Removing the HUD: The Impact of Non-Diegetic Game Elements and Expertise on Player Involvement

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ABSTRACT
Previous research has shown that player involvement can be influenced by a range of factors, from the controllers used to the perceived level of challenge provided by the game. However, little attention has been paid to the influence of the game interface. Game interfaces consist of both diegetic (that can be viewed by the player-character, e.g. the game world) and non-diegetic components (that are only viewed by the player, e.g. the heads-up display). In this paper we examine two versions of a first-person shooter game to investigate how immersion is influenced through interacting with a diegetic and non-diegetic interface. Our findings suggest that the removal of non-diegetic elements, such as the heads-up display, is able to influence immersion in expert players through increasing their cognitive involvement and sense of control. We argue that these results illustrate the importance of considering the role of expertise in relation to how particular design choices will influence the player experience.

Author Keywords
Player involvement; game user experience; immersion; diegesis.

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INTRODUCTION
From playing matching-puzzle games like Candy Crush to first-person shooters (FPS) such as Call of Duty, digital games offer a huge array of experiences to their players. The medium is constantly evolving, while player audiences have grown to include casual as well as hardcore players [28]. Despite the large amount of interest in different aspects of the gameplay experience, such as immersion, there is still much to be understood about how to influence player involvement.

One concept that has been underexplored in relation to the player experience is "diegesis", a term that has traditionally been used within literary and film theory and more recently applied to games [17]. In film, diegesis is used to describe the world that the characters exist in while non-diegetic elements, such as titles or the musical score, are only available to the audience. Similarly, game interfaces are both diegetic and non-diegetic, where the former relates to the narrative of the game, e.g. what the player-character can see and interact with; and the latter does not, e.g. classic heads-up displays (HUDs) showing health, maps, etc. These non-diegetic elements arguably make games easier through providing the player with additional information about the game environment, other game characters and their own status. In addition, the terms have been used within the game industry, where the assumption is made that the addition of non-diegetic elements on the interface results in a less immersive experience [e.g. 43; 45]. However, little research has been carried out to test these claims empirically.

The lack of research in this area means it is not clear how the addition or removal of non-diegetic elements actually influences player involvement. Clearly, some non-diegetic components, such as music, can add to an experience by increasing excitement and tension. However, it could be argued that monitoring additional visual elements on the interface might distract from the narrative of the game and therefore have a negative impact on the experience of playing. Further, while novices are probably more reliant on non-diegetic elements, experts might actually have a better experience without them.

In order to address these issues, we report on two studies that involved participants playing two versions of the same FPS game, *Battlefield 3*. The first version (non-diegetic) retained the HUD and other non-diegetic elements while the second version (diegetic) had these removed entirely in order to increase the realism of the game. In the first study we compare the two versions to ensure they are both still capable of leading to a positive gaming experience and in the second one we examine the involvement experienced by novice and experts when playing each version.

DIEGESIS AND GAMES

Galloway [17] introduces the concept of diegesis to video games, where diegesis refers to "the game's total world of narrative actions" and non-diegesis to "gamic elements that are inside the total gamic apparatus yet outside the portion of the apparatus that constitutes a pretend world of character and story" (pp. 6-7). Galloway also distinguishes between operator and machine acts, where the former relates to the player and the latter to the game that results from an interaction between software and hardware. Thus a diegetic operator act involves actions such as moving the game character or firing a gun, whereas a non-diegetic operator act would be to pause the game. In terms of a diegetic machine act, a good example is the ambience within an environment, where non-playable characters continue to move around the game world, while non-diegetic machine acts are events such a game-over screen or when actionable objects are highlighted on the game screen.

Diegesis has been considered in terms of the role of audio in games [e.g. 20] – as with films, sounds are sometimes part of the game world (diegetic) and other times music is used to communicate atmosphere to the player (non-diegetic) – but there has been less attention paid to the role of diegetic and non-diegetic game interface elements within player experiences. The terms have been used within the gaming industry, for instance Dino Ignacio, Visceral Games' lead User Interface designer, spoke at the Game Developer Conference in 2013 about how *Dead Space 2* was made deliberately diegetic in an effort to increase immersion [24] e.g. instead of imposing a health bar on the screen, the health meter is displayed on the playable character's back as part of his space suit. The assumption is that player involvement will be increased through incorporating such features into the narrative of the game.

Further, in a Gamasutra article [43] games blogger Anthony Stonehouse discusses user interfaces of different games in relation to the different elements they contain, including diegetic and non-diegetic. This article was based on the work of Fagerholt and Lorentzon [16] who present a set of design guidelines intended to increase immersion in FPS games e.g. "Strengthen the Player-Avatar Perceptual Link". These guidelines were based on a mix of interviews, focus groups and user studies but critically they did not actually use any measures of immersion so it is difficult to know how manipulating the types of game elements they identified would actually influence player involvement.

GAMEPLAY EXPERIENCE

With respect to understanding the gameplay experience, researchers have developed a number of different concepts. "Immersion" is one of those concepts which Brown and Cairns [5] identify as occurring at three distinct levels. The first is "total immersion", where the player feels that the game is reality, requires the highest level of attention and is a rare and rather fleeting experience when gaming. The other two levels, "engagement" (getting to grips with the interface) and "engrossment" (empathizing with the characters) are more likely to occur and are also enjoyable experiences. We argue that games might have different features that draw a person into the gameplay [8; 15]; however in terms of the immersive experience itself and the way that immersion progresses, all immersive experiences follow a similar course of events.

The Immersive Experience Questionnaire (IEQ) was created to measure a person's degree of immersion where a factor analytic study [27] revealed that the general experience of immersion can be divided into five components:

- Cognitive involvement consists of items that measure effort and attention, e.g. "To what extent did you feel focused on the game?"
- Emotional involvement consists of items that measure affect and suspense, e.g. "To what extent were you interested in seeing how the game's events would progress?"
- Real world dissociation consists of items that measure lack of awareness of surroundings and mental transportation, e.g. "To what extent did you feel consciously aware of being in the real world whilst playing?"
- Challenge consists of items that measure how difficult the user found the game, e.g. "Were there any times during the game in which you just wanted to give up?"
- Control consist of items that measure ease of use of the gaming interface, e.g. "At any point did you find yourself become so involved that you were unaware you were even using controls?"

Given the correlations between these factors, they should be seen as reflecting different aspects of an immersive experience (rather than as independent factors). The IEQ is essentially a unidimensional construct made up of these five interrelated components.

Besides immersion, there are many other different terms used to describe different aspects of gaming experience [see 32 for a review]. “Presence” is one example and has been used to describe the sense of being in a virtual environment [25]. While presence can also occur at the highest level of immersion [5] - a player might even describe his or herself as being “in the game” [26] – it does not necessarily equate with immersion [6]. For example, it is possible to have presence without being immersed, e.g. carrying out a tedious task in a virtual simulation.

Another term is “flow”, which is used to describe an experiential state where there is an appropriate match between someone’s skills and the challenge presented to them, resulting in an experience of intense involvement [14]. When a player is in flow they are described as being highly engaged in the game and performing at their best [12]. It can be argued that flow in games corresponds to the highest level of immersion, “total immersion” [5]. Flow is specifically an optimal and therefore an extreme experience. In contrast, game immersion is normally a suboptimal experience: the player is usually immersed in the game to some extent, but being in flow means being immersed to the exclusion of everything else.

On the opposite end of the spectrum, there is also the concept of the Core Elements of the Gaming Experience [CEGE; 9]. The CEGE theory explores the minimum conditions necessary to provide users with a positive experience. These conditions consist of puppetry factors (control, facilitators, ownership) and video game factors (environment, game-play). As immersion is a graded experience [5], the CEGE corresponds to the lowest level of immersion, engagement. Higher levels of immersion would depend on satisfying other aspects of gaming experience, beyond these core elements. For a comprehensive discussion concerning how immersion relates to other game experience constructs see Cairns et al., [6].

THE ROLE OF EXPERTISE

In terms of the how to influence the gameplay experience, researchers have investigated a number of different game factors such as types of controllers [e.g. 3; 7; 19; 36] and different forms of audio [e.g. 10; 18; 40, 37]. Challenge is often considered a significant component of involvement [e.g. 14; 27; 34; 44], where Cox et al., [13] note that the challenge experienced by a player results from an interaction between their expertise and the challenges provided by the game. Increasing cognitive challenge by adding time pressure, they found that higher levels of immersion are experienced when the player perceives that the game is at just the right level of difficulty for their own skill level. Thus, those with who were less experienced were more immersed at lower levels of challenge and conversely those with more experience were more immersed at higher levels of challenge.

Similarly, Sweetser and Wyeth [44] argue that the game *Lords of EverQuest* was rated less positively by game reviewers as the campaign mission lacked strategic depth, only requiring superior fire power to win. As a result, the challenge was especially poor for experienced players, and would probably only accommodate novices. In contrast, *Warcraft 2* was rated much more highly because as the campaign progresses the difficulty of the mission increases levels of challenge; thus the game is able to accommodate novice and experts.

The perception of time may also be experienced differently by novices and experts. Rau et al. [41] found that expert gamers of *Diablo 2* underestimated the time they spent playing the game and they perceived the 60 minutes playtime as passing more quickly. In contrast, novices were more likely to overestimate the perceived time. This could suggest that they had a less positive experience, possibly because they were still trying to get to grips with the controls of the game at this stage.

Expert gamers clearly have more knowledge of the game domain, due to their greater experience. Several studies have also proposed that expert gamers think in a different way to novice gamers. For example, Maglio et al. [33] suggest that expert players use the game world more effectively than novices, e.g. while playing *Tetris*, experts make more epistemic actions (rotating the falling game pieces) in order to enhance their ability to decide whether the piece will fit in a game board. In another study, Hong and Liu [21] found that expert gamers were more likely to use analogical thinking while playing *Klotski*, whereas novice players were likely to use trial-and-error thinking. Iacovides and colleagues [23] argue that while trial and error may be useful for initial learning, more sophisticated strategies are required to gain a deeper understanding of a game. Similarly, Blumberg [2] found that experts playing *Sonic the Hedgehog 2* were more standard-driven, they placed a greater emphasis on specific goals for mastering the game; whereas novices were more affect-driven, i.e. they just referred to the game in terms of liking.

Definitions of expertise are likely to differ within the literature [23; 30] but previous research does indicate that the amount of experience players have is likely to impact their involvement in different ways. It would appear that more experienced players prefer higher levels of challenge [13; 44], underestimate the amount of time they spend playing [41], and engage in different forms of thinking than those with less experience [2; 21; 33].

OVERVIEW OF STUDIES

The research discussed above has considered numerous aspects of the player experience, however there is a lack of empirical work investigating the influence of the game interface in relation to diegetic and non-diegetic game elements. While having to pay attention to non-diegetic parts of the interface may provide useful information to players, they may also distract from the narrative of the game and therefore have a negative impact on the experience of playing. Further, it is not clear how non-diegetic elements influence the cognitive challenge experienced by players – do they make the game easier or harder? The literature also suggests that player expertise is likely to impact involvement in terms of how challenge is perceived, the perception of time and the kinds of thinking during play.

In order to further explore these factors, we present two studies that investigated how different versions of a game interface influence player involvement. The first compares the interfaces to ensure that the diegetic version (where the HUD has been removed) did not lead to an unplayable version of the game which would be unable to support initial engagement. The second study then went on to examine the interfaces in more depth by considering how they influenced higher levels of involvement in novices and experts.

STUDY 1

Method

Design

The study employed a within-subjects design where participants played two versions of the same level in *Battlefield 3*. One version was non-diegetic (with the original game interface) and the other diegetic (where any non-diegetic information was removed). Figure 1 shows a screenshot of the original game interface with non-diegetic information included.

Figure 1: Battlefield 3 non-diegetic interface

Participants

Nine participants were recruited for the study from a university course (all male; mean age: 26; SD = 2.64). Participants were screened to ensure that they enjoyed playing FPS games, preferably on a PC but also on consoles. This was to ensure that the participants could easily pass through Brown and Cairns' [5] barrier of access in order to experience initial engagement. All of the participants had over two years of gaming experience and played games more than once a week for over half an hour. They were paid £5 for taking part.

Materials

Battlefield 3 was chosen due to the fact it is a popular FPS game set in a modern setting (mainly in the Iran-Iraq region). The game also uses a realistic physics engine and has generally received positive reviews – the PC version has an overall Metacritic score of 89 [38].

In the diegetic version (Figure 2) the following elements were removed from the interface: crosshairs, teammate markers and names, ammo display, compass, notifications (saving, visual objectives, item walkovers, and environment interaction), goal markers and grenade indicators. The non-diegetic condition included the same level but retained all the elements listed.

Figure 2: Battlefield 3 diegetic interface

There are audio instructions built into the game to aid goal clarification and objectives, and visual diegetic cues (e.g. lights over actionable doors) which were present in both conditions. The following script was used to change the game interface:

- Press ~ to open the command line.
- Type UI.DrawEnable 0 (followed by the return key) to remove all the non-diegetic features.
- Type UI.DrawEnable 1 to reset the changes.

Battlefield 3 was not specifically designed to be played without any non-diegetic elements; the section of the game selected for testing - Level 3: Uprising - was chosen as progress was not likely to depend on any non-diegetic information (apart from a single quick-time event which would occur when the researcher was showing the controls to the participant).

The game was played on A Dell OptiPlex 960s running Windows 7, with 3GB RAM, an Intel Core 2 QUAD Q9550 processor, 256MB ATI RADEON 3470 graphics card and combination output, which connected to headphones. It was run at a resolution of 1152x648.

The CEGE questionnaire (CEGEQ) was used to assess the core elements of the gaming experience [9]. The questionnaire was created to measure the minimum conditions necessary to provide users with a positive experience while playing a game. It consists of 38 items that are answered on a 7-point Likert scale. The CEGEQ corresponds to the lowest level of immersion, engagement, where we used the questionnaire to investigate whether removing the HUD would create an unplayable version of the game that would not be able to support higher levels of involvement.

Procedure

The study took place in a lab environment, where participants were introduced the study and shown the controls of the game. Each version was played for a maximum of 20 minutes, unless the level was completed before this. The order was counterbalanced. After playing each version, the participants were given the CEGEQ to fill in. At the end of the session a brief interview was conducted (up to 10 minutes) where participants were debriefed and paid for their participation.

Results

Paired samples *t*-tests were used to determine whether there was a difference in the core gaming elements between the two versions of the game. CEGEQ scores were calculated for the diegetic and non-diegetic versions of the game (Table 1). The questionnaire consists of three main scales: enjoyment, frustration and the core elements of the gaming experience.

	Diegetic		**Non-diegetic**	
	Mean	SD	Mean	SD
Enjoyment	17.67	2.83	17.78	1.39
Frustration	7.33	1.27	6.11	0.96
CEGE	156.98	3.80	164.78	3.58

Table 1: CEGEQ scores

No significant differences were found in relation to enjoyment (t = -0.17, df = 8, p = 0.87, Cohen's d = 0.056), frustration (t = 1.02, df = 8, p = 0.34, Cohen's d = 0.34) or the CEGE scale (t = -1.97, df = 8, p = 0.08, Cohen's d = 0.66).

Discussion

Following discussions in Psychology [1] and HCI [29] about more measured interpretation of p values and the importance of interpreting effect sizes, we suggest that, while the results are not significant, it is possible that the different interfaces may have had an effect on the player experience. As Mayo & Spanos [35] argue, small sample sizes that show large effects in support of a severe test are likely to be more suggestive of meaningful effects than large samples that show small effects (p. 22). Thus, our results can be interpreted to suggest that in relation to the non-diegetic interfaces, players may have been more likely to have a better experience, at least in terms of the core elements and possibly less frustration. This interpretation indicates that the non-diegetic interface is facilitating gameplay and is valued by players because of that. For instance, P4 noted that the HUD provided "more relevant information, like where to go and it augmented the information without breaking the immersion." However, this in contrast to P1 who "wasn't really sure, in the version with the interface, what the interface was showing … after the first few minutes I didn't refer to it".

Of course, given the lack of significance and the small sample size, the results may not represent systematic effects. Even if they are systematic, they are not measures of other aspects of players experience had by players. In particular, enjoyment did not differ between the conditions (with a very small effect size) suggesting that in this case, the interface style does not cause significant issues that would provide a barrier to overall involvement.

The responses from the brief post-play interviews suggest some ways the interfaces may influence immersion. For instance, with respect to the diegetic version of the interface, P9 suggested "I preferred the challenge of the first game … everything was kind of hidden as well so I had to figure it out for myself. So I seemed to get more involved in it I think" while P3 noted "I did feel that I felt a bit more immersed in the version without the interface simply because there were no flashy things around. So compared to the other one where I was constantly looking at the screen and darting between everything, so I was able to focus on the actual gameplay more."

Overall, the findings indicate that the removal of the non-diegetic game elements did not provide significant barriers to engagement. Further, the interviews also suggest that the diegetic interface may increase higher levels of involvement, such as immersion, through increasing challenge and requiring greater player attention. The second study investigates these potential effects in more detail by examining the influence of non-diegetic elements on immersion in relation to novice and expert players.

STUDY 2

Method

Design

A between-subjects design was used. Half of the participants played the game with the diegetic interface and the other half played the non-diegetic interface. Participants were also categorized by expertise.

Participants

Twenty-four participants took part in the study, who were recruited from the university participant pool (F = 7; M =

17; mean age: 24, SD: 4.15). As in Study 1, participants were screened to ensure that they enjoyed playing FPS games, preferably on a PC but also on consoles. On the basis of self-report, participants were categorized as being novices or experts. There was a clear distinction between those who played FPS games regularly for at least an hour per week (Experts) and those who played FPS games much more intermittently or had not played in a while (Novices). Seven potential participants had to be excluded from the study as they were obviously struggling with the controls. This lack of familiarity meant they were unlikely to overcome the barrier of access [3] and experience any subsequent engagement within the time frame of the study. In total, 10 experts and 14 novices took part; who were paid £5 for their participation.

Materials

The same computer and versions of the game were used as those described in Study 1. Involvement was measured using the Immersive Experience Questionnaire (IEQ) which has 31 items [27]. The questionnaire divides the general experience of immersion into five components: cognitive involvement, emotional involvement, real world dissociation, challenge and control.

Procedure

The procedure was very similar to Study 1 though in this case participants were randomly assigned to play either the diegetic or non-diegetic version of the game. They then played for up to 20 minutes, unless they completed the level before this time limit was reached. After the gameplay session, the participants filled in the IEQ.

Results

A 2X2 ANOVA was conducted to investigate differences between condition and expertise. Normality here is established as a theoretical assumption that follows from the use of a 31 item questionnaire to measure a unidimensional latent concept [31], while homogeneity of variance is within the tested guidelines as standard deviations are within a factor of 2 [4]. Table 2 shows the descriptive statistics for the IEQ and its subscales.

While there were no significant effects for condition ($F_{(1, 20)} = 2.68$, $p = 0.117$, partial $\eta^2 = 0.118$) or expertise ($F_{(1, 20)} = 6.13$, $p = 0.797$, partial $\eta^2 = 0.003$), there was an interaction between the two that approached significance and reflected a medium effect size ($F_{(1, 20)} = 4.32$, $p = 0.051$, partial $\eta^2 = 0.178$). From the mean scores in each condition (see Table 2), it is clear that the main cause of this interaction is that expert's immersion drops substantially from the diegetic to the non-diegetic condition. A test of simple effects, shows that for experts alone, there is a substantial effect ($F_{(1, 10)} = 4.896$, p=0.058, partial η^2= 0.380).

In order to provide insight into this, further ANOVAs were conducted on the subscales of the IEQ (means and SDs are given in Table 2). Further interactions were found for Cognitive Involvement ($F_{(1, 20)} = 7.80$, $p < 0.05$, partial η^2= 0.280) and Control ($F_{(1, 20)} = 10.05$, $p < 0.01$, partial η^2 = 0.334). In both cases, they reflect a drop for experts between the diegetic and non-diegetic conditions. There was also a significant main effect for Challenge with respect to expertise ($F_{(1, 20)} = 7.62$, $p < 0.05$, partial η^2 = 0.276).

	Diegetic		Non-diegetic	
	Expert [N = 6]	Novice [N = 6]	Expert [N = 4]	Novice [N = 8]
IEQ overall	133.83 (7.60)	124.50 (8.67)	119.00 (13.83)	126.25 (8.94)
Cognitive Involvement	46.83 (2.48)	43.67 (3.14)	37.50 (5.45)	43.63 (4.67)
Real World Dissociation	26.67 (2.80)	26.67 (2.80)	27.25 (1.26)	26.63 (4.14)
Emotional Involvement	50.00 (6.07)	42.33 (7.39)	43.00 (8.45)	45.75 (5.70)
Challenge	19.83 (19.4)	17.00 (1.41)	18.25 (0.96)	17.5 (1.51)
Control	35.00 (1.76)	30.67 (4.50)	27.75 (4.27)	32.37 (3.38)

Table 2: IEQ mean scores (SD in brackets)

Discussion

Following the discussion of Study 1, where we argued that small samples that produce large effects are stronger evidence of meaningful effects [35], we interpret the results of Study 2 as indicating that diegetic and non-diegetic interfaces do indeed have an influence on players' levels of immersion in the game. However, the effect is seen only for experts, where non-diegetic interfaces offer a substantially lower level of immersion than diegetic interfaces. Further analysis suggests that these effects are due to the cognitive involvement and control components of immersion.

These findings makes sense in that experts should already have rich knowledge and schema of the game based on their extensive playing experience. As a consequence, the information in a HUD is not so important to them to help them play the game. Instead, the HUD may act as a barrier, possibly providing information that distracts them from the game and impedes their control of the game. By contrast, for novices the HUD does not particularly increase or decrease immersion though there may be some underlying differences around exactly how immersion is experienced. Regardless of condition, novices did indicate they generally found the game to be less challenging than experts.

GENERAL DISCUSSION AND CONCLUSIONS

While there has been much interest in understanding different aspects of player experience, there has been a lack of empirical work examining the influence of game interface elements and the role of expertise. We carried out two studies to investigate how the involvement of novice and expert players was affected by non-diegetic game elements. Our findings suggested that the removal of non-diegetic elements, namely the HUD, did not present an obstacle for initial engagement and enjoyment. However, with respect to higher levels of involvement, the removal of the HUD was seen to increase immersion for expert players.

In relation to the components of the IEQ [27], this increase in immersion did not appear to be related to challenge. Experts may have rated the game more challenging than novices (most likely due to having a greater capacity to understand the complexity and potential challenge of the game) but this did not differ between conditions. Further, despite potentially increasing the realism of an FPS game through removing the non-diegetic elements, emotional involvement and real world dissociation were not affected in either group. However, there were differences in cognitive involvement and control between conditions, suggesting that expert players were more able to focus on the game and felt more in control (and less aware of their controllers) without the HUD.

We used *Battlefield 3* in our studies, which also contains a multiplayer mode where players can compete in teams against each other. There are “hardcore only” servers for those who want to play with other more experienced players, where multiple changes are made to increase difficulty e.g. overall health is reduced and friendly fire is enabled [46]. In addition, when playing on these servers the game only provides a limited HUD (lack of a minimap, removal of crosshairs for most weapons, absence of ammo count etc.). Our findings suggest that instead of increasing the challenge of the game, the lack of information may be increasing immersion through providing fewer distractors.

With respect to game analytics research, studies have shown that experts behave in different ways to novices [32], where performance indicators have been used as a way to identify expertise and dynamically alter levels of difficulty [e.g.11; 22]. For instance, Cechanowicz and colleagues [11] tested a set of techniques to balance performance in a racing game by either assisting novices and/or providing a hindrance to experts. Balancing and dynamic difficulty approaches are important to consider in relation to configuring challenge within games, but our findings suggest there may be other ways to improve the player experience that relate more to how players think and process information. While novices may or may not have paid much attention to the HUD through being more affect driven [2] and relying on trial and error strategies [23], the HUD appears to negatively impact experts by distracting them and reducing overall involvement. One explanation is that expert players in the non-diegetic condition spent time looking at the HUD elements, assuming they would be useful in some way, whereas those in the diegetic condition were able to leverage their existing expertise to progress without this information and to focus more on gameplay as a result.

These findings are particularly important to consider in relation to the fact that many people do not actually play games until completion [39]. Designers need to consider ways in which to support player involvement throughout the entire gameplay experience and this should include a consideration of how expertise evolves during play. While challenge is often a significant part of involvement and needs to be balanced appropriately [e.g. 11; 13; 22; 30; 44], our research suggests it is also important to also consider how players think during play, especially in relation to how they attend to different types of interface elements. The HUD may initially provide important information to players, but can later act as a barrier to deeper levels of involvement when the player has gained sufficient expertise to continue without it.

Our findings should be interpreted with caution however as the studies focused on a particular level within a single FPS game. The level was selected on the basis that it could be completed without having access to non-diegetic information, but this does not mean the HUD is unnecessary throughout the whole game. Similarly, non-diegetic game elements are likely to vary across games in terms of what information they display and how they are depicted. Future investigations could focus on particular aspects e.g. walkover notifications or team markers. In addition, though the effect sizes regarding cognitive involvement and control were substantial, the sample sizes for both studies could be increased. Further research is needed looking at the role of different non-diegetic elements across a range of game genres and involving larger numbers of participants.

In terms of the conditions investigated, we were specifically comparing how non-diegetic information influenced involvement – the non-diegetic version of the game retained this information, while the diegetic version had it removed. While the removal of the HUD arguably made the FPS more realistic, since much of the information provided would not be available in a real world military scenario, our studies did not examine the effects of incorporating non-diegetic information into the narrative. For instance, in *Far Cry 2* there is no HUD but the character can look at a handheld GPS for location information. While beyond the scope of this research, further studies could examine two different versions of the same game where information is incorporated into the game world either diegetically or non-diegetically. Though it has been suggested that integrating information in a diegetic format is more immersive [16, 43; 45], there is a need for further empirical evidence to substantiate these claims.

Similarly, diegesis can be rather complex within the context of video games. For the purposes of simplicity, we treated all the information provided in the HUD as non-diegetic but this may not always be the case. For instance, crosshairs could be diegetic game elements if the character is using a gun with a sight. Arguably, there are also further distinctions around the type of information a HUD may provide. For instance, in the case of walkover notifications, whilst presented non-diegetically, this could be diegetic information that a character within the narrative would be aware of, if not for the narrow field of view provided by the game. In contrast, when a HUD highlights actionable objects on screen, this provides additional non-diegetic information that only the player would be privy too. Given that Galloway [17] notes that there are occasions when "the line between what is diegetic and what is nondiegetic becomes quite indistinct." (p. 28), there is clear scope for further study to examine the concept of diegesis in relation to particular types of game elements, the information they represent and their influence on involvement.

In addition, any study within this area needs to also consider the role of expertise, since interface manipulations are likely to have a different impact on novices and experts. Researchers need to be clear about how they are defining expertise within each context [23] to enable a clearer comparison between studies while there is also scope to investigate how expertise develops over periods of time. A longer term study would lead to a richer understanding of how novices become experts and when particular interface changes are most likely to lead to increased player involvement. Similarly, this could allow a consideration of situations where the distinction between novice and expert is less important, e.g. after someone has returned to a game after a long absence. In addition, there is scope to investigate expertise and interface elements in relation to multiplayer gameplay.

Conclusion

When considering player expertise in games, the focus is often on how to improve involvement through supporting skill development, providing greater challenge through increasing difficulty and displaying information via complex interfaces. Through examining the role of non-diegetic interfaces our findings suggest that the gameplay experience could actually be improved by removing some of the elements presented on screen. This information may initially be required to scaffold learning about the mechanics of the game and the wider environment, but for more experienced players, it may only serve as a distraction. The role of non-diegetic and diegetic interface elements is a promising area of research that requires further investigation in order to develop a deeper understanding of how to provide information to players in a way that augments player involvement throughout the gameplay experience.

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