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The Study of Factors Influencing the Intention of Continuous Usage Using Augmented Reality Games: Comparative Analysis of Korean and Chinese Users

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ABSTRACT

This study is to focuses on users' attitudes toward augmented reality games. Based on the Technology Acceptance Model (TAM) and Flow theory, continuous usage intention was set as a dependent variable, and immersion was set as a mediating variable. As independent variables, spatial presence, perceived interactivity, perceived pleasure, and sickness were set. Besides, this study strived to compare and analyze Korean and Chinese Data. The results of this study were as follows. First of all, Korean users significantly affected spatial presence, perceived pleasure, and immersion. Spatial presence and perceived pleasure had also mediated effects on continuous usage intention through immersion. However, perceived interactivity and sickness did not affect immersion and even no mediating effect to continuous usage intention. In the case of Chinese users, spatial presence, perceived interactivity, and perceived pleasure were grouped into one variable. This variable influenced immersion and also had mediated effect on continuous usage intention. However, sickness, like Korean users, did not affect the set path. This study had implications for analyzing user perspective using immersion, a significant variable in previous research. In addition, this study found similarities and characteristics through a comparative analysis between Korean and Chinese users indirectly.

Keywords: Augmented Reality Game, Pokémon Go, Continuous Usage Intention, Technology Acceptance Model, Flow Theory, Comparing Korea and China

Ⅰ. Introduction

In the past few years, mobile technology has expanded to most consumption areas (Salehan and Negahban, 2013). With the development of technology, an augmented reality game field has been pioneered as a new market. The development of smartphone technology has made it possible to enjoy games

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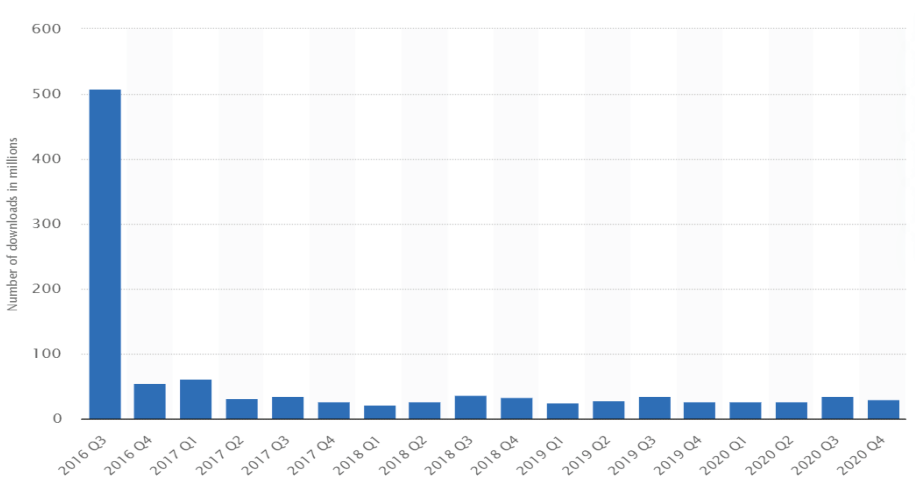
anytime, anywhere, from games enjoyed only at home with computers or laptops in the past. Moreover, playing a mobile game has become so common that 7 out of 10 people play mobile games in South Korea (Korea Creative Content Agency, 2020). In particular, the launch and success of the augmented reality game Pokémon Go in 2016, augmented reality technology, and the combination of the game industry have raised interest among related industries (Shin, 2017). Pokémon Go was developed to play games using a smartphone's satellite positioning system and built-in cameras (Rack, 2020). Pokémon Go was sensational in Korea and made a new term Pokénomi (Pokémon + Economy), which means the economic effects of Pokémon Go and Pose-Kwon, which means the areas where Pokémon is possible to catch (Lee, 2020). Pokémon Go, a representative game of augmented reality games, was introduced in Korea in 2017 and secured 7 million users in just three weeks (Choi et al., 2021). However, according to a statistical survey by Startista, a significant number of Pokémon Go users have stopped playing since its launch.

Augmented reality technology has become more common and interested in many users and industries. As the chart, however, users are not steadily using services that incorporate augmented reality technology (such as Pokémon Go). Researchers conducted studies from various perspectives to find out why users quit augmented reality technology or cannot use it steadily. Many reasons are found, but representatively, previous studies have mainly dealt with technical topics (Kaufmann and Schmalstieg, 2003; Shen, 2018), and research on user behavior in augmented reality games was usually focused on subjects related to exercise (Rauschnabel et al., 2017). Previous studies on AR games mainly dealt with topics related to user health, such as identifying the amount of exercise before and after using the game, increased physical activity due to the use of AR games, and analysis of the relationship between user's exercise and sociality (Paavilainen et al., 2017).

This study would focus on the behavior of users instead of focusing on technical problems or user health. Immersion, one of the essential characteristics



<Figure 1> Number of Pokemon Go App Downloads Worldwide from 3rd Quarter 2016 to 4th Quarter 2020

of augmented reality, we set as a mediating variable. Additionally, variables (Spatial Presence, Perceived Interactivity, Perceived Pleasure, Sickness) that have been treated importantly in the AR game research field are set as independent variables. This study would analyze how these variables affect the user's Continuous Usage Intention set as a dependent variable.

Therefore, the purpose of this study is as follows. First, by identifying variables affecting the user's Continuous Usage Intention, focusing on users who have experienced augmented reality games, this study would identify critical variables that augmented reality games should treat significant factors in the future. Second, based on the immersion theory, which was crucial in augmented reality research, this study would analyze how immersion is related to the user's Continuous Usage Intention from the user's perspective. This result intends to understand what factors should be satisfied and the relationships among the variables for the immersion. Third, the same questionnaire would be distributed and collected in Korea and China. The data would be compared and analyzed. Through the result, this study strives to confirm whether they have differences in perspectives on new technologies between countries or cultures.

Ⅱ. Theoretical Background

2.1. The Concept and Characteristic of Augmented Reality

In 1968, Sutherland's study about the three-dimensional display was published (Sutherland, 1968). The study is generally known as the beginning of augmented reality research. However, the word (augmented reality) was used in 1990 when Boeing's Aircraft assembled wires. Boeing performed by overlapping virtual images on the actual screen and visualizing the process of assembling wires (Jeong, 2010). The concept of augmented reality is often confused with virtual reality or used in the same meaning, but they have differences, especially in conceptual terms. Augmented reality could be explained one of forms of virtual reality (Shen, 2018). Virtual reality is a technology that allows a user to provide spaces and experiences that are not in reality through computer simulations (Bae and Kim, 2014), however, augmented reality could be described to be a technology that provides experiences to users by overlapping virtual screens in reality (Kim et al., 2017).

Augmented reality has several features. The first is the initiative of the user (Shin, 2017). Unlike the user's pattern in the past, the degree of freedom, which means that the user could act according to the user' will, is crucial in augmented reality (Kim, 2014). The higher degree of freedom affected the higher fun and immersion (Sweetser and Wyeth, 2005). Second, augmented reality has the feature of providing a service based on location and map information (Heo and Chung, 2011). Such as Pokémon Go, the game was also able to provide services by location information with virtual content (Kim et al., 2010). The third feature of augmented reality is immersion. Immersion is the most critical feature of augmented reality (Bae and Kim, 2014), and the factor has been studied in various ways in related academic fields. Since augmented reality technology provides contents including a three-dimensional spatial concept, the user's immersion is increasing gradually (Shin, 2017). Due to the immersion, augmented reality is used in various media industries (Choi et al., 2010), such as education (Lee et al., 2015) and experiencing content (Suh, 2015). Among augmented

reality features, this study focuses on the game industry among various industries which immersion is applied. Additionally, this study is based on Technology Acceptance Model and Flow Theory.

2.2. Research Fields Applied Augmented Reality

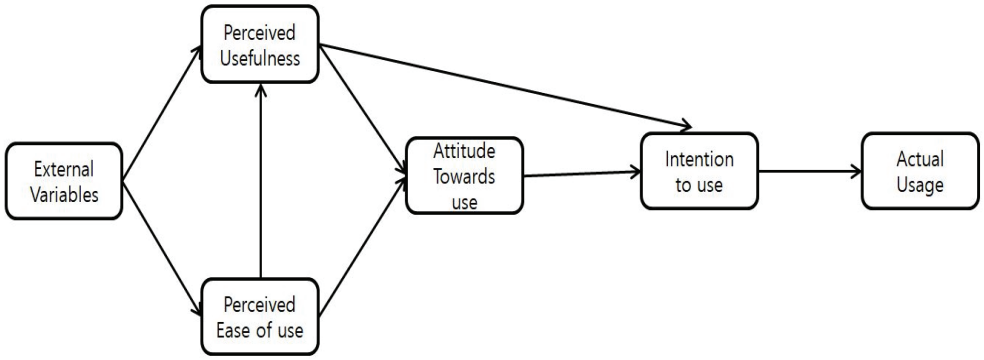
Examples of research applied augmented reality technology could be found in fields such as technology science, social science, art, and even history. For example, in the technology science field, analyzing Marker-less Tracking Algorithm for applying augmented reality in a mobile environment (Yoon and Moon, 2012), research on service provision by combining broadcasting and augmented reality (Choi et al., 2012) were investigated. In the social science field, a study on the effects of augmented reality game attributes and immersion on user satisfaction (Cho, 2017) and research on education using augmented reality (Lee et al., 2010; Yang and Ryu, 2018) could be confirmed. Additionally, in the field of art, design and image systems for augmented reality (Kim et al., 2010; Yim and Lee, 2017) were mainly conducted.

An issue related to the business research field, Kim and Jung (2020) conducted to analyze satisfaction with augmented reality services. The study investigated satisfaction and usage intention by classifying augmented reality features among 10s to 30s experienced augmented reality services. The study found the satisfaction had a partial mediating effect between usefulness, pleasure, and usage intention. In addition, a study analyzed the psychological process from the view of a consumer to prove the effectiveness of augmented reality advertisements. As a result of this study, augmented reality advertisements formed a more positive brand attitude than general advertisements. Besides, an augmented reality advertisement was more helpful in evaluating products, and that the psychological distance consumers feel was closer than general advertisements (Jo and Sung, 2014). Thus, augmented reality technology is applied according to each study in various fields rather than limited to one field. Therefore, its significance is gradually increasing.

2.3. Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) has been confirmed the validity for measurement tools based on accumulated previous studies (Lee et al., 2021). In the 1980s, TAM was developed to understand users' acceptance intentions for computers (David, 1989; Yoon, 2020). TAM consisted of variables is the helpful model for understanding new technologies and users' intention to reuse new IT products. Specifically, in TAM, external variables affect the perceived ease of use and perceived usefulness, which influences the attitude toward use. Furthermore, the attitude toward use affects the user's intention to use, which affects actual use. In addition, perceived usefulness also affects the user's intention to use (Chae, 2016).

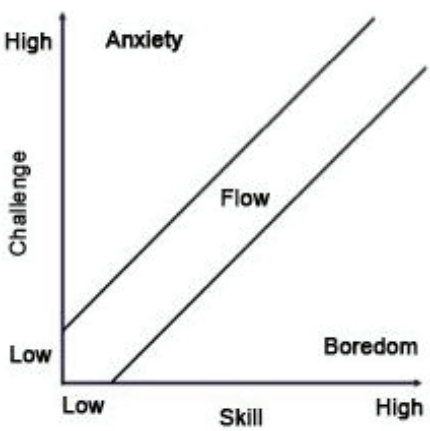
TAM has been actively researched in academic fields to analyze the user's intention to use new technology and find variables that influence users' intention (Qiao and Han, 2019). TAM is a magnificent model to understand the user's intention to use the new technology. Many studies used the user's intention to use setting as a dependent variable (Chung and Dong, 2019; Lee et al., 2021; Na and Wui, 2019; Yoon, 2020). In the study, the user's intention to use was set as a dependent variable, which was a crucial variable of TAM and was widely used as a dependent variable in previous studies.



<Figure 2> Technology Acceptance Model

2.4. Flow Theory

The flow is defined as a state of extreme concentration on a specific act and of not being aware of other situations (Csikzentmihlyi, 1975; Csikzentmihlyi, 1990). Individuals with strong self-purpose tendencies are more likely to enjoy pleasure by immersing themselves in specific actions without being tired (Csikzentmihlyi, 2003). In other words, if individuals have a sense of purpose for a specific action, the situation could be interpreted that he or she is more immersed in the action to achieve the purpose, and when the purpose is achieved, enjoyment could be maximized.



<Figure 3> Flow Theory

Flow experienced by individuals occurs when challenges and technologies remain balanced (Kwon, 2012). If the challenge given to an individual is higher than the individual's ability, it becomes a psychological state of anxiety, and if the individual's ability is higher than the challenge, it becomes psychological boredom. Therefore, balancing challenge and technology is essential to maintain an individual's immersion experience and state. The perspective of Flow theory means that utilization in the game field could be high. A previous study found that the difficulty of the game and the level of an individual's ability to play the game should be balanced (Kim et al., 2010). Based on Flow theory, the study was judged that the higher the immersion experience or immersion level of users, the more influenced the intention of continuous usage of the game.

Ⅲ. Research Methods

3.1. Research Subjects and Variables

Data were collected from Korea and China to achieve the purpose of this study. The primary target age was set for young people from 20s to 30s because

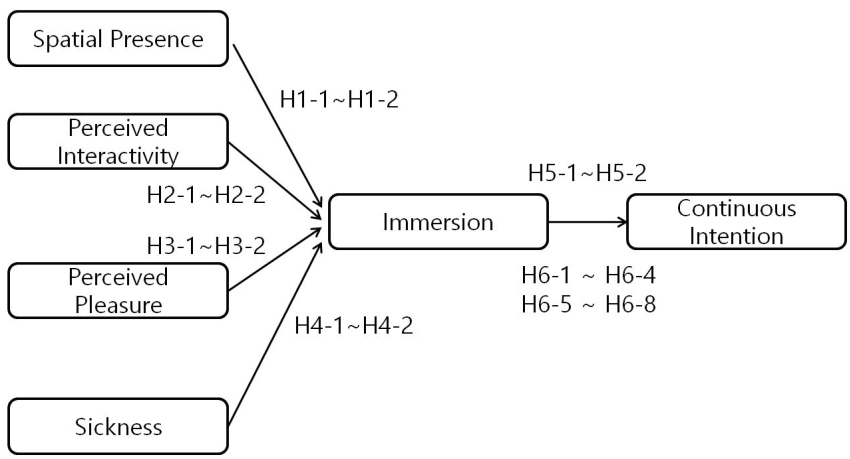
it was judged that accessibility and experience in using augmented reality technology would be higher than other ages. In the case of Korea, data were simultaneously collected online and offline around universities in Seoul and through SNS, and data were also collected near universities in Xinjiang and SNS in China.

This study established a research model to identify the factors influencing the intention of continuous usage of augmented reality games based on TAM and Flow theory. The intention of continuous usage was set as a dependent variable, and the immersion was set as a mediating variable. Besides, among the studies on augmented reality technology, including the game field, this study set Spatial presence, Perceived interactivity, Perceived pleasure, and Sickness, as independent variables which were judged to be significant through previous studies. This study did not set control variables in order to focus on the relationship among the variables. In particular, the respondents of this study were randomly selected and surveyed online and offline using SNS, and through this method, efforts were made to minimize the effect of exogenous variables (Kerlinger and Lee, 2000; Park et al., 2010). The program used to verify the hypothesis of this study was used SPSS 21 version and AMOS 21 version. SPSS program was used for exploratory factor analysis, frequency analysis, and correlation analysis. AMOS program was used for confirmatory factor analysis, multiple regression analysis, and mediating effect analysis.

3.2. Previous Research and Hypotheses

3.2.1. Spatial Presence and Immersion

Presence is explained by dividing it into a sense of spatial presence and social presence in a feeling of the state where the user exists in a virtual environment (Slater and Usoh, 1993). Spatial presence is a state in which a user is not aware of the actual physical space and the mediated media, and Social presence refers to a state that a user feels to exist with virtual objects (Kim and Seo, 2017). According to a previous study (Barfield et al., 1995), immersion comes from the presence. Many previous studies also found that various factors that made up the presence influenced the immersion (Joo et al., 2015). However, on the contrary, studies show that the level



<Figure 4> Research Model

of immersion could affect presence. Kim and Kang (2008) conducted a study to investigate the relationship between the level of immersion and the level of presence in cyber-sports games, and the study found that immersion had a partial effect on the presence. This study applied previous studies that presence affected immersion, and this study defined the presence as one of the sub-concepts, spatial presence.

3.2.2. Perceived Interactivity and Immersion

Interactivity is one of the crucial features of the concept of augmented reality. Interactivity is all actions exchanged between humans and humans or between humans and objects, and the medium that enables such actions is defined as interacting (Lombard and Jennifer, 2001; Yang, 2014). Interactivity is more significant to apply based on object and context than basic concepts. The reason is that interactivity is a complex multidimensional concept. Various analyses and studies could be conducted face-to-face and media or computer-mediated interactions (Jennifer, 2003). Research on interactivity and immersion has been conducted on various topics. For example, the study of Song and Shin (1999) divided types of the interactivity into three categories and analyzed the relationship among the categories and immersion in the Internet site. Each of the interactivity had a significant effect on immersion. In addition, even if it is a similar game, a game with more interactive elements showed a higher level of immersion than a usual game (Park and Noh, 2015). This study defined interactivity as 'perceived interactivity' which means the degree to which users perceive interactivity with media suggested by Newhagen and Rafaeli (1995).

3.2.3. Perceived Pleasure and Immersion

Perceived pleasure means the degree to which a user feels happy and joy while playing games, and it is one of the significant factors that a user plays the game (David et al., 1992). The expectation of a user who participates in augmented reality games is pleasure, and, predictably, the higher pleasure affects the more positive effect on the intention to reuse (Nam et al., 2017). Seong (2012) conducted a study on the four sub-elements and analyzed the relationship among the sub-elements, immersion, and satisfaction. In this study, Perceived pleasure affected immersion and was a crucial factor that made users to play games. In other words, an element of pleasure is essential for a user to feel satisfied with a game (Lee et al., 2003). In addition, pleasure is a critical factor in research on developing augmented reality theme parks, and pleasure is an element that enables users to immerse themselves (Lee, 2000). This study established the hypothesis based on previous studies that defined pleasure as perceived pleasure and significantly affected immersion.

3.2.4. Sickness and Immersion

Sickness is mainly used in the same meaning as cybersickness. Sickness refers to symptoms including vomiting, nausea, eye fatigue, and dizziness while using virtual reality or augmented reality devices (Zhang, 2020). Sickness was mainly treated as a significant factor in research related to virtual reality (VR). It is divided into personal factors such as age, gender, user-health status, and technical factors such as delay time, location tracking error, and background complexity (Kim and Park, 2016). Sickness was used to determine the relationship between users' satisfaction with device use. The higher sickness, the

user's satisfaction with content and system was affected, the more negative. Users who had experienced 3D film content felt the higher sickness, the more negatively it affected the intention to use (Zhang, 2020). Besides, a study to reduce sickness in VR or augmented reality (Jung, 2018; Son, 2017) conducts the difference in sickness and cause analysis by personal characteristics (Ko, 2020). A study on the relationship between sickness and immersion was not actively conducted, but the higher the motion sickness, the lower the user's satisfaction or intention to use it. Therefore, the sickness likely hinders the user's immersion. In this study, the hypothesis was established based on the expected relationship.

3.2.5. Immersion and the Intention of Continuous Usage

Immersion and the intention of continuous usage are also essential variables of Flow theory and TAM, and variables are significant factors in augmented reality research. A study comparing and analyzing the effect the intention of continuous usage between augmented reality and VR found that immersion had a significant effect on the intention of continuous usage for both (Bae and Kwon, 2018). Immersion positively affected the intention to reuse SNS games (Chang and Zhu, 2012). A study that analyzed the relationship between immersion and intention to use fashion product applications also found that immersion positively affected the intention to use (Kim et al., 2020). Other studies analyzed the effect of immersion on user satisfaction, not intended to use. The relationship between immersion and satisfaction of SNS game users was analyzed, and the study found a significant positive relationship between them (Lee et al., 2017). In the analysis of a user who experienced the trick eye museum using the augmented reality app, immersion affected the user's satisfaction (Jang, 2019). Therefore, this study judged that the immersion of augmented reality influenced the intention of continuous usage, and the hypothesis was established.

Additionally, this study established a hypothesis to determine the mediating effect based on the previous studies discussed above. Through the studies, variables influencing immersion were identified, and immersion had a significant effect on the continuous usage intention of augmented reality users. Based on this, the following hypothesis was established that immersion would be influenced by independent variables and mediate the intention of continuous usage.

3.2.6. Hypothesis in Korean Users

The following hypothesis for Korean users was established based on the relationships between the variables examined through previous studies.

H1-1: Spatial presence of Korean users is positively associated with immersion.

H2-1: Perceived interactivity of Korean users is positively associated with immersion.

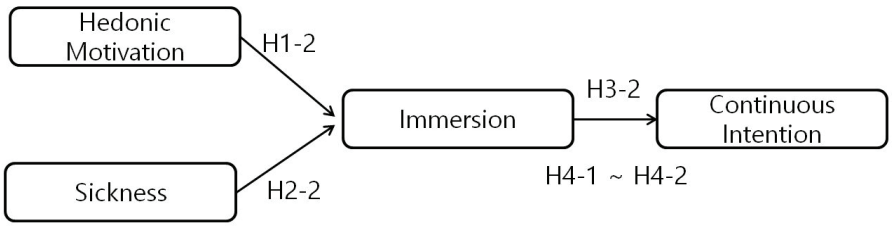
H3-1: Perceived pleasure of Korean users is positively associated with immersion.

H4-1: Sickness of Korean users is negatively associated with immersion.

H5-1: Immersion of Korean users is positively associated with the intention of continuous usage.

H6-1: Immersion of Korean users will have a mediating effect on spatial presence and the intention of continuous usage.

H6-2: Immersion of Korean users will have a mediating effect on perceived interactivity and the intention of continuous usage.



<Figure 5> Research Model in Chinese Data

H6-3: Immersion of Korean users will have a mediating effect on perceived pleasure and the intention of continuous usage.

H6-4: Immersion of Korean users will have a mediating effect on sickness and continuous usage intention.

3.2.7. Hypothesis in Chinese Users

For the analysis of Chinese users, the equal research model and questionnaire to Korean users were conducted to collect data. However, as a result of exploratory factor analysis, Chinese users perceived spatial presence, perceived interactivity, and perceived enjoyment as one variable. Therefore, reflecting the results, the hypothesis for Chinese users was changed as follows. In addition, three variables were set to Hedonic Motivation, and hypotheses were established.

H1-2: Hedonic Motivation of Chinese users is positively associated with immersion.

H2-2: Sickness of Chinese users is negatively associated with immersion.

H3-2: Immersion of Chinese users is positively associated with the intention of continuous usage.

H4-2: Immersion of Chinese users will have a mediating effect on Hedonic Motivation and the intention of continuous usage.

H4-3: Immersion of Chinese users will have a mediating effect on sickness and the intention of continuous usage.

<Table 1> Definition of Operational Variables

Name	Definition	Quarry
Spatial Presence	The feeling of space that users of augmented reality games perceive psychologically through immersion in the game	Kim (2013); Kim and Bioca (1997).
Perceived Interactivity	The degree of response to the personalization and behavior of the communication-mediated environment where the user controls the interaction process.	Wu (2005).
Perceived Pleasure	The degree to which the user feels that using the game evokes fun and interest and is enjoyable.	Shin and Shin (2011); Lee et al. (2011).
Sickness	Symptoms such as discomfort, eye fatigue, headache, and nausea were exposed while playing augmented reality games.	Rebenitsch and Owen (2014); Davis et al. (2015).
Immersion	A state in which unnecessary information is not remembered by focusing perfectly on augmented reality games.	Susna and Marsh (1996).
Continuous Intention	The user's intention to use the game continuously.	Bhattacherjee (2001).

<Table 2> Measurement of Items

Name		Item	Quarry
Spatial Presence	RE1	I felt like I was in a game.	Kim (2016); Kim and Bioca (1997);
	RE2	I felt like I experienced a different world while playing games.	
	RE3	When playing a game, I felt like entering the world of games through my characters in the game.	
	RE4	When I play a game, the character's movement in the game feels as if I have moved.	
Perceived Interactivity	IN1	Two-way communication is possible through augmented reality games.	Kim (2009); Lee (2006).
	IN2	Augmented reality game content is interactive.	
	IN3	Simultaneous communication is possible through augmented reality content.	
	IN4	Augmented reality content is diverse.	
Perceived Pleasure	EN1	Playing augmented reality games is fun.	Jang (2013) Nam et al. (2017).
	EN2	Augmented reality games interest me.	
	EN3	Augmented reality games are fun.	
	EN4	I think augmented reality games are fun and attractive.	
Sickness	DI1	Playing augmented reality games is inconvenient.	Pyo (2019).
	DI2	I'm tired when I play augmented reality games.	
	DI3	When I play augmented reality games, I have a headache.	
	DI4	When I play augmented reality games, my eyes get tired.	
	DI5	When I play augmented reality games, I feel dizzy.	
Immersion	AB1	I focused my attention on the augmented reality game when I played.	Cho et al. (2001); Susna et al. (1996).
	AB2	While playing augmented reality games, I never thought of people who had nothing to do with games.	
	AB3	I'm totally into augmented reality games.	
	AB4	While I played augmented reality games, I focused all my attention on the game.	
	AB5	I tried not to make mistakes while playing augmented reality games.	
Continuous Intention	USE1	I will continue to use augmented reality games as I do now.	Kim (2011); Kim (2019).
	USE2	I am willing to continue to use augmented reality games in the future.	
	USE3	If possible, I think I will continue to use augmented reality games.	
	USE4	I am willing to recommend augmented reality games that I have experienced to others.	
	USE5	I will continue to play augmented reality games that I have experienced even if other types of games appear.	

Ⅳ. Results of Analyzing Korean Data

4.1. Characteristics of the Sample of Korean Data

Online and offline surveys were conducted on social networks such as Facebook and near universities in Seoul to collect data from Korean users. Demographic questions were surveyed on gender, age, occupation, and use of augmented reality games. The result of sex was 163 males (71.8%) and 64 females (28.2%). The distribution of age groups was respectively 92 (40.5%) in their 20s, 125 (55.1%) in their 30s, 8 (3.5%), and 2 (0.9%) in their 40s and 50s. The respondents' jobs were 100 college students (44.1% including graduate students), 80 office workers (35.2%), 13 self-employed (5.7%), 15 specialized jobs (6.6%), and 19 freelancers (8.4%). With the use of augmented reality games, 215 (94.7%) responded that they had experienced and that only 12 respondents (5.3%) had no experienced.

4.1.1. Exploratory Factor Analysis of Korean Data

The results of exploratory factor analysis of Korean user data are as follows. Overall, the factor loading showed a good level, but in the case of DI1, a value of 0.514 less than 0.6 was derived. Therefore, the analysis was conducted again, excluding the DI1 factor, and the results were shown in <Table 3> below.

Cronbach's alpha analysis was performed to confirm the reliability of the measurement tools used. The result values of each variable were as follows <Table 4>. As a result of the analysis, all variables were over 0.8, and the reliability of the measurement tool used was secured.

<Table 3> Exploratory Factor Analysis in Korean Data

Items	Factor Loading				
RE1	.749				
RE2	.818				
RE3	.795				
RE4	.655				
IN1		.611			
IN2		.769			
IN3		.820			
IN4		.657			
EN1			.707		
EN2			.747		
EN3			.684		
EN4			.721		
DI2				.708	
DI3				.800	
DI4				.848	
DI5				.870	
AB1					.765
AB2					.762.
AB3					714
AB4					.747
AB5					.787
USE1					.677
USE2					.711
USE3					.737
USE4					.765
USE5					.747

Note: Total explained variance: 72.900%
Kaiser-Mayer-Olkin: .921
Barttlett's chi-squared: 4005.289, the degree of freedom: 325, sig: .000
*RE: Spatial Presence, IN: Perceived Interactivity, EN: Perceived Pleasure, DI: Sickness, AB: Immersion, USE: Intention of Continuous Usage

<Table 4> Cronbach's alpha in Korean Data

Variables	Cronbach's Alpha
Spatial Presence	.903
Perceived Interactivity	.814
Perceived Pleasure	.895
Sickness	.848
Immersion	.884
the intention of continuous usage	.881

4.1.2. Analysis of Correlation, Mean, and Standard Deviation in Korean Data

Analyzing correlation, mean, and standard deviation between variables was performed. The results of the analysis were shown in <Table 5> and <Table 6>. As a result of correlation analysis, it was found that most variables were correlated at the significance level of $p < 0.05$. However, in the case of sickness, the variable had a negative correlation with all variables.

<Table 5> Mean, S.D. in Korean Data

	Means	Standard Deviation	N
Spatial Presence	3.8480	1.02433	227
Perceived Interactivity	3.6156	.90909	227
Perceived Pleasure	3.8403	.83487	227
Sickness	2.4643	1.05071	227
Immersion	3.9322	.87268	227
Intention of Continuous Usage	3.4626	.91582	227

<Table 6> Correlation in Korean Data

	1	2	3	4	5	6
1. Spatial Presence	1					
2. Perceived Interactivity	.599**	1				
3. Perceived Pleasure	.546**	.549**	1			
4. Sickness	-.264**	-.137*	-.444**	1		
5. Immersion	.605**	.467**	.511**	-.197**	1	
6. Intention of Continuous Usage	.569**	.452**	.625**	-.302**	.531**	1

Note: * p < 0.05, ** p < 0.01

4.1.3. Confirmatory Factor Analysis of Korean Data

Confirmatory factor analysis was conducted to verify the relationship between the measurement variable and the latent variable. As a result of the analysis, all factors had significance at the p<0.000 level. The result of AVE was over 0.5, and CR values were over 0.5, excluding perceived interactivity and sickness. Perceived interactivity and sickness values were derived, AVE values were less than 0.5, but the variables were sufficiently acceptable if C.R. values of 0.6 or more (Fornell et al., 1981). Therefore, considering that the C.R. value of both variables was over 0.7, this study was conducted without excluding variables. In addition, the model fit of confirmatory factor analysis was derived CMIN: 481.548 (DF: 284, p: 0.000, CMIN/DF: 1.696), RMSEA: .055, NFI: .885, IFI: .949, TLI: .941, and CFI: .949.

4.1.4. Result of Research Model Fit in Korean Data

This study analyzed the AMOS program's Bootstrap ML method (Perform Bootstrap: 1000, PC confidence level: 95, BC confidence level: 95). The results of the model fit were as follows. CMIN: 724.918 (DF: 290, p: .000, CMIN/DF: 2.5), RMSEA: .081, NFI: .827, IFI: .888, TLI: .874, and CFI: .887 were derived. The results were suitable or acceptable to accommodate the model. In addition, the analysis of multicollinearity was conducted during multiple regression analysis. All of the values were less than 2, and the multicollinearity problem did not exist.

4.1.5. Result of Verifying Hypothesis in Korean Data

SPSS was used to verify hypotheses H1-1 to H5-1. Besides, this study used AMOS to investigate the mediating effect hypothesis H6-1 to H6-4 and to analyze the direct, indirect, and total effects. As a result of multiple regression analyses, spatial presence and perceived pleasure significantly affected immersion. However, perceived interactivity and sickness did not have a significant relationship. Besides, immersion had a positive (+) significant effect on the intention of continuous usage. Therefore, hypotheses H1-1, H3-1, and H5-1 were accepted, and H2-1 and H4-1 were rejected (<Table 8>). The results of hypotheses H6-1 to H6-4 established to find out the mediating effect were as follows. Spatial presence and perceived pleasure had direct, indirect, and total effects that influenced the intention of continuous usage through immersion within a significant range. Spatial presence and perceived pleasure, a result value with a partial mediating effect, were derived. However, in the case of perceived interactivity and sickness, all three effects were not found to be insignificant (<Table 9>).

<Table 7> Confirmatory Factor Analysis in Korean Data

Name	Items	Non-Standardization Coefficient / Standardization Coefficient	C.R.	p-value	AVE	Construct Reliability
Spatial Presence	RE1	1.000 / .824	-	-	0.6423	0.8774
	RE2	1.110 / .873	15.904	.000***		
	RE3	1.089 / .898	16.566	.000***		
	RE4	1.072 / .775	13.368	.000***		
Perceived Interactivity	IN1	1.000 / .789	-	-	0.4388	0.7533
	IN2	1.081 / .792	12.257	.000***		
	IN3	1.114 / .843	13.029	.000***		
	IN4	.827 / .533	7.849	.000***		
Perceived Pleasure	EN1	1.000 / .789	-	-	0.4488	0.7643
	EN2	1.052 / .767	12.379	.000***		
	EN3	1.241 / .883	14.767	.000***		
	EN4	1.242 / .868	14.449	.000***		
Sickness	DI2	1.000 / .696	-	-	0.7075	0.9060
	DI3	1.105 / .814	10.611	.000***		
	DI4	1.181 / .740	9.839	.000***		
	DI5	1.208 / .814	10.604	.000***		
Immersion	AB1	1.000 / .683	-	-	0.5930	0.8782
	AB2	1.440 / .745	10.184	.000***		
	AB3	1.728 / .863	11.559	.000***		
	AB4	1.679 / .873	11.669	.000***		
	AB5	1.336 / .711	9.757	.000***		
Intention of Continuous Usage	USE1	1.000 / .803	-	-	0.5668	0.8644
	USE2	1.124 / .878	15.369	.000***		
	USE3	1.160 / .877	15.362	.000***		
	USE4	1.118 / .841	14.489	.000***		
	USE5	.862 / .538	8.305	.000***		

Note: *** p < .001

<Table 8> Results of Hypothesis H1-1 ~ H5-1

Model		Coefficient		Standard Coefficient	t	p-value	Multicollinearity	
		B	S.E.	β			Tolerance	VIF
1	(Constant)	1.230	.311		3.949	.000***		
	Spatial Presence	.366	.058	.430	6.341	.000***	.572	1.747
	Perceived Interactivity	.077	.066	.080	1.171	.243	.558	1.792
	Perceived Pleasure	.253	.074	.242	3.395	.001***	.518	1.929
	Sickness	.018	.048	.022	.708	.708	.784	1.276

Note: R: .645[a], R^2: .417, adjusted R^2: .406, Durbin-Watson: 1.743
**: p<0.05, ***: p<0.01
Dependent Variable: Immersion

<Table 8> Results of Hypothesis H1-1～H5-1 (Cont.)

Model		Coefficient		Standard Coefficient	t	p-value	Multicollinearity	
		B	S.E.	β			Tolerance	VIF
2	(Constant)	1.271	.239		5.324	.000***		
	Immersion	.557	.059	.531	9.401	.000***	1.000	1.000

Note: R: .531[a], R^2: .282, adjusted R^2: .279, Durbin-Watson: 1.885
**: p<0.05, ***: p<0.01
Dependent Variable: Intention of Continuous Usage

<Table 9> Mediating Effect Results of Hypothesis H6-1～H6-4

Path Analysis (Direct Effects)						Estimate	S.E.	95% CI		P
								Lower	Upper	
H6-1	Continuous Intention	←		←	Spatial Presence	.235	.100	.062	.391	.033**
H6-2	Continuous Intention	←		←	Perceived Interactivity	-.026	.074	-.139	.109	.725
H6-3	Continuous Intention	←		←	Perceived Pleasure	.565	.084	.415	.688	.002***
H6-4	Continuous Intention	←		←	Sickness	.001	.066	-.117	.101	.998

Note: ** p < .05, *** p < .001

Path Analysis (Indirect Effects)						Estimate	S.E.	95% CI		P
								Lower	Upper	
H6-1	Continuous Intention	←	Immersion	←	Spatial Presence	.110	.063	.028	.230	.015**
H6-2	Continuous Intention	←	Immersion	←	Perceived Interactivity	.019	.022	-.009	.058	.325
H6-3	Continuous Intention	←	Immersion	←	Perceived Pleasure	.064	.038	.014	.134	.017**
H6-4	Continuous Intention	←	Immersion	←	Sickness	.015	.019	-.013	.050	.389

Note: ** p < .05, *** p < .001

Path Analysis (Total Effects)						Estimate	S.E.	95% CI		P
								Lower	Upper	
H6-1	Continuous Intention	←	Immersion	←	Spatial Presence	.345	.082	.201	.473	.002***
H6-2	Continuous Intention	←	Immersion	←	Perceived Interactivity	-.008	.076	-.122	.124	.949
H6-3	Continuous Intention	←	Immersion	←	Perceived Pleasure	.629	.072	.491	.738	.002***
H6-4	Continuous Intention	←	Immersion	←	Sickness	.016	.068	-.106	.115	.809

Note: ** p < .05, *** p < .001

<Table 10> Results of Hypothesis

	Hypothesis	Result
H1-1	Spatial presence of Korean users is positively associated with immersion.	Accepted
H2-1	Perceived interactivity of Korean users is positively associated with immersion	Rejected
H3-1	Perceived pleasure of Korean users is positively associated with immersion.	Accepted
H4-1	Sickness of Korean users is negatively associated with immersion.	Rejected
H5-1	Immersion of Korean users is positively associated with the intention of continuous usage.	Accepted
H6-1	Immersion of Korean users will have a mediating effect on spatial presence and the intention of continuous usage.	Accepted
H6-2	Immersion of Korean users will have a mediating effect on perceived interactivity and the intention of continuous usage.	Rejected
H6-3	Immersion of Korean users will have a mediating effect on perceived pleasure and the intention of continuous usage.	Accepted
H6-4	Immersion of Korean users will have a mediating effect on sickness and the intention of continuous usage.	Rejected

4.2. Results of Analyzing Chinese Data

4.2.1. Characteristics of the Sample of Chinese Data

Online and offline surveys were conducted on social networks such as WeChat and near Xingtai University in Xinjiang Province to collect data from Chinese users. The demographic questions asked to find out the characteristics of the sample were divided into gender, age, recognition of augmented reality games, and experience. The collected data was 274, with 153 males (55.8%) and 121 females (44.2%). The age group was 13 people in their 10s (4.7%), 158 people in their 20s (57.7%), 86 people in their 30s (31.4%), and 17 people in their over 40s (6.2%). All 274 people who participated in the survey knew and experienced augmented reality games.

4.2.2. Exploratory Factor Analysis of Chinese Data

As explained above, due to exploratory factor analysis of Chinese users, spatial presence, perceived interactivity, and perceived pleasure were bound as one variable. In the case of sickness, immersion, and

<Table 11> Exploratory Factor Analysis in Chinese Data

Items	Factor Loading		
HE1	.716		
HE2	.765		
HE3	.729		
HE4	.710		
HE5	.705		
HE6	.742		
HE7	.720		
HE8	.695		
HE9	.708		
HE10	.742		
HE11	.757		
DI1		.850	
DI2		.803	
DI3		.841	
DI4		.807	
AB1			.757
AB2			.766
AB3			.824
USE1			.801
USE2			.799
USE3			.843

Note: Total explained variance: 57.580%
Kaiser-Mayer-Olkin: .897
Barttlett's chi-squared: 1957.287, the degree of freedom: 105
Sig.: .000
HE: Hedonic Motivation, DI: Sickness, AB: Immersion, USE: Intention of Continuous Usage

<Table 12> Cronbach's alpha in Chinese Data

Variables	Cronbach's Alpha
Hedonic Motivation	.912
Sickness	.846
Immersion	.683
Intention of Continuous Usage	.746

<Table 13> Mean, S.D. in Chinese Data

	Mean	Standard Deviation	N
Hedonic Motivation	3.9751	.65971	274
Sickness	3.3349	.96711	274
Immersion	3.9161	.71658	274
Intention of Continuous Usage	3.9282	.76351	274

<Table 14> Correlation in Chinese

	1	2	3	4
1. Hedonic Motivation	1			
2. Sickness	.165**	1		
3. Immersion	.798**	.222**	1	
4. Intention of Continuous Usage	.833**	.158**	.755**	1

*Pearson: *, $p < 0.05$, **, $p < 0.01$*

the intention of continuous usage, the results were shown in <Table 11>.

Cronbach's alpha analysis was performed to verify the reliability, and the results were as follows (<Table 12>). In the case of immersion, the result value was over 0.6, and the other variables were over 0.7, which were acceptable and reliable values.

4.2.3. Analysis of Correlation, Mean, and Standard Deviation in Chinese Data

As a result of analyzing the correlation and mean and standard deviation among variables, Hedonic Motivation had a significant correlation with immersion and the intention of continuous usage. In addition, all the correlations among variables were found to be significant. The mean, standard deviation, and correlation results were shown in <Table 13> and <Table 14>.

4.2.4. Confirmatory Factor Analysis of Chinese Data

Confirmatory factor analysis was performed, and the model fit of confirmatory factor analysis was as follows. The values of CMIN: 435.951 (DF: 183, p: .000, CMIN/DF: 2.382), RMSEA: .071, NFI: .863, IFI: .916, TLI: .902, CFI: .915 were derived, the results indicated a suitable model for overall research analysis. The detailed results of confirmatory factor analysis were shown in <Table 15>.

Among the analyzed variables, in the case of immersion, the AVE value was slightly less than 0.5. However, the C.R. value was over 0.7, and this study was conducted without excluding immersion.

4.2.5. Result of Research Model Fit in Chinese Data

Before analyzing the hypothesis for Chinese data, this study set the identical method to Korean data. The model fit was as follows. Values of CMIN: 443.818 (DF: 184, p: .000, CMIN/DF: 2.412), RMSEA: .072, NFI: .860, IFI: .913, TLI: .900, and CFI: .913 were derived, and the model fit was determined to be suitable for conducting research. In the case of multicollinearity, the result value was up to 2.818. The multicollinearity problem was solved.

<Table 15> Confirmatory Factor Analysis in Chinese Data

Name	Items	Non-standardization coefficient / standardization coefficient	C.R.	p-value	AVE	Construct Reliability
Hedonic Motivation	HE1	1.000 / .678	-	-	0.5349	0.9266
	HE2	1.131 / .737	11.244	.000***		
	HE3	1.080 / .698	10.689	.000***		
	HE4	1.105 / .683	10.485	.000***		
	HE5	1.045 / .658	10.125	.000***		
	HE6	1.087 / .693	10.620	.000***		
	HE7	1.094 / .691	10.603	.000***		
	HE8	1.028 / .645	9.949	.000***		
	HE9	1.075 / .710	10.866	.000***		
	HE10	1.105 / .709	10.849	.000***		
	HE11	1.210 / .747	11.373	.000***		
Sickness	DI1	1.000	.798	.000***	0.5059	0.8034
	DI2	.945	.755	.000***		
	DI3	1.015	.788	.000***		
	DI4	1.049	.717	.000***		
Immersion	AB1	1.000	.568	.000***	0.4618	0.7192
	AB2	1.130	.695	.000***		
	AB3	1.129	.655	.000***		
Intention of Continuous Usage	USE1	1.000	.701	.000***	0.5306	0.7721
	USE2	.968	.680	.000***		
	USE3	1.068	.734	.000***		

Note: *** p < .001

<Table 16> Results of Hypothesis H1-2, H2-2, 3-2

Model		Coefficient		Standard Coefficient	t	p-value	Multicollinearity	
		B	S.E.	β			Tolerance	VIF
1	(Constant)	.057	.169	-	.336	.737		
	Hedonic Motivation	.960	.039	.829	24.338	.000***	.973	1.028
	Sickness	.017	.027	.021	.629	.530	.973	1.028

Note: R: .833[a.] R^2: .694, adjusted R^2: .692, Durbin-Watson: 2.087
**: p<0.05, ***: p<0.01
Dependent Variable : Immersion

Model		Coefficient		Standard Coefficient	t	p-value	Multicollinearity	
		B	S.E.	β			Tolerance	VIF
2	(Constant)	.777	.169		4.610	.000		
	Immersion	.805	.042	.755	18.999	.000	1.000	1.000

Note: R: .755[a.] R^2: .570, adjusted R^2: .569, Durbin-Watson: 1.953
**: p<0.05, ***: p<0.01
Dependent Variable : Intention of Continuous Usage

4.2.6. Result of Verifying Hypothesis in Chinese Data

SPSS and AMOS programs were used equivalently as previously analyzed by Korean users. The verification results of the changed hypotheses H1-2, H2-2, and H3-2 were as follows. Hedonic Motivation had a significant positive influence on immersion. However, sickness had no significant relationship with immersion. In addition, immersion had a significant positive relationship with the intention of continuous usage. Therefore, hypotheses H1-2 and H3-2 were accepted, and hypotheses H2-2 were rejected (<Table 16>). The analysis results to verify the mediating effect hypothesis were as follows. Hedonic Motivation directly affected the path of immersion and the intention of continuous usage but did not have an indirect effect. In the case of sickness, neither direct nor indirect effects were found to be significant. Therefore, hypotheses H4-2 and H4-3 were all rejected (<Table 17>).

Ⅴ. Conclusion

5.1. Research Conclusion

This study analyzed the factors influencing the intention of continuous usage to augmented reality games and compared users in Korea and China. The results of this study are as follows. First, in the case of Korean users, spatial presence and perceived pleas-

<Table 17> Mediating Effect Results of Hypothesis H4-2～H4-3

Path Analysis (Direct Effects)						Estimate	S.E.	95% CI		P
								Lower	Upper	
H6-1	Continuous Intention	←		←	Hedonic Motivation	1.562	1.269	.606	7.617	.006**
H6-2	Continuous Intention	←		←	Sickness	.083	.142	-.035	.688	.182

Note: ** p < .05, *** p < .001

Path Analysis (Indirect Effects)						Estimate	S.E.	95% CI		P
								Lower	Upper	
H6-1	Continuous Intention	←	Immersion	←	Hedonic Motivation	-.550	1.275	-6.535	.424	.274
H6-2	Continuous Intention	←	Immersion	←	Sickness	-.051	.128	-.685	.026	.193

Note: ** p < .05, *** p < .001

Path Analysis (Total Effects)						Estimate	S.E.	95% CI		P
								Lower	Upper	
H6-1	Continuous Intention	←	Immersion	←	Hedonic Motivation	1.012	.027	.947	1.059	.005***
H6-2	Continuous Intention	←	Immersion	←	Sickness	.032	.044	-.045	.129	.380

Note: ** p < .05, *** p < .001

<Table 18> Results of Hypothesis

	Hypothesis	Result
H1-2	Hedonic Motivation of Chinese users is positively associated with immersion.	Accepted
H2-2	Sickness of Chinese users is negatively associated with immersion.	Rejected
H3-2	Immersion of Chinese users is positively associated with the intention of continuous usage.	Accepted
H4-2	Immersion of Chinese users will have a mediating effect on Hedonic Motivation and the intention of continuous usage.	Rejected
H4-3	Immersion of Chinese users will have a mediating effect on sickness and the intention of continuous usage.	Rejected

ure had a positive (+) significant relationship with immersion. Unlike virtual reality, the significant influence of spatial presence on immersion means that the reality in which users exist and the game's situation were fused without any sense of incompatibility. In other words, if the screen on the game was consistent that it was difficult to distinguish between the real world and the screen on the game, the user's immersion increases, and the user could stay on the game. In addition, perceived pleasure, which was a crucial variable influencing immersion in previous studies, also had a significant relationship. Perceived pleasure influenced immersion in virtual reality and was found to have a significant relationship with game motivation. Even in augmented reality games, it was confirmed that users had an attitude that was not different from previous studies. From this point of view, immersion had a significant effect on the intention of continuous usage. The result could be explained as an essential factor for users to play and enjoy augmented reality games. Besides, spatial presence and perceived pleasure had a partial mediating effect on the intention of continuous usage through immersion. The user could recognize that immersion increases as the reality and the screen in the device converge. This situation made users use the games for a long time. Additionally, from the psychological point of view, if a user was enjoying a user-self, the psychological impact also affected immersion and be a motivation to stay in the game. Perceived interactivity and sickness in the analysis of Korean data were rejected. In the case of augmented reality games, the types of games enjoyed by individuals than by people around them, perceived interactivity did not seem to affect immersion. Sickness was judged to have no significant negative (-) relationship because the game was usually played by looking at the mixed screen of reality and the game, not only the computer screen.

Second, as a result of Chinese users, Hedonic Motivation had a significant effect on immersion. Chinese users also confirmed that the positive emotion while playing augmented reality games was a crucial factor. Besides, immersion affects the intention of continuous usage. Therefore, it could be explained by a virtuous circle of positive emotion, immersing, and continuously playing games. However, sickness did not affect immersion, including the negative relationship set as a hypothesis. As with the conclusion of Korean users, this result was judged to have the characteristics of augmented reality games. In other words, augmented reality users had no difficulty immersing themselves in the game as they felt the screen overlapped the real world and the virtual screen. Additionally, the results of Chinese users about immersion, the variable did not have mediating effect between variables. Instead, immersion had a causal relationship that influenced

an independent variable rather than a role as a mediating variable. Based on this result, it can be interpreted that Chinese users do not become immersed in the game over time but become immersed at the start of the game. This conclusion is interpreted as a unique characteristic of Chinese users and explains what companies should prepare to enter the Chinese market. For the immersion of Chinese users, companies need to design a game that allows them to immerse themselves with the start of the game rather than considering other variables.

Third, due to the data problem of the Chinese, it was difficult to compare with Korean data directly. However, similarities could be inferred through the conclusions. For both Chinese and Korean users, the result that pleasure affected immersion was derived. Moreover, immersion appeared to impact the intention of continuous usage. These results were consistent with previous studies and meant they had no differences depending on users between countries. In addition, in the case of sickness, users in both countries did not have a significant relationship with immersion or the intention of continuous usage, even a mediating effect. This conclusion could be interpreted as another characteristic of augmented reality having a different user screen from virtual reality. Differences were also found. Korean and Chinese users had different attitudes toward immersion. Immersion had some mediating effects in Korean data. However, in the case of Chinese users, immersion directly affected the intention of continuous usage, but immersion did not have a mediating effect among the set variables. In addition, in the case of Korean users, each independent variable was recognized according to the set variable, but in the case of Chinese users, independent variables were comprehensively understood and recognized. Both conclusions can be explained as the unique difference between users in countries about the new technology. In the previous related research, the study found a clear difference in new technologies and services due to cultural differences between countries in comparative analysis of users' attitudes toward third-party mobile payment services between Korean and Chinese users (Kim et al., 2019). Differences in the background culture of a society can cause differences in the consensus of members of each society. From this point of view, it is judged that the result would be no difficulty in interpreting differences in attitudes toward new technologies according to cultural differences. However, detailed studies on the causes of differences will be needed in the future.

5.2. Research Implication and Limitation

The Research implications and limitations were as follows. First, this research on augmented reality games was conducted from the user's point of view. The research model was confirmed by focusing on immersion, which was explained as significant in previous research. From the user's point of view, the conclusion has also practical significance. To make users stay longer in the game, companies need to provide a series of missions rather than fragmentary mission performance forms, such as Pokémon Go. In the case of Pokémon Go, the game temporarily experienced an explosive increase, but users left without continuously enjoying it, which could be explained by the relationship between the shape of the game and immersion. Therefore, if it is changed to a connected mission in the form of a series rather than performing a fragmentary mission, users could feel pleasure and immerse themselves in the game. Second, the differences between augmented reality and virtual reality were partially confirmed. Significantly, this study confirmed the

sickness, which was used as an essential variable in the virtual reality research field. This difference is judged due to the form of devices used in AR and VR games. VR games cover the surrounding field of view entirely, and the process of feeling comfortable by minimizing the physical discomfort of the user was necessary. However, in the case of AR games played on the device's screen, the physical discomfort felt by the user was significantly reduced. Thus, sickness would be evaluated not to mean in the augmented reality research field. Third, by indirectly comparing the results between countries, differences were found. This study set the four independent variables, which were found exclusion in previous research. However, Chinese data showed that Chinese users were more widely aware of the concept of pleasure. Thus, confirming characteristics of technology according to culture were perceived. The limitations of this study were as follows. First, as the study was conducted focusing on users who experienced augmented reality games, most respondents were in their 20s and 30s. As responses focused on young generations were analyzed, this study was limited to the generalization of results. Therefore, future studies should be conducted in consideration of the age of respondents. Second, when the Chinese data were analyzed for exploratory factors analysis, the results of three independent variables were grouped into one variable. Due to the result, this study could not perform a direct comparative analysis of results with Korean users, and it had a limitation in the results of deriving the characteristics of Chinese users. Future studies will need a detailed study to investigate if Chinese users perceive the three variables as one variable. By supplementing these limitations, we hope that future research would be secured higher completeness.

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