# Using In Death: Unchained as case to investigate embodiment-related elements in VR game design

Xiaolin Wang*

Shanghai Pinghe School, Shanghai, China

*Corresponding author: a14725831116@163.com

**Abstract.** The research focuses on the concept of embodiment in VR game design, which is a trending topic in VR theories and applications. Currently, other investigations focus on a more broad term of VR products or a specific category of VR games, which ignores the importance of embodiment in generic VR game design. This research focuses on various approaches towards embodiment and uses the VR game In Death: Unchained as an example to demonstrate those approaches' application, effect, and limitations. To begin with, the virtual environment on embodiment in VR games like In Death will be examined, the same as the usage of players' actions and haptic feedback designed to increase the sense of presence. Next, the limitation of VR games will be listed after comparing with other VR projects from Meta or Google, which undermine the embodiment of VR games. finally, this research is looking forward to the future and trend of development in VR games' embodiment.

**Keywords:** VR games, embodiment, haptic feedback, sense of presence, interaction.

## 1. Introduction

Virtual reality (VR) is always a trending topic in technologies, proposed in the 20th century and continuously developed until today. VR technologies contain lots of key factors in their basic structure or composition, which includes the concept of embodiment. Embodiment is one of the major elements in the immersive experience of VR, not solely limited to VR games or other specific VR genera, It basically means the sense of realistically interacting in an immersive experience without discontinuity for VR in general. Based on the 6 Elements of Active VR, the embodiment is certainly connected to the effect exerted by the virtual environment [1]. In addition, devices like Meta's Haptic Gloves or simulation experiences like Somniacs' Birdly VR Flying Simulator all proved the existence of embodiment that is able to trick people's brains and feelings about the environment they presented in and the actions they conducted [2, 3]. On the other hand, video games also focus on embodiment, like Astro's Playroom which makes players sense different textures from the controller, although it is believed that video games are not as effective as VR technologies in this aspect [4]. Thus, it is undoubtedly crucial to investigate how games and VR technologies' usage of embodiment is integrated and the relative effects, which are related to the advancement of VR games by making players more immersed.

Currently, the study of embodiment in generic VR games is limited and requires advancements, even though VR games obviously use those features common in video games and novels or movies like Ready Player One constantly depicts a fully immersed VR game. In this case, many investigation projects were conducted using VR technologies, like Google's Haptic Helpers which contained a donut-eating perception, or Daniel Landau's Time-body study, but these investigations focus mostly on psychological experiments about embodiment rather than games that entertain people [5, 6] Furthermore, the research of embodiment's applications and effects on VR games concentrated on serious games that are educational and expect people to learn from their contents, which excludes other VR games in the market [7]. Thus, to fill this gap, a specific case in the market of VR games will be analyzed and a list of questions about its applications of embodiment will be discussed, along with the effects, which is able to reflect on other VR games that utilized the concept of embodiment.

# 2. Mainbody

## 2.1. In Death: Unchained

In March 2019, the development team of the game In Death: Unchained, represented by designer Claudio Pedica, participated and talked about their work at that year's Virtual Reality Developers Conference (VRDC), more than one year before the official launch in 2020 [8]. During the conference, the representative of the development team introduced major functions and designs comprised in their prototype. But the case it is hard to tell how some functions of In Death were related to embodiment, and how those functions were able to create the sense of embodiment in a VR game. In addition, what are the limitation of VR games in the aspect of embodiment is undoubtedly critical, which is demonstrated by In Death during the conference and also shared by other VR games in the entire market.

## 2.2. Analysis of the problems related to immersive in VR games

### 2.2.1 Players' actions on embodiment in VR Games' virtual environment

At the start of the presentation, way before demonstrating specific details of In Death, Claudio Pedica mentioned the uniqueness of VR games compared to other games. He mentioned players' physical movements are an important aspect of VR games, compared to video games when players play with a static posture (Fig.1) [8].

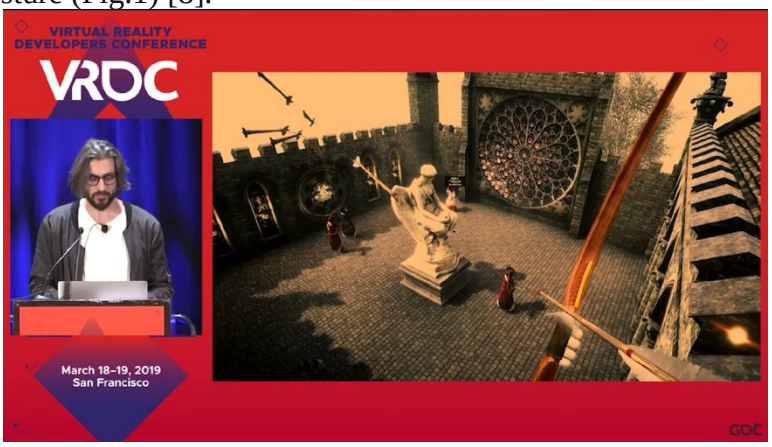



**Fig. 1** The 3D environment in In Death [8]

Thus, the development team of In Death created a 3D environment in the VR game for players to explore, along with audio and sound effects. In this environment, based on the pre-released playing experience from an invited Youtuber, players can travel around throughout this highly complex environment, and use their headset to look around [9]. During the process, players need to do movements like turning their heads around and transport through an instant transportation mechanism, which further enhances embodiment. This is proved by the study of Seibert and Shafer in 2018. After inviting 207 undergraduate students from a certain research university to play another VR game called Half Life 2, a model for the VR experience's enjoyment is proposed, which considers spatial presence, like how players present in an environment with audio in In Death, is able to elevated players experience positively [10]. Apart from the model, the significance of In Death to having a 3D environment composed of brick walls, floors, and complicated structures to place enemies is the sense of self-location. This sense is considered to be crucial for embodiment by researchers, and players' actions like "translation and rotation of the body in addition to orientation with respect to gravity" are possible in a virtual environment, which enhances self-location [11].

### 2.2.2 Players' actions on embodiment in VR Games' weapon design

Claudio Pedica concentrated on the topic of embodiment with how dancers learn choreographies with a technique called marking and a study conducted by David Kirsh. The fact is research concluded dancers learn choreography at a faster pace through really practicing movements, which means

moving their body is beneficial for learning something like choreography (Fig.2 ) [8]. Thus, Claudio and the development team started to work on how to integrate hand movements into their game to accomplish an upgradation of players' learning, which also stands for how immersed are players in the VR game. Taking the design of bows and crossbows in In Death as examples, both weapons require players to perform the whole process of drawing a bow and aiming to release it through hand movements, which actually makes the players feel the sense of actually shooting arrows from a bow. Furthermore, for crossbow, the player can choose to hold the bow with one hand or two hands through their controllers for better precision or reload speed. The case is such an application will increase the level of enjoyment because it allows players to conduct a high degree of interaction and embodiment, compared to pressing the right or left mouse key for common video games [12].

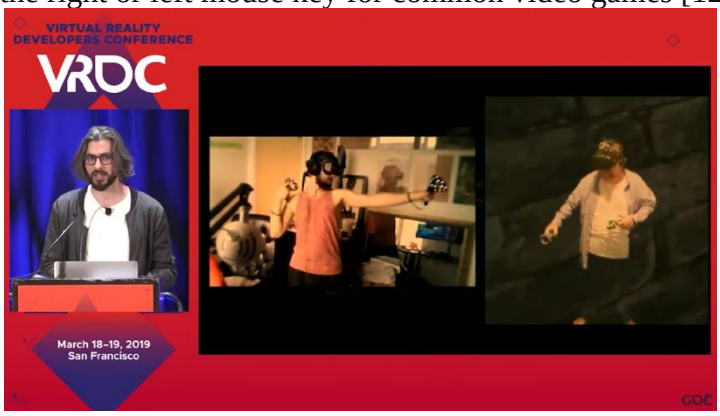



**Fig.2** The demonstration of bow and cross bow in In Death [8]

According to the model proposed by the study of Seibert and Shafer in 2018, such type of interaction mentioned above in action games, like In Death, is crucial in raising the level of enjoyment based on the model [10]. In addition, enjoyment for players is certainly important for almost any game to be popular in the market, which will become a key in upgrading the applications for better effects.

### 2.2.3 Utilizing haptic feedback to improve players' sense of presence

Haptic is an embodiment-related element that any VR products trying to cultivate and elevate. It can't be concluded into a very specific definition, but it is able to classify many functions some VR products have, especially the concept of vibration. In In Death, considering the significance of the weapon bow in the game, haptic feedback also exists through the vibration of controllers. The case is the degree of vibration is different in each phase of shooting an arrow, and it is accomplished by the motion design and a motion sensing controller [8]. Its effect is it basically tricks the minds of players, and it makes players feel that they are actually holding something. The approach's aim is to make the entire feedback more realistic and closer to the feedback of shooting an arrow in reality, and it is similar to Daniel Landau's Time-Body Study that allows the assistant to touch the participant's finger following the content playing in a VR headset [6]. In addition, about the effect of such application of embodiment, such feedback is able to generate a sense of presence through interaction, based on the positive correlation between interactivity and presence proposed by Lombard and Synder-Duch"s study on the concept of presence [13].

## 2.3. Understanding the Limitations of the Applications and Effects of Embodiment Specifically in VR Games

### 2.3.1 The nature of VR games that determines their inefficiency in achieving embodiment

To begin with, the applications and effects of embodiment specifically in VR games are limited, which means all content addressed above, even though well designed for presence and enjoyment, is limited to some extent. Thus, it basically represents an aspect of applications and effects of VR games' embodiment: it is unable to fully conduct embodiment and to further address the problem,

comparisons with other VR projects will be made. The case is all characteristics of VR games are determined by their nature, and it is a fact that needs to be clarified before further analysis.

Other VR projects were related to the study of three aspects of the sense of embodiment, encompassing self-location, agency, and body ownership [12]. For example, the virtual hand illusion experiment used a data glove to capture the movement of a participant's hand and display such movement on a screen while blocking the real hand from the participant's vision, which generated a sense of embodiment under the concept of body ownership [14].

However, in a VR game like In Death, the development team's goal is not to learn about embodiment but to implement it in their game for presence and enjoyment. For instance, the controller captures the data of players' actions, and it uses the illusion of body ownership to enhance the combat experience rather than analyze the concept. Furthermore, VR games also rely on theories like 'Mind flow' proposed by Mihaly Csikszentmihalyi about enjoyment in game design, which is something in addition to embodiment itself [15]. In this case, the difference in focus determines the direction of development efforts, which makes the limitations exist.

### 2.3.2 VR games' embodiment weakness in the aspect of equipment

Next, equipment or gears are realistic issues faced by VR games' embodiment. Compared with other VR projects like Birdly VR from Somniacs, VR games relied only on simple devices. For Birdly VR's embodiment application, like fig.3, Somniacs designed and created an entire machine for a "full-body flight experience" that mimics the flying pattern of birds and reflects such experience on the users, which enabled users to lay down and incorporate "Swiss precision design and German engineering" [2]. However, for VR games like In Death, a headset and pair controllers in fig 3 are the only devices that can bring haptic feedback that can lead to embodiment experiences [16]. In this case, while making the gaming experience immersive through weapons like bows and crossbows, it's impossible to achieve the degree of embodiment VR projects like Birdly VR accomplished through its devices.

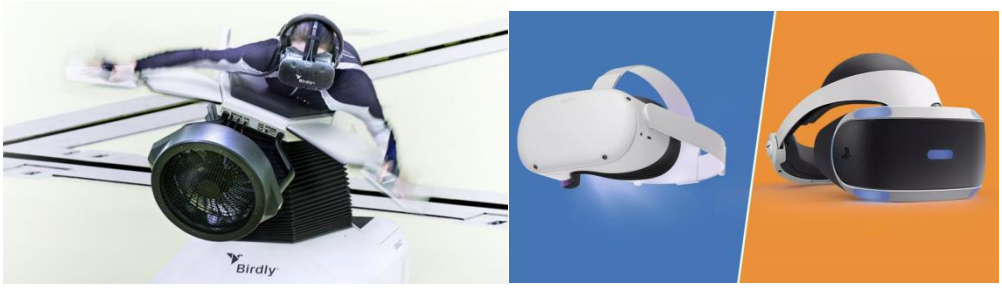



**Fig.3** Birdly VR [2] and VR headsets [16]

### 2.3.3 VR games' embodiment weakness in the aspect of the external environment

Last but not least, weakness in having a supportive external environment causes limitations in applying embodiment is a problem for VR games, given that other embodiment-related VR projects can conduct complicated operations. For instance, Google's Haptic Helpers proved how limited haptic feedback is in VR games because the project encompassed a donut eating test or car driving to discover to what extent can the user interact with content in his headset to match the reality [5]. To further illustrate the issue, the Haptic Helpers required actual staff to wait aside and put a donut into the participant's mouth or add wind through an electric fan while watching the screen which demonstrates the users' behaviors. Therefore, to implant this type of application of experiment, a lot of preparation is required, encompassing assistance from staff, the location where every operation took place, and complicated tools or equipment. It is impossible for VR games like In Death that players wish to purchase and play only on a headset and controller to reach that level of embodiment in their personal dwellings straight away.t. Thus, actions like movement are limited due to small space, which creates discontinuity in VR gaming experiences. In a nutshell, the case is more complicated simply by the content, and more difficult for the embodiment to be applied more complicated the application of embodiment, because it's impossible to accomplish them both, based on various

examples mentioned above, both experimental and commercial, which is now an issue for games like In Death to actually advance in the level of embodiment.

### 2.4. Suggestions on the developments of immersive experience in VR games

The application, including reliance on players' actions and haptic feedback, can further dig into the effect of presence and enjoyment in the embodiment to overcome the limitation mentioned in the last question, and the improvement can be classified based on how can different applications break through the limitation by elevating VR games.

First, the application of players' actions for enjoyment related to embodiment can be further developed. Just as the development team addressed in the conference, the type of actions that bow or crossbow required players to do is solely limited to these two types of weapons, so upgrading this application can be accomplished by expanding this type of attempt in In Death. For instance, holding different types of swords can require players to use different types of gestures, including using a rapier with one hand and a double-edged sword with two hands.

Second, about the link between haptic feedback and presence in the field of embodiment, VR game development teams can try to create elevated versions of their previous games and invest in new haptic devices or venues that support VR activities. The entire elevation can focus on utilizing new or even experimental devices and gears for better haptic effects. New devices that are able to give better haptic feedback include Meta's Haptic Gloves which demonstrated the function by making the participant feel she is physically playing with dominoes in a virtual world. In this respect, such feedback can definitely benefit In Death's Arrow shooting feedback and other possible haptic effects in other VR games. Besides new devices, a better space to play VR games is also crucial, because In Death, like other similar products, relies on Instantaneous movement through the virtual environment with a controller, which largely undermines the sense of spatial presence and creates unavoidable discontinuity in games, another key to embodiment from Seibert and Shafer's model. Thus, a gym-like area specifically for playing action games like In Death is able to enhance the sense of spatial presence above the haptic feedback. In addition, such attempts can even promote a new commercial or business model for VR games and people who wish to experience the most immersive and fluent experience, which all leads to a better VR gaming experience of embodiment.

## 3. Conclusion

Embodiment is a crucial aspect that is worth consideration for VR technologies, surely for VR games. Through the case of the VR game In Death: Unchained, it is quite valid to say that the applications of embodiment include making players do particular actions in reality and haptic effects that utilize vibration to mimic the feeling of shooting arrows. Furthermore, the effects of those elements are about presence and enjoyment, like what many previous studies concluded.

However, the importance of this investigation is stating the fact that there's still one crucial limitation for VR games that rely solely on controllers and headsets. After comparing the game In Death with other VR projects from Meta or Google, the evident crux of this problem is current VR games lack the ability to imitate a physical world of reality like other VR projects, which require a lot of preparation but are not suitable for current VR games. In this respect, it's important to search for solutions to break the limitations of VR games. Thus, to elevate the application of embodiment for generic VR games, and certainly its effects, a lot of upgradation and development is necessary.

## References

[1] Active VR - Survios. (n.d.). Retrieved September 4, 2023, https://survios.com/studio/active-vr/#six_principles_of_active_vr

[2] Birdly VR. (n.d.). Retrieved September 4, 2023, https://birdlyvr.com/

[3] Inside Reality Labs Research: Bringing Touch to the Virtual World. (2021, November 16). Meta. https://about.fb.com/news/2021/11/reality-labs-haptic-gloves-research/

[4] 10 Best PS5 Games For DualSense Haptic Feedback. (n.d.). Retrieved September 11, 2023, from https://www.thegamer.com/best-ps5-games-for-dualsense-controller-haptic-feedback/#astro-39-s-playroom

[5] Rosenbaum D A , Dawson A M , Challis J H .Haptic tracking permits bimanual independence..Journal of Experimental Psychology Human Perception & Performance, 2006, 32(5):1266.

[6] Pfeiffer, A. , Bezzina, S. , Koenig, N. , Kriglstein, S. . (2020). Beyond Classical Gamification: In-and Around-Game Gamification for Education. ECEL 19th European Conference on e-Learning.1-10.

[7] Rodriguez,Alejandro,Perez-Lopez,et al.A VR-Based Serious Game for Studying Emotional Regulation in Adolescents.IEEE Computer Graphics and Applications, 2015, 35(1):65-73.

[8] Haifeng, L. , Wei, W. , University, X. N. . (2015). The design research on educational game based on the theory of embodied cognition——from egec frame construction to the development and application of "sanitation fighter"game. China Educational Technology, 1-11.

[9] Beardo Benjo (Director). (2020, November 2). IN DEATH UNCHAINED QUEST 2 Gameplay // VR archery feels SO GOOD // In Death Unchained Quest 2 Update. https://www.youtube.com/watch?v=t6KFjIZ5USU

[10] Seibert, J., & Shafer, D. M. (2018). Control mapping in virtual reality: Effects on spatial presence and controller naturalness. Virtual Reality, 22(1), 79–88.

[11] Kilteni, K., Groten, R., & Slater, M. (2012). The Sense of Embodiment in Virtual Reality. Presence Teleoperators & Virtual Environments, 21.

[12] An adoption model for virtual reality games: The roles of presence and enjoyment. (2019). Telematics and Informatics, 42, 101239.

[13] Lombard, M., & Snyder-Duch, J. (2001). Interactive Advertising and Presence. Journal of Interactive Advertising, 1(2), 56–65.

[14] Wooff, D.. (2015). Bringing the Virtual World to the Real World; Use of Augmented Reality (AR) to Enhance the Learning Experience. Centre for Learning & Teaching (CLT) Conference, 437.

[15] Sharek, D, & Wiebe, E. . (2011). Using Flow Theory to Design Video Games as Experimental Stimuli. Warwick & York, Inc. .34.

[16] Kim, C., Klement, A. , Park, E. , Han, J. , Rao, L. , & Zhuang, J. . (2022). High-ppi fast-switch display development for oculus quest 2 vr headsets. SID International Symposium: Digest of Technology Papers (1), 53.