Do Gender, Types of VR Game, & Virtual Presence Matter in VR Games?

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Abstract: *VR technology has become a game changer in the game industry. VR game market has increased exponentially worldwide. The current study is designed to examine effects of VR game players' gender (male vs. female), types of VR games (solo game vs. multiplayer game), and the level of perceived virtual presence (low virtual presence vs. high virtual presence) on enjoyment and intention to replay. Study findings suggest that male players, after playing VR games, showed higher enjoyment and intention to replay VR games. In terms of types of VR games, multiplayer VR games lead to higher enjoyment intention to replay than solo play games. Finally, this study found that the high level of perceived virtual presence incur higher enjoyment and intention to replay than the low level of perceived virtual presence in playing VR games. Practical implications were discussed in the last section of this paper.*

Keywords: VR game; gender; virtual presence; enjoyment; intention to replay

1. Introduction

Virtual reality (i.e., VR) technology has changed our everyday life. In particular, virtual reality has played a significant role in entertainment business including game industry. VR encouraged many tech-driven companies to jump onto the VR movement to transform the user experience. In gaming sector VR acted as a game changer and improved user experiences such as immersiveness and virtual presence which previous online and video games could not provide.

In 2018 the global virtual reality in gaming and entertainment market size was 4.15 Billion dollars and is forecast to reach 70.57 Billion dollars by 2026 [1]. Factors such as increased disposable income of people worldwide and continuous improvement in existing gaming technology (i.e., 3D effects, motion tracking, and interactive graphics) have helped the market for VR in gaming grow exponentially [2].

According to 2019 White Paper on Korean Games published by Korea Creative Content Agency (KOCCA), mobile platform is leading gaming industry worldwide [3]. The worldwide gaming market reached at 178.3 Billion dollars in 2018 is predicted to grow 5% annually for the next three years [3]. In 2018 VR gaming market grew 4.2% and showed a potential to grow in the near future.

In Korea licensed affiliates have expanded stationary VR games to "VR Game Rooms" or small-sized "VR Theme Parks." Korea Telecom (KT) opened its first VR Theme Park, calling it "Vright" and announced their goal of expanding their VR theme parks nationwide. According to Korean Creative Content Agency, the Korean VR gaming market will be increased to 5.7 Trillion Won by 2020 [3].

Since VR game has become an important business sector in Korea, much research is required. Thus, this study is designed to examine which factors influence consumers' enjoyment and intention to replay when it comes to playing VR games. In the current study VR game players' gender (male vs. female), types of VR games (solo game vs. multiplayer game), and the level of perceived virtual presence (low virtual presence vs. high virtual presence) are examined as important factors which may influence enjoyment and intention to replay.

2. Literature Review

2.1 Gender: Male vs. Female

Gender differences have been reported in cognitive abilities [4]. To be more specific, prior research suggests that males have greater spatial ability, which is closely related to visual information processing [5]. According to Collins and Kimura, males are likely to perform better than females on a variety of spatial orientation and mental rotation tasks [6]. Previous studies also demonstrate that males have a tendency to perform better than their counterparts on visual-spatial abilities [7-9].

As Adamo-Villani and Wilbur suggest, gender difference on science and technology exists as early as elementary and middle school. In the context of games, digital games have been considered as a male pastime [10]. Females are less attracted to action-oriented tasks while they prefer social interaction and meaningful dialogue [10]. Previous research shows that males perform better than females in terms of mental rotation of 3D objects, 3D navigation and target-directed motor skills [11]. In addition, Heeter found that female novices think a VR game as less relaxing and more embarrassing than male novices [12]. Thus, it is plausible to assume that males are more likely to enjoy and re-play VR games than their counterparts.

Based on the above discussion, the following hypotheses are proposed as below:

H1: VR game players' gender will have an impact on enjoyment and intention to re-play.

H2: After playing VR games, males will show a) higher enjoyment and b) intention to re-play than females.

2.2 Types of VR Games: Solo Game vs. Multiplayer Game

Many games including VR games can be divided into a solo game and a multiplayer game. Multiplayer games are believed to enhance enjoyment and intention to replay due to players' perceived social interaction and competition. First, social interaction is common in massively multiplayer online games and contributes to enjoyment [13]. In general, multiplayer games help to create meaningful relationship among players. According to Gajadhar, de Kort, and Ijsselsteijn [14], individuals playing a game with a co-present individual show greater enjoyment than those playing with the same game in solo. Second, competition plays a pivotal role in enhancing players' enjoyment while playing games. Verderer et al. suggest that "competition increases the urgency of responding to interactive media and heightens the emotional payoff of a successful response" (p. 359) [15].

Peng and Crouse found that multiplayer games result in higher enjoyment and future play motivation compared to solo player games [16]. They suggested competition and cooperation are two common multiplayer modes implemented in game [16]. Playing with another person is more enjoyable and more motivating than playing alone. In sum, it is carefully assumes that attributes such as social interaction, competition, and cooperation make multiplayer games more enjoyable and increase intention to replay in the future.

Based on the above discussion, the following hypotheses are posited as below:

H3: Types of VR game will have an impact on enjoyment and intention to replay.

H4: A multiplayer game will lead to a) higher enjoyment and b) intention to replay than a solo game.

2.3 Level of Virtual Presence: Low vs. High Virtual Presence

Virtual presence can be defined as a psychological state in which virtual objects are experienced as actual objects in either sensory or non-sensory ways [17]. According to Zeng and Richardson, virtual presence is the perceptual illusion of non-mediation or the feeling of being in the virtual environment [18]. Witmer and Singer suggest that presence consists of involvement and immersion [19]. According to Witmer and Singer, involvement refers to "a psychological state experienced as a consequence of focusing one's energy and attention on a coherent set of stimuli or meaningfully related activities and events" (p. 227) whereas immersion refers to "a psychological state characterized by perceiving oneself to be enveloped by, included in, and interacting with an environment that provides a continuous stream of stimuli and experiences" (p. 227) [19].

Prior research found that virtual presence plays a significant role in affecting users' excitement, virtual reality, enjoyment, and interaction positively [20, 21]. Heeter found that players are to feel greater enjoyment when they feel higher level of virtual presence [20]. Study findings also suggest that virtual presence influences users' game satisfaction, enjoyment, and excitement [22, 23]. In addition, Um, Lee, and Koh found that high level of users' perceived virtual presence incurred more favorable intention to replay than low level of users' perceived virtual presence [24]

Based on the above discussion, the following hypothesis was put forth;

H5: Level of virtual presence will have an impact on enjoyment and intention to replay.

H6: People with high virtual presence will have a) higher enjoyment and b) intention to replay than those with low virtual presence.

3. Method

3.1 Participant

For this study a total of 180 VR game players participated voluntarily. Face-to-face interviews using a structured interview questionnaire was conducted to collect data in a VR game store. Participants played at least one VR game which is a solo play game or multiplayer game. Among participants, males consist of 51.3% (n = 92) while females consist of 48.7% (n = 88). The mean age of participants was 29.1. The participants' age ranges from 13 to 53 years.

3.2 Measure

The perceived virtual presence was measured by a 8-items scale (α = .94, e.g., "I felt like I was actually there in the VR game" where 1 - "strongly disagree" and 7 = "strongly agree"). Enjoyment was measured by a 3 items scale (α = .91, e.g., "I enjoyed this VR game" where 1 - "strongly disagree" and 7 = "strongly agree"). Lastly, the intention to replay was measured by a 3-item scale (α = .92, e.g., "I have intention to replay the VR games" where 1 = "strongly disagree" and 7 = "strongly agree").

4. Results

4.1 Hypothesis Tests

4.1.1 *Gender: Male vs. female*

H1 posits that VR game players' gender will have an impact on enjoyment and intention to re-play. As seen in Table 1, results show that the Wilks' lambda was significant for perceived level of personalization (F = 14.80, p < .001). Thus, H1 was supported in this study. Since gender was a significant factor, further analyses were conducted to examine its effects on enjoyment and intention to replay.

Table 1. MANOVA Results

Effects	Wilks' Lambda	df	F	P
Main Effects				
Gender (A)	.85	(2, 172)	4.63	.001
Types of VR Game (B)	.94	(2, 172)	3.53	.031
Level of Virtual Presence (C)	.60	(2, 172)	5.14	.007
A X B	.95	(2, 172)	4.49	ns
A X C	.97	(2, 172)	2.56	ns
B X C	.96	(2, 172)	3.75	ns
A X B X C	.98	(2, 172)	1.31	ns

As seen in Table 2, examination of mean differences between males and females suggested that males have higher enjoyment (F = 5.15, p < .001; Mean males = 5.84 vs. Mean female = 5.50) and intention to replay (F = 23.33, p < .05; Mean males = 5.83 vs. Mean females = 5.13). Hence, H2a and H2b were supported in this study.

Table 2. Tests of Between-subject effects

Source	Dependent Variables	df	F	p
Gender (A)	Enjoyment	(1, 172)	5.15	.024
	Intention to Replay	(1, 172)	7.17	.008
Types of VR Game (B)	Enjoyment	(1, 172)	5.87	.016
	Intention to Replay	(1, 172)	11.31	.001
Level of Virtual Presence (C)	Enjoyment	(1, 172)	12.12	.001
	Intention to Replay	(1, 172)	15.31	.000
A X B	Enjoyment	(1, 172)	2.89	ns
	Intention to Replay	(1, 172)	3.46	ns
A X C	Enjoyment	(1, 172)	1.89	ns
	Intention to Replay	(1, 172)	2.14	ns
B X C	Enjoyment	(1, 172)	.78	ns
	Intention to Replay	(1, 172)	1.03	ns
A X B X C	Enjoyment	(1, 172)	.089	ns
	Intention to Replay	(1, 172)	1.17	ns

4.1.2 *Types of VR Games: Solo Game vs. Multiplayer Game*

H3 predicts that types of VR game will have an impact on enjoyment and intention to replay. As Table 1 illustrates, results show that the Wilks' lambda was significant for types of VR game ($F = 5.70$, $p < .01$). Thus, H3 was supported in this study. As types of VR game were a significant factor, further analyses were conducted to examine its effects on enjoyment and intention to replay. As seen in Table 2, an examination of the mean differences between a solo game and a multiplayer game suggested that the latter yielded higher enjoyment ($F = 5.63$, $p < .05$; Mean solo game = 5.49 vs. Mean multiplayer game = 5.85) and intention to replay ($F = 10.62$, $p < .01$; Mean solo game = 5.24 vs. Mean multiplayer game = 5.73). Thus, H4a and H4b were supported in this study.

4.1.3 *Level of Virtual Presence: Low vs. High Virtual Presence*

H5 proposes that the level of virtual presence will have an impact on enjoyment and intention to replay. As seen in Table 1, results show that the Wilks' lambda was significant for the level of virtual presence ($F = 56.91$, $p < .001$). Thus, H5 was supported in this study. As the level of virtual presence was a significant factor, further analyses were conducted to examine its effects on enjoyment and intention to replay.

As seen in Table 2, an examination of the mean differences between the low level of virtual presence and the high level of presence suggested that the high level of virtual presence incurred higher enjoyment ($F = 64.88$, $p < .001$; Mean low level of presence = 5.08 vs. Mean high level of presence = 6.26) and intention to replay ($F = 114.1$, $p < .001$; Mean low level of presence = 4.70 vs. Mean high level of presence = 6.26). Therefore, this study supports H6a and H6b.

5. Discussion

This study was designed to examine which factors influence consumers' enjoyment and intention to replay when it comes to playing VR games. Since VR games are increasingly popular worldwide, this study may shed some light on how to increase the number of potential VR game players and grow VR game industry in the future. Study findings indicate that players' gender (male or female), types of VR games (solo play game or multiplayer game) have an impact on enjoyment and intention to replay.

First, in terms of players' gender, male players, after playing VR games, showed higher enjoyment and intention to replay VR games. This finding is consistent with the prior research which suggests that males are likely to perform better than females on a variety of spatial orientation and mental rotation tasks and females feel less relaxing and more embarrassing than males when playing VR games [6, 11, 12]. To increase the number of female VR game players it is important to note that females are interested in social interaction and

meaningful dialog [10]. Female-oriented VR games, thus, need to focus on how to integrate social interaction in VR games.

Second, in regards with types of VR game, the study findings suggest that multiplayer VR games lead to higher enjoyment intention to replay than solo play games. Previous studies also suggest that attributes of multiplayer games such as social interaction, competition, and cooperation may make players feel more enjoyable and more motivating than solo play games [13-16]. When it comes to developing multiplayer VR games, creators need to take social interaction, competition, and cooperation into consideration.

Lastly, with regard to the level of perceived virtual presence, this study found that high level of perceived virtual presence incur higher enjoyment and intention to replay than the low level of perceived virtual presence in playing VR games. Prior research also found that virtual presence affects users' excitement, virtual reality, enjoyment, and interaction positively [20, 21]. In designing VR games, it is advised that system quality and interface quality need to improve in order to enhance VR game players' perceived virtual presence.

Conflicts of Interest: The authors declare no conflict of interest.

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