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# Creation and Evaluation of Exer Dungeon

A multi-player exergame using exercise
bikes

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# Acknowledgements

**Abstract**

This report is a study into different topics to create and develop an exergame (Exertion game) for gamers who do not enjoy exercise. To develop such a game, the different topics of research were previous exergames and technologies, and what makes video games fun to play.

Exergames are video games that require physical activity in order to be played. The goal of these games is to encourage players to exercise, by using gameplay as a means to make exercise a more enjoyable experience. There exist several exergames currently on the market, but many of them were developed to target the casual gamer demographic, which are people who only play video games in short sessions at a time. Hardcore gamers are people who play in long sessions and consider playing video games as a main hobby. Sitting for long periods of time with little to no exercise can cause health problems, and since casual gamers do not play games as much as a hardcore gamer, they are at less risk to get diseases such as diabetes type 2.

Through researching flow and rewards in video games, a game concept was designed and developed into a prototype in Unity. Cognitive flow is a state of mind in which people become hyperfocused on the task at hand, and is considered a method of evaluating enjoyment. The concept was designed to allow players to enter a state of flow, such that players become less aware of their fatigue during play. Rewards are needed in video games to give the players an incentive to continue playing.

The final version of the game was tested with a small group of players which were interviewed after the session in order to gather data. They answered in the interview that they enjoyed the game and that they could use it as a method of warming up. On one hand the test was missing data in order to draw a conclusion on the exercise effect of the game, but on the other hand it pointed in the direction that the game was fun to play and can be further developed to create a more complete gaming and workout experience.

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# Part I

# Introduction

# Chapter 1

# Motivation

Working out is important to live a healthy life, but in the gaming community there are many gamers who do not enjoy it or do it at all. Many gamers play video games for several hours a day, often in long sessions that can last up to 8 hours or more. Sitting in a couch or at a computer for that many hours without exercise can lead to obesity and increase the risk of developing serious health issues such as diabetes type 2 [4]. A possible solutions to this is exergames, video games that requires physical activity to be played [5].

I have a personal interest in video games both as a gamer and a developer. Creating a game that manages to combine exercise and video games is a novel idea worth researching to get gamers to exercise more regularly and make exercise more fun. Many gamers including myself would rather play video games than exercise, because gaming in general is a fun activity to do. It is challenging and can function as a way to escape from our daily lives. For people who do not exercise regularly, working out can be very boring and be considered a hassle. If it is possible to make exercise fun and encouraging through exergames, it is worth researching to encourage gamers to live a healthier life.

# Chapter 2

# Research Questions

This project was selected from a list of available master thesis projects. The project description was to research exergames and develop new game concepts for a game where an exercise bike is used as a game controller. Players enter input through buttons on the handlebar and movement of the bike pedals. The goals of the project are:

- Research existing exergames and games that could fit this purpose

- Design and implement a prototype game

- Evaluate the game through play testing and interviews with participants

Based on these goals, I have made the following research questions:

RQ1  How do I create a game that is enjoyable to play over a long time period?

RQ2  How do I create a game that motivates players to exercise through gameplay?

RQ3  How do I create a game that can be used as an replacement to normal aerobic exercise?

RQ4  How will the game I create affect the players motivation and immersion?

# Chapter 3

# Research Method and Process
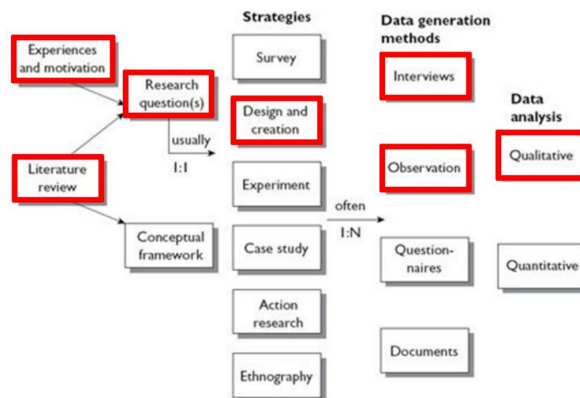


Figure 3.1: Research Methods framework from Briony J Oates [1]

The research method used in this project is based on empirical research, based on Briony J Oates framework [1]. Empirical Research is a method of gaining knowledge through observations and experiments. Figure 3.1 shows the different methods and components that make up a research project: Methods of pre-study, research strategy, data generation method and data analysis. The components marked in red are the ones used in this project.

The strategy used is design and creation, meaning the problems or questions can be solved through designing and implementing product: in this case a computer game. To draw a conclusion, data needs to be gathered and analysed. The data generation method is done through interviews and observations, with qualitative data analysis. Play testers will be observed while playing, and in-

terviewed after the play session is over. A conclusion is then made based on the observations made during testing and the interview answers from the play testers.

$$\text{Pre-study} \rightarrow \text{Prototype} \rightarrow \text{Experiment} \rightarrow \text{Analysis}$$

Figure 3.2: Research Process

The process can be described as followed(Figure 3.2): A pre-study is conducted to gather information to create a prototype. The prototype is then tested through experiments, and a conclusion is made based on the data gathered from the test.

Following the empirical research method and process, I started by looked into current exergames and their technologies, and was given a demonstration of the game Pedal Tanks. Based on the demonstration and earlier games, I looked into the topics of immersion, flow and rewards. These are important components of making an engaging video game. Using this knowledge, I came up with a game concept which I then made into a game in Unity. The game was player tested by a small group of people, which were interviewed afterwards. Based on the results of the test and observations made during testing, a conclusion was made.

# Chapter 4

# Report Outline

Part II is the literature study of the report. It contains the research of previous exergames, cognitive flow in video games, and use of rewards.

Part III contains the limitations of the exercise bikes and how it affects gameplay, and how these limitations affect what video game genres can be played on the bikes.

Part IV contains the final game concept and what video games that inspired the game. The description on the final concept also contains a information describing the software architecture used.

Part V contains the play test session with information on its process and results.

Part VI contains the report conclusion and further work for the project.

# Part II

# Pre-study

To answer the research questions we need to look at what types of exergames that exist today and what makes them fun. This part is a literature study which looks into current games and technologies, and some of the psychology behind enjoyment in video games.

# Chapter 5

# Exergames

Exercise games (Exergames for short) are video games that requires physical activity to be played [5]. There are many different types of exergames, but they all have the same goal, to encourage exercise. People who play video games several hours a day without any exercise are at greater risk to develop medical problems in the future such as diabetes type 2 and heart disease [4]. Exergames combines the two activities and allows gamers to keep doing what they love and exercise at the same time.



Figure 5.1: Foot Craz advertisement still

Exergames have existed since the late 1980s, with one of the first games being Foot Craz (Figure 5.1) for the Atari 2600, released in 1987 [6]. At that time, video games were very simple in terms of visuals and gameplay. This was due to the hardware being very limited, compared to modern standards. Computers got faster and faster as the years went by, allowing for better graphics and bigger games. More computer power made new technologies possible, such as the EyeToy for the Playstation, which used the players body movment as input through a camera [7]. This evolution continues to this day, where new innovative methods of using the human body as input gets discovered as technology evolves.

## 5.1 Exergames Examples

There exists many different exergames on a variety of platforms. To get a better idea of how much variety exists within the genre and how different technologies can be utilized, here are some game examples on various platforms:

### 5.1.1 Console Games



Figure 5.2: Wii Fit Yoga Exercise

Wii Fit for the Nintendo Wii [8] is an exergame that uses the Wii Motion controllers and the Wii Balance Board to detect body movement, weight, and balance (Figure 5.2). The game's goal is to make exercising fun, and features several mini-games where each game focuses on working out different parts of the body. It sold over 22 million copies [9] worldwide and was well received among critics [10].

It has two categories of mini-games: Yoga and strength training, and Aerobics and balance games. In the yoga and strength games, a personal trainer on screen is giving instructions on exercises for the player to perform (Figure 5.2), while in the aerobics and balance games the screen shows more fantasy related activities, such as snowboarding or sliding a penguin from side to side to catch fish (Figure 5.3).

Figure 5.3: Wii Fit Penguin Slide mini-game

The Penguin Slide mini-game functions as a balancing exercise, where the goal is to catch as many fish as possible before the time limit runs out. The player tilts the platform by shifting their balance from side to side which causes the penguin to slide into fish that has jumped onto the platform.

Wii Fit was tested as a tool to improve the balance in an elderly community. The results show that a small improvement in balance was made and that the participants voluntarily continued to use it as an activity [11]. In another study of the game's exercise effect, the aerobic portion of the game did not reach the recommended intensity for cardiorespiratory fitness, but was still higher than playing video games with a hand held controller [12].

### 5.1.2 PC Games



Figure 5.4: HTC Vive full room setup

Valve together with HTC released the HTC Vive in 2016 [13], a virtual reality headset that can track a player's movement. When a player moves around in the real world, the tracking of the headset changes the position of the camera in the virtual world. Even though the headset was not designed specifically for exergames, developers can use the technology in exergames. The limitations of the Vive is that the player can only move around in the assigned space in their room, with the recommended area being a rectangle or square with a diagonal of 5 meters [14]. Figure 5.4 shows the full setup required to use the device and the useable area which is within the two black poles.
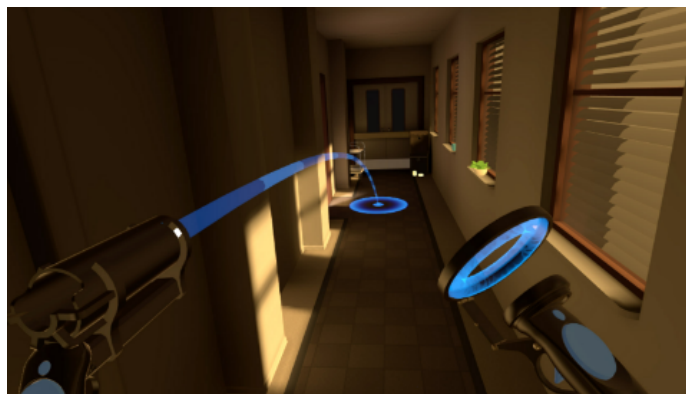


Figure 5.5: Budget Cuts in-game view with teleportation gun

Budget Cuts [15] is a stealth VR game currently in development for the HTC

Vive. In the game's demo the player's objective is to infiltrate an office building while avoiding or taking out deadly robots. The player can use the size of the room they have set up for the Vive, but the virtual environment you can move in is much bigger than the largest supported room size on the Vive. Since the room setup has a fixed size, using teleportation is the only way to move around in the game (Shown in Figure 5.5).



Figure 5.6: Virtuix Omni

The Virtuix Omni is a virtual reality motion platform [16], which allows players to walk, run, sit and strafe in all directions as shown in Figure 5.6. The platform functions like an omnidirectional treadmill by tracking the player's feet movement as they slide on the surface. Combined with a virtual reality headset like the HTC Vive it can fully immerse players into a virtual reality world. When the player walks forward on the base surface it registers the movement and makes the player move in the virtual world. Using this together with games such as Skyrim [17] it allows the player to move around in the game's vast landscape.

Since the Virtuix Omni is still in development, data on its workout effect has not been properly researched, although it shows great potential for use in exergames.

### 5.1.3 Arcade Games



Figure 5.7: Dance Dance Revolution X arcade machine

In the arcades there are several game machines that could go under the genre of exergames, and one of the most successful arcade games is the game Dance Dance Revolution (DDR for short). It is a dancing game where the player gives input by stepping on different panels. The game screen gives cues on which panel to step on and when to step on them, as shown in Figure 5.7. Music is a big part of the game, since the timing of the panels are synchronized to the beat of the music.

DDR has become a worldwide franchise in both the arcade and home console version, with the latest version released in 2016. The game was released in Japanese arcades in 1998, and in Europe and the US in 1999. Console versions of the game came with their own dance mat with the first release in 1999 for the PlayStation. [18]

The game is a good source for aerobic training and a method to loose weight according to regular players [19]. It has also been used in different schools around the world to motivate students to exercise [18].

Figure 5.8: Prop Cycle Arcade Machine

Another arcade game is Prop Cycle (Figure 5.8). The goal of the game is to fly a man-powered aircraft through balloons before the timer runs out [20]. Flying through balloons gives the player points or more time based on what type of balloon it is. To win, a player needs to get the minimum points quota for the level played. The game uses a bike as a controller where the handlebar functions like a aircraft joystick, which allows for vertical movement.

### 5.1.4 Mobile Games
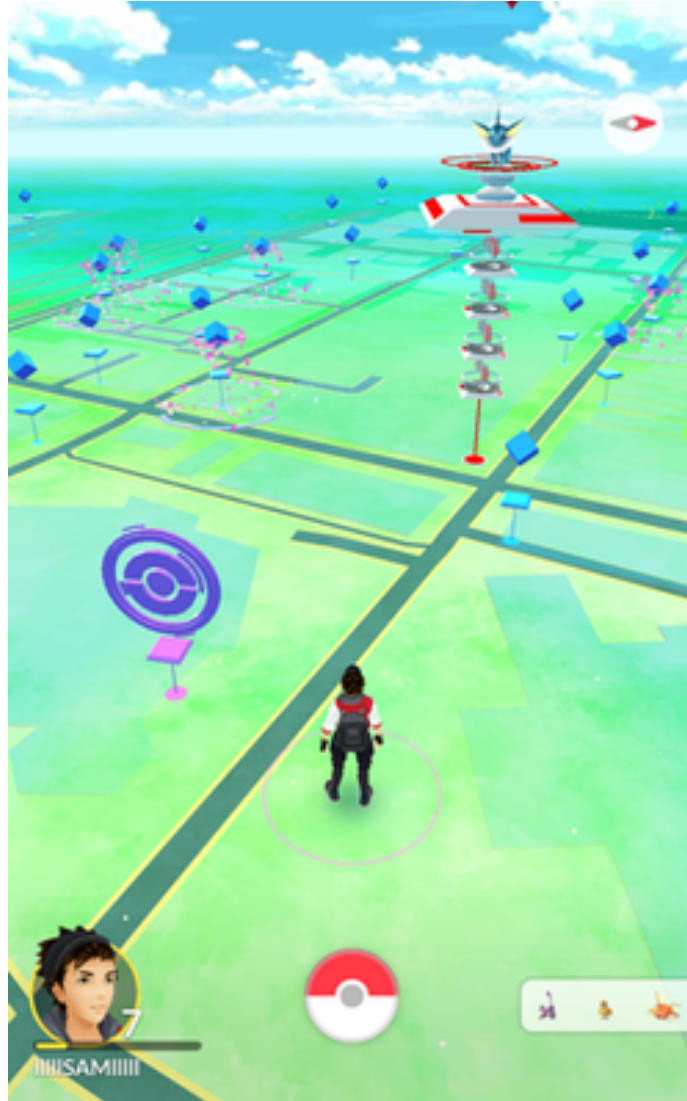


Figure 5.9: Pokemon GO

Pokémon GO (Figure 5.9) is a mobile game released in the summer of 2016. The player avatar in the virtual world is moved using the mobile phone build in GPS, such that the avatar is always located where the player is located. The goal of the game is to catch pokémon, which are virtual monster used for combat. Players use their pokémon to take control over pokémon gyms, which are usually located at different landmarks in a city. To catch a pokémon, a

player must move close enough to be able to catch it, meaning a player must move to the location in the virtual world by walking in the real world.

By walking, players would level up and get pokémon eggs, which could be hatched inside incubators. To hatch an egg, a player would have to walk a certain distance with the game open, ranging from 1 to 10 kilometres. To stop players from cheating and using cars or other vehicles, the game monitored how fast a player was moving. If a player was moving at a higher pace than what is humanly possible, it would not register the movement as a distance travelled.

The game encourages players to go outside and walk around. Through walking players would level up their character and achieve new pokémon.

Niantic, the game's developers announced that the game has been installed more than 650 million times on various devices [21], and has resulted with the game becoming a worldwide phenomenon.



Figure 5.10: Locosnake

Another game on the same platform is Locosnake, which is a mobile game that also uses the built in GPS to track the players movement [22]. The game is played like the classic snake game, in which the player controls a snake inside a rectangle where the goal is to eat as much food as possible (Figure 5.10). The length of the snake depends on how much food it has eaten, and if the snakes head comes in contact with another part of its body, it dies.

## 5.2   Pedal Tanks



Figure 5.11: Four people playing Pedal Tanks together

Pedal Tanks is a competitive multiplayer exergame that uses rewards and competition to immerse players into the game [23, 24, 25]. The game uses exercise bikes which are able to measure how fast the players are pedaling and buttons on the handlebar for steering and abilities (Shown in Figure 5.11).

The exercise bikes were made by using arduinos linked to buttons on the handlebar and a sensor at the wheel to measure rotation speed. On the handlebar there are a total of 6 buttons, one for each thumb and four buttons for the index and middle fingers. To control the tanks the player uses the thumb buttons to steer and pedaling works as a throttle, which means the faster the player pedals the faster the tank moves. Using abilities are done using the index and middle finger buttons.

Figure 5.12: In-game screenshot of Pedal Tanks

The goal of the game is to capture the other team's flag and bring it to back to home base. Players select what kind of tank they want to play with before each match, where different tanks have different abilities, amount of health and movability. To capture the enemy team flag the team first has to eliminate at least one enemy player. This has been done to stop players from only focusing on the flag and not caring about engaging the enemy. Figure 5.12 shows from the perspective of a player in-game, where the enemy is firing a projectile towards the player.

The game is using rewards and immersion to keep the player engaged. By fully immersing the player into a state of flow the player won't notice that he is exercising. The target audience for the game is gamers who do not regularly exercise or exercise at all, gamers who love competitive games and play for several hours a day. If the game is able to fully immerse a player into the game, the player will lose the sense of self and only be focusing on what is going on in the game world, making the player unconscious of the fact that they are exercising.

The test results from their report concludes that playing exerts more energy than a moderate walk and that players clearly preferred to play the game rather than going outside for a walk [23, 24]. Testing was done by having three play sessions per subject group then have all players answer questions related to their exertion and enjoyment of the game. With the limited amount of resources and time they could not draw any definite conclusion to the game's lasting entertainment value, but the results they got were very positive and shows optimism towards the potential of exergames.
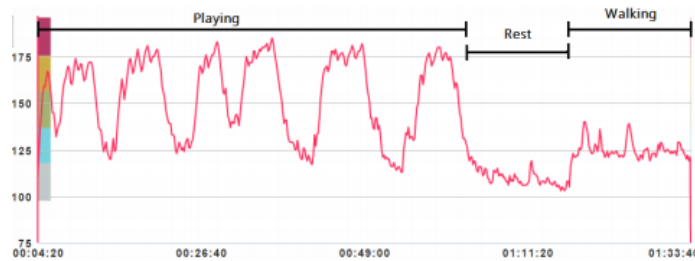
Figure 5.13: An average test participant's pulse during a session in Pedal Tanks

Playtesters were also with heartbeat monitors to gather data on players exertion while playing and after playing. Since they used stationary exercise bikes as controllers they wanted the game to subconsciously encourage players into exercise in intervals. Figure 5.13 shows the average pulse of players when playing the game, and it clearly shows that players were indeed encouraged into exerting energy in intervals.

## 5.3   Pedal Tanks Workout Results

Many games can be high intensity over a long period of time, much longer than what is normal for a standard exercise session. For exercise bikes a very effective method of working out is using interval training.

| Time | Intensity of Pedaling |
|------|----------------------|
| 10 seconds | Hard |
| 60 seconds | Recover |
| 15 seconds | Hard |
| 60 seconds | Recover |
| 20 seconds | Hard |
| 60 seconds | Recover |
| 20 seconds | Hard |

Figure 5.14: Bike interval exercise example

In Figure 5.14 you can see an example of interval exercise which consists of several segments with mixed intensity. There are different exercise methods that have different times on each segment and the workout session as a whole, and is an effective way to increase cardio, oxygen intake and for burning calories.

In Pedal Tanks, they designed the gameplay so that it would fit with this kind of exercise. The game could have become a base race to see who could get the enemy team's flag first, but since the flag only spawns after a player on the enemy team has been killed it stopped players from pedaling at full speed through the entire match.

## 5.4  Other Exergames

Here are some other exergames and research projects that were found while researching the topic.

Exermon is a mobile game in which a player performs strength exercises to evolve and grow a virtual pet monster [26]. The game uses the accelerometer sensor on the smart phone to count push-ups and other activities. Exercising causes the monster to grow bigger and stronger which then can be used for combat against other monsters.

Similarly, the game Fish'n'Steps is a game that uses a foot step counter to grow fish living in a virtual fish tank [27]. The growth and emotions of the fish changes based on the amount of steps the player walks.

Brains & Brawn is a strategy card game in which players must perform anaerobic exercises in order to use the cards on their opponents [28]. The exercise that is executed and the number of repetitions required is displayed on the card.

Remote Impact is a boxing game in which players fight each others shadow which is projected onto a wall [29]. By punching the other players shadow they gain points, and the player with the most points at the end win.

iFitQuest is a mobile location-aware in which players visits local landmarks to collect items and play mini-games [30]. Similar to Pokemon GO, players have to move around in the real world to move their virtual characters and landmarks are used in the game as points of interest where non-player character interactions take place.

## 5.5  Summary

Exergames are video games that require physical activity to played, which often require specific technologies or devices in order to be played. The goal of an exergame is to motivate and encourage the player to exercise through gameplay.

There exists plenty of commercially available exergames over many different platforms: Mobile, PC, and Consoles.

To get the most out of a workout session, the method of exercise needs to suit the equipment used. Pedal Tanks designed its gameplay such that players exercise in intervals and for an appropriate amount of time.

# Chapter 6

# Cognitive Flow and Immersion

Cognitive Flow is a state of mind which can occur when playing video games or performing any task that requires some skill to it. The Hungarian psychologist Mihaly Csikszentmihalyi studied this phenomenon and created a model describing the effects and conditions required to reach this state [31].

While in this state people experience [32]:

1. Extreme focus on a task

2. A sense of active control

3. Merging of action and awareness

4. Loss of self-awareness

5. Distortion of the experience of time

6. The experience of the task being the only necessary justification for continuing it
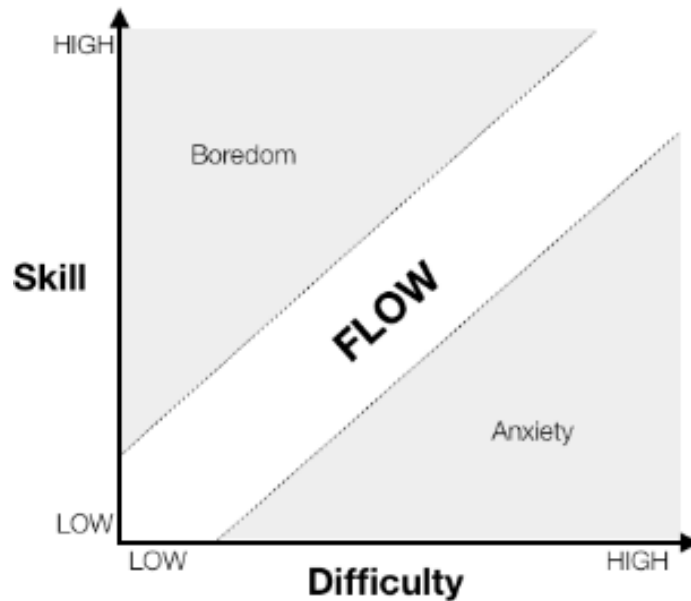
Figure 6.1: An adaptation of Csikszentmihalyi's flow model

Figure 6.1 shows how flow is related to the difficulty and skill of a task. Every task has a difficulty to it, and to complete any task some skill is required. If someone does not have the required skill they will be unable to complete the task which results in anxiety. If a person's skill is high and the task difficulty is low, they will be bored due to lack of stimulation [31].

"Flow is an experience so gratifying that people are willing to do it for its own sake, with little concern for what they will get out of it, even when it is difficult or dangerous" [31]. If an exergame can make players enter a state of flow, it could be very good for people who do not like to exercise. Due to the intense focus players would have on the game, it would make them less aware of the fact that they are exercising, resulting in less awareness of fatigue which would normally had them stop working out.

Csikszentmihalyi also stated a few guidelines to increase the chances of flow [32]:

1. Have concrete goals with manageable rules

2. Demand actions to achieve goals that fit within the person's capabilities

3. Have clear and timely feedback on performance and goal accomplishment

4. Diminish extraneous distraction, thus facilitating concentration

Have concrete goals with manageable rules Demand actions to achieve goals that fit within the person's capabilities Have clear and timely feedback on performance and goal accomplishment Diminish extraneous distraction, thus facilitating concentration

According to the article "What Makes Things Fun to Learn?" the best goals are often practical or fantasy goals, such as reaching the moon with a rocket [33]. The use of fantasy in video games is often to make the virtual world more interesting and can make players emotionally invested, which would further immerse the player in the game.

If a player is certain to win or lose a game, the game is usually boring to play [33]. Players need to be challenged at the appropriate level, resulting in a game where players are uncertain if they will win or lose. In competitive games players play against other players, where it is usually uncertain if they are going to win even with a relative large gap in skill level. We can all make mistakes when playing a game, but computers can be programmed to play a game perfectly. If player is playing against a computer or an artificial intelligence, it needs to be able to make mistakes in order to make the game winnable and at the same time challenge the players enough so they do not get bored.

According to the article "GameFlow: A Model for Evaluating Player Enjoyment" [3], there are currently no accepted model of player enjoyment in video games. While flow is a widely accepted model of enjoyment, they adapted the model to better suit enjoyment in video games, which resulted in the Game Flow model [3]. The Game Flow model has a set of criteria, shown in the table below.

| | |
|---|---|
| Concentration | Games should require concentration and the player should be able to concentrate on the game |
| Challenge | Games should be sufficiently challenging and match the player's skill level |
| Player Skills | Games must support player skill development and mastery |
| Control | Players should feel a sense of control over their actions in the game |
| Clear Goals | Games should provide the player with clear goals at appropriate times |
| Feedback | Players must receive appropriate feedback at appropriate times |
| Immersion | Players should experience deep but effortless involvement in the game |
| Social Interaction | Games should support and create opportunities for social interaction |

Table 6.1: GameFlow Criteria for Player Enjoyment in-game [3]

## 6.1 Summary

For video games to help players get immersed they need to:

- Have clear objective and goal to the game, which is presented at appropriate times.

- Challenge the player accordingly, so that the player does not get anxious or bored of the game.

- Give good and timely feedback to give player sufficient information on their progress towards their goal.

- Set the game in a fantasy environment can increase emotional immersion and investment in the game.

- Have an uncertain outcome, meaning players does not know before playing if they will win or lose the game.

- Support for social interaction either within the game or outside the game.

# Chapter 7

# Rewards in Video Games

Rewards is crucial to human survival, it's what powers us to eat and drink [34]. When rewarded the brain releases dopamine into our system which makes us feel pleasure or happiness (Shultz, 2015). Figure 7.1 showcases how positive rewards can spark motivation and positive emotions [34].
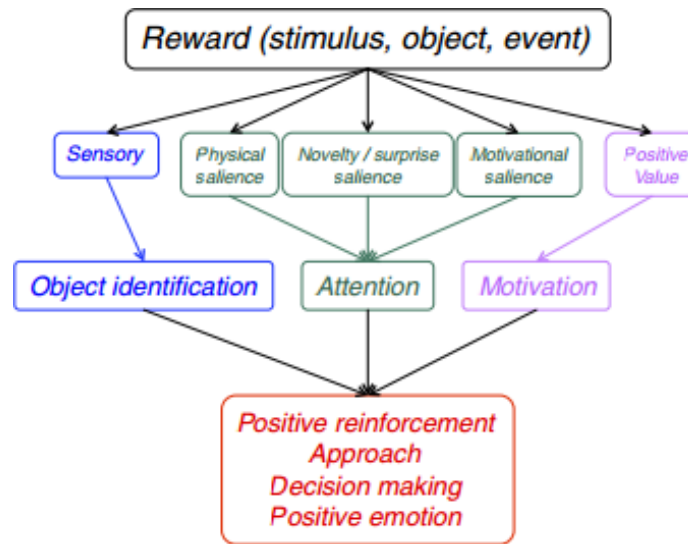


Figure 7.1: Rewards components and their functions

The sensation does not only come from real life stimulus or events, but can also be achieved through video games. There are many ways to rewards players in video games, and some are more obvious than others.

## 7.1 In-game rewards

"Loot" and items such as weapons and armor is an important part of role-playing games. In these games, weapons have different statistics such as the amount of attack damage they do when striking an enemy. Progression in such a game is achieved by getting better weapons which allows the player to fight stronger enemies. In a game like Skyrim, players can loot the enemies they have defeated, picking up their weapons and use it for themselves.



Figure 7.2: Skins in overwatch can be purchased or unboxed in loot boxes

Looting and item drops are not the only methods of rewarding a player for playing. In games such as Overwatch [35] players are rewarded with loot boxes. These boxes unlock cosmetic items and animations that player can use in the game (Figure 7.2), without giving any gameplay benefits over other players. Players are not required to be lucky in order to unlock these skins. Loot boxes can give the player coins which functions as an in-game currency, which players can use to purchase the skins they want.

Some cosmetic items do minor changes to the character such as changing the colour of some body parts, while other items change the whole appearance such as changing the normal armour into a Santa Claus costume. The more extensive cosmetics cost more than the minor changes and have a lower unboxing chance, such that players need to be either lucky or play a lot to gain access to these skins. This gives players a long term goal in the game which is not related to the combat or gameplay. Players who have played the game for a long time feel rewarded when they are able to purchase these skins or feel very lucky when they randomly unboxes a skin they were aiming for.

## 7.2 Sensory rewards

A less obvious method of rewarding players is through sound and visuals. Sound and visual effects can be used to reward players for good performance [33].

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For example playing positive or uplifting sounds when the player completes a difficult task such as hitting a difficult spot on the enemy that deals extra damage.
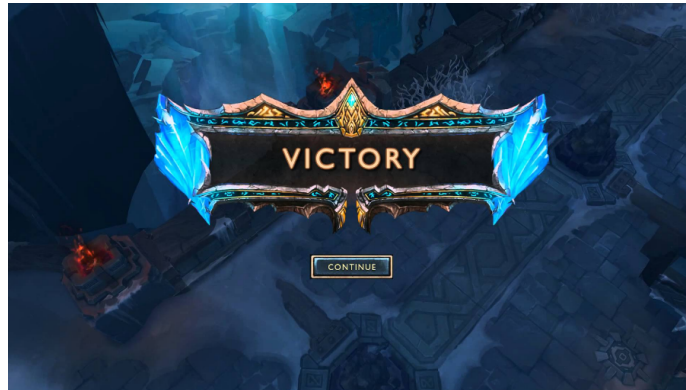


Figure 7.3: Victory screen in League of Legends

A good example of this is in the game League of Legends [36]. After winning a match the player gets to see the satisfaction of the enemy base exploding, followed by the victory screen shown in Figure 7.3 and a voice saying "victory".

## 7.3   Summary

Players need to be rewarded for their effort, by showing animations, playing sounds, or giving the player in-game items. Rewards are an incentive for players to put a great deal of effort into the game, and should be handed out to the player in the right amount, at the right time. Not giving the player too many rewards, or too few.

Adding cosmetics to a game can increase the longevity of a game, since it can add a long term goal for players to accomplish. Every game has their own methods of distributing cosmetics to the player, by pure chance or by giving the player a virtual currency which they can purchase items with.

# Chapter 8

# Unity

Unity [37] is a multi platform game development which allows users to make 2D and 3D, singleplayer and multiplayer games. The platform supports programming game objects with object oriented scripting in multiple languages such as C# and Javascript, and programming the graphics pipeline with HLSL (High Level Shading Language). Game objects are programmed using the scripting languages, while visual effects are programmed using HLSL. A good reason to use tools such as Unity when developing video games is because it allows user to effectively create game objects and run the game directly in the editor.

## 8.1 The Unity Editor
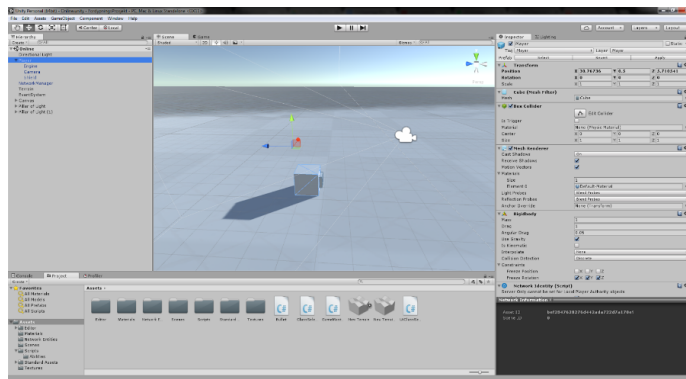


Figure 8.1: Unity editor

Every game object, script or other game functionality is stored within scenes. The scenes function like a different level of a game. An example of this could be that a simple game has a scene for the main menu and a scene for the actual

game. The main menu scene is loaded when the game starts up and by pressing a play button in the menu can make the game load the game scene.

Figure 8.1 shows the editor with a game scene is opened. At the bottom of the editor is the game directory, showing all files such as scripts, textures, models and prefabs. On the left side of the editor are the objects that are used in the scene, and the selected object's properties is shown on the right side of the editor.

Game objects that can be used on multiple scenes, or that can be spawned in runtime are called prefabs, short for prefabrication. Prefabs are created by saving game objects that are currently in the scene to the directory. The figure above shows the player object in the scene which is also stored as a prefab. The reason for this is that in a multiplayer game when a player connects they need a game object which they control, these are spawned in from the prefab.
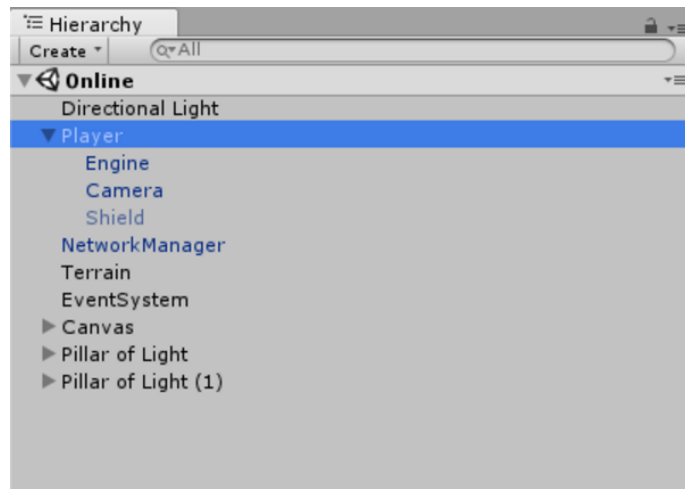


Figure 8.2: Unity editor hierarchy window

Every game object is stored in the scene hierarchy, shown in Figure 8.2. Using a hierarchy allows for objects to have children and parents, allowing for better structure and more complex game objects. In the figure we see that the current selected item is the player object, highlighted in blue. The player object has other objects connected to it, like its engine, a camera and a shield. Since the player object and the network manager are saved as prefabs their text is colored blue to highlight this.
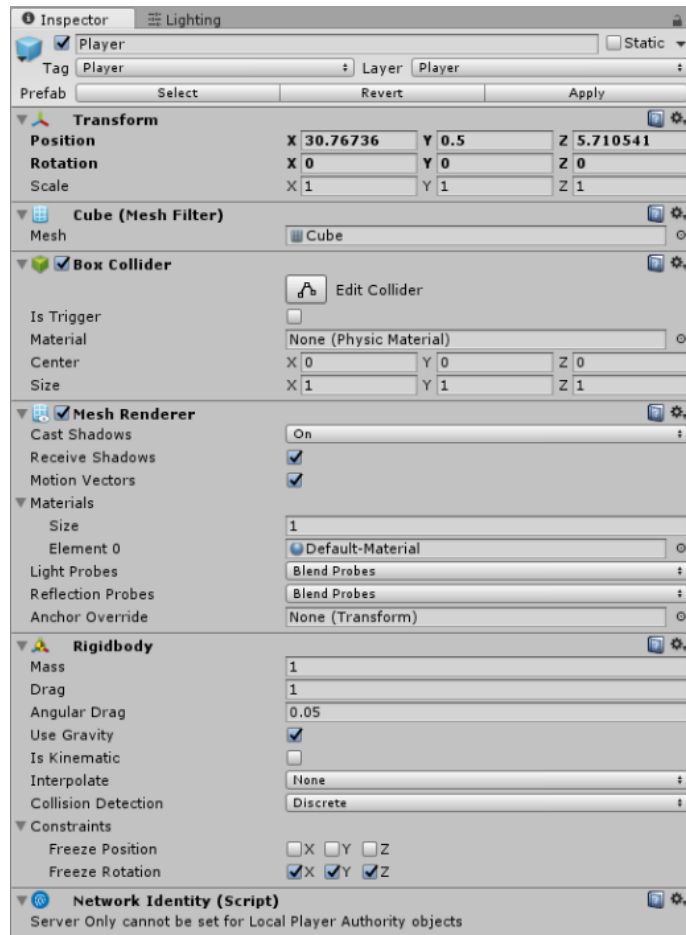
Figure 8.3: Unity editor property window

In the property window shown in Figure 8.3 we can see all the components that make up the player object. All game objects consists of a transform, which tells the position and rotation of an object. Other components such as scripts and physical properties are shown in the property window where their public variables can be edited.

Unity supports the use of custom shaders, allowing to create effects that otherwise would be impossible or result in a very poor performance if made with scripts. Shaders are programs run on the graphics processor resulting in increased performance when dealing with drawing objects compared to the CPU.

## 8.2 UNET

Creating a multiplayer game is more complicated than making a singleplayer game. In a networked multiplayer game there are objects and data that needs to be synchronized in order for players to see each other move and perform actions. Networking also comes with latency and data loss problems, since networking over great distances and poor connections can cause data to arrive much later than expected or never arrive at all. Unity comes with a large library of objects and functions for users to quickly set up a functional multiplayer environment, called UNET (Figure 8.4).
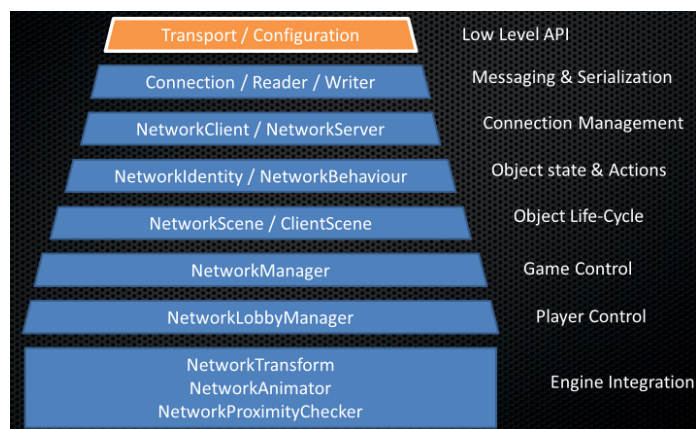


Figure 8.4: UNET High Level API structure

UNET uses the server-client architecture model, where the player hosting a game becomes both the server and the client. This allows networked games to be played without the need of a separate dedicated server.
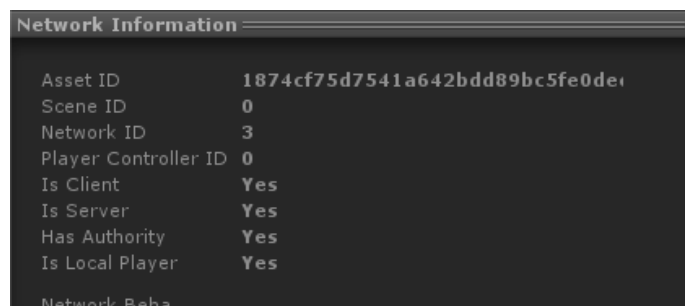


Figure 8.5: UNET uses flags to assign control over objects

In a multiplayer game there are only certain objects that needs to be synchronized, such as the player and enemy objects. Objects that are purely decorative

or stateless does not need to be synchronized and are therefore handled by each client running the game. Every networked object has a set of flags that indicate if the client or server has authority over an object or not (Figure 8.5).

When programming a networked object, developers can use these flags to determine what parts of the code to executed on the different sessions. For example, the authority of the player object is given to one specific client. That client will have the "has authority" flag enabled, while all other clients and the server will have that disabled. In Figure 8.6 it shows how a single object has code that is executed on the owner client and the server, since some behaviour needs to be controlled by the server and other by the client.

```
80
81    void Update()
82    {
83        if (hasAuthority)
84        {
85            if (playerState == PlayerStates.Alive)
86                PlayerStateAlive();
87            else
88                PlayerStateDead();
89        }
90
91        if (isServer)
92            modifierCollection.Update();
93    }
94
```

Figure 8.6: Code snippet from the final game concept

UNET has some built in functionality for synchronizing objects position data through built inn components, but it is not enough to create a completely functional game. Variables and states needs to be synchronized as well, which can be done through Remote Procedure Calls and Commands. Remote Procedure Calls are methods used by the server to execute code on the clients, and Commands are methods used on the client to execute code on the server. These calls can contain data which is can be used to set the states and variables of networked objects.

# Part III

# Designing an Exergame

To design an exergame the limitations of the equipment and gameplay need to be taken into account. In this chapter we are looking at different video game genres and how certain types of games fit better as an exergame than others, as well as the limitations of the controller.

# Chapter 9

# Technology Limitations and Fitting Game Genres
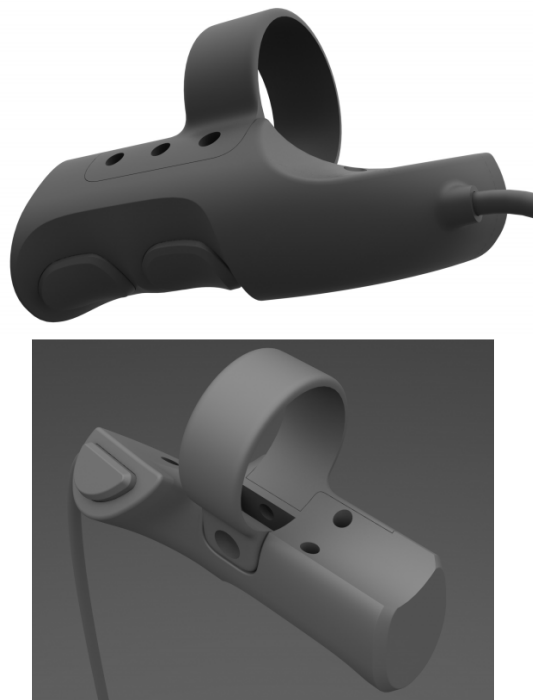


Figure 9.1: Playpulse [2] handlebar controller

The design of the game needs to take into account the limitations of the controller (shown in Figure 9.1) and exercise when it comes to gameplay. The

exercise bike handlebar officially has six buttons, two for the thumbs and four for index and middle fingers. Having gameplay the uses more buttons then available could make the game too complicated and difficult to play.

Modern Massive Multiplayer Online Role-Playing Games (MMORPG) like to use a vast number of abilities to add depth and strategy to the combat system by having multiple abilities for attack, defense and utility. These types of games are mostly only available for PC in which uses a keyboard and a mouse as controllers, allowing for precise input with the mouse and a vast number of abilities bound to keys on the keyboard.

In many video games, players are able to look around freely in the virtual world by controlling the camera, but on with limited amount of inputs this can be problematic. In first person shooter games players are able to look around both horizontally and vertically, which allows players to aim at any target visible from the character's position. Pedal Tanks solved this problem by having the camera locked to the character's orientation and keeping all enemies in the game on a flat surface, by eliminating vertical movement and aiming.

There exists many different types of video game genres [38], but not all of them would go well as an exergame. With the limited amount of buttons on the bike handlebar and the analog input of the pedals, games like strategy games that use a mouse and keyboard would be very inconvenient or impossible to play.

To find fitting game genres we need set some criteria for the gameplay based on the controller limitations and the support of multiplayer:

- Players should only control a single character. With the limited number of buttons on the bike it could be troublesome having the player control several characters at once. Switching between characters is an option, but the downsides would be that the control scheme would be more complex and harder to learn.

- Having the character be some sort of vehicle which is powered or moved can increase the immersion by creating a connection to physically pedaling and virtual movement in the game.

- Players should only be somewhat restricted to only move horizontally, since the handlebar only has six buttons to use during gameplay. All buttons are also placed horizontally, which could make it difficult to navigate vertically such as in an flying simulator.

- The gameplay and the controls should be easy to understand, such that a new player can quickly learn how to play and the controls feel intuitive related to the gameplay.

Below are the genres I found fitting based on this criteria and why they could work more or less as an exergame that uses stationary exercise bikes, as well as if they would fit for the use of interval exercise in gameplay.

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## 9.1 Platform

Platform games require players to jump from from one platform to the next to progress in the game. The challenge in these games comes from timing jumps correctly and/or planning a route to jump when confronted with multiple paths and obstacles. As a game example, players could have to time jumps correctly and pedal at the correct speed to not overshoot or undershoot the next platform. The genre could suit well for interval exercise, having players increase and decrease speed to jump be able to jump across platforms.



Figure 9.2: Super Mario 64 for the Nintendo 64

Games like Super Mario 64 [39] (shown in Figure 9.2) would suit rather well with the current controllers, as the game supports moving the character at various speeds. Some functionality would probably be removed due to the lack of input on the controller, but otherwise would work as is.

## 9.2 Shooter

Shooter games requires the player to shoot projectiles at targets or enemies to win. These games often features a crosshair in the center of the screen to help players aim at targets or to display in what direction players are shooting. The challenge often comes from what types of targets players are shooting at and if the targets are stationary or in motion. Pedal Tanks from section 5.2 is a competitive shooter game, where players have to aim at enemy players to win. Since projectiles in that game move at a certain velocity, players also have to aim according to the opponent's movement velocity to hit. From the test results from their game, it proves that the genre fits perfectly well as an exergame.

## 9.3 Stealth

Stealth games requires players to use stealth and strategy to sneak past enemies or obstacles to progress, such as finding a good path to the exit without being

detected by guards. Some games use sneaking as a way to lower the sound of footsteps to avoid detection. A pure stealth game might not encourage interval exercise as much as other genres, since it relies heavily on sneaking and taking it slow. The game might become too slow paced, resulting in players not exerting enough energy.



Figure 9.3: Metal Gear Solid for the Playstation

Metal Gear [40] (shown in Figure 9.3) is a stealth game where the player must navigate the environment and hide behind objects in order to not be detected. Players could use a bike controller to move around in the game, but the gameplay could be too slow to count as exercise since players need to be patient and wait for the right moment to move.

## 9.4   Survival Horror

Survival horror games comes in many different forms, some are more action oriented while others are similar to stealth games. In games such as Amnesia [41], players are chased by a monster that can not be stopped or killed. The only way to survive is by hiding or running away if the monster detects the player. As an exergame this feature could work very well. Players could explore a mansion which has enemies lurking around corners, and when players are spotted, they must pedal as fast as they can in order to escape.

Figure 9.4: Player being chased in Outlast

Outlast [42] is a survival horror game where the player is often chased by dangerous killers down narrow hallways in an asylum (shown in Figure 9.4). The chase sequences should work as a great motivator to make the player pedal as fast as possible, since it appeals to the human fight or flight instinct.

## 9.5 MMORPG / MMO

MMORPGs are roleplaying games that uses large persistent worlds where hundred, even thousands of players can go on adventures together and fight monsters. Existing MMOs would not suit well as an exergame due to the vast amount of abilities players have at their disposal, which is also a reason most MMOs are only playable with a mouse and keyboard. This does not make it impossible to create an MMO as an exergame, since the genre does not restrict gameplay to be in a certain way. As long as gameplay does not require actions that go beyond the limitations of the technology, it is totally possible to create an engaging and fun exergame MMO.

Figure 9.5: World of Warcraft

Figure 9.5 shows a screenshot from the game World of Warcraft [43], where the player controls a single character moving around in a vast environment. While the game would be impossible to play on a bike, navigating the world would be fully possible.

## 9.6    Role playing game (RPG for short)

In role playing games players controls a character in a virtual world where they can go on an adventure and complete missions, similar to that of an MMORPG, but usually on a smaller scale and often as a single player or cooperative experience. In the same way as an MMO, the gameplay is not restricted by the genre, making it possible to create a role playing exergame.

Figure 9.6: Skyrim

Skyrim is a RPG in which the player walks around in a large environment, completing quests and killing monsters (Figure 9.6). The problem with RPG's like Skyrim is the same as with MMORPGs World of Warcraft. Performing many actions with the limited control scheme makes it difficult to engage in combat, but navigating the environment is fully possible.

## 9.7 Simulation

Simulation games tries to simulate a job or task that exists in the real world into the virtual world, such as driving a truck or flying a plane. These games use keep their setting very realistic, since they want to simulate the real experience as good as it possibly can. For a game that would use exercise bikes, one such game could be a bicycle racing game, where players race on famous segments of Tour de France. While the genre works fine as an exergame, it might be targeting a different demographic. Simulation games are more targeted at people who already enjoy exercise or riding bikes, and not hardcore gamers who play video games as a way to escape reality.

Figure 9.7: Zwift

Games like Zwift [44] is a social cycling simulator in which players bike on their exercise bikes at home can compete in virtual races online (As shown in Figure 9.7).

## 9.8    Racing

Racing games are games where players race some form of vehicle around a track to be the first to get to the finish line or achieve some goal. Compared to simulation games, racing games does not require a realistic setting or experience, which allows racing games to have an element of fantasy to them, such as racing with cars on the moon. Racing games can have a problem with interval exercise if the goal of the game is only about who finishes first, which would have players pedal at full speed to get to the finish line.



Figure 9.8: Mario Kart 8

Mario Kart 8 [45] is a kart racing game where players race on a circuit

against each other (Figure 9.8). Player can pick up special abilities on the track which can be used on one self or an opponent, such as shooting a turtle shell as a projectile to temporarily stop an opponent. Playing Mario Kart with the Playpulse controller should be perfectly possible, as the number of buttons required to play should not exceed the number of buttons on the handlebar.

## 9.9 Summary

To find out what video game genres that could work as an exergame that uses exercise bikes as a controller I first set some criteria:

- Players should only be allowed to control a single character in the game.

- The controllable character in the game should be some form of vehicle, to increase immersion and create a clear connection between the bikes and the character on screen.

- The player controlled vehicles should only be able to steer horizontally, and not vertically due to the few buttons on the handlebar.

Using these I concluded that the following genres would fit more or less as an exergame (from most fitting to least fitting):

1. Simulation games

2. Racing games

3. Shooter games

4. Platform games

5. Survival Horror games

6. MMORPGs

7. RPGs

8. Stealth games

Using more than one genre can solve the limitations of certain genres and result in a more complete and enjoyable gaming experience.

# Part IV

# Game Design and Implementation

# Chapter 10

# Inspiration

The game design proposed in the next chapter takes ideas from several different existing video games.

Pedal Tanks (from Section 5.2) is the main source of inspiration. The use of the gameplay to encourage interval training on exercise bikes is a noteworthy design choice to use in the proposed design. In the game players acquire ammunition by pedaling which they use to take down enemy players. Using the pedaling to both move the tank and charge up abilities is a clever way to not have the player standing still for too long. The game also features different types of tanks (Figure 10.1), ranging from light tanks to heavy tanks. The difference between them being health, damage, movement speed and abilities. Each tank has a special ability unique to that tank class.



Figure 10.1: Playable classes in Pedal Tanks

Figure 10.2: Group of players raiding in World of Warcraft

World of Warcraft [43] is a MMORPG in which players can fight against monsters or each other. Players progress by leveling up their character and acquiring items from monsters they have killed.



Figure 10.3: A dungeon in World of Warcraft

In World of Warcraft players can join together in raids to fight large monsters in dungeons shown in Figure 10.2. Players can form parties to go through dungeons which contain a large number of enemies to fight, and at the end fight the final boss of the dungeon. Dungeons in World of Warcraft are based on the role playing scenario of dungeon crawling, where players navigate a labyrinth environment battling various monsters and looting any treasure they may find [46]. Figure 10.3 shows a typical dungeon from the game, called Wailing Caverns. In this dungeon, players start in one end of the dungeon and fight their way through, fighting several enemies and bosses.

Some of these boss battles can have several stages, where in each stage a different task must be accomplished to move on to the next stage. After fights players are rewarded with items that improves their character, and allows them to join new raids to fight more difficult monsters.



Figure 10.4: Alien Swarm gameplay

Alien Swarm [47] is a four player cooperative dungeon crawler made by Valve Corporation which was released in 2010. The game takes place on a remote location where they are instructed to complete different objectives and defeat the alien infestation using their weapons and various abilities. Players start the game in the lobby where they select what level to play and their weapons and abilities (Figure 10.5), which gives players time to come up with a strategy before entering the level. On the harder difficulty settings, the selection of abilities can be crucial for the players to succeed.



Figure 10.5: Alien Swarm lobby

The game has eight playable characters spanning over four different classes:

Officer, Special Weapons, Medic and Tech. Each class has some abilities and weapons that are only available to them, for example the Special Weapons class can use a minigun which fires bullets rapidly with a large magazine capacity. Some abilities are available for new players and need to be unlocked by levelling up their account.

The end result is a game in which each player controls a tank which can use different abilities, and they must then work together to defeat enemies and bosses. The environments should be large and complex dungeons where multiple different types of enemies must be defeated. Each enemy is somewhat unique, in that each requires a different combat strategy in order to be defeated. Players pick their abilities at the start of the game, allowing players to somewhat create their own class. Defeating enemies grants the players experience points which allows players to unlock new abilities or other tools they can use in more difficult dungeons.

## 10.1   Summary

From these games, the most interesting features that inspired my concept are:

Players use the pedals to move a character gives players a clear connection between the exercise bike and the visual representation on the screen, which can further increase a player's immersion.

Players fight various monsters which requires different strategies to be defeated. Enemies are located at various locations in the level, leading players from one fight to the next.

Players can choose what abilities they want to use and develop strategies depending on their choice. Classes can be used to limit abilities or assign roles.

Include some form of progression, where players level up and unlock new content by playing.

# Chapter 11

# First Version of Game Concept

Since this project further builds upon a previous project, game concepts and gameplay have changed to further expand the game. The core game concept is the same in both versions, as they both are cooperative dungeon crawlers. The biggest changes from the old version is the behaviour of players and enemies.

## 11.1 Gameplay
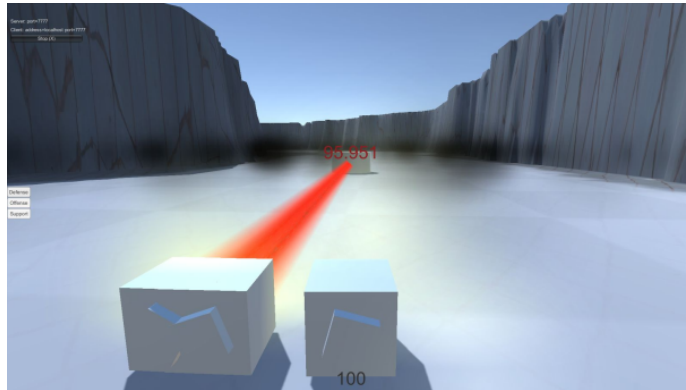


Figure 11.1: Players attacking an enemy

The game had one simple goal, to defeat all the enemies in the level. To accomplish this, players have to cooperate by moving together as a team and use their abilities together.

In this version, players are able to lock onto enemies, allowing players to move around a targeted enemy. While locked on, players would always be facing

the enemy, where moving left and right caused the player to move around their target in an orbit (Figure 11.1).

Players were able to pick between three classes: Defense, Offense and Support. The three are played very differently in terms of game-play Defense players used shields to protect the party from incoming enemy damage. Support players use their abilities to heal any damage a player might have taken. Offense players use their abilities to take down the enemy.

The enemies had different attacks and abilities which would require players in certain classes to exert more energy to survive. Enemies had three stages of combat: Attacking, Healing and Ultimate. During the attacking phase the defense players would have to pedal fast to keep their shield up and block incoming attacks. During the healing phase the enemy attempts to heal itself, and the only way to prevent it is for the offense players to use their laser attack. The damage of the laser depends on how fast the player is pedaling, so to counter the enemy healing players are required to pedal fast enough. In the third phase the enemy uses its ultimate attack, during which is damages all nearby players and becomes invulnerable. This is where the healing players are required to pedal fast to heal up the damage players are taking.

## 11.2   Issues and Limitations

A game session would consist of players going through a dungeon together fighting enemies and bosses on their way to the end. Fighting more than one enemy at the time would be very difficult, since locking on only allows players to lock onto a single enemy. Creating new fighting scenarios can therefore only be limited to one enemy, and often in the same style of combat. Players will always be locking on to an enemy and perform the same routine of attacking and defending. This makes features such as environmental hazards and different enemy movement patters difficult to implement and be a gameplay factor during combat.

Figure 11.2: Touhou project, a bullet hell game

The game style was more similar to a "bullet hell" type game than a dungeon crawler. In the bullet hell scenario, players are attacking a target that is firing a vast number of projectiles outwards in different shapes which the player must avoid (shown in Figure 11.2). While this was not a big problem in terms of making the game fun and enjoyable, it was clashing with the targeted genre.

# Chapter 12

# Final Game Concept

Like the previous game concept, the final game is a cooperative dungeon crawler where players go through a level together and defeat enemies.

## 12.1   Gameplay

Players control a self-propelled artillery vehicle, capable of shooting projectiles and use various abilities. The main method of attacking enemies is with the cannon, which shoots projectiles in a style similar to artillery cannons. Other methods of attack comes in the form of different abilities, chosen by the player before a level starts.

Players move their vehicle by pedalling, meaning that the faster the player pedals, the faster the vehicle moves forward. The thumb buttons on the handlebars allows the player to steer their vehicle left and right, as well as strafing when using different abilities and the main cannon. During combat, players often need to move to dodge projectiles or enemies that have short range attacks.
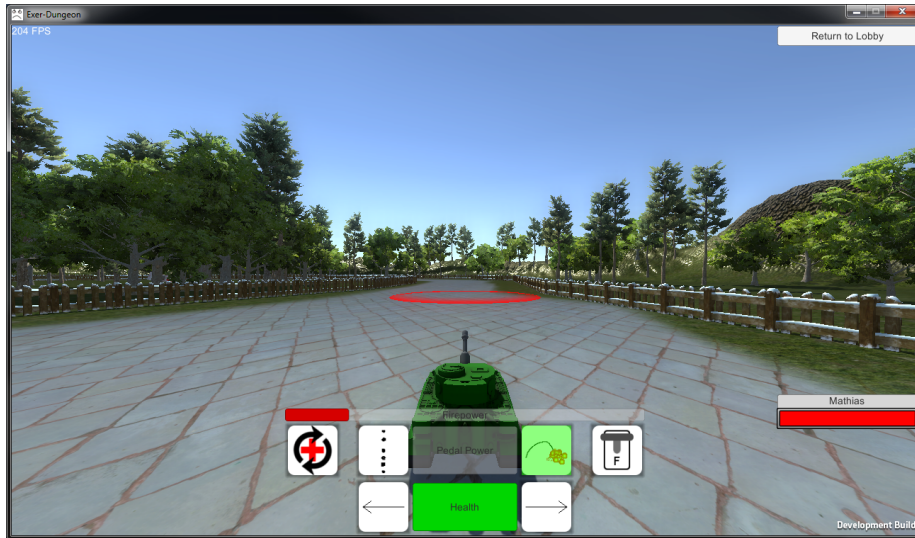
Figure 12.1: Shooting projectiles in Exer Dungeon

In the previous version, players only had to press the fire button in order to shoot projectiles. This was reworked so that pedalling also plays a part in the combat. Projectiles are shot in the forwards direction of the vehicle, but upwards at a 45 degree angle. To shoot, players now have to hold down the fire button, then pedal to increase their fire-power. The more fire-power a player has, the further the projectile will go. While firing, a red circle will display to the player where the projectile will eventually hit (Figure 12.1). After releasing the fire button, the projectile is launched towards the target area and will damage nearby enemies upon impact.
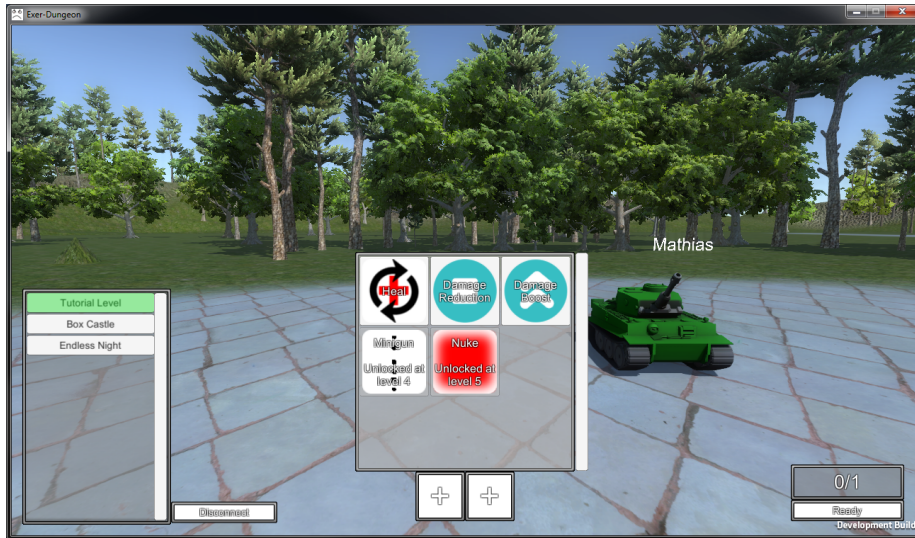
Figure 12.2: Lobby ability selection menu

While in the lobby, players can choose two special abilities to use during gameplay (Figure 12.2). Special abilities have different uses in the game, such as healing, boosting damage output or perform some special attack. Abilities currently added to the game are:

- Heal. Allows for players to heal themselves and nearby players. The amount healed is based on how fast the player is pedalling (Figure 12.3)

- Damage Boost. Grants a buff to nearby players which doubles their damage done to enemies for a short period of time.

- Damage Reduction. Grants a buff to nearby players which reduces damage taken from enemies.

- Minigun. A special attack which damages enemies directly in front of the player, based on how fast the player is pedalling

- Nuke. Fires a special projectile which inflicts a lot of damage to enemies hit within the target area.

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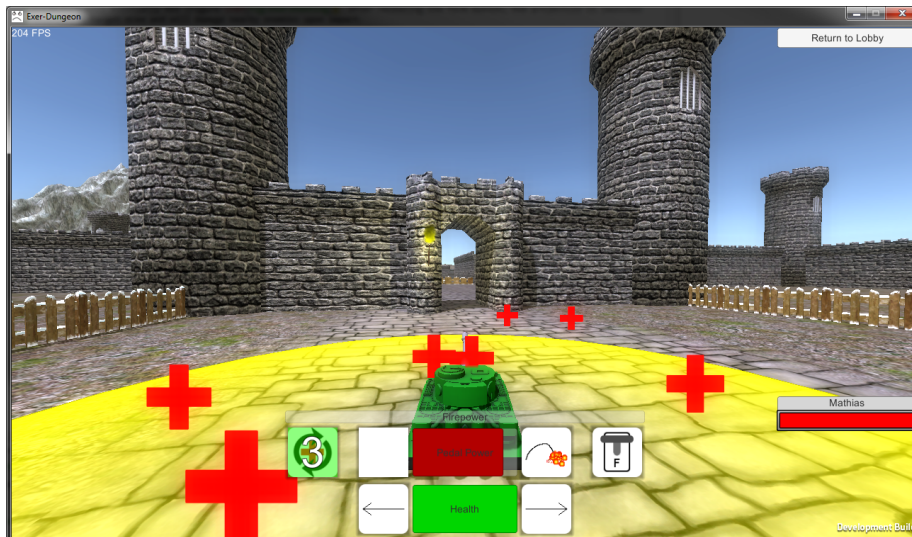
Figure 12.3: Using the healing ability

The special abilities allows players to choose their own play style and create strategies with abilities that work well together. For example during a difficult fight, one player could use the damage boost buff on players when everyone is ready to deal damage to the enemy or damage reduction when an enemy is about to use a special attack.
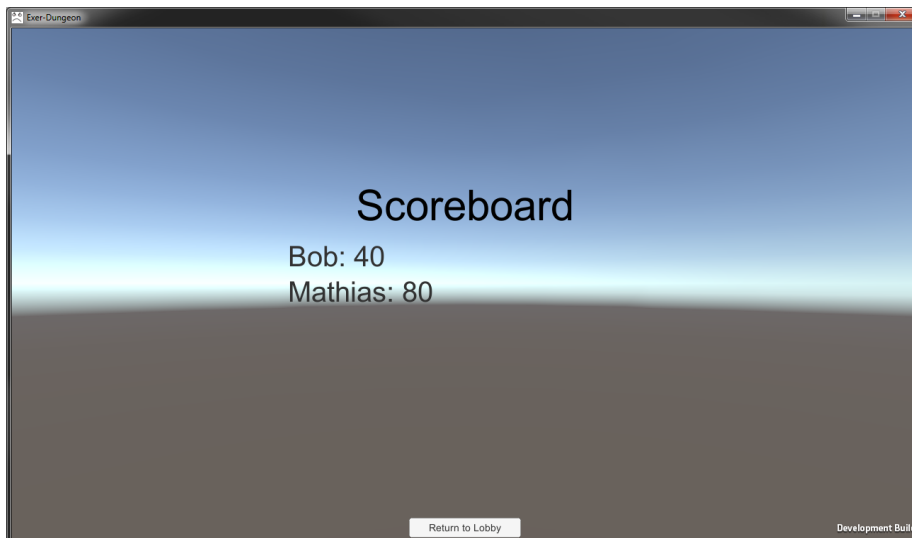


Figure 12.4: The victory screen scoreboard displayed at the end of a game

After players finish a level or are defeated, they are presented with a score-board which shows the amount of damage players did to the enemies during play (Figure 12.4).

## 12.2 Gamemodes and levels
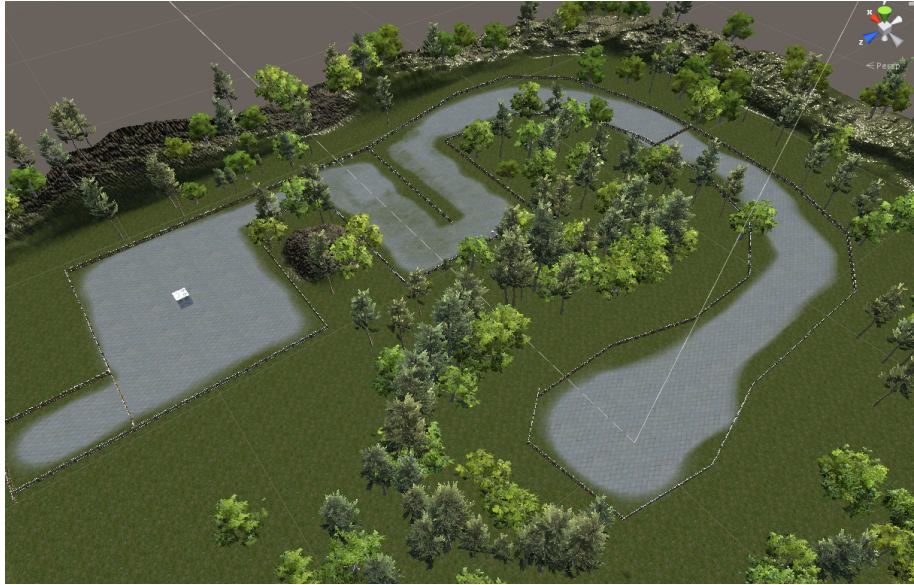


Figure 12.5: Tutorial level

The first level is the tutorial level (Figure 12.5). It introduces the player to different elements of the game, such as how to use the main cannon and the importance of dodging projectiles. The only enemy in the level is standing still and shoots artillery projectiles outwards in random directions, making it an easy first target for players to defeat.
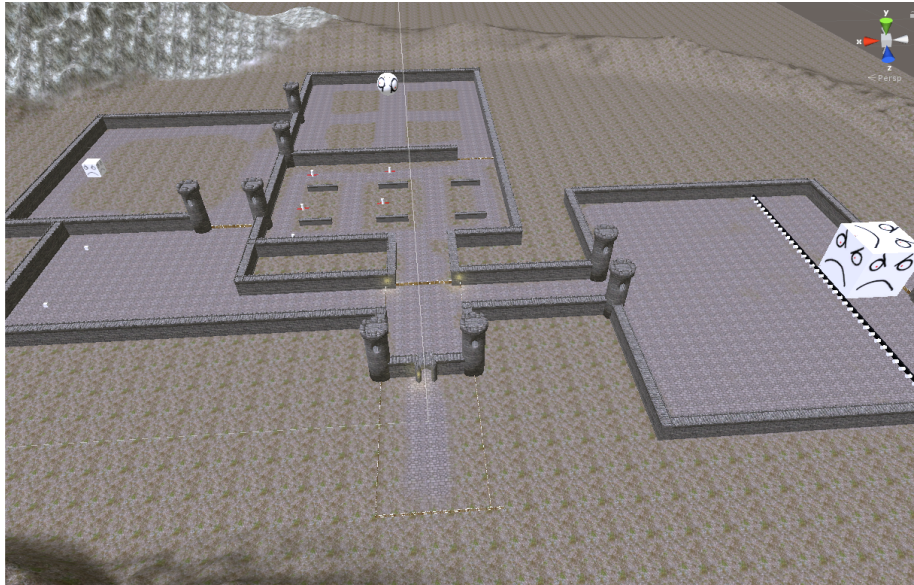
Figure 12.6: Box Castle level

The second level functions more like a dungeon from World of Warcraft, with different enemies placed in different areas of a castle. The goal of the level is to clear out all the enemies and bosses inside the castle (Figure 12.6). As the players enter, they are met with three gates. Each gate leads to new enemies for the players to defeat. The first gate opens as the players enter the castle, but the other gates can only be opened by defeating the boss at the end of each path.
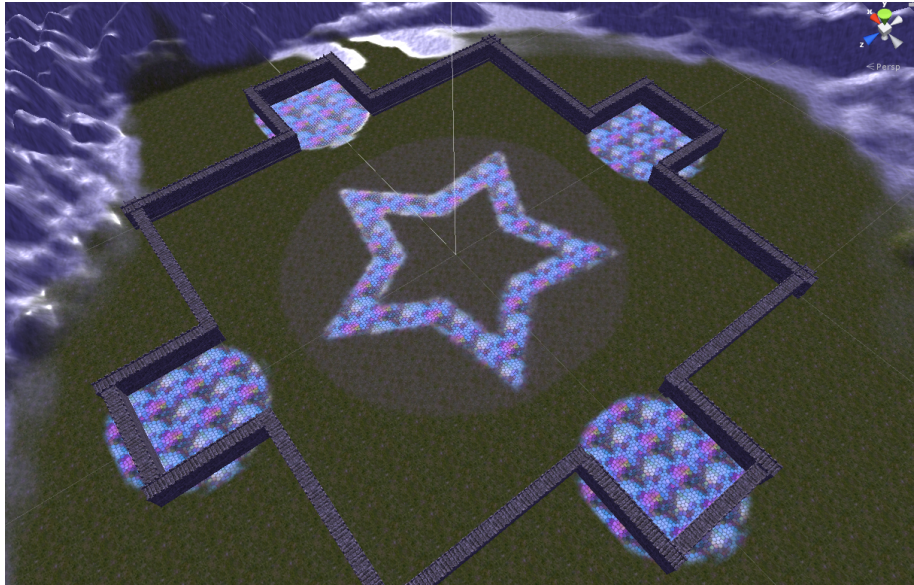
Figure 12.7: Endless Night level

The third level is an arena where players are attacked by enemies from different directions (Figure 12.7). Players are located in the middle of the arena, with enemies swarming inn from four different entrances. Enemies spawn in waves, meaning that they spawn in groups. After one group of enemies have been defeated, the next group starts attacking. To win, players must defeat all the waves of enemies.

## 12.3 Immersion

For a players to get immersed into the game, different features have been added to the game to increase the chance of immersion.

### 12.3.1   Player Customization



Figure 12.8: The in game player customization panel

To increase player immersion, the game allows for customization through personalization. Players can customize their in-game names, colour, and player model in the main menu. Personalization is used in video games to strengthen the connection players have with their virtual character, resulting in increased immersion. In the current version of the game, players can choose a player model out of a selection of models (Figure 12.8). The colour of the model can then be set using the red, green and blue colour sliders, which allows the player to set the models colour to whatever they may prefer.

### 12.3.2   Goals and Challenges

For players to be immersed, they need clear goals with gameplay that challenges players according to their skill level. To suit different player skill levels, the levels in the game function as a difficulty setting. The tutorial level is the easiest level to finish and serve as a place for players to test out different abilities. With the second and the third level, it gets more difficult the further players get, meaning each encounter in the level increases the difficulty of the battle.

Playing the game rewards players with experience points and in game currency, which can be used to unlock new abilities and player models. How much experience and money players get depends on how much damage they inflicted on the enemies during play. At the end of a game the scoreboard is displayed, which displays how much damage each individual player inflicted on enemies.

Players are rewarded with experience points even if they do not complete a level, such that even if a dungeon is too difficult for players to complete they will still feel rewarded for playing.

Each map has a single goal for the players to achieve, which is to eliminate all enemies on the map. A problem with only having a single goal is that after players complete a map they do not have any incentive to play the map again. Adding new abilities that are unlocked with experience points gives players new tools to play around with, which again adds replay value. Since player models and abilities requires players to play levels more than once to unlock, it gives players a long term goal to accomplish. Having an overarching goal gives players incentive to play more and possibly increase their immersion even after completing a level.

All experience points and currency is stored on the local computer, such that when a player quits the game all progress is saved.

### 12.3.3  Feedback

A requirement for players to be immersed, they need good feedback from the gameplay. Ability, enemy and player status needs to be displayed to the player such that the player understands what is going on at all times during play.



Figure 12.9: The graphical user interface

The main way of conveying information is through the user interface (Figure 12.9). The main display shows a variety of information:

- The health bar is a rough visualization of how much damage a player can receive before dying.

- Pedal power shows how fast a player is pedaling.

- Firepower shows the current charge put into the main gun. The more power, the further the projectile travels.

- First and second ability button, highlighted in green when the button is pressed. The icon on the different buttons shows which ability is selected from the lobby.

- Ability cooldown timer. After an ability has been used, it informs the player when it is ready to be used again.

- The main cannon fire button.

- Forward / Reverse button, which toggles between forward and reverse movement.

- Buffs panel shows what buffs are active on the player and how much time is left before it is removed.

- Player party panel shows all players currently playing in the game and how much health they have left.

- Player names are displayed above players in game to help players locate each other more easily.

The layout of the user interface is mapped such that it mirrors the layout of the buttons on the handlebar. This was done such that players can easily keep track of which button they are pressing and which ability is mapped to a certain button.



Figure 12.10: Enemy health bar is displayed in game

During combat, players need to be informed on how well they are doing and how far they have progressed. A simple way to convey this information is by showing how much health enemies have left, which is displayed by a small health bar above each enemy (Figure 12.10).

Since shooting can be quite tricky to hit enemies, the game needs to give proper feedback if an enemy was hit or not. When a player hits an enemy, a display shows how much damage was done (Figure 12.11). If players shoot many projectiles in quick succession and every projectile hits, the amount of damage displayed increases with the amount of damage done additionally.

When the player is shooting, audio feedback is also given by playing different sounds. In the events that a player is preparing to fire, actually fires the projectile, and the projectile hits a target, different sounds play. A loading sound, gun fire sound, and an explosion sound.

Figure 12.11: After hitting an enemy, that damage inflicted is displayed in red

### 12.3.4 Gameplay

For both user enjoyment and immersion, the game should give players a playing experience that feels satisfying to play and looks smooth on screen.

In Unity, the physics and graphics run on different update rates. The game updates physics 60 times a second, while the graphics are updated depending on the power of the graphics processor unit. The graphics update rate is capped at 200 frames per second which makes for a very smooth experience depending on the refresh rate of the monitor. Normally a physics object only moves when the physics are updated, which would result in the game only updating 60 times per second. Unity allows for interpolation of objects in between physics update, such that objects still move at higher frame rates.

The player avatar needs to behave in a way such that it feels responsive, yet moves smoothly when playing. While having a higher frame rate with interpolation helps out to a large degree, there are other tricks one can use to further improve the feel of the gameplay. Detaching the camera from the player object such that it follows the player at its own pace adds another layer of smoothness to the gameplay, as long as the camera is not to slow or falls behind when moving at top speed.

### 12.3.5 Social Interaction

To help social interactions to occur during or after play, the game needs to offer players something to discuss or have conversations over. In the game lobby, players have to choose two abilities they can use in game. Players can here discuss what abilities they should use and create strategies based on their

choices. During play, players can communicate just like they would in other multiplayer games. Request assistance, call out for help or make up strategies on the spot.

After the game is finished, players are shown the scoreboard. While the gameplay is cooperative, a competitive environment might occur where players compete against each other to get the best score.

There is no guarantee that players will have social interactions over the different features in the game. It is possible that players will start conversations over other features not planned of beforehand.

# Chapter 13

# Software Architecture
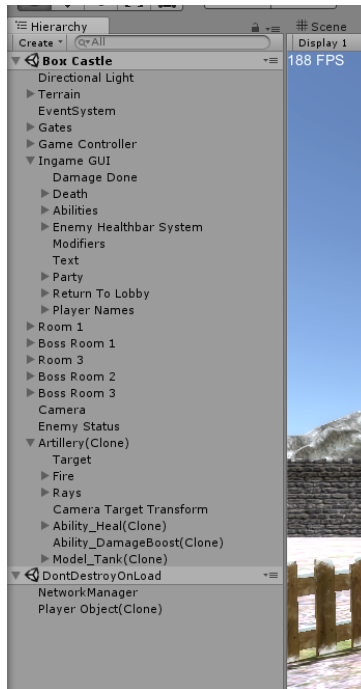


Figure 13.1: The Unity hierarchy during online play

Since the game uses Unity as a base to build upon, all the components that make up the game are within the Unity hierarchy (Figure 13.1). The camera, players, user interface, visual effects, and network controllers are all contained in the hierarchy. This can easily make the project very disorganized during development, since it is very easy to make shortcuts which will become a problem

when attempting to add new functionality later on in the process. Using software design patterns and strategies in a project helps keeping the system decoupled with high cohesion.

In the final game, these are the design patterns I used:

## 13.1   Model-View-Controller
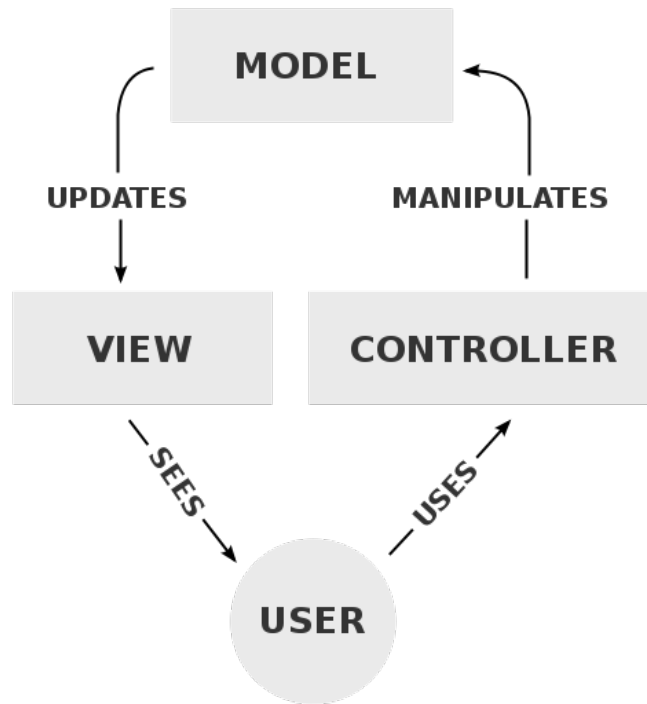


Figure 13.2: The MVC design pattern process

The MVC pattern is used to increase decoupling in the software architecture, such that the components that control the interface are decoupled with the rest of the system. In Figure 13.2 the user is displayed information from the view which reads data from the model, and the user interacts with the controllers which manipulates the data in the model.

In Unity this pattern is used such that the canvas reads information from the game objects, to insure that a change in game objects does not require changes in the view. While the canvas view is easy to keep separate, the line between model and controller is blurred. Due to the complexity of the game world and amount of objects that inhabit it, objects tend to be both the model and the controller.

Each object has various components which controls their behaviour, such as a rigidbody which enables physics for the object and a script which controls the movement of the object. For example, the movement script checks if a player is holding down a certain key and moves the object accordingly.

## 13.2   Observer Pattern

Objects within the game sometimes needs to communicate with each other and use each others data. To keep the objects decoupled the Observer Pattern is used. In this pattern, objects can subscribe functions to events on other object. When an event occurs, the listening objects are notified and their functions are executed. This is used to stop objects having a direct connection to other objects, and results in decreased coupling.

## 13.3   Singleton Pattern

The singleton pattern is used to insure only a single instance of an object can exist. This is quite useful in Unity to make objects accessible across the entire system, such as the network manager and game logic controllers. Normally the pattern is used during the instantiation of the object, but with Unity the object already exists within a scene and the pattern is therefore used to allow easy communication to the object.

## 13.4   Comments on the Architecture

Not everything in the final project is following the patterns perfectly. This is due to the long development time and me learning more about Unity over time.

# Part V

# Playtesting and User Experiences

To find the exercise and enjoyment value of the game, it was tested with a small group of people. Following was an interview with the participants to get their opinions and to gather data.

# Chapter 14

# Playtest



Figure 14.1: Test environment setup, with exercise bikes linked to the computers

The playtest consisted of a single play session with four participants, in which all participants were men between the ages of 22 and 23 years old. All of the participants consider themselves gamers, and also exercise more or less regularly at the gym. The participants are a mixture of friends and familiars who voluntarily participated in the study. The test environment consists of four exercise bikes, each linked to a computer which the game ran on (Figure 14.1).

## 14.1 Test Process

At the beginning of the test, the participants first signed a participation agreement (Appendix A), which allows me to use their answers and data in this report. They were each given a heartbeat monitor which they put on their wrist, such that I could log their heartbeats per minute over the course of the test.

While the participants were playing the game, I observed and took notes regarding the communication between the participants, their performance and status within the game, and their general engagement.

At the end of the session, I had an open one-on-one interview with each participant, where I asked several questions regarding three topics: gameplay, exercise, and immersion.

| | |
|---|---|
| 14:00 | Participants arrive |
| 14:11 | Test starts with the tutorial level |
| 14:15 | Tutorial is completed |
| 14:15 | Box Castle is started |
| 14:17 | Box Castle boss 1 is defeated |
| 14:22 | Box Castle boss 2 is defeated |
| 14:26 | Box Castle boss 3 is defeated |
| 14:26 | Box Castle is completed |
| 14:26 | Water break |
| 14:29 | Endless night start |
| 14:32 | Endless night completed |

Table 14.1: Playtest timeline

The four participants were told to meet at the lab at 14:00, and that the test would start as soon as everyone were ready. During the test, I noted down the time of important events such as when they started playing and when a boss in the game was defeated (Shown in Table 14.1).

## 14.2   Observations

While the participants were playing the game, I observed the players from the sidelines and took notes of their performance and overall experience. The topics of interest were: communication, engagement, difficulty, physical exertion, and time used. These were the observations I made during the test:

### 14.2.1   14:11 - 14:15 Tutorial Level

The players seemed to be communicating a lot throughout the tutorial, mostly explaining to each other how the game is played, such as how to move, shoot, and use abilities. Players quickly learned that they could damage each other, which led to three of the four players being dead within a minute of play time as they started attacking each other. After quickly healing each other up, they moved on. All the players seemed very motivated in learning how to play and throughout the level kept a very positive attitude.

The level was very easy for the group to complete. Players mostly died from damaging themselves instead of taking damage from the enemy located at the end of the level. Even with that in mind, they managed to complete the level in four minutes.

### 14.2.2   14:15 - 14:26 Box Castle Level

As the players went on to the next level, their communication became more directed towards the gameplay. Throughout the entire level, players called out to each other for healing, and often called people to group up such that they could heal faster together. During the second boss, they quickly figured out that the boss was only following a single player, and they started asking each other if anyone could tank the boss while the rest were doing damage. Communication was decent during the first two bosses, but at the third one it was kept at a minimum with very little talking going on. They started laughing and talking again after the boss was defeated as they saw a big difference between players on the scoreboard.

The players seemed very engaged throughout the entire level, and even stressed during the second boss. Since the second boss is following a single player while shooting a lot of projectiles, I often heard the targeted player yelling and pedalling faster to get away.

Each enemy in the game varied to a large degree in difficulty, especially the bosses. The first boss was quite difficult, in the sense that a lot of players died during the combat, but they were not very close to completely losing the fight since they were always at least two players alive. The second boss fight was even more difficult, as they were very close to losing the fight since three out of four players were dead, and the last player had little health left. Compared to the first two, the third boss was relatively easy where at most one player was dead and the rest slightly injured.

It is during this level that I could see that the players started getting into the game and they were pedalling faster at times. At the first and second boss they seemed to pedal at very high speeds when they were healing or trying to get away from incoming damage. The tempo at the third boss seemed quite slow in comparison to the other two.

The entire level from beginning to end took the group ten minutes to complete, making it the longest level in the game.

### 14.2.3   14:26 - 14:32 Endless Night Level

After a short water break, the players got back into the game to play the third level. Since some players levelled up after the last level, they now had the nuke ability to try out. As soon as the level started, a player launched a nuke into the middle of the group, killing three players including himself. They all burst into laughter over the entire situation, and the last player had to rush to the scene to heal them back to life. Other than this incident, there was little communication during the level.

The players did not seem to have any issues throughout the level, since they were quick to defeat all the enemies that entered the arena. Even the boss at the end were no problem, and they quickly finished the level in six minutes.

## 14.3 Participant Pulse Data

Throughout the test, all participants were wearing a FitBit Charge 2 [48] wristband to measure their pulse as they were playing. Following is the resulting pulse data from all four participants, showing their heartbeat throughout the test (Figure 14.2 - 14.5). The most interesting values on the graphs are those which lie in between 02:11:00 and 02:32:00, since this is part in which they were actually playing the game. Most participants heartbeat correlates with in-game events, such as a rise in beats per minute when fighting the second boss in the Box Castle level, roughly at 02:20:00.
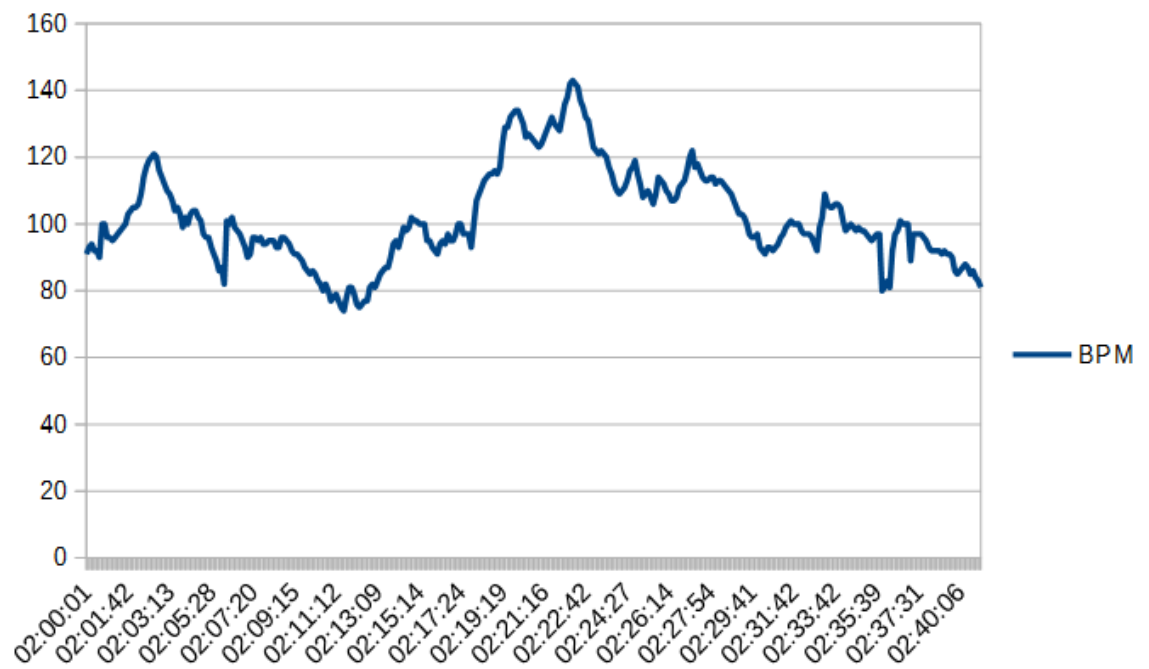
Figure 14.2: Heartbeat data for participant 1

Figure 14.3: Heartbeat data for participant 2
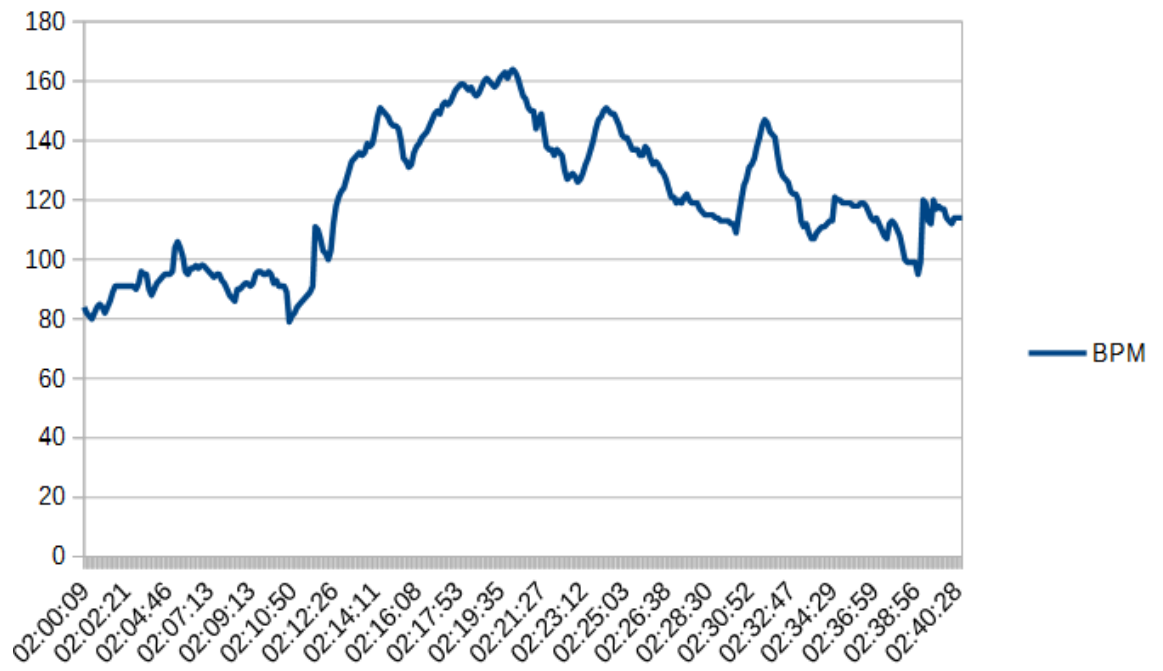
Figure 14.4: Heartbeat data for participant 3
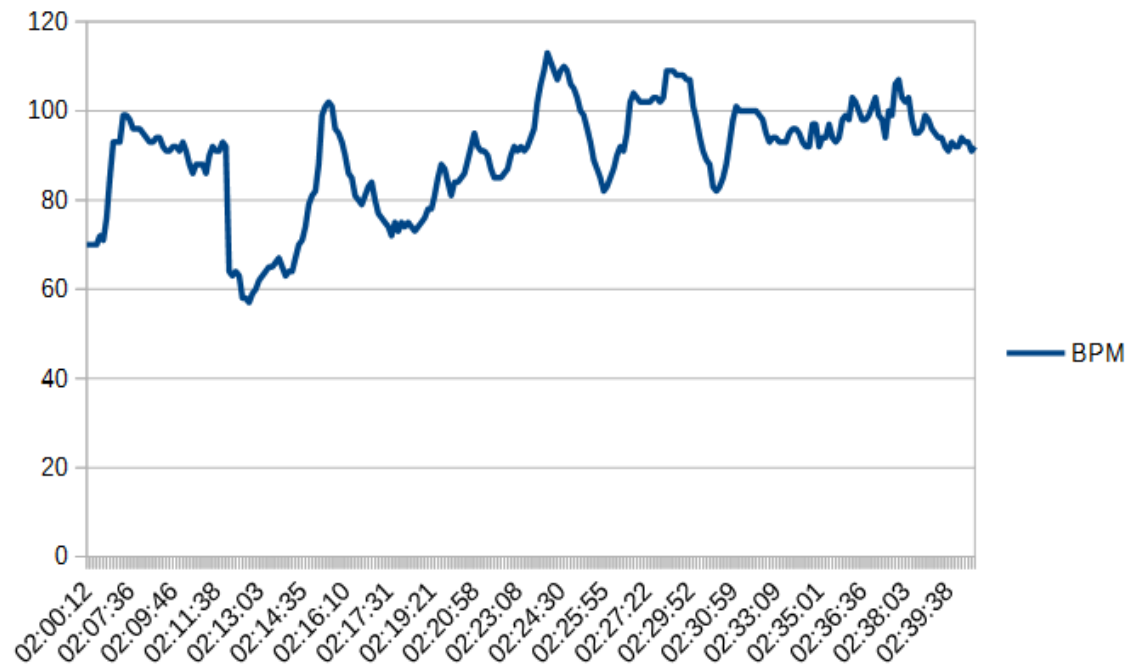
Figure 14.5: Heartbeat data for participant 4

## 14.4 Interviews

After the test, all participants were interviewed one by one where they were asked several questions regarding different topics. The complete answers from the individual participants can be found in Appendix B. Table 14.2 is a summary of the questions and answers from the participants.

| General Information | |
|---|---|
| Age | The participants were between 23 and 22 years old. |
| Gender | All participants were male. |
| How often do you exercise? | All participants exercise a couple times each week, and sometimes more and sometimes less. |
| Do you play a lot of video games? | Each participant play video games between 2 - 4 hours a day. |
| Have you tried the game before? | One of the participants had tried the game before on PC, but not on the exercise bike. |
| **Gameplay** | |
| Which parts of the game did you enjoy the most? | All participants were in agreement that they enjoyed that the game was a cooperative experience, and that they had to work together to win. Other features they seemed to like were the fact that shooting and abilities required some skill to be used properly, especially the fact that they had to pedal in order to fire projectiles. One player noted that he enjoyed the freedom of movement around the level and that he could go anywhere. |
| Which parts of the game did you enjoy the least? | Each of the participants had complaints regarding different features. Movement in the game was a bit of a problem, since stopping was rather difficult unless you repeatedly pressed the reverse button, which was bothersome. One player wanted to be able to drift in the game, such that turning around or attacking while moving would be more satisfying. Last noted was the fact that the game was too short, and there was too little to do. |
| How did you feel playing on the exercise bike with the controllers? | All participants agreed that the controllers worked well and that they were very intuitive. One player had a bit problems later on as his hands were starting to hurt a bit. |

| | |
|---|---|
| Could you see yourself playing this game in the future? | All participants said the game would be fun to play if it had more content, and some noted that if they were to play it, they would mostly play it during warm-up at a gym. |
| What features did you miss from the game and want to see implemented? | One player wanted drifting as noted earlier, but they all mostly just wanted more content and stuff to do. They wanted the game to be more replayable, as they had no urge to go back and play it again after the test. One participant wanted the game to have distinct roles and classes for players to chose, making it more similar to games such as World of Warcraft. |
| Exercise | |
| Did you consider or notice the fact that you were exercising? | Most participants did not really notice at all that they were exercising, they just felt that they had to step it up when the game required them to. One participant were more aware of it than the others, and noted that he felt quite exhausted during the most intense parts of the game. |
| Did you feel exhausted after playing? | Everyone answered that they got sweaty and warm after playing, but no one got exhausted from playing. They reported it to be similar to jogging or biking. One participant said that he took it a bit calm since he was not wearing exercise clothes. |
| Did you feel like you pressed your body more than you would during normal exercise? | All participants answered no to this question, as they did not really feel a need to push themselves to the extreme during the session. One player noted that he would have pressed on much more if he was playing it at a gym, and another said that it needed to be more competitive for him to push on. |
| Could you see yourself replacing normal exercise with playing this game? | Some participants answered partly yes and others no, but they were mostly in agreement that it would be mostly used as warm-up or replace some parts of their exercise program. One participant said he could use it for his fat-burning program, and another could use it, if it had strength exercises as well. |
| Immersion | |

| | |
|---|---|
| Did you feel like you communicated with the other players? | All players answered that they needed to communicate to each other regarding healing. They did not have any "salt" in between them, since the game was too short. On the other hand, one of the player said that communication was important in order to win the game. |
| Was there a need to communicate with the others? | They all think communication was important, and one said for teaching how to play and in-game strategy. |
| What is your opinion regarding graphics and sounds? | They all said the graphics and sounds were fine for testing purposes, and more would be required for a release version. |
| Did you feel yourself immersed in the game? | Three out of the four answered yes to this question, while the last one answered "not in particular". It was enough for him not to notice the exercising, but not as immersive as big studio video games. |

Table 14.2: Summary of the participant interviews

# Chapter 15

# Results

On of the goals of the study was to find the game's overall enjoyment value and to see if players got immersed into the game. Looking at the interviews, we can see that the players liked playing the game and enjoyed it, but they had no incentive to play it again after they were finished. The reason for this can be found by looking at the game from the perspective of immersion and rewards.

Table 6.1 from Chapter 6 lists a set of criteria for players to get immersed into a game: Concentration, Challenge, Player Skills, Control, Clear Goals, Feedback, Immersion, and Social Interaction. Looking at the observations and the interview, we can see how well each criteria was met:

- We can tell that the players were able to concentrate based on the observations made, since all the conversations that were going on while they were playing was concerning the gameplay, such as requesting healing or laughing at game related events.

- We can tell that the players were somewhat challenged, especially during some boss fights because they were put in danger of losing when many of them were dead or heavily damaged.

- We can tell that the game required some player skills, since they reported it in the interviews.

- We can tell that the players got a sense of control, because the players managed to defeat all the enemies relatively easily, and they said that the controllers worked well and were very intuitive.

- We can somewhat tell that the game had a clear goal, since the players managed to beat the game in a short time and they never asked each other about what they were supposed to do.

- We can somewhat tell that the game had some feedback, since all players communicated to each other when they needed assistance or when they were low on health.

- We can say that the players got immersed into the game since they all reported it themselves in the interview, and that they mostly did not notice that they were exercising.

- We can tell that they players were socially interacting, based on the results from the interview and observations made during the test.

These results tell us that the players were getting into the state of flow when playing. Since flow is a method to measure enjoyment, and we can therefore assume the game is fun to play since the participants enjoyed playing the game. The players also said in the interview that they found the game fun to play, which further confirms this assumption.

Chapter 7 talks about how rewards must be given to players to give them an incentive to play. In the interviews, the players reported that they did not really feel the urge to play again. They said that the game was missing content and had little replay value. We can look at this from the perspective of rewards to explain why. In the game, players are rewarded with new abilities and unlockable cosmetics. The abilities are awarded as the players level up, and the requirement to level up is quite high. Players need to finish a level at least twice or more in order to level up, which is way to much for the purpose of the test. Cosmetics are also rewarded to slowly, as they also requires the player to complete levels multiple times to be unlocked. In short, the game does not give out enough rewards, and the rewards given are handed out too slowly. For the test players, they were hardly even noticed, as there was only one player who got to unlock one of the later abilities. The rewards themselves might not be interesting enough for the participants, as one participant felt that the abilities should be available from the start.

To find out how well the game functions as a method for aerobic exercise, we need to look at the heartbeat data and from the interviews. From Figure 14.2 to Figure 14.5 we can see the different heartbeat data that was gathered during the test. Comparing these to the answers from the players (Appendix B), we can see how it correlates with how they felt they exercised (Table 15.1). Based on their answers from the interview, I assume that their resting heart rate is at 80 beats per minute, and that their target heart rates during exercise ranges from 100 to 170 beats per minute[49].

| Participant | Result |
|---|---|
| 1 | In the interview, he said that he felt that he got a bit exhausted from playing, but never pushed himself to the extreme because of the clothes he was wearing. Looking at the heartbeat data (Figure 14.2), we can see that he pushed himself during a couple of fights, and that he was consistently above his assumed resting pulse. He peaked his pulse at 140 beats per minute during the second boss fight in the Box Dungeon level. |

| | |
|---|---|
| 2 | In the interview, he said that he felt a little exhausted after the playtest was over, but did not push himself to his limit. He also commented that he felt that he was exercising during the most intense moments of the game. Looking at the heartbeat data (Figure 14.3), we can see that he peaked at 160 beats per minute when they were fighting the second boss of Box Castle. From the beginning of the second level, his heart rate was also consistently above 120 beats per minute. |
| 3 | In the interview, he said that he got sweaty, but never exhausted. Looking at his heartbeat data (Figure 14.4), we can see that too got well above his assumed resting pulse and peaked at 160 beats per minute during the second boss fight in Box Castle. His pulse was also consistently above 110 beats per minute from the start. |
| 4 | In the interview, he said that also got sweaty from the game, but did not push himself to any extreme levels. Looking at his heartbeat data (Figure 14.5), we can see that he almost never got above 100 beats per minute. He peaked at 110 beats per minute, during the last boss of the Box Castle level. |

Table 15.1: Participant workout effect

It is impossible to find out if any of the participants got any proper exercise out of the session, since heartbeat data alone is not enough to figure out the workout effect. We can instead use the data as a pointer to see how engaged the players were in the game at different times.

During the second boss battle in the Box Castle level, all of the participants were at their peak regarding pulse beats per minute. With the knowledge that this is a difficult battle, based on the observations made during the fight, we can see the correlation between a difficult battle and their dedication to win. This supports what they said in the interviews, that the did not notice that they were exercising and that they just had to pedal fast in order to win.

# Part VI

# Conclusion and Further Work

# Chapter 16

# Conclusion

The goal of this project was to design and develop a new game concept for a game where an exercise bike is used as a game controller by using the PlayPulse controllers. To accomplish this goal, I researched existing exergames and different technologies to get a better understanding of the genre, and researched flow and rewards to find out what makes games engaging and entertaining. The Unity engine was used as a base and a tool to develop the game, and using its multiplayer functionality I created a online cooperative multiplayer dungeon crawler, called Exer Dungeon.

When designing the gameplay, I looked through the different video game genres and found out that single controlled character games are the best fitting games for the PlayPulse controllers. Further to develop the game, I looked for inspiration in modern video games.

To evaluate the game's enjoyment value, I researched the state of flow and how it applies to video games. Even if a game manages to bring the players into this state, it is not always enough. Rewards are also a requirement for video games to be enjoyable, as they give the player incentive to keep playing a game.

The final game was tested with a small group of people to find out the game's enjoyment value and exercise value. The end result is a game which players found fun to play, but no one had any incentive to play again after completion. The reason behind this is that the players got immersed into the gameplay and the combat, but the game did not reward the players properly for their effort. It also lacked in content, as they managed to complete the entire game in roughly 20 minutes.

Another possible reason for the game lacking in replay value can be because it is a cooperative game, and not a competitive game. When playing against other players, every game is different from another since people tend to be unpredictable and not follow a fixed pattern.

The playtest did not get collect enough data to find the exercise effect of the game, but it does show an increase in most of the players heart rate when they started playing and at what point during play they likely exerted most energy. Taking into consideration that the heartbeat monitor equipment might

not return correct values, the fact that the increase and decrease of values correlated with intense moments in game reaffirms that the players exerted more energy at those moments. After the second level, the participants had a water break and they reported in the interview that they got sweaty. We can therefore conclude that the participants got some exercise out of the game, and that it at this stage can be used as a method to warm up.

To summarise my results, here are the answers to the research questions defined in Chapter 3:

**How do I create a game that is enjoyable to play over a long time period?**

For a game to be enjoyable, it needs to help players reach a state of flow, which is a state where the person is hyper focused on a single task. The players also needs to be rewarded for playing the game, through ether in-game rewards such as items, or sensory rewards, such as sounds and graphics. To make the game enjoyable over a longer time period, it needs enough content and challenge to allow the player to get better at the game, and still be challenging.

**How do I create a game that motivates players to exercise through gameplay?**

There are multiple requirements needed by the game for it to motivate exercise. The game needs to be interesting and engaging, such that players enter a state of flow when playing. Its gameplay needs to be directly connected to exercising, meaning that the player is required to exert energy in order to win. The motivation to exercise should come from the gameplay increasing in intensity and the players exerting more energy as a result.

**How do I create a game that can be used as an replacement to normal aerobic exercise?**

The gameplay should encourage the player to exercise in the method best fitted for the equipment used. For example, a game made for exercise bikes should encourage the player to exercise in intervals through its gameplay, such that it varies in intensity in a similar manner.

**How will the game I create affect the players motivation and immersion?**

The game i created positively motivates and immerses the players with its gameplay. It motivates players to exercise by requiring the player to exercise in order to win, and it immerses the player by fulfilling the list of criteria needed for players to enter a state of flow.

# Chapter 17

# Further work

The playtest showed that the game is not yet completed, and needs more work for it to be a game that players want to come back to. Since the test participants enjoyed playing the game and its combat mechanics, it shows that the base gameplay is competent and only needs refining and the inclusion of more content. The area that needs the most work is the reward system, since the players did not feel rewarded after playing. Researching good methods of rewarding players and finding ways to add replay value is important if the game is to succeed. Abilities needs to be refined such that they are all fun to use and serves a purpose in the gameplay.

The game's exercise effect needs to be properly tested in order for a proper conclusion to be made. To find out if the game actually endorses players to exercise in intervals, it could be tested by recording the rotation speed of wheel over time and plotting it to a graph. If the game does encourage interval exercise, the graph should be similar to Figure 5.14 in how the intensity changes over time. To find the exercise effect, a game test should be compared with a standard exercise session at a gym, such that it can be compared to see if it is more beneficial to play or not.

To further increase immersion in the game, more graphics and sounds should be added to make it a more complete experience. Adding more visual effects for abilities will make them more satisfying to use in game, as long as the ability itself is fun to use.

To further validate the current result, more experimentation with more participants is required. It should also be tested with a more varied group, meaning that the participants are of various age, gender, and if they are gamers or not.

As the current version of the game only allows for cooperation, more research into competitive gameplay and other gamemodes should be done. For example, having a competitive match with players fighting in teams against other teams, or having different objectives to be accomplished in the level.

To further add to the Endless Night level, a possible procedural generation of enemies could be researched, to see if there is a way to have endless amounts of enemies attacking with varied abilities and functionality.

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# Appendices

# Appendix A

# Participation Agreement

# Forespørsel om deltakelse i forskningsprosjekt

## Bakgrunn og formål

Formålet med studien er å skaffe kvalitativ data om spillets underholdningsverdi og treningseffekt, i forbindelse med en masteroppgave ved IDI, NTNU.

## Hva innebærer deltakelse i studien?

Det vil bli samlet inn data om deltakeren før, under og etter testen av spillet. Denne dataen inneholder informasjon om alder, høyde, vekt, kjønn, trenings vaner, og spille vaner. Under testen vil pulsdata måles og deltakeren vil bli observert. Etter testen vil deltakeren bli intervjuet med åpne spørsmål angående spillet og opplevelsen.

## Hva skjer med informasjonen om deg?

All informasjon og data som blir tatt opp under testen vil bli behandlet konfidensielt, slik at deltakeren ikke kan gjenkjennes i publikasjonen. Deltakerne bruker et tilfeldig nummer som identifikasjon under testen, der nummeret har ingen forbindelse med deltakerens navn slik at gjenkjenning er umulig.

## Frivillig deltakelse

Deltakelse i studien er helt frivillig, og trekke fra undersøkelsen kan gjøres når som helt. Ved trekking blir persondata anonymisert.

## Samtykke til deltakelse

Jeg har mottatt og forstår informasjon om studien og er villig til å delta

_____
__
(Signert av prosjektdeltaker)

# Appendix B

# Playtest Interviews

| Deltaker Identitet | 1 |
|---|---|
| Alder | 23 |
| Høyde | 1.80 |
| Vekt | 78 |
| Kjønn | Mann |
| Hvor ofte trener du? | Periodisk ofte |
| Bruker du mye tid til gaming? | Ja, sjekk steam profilen min, burde være rundt. 2 - 4 timer daglig |
| Prøvd spillet før? | Ja, men bare på PC. |
| | |
| Hvilke deler av spillet likte du mest? | Ikke helt sikker. Må vell være at det er multiplayer, at abilities er skill shots, ganske fri bevegelse og ikke on rails, og at man kan gå hvor man vil. |
| Hvilke deler av spillet likte du minst? | At man ikke kan drifte i spillet. |
| Hvordan føltes det å spille med kontrolllene?<br>Positive og negative sider? | Funka greit.greit å styre når man venner seg til det, men fikk litt vondt i hendene etter en stund. |
| Kunne du tenkt deg å spille det videre? | Ja, lite replayability. Pedal tanks funker bedre fordi det er comp. Større risk i pt |
| Føler du at det er noe som mangler eller noe som trengs for å forbedre spillopplevelsen? | Drifting som sagt, mer map design, må være gøyere å spille igjen, siden jeg har ingen trang til å komme tilbake etter at jeg har fullført alle banene. |
| | |
| Tenkte du noe over at du trente?<br>Hvilke tidspunkt følte du deg sliten? | Nei, følte bare at jeg måtte trø for å vinne, ikke noe mer enn det. |
| Følte du deg sliten etter spillingen var over? | Ja, men tok det litt rolig på grunn av klærne jeg har på, men kunne ha gått all inn med treningstøy. |
| Føler du at du presset kroppen mer enn ved vanlig trening på noen måte? | Nei, bare distrahert at jeg faktisk trente |
| Kunne du ha tenkt deg å bytte ut vanlig trening med dette? | Nei, ikke en erstatning, funker som et tillegg. Gjerne som oppvarming, eller en |

| | dag med gaming og en dag med styrke. |
|---|---|
| | |
| Følte du at du kommuniserte med de andre spillerne? | Ja, spesielt for healing. Føler ikke at det er nok innhold i spillet til at kommunikasjon trengs ellers. |
| Var det vits å kommunisere? | |
| Hvilke meninger har du om grafikk og lyd? Var det tilstrekkelig? | Det funker til testing, men ikke til en release versjon. |
| Følte du at du levde deg inn i spillet? | Ja |

| Deltaker Identitet | 2 |
|---|---|
| Alder | 23 |
| Høyde | 189 |
| Vekt | 89 |
| Kjønn | Man |
| Hvor ofte trener du? | Midt på, rundt 2 - 3 ganger i uka |
| Bruker du mye tid til gaming? | Sikkert rundt en 2-3 timer dagen |
| Prøvd spillet før? | Nei |
| | |
| Hvilke deler av spillet likte du mest? | Det er definitivt at det er cooperative |
| Hvilke deler av spillet likte du minst? | Det var alt for kort, for lite å gjøre |
| Hvordan føltes det å spille med kontrolllene? Positive og negative sider? | Syntes det var ganske intuitivt og fungerte bra |
| Kunne du tenkt deg å spille det videre? | Med mer content ja, ser at dette er en alpha versjon. Kunne ha brukt spillet som oppvarming med mer variasjon hver gang jeg spilte, eller som en fatburn greie. |
| Føler du at det er noe som mangler eller noe som trengs for å forbedre spillopplevelsen? | Mer content såklart, og klasser. Vil gjerne ha faste roller slik at man er fire på laget, der en må være healer og slikt. |
| | |
| Tenkte du noe over at du trente? Hvilke tidspunkt følte du deg sliten? | Medium. På de mest intense bitene var det nokså slitsomt. |
| Følte du deg sliten etter spillingen var over? | Litt, hadde vært forskjellig med en annen lengde og intensitet. |
| Føler du at du presset kroppen mer enn ved vanlig trening på noen måte? | Nei, men kunne ha gjort det. Motivasjon er alt, og trenger mer risk. Hadde jeg gjort det på treningssenter så hadde jeg definitivt presset meg mer. |
| Kunne du ha tenkt deg å bytte ut vanlig trening med dette? | Ja, siden jeg skal drive med fatbørning program så hadde jeg heller spilt. |
| | |

| | |
|---|---|
| Følte du at du kommuniserte med de andre spillerne? | Ja, hadde det vart litt lenger hadde det blitt mer salt, og ikke bare healing talk. |
| Var det vits å kommunisere? | Ja, i dag var det litt om how to play og strategi |
| Hvilke meninger har du om grafikk og lyd? Var det tilstrekkelig? | Tilstrekkelig, men gøyere å spille når det er god grafikk og god lyd |
| Følte du at du levde deg inn i spillet? | Ja |
| | |
| Kommentarer | Hadde vært kult om man kunne styre til høyre og venstre med ratt. |

| Deltaker Identitet | 3 |
|---|---|
| Alder | 23 |
| Høyde | 190 |
| Vekt | 80 |
| Kjønn | Mann |
| Hvor ofte trener du? | Periodevis ofte |
| Bruker du mye tid til gaming? | Omtrent 2 timer hver dag |
| Prøvd spillet før? | Nei |
| | |
| Hvilke deler av spillet likte du mest? | At man skyter artillery style, og at man måtte tilpasse pedaling til skyting, krever litt skills føler jeg. Minigun var veldig kjedelig i forhold |
| Hvilke deler av spillet likte du minst? | At det ikke gikk ann å stoppe, spamming av reversj knappen var bad. |
| Hvordan føltes det å spille med kontrolllene? Positive og negative sider? | Veldig intuitivt, ihvertfall med bare en ability siden jeg bare var level 1. |
| Kunne du tenkt deg å spille det videre? | Ja, men usikker på hvilke setting. Kanskje ikke hjemme, men som oppvarming på treningssenter funker fint. |
| Føler du at det er noe som mangler eller noe som trengs for å forbedre spillopplevelsen? | Kommer ikke på noe |
| | |
| Tenkte du noe over at du trente? Hvilke tidspunkt følte du deg sliten? | Tenkte ikke over at det var trening nei |
| Følte du deg sliten etter spillingen var over? | Ja, ble svett, men ikke utslitt |
| Føler du at du presset kroppen mer enn ved vanlig trening på noen måte? | Nei, ikke veldig push |
| Kunne du ha tenkt deg å bytte ut vanlig trening med dette? | Hvis styrke trening er med, så hadde jeg kanskje gjort det |
| | |

| | |
|---|---|
| Følte du at du kommuniserte med de andre spillerne? | Ikke på en veldig konstruktiv måte nei, men kommunikasjon angående healing var bra |
| Var det vits å kommunisere? | Ja |
| Hvilke meninger har du om grafikk og lyd? Var det tilstrekkelig? | Var ikke mye lyd, kunne vært fint med flere runde kanter. |
| Følte du at du levde deg inn i spillet? | Ja |
| | |
| Kommentar | Good fun |

| Deltaker Identitet | 4 |
|---|---|
| Alder | 22 |
| Høyde | 182 |
| Vekt | 63 |
| Kjønn | Mann |
| Hvor ofte trener du? | Hvis jeg trener, så trener jeg 2 ganger i uka |
| Bruker du mye tid til gaming? | Veldig mye tid, 3 - 4 hver dag |
| Prøvd spillet før? | Nei |
| | |
| Hvilke deler av spillet likte du mest? | Likte at det var coop, og hele team aspect, og at man skulle gjøre ting sammen. |
| Hvilke deler av spillet likte du minst? | Litt vanskelig til tider å skyte fordi etter at man skjøt så beveger man seg, noe man kan venne seg til, men var litt rart. Det var intuitivt, men samtidig ikke |
| Hvordan føltes det å spille med kontrolllene? Positive og negative sider? | Komfortable, syns det kom naturlig. Ligner på ringeklokker som man har på sykkelen |
| Kunne du tenkt deg å spille det videre? | Hadde vært gøy å spille |
| Føler du at det er noe som mangler eller noe som trengs for å forbedre spillopplevelsen? | Usikker |
| | |
| Tenkte du noe over at du trente? Hvilke tidspunkt følte du deg sliten? | Nei, ikke i det hele tatt. Når man skal dodge skudd så må man bare trå på |
| Følte du deg sliten etter spillingen var over? | Begynte å svette. Følte at var like aktiverende som ved løping og sykling |
| Føler du at du presset kroppen mer enn ved vanlig trening på noen måte? | Det samme som hvis jeg skulle gjort noe annet, men hvis det hadde vært mer competitive, så hadde jeg pusha mer |
| Kunne du ha tenkt deg å bytte ut vanlig trening med dette? | Noen deler av treningsopplegget, som oppvarming eller kondistrening siden det kan bli veldig monotont i lengden. Hadde vært gøyere å spille med venner. |

| | |
|---|---|
| Følte du at du kommuniserte med de andre spillerne? | Ja, følte at man måtte kommunisere for å vinne |
| Var det vits å kommunisere? | Trengtes for å vinne |
| Hvilke meninger har du om grafikk og lyd? Var det tilstrekkelig? | For testing purposes var det akseptabelt. Liker god grafikk, men med mer grafikk så hadde det vært lettere å motivere seg selv. |
| Følte du at du levde deg inn i spillet? | Nei, ikke noe spesielt. Gjorde det fordi du slutta å tenke på trening, men ikke akkurat "last of us" opplevelsen. |
| | |
| Kommentar | Friendly fire var bra trekk<br>Kunne ha:<br>● Økt kompleksiteten<br>● Hatt RPG elementer<br>● Vært lengre games<br>● Hatt points til unlocke ting som overwatch<br>● Alt er mulig å velge fra starten av<br>● vært mer som path of exile |