

Faculdade de Engenharia da Universidade do Porto

Impact of player type and background music in player's reaction to video games

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Mestrado Integrado em Engenharia Informática e Computação

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July 23, 2019

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Abstract

There has been several different studies on the impact of some video game characteristics on the player and game itself. The goal here is to determine how different game elements can impact the view the player has of the game as well as study game reaction for different types of players. The result could prove to be useful to game developers and marketers in charge of creating an advergame. They could be used to preemptively prepare a game for different types of player, thus increasing the gamer types targeted.

This focus of advertisement on video games is a result of the growth of the video game industry which is now worth 18.4 billion USD (in the USA). As a result, marketers have tapped into this phenomenon and are creating what is called advergames, with the intent of reaching those target audiences with messages about their product/service. An advergame is a game centered around a brand and represents a unique form of brand entertainment since, unlike buying product placement space in a video game, in this case, the game itself is built around the brand.

To measure the impact of the video game, the players were asked to play a video game specifically developed for this dissertation and were subsequently presented with a survey where information was collected so that it could be used to properly explore the results of the experiment.

The results obtained confirmed a positive correlation between the degree of expertise of a player and the gaming experience and between gaming frequency and the player's perceived difficulty. The melody used also had an effect on game replayability as results showed that if the player was subjected to a typical video game background song, the game replayability value would be higher than if he was exposed to a traditional Thai song.

Keywords: Advergames, Gaming Expertise, video games, Background Music, Video Game Development

Resumo

Existem diversos estudos diferentes realizados que investigam o impacto que algumas características de vídeo jogos têm no jogador e no jogo em si. O objetivo será determinar como diferentes elementos do jogo podem ter impacto na maneira como o jogador vê o jogo e estudar as diferentes reações que diferentes tipos de jogadores terão no jogo. O resultado obtido pode ser útil para game developers e marketers responsáveis pela criação de advergames. Este resultados poderão ser utilizados para preparar um jogo para os diferentes tipos de jogadores, aumentando assim os número de jogadores alvo.

Esta atenção na publicidade em videojogos é resultado do rápido crescimento da indústria dos videojogos que vale agora 18.4 mil milhões de dólares. Devido a este crescimento, os marketers aproveitaram este fenómeno e estão a criar advergames com o objetivo de alcançar as suas audiências com mensagens acerca dos seus produtos/serviços. Um advergame é um jogo criado à volta de uma marca e representa uma forma única de entretenimento à volta da marca já que, ao contrário de simplesmente comprar product placement em videojogos onde a marca será exposta, neste caso, o jogo em si é construído à volta da marca.

Para medir o impacto do videojogo, pedimos aos jogadores para jogaram um jogo especialmente criado para este estudo e após a sua conclusão, foi-lhes pedido para responderem a um questionário onde informação foi recolhida de modo a que ser possível chegar a uma conclusão relativamente a este estudo.

Os resultados obtidos confirmaram uma correlação positiva entre o Grau de expertise de um jogador e a experiência de jogo (se um jogador gostou da experiência ou não) e entre a frequência de jogo de um jogador e a dificuldade do jogo percebida pelo jogador. A melodia usada também teve um impacto significativo no fator de repetição do jogo, já que os resultados mostraram que se um jogador fosse submetido a uma música de fundo típica de videojogo, este fator seria melhor do que se fosse sujeito a uma música tradicional Tailandesa.

Keywords: keyword1, Keyword2, keyword3

Acknowledgements

To my parents for all their support during these last 6 years.

To my friends that put up with me and made this journey fun.

To my colleague and friend Fábia Esteves for all the help during this last semester.

To my supervisor, Dr. Pedro Quelhas Brito for all the knowledge he shared with me.

To the all my teachers at FEUP during these past years

My sincere thanks,
Pedro Arnaldo

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Abbreviations

IoT	Internet of Things
MIT	Movie Induced Tourism
STB	Scottish Tourist Board
DDA	Dynamic Difficulty Adjustment
RTS	Real Time Strategy
MUD	Multi-User Dungeon

Chapter 1

Introduction

1.1 Context/Motivations

Nowadays we live in a society that is completely dependent of technology. It's present all around us being on your personal devices as computers and smart phones, the media, companies, etc. With the technology development "boom", everything is getting more available to the masses and, as a result of this, there's an even bigger demand for new and improved products. Due to this reason, the world is getting more and more dependent and corporations are forced to keep up so that they won't lose their customers. Media corporations are some of the companies that must be constantly shifting their approach to the market thanks to these events. They start to become more digital to accommodate to their new kind of costumers that are more connected than ever to the world around them. Thank to this "boom", we can say that we live in a "digital era" where even kids grow up interacting with all kinds of technologies and, as a result, are predisposed to be more "tech savvy" than older generations and thanks to this, they live their life online being in social media groups, forums, chat platforms, etc.

Marketing has been present for a long time now as an ever-changing practice with the goal to communicate, deliver and exchange offers that have value for costumers. Marketeers must always know what is going on in the markets to develop a plan to sell a product/service to their clients. Digital marketing is one of the most fundamental areas of marketing nowadays since the number of people who go online every day is massive and still increasing. The best way to define it is as the use of diverse digital tactics and channels to connect with costumers where they spend most of their time online.

Since video games are becoming a major source of entertainment for a broader audience, marketeers have tapped into this phenomenon and have been creating what is called advergames, with the intent of reaching those target audiences with messages about their

product/service. An advergame is, in essence, a game centered around a brand and represents a unique form of brand entertainment since, unlike buying product placement space in a video game where the brand is placed in, the game itself is built around the brand.

There are many different ways to create an advergame. Since these games have a specific purpose, the development must be thoroughly thought out. Before the development even starts, several aspects of the game must be planned. These aspects like game type, game difficulty, etc must be planned knowing the kinds of player that will be targeted. Therefore there has to be a way to know in advance how these elements will affect the different types of players that will be exposed to the game.

1.2 Problem and investigation objectives

In this study, the objective is to determine if the feeling of a player towards a game can change base on the player expertise, playing frequency, player's state of mind and the melody the player is exposed to while playing the game. Therefore, this study can be split into four studies with the following hypothesis:

- First study: Comparing the player's degree of expertise to the player's reaction to the game:
 - H1.1: The bigger the degree of expertise of a player, the better will be the gaming experience to the player.
 - H1.2: The bigger the degree of expertise of a player, the greater the player's willingness to play the game again.
 - H1.3: The bigger the degree of expertise of a player, the more the player considers the game to be easy.
 - H1.4: The bigger the degree of expertise of a player, the more the player considers the game to be fast.
- Second study: Comparing the frequency with which the user plays video games to his reaction to the game:
 - H2.1: The higher gaming frequency of a player, the better will be the gaming experience to the player.
 - H2.2: The higher gaming frequency of a player, the more the player considers the game to be easy.
- Third study: Comparing the participant's state of mind to his reaction to the game:
 - H3.1: The better the state of mind of a player, the better will be the gaming experience to the player.

- H3.2: The better the state of mind of a player, the greater the player's willingness to play the game again.
- Fourth study: Comparing the background music that the participant was exposed to his reaction to the game:
 - H4.1: For a specific game version, the player's reaction to the game, varies according to the background music the player is exposed to while playing.
 - H4.2: For a specific game version, the player's willingness to play the game again, varies according to the background music the player is exposed to while playing.

The results can be proven to be relevant to game developers of all types of games, even advergames. For the first, these results can be used to ensure that the game has a more positive reaction to the gamers, and by doing so, boosting its sales. Secondly, for advergames it's also important to make sure the player's don't have a bad reaction to the game since that can cause a negative effect for the brand if the players associate the brand with the game. The opposite can also be true, if a brand's advergame is fun and the players like it, they can start seeing that brand in a better light.

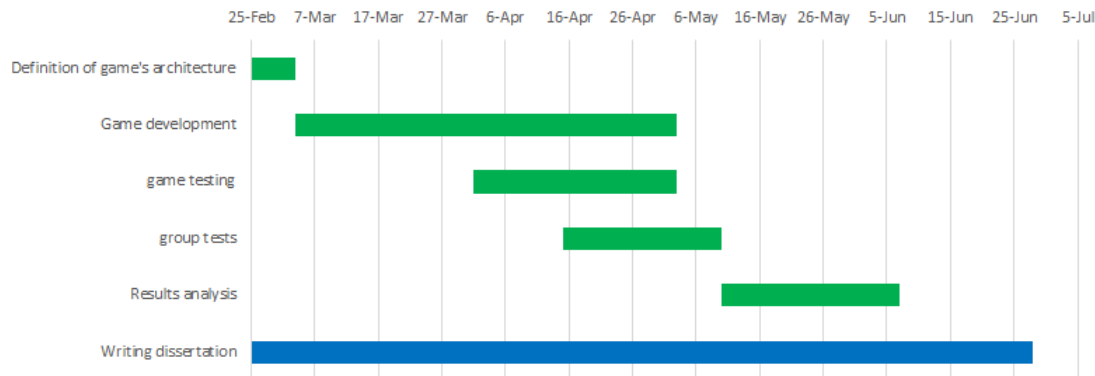
1.3 Research method

To evaluate this impact, the users were exposed to several versions of the video game. Each version had some slight deviations due to feedback given by the players. Elements like game speed, game playability (mainly movement) were changed improve the player's reaction to the game.

After they played the game, they were subjected to a survey were they were able to describe their experience and a way for data to be gathered.

Three different tests were conducted during the course of this study. Some questions were presents in all three were some, more specific group were only asked in some of them. For example, the relation between the background music and the player's reaction to the game was only present in the third and last test since, by analyzing the results of the previous tests, the other game elements (e.g. speed and difficulty) had already been set.

1.4 Work schedule



- **DEFINITION OF GAME'S ARCHITECTURE:** Before starting the development of the game, some aspects will need to be thought out. Game style is the first. After deciding that, difficulty, game speed, movement, etc will need to be addressed. After the core game is planed comes the placement of the game objects as well as its art styles;
- **GAME DEVELOPMENT:** after the details are set in stone, the development of the game will start;
- **GAME TESTING:** To ensure a balanced game, the elements that where defined during the planning will need to go through a test to ensure their likeability with the players. For that, test groups will play the game and give feedback about their opinions on the game;
- **FINAL GROUP TEST:** After the game is properly balanced, surveys will be used to obtain the results of the game on each element of the test group.
- **RESULT ANALYSIS:** The results of the final test will be used to draw a conclusion to the work done during the semester.
- **WRITING DISSERTATION:** During all the development and testing, the dissertation report will constantly be updated with all the information obtained during the course of the work.

1.5 Report structure

This report will be structured in 5 different chapters. Chapter 1 will give a introduction to the project and its context and motivation as well as a brief explanation on the problem and this investigation's objectives. Following, comes Chapter 2 were the current state of the art will be listed and explained. Here, we will mainly talk about the past and current use digital marketing, mainly in the form of in-game advertisement and advergames. This

chapter will also contain the setup of the independent and dependent variables and the hypotheses formulation. The 3rd Chapter will contain the project's methodology. It contains the game's description, the different game versions as well as the target audience and sample analysis. Before the data is analyzed, this chapter contains a brief explanation of the statistical methods used as well as the creation of new variables. The analysis of the data collected during the study can be found in Chapter 4. It will contain the analyses of all the variables and the final hypotheses testing. The final conclusions of this study as well as the real life applications and possible future work will be displayed in Chapter 5.

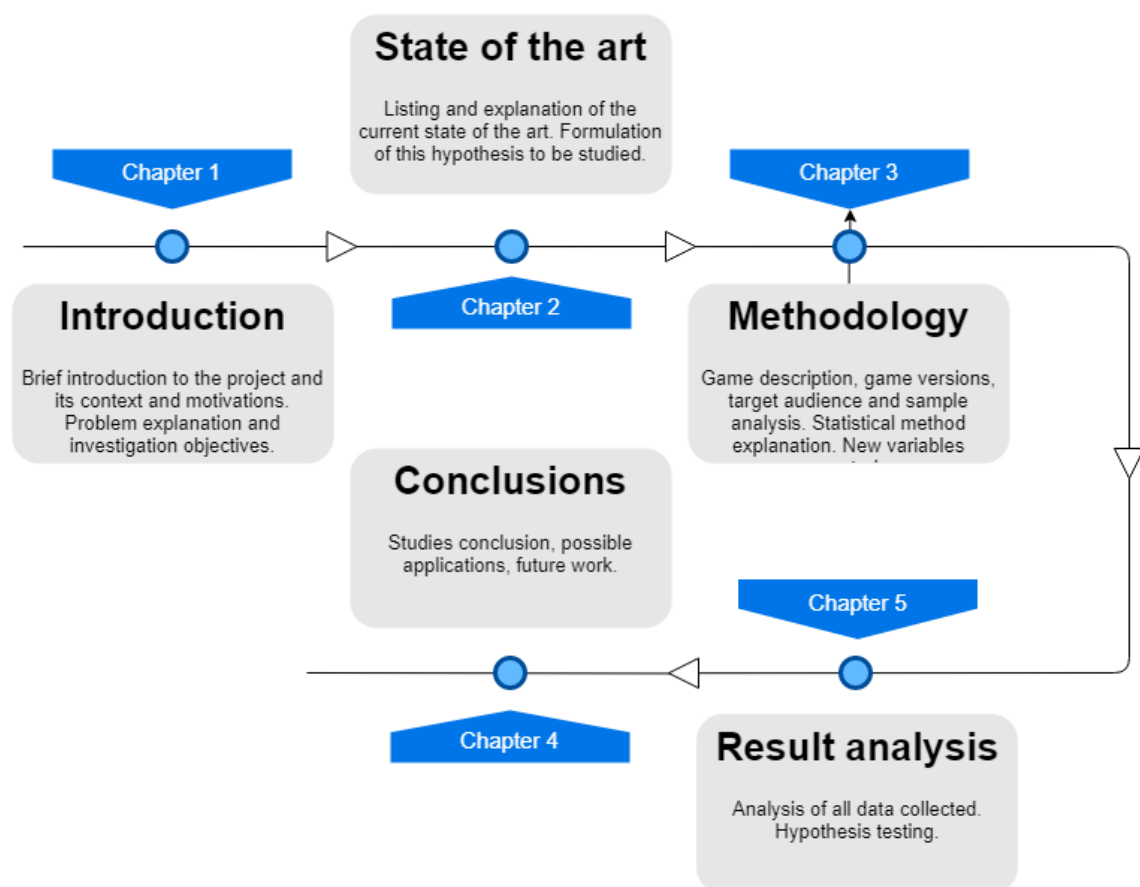


Figure 1.1: Report structure diagram

Chapter 2

State of Art

2.1 Introduction

In this chapter, the focus will be on defining the roots of this projects, where it comes from and studies already made on this subject. Since this study is mainly focused on the game characteristics than can improve an advergame, it's necessary to give a brief description of what these games are, and their evolution throughout time.

First of all, advergames are part of digital marketing strategies. So important to give a short explanation about this strategy as well as a detailed view of its evolution as well as the current state.

Having that explained, the next step is to analyze advergames. This section will start with a quick explanation of what are advergames and its goals to the brands. Since there has been several types of these games in the market with different product placement strategies, it's important to have them analyzed. The focus on these types of games has a simple reason, which is the speed and frequency with which these games have been appearing nowadays. Although the potential of this strategy is high for the brands using it, it doesn't come without its limitations. These limitations have been identified and explained as well.

Furthermore, since this study has an emphasis on the game's background music, it's important to show what has already been studied about its effects in video games. Most of these studies tried to connect the use of background music to the player's immersion which in turn was related to the player's reaction to the game.

Finally, several studies about gamer types and their motivations will be shown. These studies show some different methods that can be used to group up players by motivation.

The chapter will end with the hypothesis formulation for this study. In this section, the variables will be defined as well as the different studies and their respective hypothesis.

2.2 Digital marketing

2.2.1 Evolution

Digital marketing is one of the toughest activities to practice as a result of the constant innovation of technology and means to reach a consumer. It all started after the launch of the *World Wide Web* project, more specifically, after the first mass-market browser, *Netscape*, was released in 1994. Forward two years and the number of internet users went from 16 million to 70 [15].

As time went on, there was a need to evolve the landscape and so the first email service was created along with search engines like Yahoo! (1994) and e-commerce sites. All this was considered a brand new territory for marketing with unknown potential. Of these 3 new services, the email was the one used that became a new marketing tool at that time since search engines only catalogued the new websites that were created and allowed users to access a lot more information in a more simple way, from the comfort of their homes.

Since 2001, there has been a big emphasis on inbound marketing through information sharing and the introduction of MySpace (2003), Facebook (2004) and other social media sites made this even more possible as users started sharing more and more personal data online. With all this information, the tracking of patterns and trends of human behavior was now a big role in marketing and, even now, it's still growing.

Smartphones have become a very important tool in marketing. Since the launch of the iPhone in 2007, the rate of ownership and daily use of a smartphone has been rapidly increasing. In 2010 298 million smartphones were sold worldwide. In 2017 that number jumped to 1.54 billion [19]. The same is happening with smartphone consumption: in 2013 an average U.S. adult would spend 88 minutes with mobile media and in 2018, that number is now 203 minutes [7].

2.2.2 Current State

Nowadays, with the accessibility leap of technology, digital marketing has evolved from a separate functional role within the marketing department to a primary enabler that all marketers should be using to conduct business [13]. Thanks to the high pace of change, digital marketers are going to struggle to keep up the high demand since current, in use, platforms can change almost daily and new platforms can come from anywhere. As a result, marketers must be always ready and quick to adapt to the always changing landscape.

In 2017, voice search and IoT (Internet of Things) devices saw a substantial increase in use providing even more alternatives to content distribution and customer reach. As a result of the increase demand of digital marketing, big companies like Facebook and Google which, in 2018, account for almost 60% of total U.S. digital ad spending [6] and to help it, the last MAGNA report reveals that the global advertisement revenue grew by a

record 7.2% in 2018 to reach a total of \$552 billion with a forecast of 4.2% for 2019. This is its strongest growth since 2010 [12].

2.3 Advergames

According to Muskan Sharma [17], advergaming comprises of both advertising and gaming, "it's the process in which an advertisement message, a company's logo or other information about the brand is incorporated with online games or video games". As a result of the video game's industry constant growth, advergaming has attracted the attention from researchers, academicians and industrialists to further study its impact and to try and create frameworks to use in its development.

Since the goal of advertisement is to attract customers attention and to gain a competitive advantage, new strategies have to be created and, as a result of the increasing reach of video games, advergaming is becoming a more viable option for marketers to delve into. It can also be split into 3 different groups [16]: first, games may be place in a company's website in order to entice web visitors to remain in the site longer and, in doing so, increase the time that the company's message is in front of them; the second type is closer to a traditional, commercial video game developed to be played on consoles or computers being that the main difference is that these games are created with a specific objective in mind; The third, and final group, is what is known as product placement, or in-game advertisement, where the product or ad can be considered part of a game which can normally found mainly in sport games (e.g. FIFA, Gran Turismo). More specific methods for advergaming include:

- **SIGNAGE WITHIN AN EXISTENT GAME:** it's a more passive method which places ads within the game scene like billboards, ads on buses, etc;
- **INTEGRATING A PRODUCT INTO THE GAME:** user interacts with the product as part of the game;
- **ADS DURING TRANSITIONS:** player might see ads when in loading screens often present in video games;
- **ADS AROUND THE GAME SCREEN:** just like transitional ads, the product and its message aren't part of the game itself but can be found in the web page itself;
- **DYNAMIC ADS:** this methods allows the game manufacturer to deliver advertisements remotely and update them after the game has launched.

The use of advergames has been increasing over the years as a result of its low cost in comparison with traditional advertisement channels and the ease to capture an audience since the average time spent in an advergame is between 7 to 30 minutes which is a lot more than traditional advertisement methods like TV and radio. Its marketing effect also has

some advantages since they are not forced on the consumer as it's decided by him to play or not which, as a result, decreases the negative perception that a force ad may cause [9]. It also helps the fact that the player adopts an active stance towards the advergame which increases the brands' message impact. The psychological foundation of this process is the inducement and the use of the "state of flow". According to Csikszentmihalyi [4], this concept is used by psychologists to describe a mental state in which the attention is highly concentrated on a specific process, the environmental information is screened out and person experiences a harmonious flow of its present experience. This state of flow can be induced by any activity that a person considers interesting and it create a state of well-being as well as increased perception and learning capacity. From this we can extrapolate how important this is for advergames.

Advergaming brings an alternative to normally negative perceived advertisement methods like pop-up ads and pre-video ads as well as banner ads that normally have a low to non existing impact since they can easily be ignored by users. it's a good way to reach younger markets by entering their worlds through the games they play since they are not as intrusive and sometimes can even add realism to a game such as sideline ads in football video games or racing games. Younger markets are easier to reach using this method but, as seen previously, gaming is becoming more mainstream as the average age of "gamers" is now 35 years old [1], what makes the potential of advergaming reach even wider.

Even tough advergames are mainly used in advertisement to promote a brand/message, they can be used with other objectives in mind. Researchers have been using advergames as a way to extract information about their users being product/market research or even made with an academic purpose to study the impact of the presence of certain elements inside the game. Other uses include training and education as these games are usually titled as "serious games". The presence of advertisement within games can also be used as a way to secure funding for a publisher which is crucial as a result of the increasing cost of production of AAA titles.

2.3.1 Limitations

Although advergaming is quickly becoming a very popular method of advertisement, its creation process is not as straightforward as one might imagine. There are an abundance of elements that must be perfectly balance in order to create a good advergame.

First and foremost, the size of the ad inside the game. Several studies have been conducted to establish a relation between ad size and brand recall and brand recognition. The results of a study present in the "Computers in Human Behavior" Journal [10] indicate that "although order of placement was not important, size has an effect on memory (brand recall and brand recognition)". This might bring a problem since consumers are increasingly playing games in smaller screens such has smartphones and tablets so product placement may not be effective which brings a new challenge to game designers.

Secondly, we already established that advergaming is an appropriate method to establish brand awareness. However, according to a study produced by Michelle L. Gross [8] concluded that "advertisers must be cautious designing the content for advergaming and ensure the type of game is suitable for their target audience". It established that games with high game-product congruity led to a superior explicit memory as well as higher implicit memory effects in comparison to low game-product congruity, however, that comes with a drawback since participants had more negative attitude towards the high congruity game. Since both methods have its pros and cons, a balance must be found which can prove to be difficult.

The game's gameplay model also has a different impact depending on the strategy used. A study [18] suggests that developing a game with suitable rules and difficulty is a better approach than typical narrative guided games since it provides the "gamer" with a higher game autonomy which strengthens brand awareness and memory.

There are more elements in play when creating an advergaming such as game context, elements positioning and repetition, brand familiarity that can affect a player's memory. But those described above are the ones that are going to be discussed in chapter 3 since those are the ones that proved to be the hardest to balance.

2.4 Background music

The background music consists on all the sound present in a video game and has been acknowledged to be an indispensable part of modern video games. Its main use is to enhance the experience of the player by conveying emotions, communicating narrative points, increase the game's immersion, etc. As Zehnder and Lipscomb determined [23] it can serve to "enhance a sense of immersion, cue narrative or plot changes, act as an emotional signifier, enhance the sense of aesthetic continuity and cultivate the thematic unity of a video game".

Video games have been subjected to several studies, primarily on its negative effects, namely addiction and aggression. There has been a large focus on studying the influence of violent video games on players in terms of their aggressive behaviour. These findings claimed that this violence can significantly amplify aggressive emotions, thoughts and behaviour. Furthermore, some more conclusions were drawn from this study that proved that these games can assist in decreasing school performance, empathy and increase attention problems.

Although, in recent years these studies have moved into the examination of the potential of this media for positive purposes since it's now extremely popular, not only around kids and teenagers, but also adults. There has been research that proved that video games can be an extremely effective tool for teachers since they can improve a broad range of spatial and visual skills. With all these positive studies, there has been a tendency to

claim that "the negative effects of video games have been exaggerated in the past, and it's now a good time to examine whether may be put to some good use" [24].

Background music has been a neglected factor in these studies even though it plays a major part in video games. "Games are becoming more reliant on audio and music since it has an important role to play in supporting the user interaction with the gaming environment" [20] which is observable by the innovations in integration of supportive audio exposure. There has been studies that proved that different immersion states while playing a video game had varying effects on the player's behaviour and on the influence of the game's content, although previous researchers didn't consider this variable in their studies hence the need to study this impact on the player's behaviour and observe if it varies when involved in different attractive video games.

This music may give the players an increase in immersion by providing an audio complement for the action, therefore creating a sense of a real physical place. Jiulin Zhang and Xiaoqing Fu conducted a study to measure the proactive and reactive cognitive control ability [11]. The participants were split into 3 groups: a control group, the music game group and the no-music game group. The game groups played a RTS (Real Time Strategy) game called *Red Alert 2* for 20 minutes where the music group played with headphones and the non-music without them. From this study, it is possible to conclude that "background music does exert and influence on player's cognitive control ability by changing the player's immersion state. On another study, the influence of video game music on the player's immersion was investigated. The method was similar to the last one. A game was picked, in this case a fighting game called *The King of Fighters* (KOF) that was played in random pairs between participants. In these groups, one player would play the game with earphones on and the other without it. The result of this study supported the theory that background music can increase player's immersion which makes this an important characteristic of a game since "immersion is often viewed as critical to game enjoyment, immersion being the outcome of a good gaming experience" [3]. So the conclusion was that the video game with music, while compared to the one without, would be much more attractive an appealing to gamers. The gamers subjected to the game audio while playing displayed a higher absorption to the game play and did not notice the time running out, which lead to a higher time distortion.

2.5 Gamer types and motivations

In 1996, Richard Bartle [2] was able to identify four different approaches to playing MUDs (Multi-User Dungeons) according to their preferred actions within the game. This classification was know as "Bartle taxonomy of player types" and it is still used today in several studies. According to Bartle this study was sparked by the question "What do people want out of a MUD?". After summarizing the participants' opinions he was able to notice that a pattern had emerged. There were certain aspects that most would agree that made

the game fun, but there were four subgroupings where the opinions diverged. A player wouldn't belong to only one of these groups, instead he would lean at least a little to all four, but would drift to a specific one.

The four Bartle groups can be seen in Figure 2.1. Looking at each type in more detail, then:

- **Achievers**, also known as "Diamonds", are goal-driven players. They prefer to obtain treasures, levels, equipment all to increase their prestige in-game. These players tend to **Act** on the **World**;
- **Explorers**, dubbed "Spades" for their tendency to dig around, are players who put a higher emphasis on exploring, discovering secrets and new areas. The more they know about their virtual world, the better. They **Interact** with the **World**;
- There is a significant portion of gamers whose main goal in a game is to socialize with others. They are known as **Socializers** or "Hearts" and their main form of entertainment comes from interacting with others. They only see the game as a tool to **Interact** with other **Players**;
- **Killers** are those who use the tools provided to cause distress or help (on rare occasions) other players. Killers are those who try to impose their will by **Interacting** with other **Players** and are highly competitive.

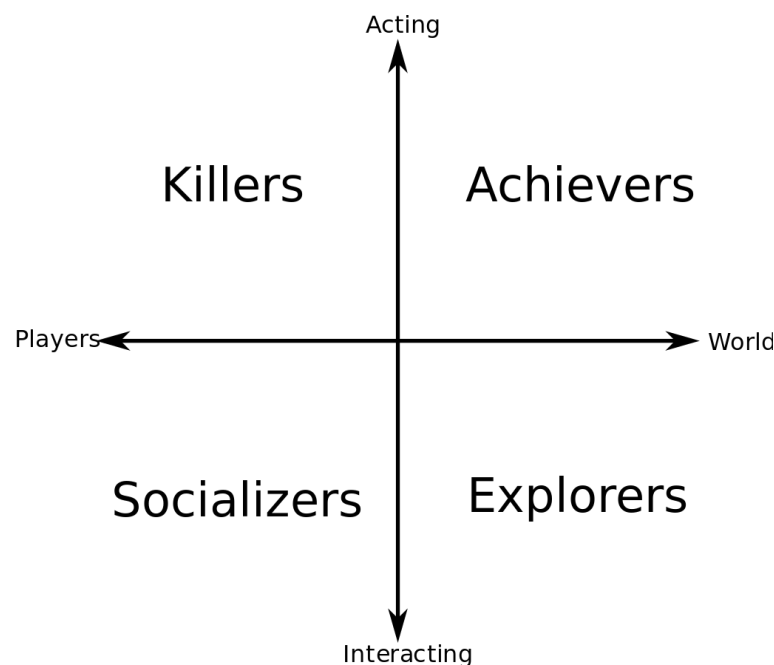


Figure 2.1: Bartle's interest graph)

According to Bartle, these areas can cross over and players will drift between all four depending on their current mood and the game they are playing. However, each person

has a primary style and will only switch to others to advance their main interest. For example, an Achiever can focus on exploring to look for new treasure and can turn into a Socializer to learn new things about the game and new ways to improve.

Although this model is a well know taxonomy of MUD users, the basic assumptions of this model are yet to be empirically tested. Therefore, Nick Yee created a new empirical model of player motivations. His reasoning for this new model was that the previous had some flaws such as Bartle's assumption that "preference for one type of play suppressed other types" [22]. This together with the fact that it has never been empirically shown that the four types are indeed independent from each other gave Yee the motivation to create this empirically grounded player motivation model.

His model consists of 3 main components as well as 10 subcomponents:

- Achievement Component
 - Advancement: focus on power and wealth;
 - Mechanics: analyze rules to optimize performance;
 - Competition: desire to challenge others.
- Social Component
 - Socializing: helping and chatting with other players;
 - Relationship: wanting to form new long lasting relationships;
 - Teamwork: Satisfaction from group activities.
- Immersion Component
 - Discovery: discovering new things about the game;
 - Role-Playing: create new stories with the character;
 - Customization: customizing the appearance of the character;
 - Escapism: use of the game to disconnect from real world issues/problems.

Having defined player types in a game may help clarify how certain game mechanics and content may attract or deter certain types of players. It helps the developing of a game by letting the developers know what each player likes and dislikes, creating a balanced game designed for everyone. For researchers, having a clear grouping of players may help to identify those who are more prone to problematic usage.

2.6 Formulation of research hypothesis

After analyzing all the related work and looking at the state of their specific fields, it's time to formulate the hypothesis for this study. However, first of all, it's important to

enumerate the different variables that are going to be used for that effect. There are two kinds of variables at play: independent variables and dependent variables. In this study, there are 4 independent variables:

- degree of expertise: the level of ability a user has in terms of playing video games. This variable was created by joining several questionnaire items regarding the player expertise as it will be seen below.
- Gaming frequency: The frequency with which a player normally plays video games. This variable is the result of a questionnaire's item where the player is asked if they usually play video games.
- State of mind: The state of mind of a participant after playing the game. it joins the player's mood, cheerfulness, and nervous state all in one variable. This variable's construction will be explained below.
- Melody: The melody that the player was exposed to while he was playing the video game. This variable only has two different values since only two melodies will be used: a traditional Thai melody, since the game is based on a beach in Thailand and a video game melody (Super Mario Sunshine).

Additionally, the dependent variables need to be defined. These variables will be used to measure the impact of the independent variables in the game since their values will fluctuate if the values of the independent variables change. The variables used are the following:

- Gaming experience: this variable represents how much the player enjoyed the experience of playing the game.
- Game replayability: this variable represents the player's willingness to play the game again.
- Game difficulty: with this variable it's possible to determine the perceived game difficulty to the player
- Game speed: this last variable indicates the game speed according to the player's gaming experience.

With all the variables selected, it's possible now to formulate the hypothesis developed for this thesis. There are going to be 4 study groups with the following hypothesis:

- First study: Comparing the player's degree of expertise to the player's reaction to the game:
 - H1.1: The bigger the degree of expertise of a player, the better will be the gaming experience to the player.

- H1.2: The bigger the degree of expertise of a player, the greater the player's willingness to play the game again.
- H1.3: The bigger the degree of expertise of a player, the more the player considers the game to be easy.
- H1.4: The bigger the degree of expertise of a player, the more the player considers the game to be fast.
- Second study: Comparing the frequency with which the user plays video games to his reaction to the game:
 - H2.1: The higher gaming frequency of a player, the better will be the gaming experience to the player.
 - H2.2: The higher gaming frequency of a player, the more the player considers the game to be easy.
- Third study: Comparing the participant's state of mind to his reaction to the game:
 - H3.1: The better the state of mind of a player, the better will be the gaming experience to the player.
 - H3.2: The better the state of mind of a player, the greater the player's willingness to play the game again.
- Fourth study: Comparing the background music that the participant was exposed to his reaction to the game:
 - H4.1: For a specific game version, the player's reaction to the game, varies according to the background music the player is exposed to while playing.
 - H4.2: For a specific game version, the player's willingness to play the game again, varies according to the background music the player is exposed to while playing.

Chapter 3

Methodology

In this chapter the methodology used in this study will be explained, in other words, the way it was executed. It will contain a description of the game (e.g. game type, mechanics), the different game versions and the differences between them as well as the an overview of the target audience and sample analysis. Since the main goal of this study is to determine how the secondary features of a video game such as speed and difficulty and player types can impact the player's perception and enjoyment, the use of an experimental method will be required. This section will contain a description of these methods as well as the creation of variables by grouping several questionnaire items.

3.1 Development

3.1.1 Game description

The game used for this study belongs to the *2D Side Scroller* genre. Its gameplay action is viewed from a side view camera angle which always moves towards the right side of the screen to ensure that the game time is always consistent and the character is only able to move in 2D (up, down, left and right). The reason why this genre was chosen is simple because of its simplicity since this is a game made for all people of all ages and backgrounds and this genre is undoubtedly popular as it has been present for more than 20 years and there has been an abundance of famous video games that used it. Given this simplicity, it's rather simple to just pick up the game and play it since the game objective is well defined and easy to accomplish and its controls are intuitive as the only input needed is the direction of the movement. Another reason was to ensure that every player has the same time window to look to a certain object in the game world. For this goal, a 2D world is preferred over a 3D one, since it's better to have less variables present in the game to make the study easier to conduct.

Since the player character consists of a biplane, there is in only one action to control the player movement:

- Joystick: to move the character, the game provides with a movement *joystick* on the bottom right of the screen. With it, the player can move the biplane across the 2D plane. The reason for this implementation is that the players don't need to move their hand across the screen, lowering the risk of the player obstructing his view of the game, lowering the time he is exposed to the game world.

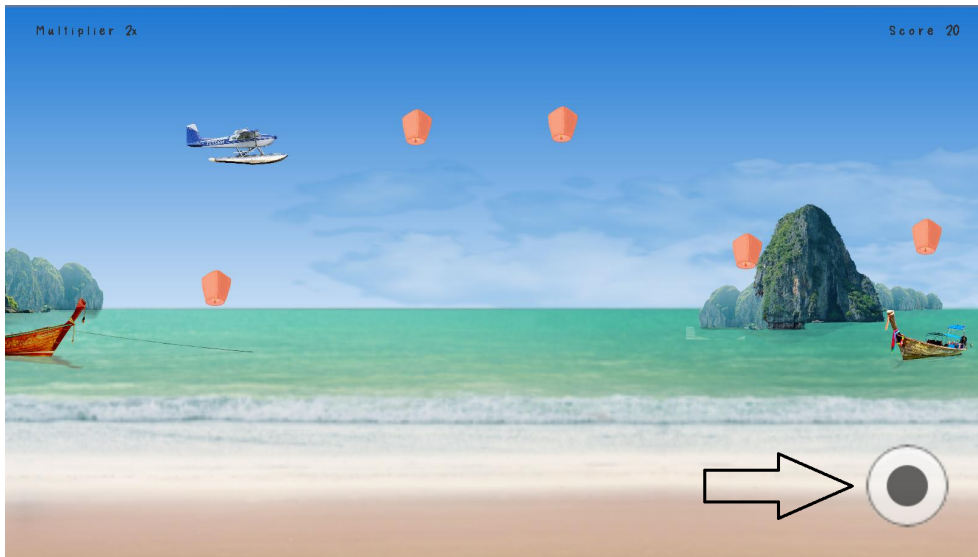


Figure 3.1: Joystick used for movement

The game consists of a single level, where the objective is for the player to collect *Kongming* lanterns, more commonly known as Chinese lanterns, which are a small hot air balloon made of paper with an opening at the bottom where a small fire is suspended. For a player to collect these lanterns, he needs to collide with them. The main goal for this game is for the player to finish it with the highest score he is able to. To do so, the player should try to collect the most amount of lanterns in a row since the game has a mechanic where, for each consecutive lantern a player collects, more points will be awarded per lantern. This is due to the existence of a "score multiplier" element in the game that will double for each consecutive lantern caught and reset to 1 if a single lantern disappears from the game view. The game difficulty is based around the speed of movement of both the environment and the biplane, the frequency as which the lanterns appear on screen and the distance in both axis (x,y) between each consecutive lantern.

Due to the simplicity of this game, it was decided that it would not have any lose conditions to make sure that every player is able to complete the game and to ensure that every playthrough last the same amount of time. This absence was intended since it simplifies the data analysis considering that "game time" would be an additional variable that would require special attention as longer playing times could result in the feeling

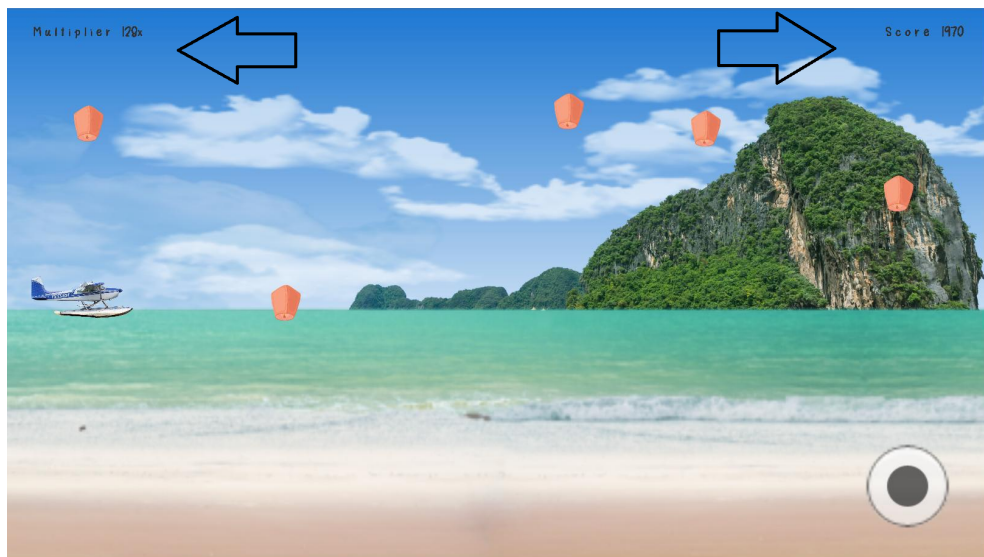


Figure 3.2: Score (Right) and Multiplier (Left) overlay

of repetition and, in result, cause the game to become tedious, diminishing the player's feelings towards the game.

The main goal of the game is to collect the most balloons possible in a row considering that doing this will increase the score since it will increase the game multiplier making each balloon more valuable. When the player reaches the end of the game, a scoreboard will appear with the best 5 results as seen in Figure 3.3. If the Player is able to have a higher score than the fifth best player, his score will appear in the high-score table.

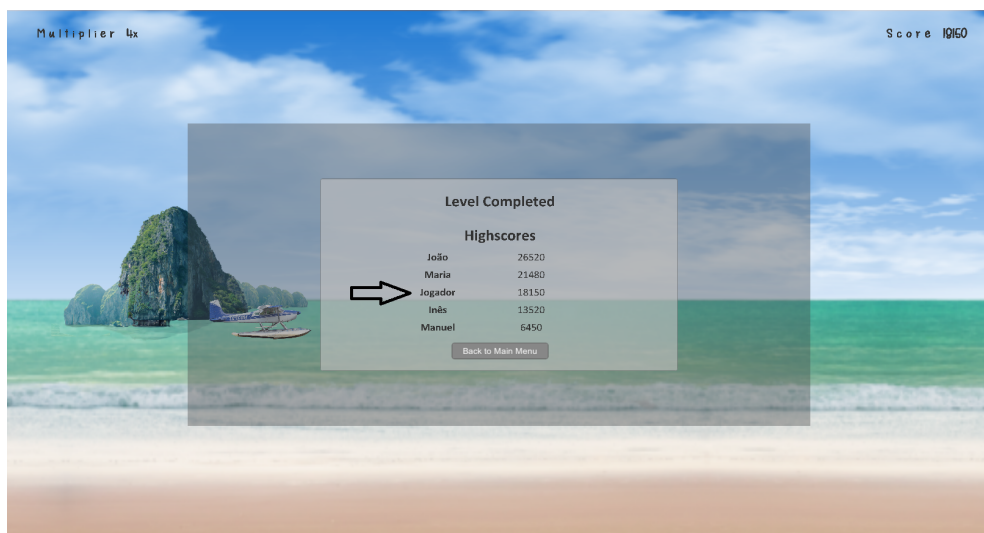


Figure 3.3: High-score table at the end of the game. The player "Jogador" was able to be third in the standings

The game has two different background songs, although only one will be played at a time. The reason for the existence of two songs is for the sake of the 4th study that

analyses the impact of different songs in the game. In conclusion, when testing the game with an audience, half will be exposed to one song, and half to the other. The selection of each group will be random.

The reason this game was created instead of just using an existing one is that, since the game was developed for the sake of this dissertation, its possible to have a higher control over the game compared to an already existing game. For example, issues with the speed and difficulty of the game that will be explained bellow, wouldn't be able to be fixed if the game used was not developed for this particular study.

3.1.2 Game versions

The first version consisted of a slower, easier game where the game speed had a lower value, the spawn rate of the balloons (the objects collected by the player in order to increase its score) was slower and the maximum distance between these balloons was higher. This created a rather simple and easy game as it didn't require as much focus to complete or to obtain a higher score. The second version was a slight improvement of version 1. These improvements were made thanks to some feedback given by the participants of the first test. The two main problems that were fixed were speed and playability. The user complained that the game speed was too low, making the game seem tedious at times, as well as the player moment, as it was hard to control. To fix these problems the speed suffered a slight increase, not too much to disrupt the flow of the game but enough to make it noticeable and the virtual joystick used to move the player around the world suffered some minor changes, mainly related to the speed at certain angles as when the player was moving diagonally, the speed would decrease significantly.



Figure 3.4: Red line defines the balloon's spawn boundaries. Version 1 and 2

In comparison, version 3 of the game focused on a higher pace type of game. Here, according to some feedback obtained in the previous versions, the game speed was increased again as well as the difficulty. Difficulty is defined as the ease with which the players are able to collect each balloon. For the game to become harder, the solution found was to simply increase the balloon spawn rate as well as increasing the max and minimum y value at which the balloons could spawn, increasing the area the player needs to cover to get all the collectibles by 42.5%. This can be observed by looking the boundaries between the red line is both Figure 3.4 (version 1 & 2) and Figure 3.5 (version 3). Since games with slower paces could contribute to a greater fallout in user immersion, version 2 of the game had its speed increased. This raise was implemented in both the environment and the playable character. In the environment, the changes were split into two parts:

- **Background** which consists of the scene's background (beach, ocean, sky and clouds): to go with the raise of the game's speed and maintain compatibility with the foreground, its scroll speed was increased by 150%.
- **Foreground** is composed by the smaller elements like boats, islands, etc: Since these appear to be closer to the player, their speed increase needed to be more noticeable and so, after testing several values, it was increased by 200% with the reason being that, if it was less than that it would be harder for the player to notice any difference during the gameplay. In contrast, a higher amount would make the game too fast, decreasing the player's ability to absorb any meaningful information of the .



Figure 3.5: Red line defines the balloon's spawn boundaries. Version 3

3.2 Target audience and sample

3.2.1 Target audience

The audience targeted on this study compromised of young adults mainly between 18 and 24 years of age. This was chosen mostly as a result of their familiarity with technology such as tablets/smartphones and video games. Their childhood overlapped with the growth of the gaming industry in Europe which resulted in an increased exposure to these video games so now, these once kids, have a high experience in this field, which was another reason for them to be selected as the target audience of this study. Another reason is that, its simple to gather a large audience with these characteristics by conducting these tests in a university.

3.2.2 Questionnaire

In order to obtain the necessary data for this study, the players had to fill a questionnaire which was divided into two parts:

- Pregame: group of questions that were answered before the participant played the game;
- Postgame: group of questions that were answered after the participant played the game.

The division into two smaller parts was done as the goal of each one was different. The pregame questions were done to try and determine the player's profile. To start, users were asked to input their age, gender, nationality, academic degree and employment status. Additionally, they were inquired about their video game frequency and its expertise. When it came to the frequency, the questions revolved around their average game time per week and their frequency (daily, weekly, etc). Regarding their experience they were inquired about their gaming expertise, if they thought their gaming abilities were good, as well as their knowledge about video games, their superiority to other gamers in terms of ability and if their willing to help friends when needed. To evaluate the expertise the players had to answer the questions using a 7 point likert scale. These 7 points go from "1-Strongly Disagree" to "7-Strongly Agree" where the middle point is "4-Neither Agree nor Disagree". These question were provided in order to characterize the participant.

Likewise, the participants are questioned about their feelings toward the game they just played. The scale used was still a 7 point likert scale with some slight differences depending on the question asked. This section is composed by the following questions:

1. I liked playing the game: : 1-Strongly Disagree, 7-Strongly Agree;
2. I enjoyed the game: 1-Strongly Disagree, 7-Strongly Agree;

3. I would play this game again: 1-Strongly Disagree, 7-Strongly Agree;
4. I consider the game: 1-Easy, 7-Hard;
5. I consider the game to be: 1-Too Fast, 7-Too Slow.

All these questions were asked on the three tests that were made with the three different versions of the game. But there are some groups of questions that were only asked in specific tests.

During the first test, after the participants were asked to answer some question regarding the game they played, a new group of questions were displayed. This group objective was to determine the current mood of the player. These questions, used the same scale as the previous, a 7 point scale. With this group, the objective was to measure the player's current mood, if the player was feeling cheerful or if he was feeling nervous/annoyed. The goal was to see if any of these would have an impact on the player's feelings towards the game.

Furthermore, during the third test and after playing the game, the user were asked if they knew the background music and if so their origin and to describe the melody as best as they could. As a way to facilitate the study of the differences of the background songs, the participant's evaluated the melody regarding its suitability to the game.

3.2.3 Sample Analysis

The player sample used in this study consists of 246 players distributed between three version of the game:

- Version 1: 101 players;
- Version 2: 47 players;
- Version 3: 98 players;

3.2.3.1 Gender

As seen in Figure 3.6 the participants in the first test were made up of 78 females (77%) and 23 males (23%). The sample of the second version consisted of 47 users of which 13 were male (28%) and 34 were female (72%). For the third and final study, out of 98 total players, 46 corresponded to males (47%) and 52 to females (53%).

3.2.3.2 Age

As detailed in subsection 3.2.1 the preferred age of the target sample were young adults preferably with ages between 18 and 24. The average age of players all three versions is 20, 21.55 and 20.07 years respectively. Looking at Figure 3.7, it's possible to confirm that the majority of the participants' age are inside the range of 18 to 22. In the first test, 97

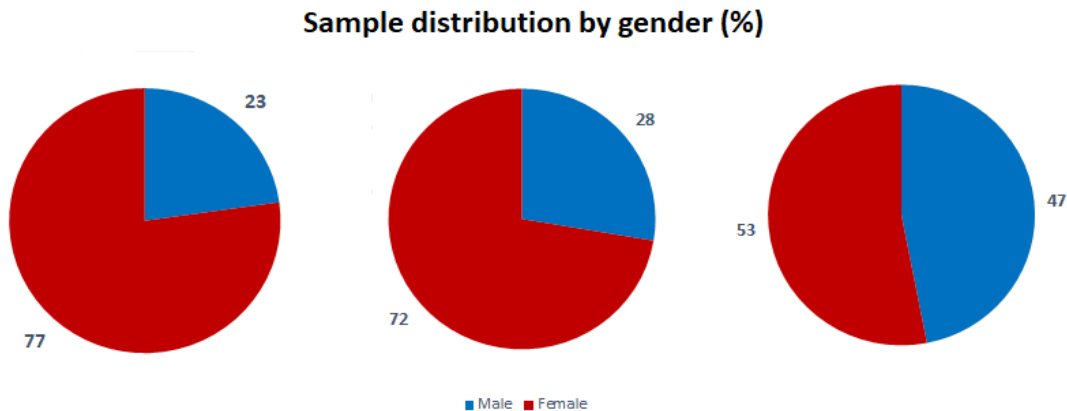


Figure 3.6: Target sample's gender for Version 1 (Left), Version 2 (Middle) and Version 3 (Right)

of 101 participants (96%) belonged to that age range, while in the second test's sample that number is slightly lower sitting at 79% and the third at 91%. The participants not in this range are either 17 (correspond to 1% in both the first and third test) or between 23 and 34 (21%, 9%, and 3% respectively).

3.2.3.3 Gaming frequency

The frequency at which participants play video games, even though not balanced, it's constant between versions. Through Figure 3.8, we are able to observe that in both version 1 and 2, the majority of players (50% and 60% respectively) only play video games for less than one hour per week. In version 2 the best part of the sample either play between one and five hours per week, corresponding to 34% of this group, or less than one hour per week, which correlates to 31%.

In essence, the overall sample has a low gaming frequency

3.2.3.4 Player expertise

Although the gaming frequency for the overall sample is low, through Figure 3.9 it's possible to discover that the participant's expertise when it comes to playing video games is not that low. The average expertise per versions was respectively 3.39, 3.26 and 3.70 where the overall average was 3.45. With these results it's safe to assume that the gaming expertise between the three versions is average.

Now this doesn't add up to the fact that the overall gaming frequency is rather low. A possible explanation is that, because the average age of this group is 21, the players could have had a higher gaming frequency when they were younger which could translate to a higher proficiency level. This assumption can be supported by data collected by Statista [5]. This data shows that the age group with a higher average playing time

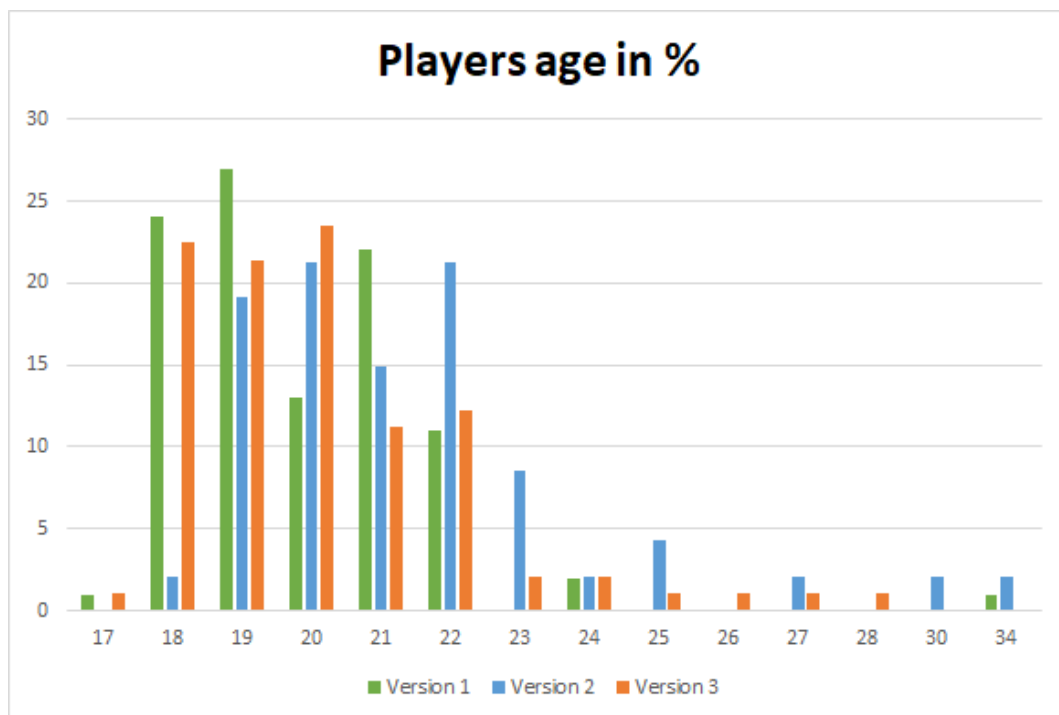


Figure 3.7: Target sample's age for Version 1, 2 and 3

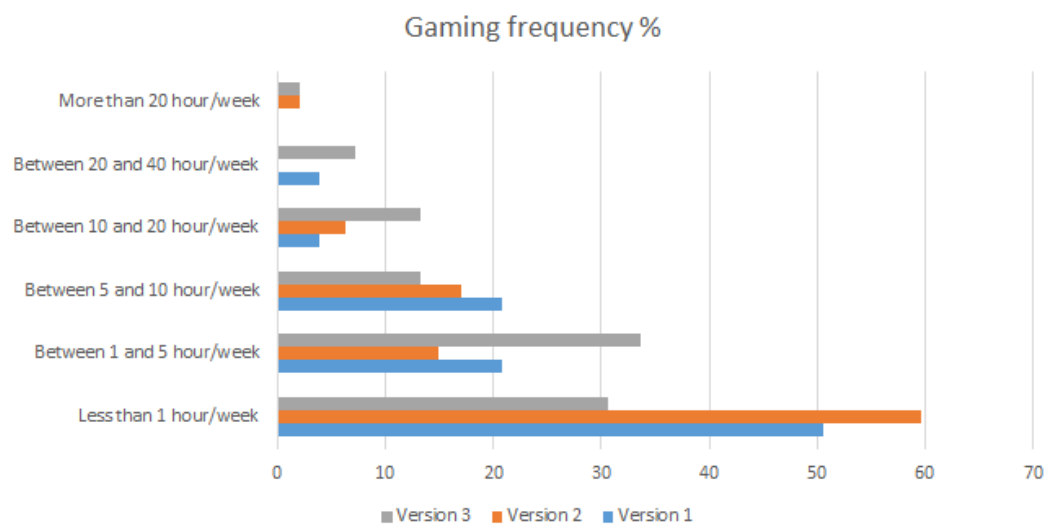


Figure 3.8: Player's gaming frequency

(48 min/week, 31 more minutes than the second highest group) is the one composed by individuals ranging between 15 and 24 years of age.

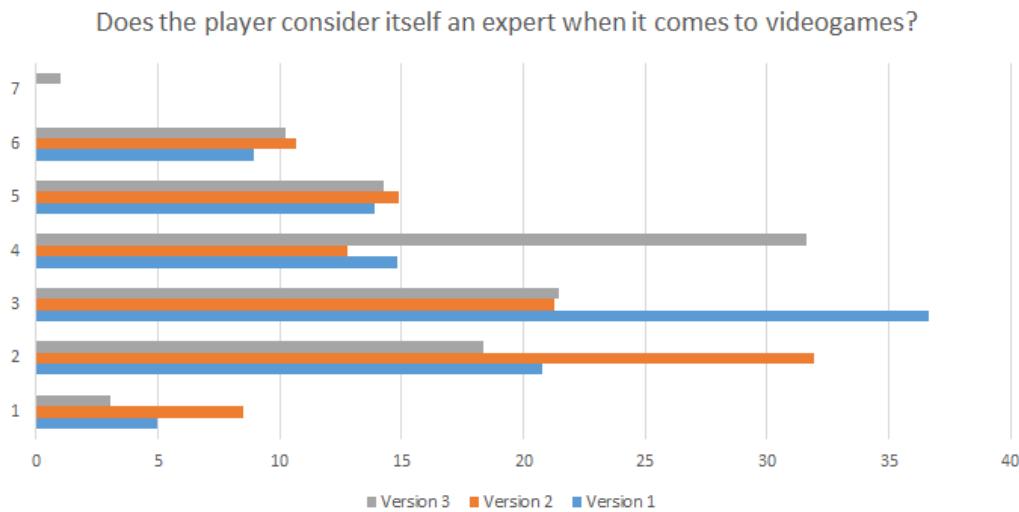


Figure 3.9: Player expertise. 1-Completely Disagree / 7-Completely Agree

3.3 Variables and Statistical Techniques

3.3.1 Statistical Techniques

3.3.1.1 Analysis of variance (ANOVA)

Analysis of variance, or ANOVA like it's usually referred to, is a statistical method used to test difference between two or more groups. To do so, it looks at the variation of the data and where it's found. ANOVA specifically compares the variation between groups with the variation within groups.

The ANOVA tests two hypothesis:

- Null hypothesis: all population means are equal;
- Alternative hypothesis: at least one population mean is different from the rest.

ANOVA is used to calculate a test statistic (F-ration), with which is possible to obtain the probability (P-value) of obtaining the data assuming the null hypothesis. If the P-value obtained is lower than 0.05, that suggests that at least one of the group's mean is significantly different than the rest, therefore denying the null hypothesis.

3.3.1.2 Chi-squared test

The Chi-square statistic is normally used for testing relationships between categorical variables. The null hypothesis of this test indicate that the categorical variables are independent from each other, that no relationship exists between them. A categorical variable is a variable that takes usually a fixed number of possible values (e.g. Gender).

An example of how this test can be used is in verifying if the participant's gender has any effect on something, as this variable is considered categorical. As with the case with

ANOVA, if the p-value < 0.05 , that means that these variables are not independent of each other and there is a statistically significant relationship between the categorical variables.

3.3.1.3 Cronbach's alpha

To put it simple, Cronbach's alpha is a function of the average covariance between item-pairs, the variance of the total score and the number of items in a test. It's used to estimate the internal consistency of a composite score. it's used under the assumption that there are multiple items measuring the same base factor.

The results obtain by this test range between 0 and 1, although they can also be negative which indicates that something is wrong with the data used. Depending on the α result, the internal consistency can be:

- Questionable if $0.6 < \alpha < 0.7$;
- Acceptable if $0.7 < \alpha < 0.8$;
- Good if $0.8 < \alpha < 0.9$;
- Excellent if $\alpha > 0.9$.

In this study, this alpha was used to determine if a group of items measuring the same factor would have a good enough internal consistency. The main goal was to transform that group into a single variable to make the statistical study easier.

3.3.1.4 Bivariate (Pearson) Correlation

A correlation expresses the strength of co-occurrence between two variables in a single value ranging between 1 and -1. This value is referred to as the correlation coefficient which is normally referred to as Pearson's r or Pearson product-moment correlation coefficient. When this r value is negative it indicates a negative relationship between the two variables. A negative correlation coefficient can be read as "The larger the variable A is, the smaller the variable B will be". In contrast, a positive r value shows a positive relation as in "The larger A, the smaller B". If this value is zero, this means that there is no relation between the variables at all.

As is the case of Anova [3.3.1.1](#), for a correlation result to be significant, The P-value obtained must be lower than 0.05 to deny the null hypothesis and, therefore, be usable for the study.

3.3.2 Variables

As a result of the existence of several question groups in the survey, each related to a certain characteristic of the player/game, it was needed to transform these groups into a single variable so that they could be used in the study.

The first group of question that were simplified were the questions related to the type of player, which is part of the section about the characterization of the player in the survey. This group is comprised of 4 questions, all of them with a 7 point likert (being 1 - strongly disagree and 7 - strongly agree). Thus, this group is going to be transformed, through factor analysis, into a single factor. Although, before doing this step, these variables must be analyzed to check their internal consistency to see if the result of this grouping would translate into reliable information. To do so, the Cronbach's alpha (3.3.1.3) will be calculated between all these variables and the only way they can be considered usable is if the alpha is higher than 0.6. After calculating it, it's safe to assume that this new variable is reliable as it has an alpha of 0.868 which correlates to a good internal consistency. Furthermore, even if one element of this group is excluded, the resulted alpha would still be lower than the whole group's alpha as seen in Figure 3.10. This means that even if one of these items was excluded from the group, the internal consistency would not be better than it already is.

Question	Scale Mean if Item Deleted	Cronbach's Alpha if Item Deleted
1	8.31	0.868
2	9.97	0.787
3	10.78	0.831
4	11.22	0.834

Figure 3.10: Cronbach's alpha if a question is deleted from the group

Another group that needs to be addressed is the only related to the game's likeness according to the player. Since this new group consists in only 2 questions, calculating the Cronbach's alpha is the only step to determine if this new variable is reliable or not. Considering the resulting alpha is 0.931 (Figure 3.11) it's possible to confirm the fidelity of this new variable as the internal consistency is considered excellent since $\alpha \geq 0.9$.

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.931	0.932	2

Figure 3.11: Cronbach's alpha of the game likeness variables

The last group of items that were subjected to the Cronbach's alpha was the group regarding the player's mood. This group's questions objective was to determine the mood of the player by asking them they were in a good mood or if they were stressed. To combine these items into a single variable, the alpha was calculated and its result was 0.711 which is a good result according to chapter 3.3.1.3. But according to Figure 3.12, when the item regarding the nervous state of the player is removed, the alpha increase to 0.869. As a result, the best course of action is to eliminate this item from the group so

that it has a better internal consistency. Therefore, the resulting new variable is made from only 2 items even though it has a pretty good consistency at 0.869.

Player's Mood	Scale Mean if Item Deleted	Cronbach's Alpha if Item Deleted
Good mood	11.91	0.336
Well Disposed	11.91	0.543
Nervous/Fretful	11.29	0.869

Figure 3.12: Cronbach's alpha if a question is deleted

Chapter 4

Result's Analysis

This section is going to be focused on the analysis of all the data collected on the questionnaires. The goal is to use the variables previously collected to do a statistical analysis of all the data.

4.1 Statistical analysis

This section will be divided into two groups: the dependent variables analysis and the hypotheses testing. In the first group, given the results of the questionnaire, each dependent variable will be analyzed independently in order to observe its behaviour when paired with the independent variables. In the second group, all hypotheses will be tested to see if it can be accepted or rejected and the reasons for that result.

4.1.1 Game experience

The first dependent variable to be analyzed is the players reaction to the game he played i.e., the gaming experience. The objective is to discover if and how this variable changes if one of the four independent variables varies. This analysis will consist in two different steps. The first step do an ANOVA test between the gaming experience variable and the independent variable. This is done to verify if the null hypothesis is true or not. If this hypotheses is denied, the next step is to verify the correlation between these two variables. Since there are 4 independent variables, these tests will need to be done 4 times.

Starting with the independent variable "Degree of expertise", the first step is to test the null hypothesis.

Looking at Figure 4.1 it's safe to deny the null hypothesis since the significance level is lower than 5% (4.5% in this case) and so the new goal now is to discover an alternative hypothesis. This means that there is a significant statistical difference between the two variables. The next step is to discover the correlation between them, how the gaming

Variable	Sum of Squares	Degrees of Freedom	Mean Square	F	Significance Level
Game experience	30.854	6	5.142	2.182	0.045

Figure 4.1: ANOVA test results between "Game experience" and "Gaming expertise"

experience changes based on the player's expertise level when it comes to playing video games.

Degree of expertise	Pearson Correlation	Gaming Experience
	Sig. (2-tailed)	0.152
	N	246

Figure 4.2: Correlation between "Gaming expertise" and "Game experience"

With the results shown in Figure 4.2, it's safe to say that there a positive correlation between the Degree of expertise and the game experience to the player i.e, how much they enjoyed the experience of playing the game. This statement is possible since the Pearson correlation value is higher than 0. This means that, the higher the player's expertise is, the better is the playing experience for the user.

Independent variable: Gaming frequency

Variable	Sum of Squares	Degrees of Freedom	Mean Square	F	Significance Level
Game experience	21.641	6	3.607	1.506	0.177

Independent variable: State of Mind

Variable	Sum of Squares	Degrees of Freedom	Mean Square	F	Significance Level
Game experience	21.581	4	5.395	2.114	0.085

Independent variable: Melody

Variable	Sum of Squares	Degrees of Freedom	Mean Square	F	Significance Level
Game experience	5.878	1	5.878	3.019	0.086

Figure 4.3: ANOVA test results between "Gaming frequency", "State of mind" and "Melody" and "Game Experience"

The next step is to do the ANOVA test for the other variables. By analyzing Figure 4.3, it's safe to conclude that for these variables, the null hypothesis has been proven since the P-value of all three ANOVA tests are higher than 5%. To summarize, it's possible to say that, when it comes to the game's experience, all populations means are equal, even when those 3 variables vary.

4.1.2 Game replayability

Following the gaming experience, it's now time to analyze if the game replayability i.e, if the player is inclined to play replay the game, is related to the player's expertise, his current state of mind and/or the background music he was exposed to while playing the video game. For this effect, this first step is the same as the previous. An ANOVA test is required to see if, in these cases, the null hypothesis is true or not. The first two groups to be analyzed will be the Degree of expertise and the player's State of Mind.

Independent variable: Degree of expertise

Variable	Sum of Squares	Degrees of Freedom	Mean Square	F	Significance Level
Game replayability	30.813	6	5.135	1.403	0.214

Independent variable: State of Mind

Variable	Sum of Squares	Degrees of Freedom	Mean Square	F	Significance Level
Game replayability	12.000	4	3.000	0.871	0.485

Figure 4.4: ANOVA test results between "Degree of expertise" and "State of mind" and "Game replayability"

Looking at Figure 4.4, it's safe to say that both null hypothesis have been confirmed as both P-values were higher than 5%. In conclusion, neither the player's Degree of expertise nor his State of mind have any effect on the game's replayability, meaning that being the player an expert or a complete amateur or totally relaxed or nervous, it wouldn't have any effect on his intention of replaying the game.

The next and final null hypothesis to prove is the relation between the replayability and the Background music the player is exposed to. The procedure is the same as the previous two variables.

After the test [4.5] is complete, the resulting P-value is 0.030 which means the null hypothesis is denied and therefore the not all population means are normal. The next step now is to find an alternative hypothesis. The first thing is to observe the replayability averages for both songs.

Variable	Sum of Squares	Degrees of Freedom	Mean Square	F	Significance Level
Game replayability	18.000	1	18.000	4.827	0.030

Figure 4.5: ANOVA test results between "Background music" and "Game replayability"

By looking at the averages of both melodies in Figure 4.6, it's possible to determine that players had a higher motivation to replay the game if they were subjected to the video game background music rather than the traditional one.

Melody	Average
Traditional	3.14
Video game	4.00

Figure 4.6: Game replayability averages for both melodies

In conclusion, the only independent variable that had an impact on the "Game replayability" was the background music used. Both the "Degree of expertise" and the "State of mind" didn't seem to influence the results of this variable.

4.1.3 Game difficulty

Game difficulty is the next variable that will be analyzed. The goal is too observe if either the player's "Degree of expertise" or its "Gaming frequency" have any statistically significant impact in this variable. The first step, as seen in the other analysis is to conduct an ANOVA test and verify the P-values of both case since, once again, the goal is to prove the veracity of the null hypothesis for each case. The first to be studied is the relation between the player's "Degree of expertise" and the "Game difficulty" (Figure 4.8).

Variable	Sum of Squares	Degrees of Freedom	Mean Square	F	Significance Level
Game difficulty	18.489	6	3.082	1.588	0.151

Figure 4.7: ANOVA test results between the player's "Degree of expertise" and "Game difficulty"

The results of the test have proven that, when it comes to the player's "Degree of expertise" when playing video games there is no difference in the player's perceived difficulty. Therefore, the null hypothesis has been proven for this case.

Having said that, it's time to conduct the same test, but now, for the player's gaming Experience. Figure 4.8 shows that the result obtained from the ANOVA test has a P-value

Variable	Sum of Squares	Degrees of Freedom	Mean Square	F	Significance Level
Game difficulty	26.239	6	4.373	2.292	0.036

Figure 4.8: ANOVA test results between the player's "Gaming frequency" and "Game difficulty"

of 0.036 which in turn means that the null hypothesis has been denied. This result implies that not all population means are equal, so the next step is now to obtain an alternative hypothesis.

Having completed the first step and now looking for an alternative hypothesis, the next step is to verify if these two variables are correlated. Therefore, to verify this correlation, the Pearson correlation has to be calculated between these two variables.

		Game Difficulty
Gaming Frequency	Pearson Correlation	-0.171
	Sig. (2-tailed)	0.007
	N	246

Figure 4.9: Correlation between the player's "Gaming frequency" and "Game difficulty"

The significance level of this operation is 0.7%, which is lower than 5%, meaning that, between these two variables, there is a statistically significant correlation. The type of correlation depends on the Pearson correlation value and seeing that this value is lower than 0, a negative correlation can be extracted. In conclusion, when it comes to frequency with which a user plays video games, the higher it is, the lower the player's perceived difficulty will be.

4.1.4 Game speed

This last dependent variable behaviour will only be compared to the player's expertise. The procedure will be the same that was conducted in the previous tests. The first step will be to determine if the null hypothesis is true or not. For that effect the test that will be used will be the ANOVA test. If the resulting P-value is lower than 5% this hypothesis is denied and therefore a new one has to be found. Here is were the Pearson's correlation coefficient needs to be determined. This value is calculated to discover the kinda of correlation that may exist.

In conclusion, by looking at Figure 4.10, there is no need to determine Pearson's coefficient since the null hypothesis has been now proven between these two variables.

Variable	Sum of Squares	Degrees of Freedom	Mean Square	F	Significance Level
Game speed	25.681	6	4.280	1.590	0.151

Figure 4.10: ANOVA test result between "Game speed" and the player's "Degree of expertise"

Since all populations means are equal, there is now change in the player's perceived speed, even if different players with different levels of expertise play the game.

4.2 Hypothesis testing

Having completed the statistical analysis of the dependent variables, it's now time to associate these results with the previously formulated hypothesis. In this section, these hypothesis will be properly analyzed and justified using all the data that was gathered in this chapter. With this in mind, for these next sections, all the hypothesis presented in chapter 2.6 will be tested.

4.2.1 1st study: Comparing the player's degree of expertise to the player's reaction to the game

- H1.1: The bigger the degree of expertise of a player, the better will be the gaming experience to the player.

To test this hypothesis the first step, as seen above, was to verify if the null hypothesis was valid for this case. The objective was to see if the all the population means were equal independent of the result. Since this hypothesis was refused by the resulting P-value of the ANOVA test, the next logical test was to find a new alternative hypothesis. The search for this new hypothesis lead to a correlation test as the goal was to observe how the Game experience would vary if the independent variable "Gaming expertise" was changed. From the results on Figure 4.2 it's now safe to say that there exists a correlation which is, in fact positive, meaning that whenever the degree of expertise value increased, so did the game experience. Having said that, after analyzing all the data collected, this hypothesis can now the accepted.

- H1.2: The bigger the degree of expertise of a player, the greater the player's willingness to play the game again.

To verify the veracity of this hypothesis, the method used was the same as the one was used the previous hypothesis. However, in this case, the null hypothesis was proven to be true. This means that all the population means are equal when it comes to these two variables. Therefore, the game's replayability factor had no correlation to the player's

expertise which implies that no matter the level of expertise the player has it hasn't have any impact on the player's willingness to replay the game, thus, denying this hypothesis.

- H1.3: The bigger the degree of expertise of a player, the more the player considers the game to be easy.

Once again, to validate this hypothesis, a correlation between the variables "Gaming expertise" and "Game difficulty" has to be found. Hence, the ANOVA test was once again used to investigate if the population means were significantly different so that a correlation could exist. Although, the results obtained [Figure 4.7] revealed that, for this pair of variables, the null hypothesis was true and therefore, no correlation existed between them. In summary this hypothesis has now been denied.

- H1.4: The bigger the degree of expertise of a player, the more the player considers the game to be fast.

For the last hypothesis of the 1st study the goal was to, once again, find any possible correlation between these two variables. The same methods were used to achieve this objective. Once again the P-value of the ANOVA test shows that there is no correlation present, thus, a variation on the degree of expertise will not have any significant impact on the player's perceived speed when it comes to the game. Therefore, once again, this hypothesis has been denied.

4.2.2 2nd study: Comparing the frequency with which the user plays video games to his reaction to the game

- H2.1: The higher gaming frequency of a player, the better will be the gaming experience to the player.

To verify this hypothesis veracity, the method is once again to verify the existence of the null hypothesis between the two variables. From the results of the ANOVA test, it's possible to confirm its existence. Thus, since no statistically significant impact is present between them, it's safe to say that this hypothesis has been denied.

- H2.2: The higher gaming frequency of a player, the more the player considers the game to be easy.

The second and last hypothesis of the 2nd study implies that there is a correlation between the frequency with which a player plays video games and the player's perceived game difficulty. This correlation was proven to be true thanks to the P-value obtained from the ANOVA test. The next step was to determine if this was a positive or negative correlation. For that effect, the Pearson's correlation coefficient was calculated [4.9] and its result confirmed a negative correlation. This confirms the existence of a correlation, which in this case meant that the perceived game difficulty goes down if the player is more experienced and vice-versa. In other word, this proposed hypothesis is therefore accepted.

4.2.3 3rd study: Comparing the participant's state of mind to his reaction to the game

- H3.1: The better the state of mind of a player, the better will be the gaming experience to the player.

These next two hypotheses had the "State of mind" as the independent variable in question. In this hypothesis, the goal was to observe the relationship between this variable and the player's "Game experience". To verify the veracity of this hypothesis, the first step was to determine if there was any significant correlation between them. After conducting the ANOVA test for this pair, it was possible to determine that all populations means were equal, therefore, proving the existence of the null hypothesis between the two variables. As a consequence, this hypothesis was considered false.

- H3.2: The better the state of mind of a player, the greater the player's willingness to play the game again

Once again, the same method was used to authenticate this hypothesis. From the second table on Figure 4.4, the P-value observed determined that, since it was lower than 5%, the null hypothesis was true in this case. Thus, regardless of the player's state of mind, the player's enthusiasm to replay the game does not change. As a results, this proposed hypothesis can be safely denied.

4.2.4 4th study: Comparing the background music that the participant was exposed to his reaction to the game

- H4.1: For a specific game version, the player's reaction to the game, varies according to the background music the player is exposed to while playing.

Thanks to the ANOVA test results obtained in the last table of Figure 4.3 the null hypothesis was deemed true, thus the conclusion that was reached was that no correlation between the game's background music and the player's experience while playing the game existed. This was possible thanks to the P-value obtained in the previous test. With this in mind, this hypothesis can be rejected.

- H4.2: For a specific game version, the player's willingness to play the game again, varies according to the background music the player is exposed to while playing.

The last hypothesis of the last study revolved around the idea that the music the player is exposed to during his gameplay session would impact his willingness to replay the game. This was proven to be true thanks to the results obtained by the ANOVA test. The next step was to measure this impact and to try and discover how it changed the game's replayability. With Figure 4.6, it was discovered that the background song

which granted a higher replayability average was the video game melody. Since there is a statistically significant difference between the songs used, this hypothesis was proven to be true.

Chapter 5

Conclusions and Future Work

After having analyzed all the dependent variables' behaviour and subsequently all the formulated hypothesis, the next step is to discover how these results can relate to the theoretical context. Therefore, this chapter will focus on the implications of the 4 studies conducted for both game developers and marketeers. Afterwards, to end the chapter there will be a quick recap of what was studied and the possible future studies that can be done.

The of this dissertation was to uncover the effect of player characteristics and some game elements and its impact on the video game played. For that effect, four studies were conducted with 10 hypotheses overall. These studies focused on the player's gaming expertise, gaming frequency and state of mind and the game's background music. The impact of these variables in the game's experience, replayability and perceived difficulty and speed were the main objective of this dissertation. The table bellow shows a brief summary of the results obtained after testing every hypotheses.

Hypothesis	Hypothesis formulation	Result
H1.1	The bigger the degree of expertise of a player, the better will be the gaming experience to the player	Accepted
H1.2	The bigger the degree of expertise of a player, the greater the player's willingness to play the game again	Rejected
H1.3	The bigger the degree of expertise of a player, the more the player considers the game to be easy	Rejected
H1.4	The bigger the degree of expertise of a player, the more the player considers the game to be fast	Rejected
H2.1	The higher gaming frequency of a player, the better will be the gaming experience to the player	Rejected
H2.2	The higher gaming frequency of a player, the more the player considers the game to be easy	Accepted

H3.1	The better the state of mind of a player, the better will be the gaming experience to the player	Rejected
H3.2	The better the state of mind of a player, the greater the player's willingness to play the game again	Rejected
H4.1	For a specific game version, the player's reaction to the game, varies according to the background music the player is exposed to while playing	Rejected
H4.2	For a specific game version, the player's willingness to play the game again, varies according to the background music the player is exposed to while playing	Accepted

Table 5.1: Summary of the hypotheses' results

Having said this, the next step is to do the theoretical interpretation of the results obtained during the statistical analysis. Even though the format for the analysis was to, given a dependant variable, observe the impact of the independent variables, for this next section, the format will be reversed. For each of the 4 independent variables, the effect of all 4 dependant variables will be examined.

5.1 First study: Comparing the player's degree of expertise to the player's reaction to the game

In regards to the impact that Gaming expertise has on the player's feeling towards the game its characteristics, the results above showed some positive results. Although when it came to the game replayability, difficulty and speed this influence wasn't significant, despite being present. Therefore, the results were considered inconclusive. However, when analyzing the connection between this variable and the player's game experience, the results showed a positive correlation between the two variables.

Having observed a positive correlation between Gaming expertise and the player's experience it's important to discover the reason behind this relationship. In retrospect, to gain expertise in any kind of field, practice is the main road to achieve it, so in this case for a player to gain a higher expertise in playing video games, he had to play a lot. If a Pearson's correlation coefficient between gaming expertise and frequency is studied, the results show a positive coefficient of 0.6 with a significance value of 0%, proving this idea. Having said this, if a player has a high gaming frequency it means that they spend a lot of time playing video games, which in turn can relate to a higher appeal towards video games. With this in mind, it's safe to conclude that players with high gaming expertise will have a positive reaction to most games, which is true in this study.

However, when analyzing the remaining dependent variables in this study a significant impact was not found. Despite there being some kind of relation between the dependent

and independent variables, it wasn't strong enough to prove a connection between them. Therefore, it's safe to assume that for the game replayability, difficulty and speed factors the player's degree of expertise won't have enough weight in order to affect the behaviour of these variables.

5.2 Second study: Comparing the frequency with which the user plays video games to his reaction to the game

The second study focuses on the frequency with which a player plays video games and its influence in the game's replayability and the perceived difficulty. Results show that the game's difficulty is perceived differently by players who have different gaming frequency, even though that, surprisingly this frequency didn't have a significant impact on the player's feelings towards the game.

The reason that the game difficulty is strongly correlated to the frequency with which a player plays video games can be explained rather easily. Difficulty in the game developed for this dissertation can be split into two types: reaction time and player movement. Player movement is simply the ease with which a player can move the avatar around the game. Since this game only requires 2D movement with a virtual joystick, this factor is almost not existing. The reaction time is the factor that should be looked at. Studies have shown that video game players of all ages have enhanced attention skills which allows them to have faster reactions to whatever is going on inside the game [14]. Since the game's mechanics relies on quick reactions (whenever a pick up appears, a player needs to quickly move in order to collect it) and more frequent players have higher attention skills, it's expected that the higher the gaming frequency, the lower the game difficulty will be for that player.

However, the gaming experience was not swayed by the player's frequency. Even if the scale used for gaming frequency was to be divided into high, average and low gamers the results would be the same. In conclusion, the frequency with which someone plays video games will not have any noticeable impact in his playthrough experience.

5.3 Third study: Comparing the participant's state of mind to his reaction to the game

In this study, both hypotheses were rejected, meaning that the player's State of mind didn't effect neither the gaming experience or the game replayability. After analyzing all the data collected in this study, there hasn't seem to exist any kind of relationship between the state of mind of a player and the dependent variables. However, this is an interesting hypothesis that, if done right, can bring forth some interesting results.

5.4 Fourth study: Comparing the background music that the participant was exposed to his reaction to the game

Video game background music is a subject that is most times dismissed from studies, but recently, some researchers focused their works on the impact of music and sound effects in games [23], [24]. The game had 2 different melodies: a video game melody and a traditional cultural melody. The objective of this study was to observe how the different background songs impacted the game experience and its replayability.

The melody didn't have a noticeable impact on the game experience. However, when it came to the replayability, it was a whole different story. There was a noticeable difference between the population means when the different melodies were present. As it turns out, the replayability results are better when the gamer is subjected to the game with the video game song. Even though the traditional song matches with the game's environment, it had worse results. The possible explanation is that the users are used to listen to video game music when playing video games. Hearing something that you are used to can increase your game immersion. According to Lipscomb and Zehnder background music can serve to enhance the sense of immersion. This immersion has varying effects on the player's behaviour meaning that it's possible that the game replayability can increase given an increase in immersion thanks to the video game background music.

5.5 Implication game developers and marketers

All the results obtained can be used by either game developers or marketers as a way to development a game with a broader reach. Creating a video game is a hard task since many aspects come into play. Balancing the gameplay is an issue that takes the get right, since there is no way to predict the player's reaction to the game without them playing. The results of these studies provide a way to better understand the relation between the player and the game.

From the studies conducted, the expert gamers, have a higher overall reaction to games meaning that, developers should focus on the less experienced players and try to build a game that tries to relate to them while not overshadowing the most expert of players. Having a game with 90% of the content accessible to lower expertise players and the other 10% to the most dedicated/experienced is a method usually followed by some developers. It makes sure that all players are happy with content tailored to their expertise. That being said, finding this balance is still one of the main hardships in game development, which is why this study was conducted in the first place: to help developers focus on certain, more important areas.

Difficulty is a main characteristic of a video game. There have been plenty of games that have been praised by their immensely high difficulty. But as good as it may be, if a game is too hard, the player base will also decrease. For this reason, the concept of DDA

(Dynamic Difficulty Adjustment) was born [21]. A way to change game difficulty base on the player. This could ensure a game tailored to a higher range of players without the two ends of the spectrum considering the game too casual or too hardcore.

As for the background music, the evolution from 8-bit sound effects to fully fledged ambiance music has proven to be quite an evolution. Music has a high weight when it comes to player immersion. As seen previously, this immersions has several benefits to the game, the gamer becomes one with the world. In this study case, it increased game the game replayability factor, but it can increase other factors as easily. This is why there has been an increase study on background music effects in video games.

5.6 Future work

During the analysis of this study a few questions popped up that could prove to be relevant to future studies. First of all, the game used was rather simple which had its advantages and disadvantages. Because of this simplicity, it is really easy to get into, anyone can play it with minimal practice but at the same time, the linear difficulty and the basic game mechanics contribute to an overall low interest by the players. If this study was made with a more complex game, the results could more dispersed increasing the quality of the data collected.

There are some hypothesis in this study that have been rejected that could prove to be quite useful in the future like the impact of the player's state of mind. This study was proved to be inconclusive in this dissertation since this is a very specific topic and some special analysis must be conducted to gather sufficient data to properly analyze it.

Another possibility is to conduct a study depicting gaming expertise as "High gamers" and "Low gamers" instead of the 7 point likert scale that this study used. The reason is that even though the gaming expertise had no impact in the player's perceived game difficulty and game speed, if the game expertise scale was divided into 3 groups (1-3: low gamers, 4: average gamers, 5-7: high gamers), the results showed a higher correlation between these variables. So it might be useful to change the scale in order to have better results.

When it comes to background music, there has been several studies observing its impact on player's immersion and cognitive behavior. Even though immersion is connected to game experience, there is no direct link between that and background music. Therefore, a study with those characteristics can give game developers some needed information about the music impact in video games and how to maximize its usage in order to improve the gamer's reaction to the game.

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Appendix A

Appendix

A.1 Questionnaire

Age: _____

Gender: ☐ Female ☐ Male ☐ Other

Nationality: _____

Academic Degree (last degree obtained):

☐ Primary School ☐ High School ☐ Bachelor's Degree ☐ Master's Degree ☐ PhD

☐ Other? _____

Professional situation:

☐ Student ☐ Working Student ☐ Self employed

☐ Worker ☐ Research scholarship ☐ Other? _____

PART 1 MUSIC

3.1. Using the tablet provided, listen to the song available on it. Describe what comes to your mind while listening to the song.

3.2 Do you know the song that was played in the videogame?

Yes

☐

No

☐

If you do, where do you know it from?

3.3 Describe the melody the best way you can.

PART 2
GAMING

4.1. I usually play video games (smartphones, tablets, computers, consoles or similar):

☐ Daily☐ Fortnightly☐ Semiannually☐ I don't play
videogames☐ Weekly☐ Monthly☐ Annually☐ Other _____

4.2. During the year of 2018 I dedicated, in average, to play videogames

☐ Less than 1 hour per week☐ Between 5 and 10 hour/week☐ Between 20 and 40 hour/week☐ Between 1 and 5 hour/week☐ Between 10 and 20 hour/week☐ More than 40 hours per week

4.3. I'm extremely good/capable at playing videogames

1- Disagree Completely

☐

2

☐

3

☐

4

☐

5

☐

6

☐

7- Agree completely

☐

4.4. I have a profound knowledge about videogames

1- Disagree Completely

☐

2

☐

3

☐

4

☐

5

☐

6

☐

7- Agree completely

☐

4.5. When compared to other players, I consider myself superior at playing videogames

1- Disagree Completely

☐

2

☐

3

☐

4

☐

5

☐

6

☐

7- Agree completely

☐

4.6. When my friends need to know more about videogames, they come to me

1- Disagree Completely

☐

2

☐

3

☐

4

☐

5

☐

6

☐

7- Agree completely

☐

Using the tablet provided, play the game on it.
After playing the game, you can continue answering the questionnaire

- 4.7. I liked the game.
1- Disagree Completely ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7- Agree completely ☐
- 4.8. I enjoyed playing the game.\\
1- Disagree Completely ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7- Agree completely ☐
- 4.9. I would play this game again.
1- Disagree Completely ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7- Agree completely ☐
- 4.10. I consider the game to be
1- Easy ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7- Hard ☐
- 4.11. I consider the game to be
1- Too fast ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7- Too slow ☐
- 4.12. I consider the game
1- Easy to finish ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7- Hard to finish ☐

4.13. Describe the characteristics present in the game that you like the most and hate the most

PART 3 - State of mind

- 5.1. Currently, I'm in a good mood.
1- Disagree Completely ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7- Agree completely ☐
- 5.2. While answering these questions, I'm feeling cheerful.
1- Disagree Completely ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7- Agree completely ☐
- 5.3. Currently I'm feeling nervous/fretful
1- Disagree Completely ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7- Agree completely ☐
- 5.4. Currently i don't feel competitive
1- Disagree Completely ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7- Agree completely ☐