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Abstract

Augmented reality has become a trend today. The effects of Pokémon Go, the most popular smart phone game recently, on medicine and tourism have been explored in many studies. However, few studies on the cognition and the consistence between emotions and the integration of virtuality (the Pokémon projected in the game) and reality (information quality) have been done. With the Stimulus-Organism-Response (S-O-R) model as the framework, this study aims to explore the fit (cognitive/emotional) and reactions (user satisfaction) of the user in the virtuality-reality integration. According to the findings of this study, information quality and virtual features have significant influence on cognitive and emotional fit and emotional fit has significant influence on user satisfaction; however, cognitive fit doesn't have significant influence on user satisfaction. It has been found that the user pays much attention to his/her feelings when playing games. Therefore, we should get acquainted with the types and emotions of game players in addition to maintaining the quality of games.

Keywords: virtuality-reality integration, information quality, virtual feature, cognitive fit, emotional fit

Introduction

Virtual reality (VR) and augmented reality (AR) have been developing rapidly in recent years. VR is a three-dimensional (3D) user interface in which the user can perform actions and experience their consequences. It is a multidimensional, real-time simulation rather than a linear animation with predefined camera movement. The user of a VR system can usually move around freely in a virtual environment (Droivoldsmo and Louka, 2016). Cabero and Barroso (2016)defines AR consists in utilizing a set of technological devices that virtual environment combines virtual and real; in other words, it can be present in the real world and real time interaction. When it comes to augmented reality, information resides in the real content and the digital content only augments and completes it. Aside from being applied to various industries, they have gradually influenced our life and lead us into the second world. Their effects can be felt almost everywhere. Virtual reality generates a 3D virtual world through computer simulation. Based on the existence in the environment and the on-site feeling, it provides the user with sensory simulation and pursues high integration into the virtual environment, so that the user would feel as if he/she were on site (Steuer, 1992). Hence, virtual reality refers to showing reality in a virtual environment. Augmented reality appeared in the late 1960s when (Billinghurst et al., 2001)developed a virtual augmented reality system called MagicBook. By confining virtual contents and interaction to a virtual environment, it enabled the user to get fully involved in the virtual environment created by the computer; it was a technology which enhanced the visual effects for the user (Feiner, 2002). As the research proceeded, Milgram and Kishino (1994)proposed the diagram of continuity between the virtual and real environments, describing the connection between the real and virtual environments. Azuma (1997)believed that augmented reality should have three basic features: (1) the combination of the real and virtual worlds, (2) immediate interaction and (3) the operation in a 3D space. Augmented reality combines the user with digital information in the real world and presents them in a real environment, thus improving the user experience. Therefore, augmented reality focuses on the "virtual-reality integration" featuring the combination of reality and virtual information and emphasizes the interaction with the technology.

Currently, augmented reality has been widely used in different areas, such as the accurate location of operation in the medical field, the game entertainment and navigation based on the virtual-reality integration, and the positioning service in tourism. Actual cases include the interactive catalog of Ikea and the app called eBay Fashion. It is obvious that augmented reality is not only attractive but also of great contribution and application. Virtual-reality integration has gained increasing attention and has been applied to various fields, such as advertising(Zhu et al., 2008), entertainment and education(Ibáñez et al., 2014; Olsson et al., 2013), mobile device (Pierdicca et al., 2016) and medicine (Carmigniani et al., 2011). Recently, the most popular game app of virtual-reality integration is Pokémon Go, an augmented reality game on the mobile platform jointly launched by Google and Nintendo in July 2016. In Pokémon Go, the players can catch, train and trade the virtual Pokémons and compete with each other in the real world. By August 1, 2016, the game had been downloaded for over 100 million times worldwide, which shows the great public passion for it. Because of the game, many people step out of their houses and visit different places though augmented reality has been catching much attention. The benefits brought by Pokémon Go have exceeded our imagination, and many scholars have begun to probe into its effects on medicine (Serino et al., 2016), game and tourism. Pokémon Go influences the cognition and emotions of the user in many ways, but few studies have been done on the consistence between cognition and emotion of the user in face of the game quality or the virtual and real contexts. There have been many questionnaires about the cognitive and emotional fit, while the number of the questionnaires adapted to the virtual-reality integration is few and unfitted in our context. Hence, this study developed a scale to measure the degree of cognition and emotion in the use of Pokémon Go, so as to explore the reactions of the user in face of different stimulus and make different responses to the reactions.

This study was based on the environmental psychology theory presented by Mehrabian and Russell (1974), and deployed the Stimulus-Organism-Response (S-O-R) framework. The S-O-R framework has been widely used to examine environmental influences on individual responses. This study probed into the issues about the virtual-reality integration in Pokémons from the perspective of cognitive and emotional fit. After getting acquainted with the feelings of the game players in the context of virtual-reality integration, it focused on the fit of the user in the context. Therefore, this study aims to elaborate on the fit (cognitive/emotional) and reactions (user satisfaction). According to the above research objectives, this study attempts to answer the following questions: (a) What is the degree of the fit (cognitive/emotional) of the user in the context of virtual-reality integration? (b) What is the degree of the user reaction in the fit?

The remainder of this paper is organized as follows: Section 2 introduces the S-O-R model, the information system success model, the concept of fit, and user satisfaction; Section 3 includes the research model and hypotheses; Section 4 illustrates the research method; Section 5 shows the results of the data analysis; Section 6 is about discussions and conclusions; Section 7 mentions the limitations of this study.

LITERATURE REVIEW

S-O-R Model

The Stimulus-Organism-Response (S-O-R) model was developed by Mehrabian and Russell (1974) to explain the effects of human behavior in the environment. With environment as the stimulus factor, the model works this way: "stimulus -- physiological and psychological reaction -- response". After influencing individual cognition and emotion, it gives reactions to influence the behavior of the user; emotion is the medium which influences environment and human behavior. Mummalaneni (2005) adopted the S-O-R theory to interpret the relationship among the features of website, the cognitive and emotional reactions of consumers, and the responses of consumers. Based on the above theory, he developed an S-O-R theoretical framework to observe consumer behaviors in the environment. In the process, environmental stimulus is the environmental hint, while the individual part refers to the emotional and cognitive states of the user; the behavioral reaction was divided into two types -- approach and avoiding (Manganari et al., 2009). Belk (1975) Approach indicates all positive behaviors, such as being willing to stay for viewing more commodities, while avoiding just means the opposite (Bitner, 1992; Mehrabian and Russell, 1974). This shows that a pleasant environment would motive the user to have a positive and active mood and drive them to stay in the environment for a longer period to discuss the products. Hence, the prerequisite of the S-O-R architecture is to stimulate and influence the emotions of the user, and the reactions of the user may lead to behaviors in the environment (Thang and Tan, 2003).

The S-O-R theory is often applied to analyze the effects of users' feeling and experience in the environment, including travel motive (Rajaguru, 2014) and website (Kim and Lennon, 2013). In the virtual world, it is usually adopted to discuss what influences user experience in an environment, such as presence and immersion (Animesh et al., 2011; Gao and Bai, 2014). Apart from experience, it is also used to probe into the emotions and responses of the user (Huang and Huang, 2013). Hence, the theory is frequently applied in the studies on virtual environments like website, smart phone and game.

Information Quality

Proposed by DeLone and McLean (1992), the information system success model was updated in 2003 when information quality was defined as the evaluation of the output of the information system. According to the evaluation, the measurement items include the knowledge, completeness, accuracy, prudence, simplicity, mobility, solvability, relevance and timeliness of the output report. Both information quality and system quality influence user satisfaction. The model aims to measure the fast-growing information system in a more efficient and rapid way and meet the advent of the E-business era (DeLone and McLean, 2003).

Information quality means making use of the performance of the information system according to self-experience, so information quality focuses on establishing the rights and interests of the user. If the information quality is high, it can promote information exchange and interaction (Li et al., 2016). The same concepts are often applied to mobile networks (Chae et al., 2002) and games (Iachan and Nenov, 2015). As it is hard to win trust and dependence from the user, it is highly important to know the reliability of information (Zheng et al., 2013). In the smart phone games, the user must rely on the reliability of information to maintain his/her continuous use of the information. Hence, information quality is an essential measurement factor in the game.

In our study, the measurements of information quality include accuracy, relevance and reliability. When the players play the game, they need to find creatures and items according to accurate location-based services. The players also care about other game information, such as Pokémon types and abilities, to help them win battles and evolve their Pokémon, so the relevance is that the information (e.g. location and Pokémon statistics) must meet player needs. The map of item and gym locations is

important to the player, and the reliability of map information can enhance their confidence to find the things they want. Therefore, the information quality is important to players in the context of augmented reality.

Cognitive fit

To date, cognitive fit has been widely applied. But in the field of information management, the model of the cognitive fit theory was first developed by Vessey in 1991 (Vessey and Galletta, 1991). Initially, the cognitive fit theory was applied to explain personal decision-making and demonstrate that the fit relation indicated in the information affects psychological state and leads to behaviors; the quality and efficacy of decision-making can be improved by getting acquainted with problems and solving them in a skillful way (Vessey, 1991). Fit depends on the consistency in thinking, and the presentation pattern of information and task would trigger thinking. If there is fit, information pattern will become consistent with task and thus decision makers will not have to think about it, which will lead to fast and accurate decision-making. On the contrary, if the information in the two forms of thinking is inconsistent, there will be no fit and decision makers will have to spend energy changing their mind.

Many current studies have derived more complicated models from the basic problem-solving cognitive theory model according to their research topics. Shaft and Vessey (2006)put forward the extended cognitive fit theory model, a research model which shows the relationship among cognitive fit, understanding and modification. Chandra and Krovi (1999) also argued that the cognitive fit theory not only lead to fit between question statement and cognition and make results more efficient in solving problem but also offer the concept of extended cognitive fit for the external information and internal presentation of the user. According to the cognitive fit theory, the efficacy difference resides in the change of information pattern and its application to different fields, such as implementing geographical tasks and using map- or table-based presentation (Dennis and Carte, 1998). In terms of perception, some studies explored how fit influenced the online shopping behaviors of consumers in the information setting pattern and shopping tasks (Hong et al., 2004). A model was proposed according to the work memory capacity of cognitive fit and the online visual effects of information load theory, and the visual effects in the interaction between cognitive fit and work memory could contribute to good results (Zhu and Watts, 2010). Therefore, the extended cognitive fit theory developed the double-task problem-solving model according to the internal and external effects on the tasks of problem presentation. Based on the model of cognitive fit theory, it illustrates under what circumstances the two tasks are needed to solve problems.

Emotional Fit

Emotion and cognition are two reactions which are totally different from each other. Emotion refers to the consistence formed by multiple reactions (Lopes et al., 2005). Emotional reaction is faster than cognitive reaction and is a more intuitive thinking. Normally, people would develop first emotional judgment and then cognitive judgment (Kahneman, 2003). Emotional fit indicates the harmony between emotional features of human and the environment (Ozcelik, 2005). In other words, the user makes his/her emotions consistent with the thinking when he/she is in the environment, so that he/she will develop emotional memory which is faster than cognition when he/she is in a similar environment. This will help the user make a quick response.

When one is concentrated on what he does, his emotional feature and thinking may be influenced by the environment and then changed. For instance, a good workplace would contribute to positive emotion and thinking of an employee, which will enhance his work efficiency. This argument is similar to the activation theory. If one is affected by environmental stimulus and his abilities become weaker, he would feel anxious and downcast. In this case, he would take actions to strike a balance between emotion and task. There are three factors which lead to the anxiety (De Leersnyder et al., 2014b): (1) lack of alert, (2) slow judgment and (3) limited coordination. Though emotion and cognition are different, both are important for thinking. But in terms of entertainment experience, there is strong consistence between behavioral and psychological reactions (Lopes et al., 2005). Therefore, this study attempts to explore the effects of the fit emotion of the virtual and real contexts in games.

User Satisfaction

User satisfaction refers to the feeling after an activity. Despite the different definitions of and views on user satisfaction, it is generally defined as users' feeling after the use of a product or service; it is the evaluation between the "beforehand expectation" and "actual performance" of a product or service. If actual performance meets or exceeds beforehand expectation, the user would feel satisfied; in contrast, he/she would feel unsatisfied. It shows that the user' emotions or feelings have great effects on satisfaction. User satisfaction has always been widely used in such fields as e-book(Huang et al., 2017), website (Bharati and Chaudhury, 2015), online group buying (Shiau and Chau, 2015) ,mobile application (Song et al., 2014), medicine (Hirst et al., 2014), and game (Huang et al., 2014). After summarizing the academic papers on user satisfaction with games, Sweetser and Wyeth (2005) developed a model to evaluate user satisfaction in games. The balance of games would influence some relevant variables, such as challenge and player skill; it also influences user satisfaction. In the game, user satisfaction would be influenced by the balance of games, and this is the challenge confronting the user (Andrade et al., 2006). Therefore, user satisfaction is often adopted to measure the gap between game and users' expectation as well as their feelings.

Research Model and Hypotheses

In this study, the S-O-R theory framework was taken as the architecture of the study on the user facing the virtual-reality integration in smart phone games. In the part of "Stimulus", the emphasis was placed on the information quality in the information success model when the user played Pokémon Go. As for the system quality frequently seen in the information success model, the Pokémon Go system is stable. The service quality is also stable because the service is provided for the user as a whole; moreover, it is considerate. Therefore, the dimension was not adopted. Additionally, the features of measuring the virtual parts of the augmented reality of smart phone games were added; the mediation of the physiological and psychological reactions (Organism) in the S-O-R theoretical framework was the measurement of the degree of fit of cognition and emotion in the context of virtual-reality integration; in terms of "Response", user satisfaction was taken as the final result to develop the research model of this study, as is shown in Figure 1. The deduction of the hypotheses of this study is illustrated as follows:

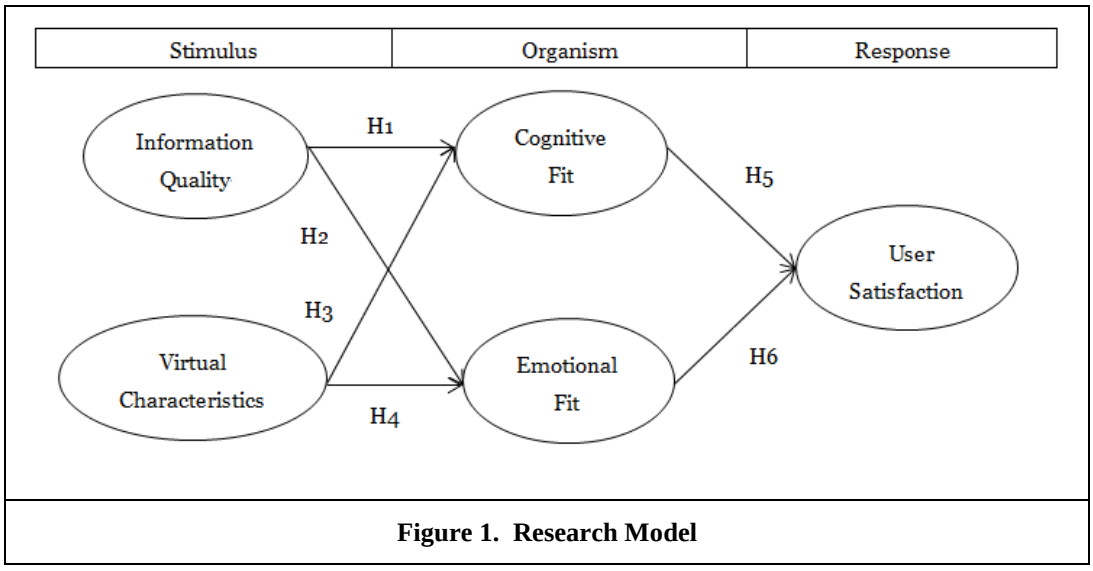


Figure 1. Research Model

According to Hsu et al. (2016), the user would have a more fruitful and delightful experience when receiving high-quality information (in terms of completeness, accuracy, diversity or reliability), which will further influence his/her feelings in cognition. In the cognitive fit theory, both the information presentation and the decision-making would trigger thinking. If there is any inconsistency in thinking, the user must make greater efforts to deliver information, which may result in delay of information delivery or reduce the accuracy of information (Rieh, 2002). Hence, fit makes the user believe that the information is accurate and reliable (Liu et al., 2014). So it is with the game: higher-quality information would make the user believe that the game is more convenient and operable (Dunn and

Grabski, 2001). Therefore, information quality may influence the cognitive fit of the user in smart phone games. In consideration of this, H1 was proposed:

H1: Information quality has positive effects on cognitive fit.

Information quality refers to the relevance, accuracy and immediacy of information. A more stable and reliable system will contribute to a better mood of the user during the game (Yang et al., 2013). Therefore, H2 was put forward:

H2: Information quality has positive effects on emotional fit.

There are many virtual objects in the virtual-real augmentation and the virtual reality, and they have different features which would have different effects. The features of virtual objects, such as attraction, form and skill, would have direct impacts on the cognition and emotion of the user (Suh and Lee, 2005). In the game, if the players can enjoy in the experience of these virtual-real augmentation, they will increase positive emotion and cognition. Hence, H3 and H4 were proposed:

H3: The features of virtual objects have positive effects on cognitive fit.

H4: The features of virtual objects have positive effects on emotional fit.

The user would develop cognition through the thinking after playing games, and the fit between cognition and feeling would enhance user satisfaction (Dunn and Grabski, 2001). Garaus et al. (2015) argued that cognitive fit had direct effects on the perceived values like satisfaction in the use of products in shopping; a low cognitive fit would result in bewilderment and reduce user satisfaction. The notion is consistent with this study: the cognition which formed after playing games may influence user satisfaction. For that reason, H5 was put forward:

H5: Cognitive fit has positive effects on user satisfaction.

User satisfaction refers to the degree of the user's satisfaction with certain product or service. If the product system offers appropriate assistance or the service works, there will be stronger user satisfaction. In the study on marketing, Parise et al. (2016) pointed it out that the cognitive fit and emotional fit in consumer experience would influence the behavior and attitude (such as satisfaction and participation) of consumers. Aside from referring to personal feeling, emotional fit emphasizes the interpersonal emotional communication. More emotional communication would contribute to greater satisfaction (De Leersnyder et al., 2014b). So it is with playing games: one would feel delighted and happy when playing games with friends, which will lead to his/her satisfaction with the whole operation. Therefore, H6 was proposed:

H6: Emotional fit have positive effects on user satisfaction.

Research Method

Data collection and subjects

The operational definitions and items in the questionnaire of this study were developed according to relevant academic papers and were modified according to the realities of this study. In the process, a scale was made to measure cognitive fit and emotional fit. To ensure the effectiveness of the questionnaire, three professors and one graduate were invited to discuss and improve the questionnaire. To make sure that the subjects would understand the items and get more acquainted with this study, eight students and commuters who had played Pokémon Go were invited to take the trial test to increase the content validity. After the modification, one of the eight respondents who had filled in the questionnaire was invited to fill in the modified questionnaire, so as to ensure that the modified one could be fully understood. The Likert 5-point scale was adopted in the questionnaire, ranging from 1 (strongly disagree) to 5 (strongly agree). Most of the subjects were college students. The data collection was done though paper questionnaire. Of the 196 retrieved questionnaire copies, 38 ones were removed because the subjects had never played Pokémon Go and 10 failed to give a complete answer. Therefore, the total number of valid samples was 148, with an effective retrieval rate of 76%.

Measurement development

Information quality refers to the user's perception of relevance, immediacy and information accuracy in Pokémon Go (Seddon, 1997). Feature of virtual Pokémons means that the virtual feature system influences the relationship the user, the game and other players and controls their roles to achieve the objectives in the game (Lo and Wen, 2010). Cognitive fit indicates the degree to which the user develops cognition and evaluates the game after thinking about and understanding it for a period of time. Emotional fit implies the degree of the user's emotion in Pokémon Go. User satisfaction refers to the positive feeling the user gets in the virtual-real transformation in Pokémon Go (Andri et al., 2015). All of the above operational definitions were based on the scale literature of relevant academic papers. Except the items about cognitive fit and emotional fit, the measurement of the scale is based on the Likert 5-point scale, ranging from 1 (strongly disagree) to 5 (strongly agree). The operational definitions of constructs and measurement items are shown in Table 1.

Table 1. Constructs' operational definitions and measurement items

Constructs and Operational definitions	Measurement items	Sources
Information Quality The user's perception of accuracy, relevance and reliability of information generated by Pokémon Go. (Seddon, 1997)	The Pokémon Go system provides the accurate information I need.	Andri et al. (2015)
	The information (e.g. location and game instructions) meets my needs.	
	I think the information in Pokémon Go is reliable.	
Virtual (object) characteristics The player's sense of the importance of the virtual objects in the game by measuring its representative design features. (Lo and Wen, 2010)	The appearance of the virtual Pokémon is attractive.	Lo and Wen (2010)
	Each Pokémon has a unique visual appearance in the game.	
Cognitive fit The degree of the user's cognitive response to the game matching virtual characteristics (virtual) with accurate real-world information (reality) in Pokémon Go after thinking about and understanding it for a period of time. (self-developed)	In the AR environment, capturing Pokémon is smooth.	self-developed
	The location of Pokémon in the AR environment is accurate.	
	Interactions in the AR environment are immediate.	
Emotional fit The degree of the user's positive emotional reaction to matching with virtual characteristics (virtual) with real-world information (reality) in Pokémon Go.	I feel good in the AR environment.	self-developed
	I feel great in the AR environment.	
	I feel excellent in the AR environment.	
User Satisfaction The positive feeling the user gets in Pokémon Go. (Andri et al., 2015)	In general, Pokémon Go makes me happy.	Chen et al. (2012)
	In general, Pokémon Go satisfied me.	
	In general, Pokémon Go delights me.	

Data Analysis and Results

The data analysis tools of this study include IBM SPSS Statistics 22 and the structural formula model IBM Amos 22. In the process, IBM SPSS Statistics 22 was adopted for the descriptive statistics the samples. IBM Amos 22 was applied to analyze the measurement model and the structural model as

well as demonstrate the relations among the variables. After the reliability and validity of the items of the questionnaire were tested, the hypothesis model of this study was tested.

Demographic profiles

There are 148 samples in this study, 52.7% (n=78) of them are males and 47.3% (n=70) females. As most of the subjects are college students, those aged from 20 to 24 (80.4%, n=114) accounts for the largest proportion. Of the 148 subjects, 46.6% (n=69) spent less than half an hour playing Pokémon Go every day on average; 41.9% (n=62), less than a day every week on average; 49.3% (n=73), less than a week every month on average; 33.8% (n=50) played the game for 1 to 2 months. The descriptive statistics about the samples is shown in Table 2.

Table 2. Descriptive statistics of respondent characteristics

Item	Measurement Item	Number of Subjects	Percentage (%)
Gender	Male	78	52.7
	Female	70	47.3
Age	Below (including) 19 years old	18	12.2
	20-24 years old	119	80.4
	25-29 years old	3	2.0
	30-34 years old	3	2.0
	Above (including) 40 years old	5	3.4
How long do you play Pokémon Go every day on average?	Less than 0.5 hours	69	46.6
	0.5-1 hours	45	30.4
	1-1.5 hours	12	8.1
	1.5-2 hours	11	7.5
	More than 2 hours	11	7.4
How many days do you play Pokémon Go every week on average?	Less than 1 day	62	41.9
	1-3 days	42	28.4
	3-5 days	20	13.5
	5-7 days	24	16.2
How many days do you play Pokémon Go every month on average?	Less than 1 week	73	49.3
	1-2 weeks	34	23.0
	2-3 weeks	16	10.8
	3-4 weeks	25	16.9
How long have you played Pokémon Go?	Less than 1 week	35	23.6
	1 week-1 month	50	33.8
	1 month-2 months	29	19.6
	2 months-4 months	25	16.9

Common method bias

We collected all data in a cross-sectional survey, so we carried out Harman's one-factor test(Harman, 1976)to examine the possible issue of common method bias. Five factors emerged with eigenvalues greater than one in an unrotated principal-component analysis of all independent and dependent variables. While one factor contributing to more than 50% of total variance is considered an indication of common method bias, the factor with the greatest variance in our analysis accounts for 45.992% of the total variance. This indicates that common method bias is not likely to be a serious problem in this study.

Measurement Model

The measurement model was analyzed to find out the dimensions of reliability and discriminant validity, and three most frequently-used indexes were selected to evaluate the measurement model (Shiau and Chau, 2016). The indexes include Factor Loading, Composite Reliability (CR) and Average Variance Extracted (AVE). According to the reliability and validity evaluation standards proposed by

Fornell and Larcker (1981), (1) if the factor loading is over 0.7, the quality is ideal; if it is over 0.6, the quality is acceptable; (2) Composite Reliability (CR) should be over 0.8; (3) Average Variance Extracted (AVE) should be over 0.5, as is shown in Table 3. Discriminant validity aims to discriminate the relations among potential dimensions, and the AVE square roots of potential variables need to be higher than relevant coefficients of other dimensions. In this study, all the AVE square roots of the dimensions were higher than the variable values shared among the dimensions. Therefore, they have high discriminant validity, as is shown in Table 4.

Table 3. Reliability and Validity of the Measurement Model

Construct	Item	Item Mean	Factor loading	Cronbach's Alpha	CR	AVE
Information Quality	IQ 1	3.22	0.807	0.770	0.781	0.546
	IQ 2	3.29	0.762			
	IQ 3	3.22	0.638			
Virtual (object) characteristics	VC 1	3.64	0.888	0.735	0.754	0.610
	VC 2	3.89	0.657			
Cognitive fit	CF 1	3.51	0.63	0.762	0.765	0.523
	CF 2	3.27	0.751			
	CF 3	3.59	0.779			
Emotional fit	EF 1	3.58	0.85	0.885	0.886	0.722
	EF 2	3.46	0.871			
	EF 3	3.29	0.828			
User Satisfaction	US 1	3.45	0.837	0.902	0.904	0.758
	US 2	3.28	0.886			
	US 3	3.34	0.887			

Table 4. Discriminant Validity

	Emotional fit	User satisfaction	Cognitive fit	Virtual feature	Information quality
Emotional fit	**0.850**				
User satisfaction	0.726	**0.871**			
Cognitive fit	0.598	0.482	**0.723**		
Virtual feature	0.600	0.568	0.590	**0.781**	
Information quality	0.708	0.496	0.539	0.473	**0.739**

Note: Bold-line values on the diagonal indicate the square roots of AVE.

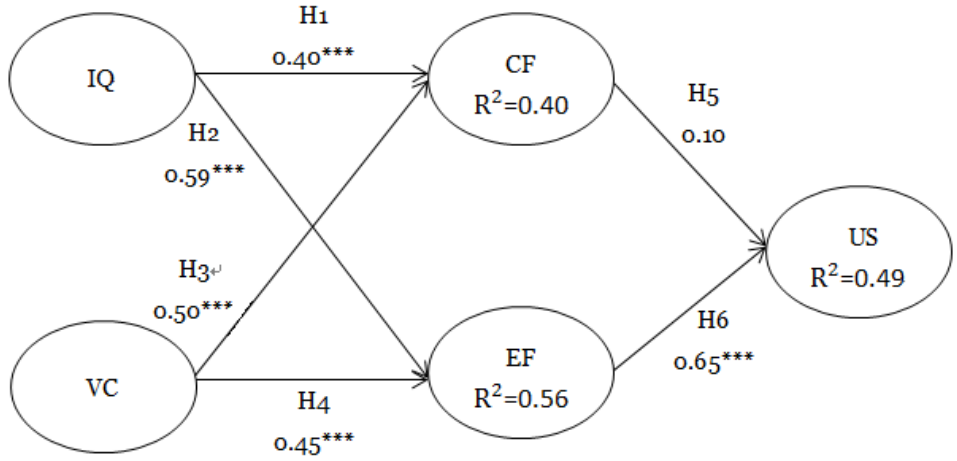
Table 5. Fit of the Measurement Model and the Structural Model

Fit Statistics	Research model	Recommended Range	References
χ^2	97.990	—	—
Degree of Freedom (d.f.)	67	—	—
Normed χ^2 (χ^2/d.f.)	1.463	<=3	Bollen (1989)
Goodness of Fit Index (GFI)	0.920	>= 0.9	Scott (1995)
Adjusted Goodness of Fit Index(AGFI)	0.874	>=0.8	Scott (1995)
Comparative Fit Index (CFI)	0.972	>= 0.9	Bagozzi and Yi (1988)
Normed Fit Index (NFI)	0.917	>= 0.9	Bentler and Bonett (1980)
Incremental fit index (IFI)	0.972	>= 0.9	Bentler and Bonett (1980)
Root Mean-Square Error of Approximation (RMSEA)	0.056	<=0.08	Jarvenpaa et al. (2000)

Structural Model

The structural model was adopted to explore the fit analysis and potential dimensions of the research model and the path coefficients among the potential dimensions. Besides, it was used to review the

summary and explanatory ability of the dependent variables. The structural model of this study is shown in Figure 2.



Note：*p<0.05; **p<0.01; ***p<0.001

(IQ: Information Quality, VC: Virtual (object) characteristics, CF: Cognitive fit, EF: Emotional fit, US: User Satisfaction)

Figure 2. Results of Structural Model

According to the structural model, 49% (=0.49) of the explanatory ability lies in user satisfaction; 40% (=0.4) in cognitive fit; 56% (=0.56) in emotional fit. As for H1, information quality had significant effects on cognitive fit (γ=0.40, p<0.001), so H1 is supported; as for H2, information quality had significant effects on emotional fit (γ=0.59, p<0.001), so H2 is supported; as for H3, the features of virtual Pokémons had significant effects on cognitive fit (γ=0.50, p<0.001), so H3 is supported; as for H4, the features of virtual Pokémons had significant effects on emotional fit (γ=0.45, p<0.001), so H4 is supported; as for H5, cognitive fit had no significant effects on user satisfaction (γ=0.10, p=.271), so H5 is not supported; as for H6, emotional fit had significant effects on user satisfaction (γ=0.65, p<0.001), so H6 is supported.

Discussion and Conclusion

The study focused on the satisfaction with information quality, features of virtual Pokémons, cognitive fit and emotional fit of the augmented reality smart phone games based on the virtual-reality integration. Except the insignificant effects of cognitive fit on user satisfaction, most of the hypotheses showed significant effects.

The results indicate that information quality positively affects cognitive fit and emotional fit. The outcome of this study is consistent with the findings of previous research(Hsu et al., 2016; Yang et al., 2013). In the game of virtual-reality integration, this study took the information quality of the game for the real part, with focus on the information of the game, including the accurate geographic location, the tools for the user, the virtual Pokémons provided by the system, the activities for different festivals. All these enhance the user's trust in the game. After a period of time, the user would believe that the information of the game is smooth and accurate; moreover, the information is updated in time, which wins the user's trust.

The results indicate that virtual (object) characteristics positively affect cognitive fit and emotional fit. These findings are consistent with previous study (Suh and Lee, 2005). As for the virtual part, the virtual features of the augmented reality game, or the Pokémon features are diverse, colorful and exquisite in form; meanwhile, each Pokémon has different skills, making the game more interesting. Because of these, the user would regard the Pokémon capture as something fresh and interesting.

The results indicate that emotional fit positively affects user satisfaction, but cognitive fit does not have a significant effect on user satisfaction. The outcome of this study is consistent with the findings of previous research (De Leersnyder et al., 2014a), but inconsistence outcome with the study of(Dunn and Grabski, 2001). In the process, the user feels as if he/she were playing with the roles in the cartoons in his/her childhood. So even after a period of time, the user would still visit the place to catch rare virtual Pokémons. This indicates the fit between the features of virtual Pokémons and cognition. But in the context of virtual-reality integration, user satisfaction doesn't increase though the user initially believes that the game is smooth, vivid and colorful. Therefore, the satisfaction fit of this game is the intuitive emotional reaction rather than the cognitive reaction based on thinking.

According to the Stimulus-Organism-Response framework, this study developed the research model to test the fit between cognitive and emotional reactions in the virtual-reality integration. In the questionnaire survey, the factors of virtual-reality integration (information quality and the features of virtual Pokémons) were adopted for the user's cognitive fit and emotional fit. Additionally, there was fit reaction to the user's follow-up satisfaction. According to the results, the user felt the cognitive fit and the emotional fit for the quality of the game as well as for the virtual part. But surprisingly, the user attaches importance to immediacy in the game. In other words, the user would decide if he/she would continue to play a game when he/she plays it for the first time. If he/she is not interested in it, he/she would immediately delete it. Therefore, the user needs to know his/her style and emotion before paying attention to the stability and diverse setting of games.

Contributions and Research Limitations

The research contributions of our study are discussed below. First, few prior studies focus on the cognitive and emotional fit perspective to discuss the integration of virtual reality in mobile games, and this study helps to fill that gap. Second, our study adapted the framework of the Stimulus-Organism-Response (S-O-R) model to explain the users' cognitive behavior and confirmed this model can suit the context of VR video games. Third, our model combined measurements modified from previous studies, new self-developed measurements and practical observation in context. After we have confirmed the reliability and validity, these measurements can be adapted in the virtual-reality context. The practical contribution is that our research identified cognitive fit did not have a significant effect on user satisfaction, while emotional fit had a significant effect on it. The results suggest that developers can focus on the users' emotions to provide game features that are more exciting, arouse users' positive emotions, and enhance user flow and satisfaction in the virtual-reality environment.

There are two limitations in this study. The first is that most of the questionnaire respondents were college students, so only the opinions of a specific group of people were collected. The second one is that the subjects were unclear about the definition of the questionnaire time. As Pokémon Go7 was launched in July 2016, there might be some deviations caused by the inadequate memory of the subjects or different levels of concentration in filling the questionnaire. Nowadays, there have been an increasing number of virtual and augmented games, and the findings of this study may offer some reference for the development of game companies. It is true that a stable system is important for a game, but the form of the game and the emotion of the user matter more. Academically, the scale for measuring cognitive fit and emotional fit, which was made according to the context of virtual-reality integration, can be useful for future scholars.

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