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The Impact of Pay-to-Win Microtransactions on the Game Experience of Players

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Abstract

In today's gaming industry, microtransactions are a prevalent revenue model. Among the wide range of employed techniques, a common pattern known as pay-to-win (P2W) stands out as a dark game design pattern in which players can obtain in-game advantages through monetary transactions. This pattern has sparked significant social discourse among players and researchers due to its perceived impact on game fairness. Existing research has largely focused on the implications of pay-to-win in multiplayer environments, but single-player games have also faced widespread criticism for how pay-to-win impacts the game experience.

This study addresses this gap by investigating its effects in a single-player game. A quantitative experiment was conducted using a game prototype with two versions: one without monetization and the other incorporating a pay-to-win microtransaction model. Participants' experiences were measured through a questionnaire and data collected from the prototype, examining various factors of the game experience such as enjoyment, perceived fairness, and autonomy.

The findings show that pay-to-win microtransactions negatively impact player experiences even without the social dimension present in multiplayer environments. Players perceived these systems as manipulative and exploitative, which diminished their experience. These mechanics were also found to impact the perceived difficulty, making challenges seem unfair and intentionally designed to pressure players into spending money. Furthermore, pay-to-win was found to undermine rewards gained through progression systems. Finally, success in the game became a dominant factor for a positive experience in the P2W version, reducing the diversity of positive player experiences.

The study underscores the importance of maintaining transparency and fairness in revenue models to prevent players from perceiving the game as manipulative, which significantly harms the player experience. Recommendations include integrating training for quality assurance teams to identify dark game design patterns, avoiding P2W models for target audiences focused on progression and achievement, and implementing cosmetic-only monetization models. Additionally, digital distribution platforms and regulatory authorities are urged to introduce labeling and classification systems to inform consumers and protect vulnerable groups from exploitative practices.

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Chapter 1

Introduction

Imagine yourself about to start a new game, excited about all the challenges you will encounter and the things you will explore. You enter the world of the game and are slowly introduced to its mechanics. While the start is hard and you struggle, slowly but surely, you begin to understand the game systems better and better. Before you know it, you start to feel a sense of mastery over the game. Challenges that were once difficult are now getting easier. This brings a sense of satisfaction and accomplishment, and you are excited to show your achievements to the world and other players.

But then another player appears in the game. Just like you, they start out learning the basics, but somehow they progress way faster and more easily through the game, making the challenges you overcame seem insignificant. You start to wonder if maybe you are just bad at the game and doubt your own abilities. This continues, and soon enough, they have outpaced you. They are now wielding powerful weapons and abilities, facing challenges that seem impossible to you, and experiencing far more success in the game than you do.

However, you soon discover the truth: instead of painstakingly spending their much-coveted free time slowly learning the game and getting good at it, they simply paid an amount of money to skip all the progress that you made by yourself. Once you realize this, you feel a sense of hollowness and question why you put in all that effort if you could have just paid for it. The achievements you were once so proud of are no longer a measure of skill but a measure of how deep your wallet goes. This realization leaves you with a deep sense of regret and a feeling of having wasted your time.

The sense of frustration and disillusionment described above is one of the major concerns raised by players regarding pay-to-win (P2W) practices. P2W is a practice where players can exchange real-life money for in-game advantages, and it is a part of a larger revenue model known as microtransactions, and the topic

of this thesis. This revenue model has grown massively in popularity over the past decades and can now be found in the majority of both PC and mobile games (Zendle, 2020). Companies earn billions of dollars in revenue each year from these transactions (Makuch, 2020; Strickland, 2022).

The microtransaction revenue model is commonly used in freemium games, which are games available at no initial cost but feature in-game purchases known as microtransactions. This business model allows players to download the game for free and then choose whether to spend money on optional in-game transactions. The key difference with traditional premium titles is that players can usually spend as much money as they like on a single title, rather than buying it for a set amount. This dynamic encourages game developers to design their games in ways that maximize player spending. The potential for exploitative practices that this creates, often referred to as predatory monetization, is one of the primary concerns raised by players and scholars alike when discussing microtransactions.

Particularly in freemium games, microtransactions intentionally attempt to exploit individuals prone to addictive behaviors, resulting in games employing a microtransaction revenue model gaining a significant portion of their revenue from a small percentage of players (Zendle, 2023). Furthermore, microtransactions are linked to gambling addiction and financial strain in individuals, due to elements like loot boxes, stimulating visuals, and random rewards sharing strong similarities with traditional gambling methods such as slot machines (Gibson, 2020). On top of this, existing regulations to protect vulnerable individuals, such as children, are few and far between (Xiao, 2024), and the existing ones fail to do so (De Jans, 2023; Xiao, 2023).

Another area of concern often voiced among players is that the presence of microtransactions and their exploitative practices impacts the overall gaming experience. Games with aggressive monetization frequently feature problematic aspects like repetitive gameplay, intrusive ads, artificial barriers, and unfair paywalls that degrade the player experience (Alha, 2020). Among these exploitative practices, pay-to-win sparks the most discussion. Players perceive pay-to-win as undermining fairness, community trust, and competitive integrity, leading to resentment—particularly when non-paying players feel disadvantaged by paid power boosts and matchmaking imbalances (Freeman, 2022).

The practice of pay-to-win and its consequences are typically associated with multiplayer games, where players may encounter others who are significantly stronger due to the use of pay-to-win mechanics, despite investing less effort and time. Existing research on pay-to-win mechanics is also focused on multiplayer environments. However, single-player games featuring pay-to-win mechanics have also faced substantial criticism. For example, the sequel to the highly popular

Plants vs. Zombies series, Plants vs. Zombies 2 (PopCap Games 2013), has sparked numerous forum posts and YouTube videos discussing the negative impact of pay-to-win mechanics on the gameplay experience, such as the forum thread "Another game ruined by pay to win model" started by MrSCARY (2013).

While the discussion around pay-to-win (P2W) started in multiplayer environments, where the presence of paid advantages harms the competitive integrity of the game by tying player strength to financial resources rather than skill and time invested, players also seem to be raising concerns about its impact in single-player games as well. These discussions, like the forum thread mentioned above, often debate whether a game is realistically beatable without spending money, with players being particularly sensitive to the latter. Common complaints include the feeling that the game's difficulty is designed to make them spend money. So while the social dimension in multiplayer games, where players can compare or compete with other players, significantly contributes to the negative perception of P2W, it might not paint the full picture.

Intuitively, the presence of pay-to-win (P2W) mechanics should not impact the game experience in a single-player game. Players can still choose to either pay or not pay any money, and since there are no other players to compare to or compete against, the spending of money should be irrelevant. Then why do players still complain about P2W in single-player games? Is it that players are just tired of P2W practices in multiplayer games and write off games as soon as they see P2W in single-player games? Is it other elements of the microtransaction revenue model that degrade gameplay and are associated with P2W? Or does the presence of P2W mechanics actually impact the player experience in single-player games? This line of thinking is what inspired this master thesis. It aims to explore the impact that pay-to-win mechanics have on the player experience in single player games, answering the following research question:

What is the impact of including Pay-to-Win microtransactions in single-player games on the experience of players?

This thesis details the process of designing and conducting a quantitative study to address the research questions. It does so through an experiment aimed at understanding how the presence of pay-to-win mechanics impacts the gameplay experience of players. To achieve this, a video game prototype was designed with two versions. Both versions were identical in every aspect except the monetization system. One version featured no monetization, while the other included a bare-bones microtransaction model that supports pay-to-win mechanics. The microtransaction model and pay-to-win mechanics are designed to be realistic and representative of pay-to-win environments players might encounter in actual games.

Participants were split into two groups, each playing one version of the game.

Afterwards, they completed a survey investigating their gameplay experience. The survey was designed to capture as many aspects of the game experience as possible that could be impacted by the presence of the pay to win microtransactions. Additionally, participants filled out a short demographic survey to provide further insights and validate the sample before playing the game. Other data, such as the time participants spent engaging with the prototype and how far they progressed, were also collected. Since the video game prototype is designed so that the only difference between them is the presence of pay-to-win microtransactions, analysis of the impact can be performed by comparing data between groups.

This manuscript will first lay a foundation of the theoretical research that the experiment is based on, introducing and going in-depth about microtransactions, virtual currencies, pay-to-win, predatory monetization, dark game design patterns, and player motivation. It also discusses related research around microtransactions, pay-to-win, and their impact, covering topics like the ethical and gameplay-related concerns that are often raised by players and scholars. Afterwards, the formal requirements to create a research environment and video game prototype in which research can be performed are described. Next, the design process of the whole study, including the video game prototype, is discussed, and decisions made during the development process are explained. The following chapters then present the results of the study, including a critical discussion about the results, the limitations of the experiment, and feedback received. Finally, the last chapter draws concrete conclusions from the discussions and explores further potential and impact.

Chapter 2

Theory

This thesis aims to create an experiment to investigate how the pay-to-win game design pattern impacts the player experience. It does so by trying to mimic a realistic pay-to-win game. To achieve this, we need to have a detailed understanding of pay-to-win and the games in which it is typically used. The goal of this chapter is to create such a theoretical foundation, guiding the research and analysis in this thesis, by introducing the existing lecture surrounding these topics.

The chapter starts off with an overview of how revenue models in games have evolved, situating the subject of research, the microtransaction revenue model and pay-to-win in a broader context. The chapter then explains the microtransaction revenue model in detail, starting off with an overview of the freemium business model and virtual currencies, bringing up different types of microtransactions that are often found in pay-to-win games. Next, the chapter introduces game design patterns and more specifically, dark game design patterns.

Finally, having dissected the elements that make up pay-to-win, the chapter gives a detailed definition of the concept of pay-to-win by combining the existing literature around it. The chapter also covers existing game experience surveys, introducing the Player Experience Questionnaire, or PXI for short (Abeele 2020) and Basic Needs in Games, or BANGS for short (Ballou 2024), which are part of the experiment.

2.1 Brief History of Revenue Models in Games

Throughout the many years of history, video games have seen their developers create and implement many ways of generating revenue from their games. Over time, as games grew in popularity and potential profits increased, developers researched and implemented a wide array of monetization strategies. This section aims to provide an understanding of the history of monetization practices and revenue models in games, serving as a theoretical framework to better comprehend the ever present

connection between game design and monetization, and the different steps leading up to the appearance of the microtransaction model.

The first appearance of monetized games came in the form of arcade games. Typically found in public arcade venues, arcade games were an entertainment service provided through machines that were usually coin-operated. The business model was simple: players would buy coins and use them to activate the machines. Arcade games reached their peak popularity in the late 1970s to the mid-1980s (Osathanunkul 2015). These games tend to be short, fast-paced challenges that incentivized multiple attempts and were seen as frantic and addictive. Furthermore, they usually were designed to be easy to learn but difficult to master, featuring a multiple-life and progressively difficult level paradigm. This design allowed players to theoretically keep playing indefinitely (Gao 2022).

The next step was the introduction of home consoles, which allowed consumers to play games at home. At first, consoles were sold with games entirely implemented in hardware, meaning players could only play one specific game. However, as technology improved, it became possible to play multiple games on the same hardware. Games were sold as physical cartridges or discs at a one-time purchase price in stores, after which the consumer owned the game and could even sell it forward (Toivonen 2010). The revenue model of having players pay a one time fee for a game is referred to as One-time Payment games. There were already some early examples of additional content that extended an existing game, called expansion packs (Mattioli 2020).

As the availability of the internet became more widespread, a new method of distributing games called digital distribution appeared. These platforms allowed for the purchasing and downloading of games through the internet. Users could now simply download games from the comfort of their own homes instead of having to go to a nearby store. For retailers, this was also very convenient as they no longer had to deal with inventories. This method of distribution grew very popular (Mattioli 2020). This is also where the spiritual successor to expansion packs, downloadable content (DLC), first emerged. DLC is best understood as a self-contained addition to a stand-alone game. These were a great way for companies to extend the shelf life of a product along with a number of other benefits, such as customers not being able to refund these additions. DLCs have since then grown to be a staple of the Triple-A industry and are now found in many games(Nieborg, 2014).

Next to digitally distributed games, another phenomenon that appeared with the rise of the internet was online multiplayer games. These early forms of games as a service, something we will get into later, required the player to connect to servers to play the game. This is where developers got the idea to charge a subscription for the service they provide instead of a one-time purchase. Players would pay a weekly

or monthly fee to continue being able to play the game, providing the developers with a continuous stream of revenue (Mikeal 2023). A famous early example that featured such a subscription is World of Warcraft (Blizzard Entertainment 2004).

Another form of subscriptions that came to be were something called game-passes, of which the first widely known one was an online service released by Xbox in 2002, Xbox Live, with Sony soon following in suit, debuting the PlayStation Network in 2006. Such services offered discounts, social spaces and exclusive discounts. More recently, game passes also tend to offer access to a library of games (Zachow 2023).

This change went hand in hand with a paradigm shift in game design. Games used to be a linear experience with a clear beginning and end. However, this has evolved. Many games these days embrace the idea of game loops, which are experiences designed for players to repeat, such as climbing leaderboards or collecting a large set of items through repeating content. Such games allow players to spend much more time on them than was possible before and opened up many new avenues of monetization (Singer 2020).

Up until this point, games were always associated with an initial cost to play them. However, a new revenue model that came into play during the mid-2000s was the idea of a free-to-play game. These games allowed players to download and play the game for free but featured in-game transactions where players could spend money on various goods within the context of the game. These transactions would later become known as microtransactions, which is the topic of our thesis and something we will explore in much greater depth. (Alha 2020).

This idea of having games free to play is often used interchangeably with the term freemium games. While similar, free-to-play is a revenue model (how a company gains profit) that exists within a business model (how a company creates a product for its customers). Freemium and premium games are the two main categories of business models used in the game industry, with premium games referring to games that have an initial cost to access and freemium games being games that are (at least partly) free to play and make their revenue in other ways. The concept of freemium games is where an explosion of new revenue models, such as the free-to-play model and microtransaction models, originated (Alha 2020).

Today, the microtransaction model is widely employed across the industry. The market for in app-purchases made up $92.6B worldwide by 2020 (Antepenko 2022) and players are frequently exposed to many kinds of microtransactions in both computer games (Zendle 2023) and mobile games. However, mobile games feature more frequent and different techniques compared to desktop games. (Petrovskaya

2022). Furthermore, these rates of exposure and frequency have experienced rapid growth between 2010 and 2019 (Zendle 2023), and one can expect this will continue.

2.2 Microtransactions and Virtual Currencies

The microtransaction model is the revenue model in which the game design pattern called pay-to-win, around which this thesis is based, exists. Hence it is important to gain a detailed understanding of just how the microtransaction model works, as the experiment aims to create a game prototype featuring it. As a quick reminder, a revenue model is how a company makes profit out of a product. Games monetized with microtransactions appeared during the introduction of a new business model in the gaming industry called freemium games. This business model allows players to download the game for free or at least partially for free and then feature transactions within the game that charge the player for content. These transactions that exist within the game are called microtransactions (Tomić 2018). The "micro" part comes from the fact that many of these transactions consist of small payments called micropayments (Rivest & Shamir, 1996), and the business model encourages players to perform many small transactions rather than a few bigger ones (as opposed to the premium business model, where the player pays one larger amount to get access to the game).

Over time, the definition has grown to encompass all types of transactions made to obtain extra content within a game, beyond an initial cost or subscription, so even transactions that usually feature a larger price tag, and may not be perse micro, like DLC (extra downloadable content that players can purchase separately from the game). Furthermore, with the introduction of something called virtual currencies microtransactions often are not carried out with real currency anymore.

Virtual currency is a term that is often used in a wider scope to refer to electronic money (e.g cryptocurrencies like Bitcoin) (Abboushi 2017), but in the context of games, it refers to currencies that are used by players within the game. The European Central Bank in Virtual Currency Schemes, defines it as “a virtual currency is a type of unregulated, digital money, which is issued and usually controlled by its developers, and used and accepted among the members of a specific virtual community” (European Central Bank 2012).

Virtual currencies can usually be obtained by exchanging real money, or sometimes through performing tasks within a game, and they tend to have no commodity-backed value (though there are exceptions) (European Central Bank 2012). This currency can then be used within the game to buy a variety of digital items and content through microtransactions. Some examples of these transactions include exchanging virtual currency for loot boxes, battle passes, cosmetic items, and more. Virtual currencies have various proven aspects that lead to increased

Figure 2.1: Virtual currency shop window in Mahjong Soul

spending behavior among players, such as decreasing the pain of paying and presenting a profitable deal (Zhirkova 2020).

The introduction of the freemium model and the subsequent diversification of revenue models have had a significant impact on the industry, with companies finding great success in employing these strategies. Electronic Arts reported over one billion dollars in profit in a single quarter through microtransactions (Makuch 2020). Similarly, Blizzard reported 5.1 billion dollars in revenue in 2021 from microtransactions across their various titles (Strickland 2022). In both examples, the revenue generated from microtransactions accounts for over 50% of the total revenue generated by the company.

They also appear in games frequently. In the paper "The Changing Face of Desktop Video Game Monetisation," David Zendle (2020) researches the frequency with which players encounter microtransactions by examining the 463 most-played games on the digital distribution platform Steam between 2010 and 2019. The results indicated that by April 2019, a significant majority of players frequently faced microtransactions in games. Over 85% of the sampled players were exposed to games featuring cosmetic microtransactions, and over 70% encountered games containing loot boxes (a type of microtransaction where a player pays to receive a random reward). Games featuring pay-to-win mechanics were somewhat less common, reaching a little over 17% by November 2015, with growth slowing down. The study concludes that microtransactions, particularly cosmetic ones and loot boxes, have grown rapidly and become a prevalent part of the computer games landscape. They are also very present in mobile games. 44 out of 50 top

mobile grossing games feature microtransactions, with an average of three different techniques (Petrovskaya 2022).

Clearly, the microtransaction business model is very present. Hence, the list of various microtransactions that are and have been employed across the industry is large. Attempts at categorizing these have been made (Lehdonvirta 2009; Luton 2013, Alha 2020). To situate pay-to-win microtransactions in a broader context and facilitate discussion, I want to introduce the five categories described in the work done by Alha (2020) in The Rise of Free-to-Play: How the Revenue Model Changed Games and Playing. Alha divides paid content that players can obtain through microtransactions into five categories based on previous work (Lehdonvirta 2009; Luton 2013): cosmetic, convenience, advancement, power, and social content.

Cosmetic items, also referred to as cosmetics, are items in games that allow players to customize or change the visual appearance of elements within the game. Cosmetics do not impact the way players play the game, have no functional benefit and purely cause a visual change in the game. Some other examples of cosmetic items are armor and weapon skins found in many RPGs like World of Warcraft (Blizzard Entertainment 2004), items that allow player characters to perform specific actions like emotes in Fortnite (Epic Games 2017) or finishing moves in Call of Duty Modern Warfare II (Infinity Ward 2022), and custom profile pictures or banners for player profiles like icons in League of Legends (Riot Games 2009). They are also the most common type of microtransaction in popular computer games (Zendle 2020).

Convenience items offer a functional advantage as opposed to cosmetics. They make the game easier by saving the player time or reducing the amount of effort necessary to complete in-game goals. Some examples include extra builders that players can purchase in Clash of Clans (Supercell 2012), which allow for building multiple structures at the same time, thereby saving time, or the extra inventory spaces found in many RPGs, which make managing items easier. In single-player games, convenience microtransactions can allow players to reattempt a part of a level after a game over, instead of having to redo entire levels.

Advancement items are a category closely related to convenience. These items help the player progress through the game in various ways and usually also save time. Examples include boosts to experience points that speed up leveling or items that allow the player to gain extra levels, thereby eliminating the need to manually level up. Many MMORPGs like World of Warcraft and Final Fantasy XIV sell so called level boosts that instantly advances a characters level,

Power items also make the game easier, but not by saving time and effort, instead, they make the players stronger through increasing player power. In

multiplayer role-playing games, where a character's strength depends on the gear they wear, a power microtransaction could be the selling of strong armor and weapons. They also exist in single-player games, like how Bloons Tower Defense 6 (Ninjakiwi 2018) sells something called "double cash mode," which significantly lowers the difficulty of most levels by doubling the amount of in-game currency the player earns.

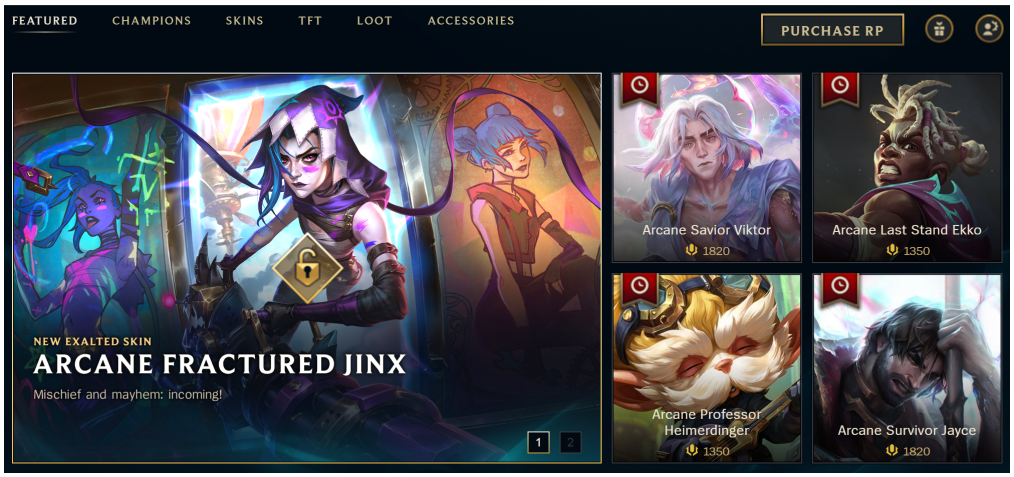

Figure 2.2: Screenshot of the store page of the League of Legends (Riot Games 2009) client, featuring various microtransactions that can be purchased with the virtual currency Riot Points (RP)

2.3 Dark Game Design Patterns

This subsection introduces and explores the concept of dark game design patterns by Zagal (2013), which is crucial to this thesis.

A game can be understood as an interaction between the players and designers, where designers shape an experience for the player. After all, game designers create the concepts, rules, mechanics, world, and many more things that are core to the experience that a player can have in a game. Hence, the role of a game designer is often described as close to the player. Fullerton (2008) introduces the term "playcentric design," which describes the process of game designers designing a game by prioritizing the player experience. "The role of the game designer is, first and foremost, to be an advocate for the player" (Fullerton, 2008, page 2).

In this approach, both parties, the players and the designers, are interested in the player having a great experience, and it is important to note that these interests overlap. However, this is not always the case. A major change that happened to games with the introduction of microtransactions over premium sales

is that players can now spend as much money in the game as they want past the initial price point or subscription. This brought with it an incentive for designers and companies to design their games in a way to make players spend money. Since in many of these games, the player initially plays for free, game designers have to motivate players to start spending money and turn them into paying players, a process called conversion (Luton 2013) While the role of a game designer is understood to be one where supporting and enabling the player is important, there may now be a mismatch in interests between designers and players, namely that designers might try enabling players to spend as much money as possible, even if this is not the players intention.

This mismatch in interests between designers and consumers and the resulting design decisions is a concept that is known as dark patterns. In the context of online user interfaces, these refer to designs intended to influence users into making decisions that benefit the developers and companies behind the product the most, even if these decisions are not in the users' best interest. Harry Brignull (2010) coined the term "dark patterns" to describe design decisions that intentionally attempt to influence users to perform actions that may not necessarily be in their best interest. On the website Deceptive Design, Brignull (2023) aims to "address the growing issue of deceptive design practices in the digital world" by shedding light on the various types of design patterns that are commonly found, and informing users of rights surrounding them. Some examples of patterns that are listed are hard to cancel, meaning a pattern where "The user finds it easy to sign up or subscribe, but when they want to cancel they find it very hard", and fake social proof, meaning that "the user is misled into believing a product is more popular or credible than it really is, because they were shown fake reviews, testimonials, or activity messages.".

This concept has also been applied to games. Zagal (2013) developed the concept of dark game design patterns in "Dark Patterns in the Design of Games.", a work that is very important and served as inspiration to this thesis. Zagal describes these design decisions in the form of game patterns, which are a formalized way to express knowledge about designing games. While traditionally, game design patterns are value-neutral and focus on the design and analysis of games, Zagal notes that games can convey values to players, some of which may be unethical. These design choices that result in harmful or suboptimal experiences for players are what Zagal then describes as anti-patterns. However, these anti-patterns do not necessarily imply that the designer intentionally wanted to cause negative experiences for players.

Zagal goes on to define dark game design patterns as:

"A dark game design pattern is a pattern used intentionally by a game creator to cause negative experiences for players that are against their best interests and happen without their consent." (Zagal 2013, page 3)

This definition features three important elements. First, a dark game design pattern is designed intentionally and is not the result of poor judgment on the designer's end. Second, they cause negative experiences for players that are against their best interests. This can include, for example, spending more time on the game than they intended or more money, which is particularly relevant in the context of microtransactions. Finally, these patterns happen without the player's consent. Dark design patterns can be manipulative and sneaky, tricking the player into taking certain actions without them realizing it. Zagal also acknowledges that defining what constitutes a negative experience and classifying dark game design patterns is very difficult, as the line between acceptable and unethical design is often blurry.

Zagal also defines various groupings of dark game design patterns. The first group is temporal design patterns. These patterns make it difficult for players to gauge the amount of time and commitment needed to play the game, leading them to spend more time than they intended. This results in a negative experience and the feeling of having wasted time. Games may require players to repeat tasks unnecessarily to artificially extend the amount of time spent, or incentivize the purchase of advancement microtransactions to save time. Similar to how temporary dark patterns make it hard for players to estimate how much time they spent, Monetary dark patterns make it challenging for players to be aware of how much money they spend or will need to spend to fully enjoy the game. Examples include virtual currencies, which make purchasing items more accessible (Zhirkova, 2020), or downloadable content, which players may find easier to purchase because they have already spent money on the original game.

The third category the paper defines is social capital-based dark patterns, which are manipulative strategies used in game design that aim to exploit a player's connections made within the game to get them to engage more or spend money. Some examples include games that pressure players to ask their friends to play or patterns that exploit player competitiveness, incentivizing them to purchase items to gain competitive advantages, similar to Alha's (2020) concept of power items. Such patterns result in negative experiences where the player's social standing could be diminished as a result of playing the game, or where the player feels they must continue playing due to a sense of social obligation.

Finally, Zagal (2013) touches upon the nuanced and often ambiguous nature of classifying certain game design patterns as "dark.". It highlights how these patterns can vary in their impact based on context, implementation, and audience.

For example, games that encourage behaviors like lying or betrayal, such as Diplomacy, might create negative feelings, but these effects aren't always harmful outside the game. Spawn timers in World of Warcraft are a textbook example of the Playing-by-Appointment design pattern, but they can create emergent, cooperative gameplay. The paper argues that the ethical implications of these patterns are not always clear-cut, which is why they are described as existing within "shades of gray."

Unfortunately, there exists no exhaustive list of dark game design patterns that are found in games, and more specifically pay-to-win games. Scholars tend to group dark game design patterns into categorizations like Zendles (2013) article, or Aagaard (2022) who studies the impact on players and awareness of dark game design patterns in mobile games. Here, pay-to-win is again listed as its own category, and is made up out of smaller elements, such as the UI design, how the store is designed or how exactly developers make non-spending players feel disadvantaged. There do exist studies that analyze game dark design patterns, like Karlsen (2019), who does this for Clicker Heroes (Playsaurus 2014), Farmville 2 (Zynga 2009), and World of Warcraft (Blizzard Entertainment 2004), but they are very genre-specific. Therefore, to satisfy the requirement of creating a realistic pay-to-win environment, the video game prototype will simply mimic identified techniques found in games within the same genre.

2.4 Predatory Monetization

Zagal's (2013) monetary dark game design patterns and microtransactions go hand in hand. While Zagal's definition specifically mentioned design decisions that make it hard for a player to be aware of how much money they spent, we can generalize this to all design decisions that attempt to influence players into spending more money than they want. Such decisions are often referred to as "predatory monetization" amongst players, a term which was initially defined by Daniel King (2018) as "Predatory monetization schemes in video games are purchasing systems that disguise or withhold the long- term cost of the activity until players are already financially and psychologically committed. " (King 2018, p. 1967).

The term predatory monetization has grown quite ambiguous, but it can be roughly defined through Zagal's work as; Predatory monetization in games refers to the use of a monetization model that employs monetary dark game design patterns. This basically means any intentional attempt at making the player spend money against their best interest. The results are for example the microtransactions described by Alha (2020) which we covered earlier like power items and advancement items. We also need to be aware of the gray nature of microtransactions and dark design patterns described by Zagal (2013).

Petrovskaya (2021), in "Predatory Monetisation? A Categorisation of Unfair, Misleading and Aggressive Monetisation Techniques in Digital Games from the Player Perspective," develops a taxonomy for such techniques often employed in games. They did this by asking players about their experiences with microtransactions and other predatory strategies, acknowledging that players can provide valuable insights due to their first-hand experiences. They also reviewed previous studies that showed players can articulate their perceptions about monetization and develop their own categorizations. They surveyed over 1,100 players to share their experiences and identified 35 distinct categories of techniques, which they grouped into eight domains. This categorization will serve as an important foundation for developing microtransaction techniques in the experiment that are representative of those found in real games. To briefly summarize the eight domains defined by Petrovskaya (2021):

- **Game Dynamics Designed to Drive Spending:** Techniques that manipulate gameplay to encourage players to spend more money.
- **Product Not Meeting Expectations:** Instances where players feel misled about the value or quality of in-game purchases.
- **Monetisation of Basic Quality of Life:** Practices that charge players for essential game features or conveniences.
- **Predatory Advertising:** Misleading marketing strategies that manipulate players into making purchases based on false promises.
- **In-Game Currency:** Systems that complicate the understanding of real money versus in-game currency, often leading to overspending.
- **Pay-to-Win:** Scenarios where players can gain significant advantages through monetary purchases, creating an uneven playing field.
- **General Presence of Microtransactions:** The pervasive nature of small, frequent purchases that can accumulate to significant amounts.
- **Other Techniques:** Additional monetisation strategies that do not fit neatly into the above categories but are still perceived as problematic by players.

One must be wary of the overlap between these categories. A technique may both introduce pay-to-win, not meet expectations, feature predatory advertising and use in game currency. Also, in this categorisation, pay-to-win is described as its own category. Other examples and loose categorizations can be found across existing literature related to microtransactions, but this thesis will use and refer to the techniques and domains found in Petrovskaya's taxonomy.

2.5 Pay-to-Win

Having introduced the microtransaction revenue model, and the concepts of "dark game design patterns" and "predatory monetization", it is finally time to talk about pay-to-win. Pay-to-win, or P2W for short, is a broad concept that is used by players of games and scholars in the context of games where players can spend money to gain a competitive advantage in the game. In the previous sections we already have some definitions or concepts that mention pay-to-win and similar strategies. Zagal (2013) describes pay-to-win as a dark game design pattern called "monetized rivalry", which is a pattern that exploits player competitiveness; encouraging them to spend money they would not otherwise, in order to achieve in-game status such as a high placement on a leaderboard (Zagal 2013, page 5). However, this definition only applies to multiplayer games.

Alda (2020) introduced the notion of power items as purchasable content that increase player strength, which is clearly pay-to-win. However, advancement items that level up characters or convenience items that save time can also be seen as pay-to-win. Builders in Clash of Clans (Supercell 2012) for example, significantly reduce the time to get a strong defense online, giving you a temporal advantage of those who do not pay. Freeman (2022) again refers to pay-to-win as exploiting player competitiveness in multiplayer games, and Petrovskaya (2021, page 9) defines pay-to-win as a transaction, with the outcome of which giving players an advantage towards being successful in the game, often at the expense of other players. This definition explicitly defines pay-to-win as a type of transaction.

Tregel defines pay-to-win as a monetization strategy where game designers create the game so that competitive advantages can be obtained through spending real money, usually through in-game purchases, in other words, through microtransactions (Tregel 2020). The Cambridge Dictionary defines pay-to-win as "in computer games, involving or relating to the practice of paying to get weapons, abilities, etc. that give you an advantage over players who do not spend money" (Cambridge 2024). This is similar to Alda's (2020) power items, implying that pay-to-win is limited to the obtaining of direct items, while saving time, having multiple accounts and other methods can also result in an in-game advantage.

Existing definitions have the problem of being too narrow, limited to multiplayer games or explicitly defining it as a transaction or monetization strategy. By players, the term pay-to-win is used in a more broad sense, and more like a descriptive property of a feature of a game that involves obtaining an advantage in game through the spending of money. A game can be pay-to-win, a microtransaction can be pay-to-win or game mechanics can be pay-to-win. Combining these definitions and using the theory already covered, I want to define pay-to-win within the context of this thesis using Zagal's (2013) dark game design patterns as:

A dark game design pattern where players that spend money are more likely to succeed in the game than players that do not.

This definition is inherently gray in nature, because whether or not something helps players to succeed in a game can be argued on a case by case basis. For example, in some games, purchasable extra inventory space just makes managing your inventory a bit easier, while in other games it can allow you to hold on to more items which can provide an advantage. This dark game design pattern is then realized through microtransactions.

2.6 Motivation to Play

This section introduces three theories that describe players' motivation for playing games, which will be used during the discussion of results to investigate the possible impact of pay-to-win.

First, we have Bartle's Taxonomy of Player Types, described in Hearts, Clubs, Diamonds, Spades: Players Who Suit MUDs (1996). Bartle is a renowned researcher in the field of online virtual worlds. While working on his research in Multi-User Dungeons (MUDs), Bartle attempted to develop a classification of players based on their primary motivation to engage with games that feature a virtual world, such as the MUDs he developed. Bartle describes four archetypes, with the first category of players known as achievers. These players engage with games to achieve goals within the context of the game that they set themselves. Explorers find gratification in exploring the virtual world and discovering as much as they can. Socializers use the game's communicative facilities to interact with other players. Finally, killers enjoy causing distress in the game world through the game's systems, for example, by attacking other players.

Building upon prior research such as Bartle's taxonomy, there is also the HEXAD model of player types, proposed by Andrzej Marczewski (2015). The model identifies six distinct player archetypes based on their primary motivations for engagement. *Achievers*, similar to Bartle's achievers, are driven by the desire to overcome challenges and accomplish goals, deriving satisfaction from completing difficult tasks, earning recognition, and obtaining mastery. *Philanthropists* are motivated by altruism and the desire to help other players, finding meaning in cooperative gameplay and opportunities to contribute to a community. *Socializers* find engagement in social interactions, playing games primarily to build relationships and share experiences with others. *Free spirits* prioritize autonomy and creative expression, wanting to explore game worlds on their own terms and interact with the environment and systems in unique ways. *Players* derive satisfaction from obtaining rewards are motivated by tangible incentives such as achievements or in-game currency, engaging with the game as long as there are clear rewards for

their efforts. *Disruptors* challenge the status quo within the game, which can take many forms, such as breaking systems, experimenting with unconventional approaches, or creating chaos simply for the sake of doing so.

Another lens that has been used extensively to describe the enjoyment behind games is the Csíkszentmihályi theory of flow. Csíkszentmihályi is a psychologist known for his pioneering work in developing the construct of flow in the field of positive psychology, which aims to model the positive features that make life worth living, such as hope, wisdom, creativity, courage, and more (Csikszentmihalyi 2014). Flow, as described in the book Flow: The Psychology of Happiness, which is Csikszentmihalyi's summary of decades of research, is a state of optimal enjoyment. Optimal enjoyment occurs when individuals are deeply immersed, focused, and enjoying themselves in some activity. It happens when a person's mind stretches to the limit in a voluntary attempt to make something difficult and worthwhile happen (Csikszentmihalyi 2014, p 3-4).

Csikszentmihalyi defined eight components that make up flow, and the appeal of games has been studied through this lens to create more engaging experiences that feel pleasant and fulfilling. Games that create flow and avoid interrupting it provide enjoyable and interactive experiences (Chen 2007). In game design terms, keeping the player in a state of flow means continuously introducing new obstacles that are slightly more difficult than the player's current ability. Too much difficulty can create anxiety, while a lack of difficulty can create boredom (Dwivedi 2022).

2.7 The PXI and BANGS

To explore the impact that including pay-to-win microtransactions has on the game experience, the experiment requires a tool to analyze the experience participants have with the game prototype. To achieve this, a game survey questionnaire was created, which includes constructs that the inclusion of pay-to-win microtransactions may have impacted. This questionnaire was designed using two existing research tools to measure game experience: the Player Experience Inventory and the Basic Needs in Games. This section introduces these two existing research tools.

The Player Experience Inventory (PXI for short) is a multidimensional research tool designed by Vero Vanden Abeele (2020). It is designed for games user research and aims to measure and analyze the experience of a player with the game, focusing on actionable insights that game designers can use to improve the game. The PXI is special because it measures the player experience at two levels, which the paper calls functional consequences and psychological consequences. Functional consequences are the immediate, tangible experiences that players encounter in a

game, which come from game design elements like the audiovisual appeal or the ease of control in a game. Psychological consequences, on the other hand, capture the second-order emotional responses that players have to a game, such as a feeling of immersion or mastery, which are results of the design elements (Abeele 2020).

The tool was developed to fill a gap in games user research, where existing tools were either lacking in scientific validation or focused solely on the psychosocial experience without linking such experiences back to choices made by game designers, as described in Abeele's (2020) paper, *"The development of the game engagement questionnaire: a measure of engagement in video game-playing"*. The PXI improves on this by examining how these lower-level design elements influence higher-order emotional states, which provides insights that can directly help game designers.

The PXI is particularly useful in experiments where researchers want to understand the impact of specific game design elements on the player experience , which fits our needs well. Secondly, the Basic Needs in Games Scale (BANGS), similar to the PXI, is a research tool designed to measure player experience. BANGS focuses on the players' experiences of satisfaction and frustration in video games, grounded in Self-Determination Theory and developed by Ballou et al. (2023). It addresses some key limitations of previous tools by emphasizing six subscales: the satisfaction and frustration of autonomy, competence, and relatedness. This dual focus captures both positive and negative gaming experiences.

As described by Ballou (2023), BANGS is versatile and validated across three contexts: single gaming sessions, experiences with a specific game over time, and general gaming over multiple sessions. It uses a 7-point Likert scale, similar to the PXI. Furthermore, its design accommodates diverse gaming contexts, capturing social interactions with both human and game characters, and addressing challenges like toxic interactions, which are often overlooked in earlier measures. Additionally, it includes a distinct construct for frustration, which is absent in many existing research tools on games and Self-Determination Theory.

BANGS improves on prior tools by providing a psychometrically robust means to investigate both engaging and disengaging player experiences. This makes it ideal for research exploring the impacts of game design on player experience and well-being, offering actionable insights to create more positive experiences for players.

Chapter 3

Related works

This section covers the available literature on the concerns raised regarding the usage of the microtransaction revenue model, dark game design patterns and pay-to-win. These concerns can be mostly grouped into two categories: ethical concerns, which refer to aspects of the microtransaction model that exploit players, and concerns related to the impact on the gameplay experience. This section not only situates the research done in this thesis in a broader context, but to design a safe, controlled and responsible research environment, it is important to understand any potential risks or consequences pay-to-win and microtransactions may have.

3.1 Targeting of Vulnerable Players and Children

A first concern is that microtransaction revenue models and pay-to-win target and exploit vulnerable individuals. David Zendle (2023) describes *in The Many Faces of Monetisation: Understanding the Diversity and Extremity of Player Spending in Mobile Games via Massive-Scale Transactional Analysis*, that microtransaction revenue models rely on substantial revenue from a small proportion of heavily involved individuals. They found that a large part, up to 38 percent, of the revenue generated from mobile games featuring predatory microtransactions comes from only 1 percent of spenders. Furthermore, they found a positive correlation between the degree of predatory monetization and the extent to which the game relies on its top 1 percent of spenders.

To put it bluntly, these games rely on getting a select group of vulnerable individuals addicted to spending money. Predatory monetization schemes encourage repeated spending by players and exploit their investments in the game. This investment that encourages more spending is described by Daniel King's (2018) concept of "entrapment through microtransactions," which is when a player justifies continued spending because of previous purchases. Games often feature a pattern where they require or incentivize players to spend increasingly larger amounts of money. Players who have already spent a small amount may feel more inclined to

spend even more. This manipulation exploits the player's investment in a game, and is often also referred to as a "sunk cost" fallacy, which is defined as a phenomenon whereby a person is reluctant to abandon a strategy or course of action because they have invested heavily in it, even when it is clear that abandonment would be more beneficial (Oxford Languages 2024).

In the industry, this targeting of vulnerable individuals is referred to as "whaling," which involves focusing on players who spend large amounts of money on microtransactions (referred to as "whales"). The term gained popularity after a YouTube video titled "Let's Go Whaling: Tricks for Monetization" was uploaded and sparked significant social discourse online. This video is a presentation by a professional named Torulf Jernström, given at the Pocket Gamer Connects conference in 2016. The presentation showcases various tricks used within mobile games to hunt these so-called whales. In other words, it presents techniques that game designers can use to manipulate high-spending players into spending money. These techniques consist of various psychological tactics and design strategies. With many controversial statements, such as *"Make sure your games aren't too skill-based"*, *"We can talk about the morality of this at the end, if there's time"*, and *"Grinding and paying should be legitimate ways to play the game"*, the video sparked social discourse and was, for many, an eye-opening experience into how some game designers view and interact with players. Many of the techniques discussed in this presentation fall under dark game design patterns and feature microtransactions.

Another concern is that these games are available to children. With microtransactions and loot boxes appearing in many games (Zendle 2020, Petrovskaya 2020) of which many are played by children, concerns have been raised of possible consequences. Cahillane (2023) explains the possible harm caused to children in *DON'T LEVEL UP WITH LOOT BOXES: A RECONSIDERATION OF SENATE BILL 1629*, an article written after the Protecting Children from Abusive Games Act legislation failed to become law. They note that children are particularly vulnerable to microtransactions, such as loot boxes, which condition them to seek gambling-like experiences, leading to potential addiction and financial exploitation. Ghosh (2023) also notes these games expose children to gambling-like mechanics and targeted advertisements that can negatively impact their development and decision-making.

Unfortunately, these studies and other existing studies that investigate the dangers of exposing children to microtransactions (Raneri 2022, Fitton 2024) cover only loot boxes and their similarity to gambling, instead of the broader revenue model. As we will see later, there is research suggesting it is not inherently loot boxes (Macy and Hamari 2018, Decamp 2020), but other aspects of these games like pay-to-win (Steinmetz 2022) that can have a negative impact. More research is needed to understand how children engage with microtransactions to address these

concers.

A study about the character traits of individuals that engage with microtransactions by Dai (2024) did note a negative relationship between age and willingness in microtransactions, and quoted as possible reasons that older individuals may have "a stronger sense of reality, shorter gaming time due to life pressures, lower need for showing off among middle and upper age groups are possible reasons. Also, older people are more inclined to enjoy the fun of the game itself, such as the story of the game, rather than comparing themselves with other players (Dai 2024, page 8), which could make them less prone to purchasing pay-to-win microtransactions.

3.2 Gambling, Financial Strain and Addiction

For these previously mentioned vulnerable individuals, these games can have a significant negative impact on their lives and mental health. In 2019, a 19-year-old player who goes by Kensgold on Reddit, of the game Star Wars Battlefront II (Electronic Arts 2017) wrote an open letter (Kensgold 2017) to the publisher, Electronic Arts, and other companies releasing similar games. In this letter, Kensgold tells the story of how through games like Star Wars Battlefront II, they developed a gambling addiction and ended up spending over $10,000 in just two years on games featuring predatory microtransactions. Kensgold explains that these games caused significant financial strain, leading him to consider dropping out of high school to work more jobs to fuel his addiction. He explains that, even at the young age of 13, he encountered such systems while playing and started spending money due to the competitive nature of these games (with other words, due to pay-to-win). Despite being aware of the negative impact, he continued to spend money.

While he acknowledges that every decision he made was his own, he comments on how these types of systems, which can get children like himself addicted to gambling, are unregulated and pose a significant threat to individuals prone to addictive behavior. He pleads with the gaming industry to acknowledge the harm caused by microtransactions.Another example is the news story (Krdzic 2022) of a father discovering over $20,000 in credit card debt caused by his daughter's spending behavior in Genshin Impact (HoYoverse 2020).

As we have seen before, dark game design patterns, such as the usage of virtual currencies, pressure tactics, pay-to-win mechanics, FOMO, and artificial scarcity, are designed to influence players to spend money. Additionally, microtransactions are often designed to make purchasing as easy as possible, sometimes as easy as a single click, or through using virtual currencies, which make it easier to spend money in various ways (Zhirkova 2020). For vulnerable individuals, such as

children and those suffering from internet gaming disorder, this ease of purchase can lead to a lack of awareness or control over their spending, resulting in unexpected expenses and financial strain.

Another common concern are the consequences of the similarity between elements of the microtransaction revenue model and traditional gambling. The paper *"Online-gaming and mental health: Loot boxes and in-game purchases are related to problematic online gaming and depression in adolescents"* (Irie 2023) looks into the connection between microtransactions, especially loot boxes, and mental health issues in adolescents. The study concludes that adolescents who make unplanned in-game purchases, often driven by impulse, are more likely to experience problematic gaming behaviors like preoccupation and overuse. These behaviors, in turn, lead to increased social isolation and depression. The study specifically highlights loot boxes, which are designed to trigger impulsive spending through gambling-like mechanisms. Adolescents who engage with loot boxes are shown to have higher levels of depression compared to those who make other types of unplanned purchases.

A systematic literature review by Gibson (2022) analyzed 19 cross-sectional studies that investigate loot boxes, problem gaming, problem gambling, and pay-to-win microtransactions. Across these studies, they identified various elements that can contribute to problem gaming, such as near-misses, random rewards, and peer dynamics in multiplayer games. They also found that certain aspects of microtransactions can exhibit behaviors very similar to gambling, potentially leading to players developing a gambling disorder. For example, microtransaction mechanics may use stimulating, bright visuals and sounds during anticipatory periods, combined with bursts of light and sound when the player receives a good reward, to reinforce the purchasing of microtransactions (Gibson, 2022, p. 2).

The loot box microtransaction (a microtransaction where a player receives a random reward) in particular has gathered a lot of attention from researchers and scholars. In fact, most of the studies investigating the relationship between gambling and microtransactions specifically point to loot boxes (Gibs 2022, Irie 2023, Decamp 2022, Zendle 2018, Raneri 2022, Daniel 2018). This is due to the similarities loot boxes share with gambling. Loot boxes are a form of microtransaction where a player usually pays a small amount of virtual currency to receive a random reward. As David Zendle points out, *"Both when gambling and when buying loot boxes, individuals stake money on the outcome of a future event, whose result is determined at least partially by chance in the hopes of receiving a valuable reward"* (Zendle, 2018). Essentially, loot boxes are structurally very similar to slot machines.

However, while these microtransactions like loot boxes may be structurally similar to traditional forms of gambling through their randomized rewards and stimulating visuals, research has also pointed out differences. Whitney DeCamp (2020) suggests

that loot boxes share little in common with traditional forms of gambling. As she points out, *"Although previous studies provide much evidence supporting the existence of a correlation between loot box purchasing (and other types of DLC purchasing) and gambling behaviors, the nature of that relationship is largely unknown"* (DeCamp, 2020, p. 191). DeCamp explains that gambling behavior in young adults and children is linked to various predictors, such as individuals with strong parental relationships being less prone to gambling and a positive correlation with mental health issues. Her research suggests that purchasing loot boxes does not share the same predictors as those for traditional gambling, aside from gender. Additional studies have similar findings, like Macy and Hamari (2018) who found an absence of correlation between playing games and problematic gambling behavior in a study exploring connections between watching esport games, playing games and gambling.

Therefore, even though loot boxes specifically have been linked to the development of gambling behavior, research suggests that more is at play, and one cannot assume that addiction to purchasing loot boxes and engaging in other microtransactions shares the same underlying issues or causes as addictive behavior with traditional forms of gambling. Research on what aspects of microtransactions (aside from the obvious structural similarities that some microtransactions like loot boxes share with traditional forms of gambling) enable problematic gambling behavior is a new and growing field.

One such aspect that could be responsible is Pay-To-Win, the focus of this thesis. Fred Steinmetz (2022), in *"Pay-to-Win Gaming and its Interrelation with Gambling: Findings from a Representative Population Sample,"* investigates how the dark game design pattern Pay-To-Win (games where competitive advantages can be obtained through spending real money) can enable behavioral patterns similar to gambling. Steinmetz finds significant relationships between pay-to-win gaming and traditional gambling, such as the frequency of payments mattering more than the cumulative amount spent, and that over-involvement in either gambling or pay-to-win purchases is a predictor for over-involvement in the other (mere involvement is not a predictor). Steinmetz concludes that while Macy and Hamari (2018) suggest that gaming in general is not associated with an increased risk of problematic gambling, making Pay-To-Win purchases increases the risk of developing problematic gambling behavior (Steinmetz, 2022, p. 809).

Although microtransactions like loot boxes have been linked to an increased risk of developing problematic gambling behavior, these studies suggest that there are more addictive elements to microtransactions other than their similarities with traditional gambling. Pay-to-win mechanics have been identified as such an element that can increase the risk. The relationship between the presence of microtransactions and gambling remains complex, and more research is needed to fully understand the impact of these practices.

3.3 Lack of Regulations

Existing regulation of microtransactions is few and far between, and far from being appropriate considering the dangers pointed out by research. This subsection summarizes the regulations that do exist.

In China, when companies use loot boxes, they are required to provide customers with information on the chances of obtaining the random rewards featured in the loot box. Other countries with similar regulations, like Taiwan and Korea, require additional measures, such as labeling. In the United Kingdom, loot boxes are unavailable for purchase by underage individuals. The Netherlands has gone beyond just regulating loot boxes, taking a stance against virtual currencies as well. Games are required to list all prices in euros instead of using virtual currencies (Xiao 2024).

Furthermore, in Belgium, the Belgium Gaming Commission has taken the stance of classifying loot boxes as gambling under existing laws. This has led to a ban on loot boxes, and companies that do not comply with this law can face criminal prosecution. However, while in theory, loot boxes should be banned, studies have shown that the ban has not been effective in reality. A significant number of games still implement loot boxes and continue using and advertising these monetization methods (De Jans, 2023; Xiao, 2023). For example, 82% of the top 100 games and 80.2% of games rated for young audiences still utilized these monetization methods (Xiao, 2023).

Regulations for dark patterns and other manipulative design practices do exist, as Harry Brignull (2023) has documented on the previously mentioned website about deceptive design practices. This list includes laws that constrain certain types or uses of deceptive design. However, when reviewing these laws, none of them seem to be specifically targeted at games; they are more focused on e-commerce and advertising. This suggests an arguable lack of regulation specifically for games. Additionally, there is also the question of whether companies actually comply with these existing laws.

This lack of regulation is another area for concern. Existing regulation only applies to a small number of countries, and mostly targets exclusively lootboxes. Research suggests that the similarity to traditional gambling of loot boxes is not necessarily the main cause of addiction, and that other aspects like pay-to-win could be responsible for the players developing gambling addiction and experiencing financial strain (Macy and Hamari 2018, Decamp 2020, Steinmetz 2022). This means that just banning lootboxes is just a band-aid solution to a bigger problem, and does not necessarily solve anything, on top of the bans not even being effective (De Jans, 2023; Xiao, 2023).

3.4 Impact on the Game Experience

Having talked about the ethical concerns around microtransactions and pay-to-win, I now want to introduce the existing literature around the impact on the game experience for players. Unfortunately, for this topic, no empirical data exists at the moment. Existing literature is mostly based on interviews with players or content/sentiment analysis. This is a research gap this thesis could help to fill, thus existing literature can give us an understanding of the things we have to look out for, and allows us to pose hypotheses. We can also link the results we will find back to this literature.

Kati Alha (2020) In her dissertation thesis "The Rise of Free-to-Play:How the revenue model changed games and playing" investigates how the free-to-play business model and by extension microtransactions impacted the industry. A part of this is investigating how it impacts the game experience for players. She notes that free-to-play games often have the following problematic aspects, which can negatively impact on the game experience: boring and repetitive gameplay, artificial hindrances and paywalls, interruptions and spamming, aggressive monetization,and toxicity and cheating (Alha 2020, page 85)

- **Boring and Repetitive Gameplay:** Game mechanics often require players to repeat similar tasks, leading to a phenomenon known as click fatigue. This issue is prevalent in social mobile games but less significant in other genres like MMO (Massively Multiplayer Online) games.
- **Artificial Hindrances and Pay Walls:** Games introduce barriers such as patience mechanics (which prevent continuous play). These barriers often evolve into paywalls, incentivizing players to pay for progression, which is generally perceived negatively.
- **Interruptions and Spamming:** Gameplay is disrupted by pop-ups, advertisements, and prompts to share on social media. Mobile games often require players to watch ads to continue playing, further intruding on the experience.
- **Aggressive Monetization:** The use of dark game design patterns and predatory microtransactions. This includes limited-time offers, price tags on features, and a cluttered user interface filled with monetized content, degrading the overall experience.
- **Toxicity and Cheating:** The divide between paying and non-paying players fosters toxic behaviors, including ranting, hacking, and bot usage. The resulting hostility within the community can negatively affect player experiences and lead to player attrition.

A second work however looks specifically pay-to-win and how players perceive it. Allowing players to purchase in-game items that impact gameplay, in other

words, introducing pay-to-win or pay-for-convenience mechanics, can negatively affect players' perception of fairness and harm the competitive integrity of a game. These mechanics allow players to gain a competitive advantage through monetary payments rather than through skill and effort in the game. Freeman (2022), in a paper titled *"Pay-to-Win or Pay to Cheat: How Players of Competitive Online Games Perceive Fairness of In-Game Purchases"* analyzed over 20,000 social media posts made by players discussing "pay-to-win" games.

The study offers qualitative insights into overall player sentiments regarding pay-to-win mechanics. The following are Freeman's key findings, and a short explanation(2022, pages 10-19):

- **Fairness Depends on Balanced Gameplay:** Pay-to-play players should not have a significant advantage over non-paying players.
- **Fairness is Achieved Through Trust Between Players and Developers:** Players must trust developers to maintain balanced gameplay for the game to feel fair.
- **Fairness Requires Resilience and Skills:** Some players believe skill and effort can offset the disadvantages of not paying, making the game less likely to be perceived as pay-to-win.
- **In-Game Purchases Lead to Imbalanced Gameplay:** Many players feel that in-game purchases provide significant advantages, disrupting balance and fairness.
- **Overpowered Purchases Lead to Common Losses for Non-Paying Players:** Perceived unfairness arises when players lose due to opponents' paid advantages, especially when these purchases are excessively strong.
- **Unfairness Due to Coerced In-Game Purchases Lacking Fair Value:** Players feel coerced into making purchases to remain competitive, often viewing these transactions as offering poor value.
- **Gameplay Becomes Gambling, Thus Unfair:** Randomized purchases create a gambling-like experience, leaving players feeling powerless and unfairly treated.
- **Game Design Encouraging Pay-to-Win with Expensive Items:** Players perceive games as unfair when developers design them to pressure spending, especially by hindering progress for non-paying players.
- **In-Game Purchases as Addiction and Exploitation:** Pay-to-win mechanics are criticized for fostering addiction and exploiting players, which is seen as unethical.

- **Skill Disparities Always Exist:** Players acknowledge that time and effort can compensate for not spending, though pay-to-win systems still influence game dynamics.
- **Significant Power Imbalances Under In-Game Purchase Systems:** Games reliant on paid resources for success are considered unfair, as they heavily favor paying players.
- **Unfair Matchmaking:** Matchmaking systems that pair non-paying players with stronger, paying opponents contribute to perceptions of unfairness.
- **In-Game Purchases Do Not Overwhelm Players' Skills:** Games where skill outweighs the impact of purchases are perceived as more fair. For example, in "Hearthstone," strategic knowledge can help overcome the advantages of expensive cards.
- **Strategies for Casual, Free-to-Play Players to Reach Competitive Success:** Games allowing non-paying players to compete on equal footing with paying players are seen as more fair, emphasizing inclusivity over monetization.

As we can see from the above two studies, there are definitely concerns and risks that these games damage the gameplay experience when employing strategies such as pay-to-win. This work will be incredibly useful while discussing the results of the experiment of this thesis.

To illustrate how large this impact can be on the success of a game, I want to bring up the examples of Bloons TD Battles 2 (Ninjakiwi 2021) and Star Wars Battlefront 2 (Electronic Arts 2017). If players perceive the monetization scheme used in a game as oppressive or feel overly pushed into spending money, they do not shy away from complaining about this or spreading the word.This is what happened during the release of BTD Battles 2 (Ninjakiwi 2021), the long-awaited sequel to the successful first entry in the series. Upon release, the game was heavily criticized for its predatory practices and deemed unacceptable by the community. The developers even had to issue an open apology with a promise to fix the systems in an attempt to save the game (Samninjakiwi 2021).

However, the damage was done, and in only two months, the game lost over 80% of its average player count on the digital distribution platform Steam (SteamCharts 2024), which is extremely high for a service game. The game never recovered. This also happened in a community where the players were generally on good terms with the developers. In contrast, their previously released title BTD 6, which is considered to have "fair" microtransactions, is currently the 32nd highest-rated game of all time on the entire platform (SteamDB 2024).

Another example is the controversy surrounding Star Wars Battlefront 2

(Electronic Arts, 2017), where a similar story happened, as described in the article "EA Admits Defeat, Unlocks All Battlefront 2 Heroes, Removes Pay-to-Win Mechanic" by Joel Hruska (2018). Star Wars Battlefront 2 is the sequel to a game that was well-received but considered to be lacking in depth. EA promised more gameplay features, vehicles, and content in general. However, the developer introduced a revenue model that included loot boxes and pay-to-win mechanics, giving advantages to players who spent real money. Players who did not spend money would have to invest an enormous amount of time to obtain the same content.

This led to significant criticism, including the most downvoted comment on the social media platform Reddit ever, where EA stated that this time spent would give the player a "sense of pride." Right before the launch, under pressure from Disney, they ended up entirely removing the microtransaction system. The backlash was so strong that investigations by lawmakers were held in Hawaii and Belgium. Although EA eventually improved the game, the massive backlash and negative publicity impacted its reputation a lot. This is reflected on Metacritic, where both users and critics can post reviews. While the game has a decently positive critic score of 68, it sits among the lowest user-scored games in existence. Also, the game sold approximately 7 million copies, falling 3 million short of its expected 10 million.

Chapter 4

Study Design

4.1 Formal Requirements

General

The goal of this research is to develop an experiment that allows for an empirical analysis of the impact of pay-to-win on the game experience of players. To achieve this, AB testing will be used. Participants will be randomly assigned, and play one out of two versions of a game that is identical in all aspects aside from the presence of pay-to-win mechanics. Afterwards, their experience will be investigated through a game experience survey. Data between the groups can then be analyzed.

This experiment will be carried out in multiple steps, the first of which is a welcome page. This page will be the first thing participants see and will provide general information about the experiment they are partaking in, with the purpose of providing context, as well as contact information in case of questions.

This page should also provide a terms and conditions section, informing participants about how their data will be handled. Collected data should be processed in full compliance with GDPR. Therefore, the terms and conditions section needs to inform participants on how the experiment satisfies GDPR principles, such as data minimization and purpose limitation. Participants should only be allowed to proceed with the experiment if they accept these terms and conditions. The page should also include a link to the data rights participants have under the GDPR.

Next, the study should conduct a short demographic survey. This is to gain insight into the sample, and its representativeness of the target audience. Furthermore, the study should identify factors that could be relevant to the research subject of measuring the impact of pay-to-win, and include these in the demographic survey. This demographic data allows for segmentation and further analysis. The survey should also include a rationale explaining why the study needs this demographic

data.

The next step is to design a video game prototype that provides an appropriate environment for researching pay-to-win in which participants can engage. The prototype should have two versions, one with pay-to-win mechanics and one without. These need to offer an identical experience, such that the only variable being tested is the presence of pay-to-win mechanics. The requirements for the various parts of this prototype are described in detail in the following section(s).

The last step of the study is to conduct a survey measuring the player's experience after playing the video game prototype. This survey should cover the various dimensions of the game experience that might be impacted by pay-to-win, with questions logically related to the constructs being measured. The survey should aim to maximize using constructs from already validated questionnaires (from existing literature). The survey questions should be designed for quantitative analysis, ideally using Likert-type questions.

Finally, all instructions and language in the experiment need to be clear, allowing participants to complete it without supervision within approximately 10-15 minutes. For participants, the study should establish criteria for eligibility to ensure a sample that fits the study's goals. Pilot testing should be conducted to refine clarity and structure and to avoid unintended biases and confusion.

Video game prototype

The game prototype needs to provide a proper environment to research pay-to-win in games. This means it needs to accurately mimic popular existing pay-to-win games and the practices found within them to create a realistic setting for the experiment, so that it can be representative of real pay-to-win situations. Engagement is a large part of the game experience, which this research aims to investigate; hence, the game needs to be engaging. This requires the prototype to have high-quality, engaging, and polished gameplay on top of satisfactory visuals, and audio. Different data to measure engagement should be identified, and be able to be measured from the game prototype. For example, total play time. Players should also be able to choose how long they play.

To be engaging, the game prototype needs to feature a well-defined gameplay loop that is clear to the player. This is a repeating sequence of actions players take within the game that allows them to experience Csíkszentmihályi's flow (Csikszentmihalyi 2013). The loop has to engage players through skill and strategy and keep them engaged throughout the experiment. This loop should also remain consistent across the two versions of the game so that the variable being tested is the monetization scheme and presence of pay-to-win.

The prototype also needs to have a difficulty curve, meaning as the game goes on, it becomes more challenging. The curve should be designed in a way that can be overcome through player effort and remain engaging. The challenges should feel fair and leave the player with a sense of achievement. However, in the pay-to-win version, the microtransactions should offer shortcuts, boosts, or other ways to make the game easier. Just like the previous point, the difficulty curve needs to be consistent across versions, so changes in perceived difficulty between the versions can be observed.

The game needs to strike a balance between a fair challenge for players and the ability to observe the impact of pay-to-win. This means it needs to be challenging enough to be engaging but not to the point of frustrating players. If the game were too easy, pay-to-win might become irrelevant, and if it were too hard, it might feel pay-to-win is the only option for players. Again, it should be representative of real pay-to-win games The difficulty should allow players to succeed in both versions, with or without paying. The game should start easy, providing an environment for players to get familiar with the game mechanics. Later on, harder challenges are introduced where paying players can use their advantages while non-paying players must rely on skill and persistence. The game should also feature difficulty peaks, creating moments where players may feel incentivized to spend money. In the non-pay-to-win version, players should not feel that the game is unfairly stacked against them, while in the pay-to-win version, purchases should offer real, but not overwhelming, advantages.

Furthermore, the game needs to feature a reward and progression system that rewards the player as they progress through the game. A common concern is that pay-to-win can undermine the sense of progression or achievement by offering faster, paid alternatives, so we want to have such a system present to test this. This could include earning currency, achievements, or other rewards. The progression system should feel engaging and natural, giving the player a feeling of satisfaction as they progress without monetary interference in the non-pay-to-win version. In the pay-to-win version, additional methods of progressing through this system should be available through microtransactions, such as convenience or power items (Alda 2020).

Next, the prototype needs to avoid introducing noise in the data collected. If the versions differ greatly in other aspects besides the presence of pay-to-win, differences in experience could arise from these other aspects rather than from the presence of pay-to-win. Therefore, both versions need to have identical game mechanics aside from the introduced pay-to-win mechanics and, in theory, offer the exact same experience regardless of spending money. This means the design needs to ensure that the extra pay-to-win mechanics are isolated and modular, so they

can be simply turned off and on within the game.

Finally, if the pay-to-win version introduces too many of the problematic aspects of microtransactions described by Freeman (2020) and Alda (2020), players may feel frustrated by the design of the game and its microtransactions, rather than by the pay-to-win elements. Examples of such elements to be cautious with include artificially inflating difficulty, introducing overwhelming power advantages, and predatory advertising practices such as disrupting flow and spamming. The goal is to measure the impact of pay-to-win mechanics, not the impact of (predatory) microtransactions.

Monetization

This section outlines the requirements for the monetization system used in the game prototype. As explained in chapter 2, pay-to-win is a dark game design pattern that is employed within the monetization model of microtransactions. Therefore, the game must support such a monetization model. The main requirement is that this model accurately represents those used in actual pay-to-win games, ensuring that the collected data reflects these games. Thus, the pay-to-win version will need to feature a proper microtransaction revenue model in the pay-to-win version.

The first part of the microtransaction model the game needs is virtual currencies. These currencies should be obtainable through completing in-game activities. In the pay-to-win version, the game needs to include a store window that simulates the purchase of virtual currency with real money. This currency is then used for transactions within the game. The entire process, from earning virtual currency to spending it, should be clear, visible, and intuitive. If players fail to perform transactions or miss noticing them, this could negatively affect the data. Virtual currencies should also be visually appealing to the player.

Next are the microtransactions themselves. These are transactions where players exchange virtual currency for in-game items. To minimize noise, the game should exclusively offer microtransactions that are pay-to-win, providing an appropriate advantage over players who do not purchase them. This advantage must be significant enough for players to feel the difference, though not essential for completing the game. Different types of pay-to-win microtransactions should be present. The transactions and how to perform them need to be clearly visible and well-communicated, using transparent language and pricing.

Additionally, players should understand the impact of these pay-to-win microtransactions. Ensuring that players grasp the advantages these purchases offer and how to make them is a critical part of setting up the experiment. If these advantages are subtle or unclear, it will be difficult to assess the impact of

pay-to-win microtransactions. Furthermore, the amount of currency obtainable per transaction and the prices should realistically mimic real-world pay-to-win games. The pay-to-win microtransactions should also be adequately advertised, reminding players of their availability.

Another common element of pay-to-win games using the microtransaction model is the inclusion of various dark patterns. While pay-to-win itself is a dark game design pattern—defined in this thesis as "a dark game design pattern where players who spend money are more likely to succeed than those who do not"—pay-to-win games tend to feature many other techniques to drive players to make use of the pay-to-win mechanics (Petrovskaya 2021).

The game needs to include an appropriate amount of such dark patterns commonly found in real pay-to-win games. The purpose of these dark patterns should exclusively to make players aware, remind them and incentivize them to purchase the pay-to-win microtransactions. Like the microtransactions, these dark patterns and their purposes should be clear to players and visible in the game, while avoiding excessive intrusiveness to prevent data distortion. Another consideration is that visual elements of these patterns may increase players' cognitive load. The game should not overwhelm players, while still clearly conveying the available information.

Finally, it is essential to maintain ethical boundaries and avoid causing any harm to participants in the experiment. Microtransactions and pay-to-win elements have been linked to negative impacts on mental health and increased risks of financial strain or the development of gambling-like behaviors (Gibson 2022; Steinmetz 2022). This means that all elements of the microtransaction model should avoid exploitative tactics beyond what is necessary to simulate a realistic pay-to-win game. Safeguards should be in place to prevent excessive or regretted spending, such as refunding all money spent after the experiment or prohibiting real-money transactions if deemed unnecessary for the research goals. The game prototype should respect ethical boundaries, creating a safe, controlled, and responsible environment for studying the impact of pay-to-win microtransactions without risking the harmful effects described in the literature.

4.2 Technical Requirements

The experiment should be designed to run without requiring installations, so both the survey and game should be accessible through a web browser, supporting most existing browsers. Additionally, downloadable versions that don't require installation should be available for participants who encounter browser-related issues. Ideally, the game should also support cross-platform compatibility to reach a wider audience, which would require accommodating multiple input methods. The game

should not be demanding on system resources, allowing users with lower-end machines to participate. This means it needs to be optimized and should avoid high-resolution textures or other elements that consume substantial processing power. Finally, to further increase accessibility, all elements within the game should be clearly explained and communicated to allow participation by those less familiar with games.

Chapter 5

Implementation

5.1 Study Overview

The study was hosted on Google Forms and divided into four parts (See Appendix B for the full study). The estimated completion time is around 10-15 minutes. However, when playing the videogame prototype, players can choose how long to keep playing after attempting level 1 a least once, so the duration of participation can vary significantly. Players who enjoyed the game may spend much longer in the videogame prototype than those who did not. Both versions of the game are included in the same prototype, and the prototype randomly chooses one of them when it loads. The four parts that participants must complete are as follows:

1. Welcome page and Terms and Conditions
2. Complete the initial demographic survey
3. Play the Bagels vs. Sandwiches video game prototype
4. Complete the questionnaire

Participants received invitations to participate in the experiment, which included a brief explanation of the purpose of the experiment, its expected duration, and the overall objective. The invitation also contained a URL that participants could click on to access the Google Forms file. Participants were recruited in various ways. These are: sending the questionnaire to friends that play games, and asking them to forward it to their friends, posting the study in online communities such as discord servers and subreddits, and finally, posting the survey on my personal social media accounts such as Facebook and x. This section will now discuss the implementation of each of these parts in chronological order.

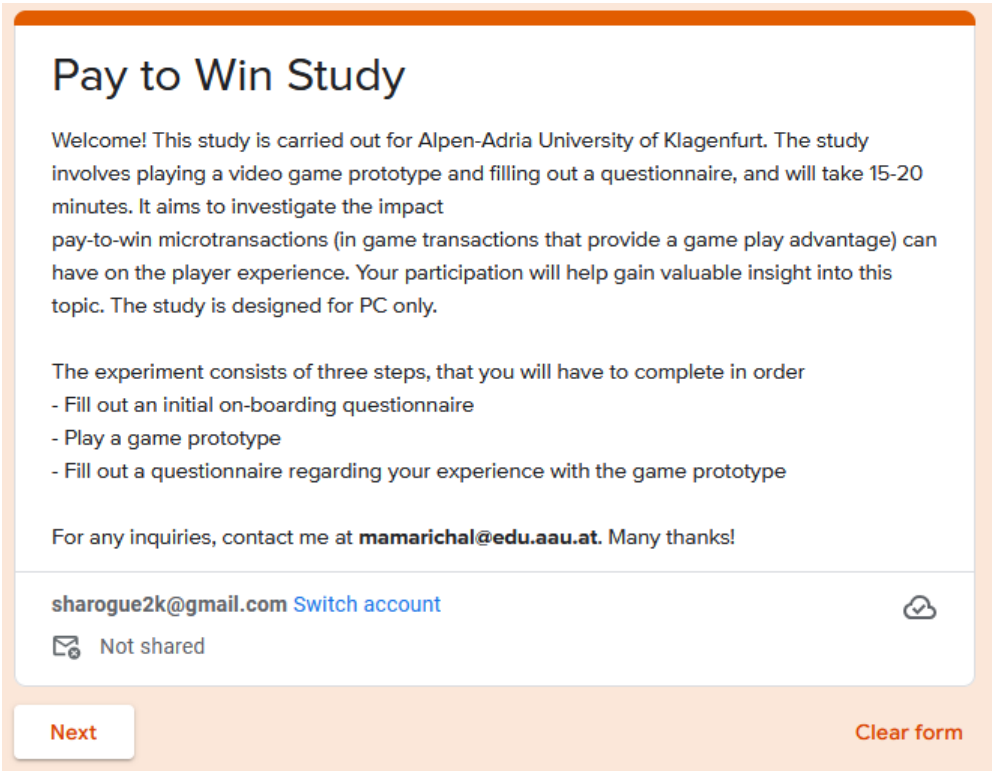

Figure 5.1: The landing page for the study

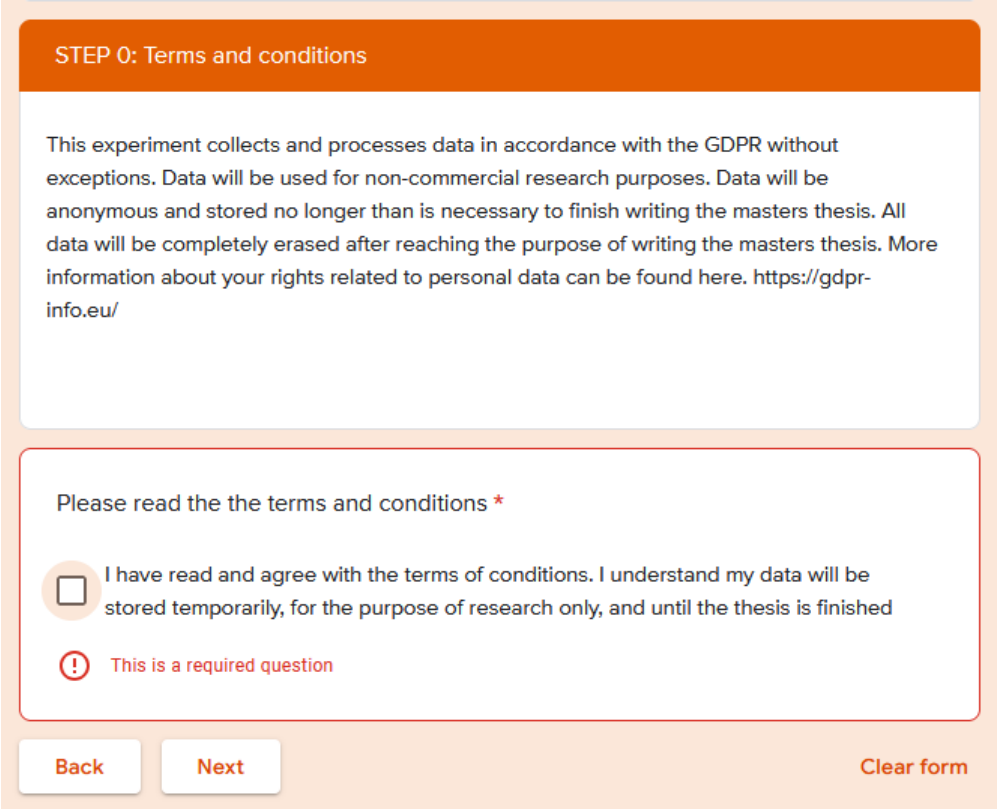

Figure 5.2: The terms and condition page of the study

Landing page

The first page that users see after clicking the Google Forms URL is the welcome page, which is shown in Figure 5.1. After welcoming the participant, a brief overview with general information about the experiment is provided, including details such as how long it will take, the purpose of the study, and who to contact if the participant may have questions. Following this, the three steps the participant needs to complete in order to successfully complete the experiment are described. Note that emails are not collected. Participants can use Google's Gmail to sign in, which allows them to save their progress; however, even if they do so, email addresses are not collected.

The next page, shown in Figure 5.2, requires participants to agree to the terms and conditions of the research. The full text of the terms and conditions reads: *"This experiment collects and processes data in accordance with the GDPR, without exceptions. Data will be used for non-commercial research purposes. Data will be anonymous and stored no longer than is necessary to complete the master's thesis. The data will not be shared, and no third parties will be involved. All data will be completely erased after fulfilling the purpose of writing the master's thesis. More information on your rights related to personal data can be found here: https://gdpr-info.eu/."*. This section explains how the experiment complies with GDPR, covering principles such as purpose limitation, storage limitation, and data minimization.

Participants must actively mark a checkbox labeled *"I have read and agree to the terms and conditions.' I understand that my data will be stored temporarily, for research only, and until the thesis is finished."*, ensuring they have read and understood how their data will be used. Finally, a link to the rights of data subjects is provided for participants who may not be familiar with their data protection rights. Participants cannot proceed to the next step of the experiment unless they have checked this box. This is enforced through a feature in Google Forms that requires a response to the question, in this case by checking the box.

5.2 Demographic Survey

The experiment first featured a demographic survey that participants had to complete before playing the video game prototype. It serves the purpose of collecting information about the participant pool that can be used to investigate potential biases or factors that might influence their perceptions of pay-to-win mechanics and microtransactions in games. Below is an explanation of each of the survey questions, its inclusion in the survey, and the rationale behind its answer structure. In total, there are five demographic questions.

General demographics

The first three questions were designed to help us gain a clear understanding of the demographic composition of the participants, creating transparency and context for the data that we would collect and analyze. By gathering information on nationality, age and gender identity, we can identify diversity within our participant pool. This diversity is essential for ensuring that the experiment's findings are not biased or overly representative of a single demographic group. By including this demographic variable, the analysis of results can account for potential differences in how various groups might perceive or experience pay-to-win mechanics.

How many days in a week do you play at least 30 minutes of video games? (1 - 2 - 3 - 4 - 5 - 6 - 7)

This question is included to measure the frequency of the participant's gaming habits, which is a significant factor in understanding how experienced they are with video games. Regular players may be more likely to have established opinions on game mechanics, including pay-to-win systems and microtransactions, while infrequent players may approach these elements with less familiarity or lower expectations. This question was taken from Balduzzi (2024), who in their research used this question to figure out the gaming habits of participants in their preliminary survey, using the Quantic Foundry's "Gamer Motivation Profile" Survey (Quantic Foundry 2015).

In your opinion, do you play mostly mobile games (games played using your phone) or through other means (computer, PlayStation, Nintendo Switch)? (Mobile - Other means - Both)

This question investigates the gaming platform preferences of participants. Mobile games are notorious in the gaming community for heavily incorporating microtransactions and pay-to-win mechanics compared to other platforms. Participants who primarily play mobile games may have different expectations or tolerance levels for these practices. The three answer options are straightforward and align with common player habits, so that participants can easily identify their platform preferences.

Are you familiar with the concepts of "microtransactions" and "pay-to-win"? (Yes - No)

Familiarity with these concepts is a significant factor in the interpretation of participant responses during the experiment. Players who are already aware of what microtransactions and pay-to-win are might approach games with these elements differently than those who encounter them for the first time. They could be more critical. The binary choice is to create clarity and simplicity in response collection.

5.3 Game Concept

The next section goes in-depth into how *Bagels VS Sandwiches*, the video game prototype developed for the purpose of research within this thesis, fulfills the requirements outlined in the previous chapter, as well as the design and thought processes behind it. The prototype has two versions (pay-to-win and non-pay-to-win), which are identical in terms of gameplay but differ in their monetization methods. This section covers the core game that applies to both versions.

Story and world

To create an environment to conduct research on the impact of pay-to-win, it was stated that the prototype must provide an engaging experience. To achieve this, the prototype features a world and a narrative. To reduce noise, the story and world are not central to the gameplay experience but rather work in the background, giving overall context to the player's actions in the game. This is called environmental storytelling, a term defined by the game studies scholar Henry Jenkins (2004). This means that a game communicates its story without using explicit elements such as dialogues or cut-scenes. Players simply play through the game, and by observing its various elements and spaces, they piece together the story themselves.

The story of *Bagels VS Sandwiches* takes place in Bagelburg, the country of bagels. The country is inhabited by humanoid bagels. As the title of the game implies, the country is being invaded by the Sandwiches, who are the enemy. The player takes on the role of a bagel commander tasked with defending various locations from the Sandwiches. The narrative is designed to be simple and easy to understand, and is communicated through environmental storytelling. In *Bagels VS Sandwiches*, this is primarily achieved through the designed environments. Players are organically introduced to new characters as they progress through the game and learn that the sandwiches are the enemy, and they must defend their castle.

Another very important part of the game is its visual design. Appealing visuals can significantly contribute to the player experience (Friedman, 2015). Garver (2015) notes that visual style is essential to convey the intended tone of a game and its appeal to its audience. The *Bagels VS Sandwiches* prototype is intended to be enjoyed by a wide variety of people. This is why a lighthearted, funny, and goofy visual style is used to fit the story and world. Character design is also one of the primary ways players connect with games, so a significant effort was made to make the game and its characters charming. Additionally, humor in the form of bread-related puns was used to further enhance the prototype's charm. For example, a bagel that uses cymbals to attack is called the "Cymbagel," and an exploding bagel is called the "Grenadel," designed to look like a grenade-bagel. The

charming design and humor are intended to help create the engaging experience the prototype aims to provide, which is crucial for the research experiment.

Game structure

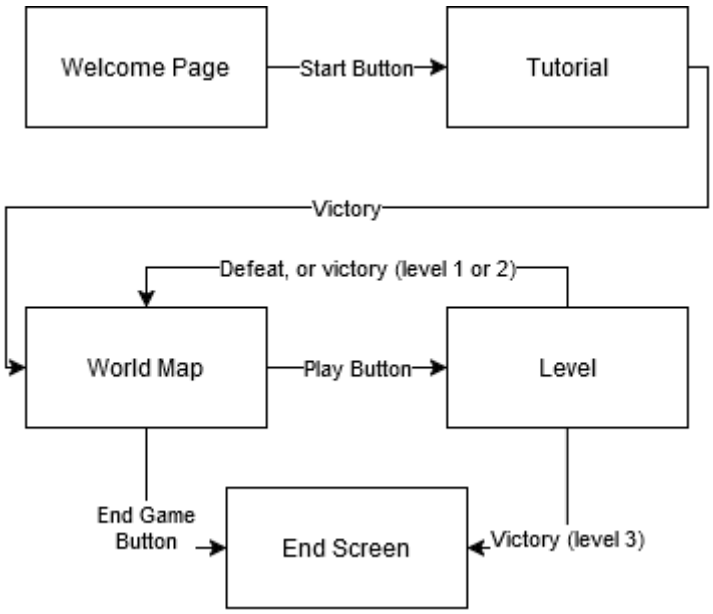

Figure 5.3: Flowchart of the game

Figure 5.3 contains a flow chart of how the game is played for the participants. Players enter the game on the Welcome Page. The *Welcome Page* (figure below) contains instructions on how to play the prototype, such as that players should not reload their browsers, and how to stop playing the game. There is also a credits button that shows all the contributors to the game prototype, which are Anja Kolundjia (Art), Nickolay Markozov (Art), CRAFTPIX.net (Art), Florian Heynen (Sound Effects), Mark van den Broeck (Music), and Krista Gray (Music). After pressing the *Start button*, they are taken to the *Tutorial level*. This level teaches the player step by step how to play the game using animated instructions. The tutorial is designed to be unable to be failed, acting as an environment for players to get familiar with the game mechanics. Upon beating the tutorial, the players are taken to the *World Map* (Figure 5.4).

The *World Map* features five buttons in total. Three of them are located at the top of the screen; the *Store button*, which is used to access the store and the *Stop Playing button*, which takes the player to the end screen. The remaining three buttons are *Level buttons* (the tents). Pressing these allows players to start a level. At any given time, only the first level that the player has not completed can be clicked, so players are not allowed to replay past levels. For example, if they have

beat level 1 and level 2, they can only click level 3. Levels that are completed have a golden star above them, and uncompleted levels have the outline of the star. If players experience defeat in one of the levels, they are taken back to the *World Map*, from which they can enter the level again. If they experience victory in level 3, they have completed the game and are taken to the *End Screen*.

Alternatively, players can manually end the game by pressing the *Stop Playing button*. This button only appears after the player has attempted level 2 at least once. This is to guarantee that players have seen the microtransactions at least once in the pay-to-win version. *The End Screen* (shown in Figure 5.5) thanks the players for playing and gives them a score, reminding them to fill it out in the study (it requires the player to fill in their score before they can continue, since it is part of the data we would like to analyze).

Game mechanics

To create an engaging experience, the game needed to have engaging gameplay. This section explains the various elements that make up the gameplay in the designed video game prototype. *Bagels VS Sandwiches* is a tower defense game, a subgenre of strategy games where the core gameplay revolves around players defending their territory from enemy attacks by building various defensive structures. This typically involves managing resources and strategic thinking to build the most effective defenses (Wikipedia 2024). This genre was chosen because there are many existing popular pay-to-win tower defense games, such as the Plants VS Zombies series (developed by PopCap), the Bloons Tower Defense series (developed by Ninjakiwi) and The Battle Cats (PONOS Corporation 2012). The gameplay is inspired from these three titles.

The game is split into three levels, one of which is the tutorial (level 1), and the others are simply called level 2 and level 3. All levels take place on a *Battlefield*. The *Battlefield* (Figure 5.6) features *grass* (green) and *dirt* (yellow brown). *Dirt* is what the *sandwiches* and *bagel* units walk on, while the *grass* acts as walls. On the left, there is the *castle* that players must defend, and on the right, *sandwiches* appear, walking toward the *castle*. When the *sandwiches* reach the *castle*, they begin attacking it, causing the *castle* to lose health points. This is represented by the green bar labeled "BASE HP." When a *castle* is destroyed, the player loses.

Players can create bagel units by clicking the *Bagel buttons* at the top (In Figure 5,6), the player can create Plain Bagels, Poppy Seed Bagels and Cymbagels). Created bagel units then appear in the castle, and start walking left on the dirt, engaging with any enemy sandwiches they encounter. Each bagel has a dough cost and the player gains dough periodically, which limits the number of bagel units they can create at any given time. A level lasts 120 seconds (the tutorial is an exception

Figure 5.4: Level select screen of the game

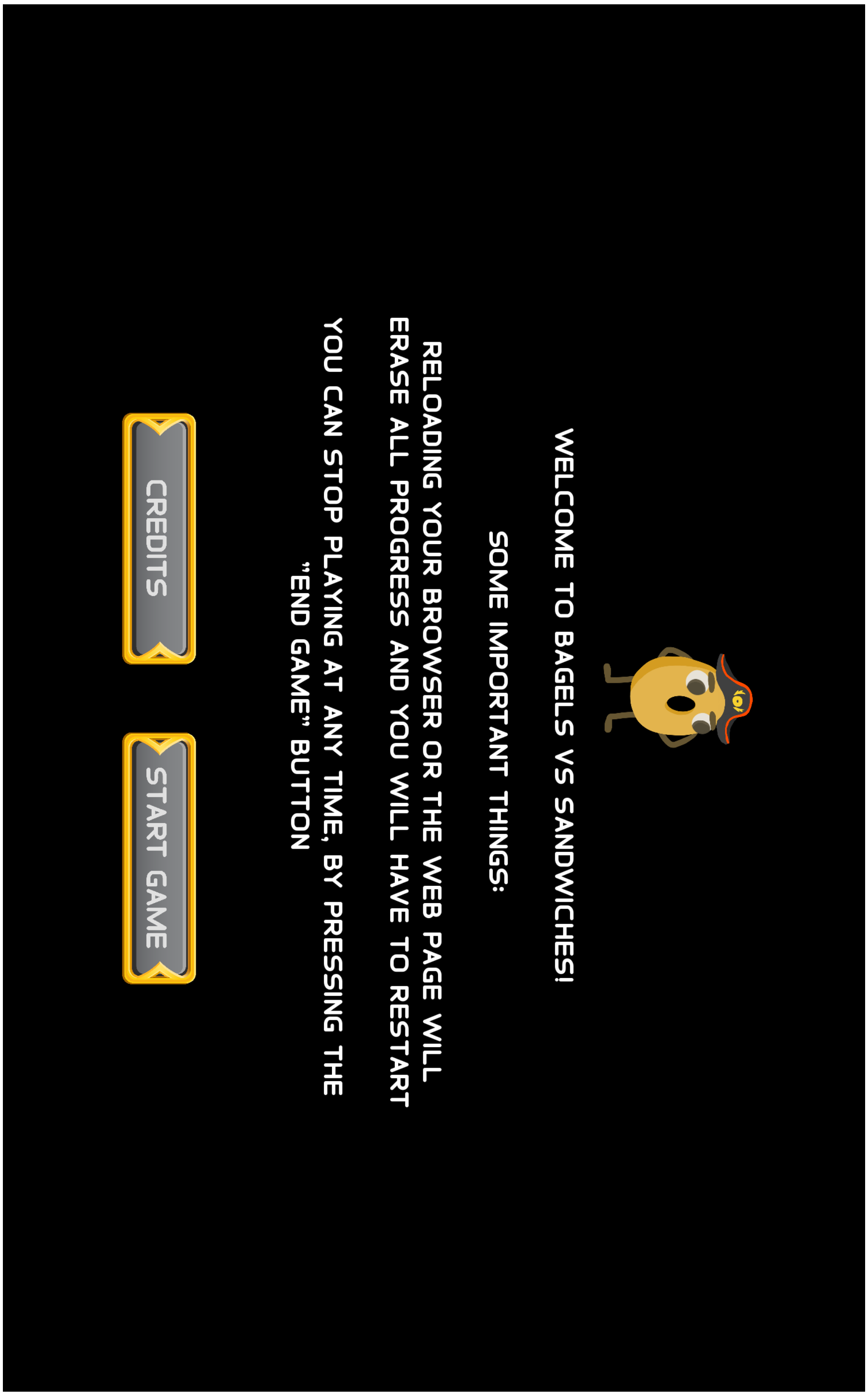

Figure 5.5: Ending screen of the game

to this), during which various waves of sandwiches will appear and attempt to destroy the castle. If players successfully defend throughout this time, the enemy commander will make their entrance. This is a stronger sandwich that the player must defeat to win the level. To communicate this, a different and more intense soundtrack will start playing, and the enemy commander sandwich is visually distinct (it has a red outline and text that says 'commander' above it). Players can check the remaining time of a level by looking at the red bar labeled 'Commander', which indicates how much time it will take before the enemy commander approaches.

Thus, the core gameplay loop is very simple: players observe the battlefield, checking how many sandwiches are approaching, and then strategically decide which and how many bagels to create to fend off the threat. This process repeats until the end condition, which is either the castle being destroyed, resulting in defeat for the player, or the player defeating the enemy commander, resulting in victory. The level length of 120 seconds was chosen after several playtests, to allow players to feel invested in the level without making it overly long. The gameplay engages players through the strategical administration of their resources, to be able to successfully defend the castle. They need to consider which bagels to create to deal with enemies effectively.

The game features different types of bagels, each with different uses and prices, which offers room for exploration and strategizing. In total, there is one type of enemy and five different bagel units. At first, eight different units and five different enemies were included, but this was deemed too complex for the scope of the experiment, so it was reduced to five bagel units and only one type of enemies. The remaining bagel and sandwich units are as follows:

- **Plain Bagel:**A bagel unit that simply attacks with its sword
- **Poppy Seed Bagel:**A bagel unit that attacks from a distance, shooting poppy seeds
- **Holy Bagel:**A bagel unit that heals the bagel in front of it
- **Cymbagel:**A bagel unit that can damage multiple sandwiches with its attack, using cymbals.
- **Grenadel:**A bagel unit that explodes upon touching a sandwich, dealing heavy damage
- **Plain Sandwich:**A sandwich unit that walks right and attacks fast

Players start the game with the plain bagel and poppy seed bagel unlocked. During the tutorial, the player can only use plain bagels, but afterwards the poppy seed bagel also becomes available. Players can then unlock more units throughout

Figure 5.6: Screenshot taken during gameplay

Figure 5.7: Selecting units before battle

the game. Before starting a level, the player can select which of their unlocked bagel units to bring to battle (Figure 5.7), up to a maximum of three. Hence, unlocking new units increases the complexity of the game by offering more options for approaching a battle. All units are estimated to be equally strong, except for the plain bagel. This is because we want to encourage players to use the new units they unlock instead of always relying on the plain bagel. Players can also read what the different bagel units do on the unit selection screen.

Figure 5.8: Obtaining new units through the store

Players can obtain new units through the store window. This screen features a button labeled bagel box, which rewards the player with a random unit that they have not unlocked yet. A bagel box costs 600 coinels, which is a currency that is given through players throughout the game. They receive an amount after attempting a level, regardless of the outcome. The *Coinel* system also doubles as a reward system, rewarding players for their actions. Players earn more for successfully completing a level, reinforcing that they achieved something, while still earning a decent amount for defeat. This is to make simply attempting a level also feel rewarding, while still incentivizing players to go for the victory. This amount totals 250 on average. However, the tutorial only rewards 150. This means that it takes a little under three attempts at levels for players to unlock a new unit and 8 attempts to unlock all the units in the game, after which the bagel box only gives plain bagels.

Difficulty

As for the difficulty curve, the requirements stated that the game should become more difficult as it progresses, but in a way that can be overcome through the effort and engagement of the player. In *Bagels VS Sandwiches*, difficulty arises from strategically allocating resources (spending dough to create bagel units and using powers) to defend against incoming enemy sandwiches as efficiently as possible. The two main factors that influence this difficulty are, first, the amount of enemies that the level throws at the player; the more enemies, the more optimal players need to be with spending their resources, and secondly, the pacing of levels. Levels that send out a lot of units at the same time are harder than those that spread them over time.

Keeping these two factors in mind, the levels are designed to offer a fair, but challenging experience. Using a level that has multiple lanes was considered, but was deemed too hard, as the intended experience is around 10 minutes. The number of enemies that appear increases each level. The tutorial is designed to be easy and acts as an initial sandbox for players to learn the game. Level 1 requires some strategic use of resources, but is not overly difficult. Level 2 is the difficulty peak, where the amount of strategy and skill required increases significantly. This is where players may feel incentivized to purchase some pay-to-win microtransactions to make the game easier.

Collecting data

To further understand the impact of pay-to-win mechanics, the prototype collects data while the player is playing. After the game ends, the player is asked to fill out their score in the questionnaire. This score contains the collected data. It also doubles as a check to see if players actually engaged with the game, since the score follows a specific format. Data entries that do not comply with this format indicate that a participant just went ahead and answered the questions without playing the video game prototype. The format of the score and the data collected is always a number consisting of four digits, which means the following:

- **First digit:** The amount of levels the player successfully completed, ranging between 1 (beat the tutorial) and 3 (beat the whole game).
- **Second and third digit:** Total amount of time spent playing in minutes from pressing the *Start Game* button on the start screen until the player completes the game or presses the *Stop Playing* button. The value ranges between 0 and 99.
- **Fourth digit:** Which version the player was playing. 1 for the non-pay-to-win version, else 2.

Thus, a valid score would for example be 2112, meaning the player spent 11 minutes playing the pay-to-win version, and beat 2 levels.

5.4 Pay-to-Win Mechanics

The prototype features three pay-to-win mechanics. They were designed such that we can simply add or remove the option to pay-to-win without impacting the gameplay experience. In other words, the pay-to-win aspect of the mechanic is modular, as stated in the requirements. The first of these and the main mechanic that can be pay-to-win is the *powers system*. This system is built on the core gameplay loop to increase complexity and keep the experience engaging throughout the experiment, while also being able to function as a pay-to-win mechanic.

Powers are special abilities that players can use during levels that temporarily give them an advantage. Players can activate them by clicking the power buttons, located on the right side of the red and green bars depicting the health points of the castle and the time before the enemy commander arrives (see Figure 5,6). Six powers were designed and implemented, but ultimately only three are used in the actual prototype to avoid the game becoming overwhelmingly complicated. The three featured powers and their effects are:

- **Miner Bagel:** After placing a miner bagel, it will start generating dough for a certain period, allowing the player to create more bagel units.
- **Turret:** After placing a turret, it will attack nearby enemies for a certain period.
- **Dough Roller:** After placing a dough roller, it rolls to the right, heavily damaging any sandwich on its path.

Powers are a limited resource, meaning the player can only use each power a certain amount of time per level, prompting players to carefully choose the right time to use the right power. The player starts each attempt at a level with a certain amount of powers that they need to use strategically to beat levels. Baseline, this is 1 Miner Bagel, 2 Dough Rollers and 2 Turrets. The modular pay-to-win aspect is that players can increase the amount of powers they receive at the start of a level by spending money on the pay-to-win microtransactions. The pay-to-win version is clearly advantageous, as having more powers provides a significant benefit during a level. Theoretically, the players can beat the entire game with enough powers.

The second pay-to-win mechanic is the unlocking of new units. As a reminder, players choose three units out of the ones they have unlocked to bring to a level, which they can use to defend. Unlocking more types of units increases the available options for players, allowing for more strategic combinations. Some combinations are significantly stronger than others, making it harder to complete levels for players who do not have access to these combinations. Also, since it is nearly impossible to make every unit equally strong, some units are inherently

stronger than others. This in turn also creates an advantage for players who have access to more units, offering a gameplay benefit. Therefore, buying units with real money is pay-to-win.

However, this differs from the powers system, which is considered a *power item* (Alda 2020). Players who do not spend money can still eventually obtain all units, though this requires significantly more time and effort. Hence, purchasing units is an *advancement item* (Alda 2020). This system also satisfies the requirement of being applicable to both versions, as in the non pay-to-win version, players can still unlock units with Coinels, while in the pay-to-win version, unlocks can be made purchasable.

Finally, the game features premium bagels. These are special units that the player can unlock and use in levels. They are designed after the premium plants microtransaction in Plants VS Zombies 2 (PopCap 2013). Premium bagels are exclusively obtainable through the spending of crystals (a virtual currency that will be introduced later). Hence they are only obtainable through real money. These are significantly stronger than normal units, thus these are also *power items* as they offer a clear advantage that can not be obtained without spending real money (Alha 2020).

5.5 Monetization

This section discusses the various monetization practices the pay-to-win version of the video game prototype employs to simulate a real pay-to-win environment. These are added on top of the non pay-to-win version of the game prototype. I will abbriviate both versions as the non P2W version, and the P2W version. Note that as stated in the requirements, the pay-to-win version simply has extra modular pay-to-win microtransactions, while not changing the gameplay, the difficulty of the game or any aspect in any way.

As mentioned in the theory, to satisfy the requirement of creating a realistic pay-to-win scenario, the game will use techniques found in existing pay-to-win games from the same genre, creating a realistic but bare-bones microtransactions monetization model featuring pay-to-win microtransactions. To achieve this, the designed revenue model will mimic practices found in the three games the gameplay was based on, which are Plants VS Zombies 2 (PopCap 2013), BTD6 (Ninjakiwi 2018) and The Battle Cats (PONOS Corporation 2012).

Virtual currencies

The first element element of the designed microtransactions revenue model is a premium virtual currency, and a currency store where players can purchase both

virtual currencies. The base game only had one currency (*Coinels*), but the pay-to-win version of *Bagels VS Sandwiches* introduces one extra virtual currency that is used within the game to complete purchases, *Crystals*. This second currency, referred to as the premium currency, is exclusively obtainable by purchasing it with real money. The game features a handful of "exclusive" transactions that can only be performed with *Crystals*, which usually offer extra value and are more appealing.

Figure 5.9: The "Crystals" and "Coinels" virtual currencies

The normal currency is the same currency as players earn in the non-pay-to-win version, *Coinels*, and the premium currency is called *Crystals*. Coinels (a pun on coin and bagel) are the small gold bagel-shaped coins shown in Figure 5.9, and Crystals are the purple objects. They are always displayed next to each other in-game. Both currencies are purchasable through the currency store, which is accessible via the *Get Currency button* on the *World Map*, located next to the currency counters.

Figure 5.10: Virtual currency store in *Bagels VS Sandwiches*

The currency store itself features eight microtransactions buttons, with four for each currency, allowing players to purchase varying amounts. These buttons are sorted in ascending order, from cheap to expensive, per currency. Each button has a visual image that shows the item that the player can purchase. This visual is either Coinels or Crystals, and the more expensive the option, the more Coinels and Crystals are displayed. The real world currency used to exchange for virtual currencies is the US dollar ($), as it is the most widely accepted global currency (Statista 2024). I plan to make the experiment available to online communities I am a part of, with people from all over the world; hence, the US dollar was chosen as it is the most global. The "FREE!" button is a dark game design pattern that will be discussed later. Note that while in the base game, players could only earn Coinels through playing the game, they can now also purchase them directly from the currency store. Crystals, however, are exclusively obtainable from the currency store.

Coinel	**Price ($)**	**Extra value ($)**
800	2	-
2100	5	0.05
4400	10	0.10
9600	20	0.20
25000	50	0.25

Crystal	**Price ($)**	**Extra value ($)**
40	2	-
105	5	0.05
220	10	0.10
480	20	0.20
1250	50	0.25

Table 5.1: Pricing for Crystals and Coinels

The amount of currency the player receives scales with the amount of US dollars it costs. A Coinel is worth $0.0025, and a Crystal is worth $0.05. Crystals are worth four times as much as Coinels, and this is because the games used as inspiration always make the premium currency more valuable than the normal currency to give the player the feeling that the premium currency is "better" and more appealing. The full distribution of the prices can be found in the table below.

The table features a column called "extra value," which is a bonus amount of currency the player receives when making these purchases, expressed as percentages. This is a dark game design pattern that will be discussed later. For example, when purchasing Crystals for $50, you receive the baseline 1000 Crystals

plus 25% of 1000 extra, which is 250 Crystals, totaling 1250 Crystals. This extra value becomes increasingly more profitable the more expensive the purchase is.

Microtransactions

Aside from the microtransactions offering virtual currencies, the game includes five additional microtransactions, which will be discussed below. All of them can be purchased through the store, accessible via the "STORE" button on the *World Map*, which in the base version only had the option to unlock new units through bagel boxes (Figure 5.8 shows the store in the non P2W version and Figure 5.11 shows the store in the P2W version).

Figure 5.11: Power microtransactions in *Bagels VS Sandwiches*

The first three microtransactions are powers. These increase the amount of the respective power the player receives at the start of the game. To explain the prices, I want to introduce the notion of value, which I use to balance everything in the game, and it expresses how valuable an item is during a level. For units, this is simple, as its value is just its cost times 10. So, if a Plain Bagel costs 60 Dough to make, it has a value of 600. Crystals are worth 400 value, so we can get the prices of

the individual power microtransactions by calculating their value. For powers, the value needs to be calculated in a different way for each power, which is done in the following ways:

- **Miner Bagel:** A miner bagel generates 6 chunks that are worth, on average, 30 dough. This totals 180 dough. Players can use this to make 3 plain bagels, which are worth 1800 in total value.
- **Turret:** Turrets shoot projectiles dealing 5 damage each over 15 seconds, at a rate of 2 projectiles per second. This totals 150 damage, enough to take out 1 bagel and two-thirds. Hence, the turret's value is 1000.
- **Dough Roller:** Dough rollers deal 30 damage to each enemy sandwich hit, averaging 4 enemies hit. This results in 120 total damage, which translates to a value of 800 using the same logic as for the turret.

The remaining two microtransactions are the aforementioned premium units. The game features two of these, the Baegel and Potagel. They are priced at $5, which is the same price as most premium plants in Plants VS Zombies 2 (Plants VS Zombies Wiki, 2024).

Figure 5.12: Premium unit in *Bagels VS Sandwiches*

The final microtransaction is a popup that presents a deal to the player. It offers a power pack, which contains 1700 coinels and three of each power (miners, turrets and rollers) microtransaction. The popup is designed to pressure the player to purchase it, employing fear of missing out. It has a label with "130% value", making the player feel like they would miss out if they did not purchase this pack (note also that the only options are to purchase the pack or press the "skip offer" button).

Figure 5.13: Special offer microtransaction in *Bagels VS Sandwiches*

The title "special offer" also implies that this is a one-time offer, and players have to purchase it now. The timing of the popup is a dark pattern. This popup appears after the player loses a level. Advertising pay-to-win after players experience defeat reminds them they could spend money to not lose. Finally, the offer features some flavor text to help present a good deal.

Dark patterns

The pay-to-win version of the prototype also features a number or dark (game design) patterns commonly found in similar games, which have as goal to remind the player and incentivize them to make use of the pay-to-win microtransactions. These patterns are exclusively connected to the pay-to-win microtransactions, such as reminding players they can spend money to make the game easier. They are also modular and non present in the non P2W version. The dark game design patterns and their purpose are designed to be easily understood by players and are clearly presented within the game, while avoiding being too intrusive. Again, the included dark patterns are mimicking those found in Plants VS Zombies 2 (PopCap 2013), BTD6 (Ninjakiwi 2018) and The Battle Cats (PONOS Corporation 2012)

Virtual currencies are used to obscure how expensive in-game purchases are for players, which consequently reduces the 'pain' felt when making purchases through microtransactions (Zhirkova 2020). The options for purchasing virtual currencies in *Bagels VS Sandwiches* feature a similar practice, where it is difficult

for players to track how much a single Crystal is worth. One Crystal is worth $0.05, and one Coinel is worth $0.0025. If they were, for example, worth a multiple of 10, it would be significantly easier for players to calculate these values.

Figure 5.14: The different options to purchase crystals.

Individual transactions are also presented as good deals to the player. Table 5.1 shows the calculations behind the price points and how many crystals the player receives (1 crystal = $0.05), with the "extra value" column showing how many free crystals the player gets when purchasing a bundle. For example, when purchasing for $4.99, the player receives 5$ $0.05 = 100 crystals, plus 5% extra value, so in total, 105 crystals. This extra value increases as the purchases get more expensive, incentivizing players to spend more money on the higher-priced options.

Additionally, the extra value makes calculating the value of crystals even harder for players. However, the $9.99 option was made to give the most extra value, with a "Best Value" star on the $9.99 option (similar to how Plants VS Zombies 2 features a "most popular" star on one of their options). Making the most expensive option the "most valuable" (but not the most expensive) is another dark design pattern. Finally, the store also features the traditional pricing strategy of just below a whole number at $0.99, which is also used by the example games.

The game prototype also employs elements to make the paid options look more appealing compared to the normal ones. This is done by adding keywords like “premium” and incorporating extra visual elements to make paid options better. Also, in both the currency store and the item store, options that can be purchased with the paid option, crystals, are placed before the other options. Hence, if a player wants to purchase something with coinels, they have to scroll past the paid options each time, since they are in the same store as the paid options.

Another common dark game design pattern found in the example games and employed in *Bagels VS Sandwiches* is the design of elements that remind players

to visit the store and that pay-to-win options exist, such as that necessary items (bagel boxes) that the player needs to purchase with coinels are placed in the same store as the paid options. Players thus need to visit the store every time they need such an item. Next, the game features a pop-up (see Figure 5.15), another element found commonly in games featuring microtransactions (Alda 2020), that appears after the player has finished the first level, the tutorial, on the main map. It reads, *"Obtain more units and powers through the store"*, communicating that the way to obtain new units and powers in this game is through visiting the store. This implies that to progress in the game, it is necessary for players to open the store. Even players who intend not to spend money will have to open the store, and be reminded that they could spend money on microtransactions.

Figure 5.15: Pop-up after reaching the world map for the first time

Store buttons are designed to be appealing and draw attention (See Figure 5.16). The currency store, which is opened through the *Get Currency* button, has a red plus sign that is animated to draw attention. The phrasing also specifically uses the word "get", instead of something like "purchase". The microtransaction store, which is opened through the *Store button*, features the same sparkles found on the premium bagel box store button (figure), and features a different color to make it visually distinct. The rest of the world map is relatively bland, making these buttons stand out, with the intention of players acknowledging them each time they return to the *World Map*.

Furthermore, other ways to access the stores were placed strategically to

make accessing them easier and remind players. The unit selection screen (where players select which units to bring to a battle as seen in Figure) has a *Buy Bagel Boxes Buttons*, which leads to the store, and inside the microtransaction store, there is a *Get More Currency button* that leads to the currency store.

Figure 5.16: "Get Currency" and "Store" buttons

The game also features elements to incentivize players to purchase microtransactions. First, there is obviously the pay-to-win nature of the game. Players who struggle to beat levels may feel frustrated and become more likely to purchase pay-to-win microtransactions to get past roadblocks. The difficulty peak in level 3 requires significantly more strategy and effort from players to get past, so in the pay-to-win versions, players could feel incentivized to spend on the pay-to-win microtransactions. Pay-to-win is usually classified as a dark game design pattern in itself, or a predatory technique, because it sells in-game advantages to the players (Zendle 2013, Alha 2020, Freeman 2020, Petrovskaya 2021), and that is no different in this game.

Very early on in Plants VS Zombies 2 (PopCap 2013), the game makes the player open the store, where they receive enough currency to purchase one premium pinatas (a type of loot box featured in the game), and then forces the player to purchase a premium pinata. This is presumably to have the player experience the value that spending real money gives. In the previously mentioned presentation *"Let's Go Whaling: Tricks for Monetization"* (Jernström 2016), one of the described techniques was the *'ice breaker'*, explaining that players are more likely to make purchases after they have made the first one. It was also explained how games need to incentivize players to make that initial purchase. Giving the player enough currency to make this initial purchase and forcing them to do so can be considered a technique to "break the ice."

In *Bagels VS Sandwiches*, I implemented something similar that has players experience the advantages that the pay-to-win mechanic of purchasing additional powers offers. In the non-pay-to-win version, players start the game with 1x Miner, 2x Dough Roller and 2x Turret. In the pay-to-win version, they only start with 1x Miner, 1x Dough Roller and 1x Turret. However, the currency store features a button that gives the player 40 crystals for free, which players can use to purchase 1x Dough Roller and 1x Turret without spending money. Note that the end result is the same in both games.

Figure 5.17: "Free Crystals" buttons

5.6 Ethical Safeguards

In the end, spending money in the pay-to-win version of the game was disabled entirely. When attempting to purchase a microtransaction, players simply receive a popup explaining that the spending of money is disabled (Figure 5.18). Allowing real-money transactions in an experimental setting could inadvertently expose participants to the risks associated with pay-to-win, which would violate the ethical boundaries set up in the formal requirements.

Furthermore, the primary goal of this research is to investigate the effects of pay-to-win mechanics on the player experience, such as perceptions of fairness, autonomy, and enjoyment. Such effects can be studied effectively by simulating the environment of a pay-to-win game without requiring participants to spend actual money. Also, introducing real-money transactions would introduce a bias to the study by linking player experience to their financial resources. By disabling the ability to perform transactions, the experiment can maintain the controlled environment where responses are based solely on their in-game experience and not linked to external financial influences.

Some other approaches that were considered:

- **Refunding any money spent after the experiment has ended:** This is not realistically achievable. The questionnaire is designed to be completed individually and anonymously, and this would require monetary transactions with personal information and maintaining contact after the experiment. Introducing this would undermine the controlled environment of the experiment.

- **Giving the participants "fake money":** This approach was tested during a pilot test, but what happened was that players spent way more money and approached the game differently than they would if it were real money, skewing the data. Also, they did not feel the impact of pay-to-win since there was no reason to not spend money.
- **Putting a limit on the amount of money players could spend:** Unfortunately, this approach does not work as well, as the experimental nature of the experiment would most likely lead to regret for any purchases made, which violates the ethical boundaries. It also links the study to the player's financial resources.

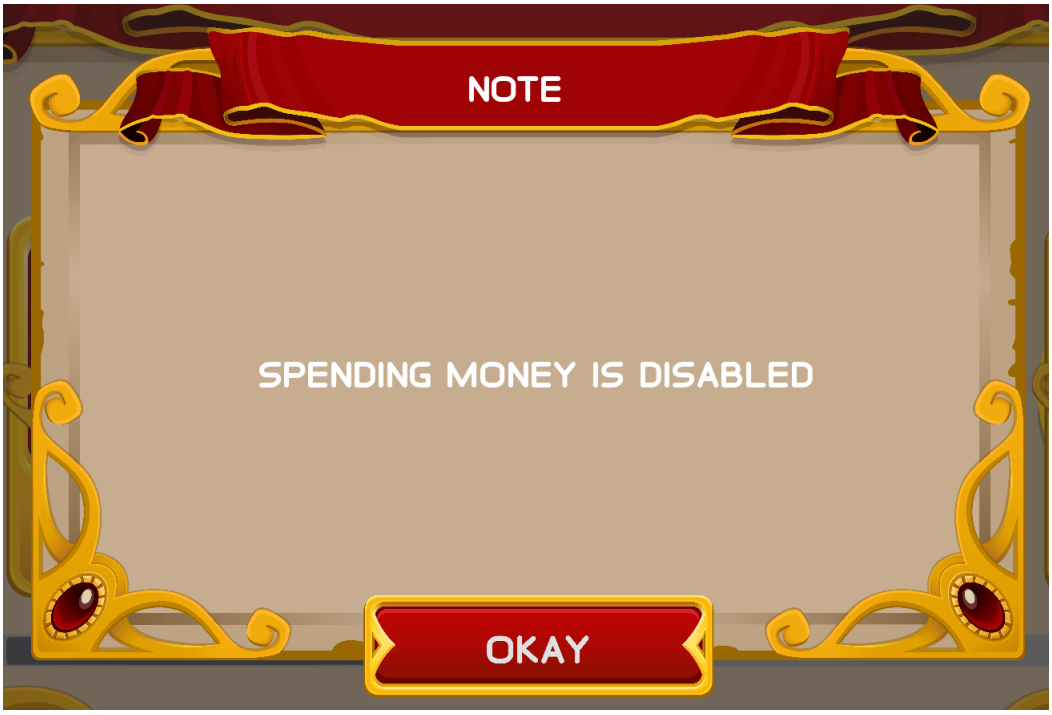

Figure 5.18: Popup upon attempting to purchase a microtransaction

5.7 Game Experience Survey

The survey I ended up including is a mix of constructs found in the Player Experience Inventory (PXI) (Abeele, 2020), the Basic Needs in Games Scales (BANGS) and three constructs I designed myself to cover areas existing game experience questionnaires do not include. It aims to cover all possible dimensions of the game experience that might be impacted by pay-to-win. Each construct features only one item. This decision was made after pilot testing, as participants

pointed out they felt the experiment dragged on for too long, which resulted in them dropping out. This comes at a loss of accuracy, but allows us to collect significantly more data because more participants could complete the study.

Each question was answered using a Likert scale type, with answers ranging from -3 to 3. I chose this scale because the PXI, from which most of the questions come, uses this scale. The BANGS uses the more traditional 1-7 point type Likert scale. I will now go over each construct and list their item, as well as what they aim to measure, and why it is included.

"I liked playing the game." - Enjoyment

This question is taken from the PXI (Player Experience Inventory 2024). Assesses whether pay-to-win (P2W) mechanics enhance or detract from the overall enjoyment of the game. If participants report reduced enjoyment, it could indicate negative effects of P2W systems on the player experience.

"Playing the game was valuable to me." - Meaning

This question evaluates whether players find the game meaningful and if P2W mechanics affect their perception of the game's value. If P2W detracts from the feeling of meaning, it could reduce overall satisfaction and engagement with the game.

"The challenges in the game were at the right level of difficulty for me." - Appropriate Difficulty

This question is taken from the PXI (Player Experience Inventory 2024). It evaluates whether P2W mechanics alter the perceived difficulty, such as by making the game feel too easy for those who pay or too difficult for those who do not. It provides insights into how P2W affects the perception of game balance and challenge.

"I felt eager to discover how the game continued." - Curiosity

This question is taken from the PXI (Player Experience Inventory 2024). It assesses if pay-to-win mechanics diminish the player's interest in the progression of the game. If P2W elements feel intrusive or obstructive for players, they may feel less like continuing.

"I felt a sense of mastery playing this game." - Mastery

This question is taken from the PXI (Player Experience Inventory 2024). It investigates if P2W interferes with the sense of achievement that players derive from skill-based gameplay. Undermining mastery could reduce player satisfaction.

"I was immersed in the game." - Immersion

This question is taken from the PXI (Player Experience Inventory 2024). Immersion is an important factor in providing an engaging game experience. Pay-to-win could disrupt immersion through elements that remind players of unfair advantages they could obtain.

"I felt free to play the game in my own way." - Autonomy

This question is taken from the PXI (Player Experience Inventory 2024). Autonomy means the player's ability to make meaningful choices in gameplay. This could be impacted by P2W if players feel like they have to spend money to succeed within the game. The question measures the sense of freedom the player feels.

"I could play the game the way I wanted." - Autonomy Satisfaction

This question is taken from the BANGS (Ballou 2024). It further explores autonomy by measuring the player's satisfaction with being able to play the game in their preferred manner.

"I felt forced to take certain actions in the game." - Coercion

This question is taken from the BANGS (Ballou 2024). Autonomy frustration happens when players feel coerced into specific choices, such as paying to progress. This question evaluates whether P2W mechanics contribute to a sense of being forced, negatively impacting the experience.

"I felt a sense of achievement while playing the game." - Achievement

This question is taken from the BANGS (Ballou 2024) from a construct called "competence satisfaction." Competence satisfaction measures if players feel accomplished through their efforts. Pay-to-win systems can diminish this sense if players perceive their accomplishments are purchasable rather than earned.

"I often felt that I lacked the skills necessary for the game." - Inadequacy

This question is taken from the BANGS (Ballou 2024). It measures whether players feel inadequate while playing. Players could perceive difficulty as designed for paying players, hence making them feel this way.

"I felt like the game was trying to influence me into making certain decisions." - Manipulation

This question was designed by myself. It assesses whether players perceive the game as honest or manipulative. The pay-to-win dark game design pattern could lead to players feeling exploited or deceived, hence causing a negative experience.

"Winning in this game feels like a result of skill." - Outcome Fairness

This question was designed by myself. Outcome fairness measures if players experience success in the game as a result of their own skill. This could be influenced through purchasable in-game advantages. This question can help understand how pay-to-win systems affect perceptions of fairness in the game.

"The distribution of rewards felt unfair." - Unfair Rewards

This question was designed by myself. It investigates a different kind of fairness, namely whether players feel that the rewards they get for playing (in this case, Coinels), are fair. The distribution, even though identical, may feel less fair in the pay-to-win version due to the ability to purchase rewards with money.

Chapter 6

Study results

This chapter presents the results of the study analyzing the collected data so that it can be used in later discussions about the impact of pay-to-win mechanics on the player experience. The chapter begins with an explanation of the filtering process for invalid data to ensure only high-quality responses were included in the analysis, as there was a risk of incomplete or inadequate responses.

Next, the demographic survey results are presented to study collected data on nationality, age distribution, gaming habits, and familiarity with pay-to-win mechanics. Following this, data collected from the game prototype itself is presented, including metrics such as the version of the game played, the playtime duration, and the highest level reached by participants.

The following section presents the results from the game experience survey, including statistical tests such as the Mann-Whitney U test. To further explore relationships between different constructs, correlation analyses are also performed. These include the Pearson r, Kendall t, and Spearman r tests. Finally, the comments from participants on the video game prototype are grouped by sentiment and presented.

The figures in this chapter were created using the following Python modules: `seaborn`, `matplotlib`, `pandas`, `scipy`, and `numpy`. The full code is available in Appendix A.

6.1 Filtering of Invalid Data

The designed study allowed participants to have a certain level of agency over the experiment, and was designed to be carried out independently to allow for easier collection of responses. This brought about some issues. Since there is no supervision, participants can ignore instructions or as explained see later, even intentionally give false replies. Users can also choose to not engage with the

prototype at all but still fill out the game experience survey. To counteract this, I implemented a check to verify whether users properly interacted with the prototype. This is done through the scoring system that was presented in section 5.4. During the study, users are asked to fill out the score they got in the game prototype. This score follows a strict format, so any deviation from this format can be interpreted as a user failing to either engage with the prototype properly, or understand the instructions, resulting in an invalid response.

Secondly, the scoring system also checks how long users engaged with the prototype. As participants are allowed to stop playing at any point, they could for example stop playing after the tutorial, without engaging with any of the pay-to-win systems. To properly measure the impact of pay-to-win mechanics on the game experience, it is crucial that players in both versions properly engage with the prototype. Therefore, to increase the quality of the data, I decided to filter out any responses that have a playtime of less than three minutes. The tutorial takes one minute, so any response that has played three minutes or more has at least attempted the first level and consequently had to chance to engage with the pay-to-win mechanics and view the dark game design patterns in the pay-to-win version. I also decided to omit any response that has a playtime of longer than 30 minutes, as this most likely indicates that they left the game running after filling out the questionnaire, introducing unreliable data to the experiment.

In total, the study received 93 respondents, of which 77 remained after filtering, meaning there were 15 total answers that were considered invalid. The possible reasons for why people did not properly engage with the prototype will be discussed in chapter 7.

6.2 Demographic Survey Results

To check if this study's sample is representative of the target audience, demographic questions were included into the study. The target audience for this experiment was anyone who regularly engages with video games. Furthermore, these questions allow us to ascertain a level of diversity in the sample, and check for any sample biases. Finally, it can be used to identify different groups that responded differently to the experiment.

Nationality

In total, participants of over 24 nationalities participated in the experiment. A large part came from Belgium (22) and the United States (15). There were six participants from Canada, four from the Netherlands, and the rest of the nationalities had one, two, or three participants each.

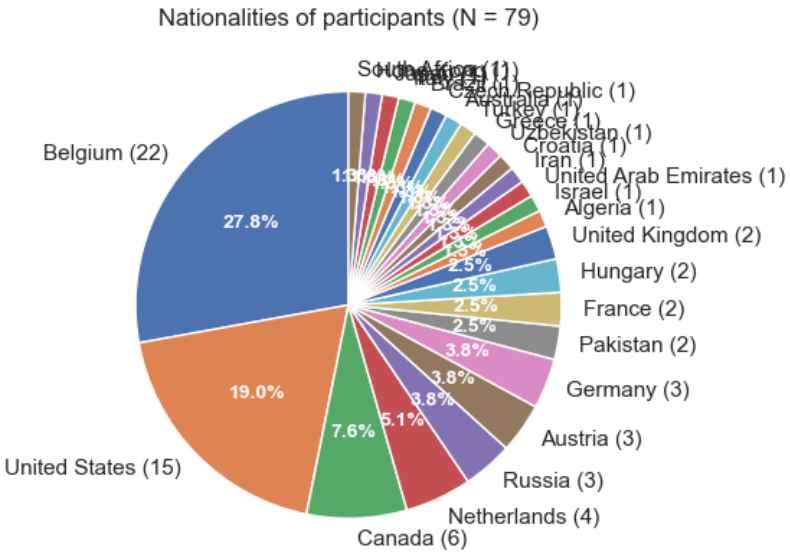

Figure 6.1: Distribution of respondents' nationalities

Age

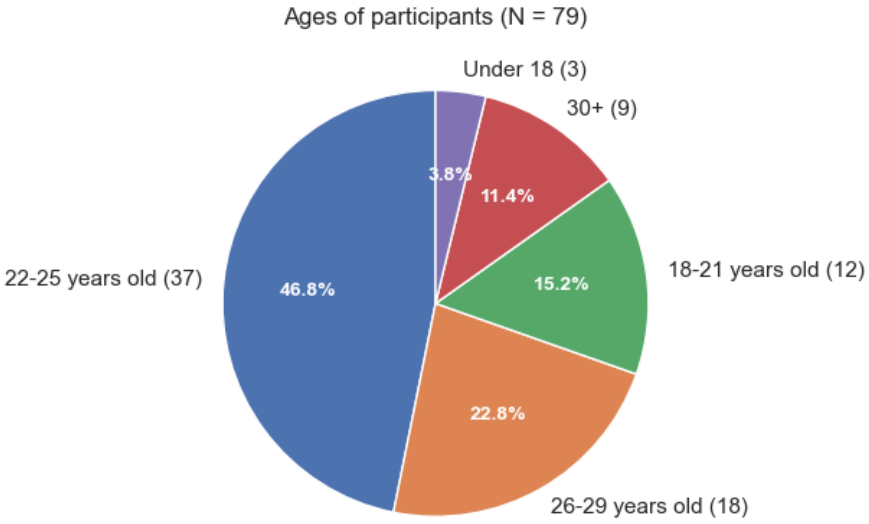

Figure 6.2: Distribution of respondents' ages

The study also inquired about the age of participants. 46.8% of participants were aged 22–25 years, 22.8% were aged 26–29 years, and 15.2% of participants were aged 18–21 years. A small part of the sample was aged over 30 (11.4%), and an even smaller part was aged under 18 (3.8%).

Gaming habits

Figure 6.3: Distribution of respondents' gaming habits

The next set of questions aims to investigate the participants' gaming habits, starting with how many days per week they play at least 30 minutes of video games. A majority of participants (32.9%) reported playing every day (7 days a week). A similar proportion of responses were distributed among those who play 5, 6, or 3 days a week, with 13.9%, 15.2%, and 17.7% of participants, respectively. Additionally, 8.9% reported playing 4 days a week, while smaller percentages of participants reported playing 2 days (5.2%) or 1 day (6.3%) per week.

Means of playing games

The possible answers are mobile games, other means (such as computer, PlayStation, or Nintendo Switch), or a combination of both. The large majority (73.4%) answered by other means, with only a small amount (3.8%) answering that they play mostly mobile games. A further 22.8% answered both.

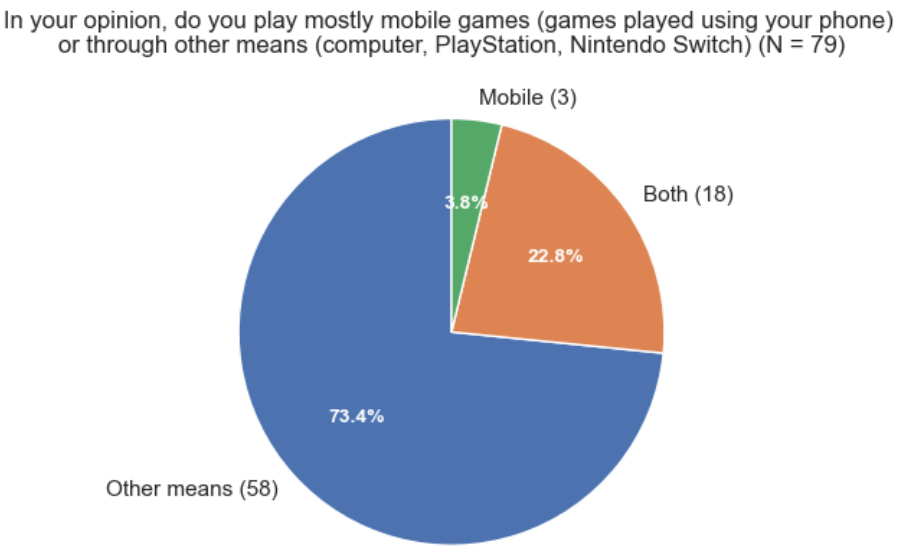

Figure 6.4: Distribution of respondents' means of playing games

Familiarity with pay-to-win and microtransactions

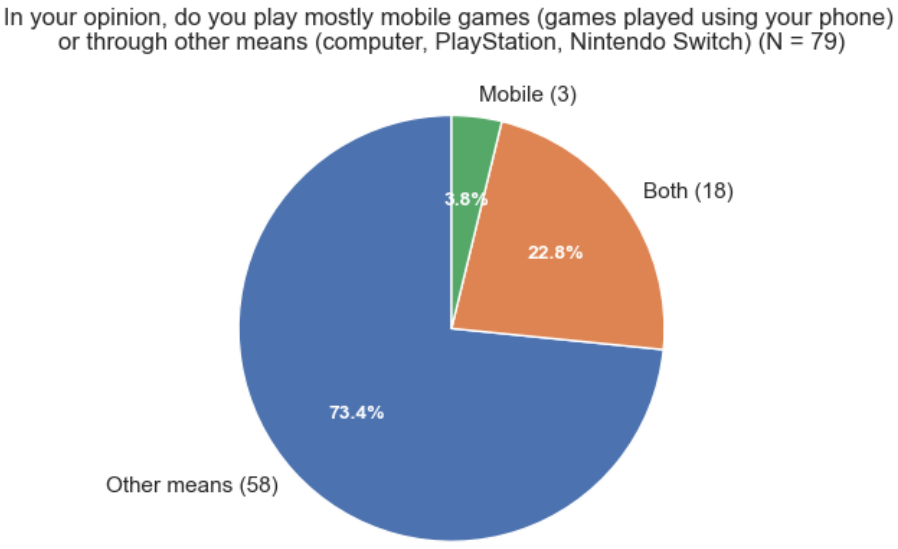

Figure 6.5: Distribution of respondents' familiarity with pay-to-wins

All participants responded yes to this question (100%).

6.3 Collected Data from the Game Prototype

During the experiment, some data was collected on the interaction of participants with the video game prototype. Through the scoring system explained earlier, this data was passed back for analysis. Three different metrics were collected: the version the participants played, the playtime in minutes (how long they engaged with the game), and the number of levels the participants managed to complete.

Version Played

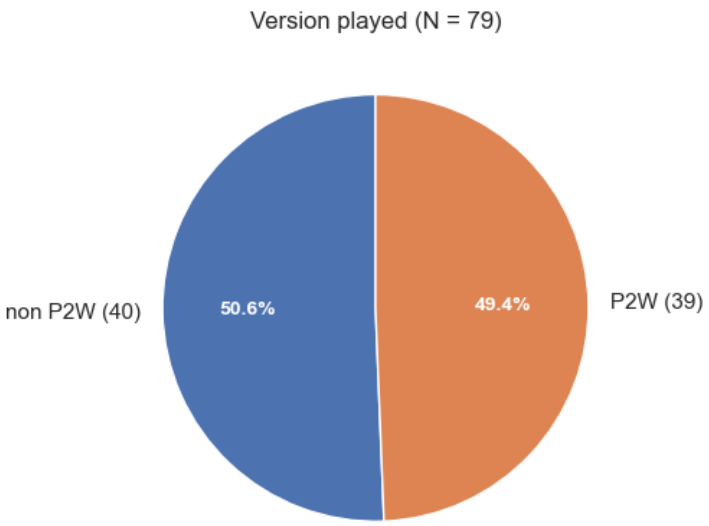

Figure 6.6: Distribution of the version that respondents' played

In the end, 50.6% of valid responses interacted with the non-pay-to-win version of the video game prototype, while 49.4% received the pay-to-win version of the video game prototype. This distribution is as equal as can be with a total of 79 responses, which is very satisfactory.

Playtime

These are histograms for the playtime distribution. Recall that only answers with playtime between two and 30 minutes were included. For the non pay-to-win version of the gameplay prototype, the playtime is more spread out, ranging between two

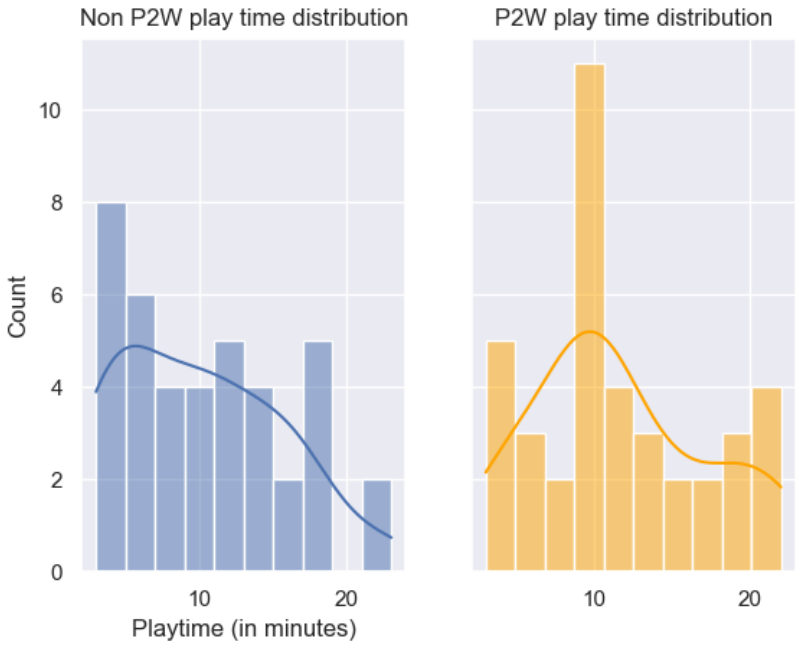

Figure 6.7: Distribution of the time participants engaged with the game

and 20 minutes. The distribution is relatively uniform with no clear peaks, but there is a gradual downward trend after around 10 minutes. For the pay-to-win version, the playtime seems to be more concentrated, with a noticeable peak around the 8 to 10 minute mark. This indicates that a large portion of players quit around that time. There is also a sharper decline after the peak. In both groups, many participants stop playing relatively quickly, which can be explained by people who don't want to spend a lot of time on the experiment or were not enjoying the game prototype. When plotting out the number of remaining players per minute, both versions look pretty similar, with the pay-to-win group having slightly more players continuing for a longer time, but with a sharper drop-off after 8 to 10 minutes.

Highest level cleared

Next is the distribution for how many levels were cleared in each version. These ended up being very similar. In the pay-to-win version of the game, the distribution was exactly equal, with 13 responses for each amount of levels beaten. In the non-pay-to-win version of the game, slightly more people ended up playing until the end compared to the pay-to-win version.

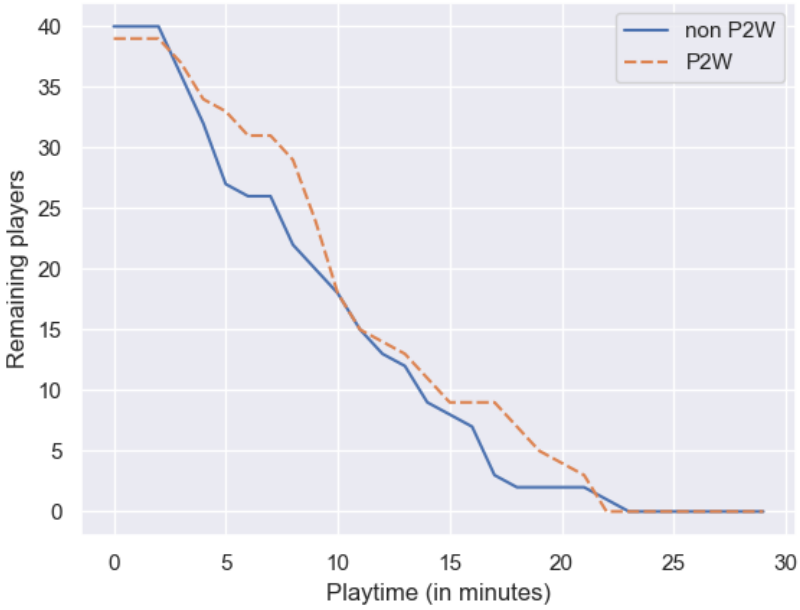

Figure 6.8: Amount of participants still playing after x minutes

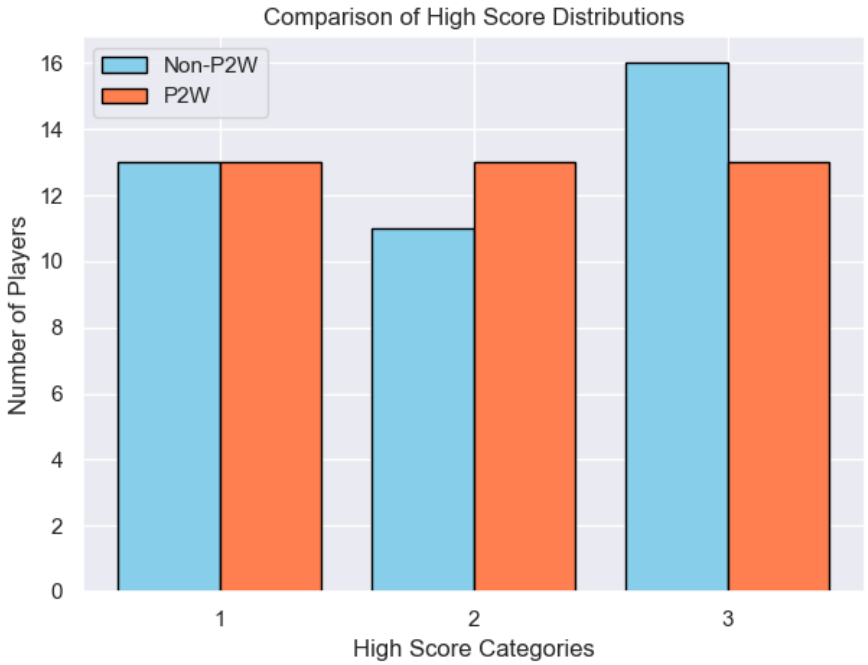

Figure 6.9: Distribution of the highest levels participants managed to beat

Question	Keyword
'I liked playing the game.'	Enjoyment
'Playing the game was valuable to me.'	Meaning
'The challenges in the game were at the right level of difficulty for me.'	Appropriate Difficulty
'I felt eager to discover how the game continued.'	Curiosity
'I felt a sense of mastery playing this game.'	Mastery
'I was immersed in the game.'	Immersion
'I felt free to play the game in my own way.'	Autonomy
'I could play the game the way I wanted.'	Autonomy Satisfaction
'I felt forced to take certain actions in the game.'	Coercion
'I felt a sense of achievement while playing the game.'	Achievement
'I often felt that I lacked the skills necessary for the game.'	Inadequacy
'I felt like the game was trying to influence me into making certain decisions.'	Manipulation
'Winning in this game feels like a result of skill.'	Outcome Fairness
'The distribution of rewards felt unfair.'	Unfair Rewards

Table 6.1: PXI and BANGS Questionnaire Items

6.4 Game Experience Survey Results

Figure 6.10 shows the results from the game experience survey that was completed after participants finished playing the video game prototype. For each row, we have the questions, which are depicted by their keywords. For example, the question of whether players felt that the game was trying to influence their decisions is represented by the keyword "manipulation". The keywords and their respective questions are shown in Table 6.1. For both the non pay-to-win version and the pay-to-win version of the prototype, the figure contains the calculated means and standard deviations of all the answers per question. Answers to these questions were given by a number ranging between -3 and 3. The results in the table are rounded to two decimals. Finally, the deltas between the means and standard deviations for both versions are also displayed.

Figures 6.11-6.23 contain histograms and box-whisker plots for each of the measured constructs, showcasing the distribution of their respective answers.

Furthermore, the Mann-Whitney U test was performed to determine whether there is a significant difference in the distribution of the answers to the individual questions. This test was chosen because the data does not meet the prerequisites of following a normal distribution for other statistical tests (as seen in many of the histograms and box-whisker plots). If the test for a construct shows that the result is significant, it indicates a meaningful divergence in how the two groups of participants perceived their experiences related to that construct.

The tests are set up as follows: the null hypothesis is that the two distributions (from the two versions of the game) of replies to a question for a given construct are equal. The test calculates a p-value, which represents the probability of obtaining this data if the null hypothesis is true. In other words, it provides a confidence interval to assess whether the observed results are the consequences of the difference in variables between groups (in this case, the presence of pay-to-win microtransactions) or due to chance. If the confidence interval is high enough, the null hypothesis is rejected, indicating a significant difference in the distributions. For this experiment, the confidence interval is set to 95% ($p \leq 0.05$), which is a commonly used threshold. The results of this test are shown in Figure 6.24.

The results show three significant differences in distributions for the answers to the questions namely manipulation, unfair rewards and appropriate difficulty. For many others such as autonomy, immersion and enjoyment the difference in means is noticeable, but they fail to meet the 95% confidence interval.

6.5 Linear Correlation Analysis

To further gain insight into the possible impact that pay-to-win mechanics can have on the game experience and help explain the survey results, an analysis was conducted to investigate the correlation between all pairs of variables measured in the experiment. Both data from the game and responses from the game experience survey were included. To achieve this, the Pearson r value was calculated for each pair of variables. This is a common way to describe the degree of linear correlation between two variables. The value of r ranges between 1 and -1, indicating the strength and direction of the linear correlation. A positive value indicates a positive linear correlation, meaning that as one variable increases, the other also increases. Conversely, a negative value indicates a negative linear correlation, where as one variable increases, the other decreases, and vice versa.

Table 6.2 shows how the Pearson r should be interpreted. Figure 6.25 and Figure 6.26 show the calculated Pearson r for each pair of variables in a heatmap.

	mean (non P2W)	std (non P2W)	mean (P2W)	std (P2W)	Δ mean	Δ std
manipulation	0.68	1.77	2.03	1.11	1.35	-0.66
autonomy	0.42	1.95	-0.13	1.87	-0.55	-0.08
unfair rewards	0.12	1.7	1.1	1.6	0.98	-0.09
appropriate difficulty	0.45	1.78	-0.41	1.53	-0.86	-0.25
immersion	1.18	1.55	0.54	2.04	-0.64	0.49
meaning	0.28	1.4	-0.18	1.86	-0.45	0.47
curiosity	0.7	1.74	0.31	1.98	-0.39	0.23
outcome fairness	0.02	1.89	-0.31	1.94	-0.33	0.05
coercion	1.15	1.53	1.21	1.59	0.06	0.06
enjoyment	1.27	1.55	0.79	1.75	-0.48	0.2
mastery	-0.25	1.69	-0.23	1.72	0.02	0.03
autonomy2	0.02	1.59	-0.56	1.73	-0.59	0.14
achievement	0.38	1.48	0.18	1.86	-0.2	0.38
inadequacy	-1.3	1.67	-1.1	1.82	0.2	0.15

Figure 6.10: Means and standard deviation of both groups per question, and the delta between them

	question	Δ mean	p (Mann–Whitney U)	Δ mean significant?
0	manipulation	1.35	0.0	Yes
2	unfair rewards	0.98	0.01	Yes
3	appropriate difficulty	-0.86	0.03	Yes
11	autonomy2	-0.59	0.14	No
9	enjoyment	-0.48	0.15	No
1	autonomy	-0.55	0.17	No
4	immersion	-0.64	0.23	No
7	outcome fairness	-0.33	0.38	No
5	meaning	-0.45	0.41	No
6	curiosity	-0.39	0.41	No
13	inadequacy	0.2	0.7	No
8	coercion	0.06	0.76	No
12	achievement	-0.2	0.78	No
10	mastery	0.02	0.96	No

Figure 6.11: Mann-Whitney U test results

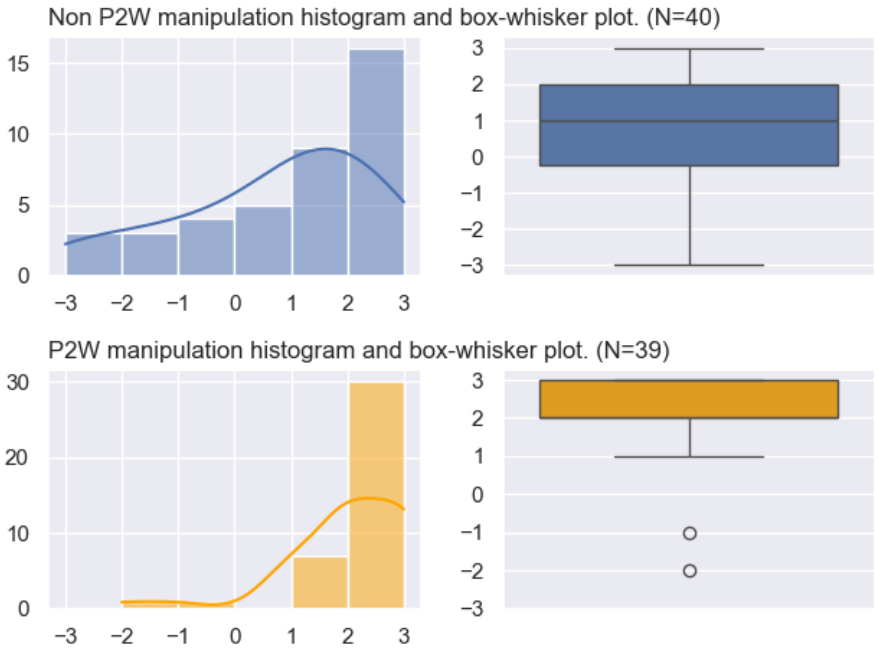

Figure 6.12: Histogram and box-whisper plots for perceived manipulation

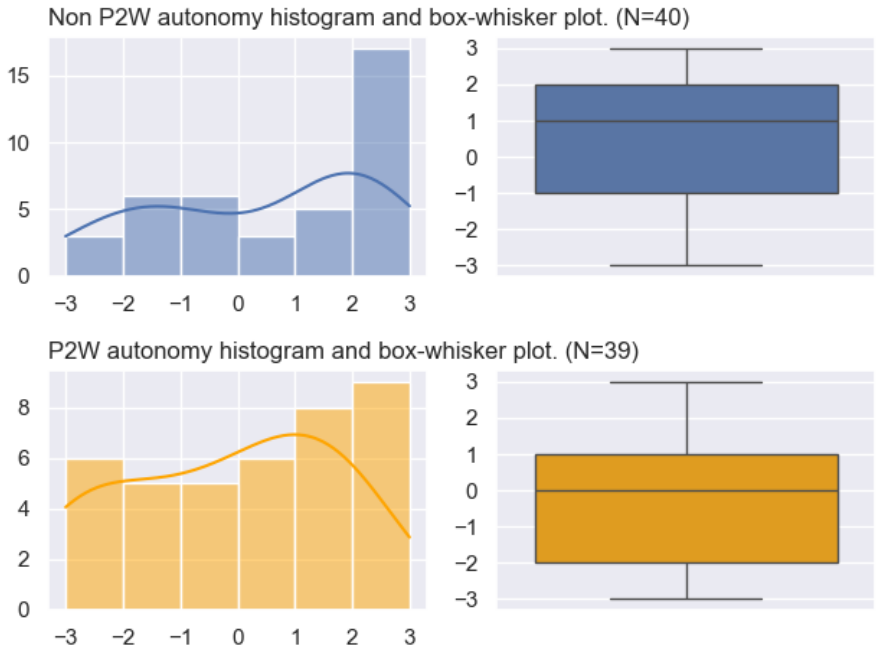

Figure 6.13: Histogram and box-whisper plots for autonomy

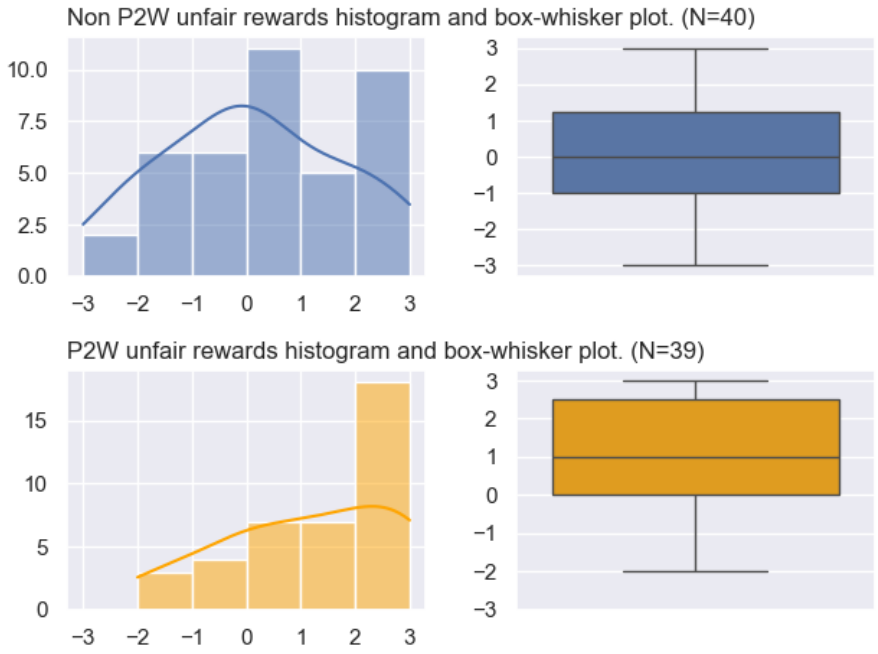

Figure 6.14: Histogram and box-whisper plots for unfair rewards

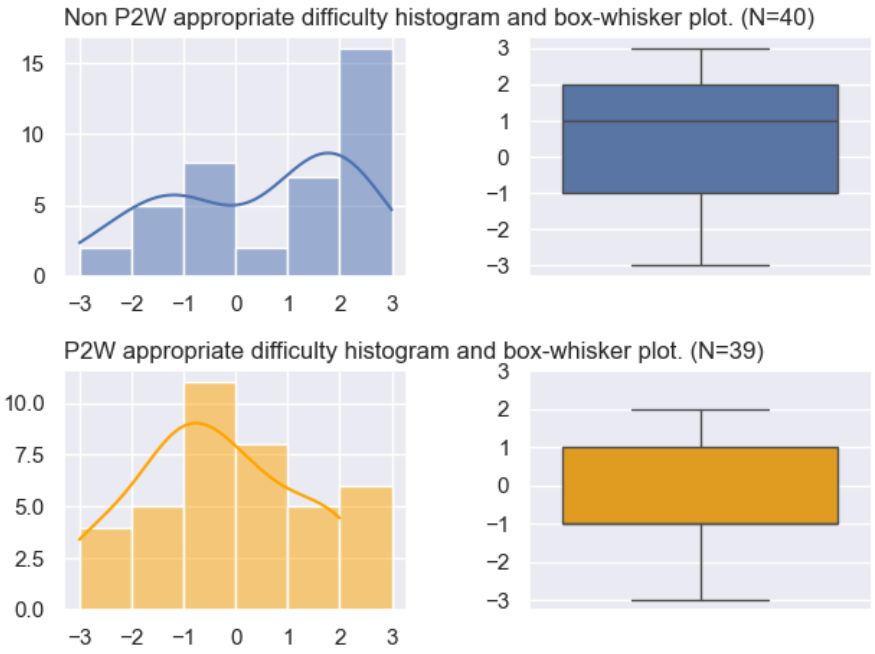

Figure 6.15: Histogram and box-whisper plots for perceived appropriate difficulty

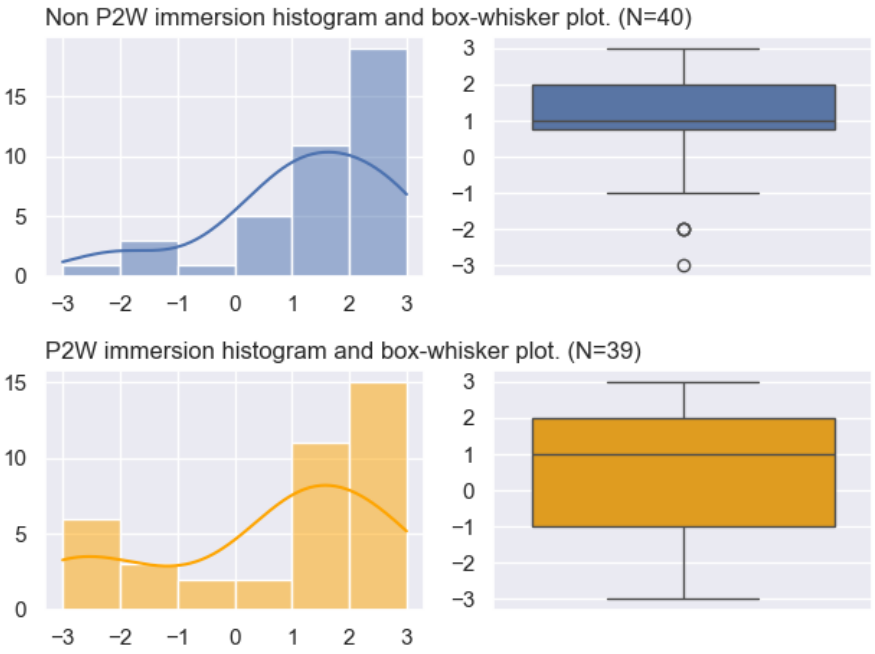

Figure 6.16: Histogram and box-whisper plots for perceived immersion

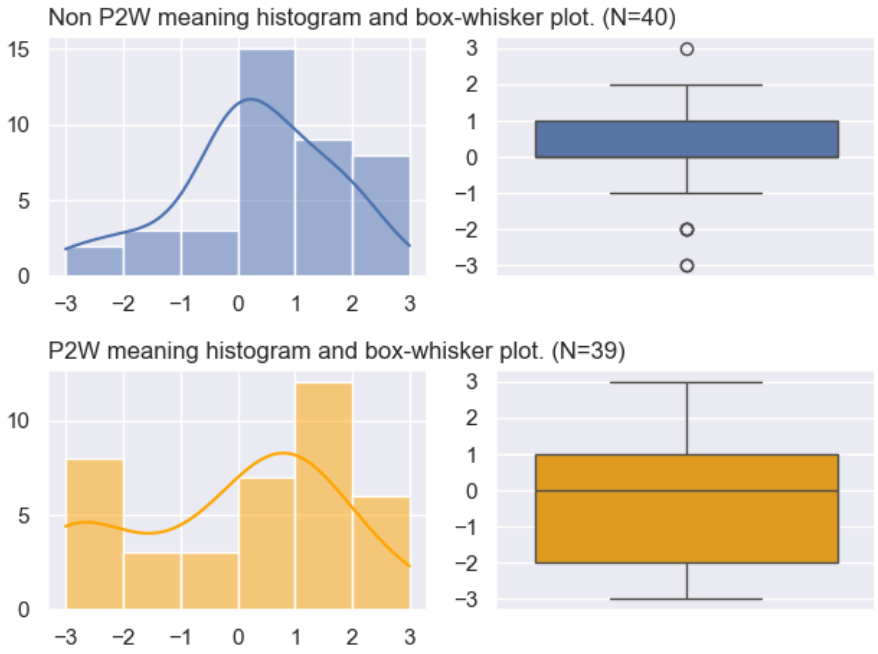

Figure 6.17: Histogram and box-whisper plots for perceived meaning

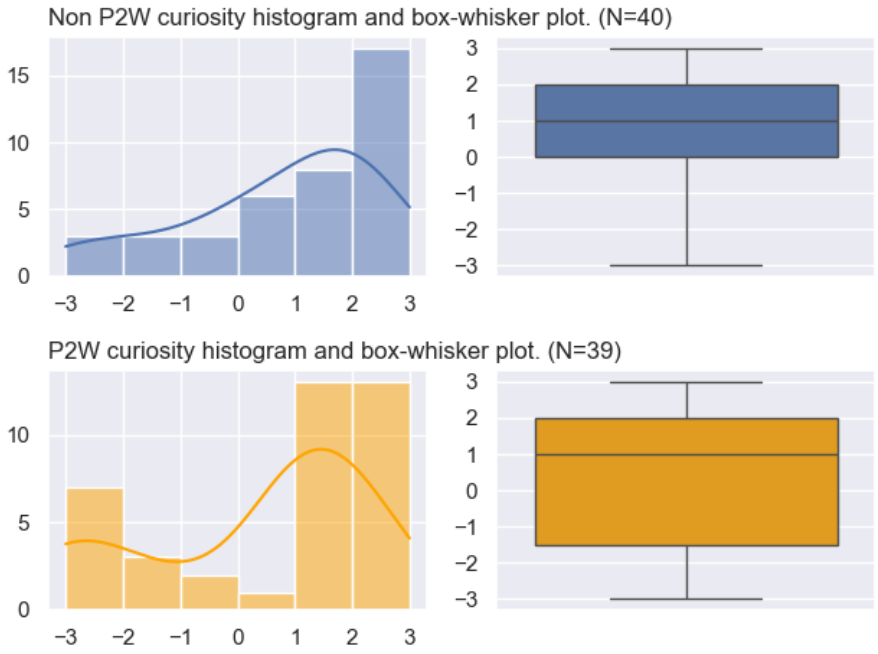

Figure 6.18: Histogram and box-whisper plots for curiosity

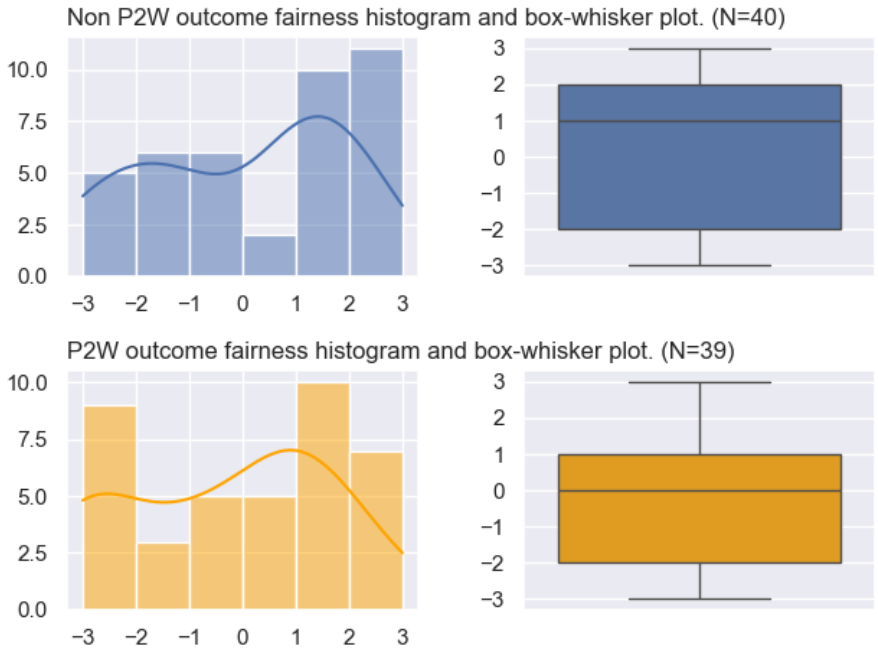

Figure 6.19: Histogram and box-whisper plots for perceived fairness of outcome

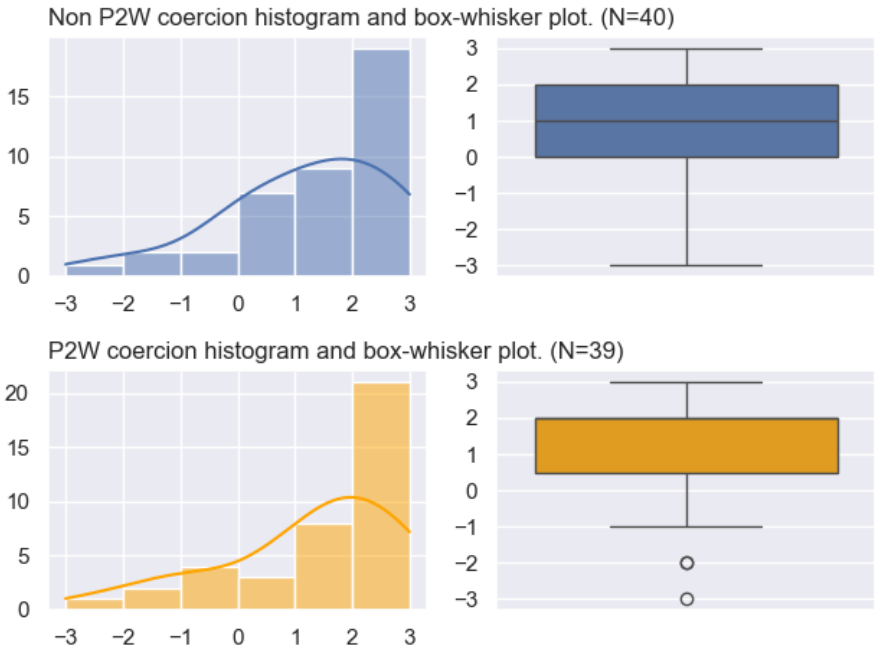

Figure 6.20: Histogram and box-whisper plots for perceived Coercion

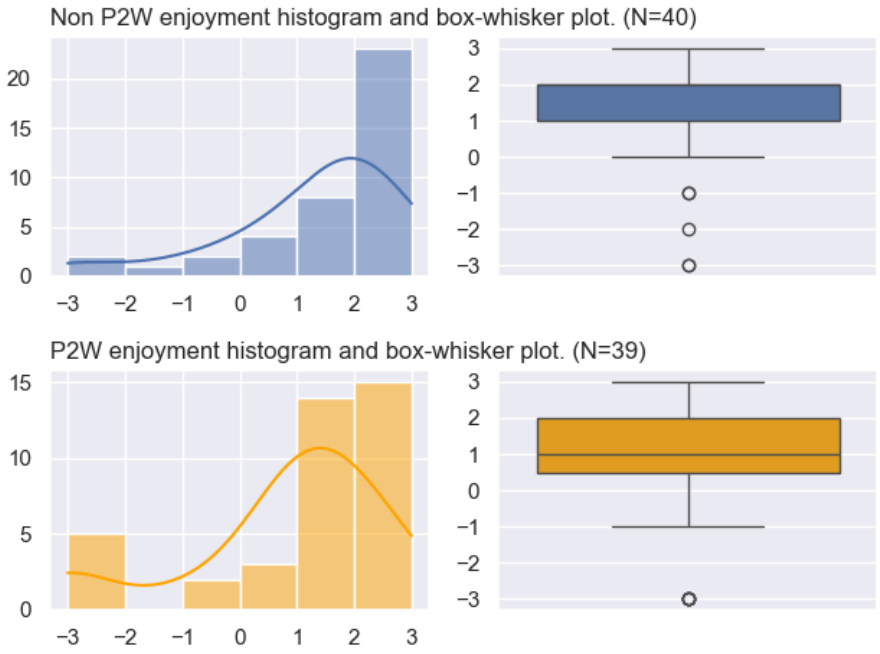

Figure 6.21: Histogram and box-whisper plots for the self reported enjoyment

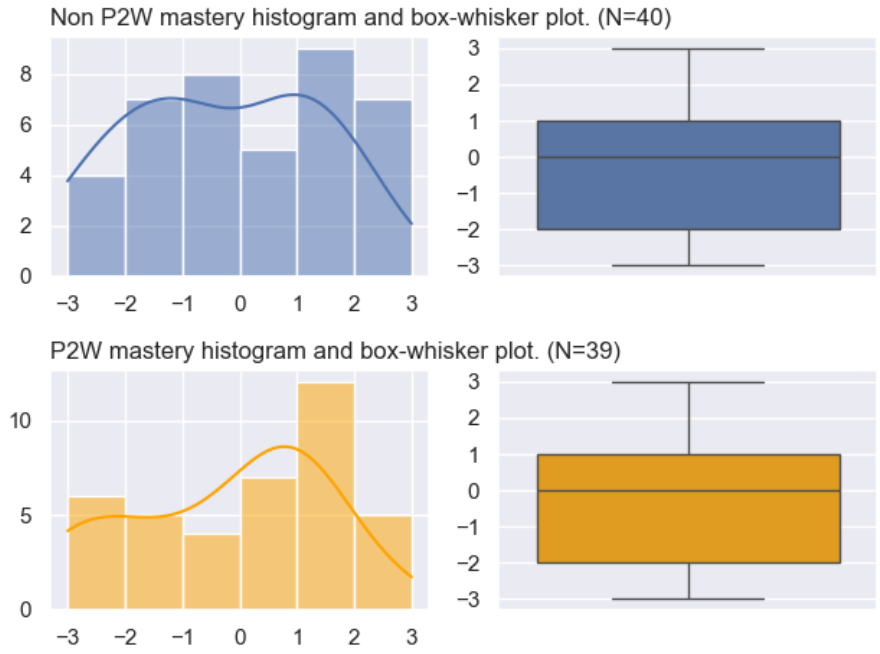

Figure 6.22: Histogram and box-whisper plots for perceived mastery

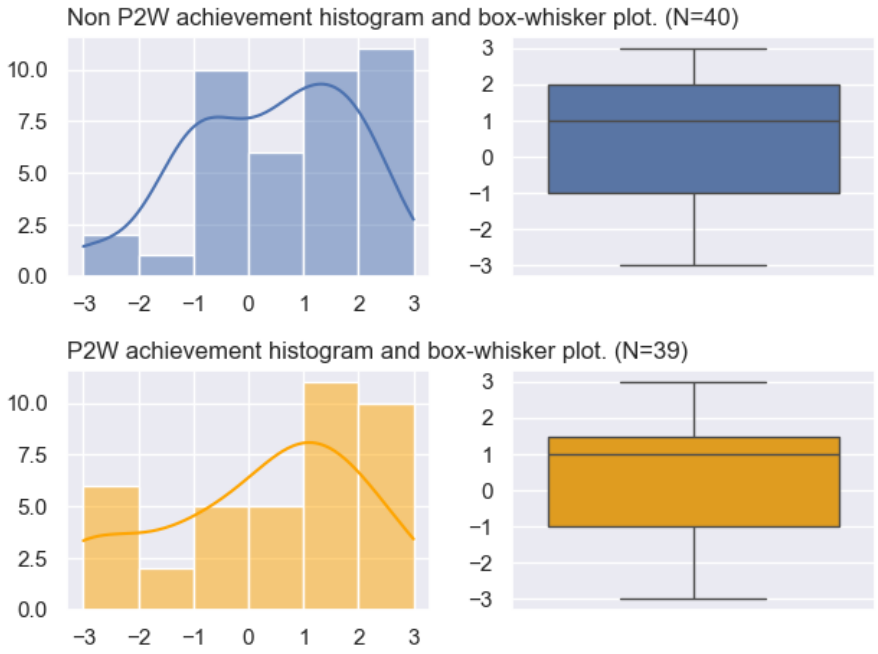

Figure 6.23: Histogram and box-whisper plots for sense of achievement

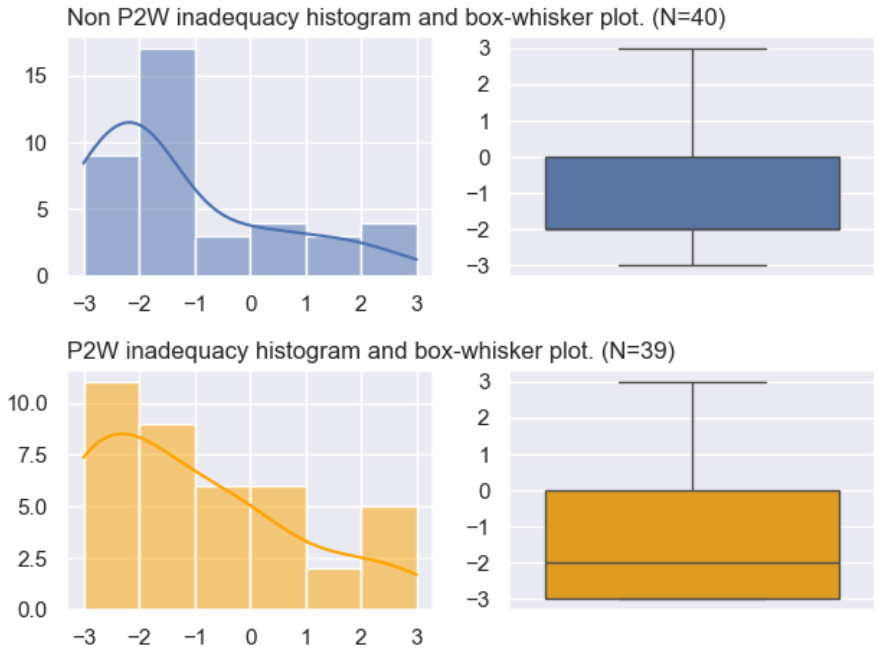

Figure 6.24: Histogram and box-whisper plots for sense of inadequacy

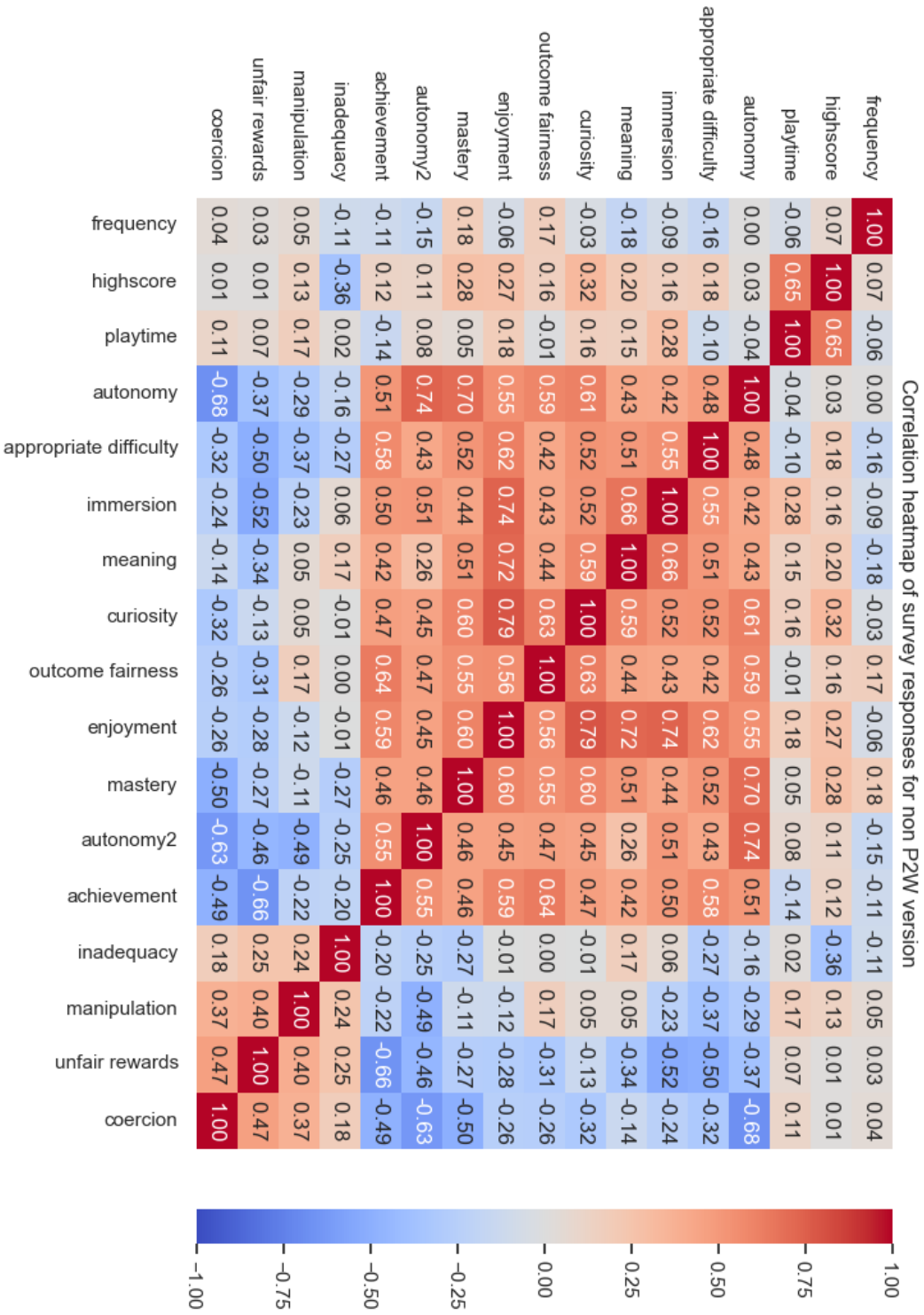

Figure 6.25: Heatmap for the pearson r between variables for the non pay-to-win version of the game

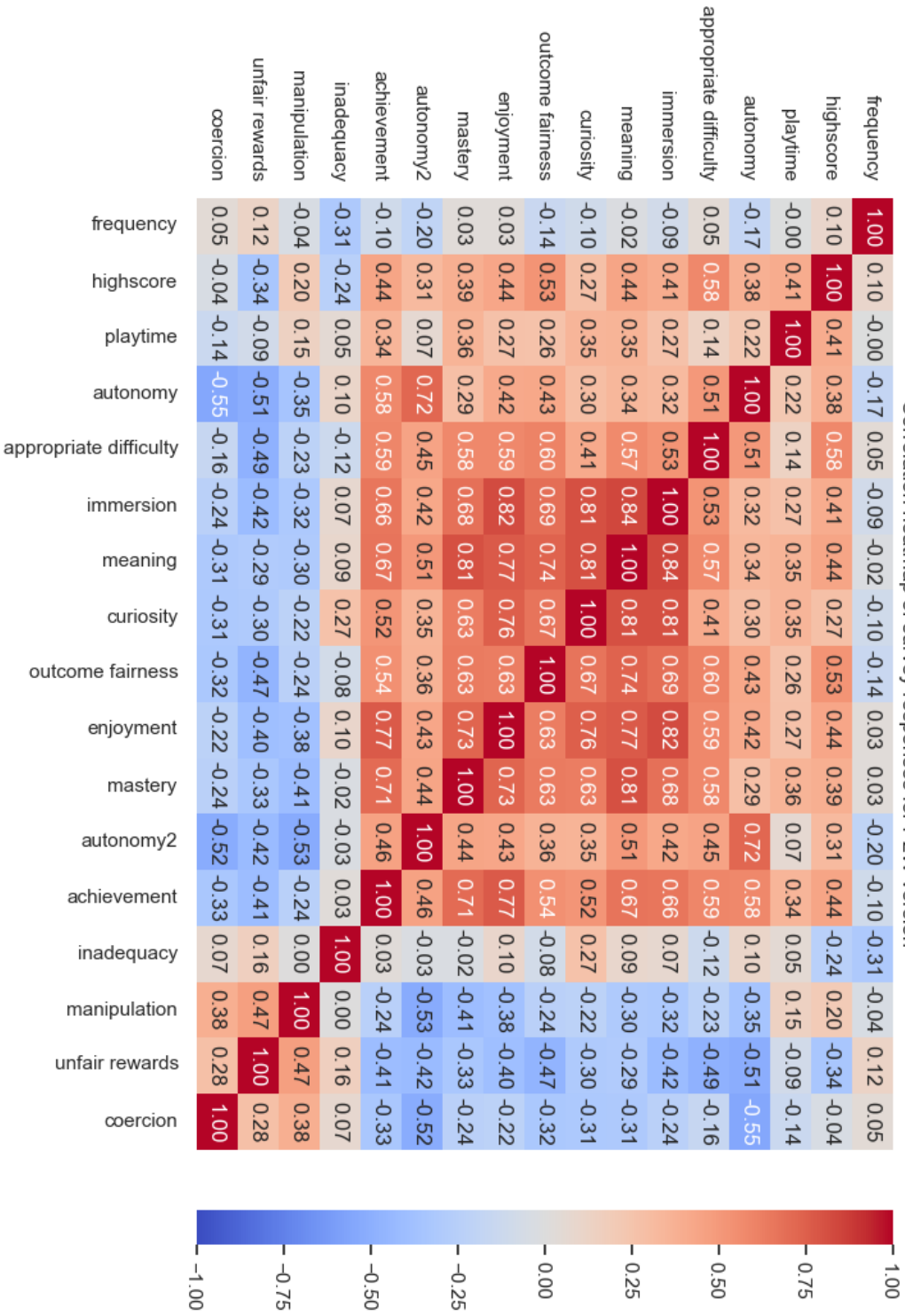

Figure 6.26: Heatmap for the pearson r between variables for the pay-to-win version of the game

Value	Strength	Direction
Greater than 0.7	Very high	Positive
Between 0.5 and 0.7	High	Positive
Between 0.3 and 0.5	Medium	Positive
Between 0.1 and 0.3	Weak	Positive
Between -0.1 and 0.1	None	None
Between -0.1 and –0.3	Weak	Negative
Between –0.3 and –0.5	Medium	Negative
Between –0.5 and –0.7	High	Negative
Less than –0.7	Very high	Negative

Table 6.2: Interpretation of Pearson Correlation Coefficient (Kuckartz 2013, p. 213)

Observed similarities between versions

- **Clusters around pairs of positive constructs:** Many pairs with constructs that have a positive meaning, such as (in the non pay-to-win version) Autonomy and Mastery ($r \approx 0.70$), Enjoyment and Immersion ($r \approx 0.74$), Curiosity and Enjoyment ($r \approx 0.79$) share a significant positive correlation, resulting in clusters of positive correlations around these constructs. These clusters remain mostly similar in both versions.

- **Clusters around pairs of negative constructs:** Similarly to pairs of positive constructs, pairs of negative constructs also mostly share significant positive correlations. Examples (in the non pay-to-win version) are Manipulation and Unfair Rewards ($r \approx 0.4$), Coercion and Unfair Rewards ($r \approx 0.47$) and Manipulation and Inadequacy ($r \approx 0.4$). These clusters remain mostly similar in both versions.

- **Negative correlations between positive and negative constructs:** Some pairs that feature a negative and a positive construct have significant negative correlations. Examples are Manipulation and Autonomy ($r \approx -0.49$), Coercion and Autonomy ($r \approx -0.68$) and Unfair Rewards and Appropriate Difficulty ($r \approx -0.52$). Thus, participants who, for example, felt that the rewards are unfair are also more likely to perceive the difficulty as not appropriate.

Observed differences between versions

To analyze how the correlations change between versions, another heat map (Figure 6.27) was made, subtracting the Pearson correlation coefficients r from the pay-to-win version from the Pearson correlation coefficients r from the non-pay-to-win

version. This value describes how the relation between constructs changes after introducing pay-to-win. A positive value means that the relation became stronger, becoming more positively/less negatively correlated, while a negative value indicates that the pair of constructs became less positively/more negatively correlated.

As understanding this table is quite complex, I suggest using the following way of interpreting a value: "Participants who reported a higher [Construct 1], reported a [greater/smaller] [Construct 2] in the P2W version than in the non-P2W version. For example: Participants who reported higher perceived manipulation, reported a smaller sense of enjoyment in the P2W version than in the non-P2W version (Δ of $\approx$-0.25).

General Observations

- **High-score and playtime's impact increases by a lot:** The constructs of high-score and the amount of time a participant spends before quitting (which are heavily positively correlated as well), see stronger correlations with pretty much every other construct. Especially relations with other positive constructs like achievement and mastery see a big increase ($\Delta \approx 0.49$ and $\Delta \approx 0.31$ respectively)

  This is interesting, as looking at the means in Figure 6.10, lower values are reported overall. So while participants accross the board enjoyed the pay-to-win version less, the ones that spent more time and got further in the game reported a significantly better experience. This could be interpreted as that participants who do not have a good experience quit sooner in the P2W version than in the non-P2W version.

- **Negative constructs have larger impact:** The negative correlations between negative constructs such as manipulation and positive constructs such as enjoyment become stronger. This means for example the relation between manipulation and unfair rewards and a positive game experience is stronger in the pay-to-win version.

  This could be because of that these concepts only become explicit in the P2W version. For example, participants may not really get what the questions for manipulation or unfair rewards are getting at without the micro-transactions.

6.6 Testing Kendall's τ and Spearman's r

The Pearson r (linear correlation coefficient) can be tested for statistical significance. Through such tests we can understand significant differences in linear correlations between the constructs between versions. However, this has the requirement for the underlying data to be normally distributed. Looking at the histograms in chapter

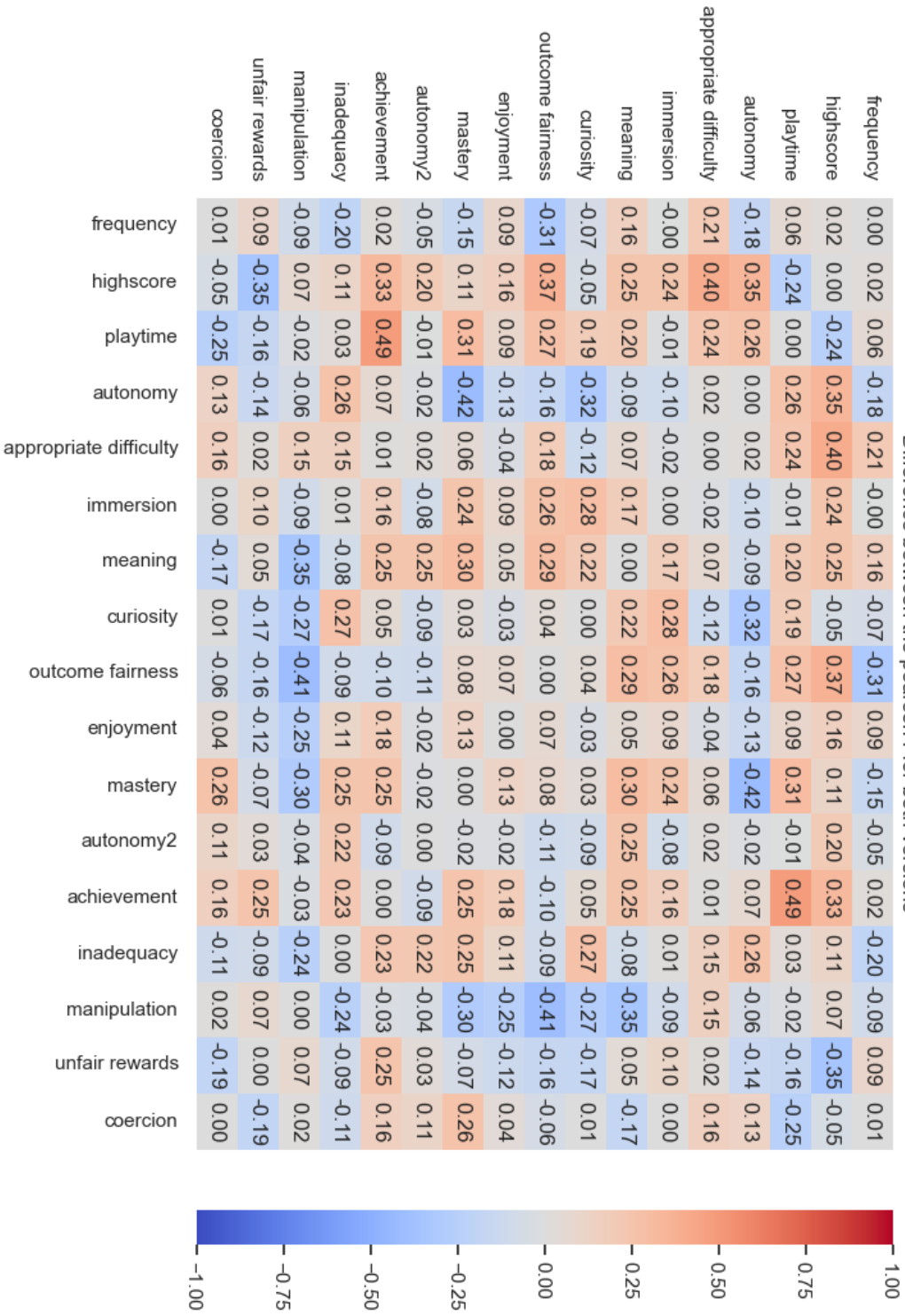

Figure 6.27: Difference of correlation coefficients between versions

6, this is not the case for the majority of data.

Therefore, to test the correlation coefficient, a non-parametric test is required, of which the two most commonly used ones are the Spearman correlation coefficient and the Kendall rank correlation coefficient. As described in the article *"Kendall Tau-b vs Spearman: Which Correlation Coefficient Wins?"* (Learn Statistics Easily 2024), the use cases of the Kendall τ include that it works well with a smaller sample size, which is the case for us, and is robust to outliers. However, the Spearman r specifically does well with small sample sizes with weak correlations, which when looking at the previously calculated Pearson r, is also the case for many pairs. Therefore, both tests were performed for both versions.

To achieve this, the Python package `SciPy`, which provides the `spearmanr` and `kendalltau` were used. Both return a p value that give us the probability that systems produce datasets which have results at least as extreme as the one computed from these datasets (SciPy 2024). The confidence interval was set to 95% ($p \leq 0.05$), which is a commonly used threshold. If the value is significant, the cell is colored green.

The results for the tests of the Kendall τ and Spearman r for each pair of variables can be found in Figures 6.28-6.31. A cell is colored if the respective pair of variables passed the test (resulting p is smaller than 0.05), meaning there is a significant correlation between the pair.

Observations

- **Clusters between positive constructs are still present** Some

6.7 Comments received on the Game Prototype

Right before submitting their responses, participants had the option to enter any opinions or thoughts about the game prototype in a free comment field. In total, the study received 32 comments, which are presented in the tables below. The tables group the comments into three categories: those that express a positive sentiment, critical sentiment, and finally miscellaneous comments (see Table 6.3-6.5 respectively).

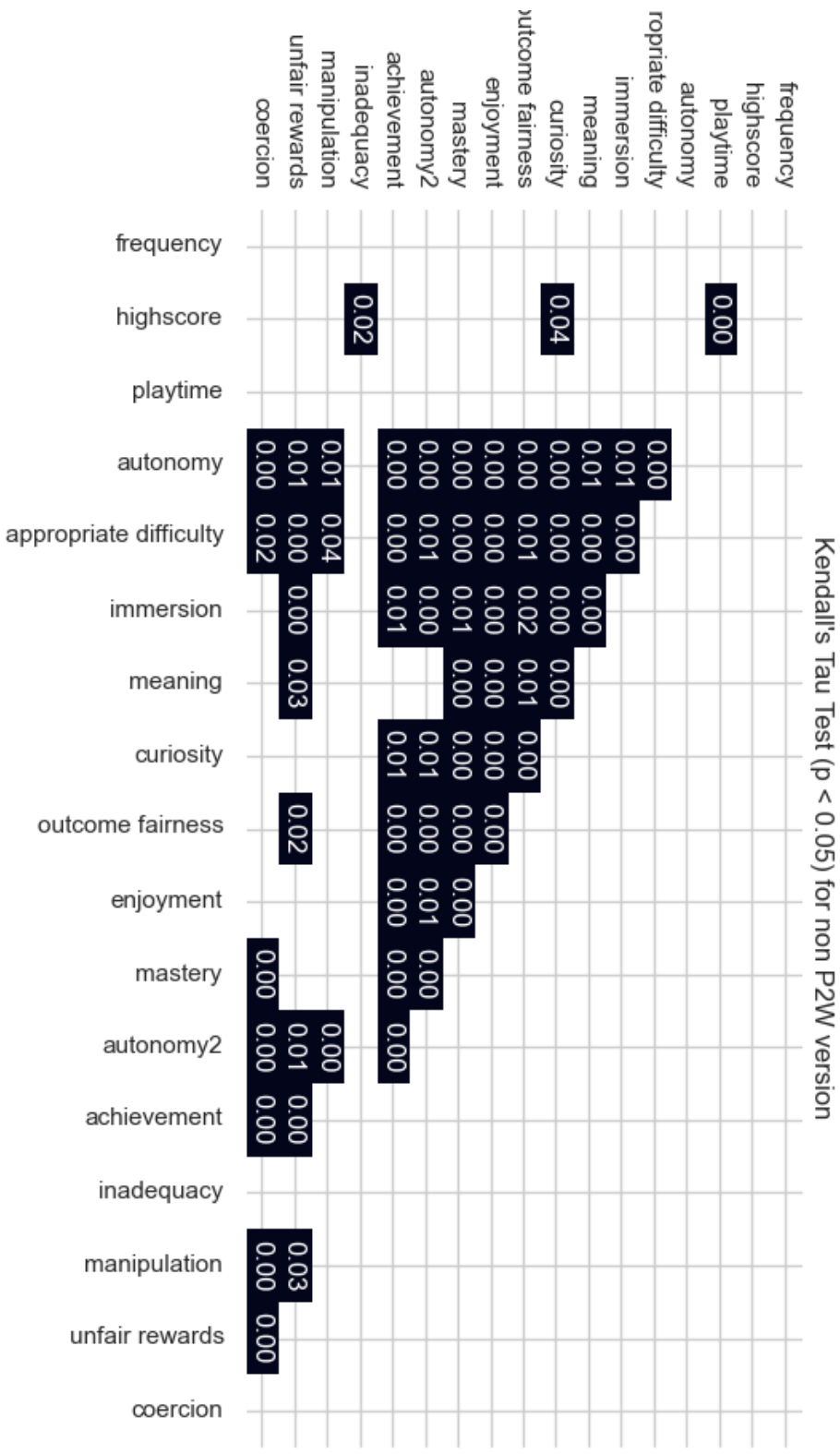

Figure 6.28: Results of testing Kendall's τ for the non-P2W version

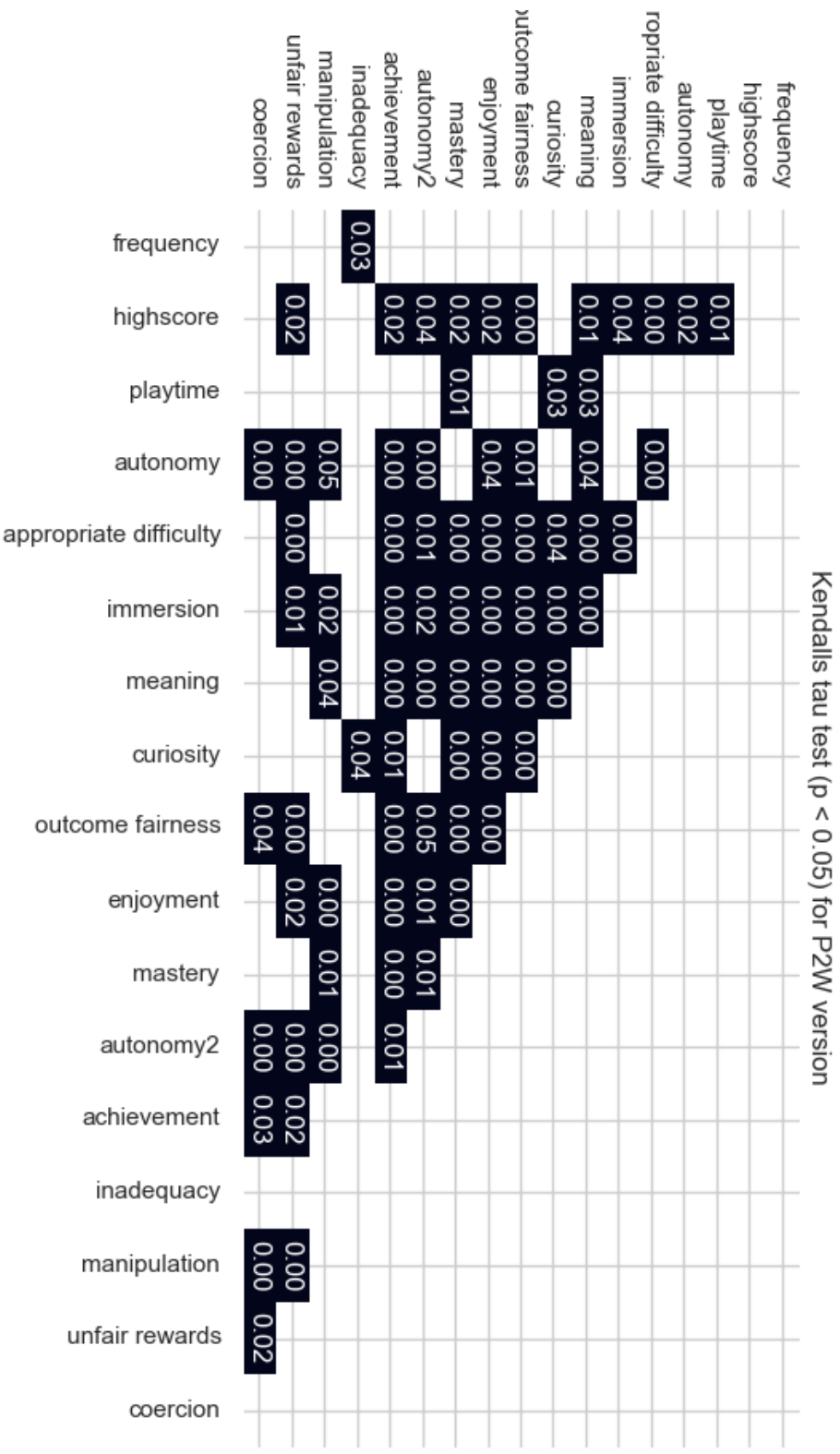

Figure 6.29: Results of testing the Kendall's τ for the P2W version

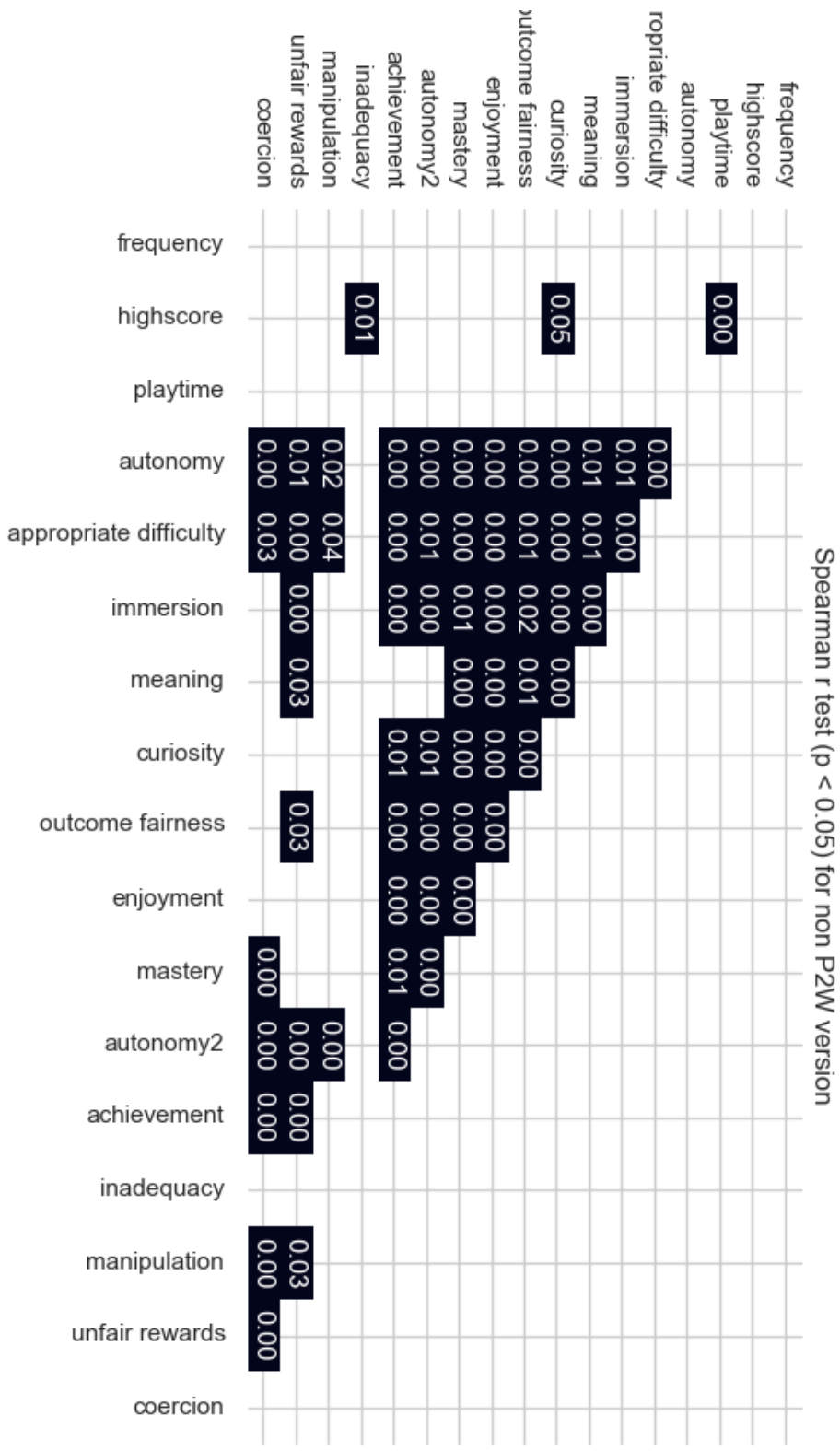

Figure 6.30: Results of testing Spearman's r for the non-P2W version

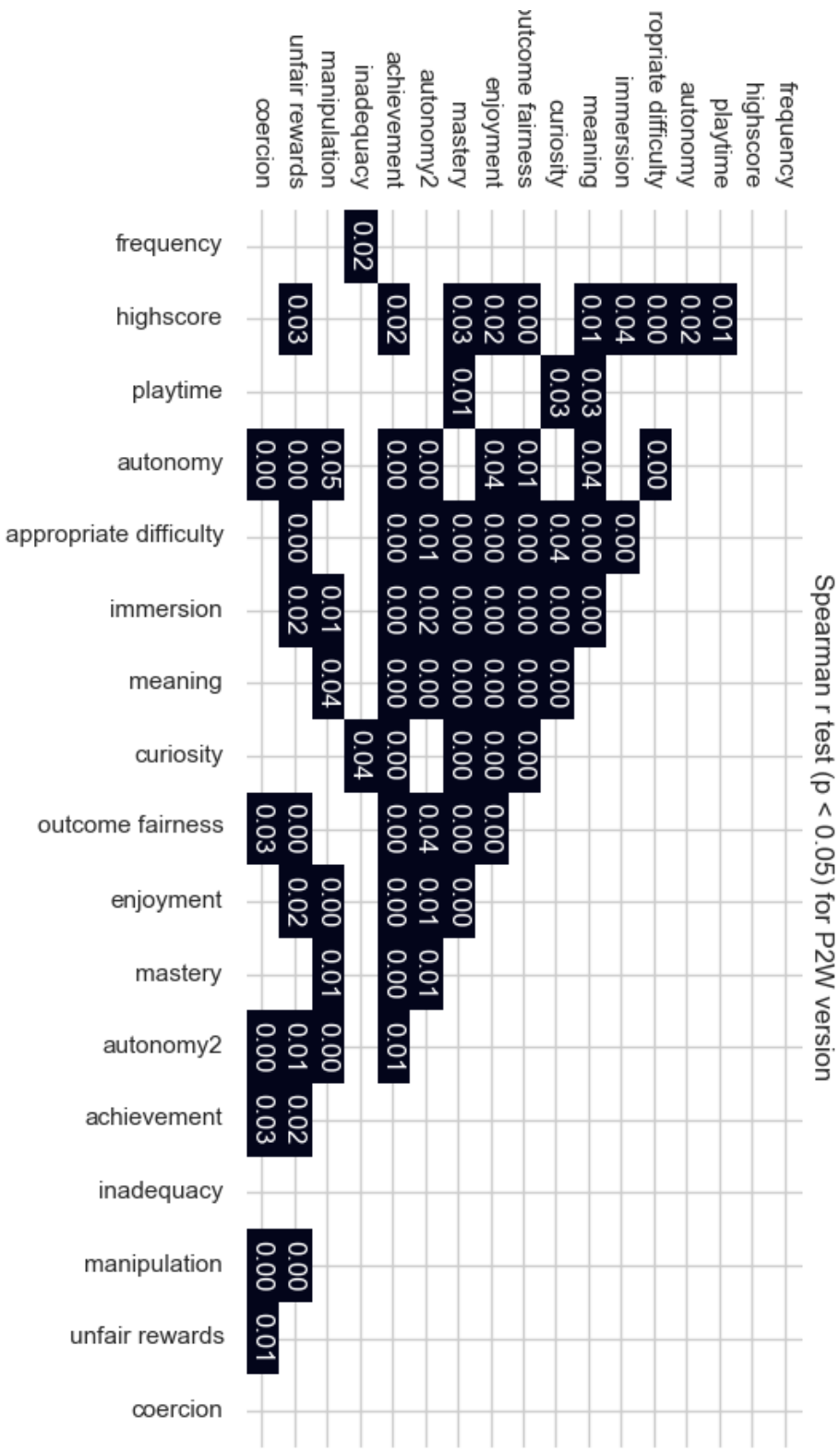

Figure 6.31: Results of testing Spearman's r for the P2W version

Version	Comments (positive)
non-P2W	"great game, add more (stonger) defensive units at the start"
non-P2W	"It was pretty fun and even when i struggled and was defeated, I felt excited that I got more currency to get new units"
non-P2W	"Loved the game design and I can tell that the vision behind it was very strong. I personally felt like when I was in the middle of the levels I had to go back because the word "Defend" didnt necessarily look like a button, instead I thought you can opt for a call to action thats more direct like "Start Level" or "Start Mission" or "Start defending", because I think more standard. For the gameplay, it's very intuitive and I personally found myself compelled to come up with my own strategy i.e "spam poppy seed 4 times and wait". For the Ui of the game I think it looks incredible! However moving the health bars to the leftest side of the screen and putting the currency creator to the right side ("around the potential purchases") I think would be a better approach since you can much easier track game finances, and at the same time putting the health bar near the base I thought would make that part also easier to look at. Gameplay wise I also really liked it, the little animations that the characters do is lovable! I was partially confused from the miner ability, I think that it increases the game spending currency but I thought it was a bit hard to track, consider adding a ("+30" Coins) or just a coin animation coming out of their direction to differentiate between automatic currency updates and the miner. All in all, loved it!"
non-P2W	"The game certainly allowed and rewarded certain strategies, e.g. spawning your troops in concentrated waves, which makes it feel like there is room for further depth. More troops, special abilities and enemy variety could make this game very interisting and varied gameplay wise. The game has potential. I also liked the theme, I've never seen anything like it."
non-P2W	"Great game :)"
non-P2W	"Cheers Mano, I wish you the best in this journey this game made me smile while I was playing"
non-P2W	"Great game :)"
non-P2W	"It's an addicting concept, but yea it felt like the second stage was impossible with just the 2 Units you got without going to the store."
P2W	"I could see the formula being set up for a pay-to-win game market "
P2W	"fun but difficult"

Table 6.3: Positive comments received via the free comment form.

Version	Comments (critical)
non-P2W	"Everything felt fair until level 3. After that, Enemies spawned faster than the money came in. Towers also left far faster in level 3 instead of having a consistent HP (At least it seemed this way.) "
non-P2W	"There was no soft curve to difficulty, I didn't get past the second level."
non-P2W	"I played until I finished level 2: it was necessary for me to unlock a new character before I could beat the level... after beating it I stopped"
non-P2W	"As a player I generally avoid any kind of store in games like this, so I never even opened it. The first level felt stupidly easy, and then the second level felt completely impossible to beat with just the default resources. Because I knew this survey was testing pay-to-win mechanics, I figured the way to win would probably be to buy things from the store, but since I would never do that as a player, I just gave up after the second level. The mechanics didn't feel fun enough for me to want to keep playing."
P2W	"this game is trash"
P2W	"the core gameplay loop was very enjoyable, however the skill curve progressed at such a rate that players who did not partake in microtransactions would be unable to proceed past level two without godly levels of skill. If the game was balanced around players who didn't make microtransactions, I could realistically see myself spending multiple hours playing."
P2W	"I felt as if to progress id have to die repeatedly to get enough miners for stage 2"
P2W	"Waiting to see new types of enemies as I gained new bagel types"
P2W	"make every x pulls without money a garanteed unit so the grind is less tedious"
P2W	"It was mainly frustrating that I couldn't try out the other cool characters since I'd need to pay for them. Although this is the case, the 3 available units did feel fun already. In the end I won the game by abusing the grenade bagles"

Table 6.4: Critical comments received via the free comment form.

Version	Comments (misc)
non-P2W	"No audio?"
non-P2W	"buff cymbagel and grenade bagel pls"
non-P2W	"the roller doesn't have any collision"
non-P2W	"Cute simulator for Average Mobile Free2Play game disguised as Pay2Win"
P2W	"Waiting to see new types of enemies as I gained new bagel types"
P2W	"no comment"
P2W	"Grenadle all the way, baby!"
P2W	"Some music might be nice :)"
P2W	"I need a baegel in my life"
P2W	"first time I loaded the game the game froze (and crashed my browser) in the instructions when I unlocked the dough roller thingy"
P2W	"Nerf Poppy Seed"
Invalid	"Don't make people waste time, you master thesis sucks. You are kicking in open doors "
Invalid	"Nothing else"
Invalid	"I played it on 10 fps for the entire run. It made the game a lot more tedious"

Table 6.5: Miscellaneous comments received via the free comment form.

Chapter 7

Discussion

7.1 Limitations

Even though the experiment conducted for my thesis provides valuable insights into the potential impacts of pay-to-win mechanics on player experience, several limitations should be acknowledged. These limitations could have influenced the outcomes of the experiment and the corresponding conclusions drawn from it, potentially making them less representative of actual pay-to-win environments. In this section, I will critically discuss the most relevant limitations of the experimental setup and explore their potential impacts.

The first and most significant limitation was the design decision to remove the option to pay in the pay-to-win version. As described in the Ethical Safeguards section of Chapter 5, while other approaches were considered, real-money transactions were ultimately disabled in the pay-to-win prototype for several reasons. One key reason was to avoid introducing bias by linking player experience to participants' financial resources, which could have introduced noise to the study. However, it is important to note that financial investment could significantly alter a player's experience. The act of paying to gain an advantage could trigger different emotions, such as a sense of accomplishment or guilt, that might substantially affect enjoyment and overall experience.

As a result, participants in the pay-to-win version may not have fully experienced the dynamics associated with real-money spending and only encountered pay-to-win games from the perspective of non-paying players. Therefore, conclusions drawn from this experiment apply exclusively to non-paying players in pay-to-win games and should be interpreted with this limitation in mind.

Secondly, the game used in the experiment was a single-player game, which introduces another limitation in terms of the generalizability of the study. Multiplayer games, especially those with competitive elements, could result in very

different experiences regarding pay-to-win mechanics. Older literature, such as Zagal (2013), even tends to define pay-to-win as paying to gain an advantage over other players in multiplayer games. In games that emphasize player-versus-player gameplay, playing against opponents who paid to gain an advantage could heighten feelings of frustration, unfairness, or resentment. Additionally, dynamics such as social comparison and status seeking in multiplayer games may prompt players to view pay-to-win purchases as more impactful due to the ability to directly compare themselves to other players.

Hence, the social dimension added by the presence of other players could lead to vastly different perceptions of pay-to-win. In contrast, in a single-player game, the absence of these social dimensions could mean that the advantages gained from pay-to-win mechanics are less likely to be perceived as unfair or exploitative. Players may generally be more accepting of their presence. Thus, while the study's results provide valuable insights into the psychological effects of pay-to-win mechanics and their impact on the gameplay experience, their implications for multiplayer environments might differ.

Next, I want to take a critical look at another design decision that may have introduced noise into the data. Before starting the experiment, players were provided with a brief explanation of the study's purpose and goals. This overview mentioned that the study is investigating the impact of pay-to-win mechanics on the player experience. However, it did not specify that there are two versions of the game: one without pay-to-win mechanics and one with pay-to-win mechanics. As a result, participants who read this overview and then proceeded to play the non-pay-to-win version may still have perceived this version as a pay-to-win game. This perception could have significantly impacted their responses.

I became aware of this through some of the comments I received on the study (all comments can be found in Section 7.4). For example, the following comment comes from a participant that played the non-P2W version:

"As a player I generally avoid any kind of store in games like this, so I never even opened it. The first level felt stupidly easy, and then the second level felt completely impossible to beat with just the default resources. Because I knew this survey was testing pay-to-win mechanics, I figured the way to win would probably be to buy things from the store, but since I would never do that as a player, I just gave up after the second level. The mechanics didn't feel fun enough for me to want to keep playing."

They explicitly stated they went in expecting a pay-to-win game thanks to the outline given before the experiment, which made them give up almost immediately. Another participant that played the non-P2W version commented "Cute simulator for Average Mobile Free2Play game disguised as Pay2Win".

However, the same can be said for participants who played the P2W version. Because the overview explicitly stated that the study is investigating the impact of pay-to-win mechanics, they may have approached the game prototype from a more critical standpoint and paid more attention to the pay-to-win mechanics. Therefore, responses from both groups might be impacted, and this should be kept in mind when discussing the results and conclusions of the study.

Finally, two mistakes during the study may have introduced noise into the data. The first of these was that, at the start of the experiment, audio was accidentally disabled in both versions of the game prototype. This included both background music and sound effects. Partway through the study, I received a comment from a participant mentioning they liked the game but noted that audio would improve it. This made me realize the error, and I immediately corrected it by re-uploading both versions of the game prototype.

The lack of audio could have impacted participants' enjoyment, immersion, and other constructs related to their experience. However, since this issue applied equally to both versions, I decided to retain the responses from participants who played this earlier version in the dataset. Removing these responses would have resulted in losing about one-third of my sample size, which I deemed more impactful than the error itself.

The second mistake occurred in the question about participants' gaming habits, which asked how many days per week they played video games for 30 minutes or more. I forgot to include an option for participants who do not game at all. These participants most likely selected "one day" as a response. However, since the target demographic of the study was individuals highly engaged with digital games, this was a very small percentage of respondents, meaning the noise introduced should be minimal.

7.2 Demographics

Looking at demographics, the majority of participants were either from Belgium or the United States. The large number of participants from Belgium can be explained by the fact that I distributed the questionnaire among people I know who engage in digital games. The higher number of participants from the United States may be due to the study being posted in English-speaking forums. However, this is a fairly diverse sample group overall.

Furthermore, a large majority of participants were between 18 and 29 years of age (84 8%). This distribution can be explained by the way the questionnaire

was distributed. I sent the questionnaire to many of my friends who play digital games and asked them to forward it to others they knew, likely explains why many participants were around my own age (24). Furthermore, university channels were used, which meant that many students had the opportunity to participate. However, individuals in this age range make up a large portion of the target audience for video games, so this does not necessarily result in a biased sample. However, participants under the age of 18 years were significantly underrepresented, although they constitute a large part of the target audience for digital games. The absence of these participants introduces a clear bias into the study.

Next, the distribution of gaming habits shows that almost all participants actively engage with digital games on a regular basis, with a majority playing daily, with few participants reporting playing 2 days (5.2%) or 1 day (6.3%) per week. Also, I forgot to add an option for zero to the question, so those who do not engage with games on a weekly bases were forced to pick another answer, and most likely choose 1 day. However, since the percentage of people who chose this is relatively low (6.3%), it should not matter too much.

The next question asks participants what means they use to engage in digital games. The goal of this question was to see if there is a difference in how pay-to-win microtransactions are perceived between people who play mostly mobile games or through other means. This is because microtransactions are very common in mobile games, and pay-to-win mechanics are often present. Therefore, users of mobile games may be more accustomed to them and find them less intrusive to the gameplay experience. The vast majority (73.4%) responded by other means, with only a small number (3.8%) responding that they play mostly mobile games. As this is a significant bias, the results of this experiment and corresponding conclusions only really apply to people who engage with games mostly through other means.

The final question was designed to check whether participants are familiar with the concepts of microtransactions and pay-to-win. In the end, everyone responded yes to this question (100%).This could indicate that the concepts of microtransactions and pay-to-win are well known among people who engage in digital games. However, a caveat must be made since participants might interpret familiar in different ways. Some may have answered yes simply because the overview of what the experiment is about mentions pay-to-win and microtransactions, leading them to believe they are familiar with it. Still, this is a strong indication that these concepts are generally well known amongst gamers. This question was included to potentially find a correlation between how the gameplay experience is impacted by pay-to-win and participants' familiarity with microtransactions and pay-to-win.

7.3 The Impact of Pay-to-Win Microtransactions

Having discussed the limitations of this research, we can finally address the main research question of this thesis: What is the impact of including Pay-to-Win microtransactions in single-player games on the experience of players? To answer this, we will examine the differences between the two versions of the game. The experiment analyzed a total of 16 elements of the player experience, 14 of which were measured through the game experience survey, while the remaining 2 were derived from gameplay data. This section examines how each of these constructs and their correlations changed between the two versions, interpreting and discussing the results.

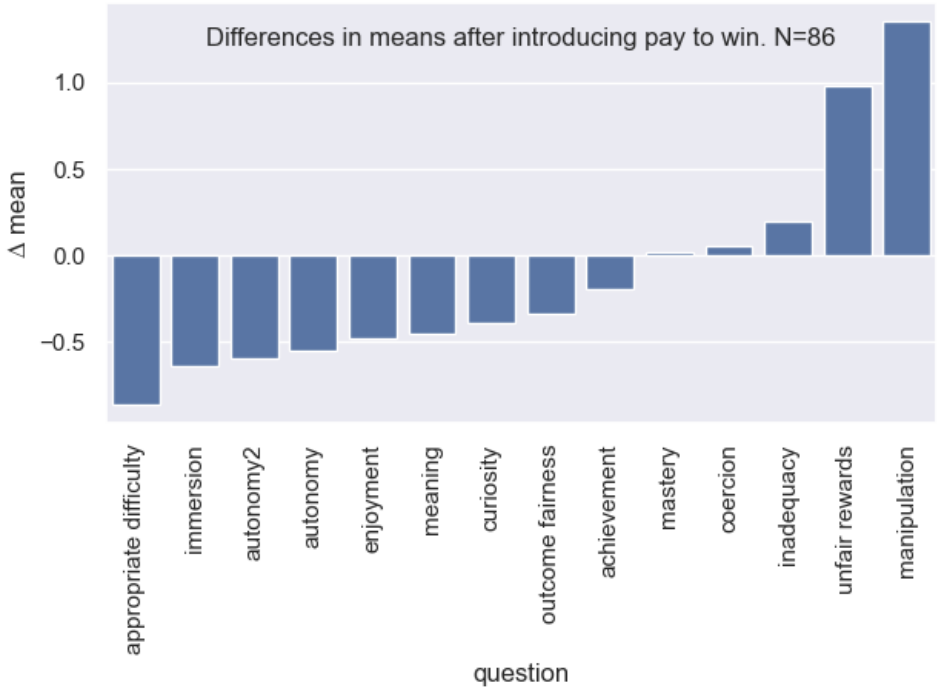

Figure 7.1: Difference in means for each construct, sorted

Figure 7.1 visualizes the differences in means between the two versions for the measured constructs. As a reminder, for a given construct, the difference is calculated by subtracting the mean result of participants who played the non-pay-to-win version from the mean result of participants who played the pay-to-win version. Therefore:

- A positive number indicates that the mean was higher in the pay-to-win group, suggesting participants agreed more with the construct.
- A negative number indicates the opposite, suggesting participants agreed more in the non-pay-to-win group.

The constructs related to inadequacy, perceived manipulation, coercion, and unfairness of rewards describe negative experiences, while other constructs represent positive experiences in the game. Looking at Figure 4, it is evident that the constructs representing positive experiences are generally stronger in the non-pay-to-win version compared to the pay-to-win version (except for mastery). Conversely, constructs representing negative experiences are stronger in the pay-to-win version. This pattern suggests that players had a more positive overall experience in the non-pay-to-win version compared to the pay-to-win version. Among these, the differences in perceived manipulation, perceived unfairness of rewards, and appropriate difficulty are statistically significant:

- Participants found the pay-to-win version to be significantly more manipulative.
- Rewards were perceived as significantly more unfair in the pay-to-win version.
- The difficulty was seen as significantly more appropriate in the non-pay-to-win version.

Although the other constructs do not show statistically significant differences, the consistent trend where positive elements were stronger in the non-pay-to-win version and negative elements were stronger in the pay-to-win version highly suggests that participants overall enjoyed the non-pay-to-win version more. This conclusion is further supported by examining the linear correlations in Figure 6.25 and Figure 6.26, which show that overall enjoyment shares medium to strong correlations with every construct except coercion in both versions.

To understand this impact in more detail, this section will discuss each of the observed constructs, how they changed between the two versions, and the potential causes for these differences in mean or lack thereof, utilizing the data and analysis presented in chapter 6.

Manipulation

The construct of perceived manipulation was measured through the question "I felt like the game was trying to influence me into making certain decisions.". The results for this show a large difference in both mean and standard deviation. The difference in mean is 1.35, and the difference in standard deviation is -0.66. The increase in mean indicates that players felt that their decisions were being manipulated significantly more in the pay-to-win version than in the non-pay-to-win version, and this change passed the Mann Whitney test with confidence $>99\%$.

Additionally, the large decrease in standard deviation means there is more consistency in the answers for the pay-to-win version. This can be interpreted

as players having a common understanding of the manipulativeness of pay-to-win mechanics, while in the non-pay-to-win version, the concept of manipulation was less universally understood. Combining this with an increase in the mean, this result suggests that participants in the sample not only felt that pay-to-win makes the game more manipulative but also shared a common understanding of the manipulative nature of pay-to-win.

Taking a look at the histogram and box-and-whisker plots for the manipulation perceived in both versions of the game, we can see that the distribution for the pay-to-win version shifts towards the right (representing the increase in mean). Outliers in the data (points that fall outside of 95% of the data) for answers -1 and -2 can be seen in the box-and-whisker plot for the pay-to-win version. This means that there is only a small number of participants who did not perceive the game as manipulative, and this is not the case for the non-pay to win version. A possible explanation for these outliers is that some individuals simply do think of pay-to-win mechanics as manipulative at all.

Existing research lead us to the hypothesis that players perceived pay-to-win microtransactions as manipulative. Zagal (2013) describes pay to win as a dark game design pattern called "monetized rivalry", defining dark game design patterns as a pattern used intentionally by a game creator to cause negative experiences for players that are against their best interests and happen without their consent." (Zagal 2013, page). The lack of consent in this definition is what leads players to experience such practices as manipulative.

Furthermore, Freeman's (2022) sentiment analysis around pay to win games found that players are concerned about game design that encourages pay-to-win; players feel that such games are designed to pressure them into spending money. They believe the developers intentionally make the game more difficult for players who do not pay, hindering fair competition or significant progress. Also, in Petrovskaya's (2021) study, 1104 players of video games were asked to describe a time when they had been exposed to transactions that were perceived to be misleading. The techniques mentioned by the players were then grouped into categories. Pay-to-win, predatory advertising, in-game currencies and the general presence were four of the main categories described by players as unfair, aggressive and misleading. These were also included in the pay-to-win version of the game prototype.

The results of this specific experiment align with the sentiment of the players, confirming that the pay-to-win dark game design pattern significantly increases the perceived sense of manipulation in games.

Furthermore, this perceived manipulation negatively impacts elements of the

game experience. Looking at Figures 6.25 and 6.26 that show the Pearson r values for the survey responses, we can see that in the nonpay-to-win version, perceived manipulation shares weak negative correlations with most of the constructs describing positive elements of the gameplay experience. However, in the pay-to-win version, these negative correlations become stronger.

This is also evident in the Kendall and Spearman tests, where manipulation shows significant relationships with most positive constructs (Figures 6.28-6.31), such as enjoyment, autonomy, and meaning in the P2W group. This suggests that the perceived manipulation of pay-to-win mechanics significantly impacts many elements of the player experience negatively, which can help to explain why many players are so worried about pay to win harming their game experience or are so critical of pay-to-win microtransactions, such as in the case of the aforementioned Bloons TD 2 launch.

Autonomy

The construct of perceived autonomy was measured through the questions "I felt free to play the game in my own way." and "I could play the game the way I wanted." Autonomy refers to the player's ability to make impactful decisions. Both of these questions show a negative change in means of -0.55 and -0.59, respectively, with barely any change in standard deviation (0.08 and 0.14). The p value for the difference in means for both questions is 0.14 and 0.17, which is not enough to be statistically significant. Both the box-whisker plots and the estimated probability density functions look very similar. This suggests that the understanding of autonomy was similar across both groups of participants, but players felt more autonomous in the non-pay-to-win version than in the pay-to-win version. Also note that in the Kendall and Spearman tests, this construct shares a significant relation with almost every other construct, suggesting that the perceived sense of autonomy is central to the overall player experience.

The decreased feeling of autonomy in the pay-to-win version may stem from participants feeling limited by external factors - in this case, pay-to-win mechanics. The fact that the optimal way to progress through the game is by spending money could undermine the individual sense of autonomy, making it feel like players' choices do not matter, or lose their meaning since the best option is always to pay to win. Participants in the non-pay-to-win version may have felt a stronger sense of autonomy because success is not tied to external factors, such as the ability to spend money. Finally, participants may also have felt a decreased sense of autonomy because of being unable to purchase the microtransactions they want. This is expressed in the following comment:

"It was mainly frustrating that I couldn't try out the other cool characters since I'd need to pay for them. Although this is the case, the 3 available units did feel fun already. In the end I won the game by abusing the grenade bagles." - P2W version

Unfairness of rewards

This construct was measured through the item "The distribution of rewards felt unfair," which evaluates whether players felt that the rewards they received (currency provided after each level attempt) were fair. The results showed a difference in means of 0.98 and a small difference in standard deviation of -0.09. The large difference in means suggests that players perceived rewards in the pay-to-win version of the game as more unfair than in the non-pay-to-win version (even though they were identical). This difference in means passed the Mann-Whitney U test with confidence of $\simeq 97\%$.

A possible explanation for why participants perceived their rewards as more unfair in the pay-to-win version is that, in this version, participants can access more rewards through paying, which can undermine the value of the rewards they receive by playing normally. Participants may also feel that the reward systems are designed to maximize revenue instead of enhancing gameplay and perceive that rewards are intentionally kept low to incentivize them to spend money.

Looking at the linear correlations that the construct of unfair rewards shares with other constructs, there is a negative correlation with every construct that describes a positive element of the gameplay experience (with many of them being significant as well). This suggests that players perceiving their rewards as unfair significantly impacts the gameplay experience negatively. Furthermore, these negative correlations are stronger for the pay-to-win version, implying that pay-to-win amplifies this dynamic.

Thus, introducing pay-to-win microtransactions significantly undermines the value of in-game rewards, and this, in turn, significantly impacts the gameplay experience in a negative way.

Appropriate difficulty

This construct was measured through the item "The challenges in the game were at the right level of difficulty for me." This item measures the perceived difficulty of the game and whether players found it too easy or too hard. The results give us a difference in mean of -0.86 and a difference in standard deviation of -0.25. The difference in mean suggests that players perceived the difficulty of the game as more appropriate in the non-pay-to-win version than in the pay-to-win version (even though the difficulty is identical in both versions). The difference in standard deviation suggests that answers for the pay-to-win version were a little bit more

consistent than for the non-pay-to-win version. Furthermore, the construct of appropriate difficulty correlates positively with most other positive constructs.

A possible explanation for why the presence of pay-to-win led participants to perceive the game as more difficult could be that participants felt disadvantaged compared to players who would pay for the game. Additionally, they may have perceived the difficulty as designed to be extra difficult for players who do not pay, in order to incentivize spending money on the game. Freeman (2020) also mentioned this, explaining that players feel that pay to win games are designed to pressure them into spending money. They believe the developers intentionally make the game more difficult for players who do not pay, hindering fair competition or significant progress. This perceived manipulation of difficulty could also explain the large difference in standard deviation and mean of the manipulation constructs discussed earlier. One participant also exactly expressed this sense in their comment:

"The core gameplay loop was very enjoyable, however, the skill curve progressed at such a rate that players who did not partake in microtransactions would be unable to proceed past level two without godly levels of skill. If the game was balanced around players who didn't make microtransactions, I could realistically see myself spending multiple hours playing." -P2W version

In conclusion, the results imply that challenge is perceived as significantly more misleading and unfair in pay-to-win games, negatively impacting the gameplay experience.

Immersion

This construct was measured through the item "I was immersed in the game," which assesses how immersed participants felt during the gameplay experience. The results show a negative difference in means of -0.64 and a positive difference in standard deviation of 0.49. This suggests that participants felt more immersed in the non-pay-to-win version of the game compared to the pay-to-win version, but that responses in the pay-to-win version were more consistent than in the non-pay-to-win version. Furthermore, examining the box-whisker plots for the non-pay-to-win version reveals outliers at values of -2 and -3, indicating that only a small percentage of participants did not find the game immersive.

One possible reason why the non-pay-to-win version felt more immersive could be the store elements and pop-ups that are part of the microtransaction revenue model inherent to pay-to-win mechanics. For instance, after losing a level in the pay-to-win version, players would receive a pop-up offering them a deal. Additionally, the store, including elements with real-world monetary costs, could disrupt immersion. Another factor might be the dark game design patterns

that remind players of the unfair advantages they could get through spending money, which could make them feel less immersed and more disconnected from the game world as the focus shifts to real money rather than the in-game experience.

The increase in standard deviation could suggest that players uniformly feel stronger about the concept of immersion when confronted with pay to win, and have more extreme opinions. We can also see this represented in the histogram for the paid to win version of the game where you can see that a large majority of answers are either -3, -2, 2 or 3, with very few answers in the middle. Also, examining the histograms shows that even in the pay-to-win version, a significant portion of participants still found the game immersive, suggesting that not all players were negatively affected by the pay-to-win mechanics and pop-ups.

Although there was a noticeable decrease (but not statistically significant) in the sense of immersion felt by participants who played the pay-to-win version, this is not necessarily a direct result of the pay-to-win mechanics. Pay-to-win is part of the broader microtransaction revenue model, and it is more likely that elements of this model, such as interruptions and spamming, impact the sense of immersion, as these are considered damaging to the player experience (Alda 2020).

Meaning

This construct was measured through the item "Playing the game was valuable to me." It measures whether players thought that playing the game was valuable to them or whether they could derive a sense of meaning from engaging with the prototype. The results show a negative difference in mean of -0.45 and a positive difference in standard deviation of 0.47. This suggests that players felt slightly more meaning while playing the non-pay-to-win version of the prototype than the pay-to-win version, but that these answers were more consistent.

The concept of meaning is very broad and can be interpreted in many ways. One possible interpretation could be that players feel they are making meaningful progression within the game and that they are doing something useful with their time. Pay-to-win could undermine this by offering an option to skip the overcoming of difficulties, therefore taking away the meaning of playing the game.

Looking at the histogram for the non-pay-to-win version, however, we can see that there are a lot of answers for zero. This could be because participants did not fully understand what the question was asking. However, in the pay-to-win version of the game, this does not seem to be the case, suggesting that participants who played the pay-to-win version of the game had a stronger concept of what meaning is. This is further supported by looking at the box-and-whisker plots, which show outliers for the stronger options (3, -2, and -3) only in the non-pay-

to-win version of the game, indicating that less than 5 percent of participants felt strongly about this question.

Curiosity

This construct was measured through the item "I felt eager to discover how the game continued." It measures the players' desire to see how the game evolves and their curiosity toward it. The results show a negative difference in mean of -0.39 and a positive difference in standard deviation of 0.23. This suggests that players felt slightly more curious about how the game evolved in the non-pay-to-win version than in the pay-to-win version, but answers were slightly less consistent in the pay-to-win version.

The difference in meaning, and consequently in the participants' curiosity, could result from a sense of detachment created by the pay-to-win mechanics, where players know they could progress much quicker by spending money and therefore feel less anticipation or curiosity toward the game. However, the difference in mean and standard deviation is quite small and not enough to draw any significant conclusions. The distribution of answers also looks relatively similar in the histograms.

Outcome Fairness

This construct was measured through the item "Winning in this game feels like a result of skill." For this construct, the difference in means is -0.33, and there is a very small positive difference in standard deviation of 0.05. These results suggest that players felt the outcome of the game was a bit more dependent on their own skill in the non-pay-to-win version. Additionally, with almost no difference in standard deviation, the results suggest that players felt similarly about the role of skill in both versions in this specific experiment setup. It could also indicate that participants, in general, were quite unsure about what this question meant. As a result, the probability density function estimated by the Kernel Density Estimate looks very similar in both histograms.

The difference in means is relatively small, which is surprising, as in the pay-to-win version of the game players can simply spend money and win without any requirement of skill. Therefore, we would expect a large difference in means, as "pay to win eliminates skill" is one of the most common complaints about pay-to-win games. However, the game was designed to be beatable by free-to-play players as well. Therefore, in this specific experiment, skill still played a large role in the player's success in the game. If the difficulty had been unreasonably difficult, requiring pay-to-win to beat it, the answers could have looked very different.

In Freeman's (2022) work, the sentiment that players have towards the relationship between pay-to-win and fairness in games was investigated. Many of their key findings (listed in Chapter 2) highlight a theme of fairness depending on whether Free-to-Play players can achieve success in the game. Looking at the distribution of levels completed by participants in both versions of the game, around two-thirds of players reached the second level, and one-third completed the game. Additionally, as mentioned in Chapter 7.2 (Limitations), the option to perform real-money transactions was disabled. Hence, the results reflect the perspective of Free-to-Play players. Clearly, participants could achieve success in the designed video game prototype without spending money in both versions, in which case our result of no changes in perceived fairness aligns with Freeman's (2022) findings of fairness depending on Free-to-Play players' ability to achieve success.

Coercion

This construct was measured through the item "I felt forced to take certain actions in the game." It measures the degree to which players feel compelled to make certain decisions. With both a difference in means and standard deviation of 0.06, along with almost identical probability density functions in the histograms, it is safe to say there was no difference in perceived coercion between the versions. In this specific experiment setup, pay-to-win does not impact the perceived coercion.

This could also be explained in a similar way as the lack of statistical significance in the difference in means of outcome fairness between versions: namely, that the game was designed to be beatable without spending any money, and the pay-to-win microtransactions were not impactful enough for players to feel forced to use them. These results suggest that players recognized this and did not feel coerced into using the microtransactions. Another possible explanation could be that the pay-to-win mechanics were not clearly presented to the participants, but results for other constructs, such as manipulation and the unfairness of rewards, suggest otherwise.

Mastery

This construct was measured through the item "I felt a sense of mastery playing this game." The results show a very small difference in means (0.02) and a standard deviation of 0.03. Additionally, the distributions in the histograms and box-whisker plots appear very similar between both versions. This suggests that participants, in general, did not feel any different about their sense of mastery over the game between the versions. This is most likely due to the limitation of not allowing players to utilize the pay-to-win microtransactions, as participants experienced difficulty in the same way across both versions. However, the sense of mastery could be affected for players who do utilize pay-to-win microtransactions to progress, so further research is needed on this topic with a different experimental setup.

Achievement

This construct was measured through the item "I felt a sense of achievement while playing the game." For this item, the difference in mean is a small negative value of -0.2, and the difference in standard deviation is a larger positive value of 0.38. This suggests that participants felt a slightly lower sense of achievement playing the pay-to-win version compared to the non-pay-to-win version. However, this difference is quite small and not statistically significant. The absence of a significant difference can be explained similarly to the absence of difference in perceived mastery: players achieved progress without paying in both versions. As a result, their sense of achievement was likely unaffected by the pay-to-win mechanics. Therefore, further research is needed to investigate the relationship between pay-to-win and the sense of achievement, employing methods different from this specific setup.

Inadequacy

This construct was measured through the item "I often felt that I lacked the skills necessary for the game." With a small positive difference in means of 0.2 and a difference in standard deviation of 0.15, not much can be concluded from these results. The means for both the non-pay-to-win version and the pay-to-win version of the game are negative, indicating that participants across the board felt a slight sense of inadequacy for the game.

Enjoyment

This construct was measured through the item “I liked playing the game.” It represents the self-reported level of enjoyment and can be interpreted as the total package of all other constructs. This connection is evident in the Spearman r test, where enjoyment shares a significant relationship with every construct except coercion and playtime.

The results indicate a negative delta of -0.48 and a small positive difference in standard deviation of 0.2. This suggests that participants enjoyed the non-pay-to-win version of the game more than the pay-to-win version. Responses were also slightly more consistent for the pay-to-win version. Outliers are present in the box-whisker plot for the non-pay-to-win version for all negative answers (-1, -2, -3), indicating that only a small percentage of participants did not like playing the game. The outlier for -3 is also present in the pay-to-win version, meaning that while participants overall enjoyed both versions, there was still a noticeable preference for the non-pay-to-win version.

The relatively large difference in delta, while not statistically significant, suggests that participants enjoyed the non-pay-to-win version more. This is further supported by examining the figure displaying differences in means across individual

survey questions. Constructs describing positive elements of the gameplay experience had higher means (or were neutral) for the non-pay-to-win group, while constructs describing negative elements had lower means for the same group.

While many of these differences in means were not statistically significant (except for perceived manipulation, unfairness of rewards, and appropriate difficulty), the consistent pattern shows that participants rated the non-pay-to-win version more positively overall. This explains the negative delta and supports the conclusion that participants enjoyed the non-pay-to-win version more.

Although the data from this specific experiment did not show a statistically significant impact on enjoyment levels, the measured difference, combined with the overall trend favoring the non-pay-to-win version, suggests underlying effects worth further exploration.

High-score and playtime

Finally, we have the constructs that were measured by the collected data. At first glance, both of these show not much difference between the versions (Figure 6.7, Figure 6.8, Figure 6.9). For the playtime, which is the time in minutes that participants spent playing the videogame prototype, a quick look at the Kendall t and Spearman r tests can explain why. In the non P2W version, playtime did not share a significant relation with any other construct except highscore (which makes sense), and for the pay-to-win version, there is a significant correlation only curiosity, mastery and meaning.

The absence of a significant correlation with enjoyment and other positive and negative constructs suggests that the amount of time players spend does not depend on their experience with the game. This makes sense as participants engaged with the game in an experimental context. Although it was communicated that they could stop playing at any time when they felt like it, with the intention to measure how engaged they were, participants may have felt they needed to play for a certain amount of time because the game is part of an experiment, regardless of whether they enjoy it or not.

For high scores, the story is different. Although the distributions look very similar, in the non-P2W version, high-score shares a significant relation with only three constructs (playtime, inadequacy and curiosity). In the P2W version, this increases to 11 out of 16, and 9 out 10 positive constructs. This suggests that in the non-P2W version, the high score was not really correlated with the overall experience of the participant, but in the P2W version, the high score correlates strongly with the player experience.

Looking at Figure 6.26, these correlations are positive. In other words, players who did not experience success had a significantly worse experience in the game than those who did, while this was not the case in the non-P2W version. In the non-P2W version, a high score is just one of many factors that influence enjoyment. Some players may prioritize exploration, immersion, or challenge. However, all of these were negatively affected by the presence of pay-to-win (see Figure 7.1), except the sense of mastery. This suggests that success in the game became a defining factor of the experience in the P2W version, while in the non-P2W version, a good experience depends more on other factors such as immersion and curiosity.

In conclusion, introducing pay-to-win microtransactions significantly impacted the experience of players who did not achieve a high score negatively.

Player types and Pay-to-Win

To conclude the discussion, I want to apply the HEXAD player model (Marczewski 2015) and Bartle's taxonomy (Bartle 1996) to the results. These models categorize players based on their primary motivations for playing games. Since our research investigated the impact of pay-to-win on various aspects of the game experience, applying these models can help identify which player types are most affected. Developers designing games for certain player types should be especially cautious about including pay-to-win if their core audience consists of players whose motivations are severely impacted by its presence.

First, *Achievers* engage with games by mastering systems, overcoming challenges, and progressing through the game. The results showed that participants in the pay-to-win version found the difficulty significantly less appropriate and more unfair. Perceiving the challenge as unfair, or intentionally designed to make them spend money can harm *Achievers*' motivation. Since *Achievers* thrive on a sense of accomplishment from overcoming challenges, pay-to-win mechanics can undermine their motivation by devaluing their achievements. Additionally, players who did not get fa

Second, *Players* (those motivated by rewards) engage with games primarily for in-game currency, points, or experience. Participants who played the pay-to-win version of the prototype were significantly more likely to perceive the rewards as unfair. When rewards are perceived as unfair, it can diminish the motivation of *Players*, making the game less satisfying for them.

Next, *Free Spirits* value autonomy and creative expression. Participants in the pay-to-win version reported a lower sense of autonomy and a (significant) higher sense of being manipulated into performing actions. However, this specific experiment did not find a statistically significant decrease in autonomy, indicating

that further research is needed to explore how pay-to-win mechanics affect *Free Spirits*.

Finally, *Philanthropists* seek meaningful experiences playing games. Participants reported a lower sense of meaning when playing the pay-to-win version of the prototype game. This player type may also feel less motivated. However, this result is not statistically significant, so further research is needed.

Chapter 8

Conclusions

Microtransactions have been a hot topic of discussion ever since their introduction into the gaming landscape, and have quickly become one of the most popular revenue models employed in games today. Among the many different types of microtransactions, pay-to-win has emerged as a topic of social discourse among players due to its perceived impact on fairness, player satisfaction, and game design integrity of games. Existing research has focused on pay-to-win mechanics in multiplayer environments, where competitive dynamics and the ability to compare with other players make the implications of paid advantages more immediately apparent.

However, the debate around pay-to-win is not limited to multiplayer games, as players have raised concerns and criticized monetization models featuring pay-to-win even in single-player games, such as Plants vs. Zombies 2 (PopCap Games 2013). This suggests that the presence of pay-to-win microtransactions impacts the game experience regardless of whether other players are present, which can have consequences for the game. The research conducted in this thesis seeks to address this gap by investigating how pay-to-win microtransactions impact player experiences in single-player settings, such that developers can develop responsibly.

The primary objective of this thesis is to answer the central research question: *What is the impact of including pay-to-win microtransactions in single-player games on the experience of players?* To achieve this, a quantitative study was designed and conducted, involving the development of a game prototype with two distinct versions: one featuring a traditional gameplay experience without monetization and the other incorporating a pay-to-win microtransaction model. By keeping all gameplay elements constant between the two versions, the study aimed to isolate the presence of pay-to-win microtransactions as the only variable. This allowed for a comparative analysis of the experiences that participants had with both versions. The microtransaction revenue model and pay-to-win mechanics that were featured in the game prototype were designed to be realistic and representative

of real single player pay-to-win games by researching existing titles.

Participants were divided into two groups, each experiencing one version of the game. A questionnaire was designed to measure various aspects of the experience of the player, such as enjoyment, perceived fairness, and autonomy. Participants were asked to complete this questionnaire and then a comparative analysis was performed to identify significant differences in the gameplay experience, which could then be attributed to the inclusion of pay-to-win mechanics.

First, the results show that players perceive games with pay-to-win mechanics as significantly more manipulative than games without pay-to-win. Furthermore, players have a shared understanding of the manipulativeness of pay-to-win mechanics and are able to recognize their exploitative nature. Correlational analyses (Pearson, Kendall, Spearman) revealed that perceived manipulation significantly negatively impacts positive gameplay elements such as enjoyment, and a sense of autonomy. This aligns with existing research, such as Zagal's (2013) definition of P2W as a "dark game design pattern" involving "monetized rivalry" and Freeman's (2022) sentiment analysis highlighting player concerns about unfair competition and pressure to spend money. Petrovskaya's (2021) study also identified P2W as one of the main misleading game transaction categories.

The study also found that introducing pay-to-win undermines the perceived value of other rewards that players obtain in progression systems. Players feel that the rewards they receive are significantly more unfair in games that feature pay-to-win microtransactions than in those that do not. Similar to the perceived sense of manipulation, the perceived unfairness of rewards also shares negative correlations with many of the positive elements of the gameplay experience in the pay-to-win version, suggesting that perceived unfairness of rewards can be damaging to the gameplay experience. Players feel that pay-to-win players can access more rewards by paying, which diminishes the value of rewards earned through regular gameplay.

Next, the study found that pay-to-win microtransactions cause players to perceive the difficulty as significantly less appropriate and more manipulative. When faced with a challenge in pay-to-win games, players are more likely to think of the difficulty as unfair, which could stem from feeling disadvantaged compared to paying players or believing that the game was intentionally made harder for non-paying players to encourage spending. Players who think this way are also more likely to view the entire game as manipulative.

Another important finding is the relationship between player performance in the game and their overall experience. The study found that introducing pay-to-win microtransactions significantly negatively impacted the experience of players

who performed poorly in the game. In the non-pay-to-win version, how far players progressed in the game correlated with only a few aspects of the gameplay experience, suggesting that players had similar experiences regardless of their level of success. Players who did not perform well could still enjoy the game for other reasons.

However, in the pay-to-win version, the level of success significantly impacted the game experience: 9 out of 10 constructs that describe a positive aspect of the game experience (such as the reported level of enjoyment, mastery, achievement and immersion) showed a significant positive relation with participants' success. Hence, the P2W microtransaction system significantly disrupted the balance of motivations for various player types. Success became a central factor for enjoyment in the P2W version, reducing the diversity of positive experiences that were present in the non-P2W version.

The remaining results were not significant. However, the overall trend of the data paints a clear picture. The questionnaire measured 14 aspects of the player experience, 10 of which described a positive aspect and the remaining four a negative element. 9 of 10 positive aspects were stronger in the version without pay-to-win, and all four negative aspects were stronger in the pay-to-win version (as seen in Figure 7.1).

Although many of these differences are not statistically significant, the trend suggests that positive aspects were generally stronger in the non-pay-to-win version, while negative aspects were more pronounced in the pay-to-win version, which indicates that the pay-to-win version provided a worse experience. This reinforces players' widespread criticism of P2W mechanics and concerns about their impact on the gaming experience, as evidenced by backlash against launches like Bloons TD Battles 2 (Ninja Kiwi 2021). As discussed in the limitations chapter, this specific experiment setup had strict constraints that limited the observable results, making further research necessary to explore these additional potential impacts.

These findings provide valuable information for game developers to understand the specific ways in which pay-to-win microtransactions impact players and which player types are most affected. They elucidate correlations between pay-to-win mechanics and gameplay elements such as immersion, enjoyment, and the sense of autonomy, which can help developers make informed decisions when designing their monetization strategies. In addition, the study underscores the importance of maintaining transparency and fairness in revenue models to prevent players from perceiving the game as manipulative, which significantly harms the player experience.

Finally, I want to conclude this thesis with some recommendations for game

developers, publishers, and lawmakers regarding the use of the dark game design pattern pay-to-win. The findings of this research highlight how pay-to-win (P2W) microtransactions negatively affect player experiences, even in single-player games, and that this impact extends beyond the fairness of the game, influencing perceived difficulty, reward satisfaction, and overall enjoyment.

As discussed, pay-to-win games can be very profitable, but this profitability comes at the cost of a damaged player experience, and to an extent a damaged reputation for both the game and the company behind it. To avoid this, developers should integrate ethical design guidelines into their production processes and train their internal Quality Assurance (QA) teams to identify dark game design patterns such as intentional difficulty spikes that pressure nonpaying players or reward systems that undermine the value of earned progression.

In particular, games that have the HEXAD player types (Marczewski 2015) *Achievers* or *Players* as part of their target audience should be careful with introducing pay-to-win, as the results showed that this significantly impacted these players' core motivations. Also, pay-to-win negatively impacts the game experience for players who struggle to progress through challenges, as they interpret the difficulty as unfair and intentionally designed to make them spend money.

In addition, developers should focus on transparent monetization models that clearly communicate the role and benefits of microtransactions to players, as perceived manipulation negatively impacts the game experience. Offering cosmetic-only purchases or other content that does not affect gameplay can provide players with monetization options without compromising gameplay.

Player engagement and long-term satisfaction are enhanced when monetization strategies prioritize user experience over short-term profits. A great example of this is *Bloons Tower Defense 6* (Ninjakiwi 2018), a single-player game that features a microtransaction revenue model that includes pay-to-win mechanics, yet it sits at rank 37 among the best-reviewed games of all time on the digital distribution platform Steam, boasting 343,394 reviews, of which 96.29% are positive (SteamDB 2024). A key reason why pay-to-win is not an issue in this game is that it avoids problematic dark game design patterns, such as intentional difficulty spikes and undermining the sense of achievement from completing challenges (pay-to-win is disabled for the hardest challenges). By researching pay-to-win and closely analyzing how it impacts players, developers can prevent their systems from negatively affecting the player experience and damaging the game.

Furthermore, digital distribution platforms such as Steam and the Epic Games Store have a responsibility to help their customers make informed decisions. One recommendation for these platforms is the introduction of warning labels to identify

games featuring pay-to-win mechanics and, on a larger scale, microtransactions. Distributors could require developers to disclose more information about their revenue models and in-game purchase mechanics before being granted access to sell their games. As shown in the thesis results, the majority of players know about and are able to recognize these practices, so user reviews and feedback systems can be leveraged to flag games containing pay-to-win and other manipulative techniques.

Pay-to-win is but one of many exploitative techniques used in the microtransactions revenue model, and given the growing concerns over microtransactions and their impact on player experiences, regulatory authorities such as the ESRB (Entertainment Software Rating Board) and PEGI (Pan European Game Information) should expand their rating systems to include classifications for games with such elements. One major concern is that these games are freely available to vulnerable individuals, such as children, so these classifications should be clear and visible on game packaging and digital store pages for games, helping parents and consumers make informed decisions.

In addition to expanding rating systems, lawmakers should consider implementing consumer protection regulations to ensure that players are not misled by exploitative monetization practices. Countries like Belgium and the Netherlands have already taken first steps by banning certain loot box mechanics that resemble gambling (even though, as discussed, they are not effective at the moment). Such regulatory frameworks can be adapted to target P2W systems that manipulate players and similar practices.

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Appendix A

Jupyter Notebook code

PayToWinThesis

December 31, 2024

[1]:
```
import seaborn as sns
import matplotlib.pyplot as plt
import pandas as pd
import scipy.stats as stats
import numpy as np
import os
```

1 Initialization

1.1 Import data

[4]:
```
# This link does not work anymore, as per GDPR personal data was erased after completion of the purpose of writing the thesis
# A copy of the survey answers (without personal data) is available in the thesis
sheet_link ="https://docs.google.com/spreadsheets/d/e/2PACX-1vQwrW6HX7kN_VL3eFTW80xAIC_o1FogNSOae2IKgeQLdhkLIOD4NZazlLZ9g5Zl_DxAmzbWrcN7pe4X/pub?gid=0&single=true&output=csv"
data = pd.read_csv(sheet_link)
output_dir = os.getcwd()  # This will get the current directory where the notebook is running
```

1.2 Rename columns to their keywords

[6]:
```
# for the demographic data
keywords_demographic_data = ['gender', 'age', 'nationality', 'frequency', 'means', 'familiarity']
demographic_data_columns = [2,3,4,5,6,7]
new_column_names = {
    data.columns[i]: keywords_demographic_data[i-2]  # Adjust index for question numbers
    for i in demographic_data_columns
}
data.rename(columns=new_column_names, inplace=True )

# for questions
```

```
keywords_questions = ['manipulation', 'autonomy', 'unfair rewards',␣
 ↪'appropriate difficulty', 'immersion', 'meaning', 'curiosity', 'outcome␣
 ↪fairness', 'coercion', 'enjoyment', 'mastery', 'autonomy2', 'achievement',␣
 ↪'inadequacy']
question_columns = [9,10,11,12,13,14,15,16,17,18,19,20,21,22]
new_column_names = {
    data.columns[i]: keywords_questions[i-9]  # Adjust index for question␣
 ↪numbers
    for i in question_columns
}
data.rename(columns=new_column_names, inplace=True )

# for the score column
score_column = [8]
new_column_names = {
    data.columns[i]: 'score'
    for i in score_column
}
data.rename(columns=new_column_names, inplace=True )
```

1.3 Filter out invalid data

[8]:
```
# Define a function to validate scores based on the rules
def is_valid_score(score):
    # Check if the score is a string of exactly 4 digits
    if not isinstance(score, str) or not score.isdigit() or len(score) != 4:
        return False

    # Extract individual components of the score
    first_digit = int(score[0])
    middle_two_digits = int(score[1:3])
    last_digit = int(score[3])

    # Validate each component
    if first_digit not in [1, 2, 3]:
        return False
    if not (2 < middle_two_digits <= 30): # Remove scores with time played less␣
 ↪than 3
        return False
    if last_digit not in [1, 2]:
        return False

    return True

# Filter the dataframe for valid scores
invalid_scores_df = data.drop(data[data['score'].apply(is_valid_score)].index)
data.drop(invalid_scores_df.index,inplace=True)
```

1.4 Organize data

[10]:
```
# Add a 'group' column based on each of the score elements
data['group'] = data['score'].astype(str).str[-1].map({'1': '1', '2': '2'})
data['highscore'] = data['score'].astype(str).str[0].astype(int)
data['playtime'] = data['score'].astype(str).str[1:3].astype(int)
```

[11]:
```
group_a_demodata = data[data['group'] == '1'][keywords_demographic_data]
group_b_demodata = data[data['group'] == '2'][keywords_demographic_data]
group_a_questions = data[data['group'] == '1'][keywords_questions]
group_b_questions = data[data['group'] == '2'][keywords_questions]
```

[12]:
```
keywords_questions_and_data =  ['frequency','highscore','playtime'] +␣
 ↪keywords_questions
group_a_data_and_questions =  data[data['group'] ==␣
 ↪'1'][keywords_questions_and_data]
group_b_data_and_questions =  data[data['group'] ==␣
 ↪'2'][keywords_questions_and_data]
```

1.5 Save function

[14]:
```
output_dir = os.getcwd()  # This will get the current directory where the␣
 ↪notebook is running
images_folder = os.path.join(os.getcwd(), 'images-test')
def save_figure(title):
    filename = os.path.join(images_folder,f"{title}.png")
    plt.savefig(filename)  # Save the figure as a PNG file in the 'images'␣
 ↪folder
    plt.close()
```

1.6 Set up for consistent styling

[16]:
```
# Set a color palette for consistency
sns.set_theme()
sns.color_palette("colorblind")
# Function to create a styled pie chart
def create_pie_chart(data, title, filename):
    value_counts = data.value_counts()
    title += " (N = " + str(data.shape[0]) + ")"
    labels = [f"{entry} ({count})" for entry, count in value_counts.items()]
    fig, ax = plt.subplots()
    wedges, texts, autotexts = ax.pie(value_counts, labels=labels, autopct='%1.
 ↪1f%%', startangle=90)

    # Style the chart
    ax.set_title(title)
    plt.setp(autotexts, size=10, weight="bold", color="white")
```

```
    save_figure(filename)

# Function to create a styled pie chart
def create_bar_chart(data, title):
    value_counts = data.value_counts()
    title += " (N = " + str(data.shape[0]) + ")"
    labels = [f"{entry} ({count})" for entry, count in value_counts.items()]
    fig, ax = plt.subplots()
    wedges, texts, autotexts = ax.pie(value_counts, labels=labels, autopct='%1.
 ↪1f%%', startangle=180)

    # Style the chart
    ax.set_title(title)
    plt.setp(autotexts, size=10, weight="bold", color="white")
```

2 Analysis of demographic survey

[18]:
```
nationality_counts = data['nationality'].value_counts()
# print(nationality_counts)
nationality_chart = create_pie_chart(data['nationality'], "Nationalities of␣
 ↪participants",  "nationalities")
nationality_unique = len(pd.unique(data['nationality']))
print("Number of unique values in 'nationality':", nationality_unique)
```

```
Number of unique values in 'nationality': 26
```

[19]:
```
age_chart = create_pie_chart(data['age'], "Ages of participants", "ages")
```

[20]:
```
frequency_chart = create_pie_chart(data['frequency'], "How many days in a week␣
 ↪do you play \nat least 30 minutes of video games",  "gaming_habits")
```

[21]:
```
means_chart = create_pie_chart(data['means'], "In your opinion, do you play␣
 ↪mostly mobile games (games played using your phone) \nor through other means␣
 ↪(computer, PlayStation, Nintendo Switch)",  "means_of_playing")
```

[22]:
```
familiarity_chart = create_pie_chart(data['familiarity'], "Are you familiar␣
 ↪with the concepts of \n\"micro-transactions\" and \"pay to win\"", ␣
 ↪"familiarity")
```

3 Analysis of the collected in-game data

3.0.1 Version

[25]:
```
right_name = data['group'].astype(str).map({'1': 'non P2W', '2': 'P2W'})
version_chart = create_pie_chart(right_name, "Version played",  "version")
```

3.0.2 Playtime

[ ]:
```
fig, axes = plt.subplots(1, 2, sharey=True)
playtime_a = data[data['group'] == '1']['playtime']
playtime_b = data[data['group'] == '2']['playtime']

# Plot the histogram for group 1 with label
sns.histplot(data=playtime_a, kde=True, bins=10, label='NP2W', ax=axes[0])
# Plot the histogram for group 2 with label
sns.histplot(data=playtime_b, kde=True, bins=10, label='P2W', ax=axes[1],␣
 ↪color="orange")

axes[0].set_title('Non P2W play time distribution')  # Title for the first plot
axes[0].set_xlabel('Playtime (in minutes)')  # X-axis label
axes[0].set_ylabel('Count')  # Y-axis label

axes[1].set_title('P2W play time distribution')  # Title for the first plot
axes[1].set_xlabel('')  # X-axis label
axes[1].set_ylabel('Count')  # Y-axis label
save_figure("playtime_hist")

playtime_after_min_df = pd.DataFrame(columns=['non P2W', 'P2W'])
for i in range(30):
    playtime_after_min_df.loc[i] = [playtime_a[playtime_a>i].count(),␣
 ↪playtime_b[playtime_b>i].count()]
sns.lineplot(data=playtime_after_min_df)
plt.xlabel("Playtime (in minutes)")
plt.ylabel("Remaining players")
save_figure("playtime_remaining_players")
```

3.0.3 Levels cleared

[ ]:
```
# Create a figure with two subplots
fig, axes = plt.subplots(1, 2)  # 1 row, 2 columns

# Plot pie chart for Group 1
value_counts = data[data['group'] == '1']['highscore'].value_counts()
labels = [f"{entry} ({count})" for entry, count in value_counts.items()]
axes[0].pie(value_counts, labels=labels)
axes[0].set_title('non P2W Distribution')  # Title for the first pie chart

# Plot pie chart for Group 2
value_counts = data[data['group'] == '2']['highscore'].value_counts()
labels = [f"{entry} ({count})" for entry, count in value_counts.items()]
axes[1].pie(value_counts, labels=labels)
axes[1].set_title('P2W Distribution')  # Title for the second pie chart
```

```
# Adjust layout
plt.tight_layout()

save_figure("levels_cleared")
```

4 Analysis of the game experience survey

4.1 Means and std table

4.1.1 Calculate means, std and their deltas

[ ]:
```
counts = pd.DataFrame()
counts['mean (non P2W)'] = group_a_questions.mean()
counts['mean (P2W)'] = group_b_questions.mean()
counts[' mean'] = group_b_questions.mean()-group_a_questions.mean()
counts['std (non P2W)'] = group_a_questions.std()
counts['std (P2W)'] = group_b_questions.std()
counts[' std'] = group_b_questions.std()-group_a_questions.std()

counts_rounded = counts.copy()
for col in counts.columns:
    if col not in ['mean (non P2W)', 'std (non P2W)', 'mean (P2W)', 'std␣
↪(P2W)', ' mean', ' std']:
        counts_rounded[col] = counts[col].astype(int).astype(str)  # Convert to␣
↪string to remove .0
    else:
        counts_rounded[col] = counts[col].round(2).astype(str)  # Round 'means'␣
↪and 'std' to 2 decimals and convert to string

deltas = group_b_questions.mean()-group_a_questions.mean()
deltas = deltas.reset_index()
deltas.columns = ['question', ' mean']
```

4.1.2 Generate tables

[ ]:
```
deltas_sorted_copy = deltas.sort_values(by=' mean')
deltas_chart = sns.barplot(data=deltas_sorted_copy, x="question", y=" mean")
plt.xticks(rotation=90)
plt.tight_layout()
plt.title("Differences in means after introducing pay to win. N=86",pad=-20)
save_figure("delta_means")
counts_rounded
```

4.1.3 Perform tests

[ ]:
```
p_values = []
for keyword in keywords_questions:
    g_a = group_a_questions[keyword]
    g_b = group_b_questions[keyword]
    t_stat, p_val = stats.mannwhitneyu(g_a, g_b)
    p_values.append(p_val)
deltas['p (Mann-Whitney U)'] = p_values

stat_signs = []
for v in deltas['p (Mann-Whitney U)']:
    if v < 0.05:
        stat_signs.append("Yes")
    else:
        stat_signs.append("No")
deltas["  mean significant?"] = stat_signs

deltas_rounded = deltas.copy().sort_values(by='p (Mann-Whitney U)')
for col in deltas.columns:
    if col in ['  mean', 'p (Mann-Whitney U)']:
        deltas_rounded[col] = deltas[col].round(2).astype(str)  # Round 'means'␣
↪and 'std' to 2 decimals and convert to string

deltas_rounded
```

4.2 Histograms and boxplots for individual questions

[ ]:
```
for question_keyword in keywords_questions:
    fig, axes = plt.subplots(2, 2)
    playtime_a = data[data['group'] == '1'][question_keyword]
    playtime_b = data[data['group'] == '2'][question_keyword]
    # Define the bin edges for the histogram (discrete values: [-3, -2, -1, 0,␣
↪1, 2, 3])
    bin_edges = [-3, -2, -1, 0, 1, 2, 3]

    sns.histplot(data=playtime_a, kde=True, bins=bin_edges, label='NP2W',␣
↪ax=axes[0,0])
    sns.histplot(data=playtime_b, kde=True, bins=bin_edges, label='P2W',␣
↪ax=axes[1,0], color="orange")
    sns.boxplot(data=playtime_a, label='NP2W', ax=axes[0,1])
    sns.boxplot(data=playtime_b, label='NP2W', ax=axes[1,1] , color="orange")


    axes[0,0].set_title('Non P2W ' + question_keyword + ' histogram and␣
↪box-whisker plot. (N='+ str(playtime_a.shape[0]) +')',loc='left')  # Title␣
↪for the first plot
```

```
    axes[1,0].set_title('P2W ' + question_keyword + ' histogram and box-whisker␣
↪plot. (N='+ str(playtime_b.shape[0]) +')',loc='left')  # Title for the first␣
↪plot

    ticks = [-3,-2,-1,0,1,2,3]  # Adjust based on your data range
    axes[0,0].set_xticks(ticks)
    axes[0,1].set_yticks(ticks)
    axes[1,0].set_xticks(ticks)
    axes[1,1].set_yticks(ticks)

    # Hide x and y labels by looping over each axes
    for ax in axes.flat:
        ax.set_xlabel('')  # Remove x-axis label
        ax.set_ylabel('')  # Remove y-axis label

    plt.tight_layout()
    filename = f"{question_keyword}_histogram_boxplot"
    save_figure(filename)
```

4.3 Analysis of pearson r, kendall tau and spearman r

4.3.1 Functions for tests

[ ]:
```
# Credit to Philpp Singer for the functions in this cell (https://github.com/
↪psinger/CorrelationStats?tab=readme-ov-file)

from scipy.stats import t, norm
from math import atanh, pow
from numpy import tanh

def z_transform(r, n):
    z = np.log((1 + r) / (1 - r)) * (np.sqrt(n - 3) / 2)
    p = stats.zprob(-z)
    return p

def rz_ci(r, n, conf_level = 0.95):
    zr_se = pow(1/(n - 3), .5)
    moe = norm.ppf(1 - (1 - conf_level)/float(2)) * zr_se
    zu = atanh(r) + moe
    zl = atanh(r) - moe
    return tanh((zl, zu))

def rho_rxy_rxz(rxy, rxz, ryz):
    num = (ryz-1/2.*rxy*rxz)*(1-pow(rxy,2)-pow(rxz,2)-pow(ryz,2))+pow(ryz,3)
    den = (1 - pow(rxy,2)) * (1 - pow(rxz,2))
    return num/float(den)
```

```
def independent_corr(xy, ab, n, n2 = None, twotailed=True, conf_level=0.95,␣
↪method='fisher'):
    """
    Calculates the statistic significance between two independent correlation␣
↪coefficients
    @param xy: correlation coefficient between x and y
    @param xz: correlation coefficient between a and b
    @param n: number of elements in xy
    @param n2: number of elements in ab (if distinct from n)
    @param twotailed: whether to calculate a one or two tailed test, only works␣
↪for 'fisher' method
    @param conf_level: confidence level, only works for 'zou' method
    @param method: defines the method uses, 'fisher' or 'zou'
    @return: z and p-val
    """

    if method == 'fisher':
        xy_z = 0.5 * np.log((1 + xy)/(1 - xy))
        ab_z = 0.5 * np.log((1 + ab)/(1 - ab))
        if n2 is None:
            n2 = n

        se_diff_r = np.sqrt(1/(n - 3) + 1/(n2 - 3))
        diff = xy_z - ab_z
        z = abs(diff / se_diff_r)
        p = (1 - norm.cdf(z))
        if twotailed:
            p *= 2

        return z, p
    elif method == 'zou':
        L1 = rz_ci(xy, n, conf_level=conf_level)[0]
        U1 = rz_ci(xy, n, conf_level=conf_level)[1]
        L2 = rz_ci(ab, n2, conf_level=conf_level)[0]
        U2 = rz_ci(ab, n2, conf_level=conf_level)[1]
        lower = xy - ab - pow((pow((xy - L1), 2) + pow((U2 - ab), 2)), 0.5)
        upper = xy - ab + pow((pow((U1 - xy), 2) + pow((ab - L2), 2)), 0.5)
        return lower, upper
    else:
        raise Exception('Wrong method!')
```

4.3.2 Calulcate pearson r, kendall tau, spearman r and save in dataframes

[ ]:
```
corr_matrix_a = group_a_data_and_questions.corr()
p_value_matrix_a = np.zeros((len(group_a_data_and_questions.columns),␣
↪len(group_a_data_and_questions.columns)))
```

```
p_value_matrix_a_spearman = np.zeros((len(group_a_data_and_questions.columns),␣
 ↪len(group_a_data_and_questions.columns)))
# Iterate over each pair of variables
for i, col1 in enumerate(group_a_data_and_questions.columns):
    for j, col2 in enumerate(group_a_data_and_questions.columns):
        if i != j:  # Skip diagonal (self-correlation)
            tau, p_value = stats.kendalltau(group_a_data_and_questions[col1],␣
 ↪group_a_data_and_questions[col2])
            p_value_matrix_a[i, j] = p_value

            corr, p_value = stats.spearmanr(group_a_data_and_questions[col1],␣
 ↪group_a_data_and_questions[col2])
            p_value_matrix_a_spearman[i, j] = p_value

# Create a DataFrame for better handling of labels
p_value_df_a_tau = pd.DataFrame(p_value_matrix_a,␣
 ↪index=group_a_data_and_questions.columns, columns=group_a_data_and_questions.
 ↪columns)
p_value_df_a_spearman = pd.DataFrame(p_value_matrix_a_spearman,␣
 ↪index=group_a_data_and_questions.columns, columns=group_a_data_and_questions.
 ↪columns)

corr_matrix_b = group_b_data_and_questions.corr()
p_value_matrix_b = np.zeros((len(group_b_data_and_questions.columns),␣
 ↪len(group_b_data_and_questions.columns)))
p_value_matrix_b_spearman = np.zeros((len(group_a_data_and_questions.columns),␣
 ↪len(group_a_data_and_questions.columns)))
# Iterate over each pair of variables
for i, col1 in enumerate(group_b_data_and_questions.columns):
    for j, col2 in enumerate(group_b_data_and_questions.columns):
        if i != j:  # Skip diagonal (self-correlation)
            tau, p_value = stats.kendalltau(group_b_data_and_questions[col1],␣
 ↪group_b_data_and_questions[col2])
            p_value_matrix_b[i, j] = p_value

            corr, p_value = stats.spearmanr(group_b_data_and_questions[col1],␣
 ↪group_b_data_and_questions[col2])
            p_value_matrix_b_spearman[i, j] = p_value


# Create a DataFrame for better handling of labels
p_value_df_b_tau = pd.DataFrame(p_value_matrix_b,␣
 ↪index=group_b_data_and_questions.columns, columns=group_b_data_and_questions.
 ↪columns)
```

```
p_value_df_b_spearman = pd.DataFrame(p_value_matrix_b_spearman,␣
↪index=group_a_data_and_questions.columns, columns=group_a_data_and_questions.
↪columns)
```

[ ]:
```
corr_matrix_diff = group_b_data_and_questions.corr() -␣
↪group_a_data_and_questions.corr()

p_value_matrix_diff = np.zeros((len(group_a_data_and_questions.columns),␣
↪len(group_a_data_and_questions.columns)))
# Iterate over each pair of variables
for i, col1 in enumerate(corr_matrix_a.columns):
    for j, col2 in enumerate(corr_matrix_a.columns):
        if i != j:  # Skip diagonal (self-correlation)
            z, p_value = independent_corr(corr_matrix_a[col1][col2],␣
↪corr_matrix_b[col1][col2], group_a_data_and_questions.shape[0],␣
↪group_b_data_and_questions.shape[0])
            p_value_matrix_diff[i, j] = p_value
        else:
            p_value_matrix_diff[i, j] = 100 # difference on diagonal
```

4.3.3 Generate heatmaps

[ ]:
```
from matplotlib.colors import ListedColormap, BoundaryNorm
sns.set_theme(style="whitegrid")
keywords_questions_and_data_sorted =  ['frequency','highscore','playtime'] +␣
↪['autonomy', 'appropriate difficulty','immersion', 'meaning',
                                                                    ␣
↪'curiosity', 'outcome fairness', 'enjoyment',
                                                                    ␣
↪'mastery', 'autonomy2', 'achievement',
                                                                    ␣
↪'inadequacy','manipulation', 'unfair rewards','coercion']

corr_matrix_a_ordered = corr_matrix_a.
↪loc[keywords_questions_and_data_sorted,keywords_questions_and_data_sorted]
plt.figure(figsize=(12, 8))
plt.tight_layout()
plt.subplots_adjust(bottom=0.2)
sns.heatmap(corr_matrix_a_ordered, annot=True, fmt=".2f", cmap="coolwarm",␣
↪cbar=True, vmin=-1, vmax=1)
plt.title('Correlation heatmap of survey responses for non P2W version')
save_figure("pearson_r_nonp2w")

corr_matrix_b_ordered = corr_matrix_b.
↪loc[keywords_questions_and_data_sorted,keywords_questions_and_data_sorted]
plt.figure(figsize=(12, 8))
```

```
plt.tight_layout()
plt.subplots_adjust(bottom=0.2)
sns.heatmap(corr_matrix_b_ordered, annot=True, fmt=".2f", cmap="coolwarm",␣
 ↪cbar=True, vmin=-1, vmax=1)
plt.title('Correlation heatmap of survey responses for P2W version')
save_figure("pearson_r_p2w")

# Create a mask for values above the diagonal
mask_upper_triangle = np.triu(np.ones_like(p_value_matrix_a, dtype=bool), k=0)

# Create a custom colormap: green for values smaller than 0.05, and transparent/
 ↪white for others
import matplotlib.colors as mcolors
cmap = mcolors.ListedColormap(["green", "white"])

# Plot
plt.figure(figsize=(10, 6))
plt.tight_layout()
plt.subplots_adjust(bottom=0.3)
plt.title('Kendall\'s Tau Test (p < 0.05) for non P2W version')
p_matrix_a_ordered = p_value_df_a_tau.
 ↪loc[keywords_questions_and_data_sorted,keywords_questions_and_data_sorted]
mask_greater_than_05 = p_matrix_a_ordered > 0.05
final_mask = mask_upper_triangle | mask_greater_than_05
sns.heatmap(
    p_matrix_a_ordered,
    annot=True,               # Show the values
    fmt=".2f",                # Format values to 2 decimals
    mask=final_mask,          # Apply the final mask
    cbar=False,               # Remove the colorbar (optional)
    xticklabels=keywords_questions_and_data_sorted,
    yticklabels=keywords_questions_and_data_sorted,
    vmin=0, vmax=0.00
)
# Save the figure
save_figure("kendall_nonp2w")

p_matrix_b_ordered = p_value_df_b_tau.
 ↪loc[keywords_questions_and_data_sorted,keywords_questions_and_data_sorted]
mask_greater_than_05 = p_matrix_b_ordered > 0.05
final_mask = mask_upper_triangle | mask_greater_than_05
plt.figure(figsize=(10, 6))
plt.tight_layout()
plt.subplots_adjust(bottom=0.3)
plt.title('Kendalls tau test (p < 0.05) for P2W version')
sns.heatmap(
    p_matrix_b_ordered,
```

```
    annot=True,               # Show the values
    fmt=".2f",                # Format values to 2 decimals
    mask=final_mask,          # Apply the final mask
    cbar=False,               # Remove the colorbar (optional)
    xticklabels=keywords_questions_and_data_sorted,
    yticklabels=keywords_questions_and_data_sorted,
    vmin=0, vmax=0.00
)
save_figure("kendall_p2w")

p_matrix_a_ordered = p_value_df_a_spearman.
 ↪loc[keywords_questions_and_data_sorted,keywords_questions_and_data_sorted]
mask_greater_than_05 = p_matrix_a_ordered > 0.05
final_mask = mask_upper_triangle | mask_greater_than_05
plt.figure(figsize=(10, 6))
plt.tight_layout()
plt.subplots_adjust(bottom=0.3)
plt.title('Spearman r test (p < 0.05) for non P2W version')
sns.heatmap(
    p_matrix_a_ordered,
    annot=True,               # Show the values
    fmt=".2f",                # Format values to 2 decimals
    mask=final_mask,          # Apply the final mask
    cbar=False,               # Remove the colorbar (optional)
    xticklabels=keywords_questions_and_data_sorted,
    yticklabels=keywords_questions_and_data_sorted,
    vmin=0, vmax=0.00
)
save_figure("spearman_nonp2w")

p_matrix_b_ordered = p_value_df_b_spearman.
 ↪loc[keywords_questions_and_data_sorted,keywords_questions_and_data_sorted]
mask_greater_than_05 = p_matrix_b_ordered > 0.05
final_mask = mask_upper_triangle | mask_greater_than_05
plt.figure(figsize=(10, 6))
plt.tight_layout()
plt.subplots_adjust(bottom=0.3)
plt.title('Spearman r test (p < 0.05) for P2W version')
sns.heatmap(
    p_matrix_b_ordered,
    annot=True,               # Show the values
    fmt=".2f",                # Format values to 2 decimals
    mask=final_mask,          # Apply the final mask
    cbar=False,               # Remove the colorbar (optional)
    xticklabels=keywords_questions_and_data_sorted,
    yticklabels=keywords_questions_and_data_sorted,
    vmin=0, vmax=0.00
```

```
)
save_figure("spearman_p2w")
```

[ ]:
```
corr_matrix_diff_ordered = corr_matrix_diff.
  ↪loc[keywords_questions_and_data_sorted,keywords_questions_and_data_sorted]
plt.figure(figsize=(12, 8))
plt.tight_layout()
plt.subplots_adjust(bottom=0.2)
sns.heatmap(corr_matrix_diff_ordered, annot=True, fmt=".2f", cmap="coolwarm",␣
  ↪cbar=True, vmin=-1, vmax=1)
plt.title('Difference between the pearson r for both versions')
save_figure("pearson_r_diff")
```

[ ]:
```

```

Appendix B

Full study (Google forms)

Pay to Win Study

Welcome! This study is carried out for Alpen-Adria University of Klagenfurt. The study involves playing a video game prototype and filling out a questionnaire, and will take 15-20 minutes. It aims to investigate the impact of pay-to-win microtransactions (in game transactions that provide a game play advantage) can have on the player experience. Your participation will help gain valuable insight into this topic. The study is designed for PC only.

The experiment consists of three steps, that you will have to complete in order
- Fill out an initial on-boarding questionnaire
- Play a game prototype
- Fill out a questionnaire regarding your experience with the game prototype

For any inquiries, contact me at **mamarichal@edu.aau.at**. Many thanks!

* Indicates required question

STEP 0: Terms and conditions

This experiment collects and processes data in accordance with the GDPR without exceptions. Data will be used for non-commercial research purposes. Data will be anonymous and stored no longer than is necessary to finish writing the masters thesis. All data will be completely erased after reaching the purpose of writing the masters thesis. More information about your rights related to personal data can be found here. https://gdpr-info.eu/

1. Please read the the terms and conditions *

Check all that apply.

☐ I have read and agree with the terms of conditions. I understand my data will be stored temporarily, for the purpose of research only, and until the thesis is finished

STEP 1: Onboarding survey

Please fill out the following questions. Demographic data will help us gain further insight.

2. What is your gender identity? *

Mark only one oval.

- Male
- Female
- Nonbinary

3. How old are you? *

Mark only one oval.

- Under 18
- 18-21 years old
- 22-25 years old
- 26-29 years old
- 30+

4. What is the country you were born? *

Mark only one oval.

- Afghanistan
- Akrotiri
- Albania
- Algeria
- American Samoa
- Andorra
- Angola
- Anguilla
- Antarctica
- Antigua and Barbuda
- Argentina
- Armenia
- Aruba
- Ashmore and Cartier Islands
- Australia
- Austria
- Azerbaijan
- Bahamas, The
- Bahrain
- Bangladesh
- Barbados
- Bassas da India
- Belarus
- Belgium
- Belize
- Benin
- Bermuda

- [ ] Bhutan
- [ ] Bolivia
- [ ] Bosnia and Herzegovina
- [ ] Botswana
- [ ] Bouvet Island
- [ ] Brazil
- [ ] British Indian Ocean Territory
- [ ] British Virgin Islands
- [ ] Brunei
- [ ] Bulgaria
- [ ] Burkina Faso
- [ ] Burma
- [ ] Burundi
- [ ] Cambodia
- [ ] Cameroon
- [ ] Canada
- [ ] Cape Verde
- [ ] Cayman Islands
- [ ] Central African Republic
- [ ] Chad
- [ ] Chile
- [ ] China
- [ ] Christmas Island
- [ ] Clipperton Island
- [ ] Cocos (Keeling) Islands
- [ ] Colombia
- [ ] Comoros
- [ ] Congo, Democratic Republic of the
- [ ] Congo, Republic of the
- [ ] Cook Islands

- [ ] Coral Sea Islands
- [ ] Costa Rica
- [ ] Cote d'Ivoire
- [ ] Croatia
- [ ] Cuba
- [ ] Cyprus
- [ ] Czech Republic
- [ ] Denmark
- [ ] Dhekelia
- [ ] Djibouti
- [ ] Dominica
- [ ] Dominican Republic
- [ ] Ecuador
- [ ] Egypt
- [ ] El Salvador
- [ ] Equatorial Guinea
- [ ] Eritrea
- [ ] Estonia
- [ ] Ethiopia
- [ ] Europa Island
- [ ] Falkland Islands (Islas Malvinas)
- [ ] Faroe Islands
- [ ] Fiji
- [ ] Finland
- [ ] France
- [ ] French Guiana
- [ ] French Polynesia
- [ ] French Southern and Antarctic Lands
- [ ] Gabon
- [ ] Gambia, The

- [ ] Gaza Strip
- [ ] Georgia
- [ ] Germany
- [ ] Ghana
- [ ] Gibraltar
- [ ] Glorioso Islands
- [ ] Greece
- [ ] Greenland
- [ ] Grenada
- [ ] Guadeloupe
- [ ] Guam
- [ ] Guatemala
- [ ] Guernsey
- [ ] Guinea
- [ ] Guinea-Bissau
- [ ] Guyana
- [ ] Haiti
- [ ] Heard Island and McDonald Islands
- [ ] Holy See (Vatican City)
- [ ] Honduras
- [ ] Hong Kong
- [ ] Hungary
- [ ] Iceland
- [ ] India
- [ ] Indonesia
- [ ] Iran
- [ ] Iraq
- [ ] Ireland
- [ ] Isle of Man
- [ ] Israel

- [ ] Italy
- [ ] Jamaica
- [ ] Jan Mayen
- [ ] Japan
- [ ] Jersey
- [ ] Jordan
- [ ] Juan de Nova Island
- [ ] Kazakhstan
- [ ] Kenya
- [ ] Kiribati
- [ ] Korea, North
- [ ] Korea, South
- [ ] Kuwait
- [ ] Kyrgyzstan
- [ ] Laos
- [ ] Latvia
- [ ] Lebanon
- [ ] Lesotho
- [ ] Liberia
- [ ] Libya
- [ ] Liechtenstein
- [ ] Lithuania
- [ ] Luxembourg
- [ ] Macau
- [ ] Macedonia
- [ ] Madagascar
- [ ] Malawi
- [ ] Malaysia
- [ ] Maldives
- [ ] Mali

- [ ] Malta
- [ ] Marshall Islands
- [ ] Martinique
- [ ] Mauritania
- [ ] Mauritius
- [ ] Mayotte
- [ ] Mexico
- [ ] Micronesia, Federated States of
- [ ] Moldova
- [ ] Monaco
- [ ] Mongolia
- [ ] Montserrat
- [ ] Morocco
- [ ] Mozambique
- [ ] Namibia
- [ ] Nauru
- [ ] Navassa Island
- [ ] Nepal
- [ ] Netherlands
- [ ] Netherlands Antilles
- [ ] New Caledonia
- [ ] New Zealand
- [ ] Nicaragua
- [ ] Niger
- [ ] Nigeria
- [ ] Niue
- [ ] Norfolk Island
- [ ] Northern Mariana Islands
- [ ] Norway
- [ ] Oman

- [ ] Pakistan
- [ ] Palau
- [ ] Panama
- [ ] Papua New Guinea
- [ ] Paracel Islands
- [ ] Paraguay
- [ ] Peru
- [ ] Philippines
- [ ] Pitcairn Islands
- [ ] Poland
- [ ] Portugal
- [ ] Puerto Rico
- [ ] Qatar
- [ ] Reunion
- [ ] Romania
- [ ] Russia
- [ ] Rwanda
- [ ] Saint Helena
- [ ] Saint Kitts and Nevis
- [ ] Saint Lucia
- [ ] Saint Pierre and Miquelon
- [ ] Saint Vincent and the Grenadines
- [ ] Samoa
- [ ] San Marino
- [ ] Sao Tome and Principe
- [ ] Saudi Arabia
- [ ] Senegal
- [ ] Serbia and Montenegro
- [ ] Seychelles
- [ ] Sierra Leone

- [ ] Singapore
- [ ] Slovakia
- [ ] Slovenia
- [ ] Solomon Islands
- [ ] Somalia
- [ ] South Africa
- [ ] South Georgia and the South Sandwich Islands
- [ ] Spain
- [ ] Spratly Islands
- [ ] Sri Lanka
- [ ] Sudan
- [ ] Suriname
- [ ] Svalbard
- [ ] Swaziland
- [ ] Sweden
- [ ] Switzerland
- [ ] Syria
- [ ] Taiwan
- [ ] Tajikistan
- [ ] Tanzania
- [ ] Thailand
- [ ] Timor-Leste
- [ ] Togo
- [ ] Tokelau
- [ ] Tonga
- [ ] Trinidad and Tobago
- [ ] Tromelin Island
- [ ] Tunisia
- [ ] Turkey
- [ ] Turkmenistan

- Turks and Caicos Islands
- Tuvalu
- Uganda
- Ukraine
- United Arab Emirates
- United Kingdom
- United States
- Uruguay
- Uzbekistan
- Vanuatu
- Venezuela
- Vietnam
- Virgin Islands
- Wake Island
- Wallis and Futuna
- West Bank
- Western Sahara
- Yemen
- Zambia
- Zimbabwe

5. How many days in a week do you play at least 30 minutes of video games *

Mark only one oval per row.

	1	2	3	4	5	6	7
Days							

6. In your opinion, do you play mostly mobile games (games played using your phone) or through other means (computer, PlayStation, Nintendo Switch) *

Mark only one oval.

- ◯ Mobile
- ◯ Other means
- ◯ Both

7. Are you familiar with the concepts of "micro-transactions" and "pay to win" *

Mark only one oval.

- ◯ Yes
- ◯ No

STEP 2: Playing the game

Please play through the game by clicking the following link. You can stop playing at any time by clicking the "STOP PLAYING" button. You can play the game only on PC.

The page will ask for a password, which is the number **987**

https://shano19.itch.io/bagels-vs-sandwiches

8. What score did you get? *
(you can see your score after clicking the "END GAME" button)

_____

Only proceed to the next step after ending the game and entering your score

STEP 3: Questionnaire

Please fill out this questionnaire regarding your overall experience with the game

Scale description

Strongly disagree	*Disagree*	*Slightly disagree*	*Neither disagree, neither agree*	*Slightly agree*	*Agree*	*Strongly agree*
-3	*-2*	*-1*	*0*	*+1*	*+2*	*+3*

9. I felt like the game was trying influence me into making certain decisions. *

Mark only one oval per row.

	-3	-2	-1	0	1	2	3
Answer	◯	◯	◯	◯	◯	◯	◯

10. I felt free to play the game in my own way. *

Mark only one oval per row.

	-3	-2	-1	0	1	2	3
Answer	◯	◯	◯	◯	◯	◯	◯

11. The distribution of rewards felt unfair. *

Mark only one oval per row.

	-3	-2	-1	0	1	2	3
Answer	◯	◯	◯	◯	◯	◯	◯

12. The challenges in the game were at the right level of difficulty for me. *

Mark only one oval per row.

	-3	-2	-1	0	1	2	3
Answer	◯	◯	◯	◯	◯	◯	◯

13. I was immersed in the game. *

Mark only one oval per row.

	-3	-2	-1	0	1	2	3
Answer	◯	◯	◯	◯	◯	◯	◯

14. Playing the game was valuable to me. *

Mark only one oval per row.

	-3	-2	-1	0	1	2	3
Answer	◯	◯	◯	◯	◯	◯	◯

15. I felt eager to discover how the game continued. *

Mark only one oval per row.

	-3	-2	-1	0	1	2	3
Answer	◯	◯	◯	◯	◯	◯	◯

16. Winning in this game feels like a result of skill. *

Mark only one oval per row.

	-3	-2	-1	0	1	2	3
Answer	◯	◯	◯	◯	◯	◯	◯

17. I felt forced to take certain actions in the game. *

Mark only one oval per row.

	-3	-2	-1	0	1	2	3
Answer	◯	◯	◯	◯	◯	◯	◯

18. I liked playing the game *

Mark only one oval per row.

	-3	-2	-1	0	1	2	3
Answer	◯	◯	◯	◯	◯	◯	◯

19. I felt a sense of mastery playing this game. *

Mark only one oval per row.

	-3	-2	-1	0	1	2	3
Answer	◯	◯	◯	◯	◯	◯	◯

20. I could play the game in the way I wanted. *

Mark only one oval per row.

	-3	-2	-1	0	1	2	3
Answer	◯	◯	◯	◯	◯	◯	◯

21. I felt a sense of achievement while playing the game. *

Mark only one oval per row.

	-3	-2	-1	0	1	2	3
Answer	◯	◯	◯	◯	◯	◯	◯

22. I often felt that I lacked the skills necessary for the game. *

Mark only one oval per row.

	-3	-2	-1	0	1	2	3
Answer	◯	◯	◯	◯	◯	◯	◯

Thank you!

Don't forget to press the submit button

23. Any additional comments about the game prototype? (Optional)

Appendix C

Raw data

A CSV file with all the data is hosted on google sheets here: link. As per the GDPR, personal data was removed after the purpose of completing the master's thesis. Below are the anonymized responses from the game experience survey and the data from the game.

Score	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**
1031	0	2	0	2	1	2
2051	-2	1	-1	2	2	-2
2051	-3	-2	0	1	1	1
2112	2	0	2	0	0	0
3142	1	1	0	0	0	0
1152	2	-3	3	-1	-2	-1
3081	-1	2	-2	2	2	2
2101	-3	-3	-3	3	2	0
3171	2	1	-1	-2	0	0
1192	2	-1	2	-2	2	1
3161	2	2	-2	2	3	1
3231	3	-2	2	-1	3	2
3181	1	3	-1	2	3	2
3092	1	2	-2	0	3	0
1042	2	-1	-1	-1	2	-2
3092	3	1	3	1	1	1
2061	0	-1	3	-2	-2	0
2092	2	1	-1	2	2	1
1051	0	1	1	-1	-1	-1
150	2	1	0	1	0	0
1171	1	-2	0	-2	1	0
1052	3	-3	3	-3	-3	-3

Score	Q1	Q2	Q3	Q4	Q5	Q6
3102	3	-2	1	-2	-2	-2
3111	1	2	-2	3	3	3
1502	3	-3	0	-2	-3	-3
3141	2	-1	3	1	1	0
3091	-1	1	0	2	2	1
3141	2	-1	2	-2	1	0
3192	2	0	-2	-1	3	2
3182	2	3	0	2	2	3
2081	3	-2	1	2	1	1
3141	1	2	0	2	1	0
2171	-1	2	1	1	2	0
20	3	-2	0	-1	-2	-2
3102	3	-1	1	0	1	1
3221	-2	3	-3	2	3	1
2041	0	2	-2	-1	0	-1
3121	3	-3	3	-3	-3	-3
2092	3	1	2	-2	-1	-3
150	1	1	-1	-2	-2	-3
2152	3	0	3	0	3	3
1032	3	-3	3	-3	-3	-3
1111	0	-3	1	-3	1	-3
2112	1	-3	0	0	1	0
1042	2	0	1	-1	-3	-3
3102	2	-2	3	1	3	1
3182	1	2	2	2	2	2
2222	3	1	2	-2	1	-1
3112	3	2	0	1	-2	-3
150	-3	-3	-3	-3	-3	-3
88	-3	-3	-3	-3	-3	-3
1102	1	1	3	-3	-1	-2
1081	3	-2	1	-1	0	0
3121	2	1	3	2	0	0
3101	2	-1	0	1	1	0
2062	3	0	1	1	1	0
1042	-2	2	-2	2	2	0
2102	2	-2	1	1	2	0
2091	1	0	2	-1	2	0
1032	-1	2	0	-1	1	2
1051	1	0	2	-1	-2	-2
2132	3	-2	2	-1	1	-1
3131	3	-1	-1	0	3	2

Score	Q1	Q2	Q3	Q4	Q5	Q6
3142	2	2	-1	2	1	1
3222	2	1	0	0	1	1
1202	2	-2	2	-2	-3	-3
2062	3	-3	3	-1	1	1
2222	2	0	1	-1	3	1
3212	3	2	-1	2	1	1
2122	1	3	0	-1	2	1
2092	2	-1	2	0	3	1
1081	1	2	2	-1	3	1
2151	-3	3	0	1	2	0
398	0	-2	-1	-1	-2	-2
150	1	1	-1	1	2	1
1082	3	1	3	-1	-3	-3
3171	2	0	2	0	0	0
1102	1	-1	1	-1	2	2
93333	0	-3	-3	-3	-3	-3
1022	3	-1	2	0	0	0
1041	2	-1	-2	2	2	0
2041	-1	2	0	3	1	-1
1051	2	3	0	2	1	2
1041	-2	3	-2	2	3	1
80	2	3	1	-1	1	1
1031	2	-2	0	-2	-2	-2
1082	3	-3	3	-3	-3	-3
2111	2	2	-1	-1	2	1

Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14
2	0	0	2	1	-1	1	0
2	1	1	3	1	1	2	-3
1	-1	2	1	-2	-1	-1	1
1	1	-2	2	1	0	2	-2
1	0	1	1	1	1	1	-2
0	-3	3	1	2	-3	-1	-3
0	2	0	3	2	1	2	-3
-2	-3	3	1	-3	-1	2	-3
1	1	2	1	-1	1	1	-2
2	-1	2	2	0	-1	2	1
3	3	0	2	1	2	1	-3
2	-2	3	3	0	-1	-1	2

Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14
2	2	1	2	0	2	1	-2
1	-1	0	2	0	2	2	-1
2	1	2	1	-1	-1	-1	-2
1	1	2	1	1	1	1	-1
0	-3	1	0	0	0	-1	-3
2	2	-1	1	0	-2	2	-1
-1	-1	1	-1	-1	-1	-1	1
1	-1	1	2	2	2	1	-2
-3	-3	2	0	-2	-2	-1	0
-3	-3	3	-3	-3	-3	-3	-3
-3	-2	2	0	-1	0	-1	-3
3	2	0	2	3	2	3	-2
-3	-3	3	-3	-3	-3	-3	-1
2	1	3	2	-2	-1	1	-2
0	-1	2	2	0	1	1	-2
2	-2	2	2	-2	-2	-1	-2
2	3	2	3	2	-2	3	-2
3	2	0	3	3	3	3	-1
0	-2	2	1	-2	-2	-1	-1
3	2	0	3	1	2	2	-2
1	-1	1	1	-1	1	-1	2
-2	-1	3	0	-3	-2	-1	1
2	0	3	2	-1	-1	0	0
2	1	-3	3	2	2	2	-3
-1	1	-2	-1	-1	2	2	-2
-3	-3	3	-3	-3	-3	-3	-3
-2	-2	3	0	-2	-2	1	-2
-2	-2	0	-1	-2	1	-1	-3
3	1	2	1	1	1	1	0
-3	-3	3	-3	-3	-3	-3	0
-3	-3	3	-3	-3	-1	-3	-2
2	2	1	1	1	-3	-2	-3
-3	-3	1	-3	-3	1	-3	-3
-1	1	3	3	1	-1	0	-3
1	2	-1	2	2	1	3	-3
2	0	-1	1	-2	-1	-1	-1
-3	-3	3	-3	-3	-3	-3	-3
-2	1	0	-2	-2	1	-2	-2
-3	1	1	-1	-3	-1	-1	-3
-3	-3	-3	-3	-3	-3	-3	-3
-3	-3	-3	-3	-3	-3	-3	-3

Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14
1	-3	0	0	-2	0	-3	3
-2	2	3	0	-3	-1	0	3
2	1	2	2	2	-1	-2	-2
1	-1	1	1	-1	-1	1	-2
1	0	1	1	0	0	0	1
-1	-1	2	3	1	2	2	-2
2	-2	3	2	0	-1	0	2
-1	1	2	2	2	0	1	-2
1	3	-1	1	2	2	0	2
0	-2	1	0	-2	-1	0	0
-2	-3	1	-1	1	-2	1	-2
1	1	3	2	1	-2	0	0
1	1	2	2	0	1	1	-3
1	1	1	1	1	1	1	-1
-3	-3	2	-3	-3	-2	-3	0
1	-1	3	1	-2	-3	-2	0
2	1	2	2	1	-1	1	2
1	1	1	1	1	-1	1	0
1	-1	-3	2	-1	2	1	-3
2	2	2	2	0	-1	1	-2
3	3	1	3	-1	2	1	2
0	-2	0	2	0	3	-1	-3
-2	-1	-2	-2	-1	-1	-2	0
2	0	0	2	1	1	1	-2
-2	-3	2	1	-2	-3	2	3
2	2	2	1	1	0	0	-2
2	0	-2	2	1	1	2	-2
-3	-3	-3	-3	-3	-3	-3	-3
0	0	3	3	0	0	3	0
1	2	1	2	-1	0	2	-1
1	1	-1	1	2	1	2	-3
2	2	3	2	2	-2	0	-2
2	0	0	2	1	3	1	-2
2	2	-1	3	2	0	2	1
-2	-2	2	-2	-2	-2	-1	-2
-3	-3	2	-3	-3	-3	-3	-3
2	1	-1	2	1	-1	2	1

Declaration of Use of AI

During the writing process of this document, ChatGPT (free version as of February 2025) and Writefull (premium version) were used. Writefull is a language model that is integrated into Overleaf (the LaTeX editor that this project used), which does automatic proofreading, suggesting better ways of wording sentences and correcting grammar. Furthermore, a large part of the thesis was written using speech-to-text (I have chronic pain in my hands that can worsen when overused, so I like to avoid typing wherever possible), of which the output was then passed to ChatGPT, to correct the output. This was done using prompts like *"You are a writing assistant, for the following text, correct grammar and syntax, and improve clarity. However, do this using minimal changes, respecting the used vocabulary and sentences as much as possible. Finally, give a quick list of what you changed."*.

Finally, ChatGPT was used to brainstorm, conceptualize and create structure, exploring knowledge on topics I was unfamiliar with. For example, I would prompt it *"Give a list of statistical tests that I can perform on correlation coefficients."*. Then I would look up academic sources describing these tests and apply the necessary skepticism to the answers.

Overall, ChatGPT and Writefull were used with conscience and consideration, in what I believe to be ethical use of current-time AI tools.