 2. Ranging from 1 (not true) - 10 (very true).

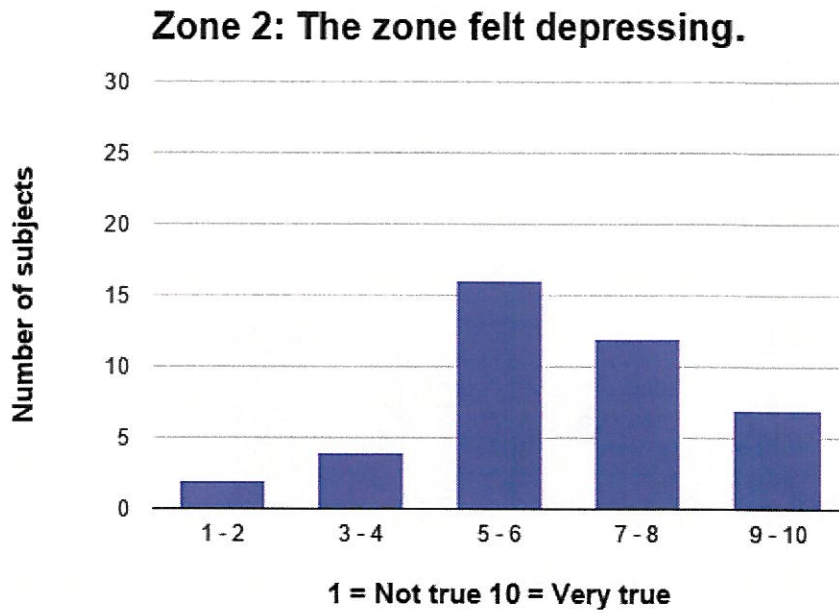


Figure 9.3.16: Second statement for Zone 2. Ranging from 1 (not true) - 10 (very true).

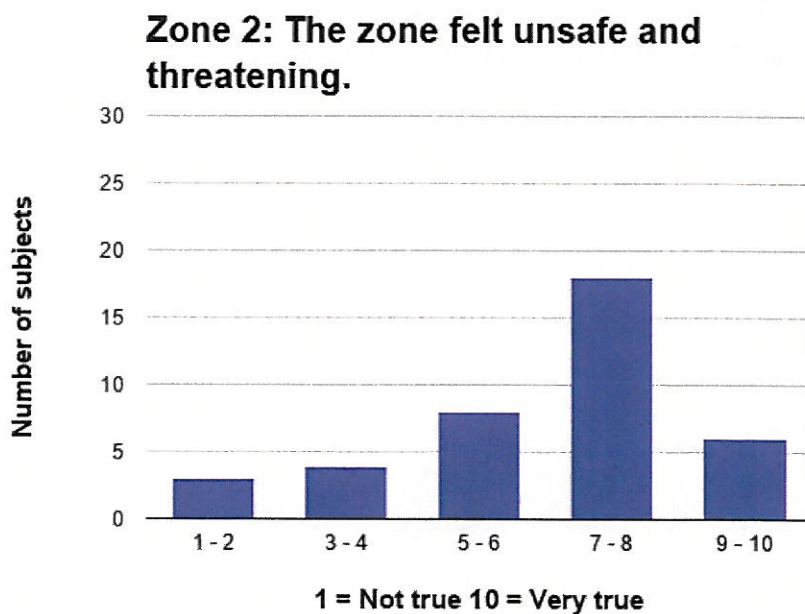


Figure 9.3.17: Third statement for Zone 2. Ranging from 1 (not true) - 10 (very true).



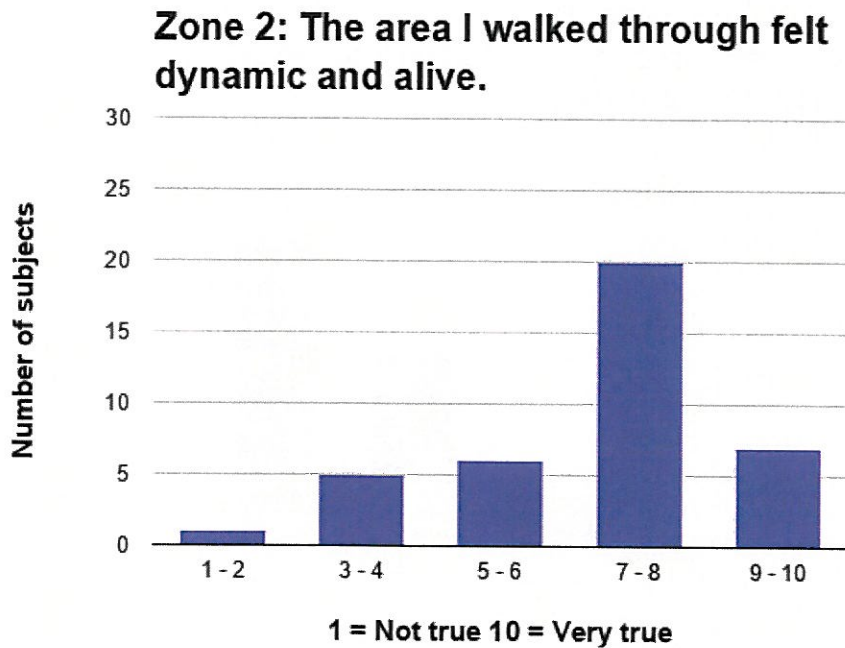


Figure 9.3.18: Fourth statement for Zone 2. Ranging from 1 (not true) - 10 (very true).

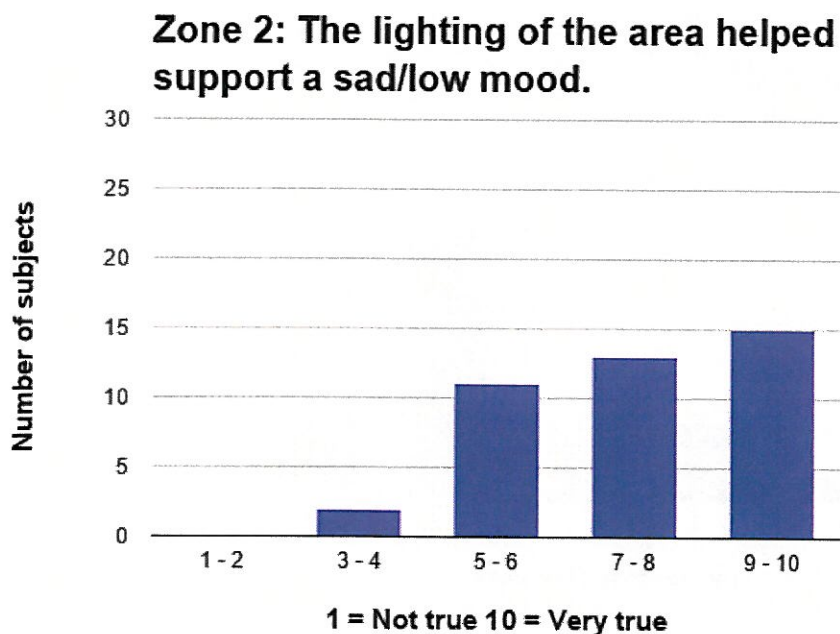


Figure 9.3.19: Fifth statement for Zone 2. Ranging from 1 (not true) - 10 (very true).

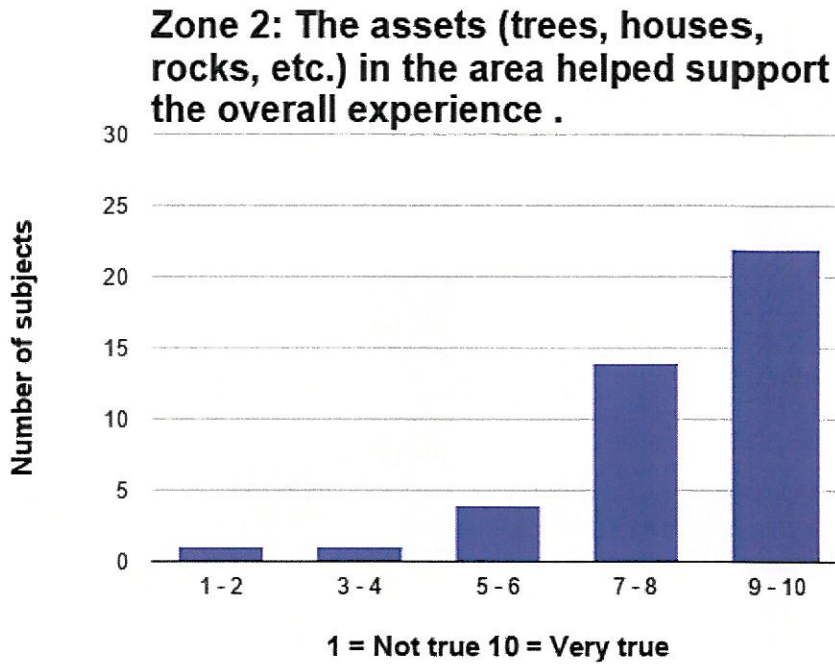


Figure 9.3.20: Sixth statement for Zone 2. Ranging from 1 (not true) - 10 (very true).

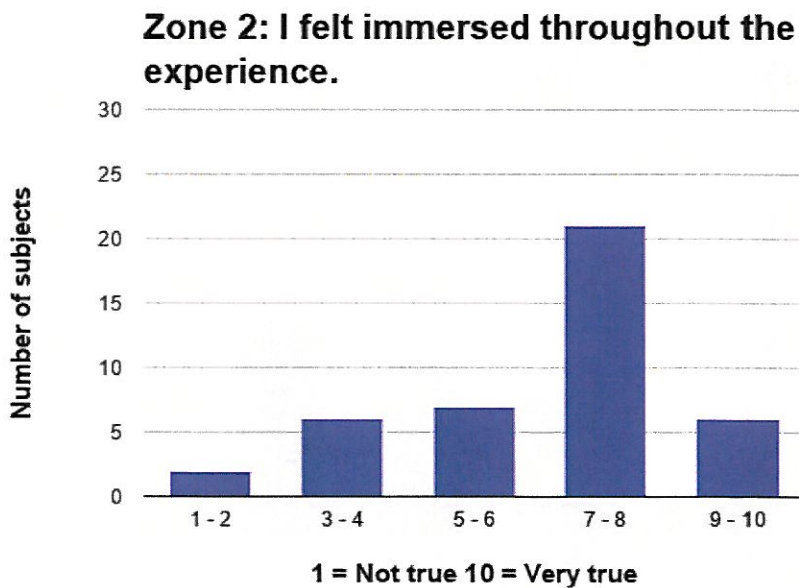


Figure 9.3.21: Seventh statement for Zone 2. Ranging from 1 (not true) - 10 (very true).

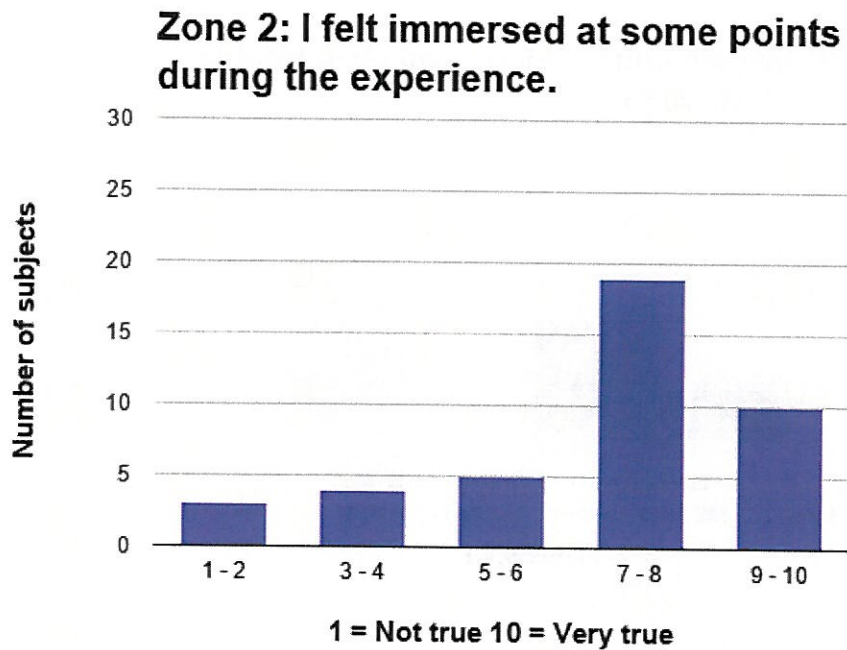


Figure 9.3.22: Eighth statement for Zone 2. Ranging from 1 (not true) - 10 (very true).

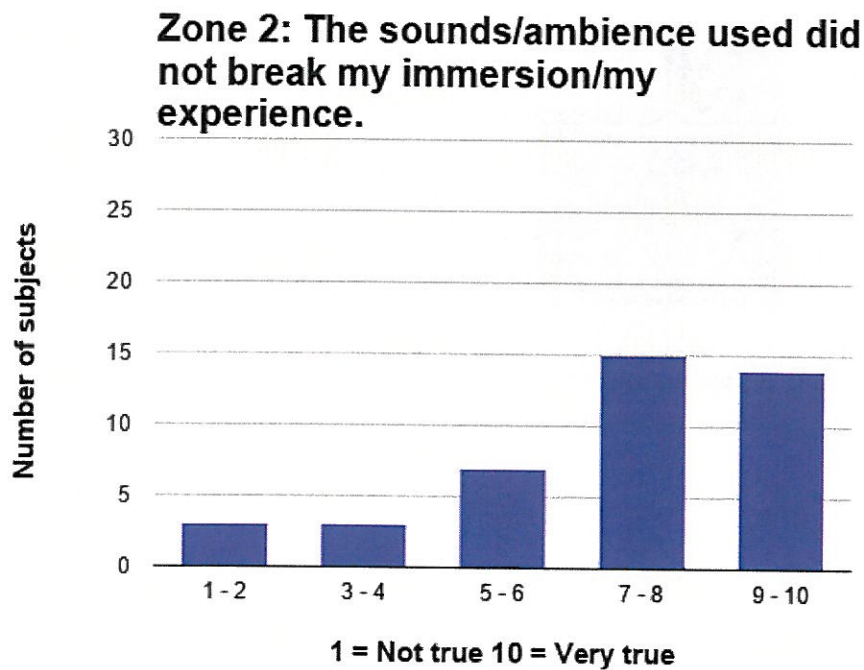


Figure 9.3.23: Ninth and final statement for Zone 2. Ranging from 1 (not true) - 10 (very true).



### 9.4 Average scores between the age-groups 18 - 25 and 26 - 45

**The path was difficult to follow, and I had trouble figuring out where to go.**

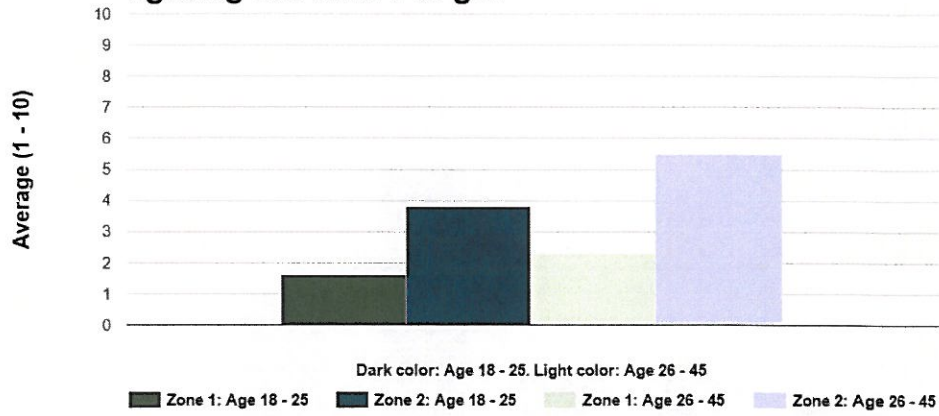


Figure 9.4.1

**Zone 1: The zone felt tranquil and happy & Zone 2: The zone felt depressing.**

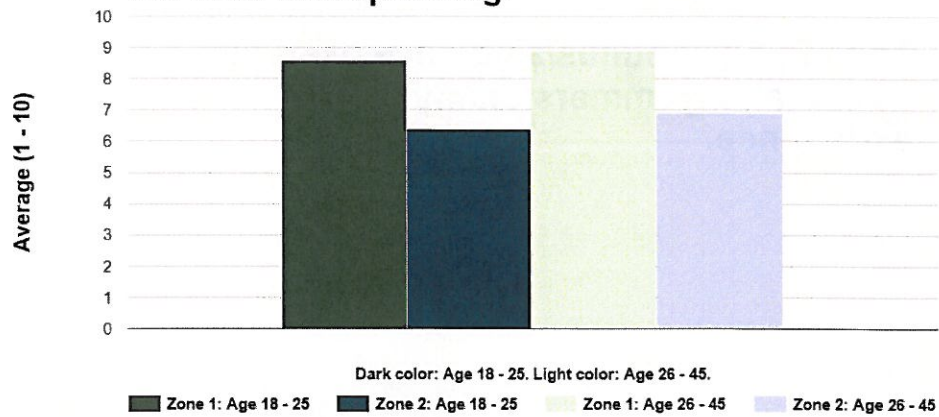


Figure 9.4.2

**Zone 1: The zone felt safe and calming & Zone 2: The zone felt unsafe and threatening.**

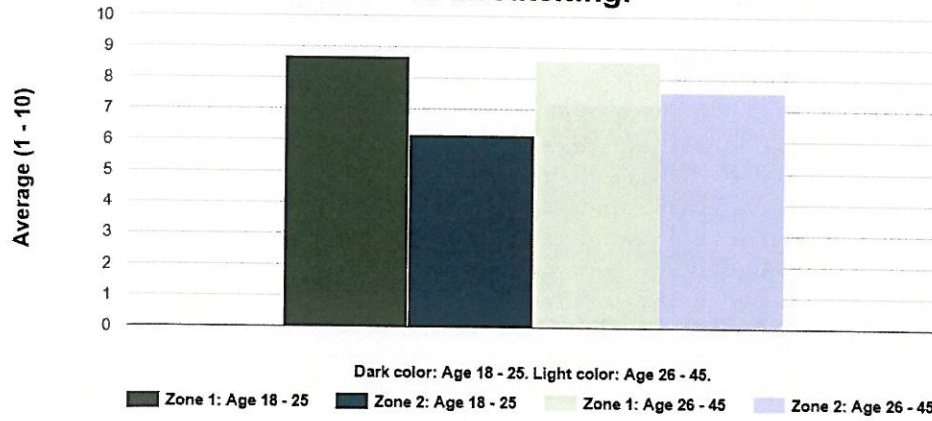


Figure 9.4.3

**The area I walked through felt dynamic and alive.**

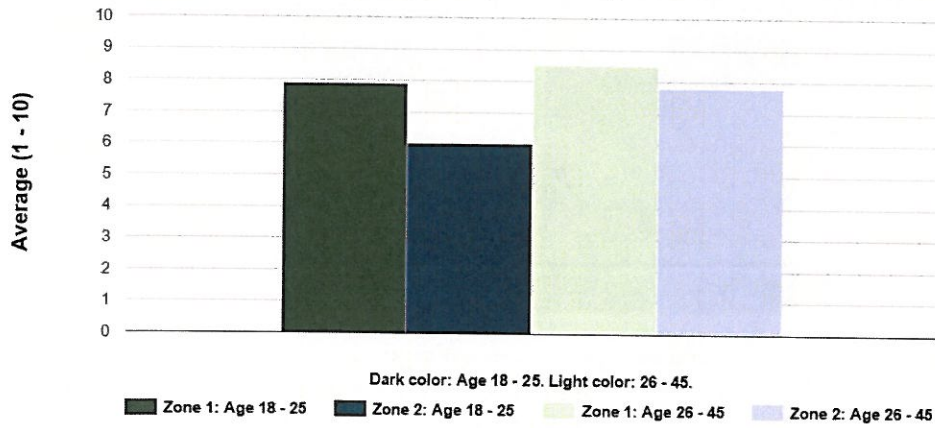


Figure 9.4.4

**Zone 1: The lighting of the area helped support a happy/cheerful mood & Zone 2: The lighting of the...**

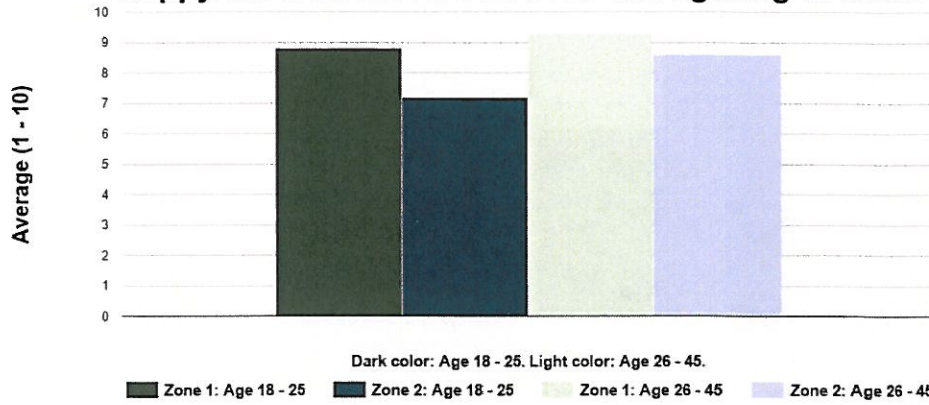


Figure 9.4.5

**Zone 1: The assets (trees, butterflies, flowers) in the area helped support the overall experience & Zone...**

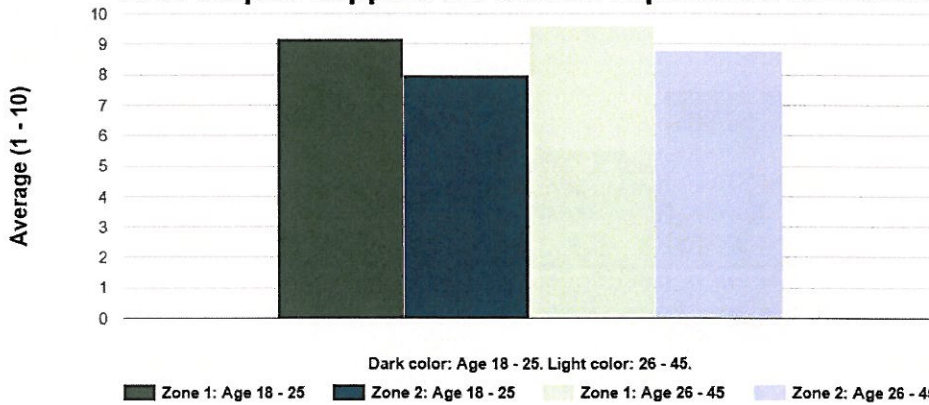


Figure 9.4.6



**I felt immersed throughout the experience.**

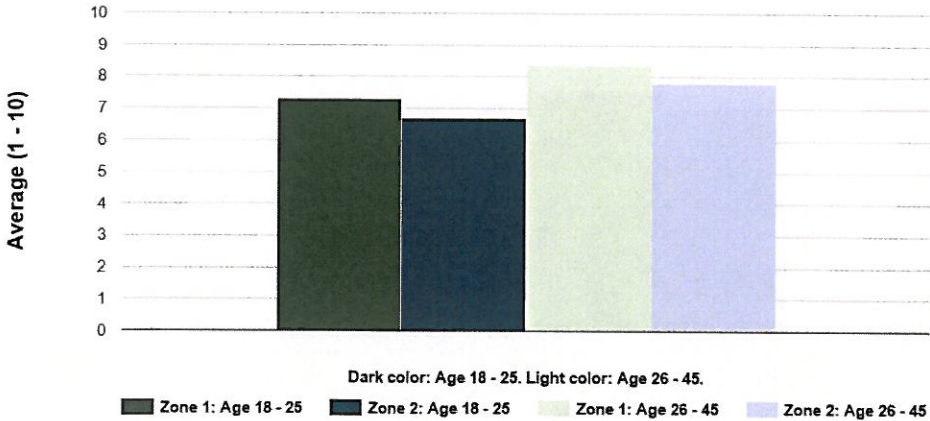


Figure 9.4.7

**I felt immersed at some points during the experience.**

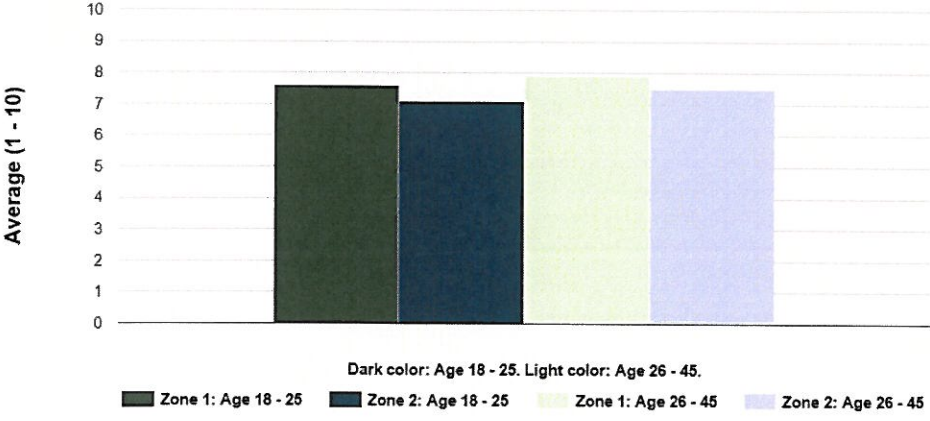


Figure 9.4.8

**The sounds/ambience used did not break my immersion/my experience.**

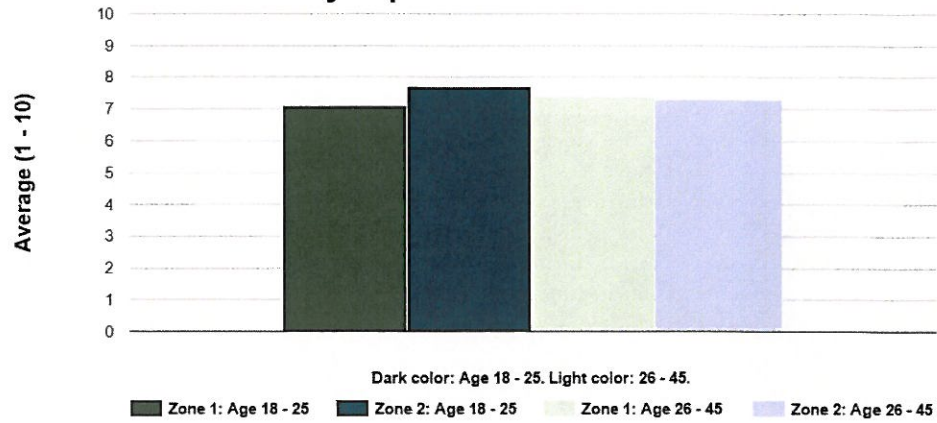


Figure 9.4.9