Being there: the challenges of porting the magical experience of *Skyrim* to virtual reality

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Abstract

Virtual reality gaming experiences are without doubt unlike their traditional counterparts, as they offer motion control and a technical immersive head-mounted display. Porting, i.e. translating, a traditional video game to virtual reality does therefore not come without any challenges. However, the exact differences between both experiences and the effects of porting on the player experience are unknown. Virtual reality seems especially underdeveloped in this discussion. This study will therefore map the challenges of porting a traditional video game to virtual reality to understand the change in game-related features and the influence they may have on the player experience. Using *Skyrim* as case study, this thesis critically compares the differences between the traditional and virtual reality game to discover changes in game-related features. These changes are then situated in a theoretical discourse to understand the influence they may hold on the player experience. The following concepts are explored: mapping, kinaesthetic-, aesthetic, and ludic pleasure, gameworld as interface, and player-avatar relation, using theories from Klevjer (2006; 2012), Nitsche (2008), Juul (2010), Calleja (2011), and Jørgensen (2013). This study believes that the player experience is challenged when a traditional video game, such as *Skyrim*, is ported to virtual reality, because game-related features and gameplay change with the Twin Motion controllers and head-mounted display. As a result, this study concludes that virtual reality gaming should be explored in various ways to understand its features, possibilities, limitations for an optimal experience.

Keywords: virtual reality gaming, video game ports, virtual reality, porting, player experience.

Contents

Introduction

With just a simple swing of my arms, a sword slashes my enemy. At the same time, I press a button and a wild fire is bursting from my hands. I feel powerful, because my opponent is defeated within seconds and I can loot his gear and other possessions. My quest is not over yet and I explore the rest of the cave. In the adjoining chamber lies a bear. He is sleeping. I could try to slowly sneak past it, but attacking the bear is more challenging and offers a greater reward. I press some buttons to swap my sword with a bow. With holding one controller in front of me and the other beside my face, I draw my bow and pause for a moment to focus. Then, I release the arrow. After a second of nervous anticipation, the arrow hits its goal. But the bear is not dead yet. Instead he wakes up, growls, and starts running towards me. Fast. I quickly draw another arrow and fire towards the bear, but the fear inside me hinders my focus and the arrow flies past the big, brown animal. The adrenaline runs through my veins. I am screaming, scared of getting hurt. The bear is almost near my fragile body. It is now or never: I try to shoot another arrow. Fortunately, it finds its target, right between the eyes. The bear collapses. He is dead, right in front of me. I finally let go of my breath. The fear inside me is gone and I move forward to loot the inanimate body.

This short anecdote gives a relatively good representation of my first gaming experience with the fantasy role-playing game *The Elder Scrolls V: Skyrim* (Bethesda Game Studios 2017) in virtual reality. Albeit somewhat technically impaired at times, this experience is unlike the traditional version of the game, i.e. the PlayStation 4 game. Indeed, both marketing and popular praise for the PlayStation virtual reality (PSVR) device announce that virtual reality (or VR) is a refreshing and attractive medium with its motion controllers and 360 degrees stereoscopic view. Bethesda mentions that "Dragons […] are even more magnificent [and] come to full life in virtual reality," (Steinman 2017). And reviews show the same excitement: "If you leave the difficulty on the default lowest setting and roam the world as a god who can slay enemies with the flick of the wrist, it's a good way to experience Bethesda's legendary RPG from a whole new perspective," (Stapleton 2017).

This change of player experience is particularly interesting, because *Skyrim VR* is a reimagined version of the original, full game (Steinman 2017). In other words, to use a more related term, *Skyrim VR* is a port. Porting is translating an original game to other consoles or platforms, i.e. from PC to PlayStation or, in this case virtual reality (Fernández-Vara 2015, 41). Here, the original code is changed to match with other platforms and their unique hardware features, such as the Twin Motion controllers or head-mounted display (HMD for short). While porting is a well-known phenomenon, there is little research available concerning the influence and effect of porting on the player experience. Tychsen et al. for example states that "there is […] a lack of formal investigation into the effect of transferal between formats on the playing experience," (2007, 50). Moreover, virtual reality seems especially underdeveloped in this discussion. While many theories explore and attempt to explain traditional video games and their textual elements, not so much is written about the transformation of a traditional video game in virtual reality. With impressive progress in the technology and increasing popularity of the VR medium, additional questions arise. Then, what happened when *Skyrim* was ported to virtual reality?

The controllers and head-mounted display are obviously different in the virtual reality experience, but how do these hardware alterations influence the player experience? To understand

this influence, it is first important to explain the player experience. This experience is often described in terms such as enjoyment, immersion, flow or fun. Various studies show that video games elicit these feelings before, after, and during play (see for example Klimmt 2009; Adams 2010; Calleja 2011; Vorderer & Bryant 2012; Wyeth, Johnson & Sweetser 2012). In line, virtual reality is often described as more immersive than traditional video games: the feeling of being there or becoming completely absorbed in the experience is greater and the player forgets the medium (Steuer 1993; Bolter & Grusin [1999] 2000; Lombard & Ditton 1997). However, these expressions do not state or explain how game-related elements could influence the player experience. The player involvement model by Calleja (2011) might shed some light on this issue. His player-involvement model is a six-dimensional, dual model that describes elements or features of the player, game, and interaction between both that shape player involvement. Involvement is here a prerequisite of any type of player experience, because one has to be involved with the game before a certain experience can occur (Calleja 2011, 35). In other words, not only game-related features influence player experience: the player and her past-experience, skill, imagination, and reasons for playing are just as important. However, as this thesis is more interested in how game-related features shape the player experience, it shall use the term game-related features instead of dimensions.

With his six-dimensional model, Calleja (2011) shows that there are many game-related features that influence player experience. Porting a video game to another console is therefore always a challenge. Especially, as changing the hardware might cause fundamental alterations to the game, i.e. removing or adding features (see Fernández-Vara 2015, 41, 72; Bogost & Montford 2007). This challenge might even be greater with virtual reality, as both the control and representation change with the Twin Motion controllers and HMD. This study will therefore explore the challenges of porting a traditional experience to virtual reality, using *Skyrim* as case study. While *Skyrim* has been published on several unique platforms, due to time and technical constraints, two platforms are analysed in particular: PlayStation 4 Pro (PS) and PlayStation VR (PSVR).[1] This study argues that the player experience is challenged when a traditional video game, such as *Skyrim*, is ported to virtual reality, because game-related features change with the Twin Motion controllers and head-mounted display. In other words, this study is asking: how do both Twin Motion controllers and head-mounted display challenge the player experience when a traditional game such as *Skyrim* is ported to virtual reality?

To answer this question, this study is divided in two chapters: control and representation. These chapters are not separated by the PSVR hardware, because the head-mounted display offers the player both vision control and representation. Both chapters answer respectively what game-related features are changed as a result of having Twin Motion controllers and head-mounted display in virtual reality and how these changes could challenge the player experience. To answer these questions, each chapter will critically compare the differences between both experiences via textual analysis to grasp changes in game-related features and situate these differences within a

[1] Note that while the PSVR runs on the PlayStation 4 and is thus technically the same console, the technical context nevertheless changes. Virtual reality requires a head-mounted display to give the player a 360° view. This means a different type of visual representation compared to traditional video games. Obviously, to achieve this effect and motion control, the original code must be changed. Hence, this study believes that PlayStation VR is a different platform.

theoretical discourse to understand the influence they may hold on the player experience. This theoretical discourse explores the following concepts: mapping, kinaesthetic-, aesthetic-, and ludic pleasure, gameworld as user interface, and player-avatar embodiment, using theories from Klevjer (2006; 2012), Nitsche (2008), Juul (2010), Calleja (2011), and Jørgensen (2013).

Textual analysis aids in understanding the change of textual elements within the game as a result of porting *Skyrim* to virtual reality (Fernández-Vara 2015, 9). Similar to platform studies, the analysis of this thesis focusses on the relationship between hardware and software design to understand the challenges of porting (Bogost & Montford 2007). Specifically, the possibilities and limitations that both the controllers and head-mounted display offer in virtual reality compared to the traditional *Skyrim*. To determine these possibilities and limitations and the influence they have on the game-related features and player experience, both games were played numerous times on the PlayStation 4 Pro following the main storyline. Certainly, it is necessary to understand what the game is about and what the general gameplay is to make any arguments. Specifically, exhaustive play was encouraged to explore all possible (inter)actions the game makes available (see Glas & Vught 2018, 214). That means attacking giants or guards with different weapons, dying multiple times and travel in different ways to notice how the hardware alterations influence game-related features in the virtual reality game. A list of these actions can be found in the appendix. On a final note, it is not only important to show the differences between both experiences. Similarities could show some challenges of porting as well: are similar elements in virtual reality for example helpful or desirable. This study also shows what could, or perhaps should, have been changed in *Skyrim VR* to reach a greater gameplay experience.

The goal of this thesis is to better understand the difference between traditional video games and virtual reality games and to map the challenges of porting a video game to VR. Especially, how platform specific elements, i.e. the controllers and HMD, might influence game-related features and player experience. An overview of these challenges could support future research on player experience in virtual reality and design concerning VR gaming experiences. Additionally, this study hopes to bridge the gap between theories of traditional video games and virtual reality games. There is abundant research in traditional video games, and some come to light in this study, but the question remains whether such research is fitting for virtual reality games as well.

Control

The very first access point of playing a video game is the avatar. As it is not physically possible to be present inside a virtual world, an avatar is needed to act within this world (Nitsche 2008, 211; Calleja 2011, 22-23). At the same time, this avatar allows the gameworld and its entities inside this world to (re)act upon the player. In other words, the avatar positions or anchors the player inside the gameworld. As Calleja mentions, the avatar is thus an important element for the player to be involved in the game. Movement is here particularly important, because this informs the relation between player and game (Calleja 2010, 61): “until players learn to move in the world, they cannot engage with its spatial dimensions,” (ibid., 170). The avatar is controlled via the player using a DualShock 4 controller in a traditional game or Twin Motion controllers and HMD in a virtual reality

game.[2] One would therefore expect to see a different connection between player and game in *Skyrim VR*. However, as this study will show in the following paragraphs, this is not the case. Then what happens when *Skyrim* was ported to virtual reality that challenges the player experience? This study will reveal that the access between player and game has changed, where the Twin Motion controllers and head-mounted display offer the player a different type of gameplay and player experience in *Skyrim VR*.

Rune Klevjer explains that the relation between the avatar and player is a prosthetic relationship: "through a process of learning and habituation [of control], the avatar becomes an extension of the player's own body" (Klevjer 2006, 10). In other words, the avatar becomes a second nature for the player, which is very similar to a real-world prosthesis. The avatar offers the player a "subjective-position" in the game world, "a vicarious body through which the player can act as an agent in a fictional world" (ibid.). Klevjer argues here that the avatar offers a body that belongs to the gameworld and is exposed and affected by this world; the gameworld acknowledges that the avatar or player is there.[3] Particularly, the avatar extends the player into the gameworld where it can act and be acted upon. Where both player and game acknowledge one another. This relation is unlike regular prostheses, as "video games extend our bodies across a material divide, into screen space," (Klevjer 2012, 10). The obvious prosthetic element during play would be the controller of the video game. It is actually the very key for the relationship between player and game, as there is no interaction between both parties without a controller. While playing the player learns and becomes familiar with the controls. After habituation, the controller becomes an extension of the body similar to a blind man's walking stick. In this situation, there is no conscious thought needed and a natural and seamless relationship is established. Changing the controller would then obviously impact the player-avatar relationship, but only at the beginning because after learning and habituation the new controls a similar prosthetic relationship is developed. Additionally, Klevjer continues stating that through the controls the player extends her body in the game environment. The controller acts as a link between the real and virtual world. And, the avatar acts as a stand-in for the player's body, because the player cannot physically be present inside the gameworld. In other words, "the avatar is the embodied manifestation of the player's engagement with the gameworld; it is the player incarnated" (2006, 10).

Yet, how does this "embodied manifestation" work? Klevjer states that the human body is both subject and object. An example would be best to explain this relation. When touching one's own hand the body is both subject and object: the body-subject has the capacity to act, whereas the body-object is an object amongst other objects in the world that consists of skin, muscles and bones. Importantly, the body-object is a medium between the subject and the physical world. During play, this subject-object relation changes. The avatar functions as a proxy object, offering a body to act within the gameworld. Without a player, the avatar is an empty vessel. In other words, the avatar serves as a replacement for the player's body object. The player is both in the real world and in the

[2] It is possible to use a DualShock 4 controller with the PSVR. While it would be appealing to research such specific control in virtual reality, the Twin Motion controllers offer more interesting insights.

[3] Note, however, that the avatar must not be seen as a tool similar to a mouse cursor. A tool or mouse cursor is not affected by the environment it is positioned in.

video game: the body-object becomes irrelevant and is safely seated on the couch, whereas the body-subject is transferred in the avatar of the game. Within the game, the gameworld becomes a new environment the player is subjected to (Klevjer 2012, 14). To make this possible, continuous and real-time action is needed: "The simulation of tangibility is not dependent on there being anything figuratively recognisable going on the screen (spaceships, gardens); all that is required is an experience of continuous physicality, of being in extended touch with on-screen images," (Klevjer 2012, 10). Additionally, long hours of play strengthen the relation between the player and avatar, because through habituation the player becomes both familiar and unaware of the controls and user interface (9). To illustrate, looking at the controls and pushing the wrong buttons disrupt the continuous action necessary, as the player is focussing on the controls instead of the gameplay itself (see also Calleja 2011, 171).

Then, what happens in virtual reality, where the player uses a motion control and where the representation is completely surrounding the player's vision? Is the body-object still irrelevant in this scenario? Or becomes the body-object relevant and will the embodied manifestation be obsolete in virtual reality? Indeed, the body-object is needed to act within the virtual reality environment: the player is not seated on the couch during play, but uses her whole body to interact with the virtual reality experience. Specifically, as Klevjer argues, these body movements are mirrored in VR, making an embodied relationship between player and avatar incompatible (Klevjer 2012, 14-15). He states that the only avatar in such games is the player herself and there is no room for an avatar as a mediator. However, the player uses her body-object in a traditional video as well to control the avatar. Then what is exactly happening? Following Klevjer, instead of the body-object, the body-subject is using the controller. As using the controller is a continuous action after habituation, the player becomes unaware of the controls and it would seem that the player-subject is directly controlling the avatar similar to as the player would control her own body. Moreover, actions made with the player's body are directly focussed on the virtual reality environment, because the head-mounted display offers the player a completely surrounding view of the virtual gameworld. Additionally, the Twin Motion Controllers used when playing *Skyrim VR* have arbitrary buttons as well to provide the player actions that are otherwise not possible with motion controllers alone. This means that the body-object is still irrelevant in virtual reality similar to the traditional video game. And that an embodied manifestation is still happening in *Skyrim VR*.

As there is still a similar connection between player and avatar, how does porting *Skyrim* to virtual reality challenge the player experience? This thesis believes that both the Twin Motion controllers and HMD change access, i.e. the control and representation, to the game. This changes the gameplay in *Skyrim VR*, because it would be unlike the traditional experience to perform the same actions. These changes will be discussed in the following paragraphs, using specific examples form the virtual reality reimagination of *Skyrim*.

Different interactions models and control between platforms request a change of code to match with the specific features of the platform. As a result, some elements of the game might change accordingly: features might be removed or added. It is always a challenge to port any video game to another console or platform (see Gerling, Klauser and Niesenhaus 2011, 83). Especially, as one would not want to change the core mechanics, i.e. the rules, elements, actions, and challenges,

of the game. Otherwise, the ported video game might become an entirely different game. Certainly, game mechanics inform how the game should be played. Changing these mechanics could support a different type of (game) play, i.e. exploration versus direct action, influencing the player experience. Indeed, as Calleja mentions in the ludic dimension of his player-involvement model, game mechanics reinforce the specific goals of a video games (2011, 152). Player experience is a result of planning and making specific choices to reach these goals, because "overcoming challenges and attaining goals create a sense of accomplishment and satisfaction in the player," (Calleja 2011, 165). This would mean that with a different type of gameplay in *Skyrim VR* the player would use an alternate approach in reaching the same goals. This change of approach equals a different player experience. In other words, porting a traditional video game to virtual reality challenges game mechanics, gameplay and player experience.

While the gameplay is challenged on different levels, there is one example that questions the game mechanics in *Skyrim VR* compared to its traditional version. In *Skyrim*, movement is impaired when heavily packed. While it is downright annoying to move very slow, this mechanic, or rule, makes sure that the player cannot equip or loot all possible items. It would be too easy and powerful to sell these items and upgrade one's own. This rule is in the virtual reality experience, however, not cumbersome with the teleportation technique. With this technique, the player directs the controller at a location she would like to move to. This type of action is visualized with a glowing arc and disc, see figure 11.[4] After initiation, the player is transported to the chosen location via rapid animation. It is different compared to the traditional experience, because movement is not a continuous flow and jumping becomes meaningless. Nevertheless, you can still move around and access every type of location, such as greater heights.[5] When overburdened, the player can teleport less far, but can press the button as fast as she can.[6] As a result, this rule becomes somewhat obsolete in virtual reality experience, even though it is still present.

While this example is a minor issue, as carrying too much items might not happen very often, it clearly shows that porting to VR offers a major challenge for developers to not change any rules or other mechanics of the game. Indeed, the gameplay is certainly different. This, however, is not the only change in gameplay. Fighting in *Skyrim VR* engages the player for example in a realistic interaction, because, instead of arbitrary buttons and joysticks on the DualShock 4 controller, virtual reality offers the player motion control. Here, physical actions are mirrored in the gameworld. In *Skyrim VR*, that means quite literally swinging swords and shooting with a bow and arrow. This does not necessarily change the mechanics of the game. There are some technical flaws that limit perhaps some mechanics, but these technicalities are just that: they can be fixed over time with a new

[4] It is possible in VR to choose for direct movement similar to the traditional version of *Skyrim*. This type of movement is, however, in my experience, very unnatural. Certainly, "these situations can be uncomfortable because the user's vision tells them they are moving through space, but their body perceives the opposite," (Oculus 2019). Hence, to avoid any type of motion sickness, virtual reality offers teleportation as movement.
[5] Interestingly, however, it is almost impossible to accidentally fall down a ravine. In the traditional game it is possible to misstep, but the teleportation technique does not support such action. Instead, it is impossible to teleport towards such a location: the glowing arc becomes red.
[6] Fast travel is still blocked.

update.[7] Instead, motion control challenges the gameplay and player experience. This study will first explain the concept of mapping and the specific type of control *Skyrim VR* offers to understand how it could change the gameplay. Additionally, the concept of kinaesthetic pleasure is explained as well to grasp the change in player experience. Examples of *Skyrim VR* are used along to show certain changes in gameplay. Moreover, suggestions on how to improve the player experience in *Skyrim VR* are provided.

Motion control eases the gameplay as it is more natural to real-world actions compared to the arbitrary buttons from traditional controllers. This can all be explained with the term mapping. Mapping "refers to the manner in which the actions performed by users of interactive media are connected to corresponding changes in the mediated environment" (Steuer, 1992). In other words, mapping describes the connection between the type of input a player offers and the type of actions that happen within the game as a result of this input. There are different types of mapping, using Gordon Calleja's terminology, ranging from symbolic to symbiotic (Calleja 2011, 63-64). Symbolic control is characterized by an arbitrary interface: there is no direct relation between the controls and the actions within the game environment. There is an extra level of translation the player would need to learn. A keyboard, or any console controller with buttons and thumb sticks are a prime example of symbolic control. Symbiotic control stands on the other end of the scale. Here, player movements are directly mapped into the game environment without using controllers. To illustrate, the Kinect registers the movement of players, without using controllers, physical buttons or keys, and translates these movements into similar actions within the game environment. This type of mapping is often considered as natural mapping, because the input is similar to real-world actions.

Obviously, *Skyrim VR* does not make use of symbolic or symbiotic control. Instead, *Skyrim VR* uses a motion controller to translate body movement within the game environment. Calleja calls this mimetic control which is a milder version of symbiotic control: there is a partial mapping of the player's movements. Still, general interactions with personas and elements in the gameworld of *Skyrim VR* are done with arbitrary buttons. Indeed, Calleja notes that video games often combine two modes of control, in particular the mimetic and symbolic (2011, 65). Such a hybrid version is necessary when actions in the game environment cannot match the controls in a symbiotic or mimetic fashion. Navigating in a digital environment is for example a difficult physical action to translate from real to digital world.[8] *Skyrim VR*, therefore, makes use of hybrid control: both symbolic and mimetic.

This characterization, however, does not entirely describe the control that is available with the PSVR, because the head-mounted display is overlooked. Not only does the head-mounted display offer vision control for the player, it also completes realistic tangible mapping. Theories from Skalski et al. will clarify the latter. Instead of mimetic control, Skalski et al. opt for incomplete or realistic tangible mapping (2011, 228). The standard Wii controller is an example of incomplete tangible mapping, whereas the Wii controller in the shape of a wheel or gun would be realistic

[7] The recognition of the PlayStation camera is flawed. At times the bow and arrow were positioned perpendicular at each other. Additionally, power attacks were registered when standing still. This is particularly troublesome, because power attacks require stamina.

[8] There are (rather expensive) walking pads for navigation in virtual reality, see for example http://www.virtuix.com/.

tangible mapping. The latter is even more engaging, as they are similar, and familiar, to real-world elements and allow users to easily access their knowledge or experience, i.e. their mental models, of the task at hand. Skalski et al. (2011) believe that this type of mapping is the most natural and offer a greater player experience. Indeed, recognizing familiar features create some form of pleasure for the player (Cowley et al. 2008, 21). The question here is whether *Skyrim VR* is an example of incomplete or realistic tangible mapping. The Twin Motion controllers do not look like real-world elements such as a sword. However, the player cannot see the physical controllers in virtual reality. Instead she can only feel the controllers and see the weapons displayed on the head-mounted display. Incidentally, the Twin Motion controllers feel somewhat like sword handles and that works in favour of the game. In this situation, the virtual reality imagery completes the realistic tangible mapping mentioned by Skalski et al..[9] Making the motion control in VR the most natural during fight compared to the Wii controller or traditional control.

The head-mounted display does not only support natural control for the motion controllers, it has natural control in itself as players use the HMD for vision control. Traditional video games have different types of camera control and *Skyrim* offers the player to move the character and the camera separately. This offers the player greater control over the character or avatar in the game, because there is greater spatial orientation: the player can see everything that is happening around the character she is controlling. I for example remember playing *Shadow of the Tomb Raider* (Crystal Dynamics and Eidos Montréal, 2018), where the camera is attached to Lara Croft, and being frustrated at times because I could not see very well which direction I should be going. This all changes in virtual reality: there is no joystick to control a camera. Instead, the player is the camera or, better yet, there is no camera at all, as the player can use her head or body to change the point of view of the game similar to real-world vision. However, vision control in combination with the teleportation technique does not necessarily mean a greater orientation, because the player cannot move and perceive at the same time: the player can only look around when standing still. This makes gameplay in some situations, i.e. fighting several enemies at the same time, more difficult because orientation and dodging comes with less ease. As a result, it takes more (precious) time to fight or the player is more easily hurt compared to the traditional experience. In other words, vision control provides natural mapping for the player, but hinders at times orientation and gameplay.

So, *Skyrim VR* makes use of hybrid, realistic tangible mapping control. This often eases the gameplay and increases player experience: a sense of realism supports a deeper level of player experience, as actions are familiar and easier to perform. Additionally, actions are often simplifications or abstractions of the real thing. This means that the player does not have to be skilled. Instead, "it gives the non-player […] the experience of being skilled," and thus increasing the player experience (Juul 2010, 115). Additionally, there is also a sense of pleasure in movement. Indeed, note here Calleja's argument, as mentioned at the beginning of this chapter, where he states that movement informs the relation between player and game (2011, 61; ibid., 170). Traditionally speaking, the combination of controllers and visuals offer players perceived movement in the

[9] But note that this only counts for fighting with swords. Other actions in the game or other types of weapons in other virtual reality experiences are different, as they do not mirror real-world actions and do not feel the same.

gameworld. This does not only happen in a third-person perspective, as the visuals change in first-person as well: change of environment when walking and swords moving when fighting. This perceived movement supports embodiment of the avatar and excites pleasure for the player (see Martin 2012, p.13-17; Swalwell 2011; Calleja 2011, p 65-67). This so-called kinaesthetic pleasure happens through muscular sympathy: the player mimics the movements internally and sympathises with the movements based on the knowledge what that action would feel like to perform. In video games kinaesthetic pleasure lies also in part of the "ability to simulate experiences that are not possible in the physical world," such as fighting dragons in *Skyrim* (Calleja 2011, 67). Calleja therefore argues that movement is an essential part of and being involved with gameplay (ibid.). Interestingly, these theories are based on traditional video games. As virtual reality offers, with its motion controllers, direct movement among arbitrary buttons, it would make sense that the kinaesthetic pleasure is greater in VR.

Beyond all these changes in *Skyrim VR* influencing the gameplay and player experience, there is, on a final note, still some room for improvement. Of course, as mentioned before, *Skyrim VR* does not solely rely on motion control. There are arbitrary buttons as well. Interacting with elements inside the gameworld is therefore roughly the same in *Skyrim VR*. Besides using weapons and swimming, with a simple push of a button the player can interact with non-playing characters, open doors, loot gear or harvest flowers (see appendix). Such interaction does not necessarily mean less player involvement, because, as mentioned at the beginning of this chapter, after learning and habituation of any type of control the player would unconsciously embody the avatar. It would have been interesting, though, to just literally pick these items up and put them in a bag or squat to access a sneak-attack, as these examples offer a more realistic interaction blurring the distinction between real and virtual. This would increase player experience based on the previously mentioned familiarity, skill, and kinaesthetic pleasure. Additionally, certain reality expectations would be met. To illustrate, during gameplay I would notice that some movements, such as squatting, were registered by the PlayStation camera. These movements, however, had no in-game effects, as I would need to press a button to squat. In other words, increasing realistic interactions in virtual reality would increase certain player experiences as well.

Summarizing this chapter, porting *Skyrim* to virtual reality did not change the relation between player and avatar. Rather, access to the game has changed. The gameplay is not only challenged by questionable rules as a result of having Twin Motion controllers and head-mounted display. These hardware modifications challenge gameplay and in particular player experience on a different level as well. For one, natural mapping offers the player easier gameplay in some degree, as actions are familiar and recognizable. Second, motion control gives the player kinaesthetic pleasure. And finally, this type of control provides the player the sense of being skilled. Nevertheless, the combination of the teleportation technique and vision control impairs visual orientation. Additionally, some interactive features could have been changed to increase realistic interactions in the virtual reality experience. Such changes support greater player experience, because they would, on the one hand, meet expectations of virtual reality and blur the distinction between real and virtual world. And on the other hand, realist interactions offer more pleasure based on familiarity, skill and movement.

Access to the virtual reality gameworld of *Skyrim VR* has certainly changed with the Twin Motion controllers, but what influence does the head-mounted display have on the representation of the game and what does that mean for the gameplay and player experience?

Representation

Before this part explains the differences and challenges of the representation in the virtual reality port of *Skyrim* that could influence the gameplay and player experience, it is important to understand that video gameworlds are designed for interaction (see Jørgensen 2013). Similar to a user interface, gameworlds are rich with information to make interaction possible: signs or clues on how the game should be played. Gameworlds do not only provide context for the player to make sense of the world and story, but make the player understand the possibilities and limitations of the game as well: what kind of interactions are possible, i.e. what can the player do? And more importantly, what should the player do to progress in an incredible and challenging adventure.

There are different ways to communicate relevant information to the player and to provide a satisfying experience. A common distinction is being made between information that is inside the gameworld geometry and superimposed imagery.[10] Natural paths and signposts are an example of the first distinction. Similar to the real, physical world, objects have affordances. The term affordance "refers to the relationship between a physical object and a person (or for that matter, any interacting agent, whether animal or human, or even machines and robots). An affordance is a relationship between the properties of an object and the capabilities of the agent that determine just how the object could possibly be used," (Norman 2013, 11). Another example of this type of information is the glowing arc in *Skyrim VR*, see figure 11. As mentioned in the previous chapter, this glowing arc is used with the teleportation technique. This arc has in normal circumstances a white, blueish glow. The arc is green when reaching further destinations (this action uses stamina, which is also green), and red when the desired destination is inaccessible. In other words, affordances and other signs within the gameworld aid the player in her gameplay, while showing the player what is possible and what the player is allowed to do in the gameworld.

These signs within the geometry of the gameworld are, however, not always enough information for satisfying gameplay, that is: at all times knowing what is possible, what is happening, and what needs to be done to move forward in the experience. Equally, similarities with the real world are not always clear for interaction. Especially, because gameworlds are often fictional worlds with different rules. Hence, extra gameplay-relevant information is necessary to support meaningful gameplay. This information, such as the character attributes (health, stamina, magicka) or ammunition, is often shown via superimposed imagery, see for example figures 1 till 10.

It is clear that information is needed and wanted to provide satisfying gameplay. Gameplay relevant information is therefore more significant than aesthetics. The entire user interface should focus on making the interaction between player and game as easy as possible: ease of use and ease

[10] Jørgensen offers a distinction between integrated or superimposed, emphatic or ecological, ludic or fictional information. Note that these types of information should not be seen as distinctive poles, but rather continuous (2013, 148). For this thesis, the distinction mentioned above are sufficient to understand the differences of porting a video game to virtual reality.

of understanding are crucial. Jørgensen mentions here the transparency fallacy: even though some scholars argue for photorealistic and immediate videogames, such an ideal is not useful for an interactive environment made for play (Jørgensen 2013, 7-8). Additionally, while gameplay relevant information is always needed and wanted, it should never be intrusive or take up all the attention of the player: good interfaces do not draw attention to themselves. Instead they draw the attention to the task at hand (Jørgensen 2013, 37). In other words, the information should feel invisible, instead of being invisible.

Of course, aesthetics is always considered to provide a wholesome experience: the representation of information should naturally fit within the narrative, genre, or style of the game. To illustrate, it would be strange to witness futuristic superimposed information in *Skyrim* as it is a fantasy game set in a world where there is no smart technology available. Hence this information is displayed conform the style of the game.

Technical features of the medium might influence this representation as well (see Fernández-Vara 2015, 70-73; Bogost & Montfort 2007). Indeed, with the head-mounted display, virtual reality offers a 360-degree stereoscopic vision. This change of hardware has three direct consequences on the representation that might influence the gameplay and player experience. For one, the player is disconnected from the real-world: the player can only see the virtual gameworld and not the real, physical environment she is playing in (the living room for example). As a result, the player cannot be easily disturbed or escape the virtual reality environment that could possibly lessen the attention needed to play the game and interrupt the gameplay (see Calleja 2011, 172).

Second, the stereoscopic vision offers the player binocular depth cues.[11] As a result, the virtual reality representation appears more natural, similar to real-world imagery: the perceived depth is greater (Schild et al. 2012; Schild et al. 2013). Additionally, stereoscopic vision is argued to provide more visual information concerning objects (size and shape), orientation, and spatial location (ibid.). Moreover, animations are perceived faster in stereoscopic vision. This means that the player can for example fight more easily in virtual reality, as there is better visual orientation.[12] Indeed, from my personal experience, fighting was certainly easier in the virtual reality experience: I was often fighting in the air or bushes in the traditional version, even though I am more experienced with traditional video games. In line, Schild et al. (2012) show an increase of immersion (a term often used to describe player experience), based on empirical data from user testing. In combination with the fact that there is no gap between the player and the visual representation, as one would have in traditional video games (the gap between the television or computer screen and the player), stereoscopic vision gives the player thus a sense of realness. An example will illustrate this argument. After escaping the dragon at the very beginning of both *Skyrim* and *Skyrim VR*, the player finds herself in a cave with a bear. The player can sneak past the bear or attack it. When attacking the bear, he wakes up and sprints towards the player. This event is definitely somewhat unsettling in the traditional experience, but in the virtual reality environment it is frightening. The gap in the

[11] "Because the human eyes are located at a slightly different position in the human head, they both receive a different image. The brain fuses these different images to one image and extracts depth information from the difference between the two," (Seuntiëns et al. 2005).

[12] Although, note that the teleportation technique in combination with the HDM, as mentioned in chapter 1, makes orientation rather difficult at times.

traditional experience increases (quite literally) a certain distance between the player and the game. Moreover, the television screen supports a boundary between the game and the player: the bear would never jump out of the screen and attack the player. Instead, the bear would rather be bumping against the screen. Deleting the gap and boundary in virtual reality offers the player a greater sense of vulnerability: the player feels the possibility of getting hurt. Indeed, aesthetical pleasure should not be underestimated, as graphics influence the emotional state of a player (Calleja 2011, 135-146). In other words, this type of realness that is offered in virtual reality supports an intensified emotional experience compared to the traditional game.

And third, the head-mounted display offers a greater field of vision compared to traditional video games where the representation is framed via the television or computer screen. There is literally more to be seen in VR and more information for the player to process. This means that the information space of the game changes. And here lies the real challenge of porting a traditional gaming experience to virtual reality: where should relevant information be placed, so that it is non-intrusive and yet still accessible for meaningful gameplay?

Interestingly, there is one difference between both experiences. One would believe that the player would need more guidance, as there is more information to process in virtual reality. Instead, character attributes (health, stamina, magicka) and direction in *Skyrim VR* are not displayed within the natural human field of vision: the player must look down to see her health status among others. Interestingly, while this may be frustrating at first, because important information is not accessible with ease, over time and with practice it becomes less of an issue. Particularly, because this type of information is communicated to the player through affordances and other signs as well. When low of health, for example, the vision brightens, encouraging the player to take a potion or use a spell to heal. With no magicka, the player cannot use any spells. And, when in need of direction, the player can use a clairvoyance spell or follow common paths and signposts to reach a specific destination. Here, the virtual reality experience becomes particularly interesting, because the aforementioned examples encourage more exploration which is one of the major gameplay mechanics of role-playing games (see Adams 2010, 453-481). Still, one might argue that strategic gameplay is declined as a player cannot easily take the character attributes into account when fighting, i.e. when the player should take an extra potion to replenish her stamina so that she can use powered attacks to fight a difficult opponent. This means, that while a 360-degree field of vision and the repositioning of character attributes do not necessarily change the core mechanics of *Skyrim* in virtual reality, they do influence the gameplay experience: a different type of play is encouraged.

Character attributes are not the only superimposed information in *Skyrim*. The inventory, pop-ups, and conversational features are superimposed as well. Interestingly, these elements are exactly the same in *Skyrim VR*, albeit somewhat technically impaired, see figures 3 till 10.[13] This, of course, makes sense because the player is in need for such information to progress in the game: it supports the intended gameplay. Still, this leaves the question: is it weird to see superimposed

[13] The PlayStation camera does not always properly register the player's position and movement. As a result, super imposed imagery is not always displayed in front of the viewers perspective. Instead, information is sometimes shown at different positions on a x,y,z scale: the wrong height, readable distance, and horizontal position.

information in virtual reality? Especially, because, as mentioned in the introduction of this study, VR is often seen as more immersive: where the player would feel present inside the virtual world. Some might even argue that the player is actually present as herself inside the gameworld. Certainly, from my personal experience, I would say that I was more engaged with the virtual reality experience, because the head-mounted display is completely surrounding my vision. Additionally, I was sometimes referring to actions done by myself and not by an avatar, which I would normally do in a traditional experience. Even though there was no body visible in the representation, as you would see in figure 12, I would feel like myself in the virtual reality experience. Would it then not be strange to witness personal information about myself, such as health and stamina? Well, on the one hand, as we have seen in the previous chapter, an avatar is always present for the player to embody and offer the player the possibility to act within the gameworld. In other words, the player is not actually present inside the virtual reality environment. Instead, the player has the feeling of being present, because she temporarily embodies the avatar. This is similar, but the feeling of being present is most definitely greater than as one would have with a traditional experience. On the other hand, the virtual gameworld is still a fictional world with specific mechanics and goals, unlike the real and physical world we live in. Therefore, the same rules of a traditional video games apply here: superimposed information is not strange to witness in virtual reality, because it is still needed for meaningful gameplay. Indeed, I was not bothered by such superimposed information. Full transparency (no superimposed imagery as information) or natural interaction does not necessarily mean a better connection between player and game. Note here the so-called transparency fallacy, mentioned by Jørgensen and the generic conventions of gameplay: players are used to and in need for such representations.

Nevertheless, there are ways to blur the boundary between the real and virtual world that would increase player experience. Gameplay relevant information can of course be fictionally explained with a smart helmet, but the genre and narrative of *Skyrim* do not support such phenomena. However, such information could have been displayed differently conform the narrative and style of *Skyrim VR*. Settings and general information could, for example, have been displayed with some sort of codex, whereas conversations could have been done with artificial intelligence not unlike the technology used for the Google Home Assistant or Amazon's Alexa. Unfortunately, these examples are technically difficult and especially time costly to implement. This is a clear example of technical limitations that influence the representation of the game: not everything is possible. But that does not necessarily mean a negative impact on the player experience, because there are many more features that influence this experience.

To summarize this chapter, the stereoscopic 360-degree vision offer the player a greater sense of involvement with the game. Additionally, only the placement of the character attributes has changed in the virtual reality port. As a result, the gameplay is challenged: the player is encouraged to explore the environment, conform the genre of role-playing games, but has a less strategical advantage. Moreover, this placement of information might be frustrating for the player, as she has to look down. This is a very unnatural movement and limits the player during fight. Other superimposed information is the same in virtual reality. While this could have been different to support a more natural type of interaction and involving experience, technical features of the PSVR

limit such possibilities. However, what I want to make clear in this part is that gameplay relevant information is always wanted and needed. In virtual reality as well. Yet, obviously, the positioning of such information in virtual reality is open for discussion.

Conclusion

This study has shown that porting a traditional video game, such as *Skyrim,* to virtual reality is a real challenge. It has mapped these challenges for future studies and developers. Particularly, this study explored the change of game-related features as a result of having Twin Motion controllers and head-mounted display and, based on theoretical discourse, how these changes might influence the player experience. Additionally, these challenges showed the differences between traditional and virtual reality gaming experiences.

A critical comparison between both experiences demonstrate especially changes in the control, representation and gameplay. It was interesting to see that the mechanics or rules not necessarily change as a result of having Twin Motion controllers and head-mounted display in *Skyrim VR*. Instead, these mechanics are challenged as gameplay changes at times: the hardware alterations offer the player other possibilities and/or limitations compared to the traditional game. Certainly, reaching the same goals in *Skyrim VR* is different compared to its traditional version. Vision control in combination with the teleportation technique, for example, limits the orientation of the player, as she cannot look and move at the same time. Or, the placement of character attributes below the natural field of vision encourages the player to explore but reduces a strategical advantage. A different type of gameplay obviously impacts the player experience, as the player engages differently in overcoming challenges and reaching specific goals.

Motion control is especially an interesting difference between traditional video games and virtual reality experiences. Motion control offers the player a different type of interaction that results in an alternate player experience. This alternate player experience is a result of three factors: familiarity of control, kinaesthetic pleasure and the experience of being skilled. This experience, in combination with the stereoscopic and 360-degree display that disconnects the player from the real and physical world makes virtual reality gaming experiences charmingly different from its traditional counterparts.

Indeed, it is not a change in the player-avatar relationship, even though it was expected. The assumption that the player is herself in the virtual reality environment is wrong: naturally there is an avatar present in the game, as it is with the PSVR physically impossible to be literally present in a digital gameworld. An avatar is therefore always needed for the player to perform actions within the gameworld and, at the same time, receive reactions from the same environment. The greatest difference between traditional and virtual reality experience is therefore access to the game, offering a different connection between player and game. A change of interaction between player and game that creates an alternate player experience in virtual reality.

It must be noted here that the player is not necessarily more involved in the virtual reality experience compared to the traditional. Player involvement is a multi-dimensional phenomenon, where the player (imagination, skill, past experience) and the reasons for playing should not be underestimated. Of course, this study has put its focus on game-related features and their influence

on the player experience, but future research could for example focus on psycho-pathological responses of the player. Or the difference between skilled and non-skilled players.

In line, there are many more questions left to be answered. Virtual reality is a refreshing medium and offers a lot of potential for video games, yet, as this study has shown, there are many challenges to overcome. Especially, when a traditional video game is ported to virtual reality. Additionally, this thesis had some limitations. Future research could therefore focus on the following aspects. First of all, this research is specific to the analysis of *Skyrim* and *Skyrim VR* and therefore, it does not extend beyond these two games in order to situate them within the larger context of VR gaming experiences and gameplay. It would therefore be interesting to explore other genres, such as first-person shooters. In line, this study has focussed on the transition from a PlayStation 4 pro video game to PlayStation VR. Not only are there more platforms available, i.e. PC or Nintendo Switch, there are different types of virtual reality consoles as well, such as the Oculus or HTC VIVE, to study the effects of porting on gameplay and player experience. Finally, as mentioned before in chapter two, the placement of superimposed information in virtual reality deserves some attention as well: how should such information be presented as to not disturb the player experience?

While there were some implications to this study, interestingly, it has, on a final note, also demonstrated that most changes in the player experience are based on the sense of realness, where virtual reality blurs the distinction between the real and virtual world. Indeed, virtual reality offers realistic vision, interaction (with movement), and familiarity. All features offering the playing a different experience compared to traditional video games. Does this mean that a good virtual reality experience is based on similarities and blurring the distinction between the physical and virtual reality world? Well, partially, yes, because the Twin Motion controllers and head-mounted display support predominantly changes in the player experience based on the sense of realness in addition to challenging the gameplay.

This study does not want to make universal claims, because the player experience is a multi-dimensional phenomenon, but, with this hypothetical belief that virtual reality should be as realistic as possible, it would make sense that *Skyrim VR* is not optimized for virtual reality. As this study has shown, the experience could have been perfected to blur the boundary between the real and virtual even more. Realistic interaction, squatting, a visualized codex or bag, and artificial intelligence could for example have been implemented. Of course, such ideas are technically difficult to implement. An ultimate goal or experience of VR should therefore be neglected, because not everything is technically feasible. Instead, creators or developers of virtual reality games should create experiences for the medium available. Virtual reality is certainly a different medium and should be treated as such. This, however, does not mean that video games should only be specifically created for virtual reality. This study believes that porting a traditional video game to virtual reality is possible, even though there are some challenges that should be considered. Virtual reality gaming should therefore be further explored in various ways to understand its features, possibilities, limitations for an optimal experience.

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Figures 2, 4, 6, 8, 10-12: Bethesda Game Studios. 2017. *The Elder Scrolls V: Skyrim VR*. [PlayStation 4 Pro & PlayStation VR.] Bethesda Softworks.

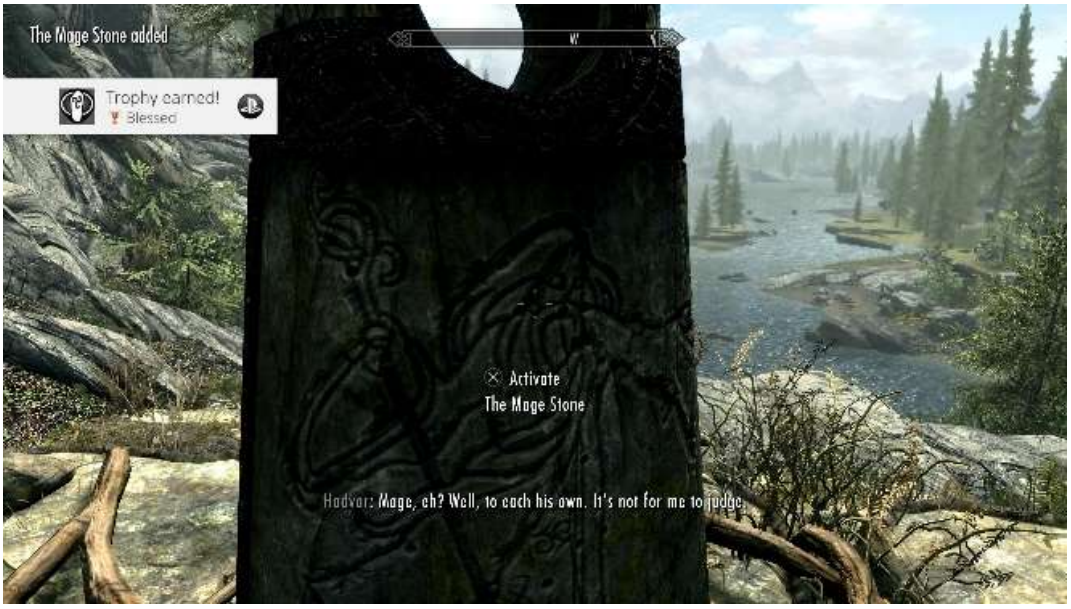
Figure gallery

Screenshots of the traditional experience are followed with the virtual reality experience of *Skyrim*, unless otherwise mentioned.

Navigation and character attributes	 Figure 1 Inside the ruins of Bleak Falls Barrow.
	 Figure 2 Defeating bandits at the Valtheim towers

Conversations	 Figure 3 Conversation with Farengar Secret – Fire in Dragonsreach
	 Figure 4 Conversation with Alvar in Riverwood

Settings & Quest journal	 Figure 5 Settings and Quest journal.
	 Figure 6 Settings and Quest journal at an awkward height

Information on how to interact with certain elements	 Figure 7 Selecting one of the Guardian stones
	 Figure 8 Harvesting

Choose and refine character	 Figure 9 Selection screen
	 Figure 10 The selection screen at an awkward position

Glowing arc to navigate in virtual reality	 Figure 111 The glowing arc and disk to navigate
Hands, but not a body visible in virtual reality	 Figure 12 Showing hands at an awkward position. No body is visually presented.

Appendix 1, list of (inter)actions in *Skyrim* compared to *Skyrim VR*

List of (inter)actions	*Skyrim*	*Skyrim VR*
Movement		
Looking	R3 joystick	Headset or use square and triangle buttons on left controller
Walk	Dual axis joysticks	Teleport or direct movement (press movement button and other buttons to rotate left or right)
Run	Holding L1 button	Teleport farther away or double press movement button
Jump	Triangle button	Teleport to a higher location or triangle button
Squat (sneak)	L3	Hold triangle button
Swimming	Dual axis joysticks	Direct movement or realistic swimming (move both arms in a realistic fashion while press and release button)
Fight		
Attack or heal: magic	R2 or L2 (depends on main hand)	Press button
Attack: sword	R2 or L2 (depends on main hand)	Swing controller
Attack: bow	R2 and L2	Use both controllers in realistic motion
Power attack	Hold R2 (or L2) button	Hold button while swinging
Shout (special power)	R1	Square button
Block with shield	R2 or L2 (depends on main hand)	Hold controller up
Block without shield	L1	Hold weapons horizontal
Steal	x-button (with pop-up)	Press interaction button
Die	Cut-scene	From red view fade to black
Interact		
Talk to NPC	x-button (with pop-up), select answers with joystick	Interaction button, select items with slight movements controller while pressing button
Harvest plants	x-button (with pop-up)	Press interaction button (with pop-up)
Loot	x-button (with pop-up)	Press interaction button (with pop-up)
Read book	Turn pages with joystick	Turn pages with slight movements controller

Sell or buy	Super-imposed window. Selecting items with joystick, buy or sell with x-button.	Super-imposed window. select items with slight movements controller while pressing button, buy or sell with interaction button.
Alchemy (make potions)	See sell or buy action	See sell or buy action
Other		
Skill tree	See sell or buy action	See sell or buy action
Inventory	Circle-button. See sell or buy action	See sell or buy action
Switch weapons	Use inventory or favourites menu with d-pad.	Hold triangle button
Map	Joysticks and click	Point and click
Create persona	See sell or buy action	See sell or buy action