The Impact of Diegetic and Non-diegetic User Interfaces on the Player Experience in FPS Games

Aryan Khazanehdarloo and Karim Mohamed

Supervisor: Kai-Mikael Jää-Aro
Södertörn University | Institute for natural science, technology and environmental studies
Bachelor Thesis 15 HP
Media Technology | Fall 2022/Spring 2023
Computer Games Programme
Effekten av diegetiska och icke-diegetiska användargränssnitt på spelarupplevelsen i FPS-spel
Abstract

In this study, a video game prototype was developed to research the impacts of diegetic and non-diegetic interfaces on two facets of player experience in the context of video games, game difficulty and immersion. A total of 10 participants took part in a play session where they played the prototype, which was followed by semi-structured interviews where the participants discussed their perceived player experience. The transcribed interviews were then analyzed using a thematic analysis approach to find recurring patterns in relation to perceived difficulty and immersion. The findings of this study showed that diegetic interfaces were perceived as more difficult but more immersive in general, while the opposite was true for non-diegetic interfaces.

Keywords: Diegetic Interface, Non-diegetic interface, User Interface, Player Experience, Immersion, Game difficulty, First-person shooter.

Abstrakt

I den här studien utvecklades en spelprototyp för att undersöka effekterna av diegetiska och icke-diegetiska gränssnitt på två aspekter av spelupplevelse i samband med videospel, spelsvårighetsgrad och fördjupning. Totalt deltog 10 deltagare i en spelsession där prototypen spelades, vilket följdes av semistrukturerade intervjuer där deltagarna diskuterade sin spelupplevelse. De transkribnerade intervjuerna analyserades sedan med en tematisk analysmetod för att hitta återkommande mönster i relation till deltagarnas upplevd svårighetsgrad och fördjupning. Resultaten av denna studie visade att diegetiska gränssnitt upplevdes som svårare men mer fördjupande i allmänhet, medan motsatsen gällde för icke-diegetiska gränssnitt.

Keywords: Diegetisk gränssnitt, Icke-diegetisk gränssnitt, Användargränssnitt, Spelupplevelse, Immersion, Spelsvårighetsgrad, Förstapersonsskjutare.
# Table of Content

1. **Introduction**  
   1

2. **Literature overview**  
   2
   2.1. Related Research  
   2
   2.2 UI Influence on Player Experience  
   2
   2.3 UI on Player Performance  
   4

3. **Research Question**  
   6

4. **Methods**  
   6
   4.1 Prototype  
   7
   4.1.1 Gameplay  
   7
   4.1.2 Three Design Elements  
   8
   4.1.3 Diegetic and Non-diegetic  
   8
   4.2 Data Gathering  
   10
   4.2.1 Participant Sampling  
   10
   4.2.2 Recruitment Process  
   10
   4.2.3 Play Session  
   10
   4.2.4 Semi-structured Interviews  
   11
   4.3 Data Analysis  
   11

5. **Results**  
   12
   5.1 Categories & Themes  
   13

6. **Discussion**  
   14
   6.1 Perceived Immersion  
   14
   6.2 Perceived Difficulty  
   16
   6.3 Design Implications  
   17

7. **Conclusion**  
   18

8. **Reference List**  
   20

9. **Appendix A: Interview Script**  
   24
1. Introduction

User Interfaces play an important role in communicating critical information to the player in the context of a video game (Yuan, 2021). The presentation of information can have several different effects on the way that a player engages with the game. Depending on how the information is communicated it can affect the player in terms of psychological experience and digestion of in-game information. There are many approaches that a designer can take when communicating information to the player, one way to communicate said information to the player is in the form of a heads-up display (HUD) (Engineer, 2020). Another approach is by employing a diegetic interface design where the critical information is displayed inside of the game world, in contrast to the traditional HUD which can be described as non-diegetic, as it is rendered outside the game world and is only visible to the player in the real world (Engineer, 2020). For the purposes of this study when using the term HUD, it is in reference to non-diegetic heads-up displays.

The purpose of this study is to examine differences in two primary effects of diegetic and non-diegetic design. These primary effects have been selected based on previous research into the impact of diegetic and non-diegetic design. The first of these effects is the impact that interfaces have on the player’s perceived game difficulty and the other is the impact on the player’s perceived immersion. The research questions that this study will focus on are:

*How do diegetic and non-diegetic user interfaces affect perceived difficulty in FPS games?*

*How is perceived immersion in FPS games impacted by diegetic and non-diegetic user interfaces?*
2. Literature overview

2.1. Related research

The related research contains 12 articles which are broken up into two categories: player experience and player performance.

2.2. UI Influence on Player Experience

In Caroux and Isbister’s (2016) article two experiments were conducted to determine the influence of heads-up displays (HUD) on player experience. The first experiment employed the use of a head-free eye tracker to track the movement of the participant’s eyes, to determine to what extent they interact with the HUD. The results showed that the HUD led to improvement in the understanding of the game's environment for the players (Caroux and Isbister 2016, 67). For experiment two Caroux and Isbister (2016, 71) tried to closely study the specific effects of different HUD designs by both player expertise and game genre (FPS and RTS). The participants were prompted to judge statements about screenshots of commercial video games, featuring different interface designs, on a 10-point likert-type scale (Caroux and Isbister 2016, 74). The results of experiment two suggested that the greater the expertise of the player the greater impact the HUD’s spatial composition had on the player experience (Caroux and Isbister 2016, 78).

In a similar study, Strubberg and Horn (2020) also studied the interaction between player experience and heads-up displays with the help of eye-tracking technology. Participants in the study were asked to play the game Destiny 2 while wearing an eye-tracking device where data were collected on the player's eye movement on the screen (Strubberg and Horn 2020, 1). The use of a heads-up display can ease player progression in Destiny 2 because it often shows on the screen what the next objective is for the players (Strubberg and Horn 2020, 2-3).

In Nesbitt and Hosken’s (2008, 15) research article, immersion is described as how engrossed in the game the player feels, how realistic the experience seems and how much they feel that they are a part of what was happening around them. Immersion in games can be influenced by various things, one of them being the user interface. Iacovides et al. (2015) examine the impact of diegetic interfaces and the lack of non-diegetic interfaces and their effect on player immersion in
video games. For the first of two studies conducted participants were asked to play the commercial FPS game *Battlefield 3*, first with the non-diegetic HUD and user interface elements that the game was designed with, and then they played the same level without the non-diegetic UI elements (Iacovides et al. 2015, 16). For the second study a similar experiment was conducted, however, the participants were assigned one of the user interface versions to play with exclusively. The results of the studies showed that there was a significant positive impact on player immersion when using diegetic interfaces as opposed to non-diegetic interfaces (Iacovides et al. 2015, 17). However, similarly to the results of Caroux and Isbister’s (2016) experiments, the player experience was only impacted by players with high expertise. In contrast, Caroux and Isbister’s (2016, 78) studies found that the inclusion of a non-diegetic heads-up display can lead to increased situational and environmental awareness so each approach has its advantages and disadvantages, with diegetic UI design offering greater immersion while non-diegetic displays can provide the player with increased awareness. Pfister and Ghellal (2018) studied the influence of non-diegetic and diegetic interfaces on player immersion in the context of 2D video games. In the study, the participants were asked to play two game prototypes that were meant to test the influence of diegetic and non-diegetic game elements on player immersion (Pfister and Ghellal 2018, 492). After playing one prototype the participants were interviewed before playing the second prototype. After the second playtest the participants filled in a questionnaire which was followed by a final interview (Pfister and Ghellal 2018, 492). Based on the results of the study Pfister and Ghellal (2018, 492-493) concluded that non-diegetic and diegetic game elements do have a significant effect on player immersion, however, the results also suggested that, in the context of 2D games, non-diegetic game elements lead to a greater sense of immersion than diegetic ones.

In comparison to the research mentioned above Robb et al. (2017) and Nesbitt and Hoskens (2008) present research that aims to explore alternate sensory interfaces as opposed to simply visual interfaces. The first of the two experiments presented by Robb et al. (2017) aims to study sound cues for player health UI and the impact that its presence or absence has on player experience. The second study focuses on different types of sound cues and explores how different sounds affect the player experience in different ways (Robb et al. 2017, 407). Both studies were conducted using a mixed methods approach with qualitative measurements in the
form of interview data and physiological measurements using sensors that they attached to the participants’ hand and facial muscles (Robb et al. 2017, 407-408). The results of the first study revealed that the presence of sound cues for the health indicators increased the player’s in-game health awareness (Robb et al. 2017, 422). The second study tried to compare the effectiveness of abstract sound cues to less subtle ones, with the results showing that both types of sounds had their advantages and disadvantages for the player, but did impact the player experience in different ways (Robb et al. 2017, 423). With a focus more specifically on multisensory interfaces, a study was conducted and presented by Nesbitt and Hoskens (2008) to explore whether or not multisensory interfaces, specifically visual, auditory, and haptic interfaces, can in tandem provide the user with more information than a strictly visual user interface (Nesbitt and Hoskens 2008, 13-15). The study found that the use of multisensory interfaces did not yield a statistically significant improvement in performance, however, players reported an improvement in immersion, confidence, and satisfaction when provided with additional sensory cues (Nesbitt and Hoskens 2008, 16). The previous two articles have shown that multisensory interfaces are a facet of diegetic interfaces that is worth exploring, as they can easily be integrated with non-diegetic interfaces to elevate the player experience without losing out on the advantages of non-diegetic design. Westerberg and Schoenau-Fog (2015) research auditory cues and diegetic design in video games with the aim of categorising video game audio. Westerberg and Schoenau-Fog (2015, 52) explore current models of diegetic spaces that can be used to categorise video game sound and found that “the flexible game audio model for categorisation” (FGAMC) was the best encompassing model for categorisation of video game audio, but did find that it was still limited in practical application.

### 2.3 UI on Player Performance

Caroux et al. (2022) researched how different characteristics of head-up displays can affect performance in action video games. The study consisted of four experiments where players of different skill levels participated to play two types of action video games with similar HUD designs (Caroux et al. 2022, 4-5). During each experiment, each player's performance was monitored and the HUD in the games was manipulated in terms of colour, size, and content (Caroux et al. 2022, 8-13). The study's result of the four experiments showed that players'
performance got affected when the HUD elements got altered. Players performed better when they had the full HUD visible to them compared to when the HUD had content not visible. The result also showed that the colour and size of the HUD did not affect player performance (Caroux et al. 2022, 9-13, 19). In contrast to Caroux et al. (2022) and their study on heads-up displays, Tran and Berg (2021) studied diegetic UI and its impact on player performance in competitive first-person shooters. Tran and Berg (2021, 24-25) created a first-person shooter prototype where players played through a level with both diegetic and non-diegetic UI to compare the player’s performance. The participant’s performance was tracked during the play session for later review and the experiments were followed by semi-structured interviews (Tran and Berg 2021, 15, 21). Tran and Berg’s (2021, 71-75) study revealed that diegetic user interfaces were worse for player performance than non-diegetic displays (Tran and Berg 2021, 71-75), however, a large portion of the players reportedly preferred the diegetic interfaces (Tran and Berg 2021, 76). On the other hand, a student thesis by Hellqvist och Härjeström (2017, 24) that also studied the effect of heads-up display on player performance, showed that player performance was improved without a HUD in terms of the number of kills the participants got when playing Battlefield 1 and Battlefield 4.

In their article, Peacocke et al. (2018) present four experiments that they conducted on the different impacts of diegetic and non-diegetic user interfaces on player performance in first-person shooters. Each of the four experiments conducted focused on a separate aspect of player performance and the related interfaces. The first of the four experiments focused on ammunition displays and the participant’s ability to manage the ammunition in their weapon during combat (Peacocke et al. 2018, 46). The results of the first experiment revealed a statistically significant difference between diegetic displays and non-diegetic displays on ammunition awareness with the in-game diegetic display performing the best, however, the results did not reveal a significant difference between the different types of non-diegetic displays (Peacocke et al. 2018, 47). The second experiment tested which of the displays was most conducive to health awareness (Peacocke et al. 2018, 48). In this experiment the participants played another prototype, however this time it was designed to test the player’s health awareness. The experiment showed that numeric non-diegetic displays performed the best in this area (Peacocke et al. 2018, 50). The third experiment tested the readability of different weapon
displays with yet another prototype design that was played by the participants (Peacocke et al. 2018, 50). The results this time found no significant difference between the performance of different weapon displays (Peacocke et al. 2018, 52). For the fourth and final experiment, the participants played another prototype, this time it was designed to test the impact of different displays on navigation (Peacocke et al. 2018, 52-53). The results suggested that one of the diegetic interfaces, an in-game line that indicates the correct path, performed the best with the HUD-based mini-map as a close second (Peacocke et al. 2018, 56). Marre et al. (2021) present another study on diegetic user interfaces, specifically whether VR games should use diegetic or non-diegetic interfaces, based on player performance and experience. 41 participants were asked to play a prototype virtual reality first-person shooter game with a diegetic and non-diegetic interface (Marre et al. 2021, 15-17). The prototype was divided into two separate versions where both the non-diegetic and the diegetic version showed a radar display, countdown timer, overheating indicator, and a score bar for the players score (Marre et al. 2021, 17-18). Marre et al. (2021, 36-37) concluded that the diegetic interface of the virtual reality game had a positive effect on the player’s performance, but there was no effect on the participants' gameplay experience.

3. Research Question

This study will focus on two interface design approaches, diegetic and non-diegetic interfaces, and two of their primary effects on the player. The two effects that this study explores are perceived difficulty and perceived immersion.

Considering the above, our research questions ask:

How do diegetic and non-diegetic user interfaces affect perceived difficulty in FPS games?
How is perceived immersion in FPS games impacted by diegetic and non-diegetic user interfaces?
4. Methods

A video game prototype was created for the purpose of data-gathering, that would help to simulate a diegetic and non-diegetic gameplay experience. The prototype was then used in tandem with semi-structured interviews to assess common trends between participants' answers, with the use of thematic analysis (Cote and Raz, 2015, 123).

4.1 Prototype

The prototype was designed to emulate a standard first-person shooter (FPS) gameplay experience to provide accurate data on how the participants typically react to different interfaces, in terms of both perceived difficulty and immersion. This section will cover its design choices and how the prototype works.

![Prototype Image](image_url)

Figure 1 (Left and right show an overview of the diegetic and non-diegetic interface)

4.1.1 Gameplay

The game consists of basic FPS elements, featuring two weapons, a semi-open level design, and basic enemy variants. The player’s goal is to traverse the level by defeating monsters that attempt to block their path, find ammo to resupply, then complete a short series of objectives before navigating to the exit of the level, which is unlocked by finding the key card hidden in the game.
The player has access to a semi-automatic sidearm at the start of the game and is able to locate a second weapon, an automatic submachine gun, within the level to help the player complete their task in a more efficient manner.

### 4.1.2 Three Design Elements

Three core user interface (UI) elements (health display, ammo counter, and navigational display) for gathering information on perceived immersion and difficulty in this study were derived from a study by Peacocke et al (2018), which compared first-person shooter information displays in FPS games in terms of player performance.

### 4.1.3 Diegetic and Non-diegetic

The prototype consists of two versions, one version features its interfaces as a non-diegetic heads-up display while the other version employs a more realistic, diegetic approach, wherein the interfaces are a part of the game world and can be seen by the player character. The prototype’s implementation of these various UI elements was based on existing examples of interfaces within contemporary FPS games. For example, the diegetic and non-diegetic counterparts of the navigational display strongly resemble the ones featured in *Firewatch* (Campo Santo, 2016) and *Battlefield 3* (Dice, 2011) respectively.

In terms of the health display, the non-diegetic version features a health bar in the bottom left of the screen that fills and empties in accordance with the player’s health. The diegetic version of the health display features much of the same design functionality, but is displayed as a circle on the player character’s left wristwatch.

![Figure 2](image.png)

Figure 2 (Left and right show diegetic and non-diegetic health bar respectively)
The ammo counter in the non-diegetic version is placed on the bottom right side of the screen and displays the player’s ammo in numerical values. When it comes to the diegetic version the numerical values are instead fixed to the back of the currently equipped weapon. Both interfaces display the number of bullets remaining in the current weapon, as well as the number of spare bullets for said weapon.

![Figure 3](image1.png) (Left and right show diegetic and non-diegetic ammo counter respectively)

The last UI element, the navigation display, in the non-diegetic version consists of a “mini-map”, a small centered map display that shows a limited portion of the map around the player as well as the player’s position, in the top right corner of the screen. For the diegetic interface, the player instead has to use a handheld map that displays the whole level layout, but not the player’s current position. To make the player have to navigate, rather than memorize the map between playthroughs, one of the objective locations differs between the two versions of the game.

![Figure 4](image2.png) (Left and right show diegetic and non-diegetic navigation respectively)
4.2 Data Gathering

4.2.1 Participant Sampling
The sample group targeted by this study were people above the age of 18 with prior experience with conventional first-person shooter games. This group was targeted for their familiarity with typical first-person shooter conventions and user interfaces and how it helps to yield more consistent and practical test results. The target age was selected to collect informed consent from the participants without the need for parental approval.

4.2.2 Recruitment Process
The recruiting process for this study was performed using the instant messaging and voice chat application Discord (Discord, 2016). Due to time constraints and limited resources, the participants chosen for this study were selected based on both availability as well as the participant criteria. In total there were 10 participants, all of whom were between the ages of 21-25, out of the 10 participants 9 were male and 1 was female. As part of the recruitment process, the participants were asked how often they play first-person shooter games in order to determine their level of experience with FPS games. All the participants had prior experience with first-person shooter games and reportedly played FPS games at least once per month. Participants were given a brief disclaimer regarding the nature of the prototype and letting the participants know that the interview data would be anonymized.

4.2.3 Play Session
After the recruitment process was completed, the participants were asked to participate in a play session of the study’s prototype as mentioned earlier. The participants were given some information regarding the game’s core mechanics, as well as being instructed to review the game’s control scheme in the main menu before the playtest started. Half of the participants started the session by playing the diegetic version of the prototype first, which was then followed by a playthrough of the non-diegetic version. The other half of the participants started with the
non-diegetic version of the prototype and then moved on to the diegetic version. This was done in an attempt to account for the participants memorizing the level’s layout as they replayed the prototype in their second playthrough; additionally, we moved one of the objective locations for this reason, as mentioned earlier. The average play session time was around 10 to 20 minutes per participant for completing both versions of the prototype.

4.2.4 Semi-structured Interviews

The play session was shortly followed by a semi-structured interview, which was conducted online using Discord (Discord, 2016). During the interview, participants were asked a series of questions designed to probe them for answers in regard to the different user interface designs and the participants’ experience with them (see Appendix A). All questions were carefully designed in such a way that they would not lead the participants to a predetermined answer or influence their judgment. In addition, the questions were also generalized and designed to make the participants talk broadly about the given question, which follows interview guidelines provided in Cote and Raz’s (2015, 108) book. The questions were also supplemented by follow-up questions tailored to the specific interview, as was recommended by Cote and Raz (2015, 108), in an attempt to prompt the participants to elaborate their answers without steering them towards a specific answer.

4.3 Data Analysis

For this study the method “thematic analysis” was used to analyze the answers from the semi-structured interview. The approach for the study’s data analysis closely followed the instructions as outlined by Cote and Raz (2015, 108-112) in a series of steps. The first step that was outlined was to transcribe all recorded interview data, to make the process of reviewing the data for frequently emerging and recurring patterns easier across several instances of interview data (Cote and Raz, 2015, 109). When the transcription process was done, the next phase of the analysis was to examine the data for codes and categories, where broad patterns, themes, and characteristics were identified, so that they could be grouped into separate categories for analysis (Cote and Raz, 2015, 109-110). For example, two themes that emerged from the interviews were “navigation” and “connection to character”. This is because many participants made statements
similar to this one from participant 3: “I also think having to use the handheld map was extra challenging and I guess more rewarding when I had to figure out where I needed to be.” and this statement from participant 8 “When playing the diegetic version, it made it feel less like a game. I felt more like I was the game character”. The themes were sorted into one of two categories, “perceived difficulty” or “perceived immersion”, for instance, the theme “connection to character” was placed in the “perceived immersion” category, while the “navigation” theme was sorted into the “perceived difficulty” category. The themes’ categories were determined by examining how often they would appear in which context, difficulty, or immersion, to better assist in answering the research questions. The data was later grouped into a thematic map to provide a visual breakdown of the analysis.

5. Results

The results derived from the In-depth thematic analysis (see figure 5) revealed seven recurring themes which then were placed into two separate categories, “Perceived difficulty” and “perceived immersion”. The former category, “perceived difficulty”, is made up of four themes, “navigation”, “readability”, “interface position” and “interface movement”. The latter category, “perceived immersion”, is composed of three themes, “connection to character”, “realism” and “engagement”.

Figure 5 (Thematic map)
5.1 Categories & Themes

These themes all represent different factors and patterns that show what the participants perceived in terms of difficulty and immersion.

The “navigation” theme represents the reemerging pattern of participants bringing up the difficulty associated with the navigation element of the game, more specifically citing that the diegetic interface was more challenging and/or that the non-diegetic interface was easier to navigate with. For example, participant 4 stated: “The map in the non-diegetic interface was easier to navigate and figure out where you are and where to go, compared to the diegetic version where it was more challenging. Due to how you had to figure out your character's position relative to the handheld map.”.

Another recurring theme in this category was “readability”, which can be further broken down into two sub themes: interface position, and interface movement. This is because when participants brought up something regarding readability they most often discussed either the interface’s positioning or the interface’s movement. “Interface position” refers to the positioning of the user interface on the screen, which had an apparent effect on readability according to the players. “Interface movement” refers to specific statements regarding the diegetic interfaces’ movements during the player character’s animations, such as the interfaces being harder to read during normal movements, several participants also noted that the interfaces could be obscured during some of these animations, due to the diegetic interfaces being fixed to the player character and therefore moving with the player’s animations. Participant 6 stated: “Sometimes when you got hit and reloaded at the same time the health bar and ammo counter moved quite a bit which made it harder to see that information during that moment.”, with several other participants also making statements to that effect.

The “connection to character” theme from the “perceived immersion” category constitutes the participants’ statements regarding a feeling of connection and identification with the player character during gameplay. For instance one commonly cited factor in relation to this theme was
the player character wearing the interfaces as a part of their outfit, making the players identify with the character when reading the interfaces.

Many of the participants made note of the diegetic version being more realistic than the non-diegetic version and therefore, adding to their perceived immersion, the theme “realism” was derived from these statements. Participants mainly noted that the diegetic interface made it feel like the interface was an actual part of the game world and thus making it feel more realistic. Participants also suggested a link between said realism and their experience of immersion in the game.

Several of the participants reportedly felt more engaged with the game while playing the diegetic version, some of them attributed this to having to pay attention to the game world to read their interfaces rather than disengage with the game to read a heads-up display or menu. For instance participant 2 stated: “The "diegetic" version felt more engaging due to it making me focus more on my environment and always having to figure out where I was on the map. With the mini-map, it took away that feeling because it made you look more on the HUD, rather than actually playing the game, especially the mini-map." These sentiments constitute the final theme “engagement” in the “perceived immersion” category.

6. Discussion

6.1 Perceived Immersion

A study conducted by Iacovides et al. (2015, 17) found that diegetic interfaces have an impact on player immersion which is consistent with this study's findings. The results of this study revealed several recurring themes derived from the interview data, in relation to perceived immersion. One of the recurrings themes found among the participants’ comments was “connection to character”, which as mentioned earlier represents the degree to which the player identifies with their player character. Bayliss (2007, 1,4) argues in their article that a sense of embodiment of the player character or avatar can impact the sense of immersion that the player feels, making them feel as though they are present in the game world through their character, Bayliss (2007, 5) refers to this as a sense of telepresence. During analysis of the interview data, it became apparent that
the participants were experiencing an increased sense of embodiment of their player character while playing the diegetic version of the prototype. A quote from participant 2 from the interviews that presents this idea is: “Especially when playing the diegetic version because it made it feel less like a game. I felt more like I was the game character itself”.

Among the interview data, one of the themes that emerged was “realism”, with the participants stating that a higher degree of perceived realism was achieved with the diegetic version of the prototype, which reportedly added to their sense of immersion. In their article Ribbens et al. (2016, 308-309) make the case that an increased sense of realism while playing a game does impact the player’s feeling of immersion, which would also be consistent with this study's findings. In the interview data, there was a multitude of quotes from the participants stating that the diegetic UI variant was both more realistic and as a consequence more immersive. For instance participant 7 stated: “The diegetic version felt more realistic to play, because often in the real world critical information would be placed on the character somewhere.” and participant 5 said “I did prefer the "diegetic" version more because of how it felt more realistic and immersive”.

In their article Brown and Cairns (2004) define engagement as the first stage of immersion. Brown and Cairns (2004, 1298) argues that to achieve engagement with a game it is important to minimize two main barriers that commonly stifle engagement and by extension immersion. These barriers are access and investment. These barriers may work to explain the results of this study, where many participants reported higher levels of engagement with the diegetic interfaces compared to the non-diegetic interface. As the initial barrier to achieve engagement with a game is stated to be access Brown and Cairns, (2004, 1298) it is possible that diegetic interfaces were more accessible due to it being more intuitive. The second barrier to engagement is investment, the amount of time and concentration that a player puts into a game. As is consistent with the statements by Brown and Cairns (2004, 1298), several of the participants stated that the diegetic version of the game was both easier to concentrate on and therefore, more engaging. For example, participant 10 explained it as such: “I felt more immersed in the diegetic version, because the UI was integrated into the game and how minimalist it was made it immediately easier to concentrate on what's happening in the game.”, while participant 1 expressed it in a
similar way: “I really felt more concentrated on the first version (diegetic), because it was less cluttered on the screen it felt more natural to read my character's information and play.”

6.2 Perceived Difficulty

As mentioned earlier in this report, the prototype used three main interface design elements based on those used in a study by Peacocke et al. (2018), navigational aid, health display and ammunition counter. The prototype featured two types of navigation, a non-diegetic mini-map display and one diegetic handheld map that did not reveal the player’s position or show any waypoints, these correspond to the mini-map and compass used in the study by Peacocke et al. (2018, 54) respectively. Peacocke et al. (2018, 55-56) states that the lowest performing navigational aid was the compass, with the mini-map performing significantly better on average. One thing to note is that Peacocke et al. (2018, 57) measures for player performance rather than difficulty, however they state that their findings could be applied reversely in terms of difficulty and their findings are reflected in the results of this report as well, the diegetic navigational display being perceived and reported as more difficult than the non-diegetic HUD based counterpart. For instance participant 9 stated: “I had a harder time navigating around the map with the diegetic version since it did not show where I was.”

In terms of perceived difficulty, many participants mentioned how the interface’s readability impacted the difficulty of the game. Specifically, the participants’ statements were in regards to the interface’s position and the fact that the diegetic interface would move around during animations. Commonly recurring statements from the participants mentioned that the diegetic interface was easier to read compared to non-diegetic because the interface elements were set in the middle of the screen and how it was in their direct line of sight. For example participant 1 stated the following in regards to ammunition management: “I found it easier when it was in the middle of the screen because I did not have to move my eyes that much from the center of the screen.”. These findings are consistent with findings from the previously mentioned study by Peacocke et al. (2015, 9), where they studied the impact of both diegetic and non-diegetic user interface on performance and player preference and concluded that the readability of diegetic interfaces elements were greater, due to it commonly being positioned in the player's direct line of sight, requiring less cognitive load.
In contrast to data showing that reading information from the diegetic interface was perceived to be easier due to it being in the player’s line of sight, which could be described as an imaginary line that goes from somebody’s eye to something that they are looking at (Oxford Dictionary). This could be due to not requiring the players to shift their gaze by much and keeping their focus on the critical areas of the screen. For example, participant 8 mentions this during the interview, “I liked the diegetic version more because it felt better and it was easier when it was in the middle of the screen because I did not have to move my eyes that much from the center of the screen.”

A surprising recurring theme in the context of readability was also that participants perceived it harder to read the diegetic interface at the same time. This was because of the player’s animations, and how they moved the interface's position. This finding was surprising since it is not mentioned by many, if any previous studies at all, therefore, this requires further research to determine whether or not this finding was significant or simply a fluke. For example the readability issues may have been caused by the animations specifically rather than the movement in general.

6.3 Design Implications

Based on the results several design implications can be derived to help develop future video game titles. However, it is important to note that the design implications derived from this study are mainly applicable to the demographic that participated in this study. The participants were exclusively between the ages 21-25 years of age, all of whom had prior experience with first-person shooter video games. This means that implications from this study could work well for first-person shooter games oriented to a young adult audience, whereas the results may not be as applicable in the development of games for an older or younger audience. According to a survey conducted in 2018 (Statista, 2021), 54% of people who play shooter games are between the ages 21-35. The sample of participants selected for this study fit within the main age demographic for shooter games and our findings should therefore, be applicable to a large portion of shooter players. Another possible concern with the sampling of participants is that there is no data on the participants’ prior knowledge regarding diegetic and non-diegetic
interfaces. The terminology used by participants during the interviews suggests that they may have acquired terms such as, “diegetic” and “non-diegetic”, from the prototype’s start menu.

An important design implication that can be implemented in the context of video games is the use cases for diegetic user interface. The results of this study suggest that diegetic interface is more difficult and therefore, less accessible in general, this implies that depending on the game that is being developed the developer might want to consider whether or not a diegetic interface is right for the intended audience. Inversely this implies that the non-diegetic interface is more user-friendly and intuitive because it gives more information upfront to the players.

Moreover, this study revealed that the inclusion of diegetic user interfaces can elevate a player’s sense of immersion in terms of realism, which may be preferable or not depending on the genre of the game that is being developed. For example, a more realistic simulator game may benefit from diegetic interfaces, since it helps build on the game’s realism.

When designing a diegetic interface for a video game, it could be a good practice to put the main elements in the player’s line of sight, as this would help players to focus on the main aspects of the game rather than needing to look away. Additionally, based on this study’s data, when creating animations it is important to consider any movement of the interface that might result from the animation. As shown by this study the movements of the interface lessen readability, to mitigate this effect one should be careful not to include drastic movements or movements that might result in obstructing the interface in their animations. This could come as a trade-off in terms of how realistic an animation is, so a developer has to choose what's more important between readability or more fluid animation.

7. Conclusion

The purpose of this study was to research how different diegetic and non-diegetic user interfaces affect perceived difficulty and immersion. The data resulting from this study shows that diegetic interfaces were perceived as being more difficult but more immersive than non-diegetic interfaces. When it comes to the diegetic interfaces, the navigational display was perceived as
more difficult to use because it gave less information than the non-diegetic counterpart. Additionally the diegetic interface was perceived as more difficult to read in some ways, mostly due to movement of the interfaces during player animations, however it was also perceived as more readable due to the UI elements being directly in the player’s line of sight. Immersion was also perceived differently depending on which interface was used. In contrast to the non-diegetic interface, the diegetic interface was perceived as being more realistic and strengthened the player’s connection to the player character, while also increasing player engagement.

Two possible limitations of this study are the age demographic of the participants, as well as the sample size being on the lower end (10 participants). Consequently this means that the results may vary with a different age group or with a larger sample size. For future research it would be beneficial to further explore the different impacts of diegetic and non-diegetic design on different types of games and more varied age demographics with a larger sample size. Contrasting studies could help strengthen the findings of this study and possibly explore related topics, for example how player performance is affected by user interface design in a competitive environment.
8. Reference List


9. Appendix A: Interview Script

1. What did you think of the two interfaces?
2. How did you feel about the differences between the versions?
3. What did you like about either version?
4. What things did you dislike about either version?
5. What were the differences in managing your health in either version of the game?
6. What were the differences in managing your ammo in either version of the game?
7. What were the differences in navigating either version of the game?
8. Did you ever forget about your real world surroundings while playing either version of the game?