

# Evaluation of immersive user interfaces in virtual reality first person games

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## Abstract

This study is part of a master's dissertation aiming to investigate the immersion of user interfaces in first person games using virtual reality. This evaluation is based on the concepts established by the Diegesis theory. Based on that, a table was created with the identified elements in the games that induce more or less immersion to the player. Through the data collected, a questionnaire was developed to obtain information from developers, designers and players, to evaluate the most and the fewer immersive elements of the interfaces in the games selected. The results showed that the Diegetic and Spatial interfaces are the most immersive for virtual reality first person games, and the less immersive were the Meta and Non-Diegetic interfaces. Thus these results can be important if they influence the creation of games interfaces more immersive, because all players want to be immersed when playing games, in particular when playing in virtual environments.

## Keywords

*Virtual reality; user interface; digital games; immersion; diegesis theory*

## I. INTRODUCTION

Virtual reality (VR) gaming is where a person can experience being in a three-dimensional environment and interact with that environment during a game. This is an essential part of the game [1].

For now, gaming is the biggest driver of VR, and will continue to be for the near future. But even among gamers, the most enthusiastic of early adopters in most cases, the potential of virtual reality gaming has been point of heated debate, and not just among fans, but developers as well [2].

Researchers, technologists and anyone else working in the field of virtual reality is all too aware of the dangers of hype and as a result, have tended to downplay its capabilities [3]. They often avoid the term "virtual reality" to prefer "virtual environment" which has a less negative connotation.

First-person view (FPV), also known as first-person point of view (POV), is the ability of the user of some technology to see from a particular visual perspective other than one's actual location, such as the environment of a character in a video game, a drone, or a telemedicine client [4].

Let's mix First-person view and Virtual Reality. The player will have the vision of the main character of a game, this may increase the immersion and make the player feel like he is the character. By "becoming" the avatar, the player also embodies his character's traits and demeanor, and the intensity of in-game situations is ramped up considerably because of that [5]. For example, in Batman Arkham VR [6], the player will experience the death of Bruce Wayne's parents through Bruce's eyes, have a father/son relationship with Alfred (his butler), use the bat gadgets, look at himself by a mirror dressed as Batman and face the same challenge and fears. All this, can make the player play by the same sense of justice of our Dark Knight.

Immersion is a term used by gamers and reviewers alike. It is often viewed as critical to game enjoyment, being the outcome of a good gaming experience. However, although there seems to be a broad understanding of immersion in the gaming community, it is still not clear what exactly is meant by it and what is causing it [7]. If you don't understand, we can give you an example of day-to-day immersion. When we start playing in the morning at the holidays a massive multiplayer online roleplaying game (MMORPG), we try to achieve things in the game and start to forget about the real world, and when we look at the window outside, it's already night, and we realize that we didn't achieve too much in the game but wasted a lot of time playing. In movie theaters is very common losing track of time, the explanation for this is our focus on the movie and the favorable environment, because you are enjoying that moment by a long time.

In the context of virtual reality, the term immersion is used to describe the user's emotional reaction to the virtual world in terms of feeling as if they are actually a part of the virtual world [8].

According to Fagerholt and Lorentzon [9], we can define immersion as moments during the play when players access their real-world perception, reasoning skills, to play the game or voluntarily adopt the game world as primary world and reason from the characters point of view, rather than having to refer directly to the rules of the game. In these moments, the player grows beyond being simply a player, instead taking the role of an agent in the fictional world (no matter how limited).

From this definition, we can notice two factors:

**Immersion concerning Reasoning**, this factor consists in real world knowledge of genre conventions [9]. For example, fire is weak against water. So, with this knowledge the player need to solve game world problems that enable the player to reside in a fictional frame rather than rule-oriented frame.

**Immersion concerning Perception**, this factor imitates a real-world situation. Games played in a first-person perspective engage a player's perception in a way similar to real life [9]. Clues about the whereabouts of objects and enemies are elicited from the environment in largely the same way as it would in a similar real world situation [9].

Still, contemporary games only offer a visual, auditory and haptic rendition of the game world, leaving out many of the subtle things that makes up our real-world perception (like our sense of balance, movement speed, etc.) [9].

Because of this, it is fair to argue that a UI element strengthening the player's in-game perception can increase player immersion. By bonding the player close to the perception of his or her avatar, a player's presence within the game world can be manifested resembling human presence in the real world.

Overwatch game is the perfect example of immersion concerning perception, the player chose one character to play, and when the game starts the player assumes the first-person view of the character chosen, this can influence the movement speed of the player and the character design.

This work wants to contribute for the development of the research in the field of virtual reality digital games, more specifically the universe of User Interface (UI) and User Experience (UX), to improve and show effectiveness of immersion with a good UI/UX in a specific game.

## II. USER INTERFACES FOR DIGITAL GAMES

User Interface (UI) in video games is the way players can interact with the game and receive feedback of their interaction. It generally applies to the interactivity and concepts of a game. This includes several aspects of gameplay such as the storyline, controls, graphics, visual perspectives (point-of-view), behaviors of AIs and level designs. The experience generated from the resultant gameplay of interaction is the main goal of the game.

User interface design in games differs from other UI design because it involves an additional element as fiction. The fiction involves an avatar of the actual user or player. The player becomes invisible, but a key element to the story, much like a narrator in a novel or film. This fiction can be directly linked to the UI, partly linked, or not at all. Historically games didn't have any real link to the game's narrative, most likely because early games rarely had strong story elements [10]. Fagerholt and Lorentzon explored theories of game UI design in their thesis titled: Beyond the HUD User Interfaces for Increased Player Immersion in FPS Games. They introduce terms for different types of interfaces depending on how linked to the narrative and game geometry they are [9].

We can ask ourselves two questions about any interface component: i) "is the component part of the game story?" (Is it part of the narrative?). ii) "Is the component part of the game

space?" (Is it behind the fourth wall?). Depending on the answers, we can classify the component into one of four representations: Diegetic, Non-Diegetic, Spatial or Meta. The figure below shows how the questions relate to the representations.

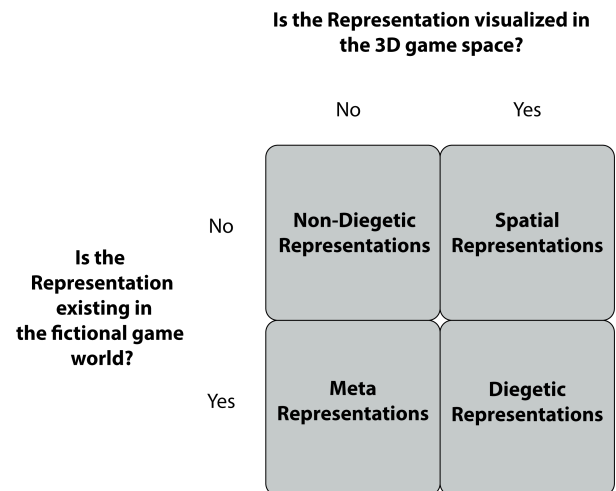


Figure 1: Terminology from Fagerholt and Lorentzon [9].

Non-Diegetic elements have the freedom to be completely removed from the game's fiction and geometry and can adopt their own visual treatment, though often they are influenced by the game's art direction [9].

The game menu from Bait! [11] shown in figure 2 is classified as Non-Diegetic representation because it's not in a 3D game Space and does not exist in the fictional game story. This menu is just flat 2D text and an image rendered in the screen.



Figure 2: Bait!, Screenshot of the menu, Non-Diegetic representation.

Spatial UI elements are used when there's a need to break the narrative in order to provide more information to the player than the character should be aware. They still sit within the geometry of the game's environment to help immerse the player and prevent them from having to break the experience

by jumping to menu screens. The closer these follow the rules of the game's fiction the more they can help immerse the player [9].

The UI from Temple Run VR [12] shown in figure 3 fits in the geometry of the street environment to give some information such how much meters the player needs to run to complete the game. This user interface is classified as Spatial representation because it's in a 3D game Space and does not exist in the fictional game world story.



**Figure 3:** Temple Run VR, Screenshot of the gameplay, Spatial representation.

The Diegetic user interface elements exist within the game world (fiction and geometry) so the player and avatar can interact with them through visual, audible or haptic means. Well executed diegetic UI elements enhance the narrative experience for the player, providing a more immersive integrated experience [10].

The UI of Balloon Shooter [13] gameplay shown in figure 4 is classified as Diegetic representation because it's in a 3D game Space and exists in the fictional game world story. In this case, the user interface in the gameplay is a blue capsule "fuel" who represents the health point of the balloon, every time the player takes damage the fuel decreases.



**Figure 4:** Balloon Shooter, Screenshot of the gameplay, Diegetic representation.

Sometime UI elements don't fit within the geometry of the game world. They can still maintain the game's narrative but sit on the 2D hub plane, these are called Meta Elements [9]. A

common example of a Meta UI element is blood splatters on the screen as a form of health bar.

The UI of Element Engine [14] gameplay shown in figure 5 is classified as Meta representation because it's not in a 3D game Space but exists in the fictional game world story. In this case, the red border indicates that the player is taking too much damage, representing the health points.



**Figure 5:** Element Engine, Screenshot of the gameplay, Meta representation.

### III. METHODOLOGY

In this section, we chosen and analyzed 20 first-person games in virtual reality, but they have different settings from a static model to the playable model. Almost four user interfaces of each of them were classified by the Diegesis Theory. The games were found on Oculus Home for Samsung Gear VR [15].

After selecting the games, the next step was to define the main features based on the Diegesis Theory that an interface needs to present in a game. Furthermore, these features can be classified as four interface components: Diegetic, Non-Diegetic, Spatial and Meta. The interfaces were separated by menu, tutorial, gameplay and high score. Since the gameplay can have a lot of different interfaces we will analyze the interfaces who are permanently or often shown to the player.

In the next step, a questionnaire was made from the information collected in the previous step, four interfaces of each kind (Diegetic, Non-Diegetic, Spatial, Meta), sixteen interfaces in total were chosen to make a part in the questionnaire. There were 50 students inquired and among them, game developers, designers and players. The questionnaire contains videos of the 16 interfaces for them to watch and rate from 0 to 4 which type of interface is more or less immersive.

Before applying the questionnaire, it was explained to the participants what is immersion, and how we can know that we are or can be immersed in a specific moment of the game. When a player is focusing in the game, if something draw their attention off the game it's because the flow was broken by something and the interface can be responsible for that. The

immersion concerning Reasoning and Perception referred in the introduction was also explained to the participants.

#### IV. USER INTERFACES MORE AND LESS IMMERSIVE

The questionnaire was applied to students of Digital Games from Catholic University of Pernambuco, in Brazil; they were seventeen Designers, seventeen Developers and sixteen gamers in a total of 50 participants, from eighteen to twenty-six years old.

From the data collected, it's clear now that the Diegetic interfaces are the most immersive type of interface for virtual reality first person games, with a huge number of votes. The second most immersive interface was Spatial, the participants liked the idea of putting information inside the 3D world, but there were some games where the interfaces didn't fit well. For the last, the Meta and Non-Diegetic interfaces were classified as less immersive interfaces, the participants were concerned about the focus in the game with these interfaces, because they broke their focus by suddenly showing up on the screen, or the user needs to look at certain point out of the main course.

#### V. CONCLUSIONS AND FUTURE WORK

From the research using the Diegesis Theory, we could identify and classify interfaces in several games, in total 20 games, almost each one with 4 interfaces classified, making a total of almost 80 interfaces identified for this research, but with the lack of some type of interface, we were able to use just 16 interfaces of this 80 in the questionnaire.

The Diegetic interfaces are masked as the environment so the participants said that was very immersive because they were receiving feedback but not noticing how, one of them said to make some changes in the colors to grab more attention, but that's the catch, maybe if the interface grab too much attention, the immersion would be lost. The Spatial interfaces, like the Diegetic, use the environment, but doesn't make part of the history of the game, so the participants were very confused about the design that doesn't fit on the game, and some of them tried to give tips to solve some problems, but this might change the type of interface. In the Meta Interface, the participants said that it takes too much attention distracting the user to the interface and getting lost in the game flow, some of them couldn't see what's going on with the game with the interface on front of it. The Non-Diegetic interfaces made the participants feel that was something missing, because the interface was too simple, not in the right place, and didn't bring immersion at all.

With this research, we have concluded that the Diegetic and Spatial interfaces are the most immersive for first-person games in virtual reality, and the Meta and Non-Diegetic interfaces were the less immersive.

To validate all data discovered in this research, one game will be developed, creating one level with the immersive

interfaces, such as Diegetic and Spatial, and another level with the less immersive, such as Meta and Non-Diegetic. Then will be possible to make some tests to evaluate the influence of the type of interface in the immersion of a virtual reality first person game (i.e. creating different interfaces in the same game).

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