“VRIFICATION”: APPLYING VIRTUAL REALITY TO DIGITAL GAMES

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ABSTRACT

In the following, we discuss the process of applying virtual reality to digital games. We named this process “VRification” and will elaborate on some of its opportunities and issues. Based on a literature survey and professional practice, this work covers several examples of VR games, which were intended as such from the beginning (Job Simulator and Lucky’s Tale) and others, which were ported to VR after their initial release (DOOM VR and LizzE). We conclude that, for VR games, it is essential to be optimized for the full potential of targeted interface technologies. Furthermore, porting former-non-VR games to VR can create successful user experiences, when aiming for the same high standard of optimization, especially regarding simulator sickness.

INTRODUCTION

Very successful science fiction works like “Snow Crash” (Stephenson 1992), “Rainbows End” (Vinge 2006) and “Ready Player One” (Cline 2011) over several decades illustrated virtual reality’s (VR) great potential in socially connecting people. Otherwise physically placed all over the world, VR users could meet in a commonly shared virtual environment. One further aspect of VR, which all three novels have addresses in some way, is gaming and in general play in VR. Relating this to our current society and the significance of gaming and play in it, a need to address this shift from common screen-based digital gaming to VR gaming seems apparent.

Examining the topics and products presented at current gaming and other consumer oriented conferences (e.g. Game Developers Conference, Electronic Entertainment Expo and QuakeCon), VR seems among the top trends. By introducing its head mounted display Oculus Rift, Oculus VR revived VR technology (Rubin 2014). Its affordability and wide developer base has led to an expansion of VR applications. This resulted in applying VR to digital games and other non-entertainment forms of digital applications. A process we have named “VRification”, to establish a corresponding vocabulary and thus simplify the further discussion.

VRIFICATION

Applications for VRification are separated into two categories: “pure-VR” and “former-non-VR”. Pure-VR applications are implemented concepts with VR as the primary user interface in mind, whereas former-non-VR applications were first developed for common interfaces and VR was in some way applied subsequently. This work focuses on VRification of digital games and disregards non-entertainment applications.

VR in its current state in games seems to be heading towards a broad success, as it offers various opportunities. The most obvious advantage is presence (Lang 2014). Lombard and Ditton describe it as the feeling of being in a realistic place

Figure 1: LizzE – And the Light of Dreams, non-VR Mode (left) and VR Mode (right) (FIERY THINGS 2013)

(1997). In other words, when presence is achieved, the user feels literally present in this virtual world and her or his body and mind will react instinctively like in the real world. This effect is particularly heightened by VR and seems intrinsic to its concept (Jerald 2016). It must be noted though, that realism in terms of physical sensual perception, e.g. through high display resolution, low latency, binaural audio, translation of body part movements, haptics, olfaction etc., magnifies the presence effect. The more senses a VR application triggers in a realistic way, the more likely, that the user feels present (Lang 2014).

Economically, VR seems very interesting, as developers can be at the forefront of penetrating a new market. Though unclear how big this market gets, the massive growth of the games market (Livingstone 2014) gives an indication.

VRification of Pure-VR Games

Other than that, by offering new interface technologies, VRification in pure-VR games raises a huge amount of game design opportunities.

From the ground up designed for VR, the Job Simulator (Owlchemy Labs 2017) delivers a really successful user experience for example (Stapleton 2016). The user's purpose is to use hand controllers, e.g. HTC Vive, Oculus Touch or PlayStation Move controllers (HTC 2016, Oculus 2016 and PlayStation 2016), to fulfill rather mundane and menial jobs. These include working at an office desk, preparing dishes in a diner, serving at a convenience store and repairing cars in a garage (Stapleton 2016). Though by reducing the visuals and interactive objects to a cartoonish style, lots of humorous and absurd situations evolve. This in combination with some funny robotic dialogues establishes the game's charm. The comic style has another effect, which is the reduction of required performance and thus a higher possible frame rate and less possibility for simulator sickness (Pausch et al. 1992 and Jerald 2016). Furthermore because of the game's rather stationary design no locomotion method is needed, as the user keeps standing on the same spot. This in turn again reduces the possibility for simulator sickness as no vection effect (Riecke and Feuereissen 2012 and Yao 2014) is involved and more complicated teleportation techniques are unnecessary.

Lucky's Tale is another successful VR experience, which was specifically developed for this medium (Playful 2016). Being a cutely illustrated 3rd person game, like Super Mario 64 and Banjo-Kazooie, it needs to overcome certain issues in VR (Hurd and Reiland 2016 and Wiedemann et al. 2016). Though a certain amount of vection is impossible to prevent in this design, the developing studio Playful made some clever decision to reduce the possibility for simulator sickness to a minimum. The reduced usage of user locomotion is mostly aimed away from her or his viewpoint and levels were designed more linearly to avoid too much turning around (Hurd and Bettner 2014, Hurd and Reiland 2016 and Wiedemann et al. 2016). Through these carefully crafted measures and thanks to the charming character of the game, Lucky's Tale is a great example for a 3rd person VR game with an old-school touch (Whitaker 2016).

VRification of Former-non-VR Games

In the case of former-non-VR games VRification can provide new angles to common gameplay mechanics and diversify the look and feel.

VRification needs to be handled with care though, as only certain games seem suitable. When the game was not developed for VR from the beginning several issues might arise, like performance setbacks, which are likely to increase latency, which in turn destroys presence and is one of the major causes for nausea. Using less performance intensive billboards instead of complex 3D geometry simply does not work, when using stereoscopic viewing (Holding 2017). Also, former design and hardware interface paradigms might not work as well or not at all. For example, head up displays to show player attributes don't seem to be well accepted by users (Oculus VR 2014). Other more natural, diegetic ways of offering this information might be preferable, e.g. the amount of remaining ammo is displayed directly on the weapon (Oculus VR 2014). Furthermore, the parameters of camera movement (Hurd and Bettner 2014) and the reduction of perceived vection seem very important (Yao 2014) and require more research. Graphical user interfaces like menus need to be designed and navigated completely differently, aiming for an optimized VR experience. Direct object manipulation (e.g. via hand controllers) should be used as much as possible for an increased user satisfaction (Bowman and Hodges 1997). Whereas the indirect Widgets and Panels Pattern should only be used for complex tasks (Jerald 2016) and should be designed for good readability and usability in the context of VR. Mouse and keyboard as input devices finally seem fairly inappropriate, given the number of buttons and being unable to actually see them.

A great VRification example of a former-non-VR game is the DOOM VR demo showed at QuakeCon in late 2016 (ZeniMax Media 2016). In its fourth non-VR iteration, released in early 2016, DOOM had a great impact on first person shooters (FPS) by reviving some of the raw old school trademarks of the genre (Shoemaker 2016). The game is played really fast and the user is practically forced to quickly move into the middle of close combat to succeed (Shoemaker 2016). These are aspects not easily transferable to VR. Moving quickly through virtual space without creating simulator sickness has been a huge challenge so far. There are a plethora of methods handling locomotion based on teleportation, physical motion, room scale tracking (TechTarget 2016) and artificial input devices like common controllers (Reddit 2016). The FPS genre though, lacked an appropriate method, which could deliver a fast pace without creating vection and simulator sickness. The DOOM VR demo seems to have solved this, by implementing a subtly fine-tuned teleportation mechanic (Butterworth 2016). Using one HTC Vive controller to fire at enemies and the other to teleport-dash through space seems to even enhance the experience (Butterworth 2016). Though compared to other teleportation mechanics, DOOM slows down the game to bullet time, when holding the teleport trigger and when released dashes the user in super speed to where she or he was aiming (Butterworth 2016).

Use Case: VRification of LizzE

Designing an experience that makes the most of VR, former gameplay paradigms need to be adjusted or completely replaced. For example, in a vrified 3rd person game, the virtual camera(s) looking at a player character is not just a simple viewport into the digital world. By translating and rotating the point of view via the user's head position and rotation, it becomes a dynamic and controllable separate entity. We noticed this effect during the VRification development of LizzE – And the Light of Dreams (LizzE, FIERY THINGS 2013), a multiplatform third-person Hack & Slay game (see Figure 1, Wiedemann 2013).

In the game's non-VR version, the player looks through the screen into the game world and identifies her or himself with the player character, as she or he controls the character's movement and actions. Playing the VR version of the game, the entity split becomes perceptible. Without looking through a viewport and seeing what surrounds the screen, but instead feeling completely encapsulated in the virtual world and in natural control of the camera(s), the player acknowledges her or himself as a distinct entity. Dynamically hovering over the player character, she or he feels more like a god that rather guides the player character than actually identifies with it.

This raises lots of gameplay possibilities, like looking around corners, uncovering for the player character unreachable spaces and objects, but also new kinds of communications and interactions between player, player character, non-player characters (NPCs) and the game world. Interesting questions arise through this, like for example "Why is it, that I can control character XY?", "Am I perceptible to NPCs?" and "Could character XY turn against me at some point?".

On the other hand, LizzE uncovered that a more linear level design might be supportive to a third-person VR game (Hurd and Bettner 2014, Playful 2016 and Wiedemann et al. 2016). Furthermore, a completely different camera behavior is needed to avoid nausea through the reduction of vection. For this matter, in a previous experimental study with an adapted version of LizzE, we explored five different camera behavior modes and tested them with users. An analysis of the resulting data showed that the mode called Buffered Pulling (Wiedemann et al. 2016) seemed to be the most promising one for the game, compared to the other tested modes. In Buffered Pulling mode, the player character can move and turn completely freely in a buffer zone, without manipulating the position or rotation of the user's viewpoint (see Figure 2 and 3). Only when reaching a certain distance will the user's viewpoint get pulled along with the player character (Wiedemann et al. 2016).

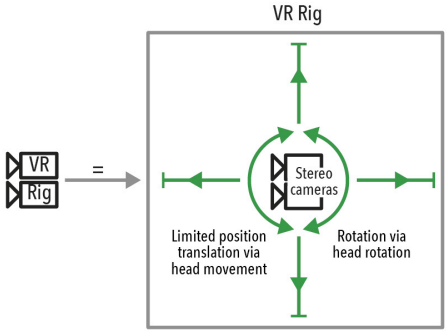

Figure 2: Explanation for VR Rig Symbol (Wiedemann et al. 2016)

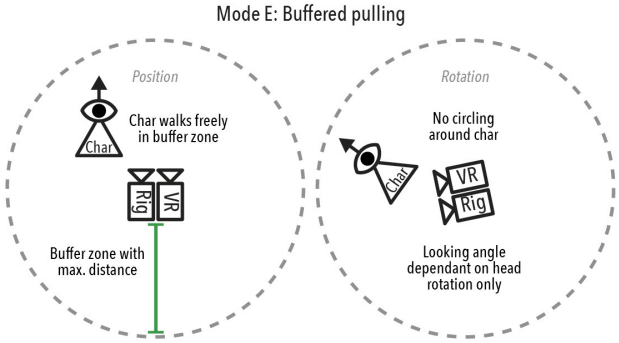

Figure 3: Buffered pulling Camera Behavior Mode Visualization (Wiedemann et al. 2016)

As the game's level design was not structured linearly like in Lucky's Tale for example, exploration in 360 degrees was required and thus the user had to physically turn, when in need of looking in a certain direction. Though this made the experience more like a stand-up or swivel chair one, most users favored this, as their natural movements added to their sense of presence (Wiedemann et al. 2016). Finally Buffered Pulling significantly reduced the vection effect and thus decreased the possibility for simulator sickness.

CONCLUSION

Concluding, a glorious and connected world of gaming in VR, like science fiction works of Stephenson, Vinge and Cline have propagated, is not easily established in practical terms. Though similarly inspired visions may already be in the making and definitely on the horizon, it seems questionable that "simply" porting existing games to VR will create good experiences. Addressing stereoscopic 3D vision (one aspect of VR) in game development, the well-known game developer Fish responded similarly: Stereoscopic 3D needs to be at the back of the developer's mind, right from the start, instead of trying to impose it on the game, once its conventional version is finished (Fish 2010). Still, in terms of former-non-VR games, technical challenges of changing existing application aspects have to be weighed against their inherent time-costs, to be adjusted or completely rebuild. We argue that games should be optimized for their technology platform and make use of the corresponding interface options in creative ways to be able to become spot on, well-made user experiences.

The pure-VR examples of this paper have shown great ways of handling VR pitfalls, by including VR in the development process right from the start. The decision to provide stationary jobs and a cartoonish visual style in Job Simulator (Owlchemy Labs 2017), did not require any possibly nausea inducing locomotion mechanic and reduced required computing performance, resulting in high framerates. Lucky's Tale (Playful 2016), on the other hand, implemented a very clever and fine-tuned combination of subtly linear level design and camera behavior. By comparison, vrifying LizzE definitely illustrated the need to specifically develop spot on solutions for problematic fields like camera behavior in VR and our Buffered Pulling mechanic seemed to be a viable solution for a game, in which users can explore in 360 degrees (Wiedemann et al. 2016). Additionally, it also uncovered the entity split and showed the great potential of VR in 3rd person games. In terms of FPS games, the DOOM VR demo finally not only seemed to have "solved" the locomotion issue, but instead simultaneously created a novel and attractive FPS gameplay and feeling.

As such, VRification, even of former-non-VR games, can work (e.g. DOOM, Butterworth 2016 and LizzE, Wiedemann et al. 2016), but only makes sense if the game design also advocates the new interface technologies and special care has been taken concerning the minimization of simulator sickness.

FUTURE WORK

We argue, that major future research on VRification will be on several topics. Eradicating simulator sickness seems to be one of the most important issues. Taking performant game engines with high framerates and stable tracking for granted, this on the other hand involves identifying and fine tuning new locomotion input paradigms. Correspondingly, camera behaviors need to avoid creating nausea, while fitting the type of game, which should be vrified. Furthermore, we see a great demand in optimizing existing graphical user interfaces for VRification, or even replacing them by using novel paradigms to provide the inherent corresponding meta information to the user instead. This again is very dependent on the type of the game. A common collection of locomotion input paradigms, corresponding camera behaviors and well-working interface designs and mechanics still has to be developed through research and design. Finally, further research seems to be required to check for possible patterns in certain game types or genres, which show better prerequisites to get vrified, or the opposite.

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