Hermeneutic relations in VR: immersion, embodiment, presence and HCI in VR gaming.

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Abstract

The emergence of Virtual Reality (VR) as a viable consumer medium for gaming offers an opportunity to reconceptualise understandings of immersion, embodiment and presence in gaming. However, many of the discourses and attempts to conceptualise experience in VR games conflate these terms rather than understanding each as a state of engagement with a VR environment or game. This results in a lack of understanding of the importance of design and intentionality in the VR game with regards to immersion, embodiment and presence. Using a post-phenomenological approach, this paper differentiates immersion, embodiment and presence as three kinds of relation utilising the I – technology – world schema. This approach allows for an understanding of these states of engagement as layered and hierarchical rather than instantly emergent on the part of the technology. The hermeneutic relation between the user and VR game [I → (technology – world)] that indicates presence can be understood as a feeling of place or placehood in VR and is intentionally the state aimed for as optional in VR games. The importance of technological intentionality as a co-constructor of embodiment and presence is exemplified through an analysis of user reviews of VR games either built-for VR or ported to VR. Built-for VR games create the possibility of a sense of place for the games by incorporating the possibility of embodiment and presence into the design of control and movement while ported VR games fail to immerse because of a lack of technological intentionality towards these goals.

Keywords: Virtual Reality, Post-Phenomenology, gaming.

1 Introduction

The emergence of virtual reality (VR) as a medium for games since 2012 poses a challenge to researchers and designers with regards to reconceptualising the relationship between system, player and game play – in essence, a reconsideration of the human-

computer interface (HCI) of gaming. The challenge has deep roots; the euphoric techno-utopianism of the discourses around 1990s VR was a reflection of the implicit and explicit revolutionary nature of VR as radically immersive and intimate compared to other interfaces. This discourse has been replicated in the publicity and hype surrounding the contemporary re-emergence of VR, particularly in gaming which has quickly become the most profitable and visible use of VR. When considering the human-computer interaction of VR and games, the notion of immersion as an a priori property of VR is problematic. The notion of immersion as a given creates a confusion when considering the relationship between immersion, embodiment and presence in VR, and fails to consider the intertwined relationship between these states felt by the gamer and how they are contingent on but also independent from one another. The enrolment of presence and embodiment into the concept of immersion ignores the critical functions and feelings of the experience of these states in VR, and potentially minimises the importance of presence and embodiment as states of experience that differentiate VR as a medium. In particular, the conflation of immersion and embodiment minimises the attention that can be paid to the creation of the sense of place and placehood in VR, and how a feeling of placehood emerges from a design and comportment towards embodiment, and a sense of embodiment is contingent on a feeling of place on the part of the user – a hermeneutic circle that is elided in a conception of embodiment as an extension or division of immersion, without which presence in VR cannot be achieved In short, the user and the mood and comportment of the user towards the game environment is ignored in conceptualising the user experience in VR. This paper explores how conceptualising immersion, embodiment and presence through a theoretical lens of post-phenomenology can avoid conflation of key experiential aspects of VR gaming and can also explain theoretically

Gaming and VR

Arguably gaming is the most visible form of VR. The Sony PlayStation 4 is one of the most popular platforms for VR through the PSVR with over 5 million units sold, and the Oculus Rift and HTC Vive are closely associated with games through the use of the Steam VR platform as a game distribution platform. VR should, in theory, aid the sense of presence in games for the player. Pimentel and Teixeira [1] explain that VR requires the same mental shift that happens when you become absorbed in playing a computer game. Tamborini and Skalski [2] argue that VR technology enhances spatial presence in games by the game technology being able to match user expectations of bodily movement and orientation in a manner that playing on a screen cannot. For example, when a player in a VR game environment turns her head, there is an expectation to see the surrounding environment move accordingly. Therefore, VR incorporates bodily movement and orientation into the game environment, arguably improving the sense of 'being there' in the game and from an HCI perspective, one would argue, an enhanced ludic experience.

Empirical research on the effects of VR on user satisfaction in gaming is promising. Shelstad et al. [3] found that VR gaming on the Oculus Rift enhanced perceptions of overall satisfaction, enjoyment, engrossment, creativity, sound, and graphics quality in

gamers. Madsen [4] argues that the commercialisation of VR has brought horror video games to the highest level of immersion and presence, generating more arousing mediated experiences in the genre. These findings are supported by Lin et al. [5], who found that in participants who identified themselves as easily scared, playing a horror game (*The Brookhaven Experiment*) on the HTC Vive led to significantly greater enjoyment ratings compared less predisposed participants. These players experienced more immersion, perceived enjoyment and perceived fear in the VR environment. However, there is a danger in reading the results of research as VR being a panacea with regards to enjoyment. Unpicking why these ratings occur is critical. Depth of presence in a game environment is contingent on how the graphics, sound, narrative, interface and orientation of the user are harnessed in the game for immersion to lead to presence [6]. The success of games in VR in creating this increased sense of presence may not be a function of the use of VR as a medium for the game, but instead is a function of the design and immersive qualities of the game itself and the mood of the user towards orientation. While this furthers a position of questioning why VR games may be more enjoyable, it is only a vantage point for further investigation rather than a satisfactory answer as to why this may occur.

Gaming in VR, at least at the early stages of consumer VR, is marked by a tension between existing and emerging gaming forms. Gaming and the kinds of games popular in VR ask fundamental questions about the kind of investment and development being put into VR in its early consumer iteration. At the early stage of development of consumer VR, games can be divided into two kinds: VR ports, which are games developed for non-VR systems and converted into VR; and built-from-the-ground-up for VR games, games developed for VR specifically. In the former, Bethesda have led the way with conversions of major console and PC titles into VR: *Doom, Skyrim*, and *Fallout IV* have been converted to VR. Other successful ports have included *Superhot, Resident Evil VII* (with the VR version released simultaneously for PSVR) and a slew of games that have had additional VR expansions such as *Star Wars: Battlefield, The Last Guardian, Tekken 7* and *Wipeout Omega.* Popular built-from-the-ground-up games have included *Job Simulator, I Expect you to Die* and *Beat Saber*. The built-from-the-ground-up games are considerably more original than the console ports; for example, *Beat Saber* is a VR rhythm game, where the goal is to slash light sabres to hit objects (the 'beats') in perfect rhythm with the music of the game. *Beat Saber* has an innovative game design with the immersive elements of vision, sound, touch and orientation working together to provide a unique experience. Games such as this can be seen as part of a developing language of VR [7] which can emerge from the experimental tone of such games, and the utilising of the unique features of VR (such as being able to mimic light sabres in the hand in a VR environment through haptic devices), where conventions of gaming are remediated and altered in the VR medium. The ported games take existing games and remediate the perspective from which they are played from on the part of the gamer. This is not to underestimate the vast amount of effort and work that goes into the creation of such games, but the underlying logic and language of the game is created for another medium and transposed to VR.

4

The schism between ported games and built-for VR games offers an opportunity to explore the differences and co-dependence of immersion, embodiment and presence in VR through the experience of gamers. This paper argues that built-for VR game environments alter the experience of place and space in VR games by using embodiment as the mechanism for the creation of a sense of place in VR. This is achieved through a shift in the relationality of the player to the game and game environment, creating a hermeneutic relationship between gamer, system and game environment. Avoiding the conflation of immersion with embodiment and presence as different kinds of the former necessitates a critical understanding of the relationship between the user and the medium at a phenomenological and post-phenomenological level, that is at the level where the user interacts with and experiences VR rather than at a material, medium or essentialist level. Using Don Ihde's post-phenomenological concept of embodied and hermeneutic relations with technology, the importance of the relationship between place and presence in VR can be understood through the lens of place being embodied in a multi-stable manner in VR games. This approach draws attention to the gamer and their embodied experience as well as considering the role of the system and the game environment as co-creators of a sense of place and embodiment in the user. The experience of place in VR is situated, embodied, specific and fully signifying through embodiment in an experiential locale or world. This approach allows for a critical analysis of the kinds of experience that users have with contemporary VR games as well as analysing how VR developers may develop embodied, place-creating experiences in the future that afford the possibility of a feeling of presence in VR.

To exemplify this conceptual approach, we consider the two typical kinds of VR games available today: VR ports, games converted into VR; and built-for VR games such as *Beat Saber* that utilise immersive elements of vision, sound, touch and orientation to create a game experience. Ported games create worlds that use familiar geographical clues to build a sense of place without a consideration for embodiment that comes would allow for the development of a hermeneutic relation. Priority is given to the architecture of the game rather than the phenomenological experience of the game for the user. From a post-phenomenological perspective, built-for VR games shift the relationality of the player to the game from an embodiment relation (seeing through VR) to a hermeneutic relation (understanding the game as a virtual experience). In ported games, the body or embodiment is not considered in the original design of the experience of place. This lack of embodiment contributes to a lack of virtual place. We consider user experiences of *Job Simulator, Moss* and *Beat Saber* as examples of the development of a hermeneutic relation in VR gaming, compared to the simple embodied but not-place building experience of *Borderlands 2 VR and Doom VR.* The post-phenomenological framework proposed offers both an analytic and developmental framework for VR games as well as proposing a theoretical framework to avoid the conflation of immersion, embodiment and presence in VR. In addition, this framework takes the form of a topology of states of engagement in VR that can inform HCI debate and VR design.

2   Post-phenomenology, human-technology relations and VR

The framework we develop here is derived from post-phenomenological or mediation theory. Classical phenomenology studies our experience of the world; post-phenomenology studies how our experience is mediated by technology [8]. Eschewing Heidegger's concerns with Dasein, the approach retains the rejection of the Cartesian subject by replacing it with the existential, lived body as a fundamental concern [9]. Post-phenomenology specifically updates phenomenology by understanding the world through the 'I – technology – world' schema [10], and thanks to this structuring of technology a mediator of experience, post-phenomenology is also known as mediation theory. Ash et al [11] argue that an advantage of a post-phenomenological approach is that this approach interrogates how digital interfaces appear as objects, and therefore allow researchers in HCI to think about the ways that interfaces are structured to modulate actions without reducing the modulation effect. The approach therefore gives an account of human experience by expanding what is meant by 'human' and by re-evaluating the role of non-human objects in the construction of experience. Interfaces in this approach refer to how multiple objects work and communicate together to construct experience. Critically, post-phenomenology considers these objects or technologies as cultural instruments which are non-neutral and deeply embedded in daily life processes. Cultural instruments are transmitters of a particular culture or ideology [12].

   Critical to the use of post-phenomenology to understanding the differences between immersion, embodiment and presence in VR is that embodiment replaces subjectivity in a post-phenomenological analysis, in effect giving a non-subjective phenomenology [13]. Action, experience and knowledge is always situated as an embodied experience, and because of this self-knowledge is reflexive as a factor in being-in-the-world and activity with other things as an embodied agent in the world. In the context of VR, the kind of engaged attitude or mood that the gamer has through their embodied engagement with the VR game will shape their mode of engagement as immersed, embodied or present (or none of these). The importance of the body and embodiment in post-phenomenological theory can be thought of as the human body being caught in the fabric of the world that enmeshes us, and digital technology is part of that fabric [14]. Stacey O'Neal terms this entanglement as the 'digital attitude' [14] when digital technology is familiar, the body is often engaged in digital experience in a taken for granted manner (such as occurs in VR with body and avatar acceptance). Digital technology is an object in the lifeworld, but it is also part of the fabric of the everyday world and is therefore a co-constructor of our everyday world [15]. In our average everydayness, we incorporate digital media into our own body and life experience in a habitual manner. For the understanding of VR, this approach sets a groundwork for a kind of analysis. VR is part of a wider context in which our bodies and lives are enmeshed with the digital; the body is critical in all our engagements with the digital as we are embodied agents in the world, and the digital and our embodied activity act as a co-creator of our world (even if that world is virtual).

Embodiment is therefore a critical part of the post-phenomenological framework, and as such should lend itself to an analysis of VR that has embodiment as a core component. The use of and digital media creates a technologically-mediated pluraculture [16], and embodiment is an element of that pluraculture as a particular form of the I – technology – world schema. This schema has four relational shifts that affect the way that technology shapes relationships between humans and their world: focal relations; embodiment relations; hermeneutic relations; and alterity relations. This analysis forsakes alterity relations as they refer to the quasi-otherness of relations to particular forms of digital technology which would be incongruous with video games and VR in particular. Focal relations refer to phenomenon of technology in the foreground being focussed upon, while other technology works in the background. This relation is akin to a focus on a particular object, experience or technology while that technology works in the background, away from circumspection on the part of the user. In this analysis, the focal relation is posited as immersion where the attention of the gamer is on the game or experience, not the technology or the inter-connectivity of the technology with other technical devices, or the functioning of hardware or software in the background. This corresponds with Bortulussi and Dixon's definition of immersion [17] as a hybrid, dynamic and interactive phenomenon that involves convergence and divergence to the state of immersion. Such a view emphasises the role of the individual in the construction of immersion, as immersion involves an orientation towards engagement with the media in question. Thon [18] positions this as a kind of attentional focus, a psychological immersive shift of attention that goes hand-in-hand with the construction of situational models of engagement. Ryan [19] furthers this notion of the psychological aspect of immersion by arguing that immersion is a kind of directed, intentional consciousness that relates to another world and reorganises the 'universe of being' around that world.

The embodiment relation is more significant, expressed as:

(I – technology) $\rightarrow$ world

Arrows and parentheses allow for permutations on the I – technology – world schema, and arrows denote intentionality towards that unit of the schema [20]. Selinger [21] describes embodiment relations as the relation that occurs when we use technology to amplify the body's perceptual abilities (in a sense, a McLuhanist extension of man). In an embodiment relation, the technology is always in a ready-to-hand state, being used to perceive the world through the technology itself. We have embodiment relations with many technologies, from eyeglasses to television. Ihde [22] argues that computers have an embodiment relation to users, as we use computers in our everyday understanding of the world; computers are part of the fabric of the everyday and our interactions with them are with an intentionality towards the world. Embodiment is, therefore, always limited by the scope of the programme being used [23] and our embodiment relations are always inter-relational. The embodiment relation in this analysis or VR and gaming translates as embodiment directly. When using VR, the technology itself is embodied (HMD on the head of the user) and the world is being 'seen' or experienced through that technology, with bodily motion and perceptual attention being mapped by

the VR equipment and fed back to the gamer as an experience that has visual fidelity and congruence.

More significant again is the hermeneutic relation. In a hermeneutic relation, we are perceiving the world through the technology itself.

I → (technology – world)

The interpreting or reading of the world is through the technology. Hermeneutic relations involve entering into practices with artefacts to gain knowledge of the world otherwise not available [24]. Wellner [25] argues that hermeneutic relations are our main post-phenomenological vehicle to understanding our special relation to media. Andrew Feenberg [26] describes hermeneutic relations like "a screenplay in which the interpreted message is, in effect, a world". Feenberg's point is that in a hermeneutic relation, technology and the world are not just two parts of a unit – technology-world as a co-entity replaces the world as a focus of our intentionality. This relation is mapped to the feeling of presence in VR. In a hermeneutic relation, the world and technology form a singular unit where intentionality is directed. understanding extended embodiment through technology is a hermeneutic circle. The hermeneutic relation involves a translational mediation of technology and technological codes back to the human, but those codes and the technology are a co-constructor of the world in which the user is an active participant. Therefore, in a hermeneutic relation we feel 'present' in the experiential world that has been co-created by the technology.

The notion of technology as a co-constructor of world leaves some room for a technologically determinist critique of the theory, but the importance of intentionality on the part of the human and the technology itself as a co-constructors is a means to avoid this critique. Verbeek [27] added to the 4 post-phenomenological relations with 'cyborg intentionality' indicating intentionality of the part of technology, as it has been programmed to commit intentional acts, and 'composite intentionality' where intentionality is distributed between human and technology [28]. In this view, "intentionality is not a bridge between subject and object, but a fountain from which the two of them emerge" [29]. Hence, technological intentionality is a co-constructor of the world rather than a determinist shaper of the world, as the intentionality on the part of the user towards the (technology – world) unit is as critical as any intentionality programmed into the technology itself. Wellner [30] proposes a new relation to explain this:

I → (technology → world)

The intentionality of the technological artefact to represent the world in a manner where the world itself becomes a part of the (technology – world) unit does not detract from there needing to be a human being with intentionality directed to that unit in order for the hermeneutic relation to exist and for there to be a hermeneutic effect i.e. the world is read through the technology and is therefore contingent upon the technology to be meaningful as a world. Intentionality plays a critical role in the establishment of

presence in VR, as the analysis of ported and built-for VR games will illustrate. The intentional nature of how those games should be played, experienced and embodied defines the gaming experience and possibility of presence as an elevated and deep engagement with the VR game.

Having mapped the three relations onto the three states of engagement with VR:

Immersion   -   Focal relation
Embodiment -   Embodiment relation
Presence   -   Hermeneutic relation

the relations between each relation need to be understood. The contention of this analysis is that these relations should not be read as discreet, but as O'Neal [31] argues the schema can be laid on one another at the same time. Presence in VR is therefore a combination of the focal + embodiment + hermeneutics relations, where the hermeneutic relation is critical, but cannot be achieved without focal immersion and embodiment. The framework also allows for shifts between these different states of engagement with the VR experience. Ihde's outlines that relations between humans and technology shift thanks to 5 potential variational distinctions [32]: materiality of the technology; bodily technique of use; cultural contents of the practice; embodiment in trained practice; and the appearance of differently structured lifeworlds. The variations between different relations occur due to pivot points. A pivot "stresses the degree to which the material of the artefact and human attentions can create different uses" [33], with the movement between pivots and stabilities creating multistabilities of use. The structure of technologies is multistable with regards to use, cultural embeddedness, politics and ethics, and most critically to a sense of place and placehood that emerges from the use of technology.

3   The role of place

Borgmann [34] argues that orientation to place is critical to human 'being', and that disorientation is be in trouble as a human being. Disorientation in a mediated space is the restless pursuit of the unobtainable, but focal presence in virtual reality emphasises the near. In the post-phenomenological model immersion, embodiment and presence in VR are all based on the focal relation between the user and technologically-mediated experience. Ihde [35] argues that post-phenomenologically, we do not experience space singularly, but always our spatiality is multistable – we self-organise into different spatial arrangements. This is important when thinking about the difference between immersion, embodiment and presence. Presence is, in this analysis, akin to a feeling of place or placehood in VR. Experientially and developmentally, places are critically important to the wellbeing of humans, particularly as spaces to dwell.

Dwelling is a feeling of being-at-home in a place in the world, and while dwellings are wildly multistable the possibility of feeling place in VR is critically important.

Another source of confusion comes from psychologists, who call immersion presence and posit that spatial presence is the closest thing to immersion [36]. A spatial presence usually denotes a feeling when media content is perceived as real in the sense that media users experience a sensation of being spatially located in the mediated environment. This kind of sensation is closer to embodiment in this post-phenomenological analysis. For presence, the most ubiquitous component of definitions is 'being there' [37].

In the world of game design, questions of space and place have always been important, even to the point that spatiality have been called a defining element of a computer game [38]. The ability of a given game to evoke a sense of place is a factor that is often used to decide on the quality of the game – a good game is the one with a captivating world[1]. Therefore, from the very beginning creators of virtual game worlds strived to make them more immersive by making them similar to the real world. In 2001 Martin Dodge [39] wrote that "*Virtual worlds (...) attempts to simulate characteristics of real-world places in the hope of making the online experience less virtual and more naturalistic, therefore more enjoyable and fulfilling*". Further technological advancements made it possible to create increasingly larger and multidimensional worlds that include intricate spatial designs, even mimicking in complexity the existing real spatial arrangements. Some gaming studios even hired architects to help them create believable objects and structures [40]. However, it was understood very early that this similarity could not be provided through a simple mirroring because the resulting representation is always imperfect and cracks in the imperfect mirror are easily spotted and this breaks the immersion. In his widely cited book Bartle [41] noticed this and instead proposed a set of guidelines designed to ensure the creation of a believable world through, among other factors, adherence to a principles of a geographical consistency (rivers run from mountains to seas etc.).

This state of affairs was further complicated with the introduction of VR. When finally made available to a wider audience, VR brought something new to the equation - the promise of technologically induced immersion and presence. However, this promise is not easy to fulfil in practice as it requires a different approach at virtual world building and the reliance on geographical consistency is no longer enough. As argued by game designer Jeff Murray "*Just because something is realistic in terms of math or physics does not mean it will feel good in the virtual world. The virtual is different to*

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1 See for example a thread on the NeoGAF forums started the user "Piano" in which forum users discuss this issue: https://www.neogaf.com/threads/games-with-a-strong-sense-of-place-screenshots.1029850/

the real world and it is a place" [42]. When experiencing VR, however rich the environment it provides, we cannot rely on our knowledge of spatial structure of the world and are instead reliant on the structure provided by the game designers. In the same way that imperfections in virtual representations of the real places make them less believable, the inconsistencies of the spatial arrangement of the body and VR environment prevent the player of building a sense of place and achieving presence. It may be tempting to think that there is just something missing in the technology itself. That adding a full set of sensory inputs to the VR experience - to simulate the sense of smell, touch, kinaesthetic sensations etc., would be more convincing and place-building. However, this relation is hard to prove [43] and recreating full range of human senses is hardly practical. There is even evidence that a more realistic representations may not effective in certain real-life applications [44] and on the other hand a deliberately non-immersive low fidelity virtual environments still can be designed to successfully evoke a sense of place [45].

The phenomenological point of view on place itself can provide a perspective on this problem of creating a sense of presence and place in VR. We may think of place as an event (congruent with the idea of a relation), as a coming-into-presence mediated by various stimuli and as an encounter between location and human modes of existence [46]. This location can be either virtual or real and, in both case, there is a virtuality component in the sense of place - the sustained relation of creating something new, the possibility of experiencing something unexpected. VR worlds that try to be realistic by mimicking the real world loose the 'virtuality' in this process and instead become 'virtuzalizations" [47]. So, in order to create the embodiment and hermeneutic relations a game designer needs to provide the element of surprise and creative experimentation. It is necessary to decouple from the real world into the virtual world that is accepted as a place, and the VR technology can achieve this if designed with this in mind [48]. In our view the certain built-for-VR games represent the effectiveness of this decoupling in creating a sense of place and presence by encompassing a technological intentionality towards these relations.

4   Gaming experience in ports and built-for VR

Reinhard [49] argues that in VR, the materiality of the landscape is always experienced because of the withdrawal of the HMD. Following this post-phenomenological framework, we argue that if a hermeneutic relation is established between the user and the technology to experience the VR world, then the materiality of the landscape in VR is experienced as place thanks to the feeling of presence on the part of the gamer that feels immersed, embodied and present in the environment. However, this is contingent on

the technological intentionality coded into the VR experience to create a sense of place on the part of the programmers and designers of the game. The importance of this can be seen in the different reactions' gamers have to built-for VR games and ported VR games. Built-for VR games look to utilise the features of VR to create an immersive experience that can facilitate the feeling of embodiment and presence on the part of the user by including embodied experience and place creation at the core of the gaming experience. Essentially, VR game utilise the immersive elements of sound, touch, vision and orientation [50] in VR systems to create a game experience. Ported games use familiar geographical cues to build a sense of place in VR, and wayfinding and navigation based on traditional gaming. As built-for VR games have embodiment as the mechanism for the creation of a sense of space and place in VR, this shifts the relationality of the player towards an embodied and hermeneutic relation with the game. In ported games, embodiment is not crafted into the design of the game itself but is an addition to the original game that may, or may not, facilitate the development of a hermeneutic relation within this new medium for the game. To assess how this difference may manifest in gaming experience, we briefly consider some of the feedback given to different ported and built-for VR games. Using reviews contributed to the site *Metacritic*, a thematic analysis [51] of reviews indicated that the major issues identified by gamers were movement, control, lack of embodiment and nausea.

Issues with movement were prevalent with the ported game *Borderlands 2 VR*, with the mechanisms for movement in the original game not being replicated in the VR version causing major issues for the flow of the game experience (and hence for the possibility of focal relations or an immersive experience in the first instance):

Move controller support is awful. Teleport move is very slow to engage and seems to get blocked by invisible walls if you're not standing way out in the open, making it essentially unusable around any kind of background cover or uneven terrain. BillLikesVR 14/12/2018

The inability to move smoothly and in a realistic fashion without glitches in the game clearly prevents a sense of immersion developing for the gamer. This is supported by other comments:

the jittery neck movement is downright horrible and breaks the immersion big time. It's also inexplicable, as the game isn't a technical marvel, either. One of the pleasures I get from virtual reality is being able to look around naturally, to get that physical sensation you can't find anywhere in a "flat" game, but that's something Borderlands 2 VR just doesn't deliver. Mlnsfn 09/03/2019

Again, immersion is prevented but also the sense of not being able to look around the environment 'naturally' indicates that there is not an embodied relation with the game, where the 'world' is seen through the technology as the rendering of the game

environment itself makes this impossible. The constraining nature of limited movement is also commented upon elsewhere:

> If you want push to move (like you play on a monitor) you can only walk directly in the way you are staring. Which is really stupid. No strafing, no backpedaling, nothing. The direction you move should be tied to the direction you point with your left hand.
> Timo98 29/10/2019

The directional movement in the original game is suited to the interface of controller-monitor where the viewpoint of the gamer is distanced from the display. In VR, for directional movement to be intuitive and natural the game needs to be responsive in a different way, but the ported game makes no affordance for this difference in perspective, embodiment and relation. This leads to issues with nausea:

> Movement just doesn't feel right: I'm able to play Skyrim VR or Gran Turismo for more than 3 hours without a single problem, but I can't play for more than 15 minutes Borderlands 2 VR because of the dizziness. It's awful, I've bought a really expensive game that I can't play because it's a sickness generator.
> Selve 02/01/2019

The uncanniness of the movements and the difficulty of translating console-based movement systems to a VR experience are not exclusive to *Borderlands 2 VR*. *Doom VFR*, another ported version of a very successful first-person shooter, was reported as having similar issues with constraint of movement and nausea-induction:

> Built for the PSVR Move controllers, you are unable to turn less than 180 degrees, and strafing left and right are both mapped to right facing buttons.
> Spidor 19/05/2019

> the gameplay is clunky and is mostly about running around which is not so pleasant in VR
> tobivv 27/11/2019

The problems with movement around the environment are complimented with issues with the control interfaces in ported games. Again, porting a control system to VR ignores the differences in embodiment in VR as a medium, and creates awkward and uncanny gaming interfaces which prevent the establishment of a smooth, focal experience that could lead to a sense of embodiment or presence:

> [Discussing *Borderlands 2* VR] Wrong pivot point on Move controllers: for some reason, the pivot point has been set in the wrist instead of the hand, so you always feel like you are holding a hand which is holding a weapon, so weird.
> Selve 02/01/2019

[Discussing *Doom* VFR] I was excited to have another game that uses the Aim Controller, but the gun doesn't even line up well with what you're seeing. It doesn't give the illusion that you're holding the weapons. The tracking seems messed up as well.
OutlawTX 03/12/2017

These issues on movement and control are fundamental in preventing the focal relation between gamer and VR system developing as the building block towards immersion, embodiment and presence. The possibility of a sense of place is therefore non-existent in ported games which ignore the unique needs and features of VR technologies, interfaces and control systems. Interestingly, reviews of built-for VR games rarely mention controls, movement or nausea because the design of the game has incorporated the idiosyncrasies of these parts of the game experience. Reviews of built-for VR games emphasised a sense of presence:

[Discussing *Job Simulator*] Once it's done, there isn't an awful lot of replay value, but it's great to show people the sense of presence you can get in VR
Crazymurdock 16/11/2016

In particular, reviews of *Beat Saber* emphasised how the game avoided inducing nausea through an intuitive control and movement system that limited the possibility for nausea while not limiting embodied experience:

The game is very fun and one of the best for any VR system. It also is one of the least taxing VR games, I think, in terms of motion sickness. It makes great use of only requiring the player to look forward for the game itself.
Kenmei 10/01/2019

I get motion sick with most Vomit Reality games, but I can play this one for hours without any motion sickness whatsoever.
Inconnux, 17/02/2019

The nature of control in built-for VR was also frequently assessed as a key factor in developing a sense of immersion and embodiment. Control interfaces that take account of the affordances and limitations of VR can increase the feeling of presence and place in a VR game:

[Discussing *Job Simulator*] The implementation of room scale and controller experience is perfect. It's a game that is guaranteed to absolutely stun anyone new to the room scale VR experience.
Scimajor 18/12/2016

This was commented on frequently in gamer reviews of the VR game *Moss:*

Fantastic immersion and a really clever implementation of the VR controls and your interaction with the environment (I'm sure more VR games will use this style in the future).
Rustigsmed 01/01/2019

The game fully immerses you in the world, from the backdrops, to the little characters running around, you really feel like a giant looking into a world of mice and other forest dwellers. All the levels are designed so that you can remain in one position and still easily see all the objectives, interactive objects, enemies and objects. You can even get up and look around to find hidden secrets and still feel part of the world.
LivewireHD 07/01/2019

Immersion through a fidelity between control, visuals and embodied action clearly makes gamers feel part of the 'world', which in the post-phenomenological framework posited here may indicate a sense of presence and placehood through a hermeneutic relation with the technology and world.

5   Conclusions

Gunkel [52] stresses that when thinking of human-technology associations, these are not relations between existing subjects who perceive and act on a pre-existing world of objects but as sites where both the objectivity of the world and subjectivity of those experiencing the world it and existing in it are created [53]. Such an approach to considering human-technology relations recasts HCI as a speculative science of self-reflecting knowing, and the post-phenomenological approach we outline in this paper is intended as a contribution to and advancement of this 'third-wave' approach to HCI. In particular, seemingly inevitable development of more VR gaming in the future challenges researchers and theorists to engage with the conceptual difficulties and possibilities of immersion, embodiment and presence and how these moods or states of being for gamers can be fostered, built and exploited. The opening theoretical gambit proposed in this paper should be seen as a starting point for further research, with close attention paid to gamer accounts of experience through empirical research supported by both qualitative and quantitative methods. The technological intentionality or towards-which of game developers is critical in the possibility of being able to develop different variations on the I-technology-world schemas, and the difference between ported cash-in games capitalising of the emergence of VR and carefully-crafter built-for VR games is a basic illustration of how this intentionality effects in-game experience. The position forwarded in this paper is intended as a potential guide towards understanding these different issues and an analytical framework for identifying contemporary, and future, issues with the development of presence in VR.

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