

Bring VR to Gaming: Investigating the Impact of Avatar on VR Gaming Experience

Anshita Sayal, Apoorv Mittal, Prashant Trivedi, Pratyush Oak, Ritwika Roychoudhary
Department of Computer Science, North Carolina State University

1. Introduction:

The aim of the study was to help Epic Games Inc. investigate the impact of an avatar in a virtual environment on the gaming experience. An avatar is defined as the three dimensional representation of the user in the virtual world [1]. The users control avatars and their appearance can also be customized to give an increased sense of reality. Aside from physical appearance, avatars can be customized in other non-physical aspects such as dialogue delivery to further ingrain the user's personality.

According to the study on the effects of an avatar on user behavior by Yoon and Patrick Vargas [2], avatars give freedom to the users to expand beyond their real-world limitations. Users can take on different identities and experience circumstances that they can never experience in real life. Studies have proved that most of the time people tend to create avatars of their ideal forms. For example, fat and short people create slim and tall forms of themselves. We can say that people create avatars similar to what they want to be. It has also been found that the player's gender also plays an important role in determining the characteristics of his/her avatar.

2. Experiments

2.1. Goals and Design

The aim of this study was to investigate the impact of virtual reality (VR) on gaming experience. Although, a number of factors affect game experience, the focus of this study was on whether the presence of an avatar in a game would improve the VR gaming experience. The results of this study would provide an insight into the effect of an avatar on game experience and make an attempt to answer the question: Should a game have an avatar or not?

The study was conducted in the form of an experiment, where participants were asked to play the same game with and without the presence of an avatar. Followed by each gaming experience experiment, the user was asked to fill up a questionnaire to measure the game engagement. Game engagement is a dependent variable and can be described as follows:

Game engagement:

One of the most important factors to study the impact of a videogame on a user is to measure how deeply the user is involved while playing the game. Game engagement is broadly characterized by immersion, presence and feeling of achievement, enjoyment and being in control [3]. Though generally subjective, researchers have found efficient methods to quantify this experience. The game engagement questionnaire provides a way to measure this subjective experience.

2.2. Hypothesis

The effect of the presence or absence of an avatar is often dependent on the type of game being played. An avatar gives the user a point of reference in the virtual world. This can often be helpful when there is a mismatch in the environment provided by the virtual world vs. that provided by the real world. On the contrary, the absence of an avatar can more deeply immerse the user in the virtual environment giving the user a more enhanced sense of belonging. This dual nature of an avatar makes predicting the results of the study a tricky job. Through our study we expected to find that the presence of an Avatar would lead to a better game engagement experience. This was because users may find the virtual environment more comfortable in presence of an avatar since having an avatar usually diminishes simulator sickness thereby making the gaming experience more

enjoyable overall. However, we would like to reiterate that the effect of an avatar would heavily depend upon the game being used for the experiment.

2.3. Methodology

Participants: A total of 14 participants, peers from our User Experience class took part in the experiment. All the participants were in the age group of 20-30 years with equalized gender distribution.

Apparatus and Stimuli: The apparatus for the experiment was provided by Epic Games and set up in the Visual Experience Lab at North Carolina State University. It included a Rift head mounted display developed by Oculus VR [4] connected to a personal computer with a mounted camera to track head movements. The game used for the experiment was Couch Knights which is an Oculus Rift DK2 Demo developed by Epic Games in conjunction with Oculus. The game was set up on the computer and in association with the Rift head set, a VR gaming environment was provided to the user.

The game was played in multiplayer mode. One of the team members played the game on a personal laptop and the participant played the game wearing the Oculus Rift. To achieve the two scenarios – presence and absence of an avatar, the blueprint of the game was edited with the help of the Unreal Engine 4 editor [5]. By default the game comes with an avatar. Changes were made to remove the avatar body for the second scenario and the viewpoint remained unchanged.

The questionnaire was developed using the questions provided in the paper by Eric N Wiebe [6]. The questionnaire was administered to the participants using Google Forms.

Procedure: The participants were given instructions on how to play the game in the set up environment. They were then allowed to interact/play in the environment without any interruptions for 30 minutes in two phases of 15 minutes each. In Phase 1, they experienced the environment in the presence of an avatar and subsequently given a questionnaire to answer. Similarly in phase 2 they experienced the environment in the absence of an avatar. Out of

the 14 participants, 7 were exposed to Phase 1 followed by phase 2. The remaining 7 were asked to perform phase 2 before phase 1. This was done in order to eliminate any erroneous results due to bias, which could be introduced due to familiarity with the game. The results obtained from the questionnaires after the completion of 2 phases were compared. The details of the questionnaire have been described below.

Game Engagement Questionnaire:

The game engagement questionnaire by Eric N Wiebe was used to evaluate the overall gaming experience of the user. The questionnaire is originally meant for gaming websites offering gaming as a service. Some of the questions of the questionnaire were edited to suit the aim of the experiment. There were a total of 28 questions. The User Engagement Scale (UES) was measured as a 5-point Likert scale and is comprised of six subscales: focused attention (FA), aesthetics (AE), perceived usability (PU) and satisfaction (SA) [6]. Some of the questions present in the questionnaire are tabulated in Table 1.

No.	Question
1.	I was absorbed in my gaming task
2.	I was so involved in my gaming task that I lost track of time
3.	I felt annoyed while playing the game.
4.	I found the game confusing to play.
5.	I liked the graphics used in the game.

Table 1: Sample question from Game Engagement Questionnaire

3. Calculations

For each question, the mean across all responses by all the participants was calculated. The mean Game Engagement Index was then calculated as the mean of the values obtained in the previous step to get a single value denoting the measure of game engagement of the user while playing the game. Some questions like –“I felt discouraged while playing the game” asked the participant for feedback on a negative experience and hence a lower value of response for these type of questions would mean better game engagement. Therefore, while calculating the Game

S. No.	Questions	Sub-Scale	Phase 1 (Avatar Present)	Phase 2 (Avatar Absent)
1.	When I was playing the game, I lost track of the world around me.	FA	3.28	2.92
2.	I blocked out things around me when I was playing the game.	FA	3.50	3.21
3.	The time I spent playing the game just slipped away	FA	3.64	3.42
4.	I was absorbed in my gaming task	FA	4.00	3.78
5.	I was so involved in my gaming task that I lost track of time.	FA	3.50	3.21
6.	During this gaming experience I let myself go.	FA	3.64	3.71
7.	I lost myself in this gaming experience.	FA	3.28	3.42
8.	I was really drawn into my gaming task.	FA	3.71	3.85
9.	I felt discouraged while playing the game.	PU	1.92	1.71
10.	I felt annoyed while playing the game.	PU	1.71	1.57
11.	Playing the game was mentally taxing.	PU	1.92	1.92
12.	I found the game confusing to play.	PU	2.00	1.71
13.	I felt frustrated while playing the game.	PU	1.50	1.42
14.	I could not do some of the things I needed to do in the game.	PU	2.42	2.07
15.	The gaming experience was demanding.	PU	2.35	2.35
16.	The gaming experience did not work out the way I had planned.	PU	2.28	1.92
17.	I liked the graphics used in the game.	AE	3.42	3.42
18.	The game appealed to my visual senses.	AE	3.50	3.71
19.	The game was aesthetically appealing.	AE	3.35	3.85
20.	The screen layout of the game was visually appealing.	AE	3.35	3.78
21.	The game was attractive.	AE	3.92	4.07
22.	The content of the game incited my curiosity.	SA	3.71	4.00
23.	I would continue to play this game out of curiosity.	SA	3.78	3.92
24.	I would recommend playing this game to my friends and family.	SA	3.64	3.85
25.	Playing this game was worthwhile.	SA	3.78	4.21
26.	I felt interested in my gaming task.	SA	3.92	4.00
27.	My gaming experience was rewarding.	SA	3.64	3.78
28.	This gaming experience was fun.	SA	4.07	4.50

Table 2 – Mean Values of responses to Game Engagement Questionnaire

Engagement Index, these values were flipped on the same 5 point scale and then incorporated into the calculations. Table 2 shows the questionnaire along with the mean values of each question calculated across all participants.

4. Results

The mean Game Engagement Index calculated for both the cases is tabulated in Table 3. The values indicate that there is no remarkable

difference in the game engagement index obtained for both the scenarios. Figure 1 provides

Dependent variable	Scale	Phase 1 (Avatar present)	Phase 2 (Avatar absent)
Game Engagement	1-5	3.45	3.57

Table 3: Game Engagement Index

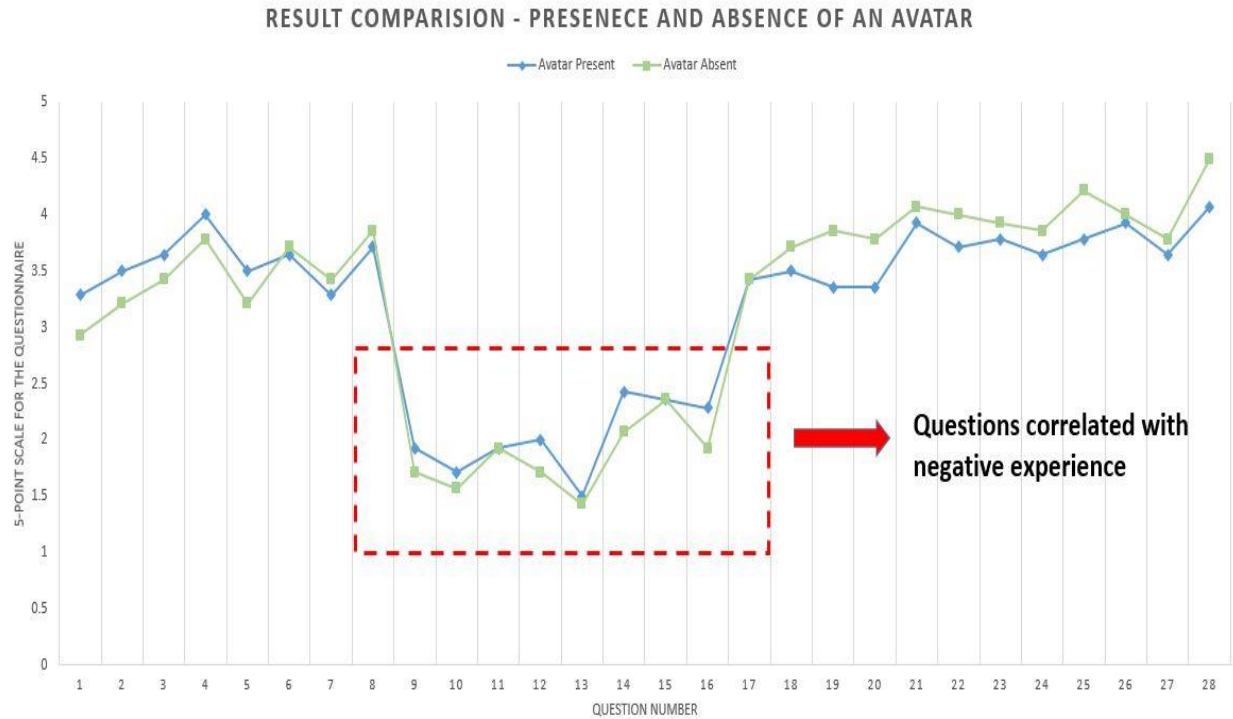


Figure 1 – Mean Values of responses to Game Engagement Questionnaire

a graphical representation of Table 2 for easier analysis of the calculated results. The blue line depicts the presence of an avatar and the red line depicts the absence of the avatar.

5. Conclusions

There was no significant difference observed in the game engagement parameters in the two cases i.e. with the presence of an avatar and without the presence of an avatar. Like we suggested in our hypothesis, the effect of an avatar depended very much on the game used in the experiment. Couch Knights was a game that virtually provided two avatars: one being controlled as a variable by us and the other being the actual knight figure battling in the game. We feel that since the knight figure was the actual focus of attention of the user during the experience, it was difficult to judge the impact of the actual avatar i.e. the person on the couch. Hence, the effects of an avatar on game engagement in a VR environment is influenced by the game being played and therefore many other parameters need to be considered while estimating the effects of this dependent variable.

6. Evaluation

A few interesting points were raised during the final project presentation. One of them being, what if the player had no personal avatar but the other player's avatar still remained? Here we are assuming that the first player is the one wearing the Oculus and in the VR environment. In such a scenario, we predict no remarkable changes in the game engagement of the first player since the second player's avatar is static. Another interesting question raised was, why does an avatar have a weaker effect than vestibular? The answer to the question really depends on the game under consideration. Assuming that we are considering couch knights, if the viewport is still the viewpoint of the avatar, the effect of avatar is weaker since avatar is static and hence the focus of the player is on the knight which moves, wields a sword, defends and fights. The avatar, on the other hand, remains seated on the couch and the head movement is all there is to it. The player sees the arms and legs of the avatar but that has negligible effect on the game play, according to our participants. There is no vestibular mismatch observed in the gaming scenarios we presented to

the participants. However, if we changed the viewport to the viewpoint of the knight, we might have noticed some vestibular mismatch when the knight jumps off the table and makes rapid movements in the game while being able to look around the entire room.

7. References

1. "Avatar (computing)." Wikipedia. Accessed May 6, 2015.
2. Gunwoo Yoon and Patrick T. Vargas. (2013). Know Thy Avatar: The Unintended Effect of Virtual Self Representation on Behavior. Institute of Communications Research, University of Illinois at Urbana-Champaign, College of Media.
3. Jeanne H. Brockmyer (2009). The development of the Game Engagement Questionnaire: A measure of engagement in video game-playing. University of Toledo.
4. "Oculus Rift." Wikipedia. Accessed May 6, 2015.
5. "Blueprint Editor Reference." Unreal Engine. Accessed May 6, 2015.
6. Eric N. Wiebe (2013). Measuring engagement in video game-based environments: Investigation of User Engagement Scale. NC State University.