Acceptance of GPS-based Augmented Reality Tourism Applications

Timothy Jung, Senior Lecturer, Manchester Metropolitan University
Mincheol Kim, Professor, Jeju National University
M. Claudia Leue. Research Assistant, Manchester Metropolitan University

Abstract
The rapid development of Augmented Reality (AR) has resulted in an increased interest by the tourism industry to implement this cutting edge technology into the visitor experience at destinations. However, tourism research focusing on augmented reality is still relatively limited with only few studies focusing on augmented reality acceptance. This study uses an extended technology acceptance model to test tourists' acceptance of GPS-based Augmented Reality application at a themepark in Jeju Island, South Korea. A total of 186 usable data were collected and analysed using a structural equation modelling. The findings show that personal innovation, trust and relative benefits influence tourists' adoption of GPS-based AR applications.

Key Words Augmented Reality, GPS-based, Technology Acceptance, Jeju Tourism

Theme Theme 4 – Technological Futures

Introduction
The rapid development of Augmented Reality (AR) has resulted in an increased interest by the tourism industry to implement this cutting edge technology into the visitor experience in particular at heritage tourism destinations (Jung & Han, 2014). AR can be described as the overlay of information into the real environment (Han, Jung, & Gibson, 2014; Van Krevelen & Poelman, 2010). There are two different types of AR applications; marker based applications which are ideally for the implementation in indoor environments as well as GPS-based AR application which are favourable for the implementation outdoors (Walsh, 2011). Tourism practitioners and researchers have increasingly gained an interest as to how AR can be implemented into the industry, however there has only been few research that investigated users' intention to accept AR applications (Haugstvedt & Krogstie, 2012; Leue, tom Dieck, & Jung, 2014). Technology acceptance research to date focused on the intention to use AR for cultural heritage sites (Haugstvedt & Krogstie, 2012) as well as e-learning (Wojciechowski & Cellary) while studies focusing on the adoption of GPS-based AR within the tourism sector are scarce. Leue et al. (2014) proposed a theoretical model of AR acceptance and called for empirical investigation of the acceptance of AR within the tourism context. Therefore, this research aims to close the gap in the literature by focusing on tourists' acceptance of GPS-based AR application at a themepark in Jeju Island, South Korea.

Literature Review
Augmented Reality in Tourism
AR developed as one of the most promising technological innovations and has already been adopted within a number of industries, most prominently the manufacturing industry. AR enables the overlaying of digitally created information into the real world environment. To access this kind of information, users require camera or

GPS enabled devices. The emergence of smartphones has led to an increased interest in AR application within the tourism industry (Yovcheva et al., 2012). Due to the possibility of using AR applications anywhere and anytime, Pang et al. (2006) argued that AR has the potential to become the next generation of computerised tourist guide. Han et al. (2014) acknowledged that the tourism industry is a highly competitive market, where destinations have to constantly invest in modern information technology in order to stay competitive. According to Yovcheva et al. (2012), mobile tourism applications are constantly being developed in order to account for the demand in this new technology. Höllerer and Feiner (2004) pointed out that mobile devices should not only provide GPS-based navigations, but in order to increase the visitor experience they should also be able to provide background information in regards to the user's immediate surroundings.

Technology Acceptance Model

Scholars took a number of perspectives to examine the acceptance of technological innovations. The technology acceptance model (TAM), proposed by Davis in 1989, is amongst the most influential and accepted models (Ayeh et al., 2013a; Morosan, 2012; Wu et al., 2011). According to Davis (1989) two factors, perceived usefulness and perceived ease of use, affect users' behavioural intention to accept new technologies. Since its original development, The TAM was validated and applied to different research contexts (Schepers & Wetzels, 2007). Recently, scholars applied the TAM within the context of mobile applications and services (Chen et al., 2011; Choi et al., 2011; Gao et al., 2011; Liang et al., 2011; Liu & Li, 2011; Zarmpou et al., 2012). Also within the tourism context, Peres et al. (2011) and Tsai (2011) investigated the acceptance of mobile tourist guides. At the latest, researchers (Haugstvedt & Krogstie, 2012; Wojciechowski & Cellary, 2013) investigated users' acceptance of mobile AR. To increase the explanatory power of the TAM, scholars extended the traditional TAM with external variables that are specifically applicable to the context of research (Wu et al., 2011).

Relative Benefits

The external variable of relative benefits stems from the Diffusion of Innovation Theory (Rogers, 1995). Wu and Wang (2005) strengthened the construct's importance and pointed out that relative benefits (advantages) is commonly adopted for acceptance research of innovative technologies. Venkatesh et al. (2003, p. 449) defined relative benefits as the "degree to which using an innovation is perceived as being better than using its precursor". Also Kolodinsky et al. (2004) supported within their research that users are more likely to adopt a new and innovative technology if they have positive perceptions about the relative benefits and therefore, the following hypotheses were constructed:

H_{1a}. Relative benefits has a positive effect on PEU (perceived ease of use) of GPS-based AR system.
H_{2a}. Relative benefits have a positive effect on PU (perceived usefulness) of GPS-based AR system.

Perceived Enjoyment

The external construct of perceived enjoyment has experienced increased interest from TAM researcher focusing on e-commerce applications (Ha & Stoel, 2009; Lee et al., 2012). It was defined as "the extent to which the activity of using a specific system is perceived to be enjoyable in its own right, apart from any performance consequences resulting from system use" (Antón et al., 2013, p.374). As identified above, only few studies have focused on AR acceptance and those who did incorporated perceived enjoyment as an external variable into their AR acceptance model (Haugstvedt & Krogstie, 2012; Leue et al., 2014; Wojciechowsk & Cellary, 2013) and therefore, the following hypotheses were constructed:

H_{1b}. Perceived enjoyment has a positive effect on PEU (perceived ease of use) of GPS-based AR system.
H_{2b}. Perceived enjoyment have a positive effect on PU (perceived usefulness) of GPS-based AR system.

Trust

Also trust was perceived as important determinant of e-commerce acceptance by previous researchers (Ayeh et al., 2013a; Wu et al., 2011; Zhang & Mao, 2008). According to Wu and Liu (2007), trust is defined as a belief that applications perform in accordance with users' expectations and confidence. Ha and Stoel (2009) acknowledged the importance of trust for perceived usefulness and also within the tourism context, Ayeh et al. (2013a) confirmed that trustworthiness influences travellers' perceived usefulness of social networks. In addition, previous mobile service acceptance research (Zarmpou et al., 2012) supported the paths of trust towards perceived usefulness and perceived ease of use and therefore, the following hypotheses were constructed:

H_{1c}. Trust has a positive effect on PEU (perceived ease of use) of GPS-based AR system.
H_{2c}. Trust has a positive effect on PU (perceived usefulness) of GPS-based AR system.

Personal Innovation

Based on the Diffusion of Innovation Theory (Rogers, 1995), personal innovativeness can be defined as users' willingness to adopt or reject a new technological innovation. A number of scholars acknowledged that personal innovativeness is an important external construct of technology acceptance (Choi et al., 2011; Hung et al., 2003; Morosan, 2012; Yang, 2005). Yang (2005) identified a number of key characteristics of personal innovativeness including an optimal stimulation level, variety as well as novelty-seeking. Also Leue et al. (2014) proposed to integrate personal innovativeness into an AR tourism acceptance model and Zarmpou et al. (2012) supported the paths from personal innovation towards perceived usefulness and perceived ease of use of mobile service acceptance and therefore, the following hypotheses were constructed:

H_{1d}. Personal innovation has a positive effect on PEU (perceived ease of use) of GPS-based AR system.
H_{2d}. Personal innovation has a positive effect on PU (perceived usefulness) of GPS-based AR system.

Perceived Ease of Use and Perceived Usefulness

Perceived Ease of Use and Perceived Usefulness are mediating variables within the TAM. Davis (1989) proposed that perceived ease of use influences perceived usefulness of new technological innovations. In addition, it was proposed that perceived ease of use and perceived usefulness influence the attitude towards using technologies. These relationships were supported by a large number of TAM researchers (e.g. Castaneda et al. 2007; Gao et al., 2011; Lee et al., 2012) and also within the AR tourism acceptance context, Leue et al. (2014) proposed the aforementioned relationships. In addition, a number of researchers (Ayeh et al., 2013a; Castaneda et al., 2007; Lee & Lehto, 2013; Zhang & Mao, 2008) concluded that there is also a direct relationship between perceived usefulness and the intention to use and therefore the following hypotheses were constructed:

H_3. Perceived ease of Use (PEU) has a positive effect on PU of GPS-based AR system.
H_4. Perceived ease of Use (PEU) has a positive effect on attitude to use of GPS-based AR system.
H_5. Perceived usefulness (PU) has a positive effect on attitude to use of GPS-based AR system.
H_6. Perceived usefulness (PU) PU has a positive effect on intention to use of GPS-based AR system.

Attitude

Within the present study, tourists' attitudes toward the usage of AR applications can be defined as respondents' feelings and beliefs toward using their AR applications when experiencing the themepark (Gao et al., 2011). The TAM proposes that the attitude towards using a technology influences users' intention to actually use the innovation (Davis, 1989) which was confirmed by a number of scholars (Ayeh et al., 2013a; Castaneda et al. 2007; Lee et al., 2011; Lee et al., 2012; Leue et al., 2014; Shin, 2007). Lee et al. (2011) confirmed that a positive attitude will lead to the acceptance of a technology while a negative attitude will most likely lead to a rejection thus, it is an important determinant of the intention to use. Therefore, the following and final hypothesis was constructed:

H_7. Attitude to use of GPS base AR system has a positive effect on intention to use of GPS-based AR system.

Intention to Use

In the TAM, intention to use is the dependent variable. Van der Heijden (2004) identified that the intention to use is dependent on the hedonic or utilitarian nature of the technology. According to Ayeh et al. (2013a, p. 258) behavioural intention "has generally been regarded as a person's subjective probability that he will perform some behaviour". For the present study, this behaviour constitutes visitors' future intention to use GPS-based AR applications.

Methods

The study was conducted with 186 tourists who participated at the AR experience centre of Characworld theme park at Jeju Island, South Korea. Characworld theme park is operating since 2011 and offers families a large variety of interactive experiences that are inspired by famous movie and cartoon characters. Attractions include video game stations and virtual horse-racing as well as illusion studios with a wide array of photo opportunities (The Jeju Weekly, 2011). The data were collected using a convenience sampling technique. The questionnaire was distributed to visitors who have experienced marker-based AR application and asked their intention to use GPS-based tourism AR application. The questionnaire included eight sections and each construct was measured by two to seven measurement items which were adopted from previous research. The eight measured constructs included trust (Gefen et al., 2003), personal innovation (Choi et al., 2011), relative benefits (Venkatesh et al., 2003; Wu and Wang, 2005), perceived enjoyment (Lee et al., 2012), perceived ease of use (Choi et al., 2011), perceived usefulness (Van der Heijden, 2004), attitude (Gao et al., 2011) and intention to use (Lee et al., 2012). All items employed a five point Likert-type scale with 1 being "strongly disagree" and 5 being "strongly agree". In regards to the data analysis, a review of TAM literature showed that prior studies used structural equation modelling (SEM), a regression-based technique rooted in path analysis. In order to ensure the reliability and validity of measurement items, exploratory factor analysis (EFA) as well as confirmatory factor analysis (CFA) were conducted prior to the SEM using AMOS 20.0.

Findings

Sample Characteristics

Among the 186 respondents, 114 respondents (61.3%) were males and 72 respondents (38.7%) females. Approximately 46.8% of respondents were in the age group of 30 to 39, 23.7 per% in the age group of 20 to 29, 24.7% were 40 and above; and 4.8% were under 20. With regards to the highest education level, 50.0% of the respondents had a higher university-level. In terms of smartphone experience, 64.0% of the respondents have used their smartphone for over 1 year.

Exploratory Factor Analysis and Confirmatory Factor Analysis

An exploratory factor analysis (EFA) was conducted to examine the validity and reliability of the independent and dependent variables employed in the present study. The results of the EFA show that there are four main factors such as relative benefits, perceived enjoyment, trust and personal innovation as independent variable. Further, EFA on mediating and dependent variables was performed separately and the results showed that the communality value of all variables was over 0.4 and the accumulated explanation rate was calculated as 66.783, 77.236, 69.489, and 74.938 separately. In addition, Cronbach's alpha for reliability analysis was all over 0.75 and thus, the reliability was ensured (Nunnally, 1978).

In addition to EFA, confirmatory factor analysis (CFA) was conducted and Table 1 presents the results of the confirmatory factor analysis. The standardised loadings and the squared multiple correlations (SMC) are examined as evidence of convergent validity (Bollen, 1989). To confirm validity, the SMC should be greater than 0.4. and after the analysis of confirmatory factor analysis, one measurement item of Trust was removed (I

believe my personal information is not available to others through GPS-based tourism AR application) as the SMC was less than 0.4.

Further, CCR (Composite Construct Reliability) and AVE (Average Variance Extracted) exceeded the criteria (CCR>0.7, AVE>0.5) and therefore secured the convergent validity of data used in the present study (Hair, et al., 1998). Also, the AVE scores exceeded all the square of correlation coefficient between latent factors (as suggested by Fornell & Larcker, 1981), thus the result showed that discriminant validity is confirmed.

Table 1. Results of confirmatory factor analysis

Scale items	Standardized loadings	T-values	SMCs	CCR	AVE
Relative Benefits					
I believe GPS-based tourism AR application is more convenient than QR code based AR application	.724	-[a]	.525		
I believe GPS-based tourism AR application is more effective than QR code based AR application	.720	9.437	.519		
I believe GPS-based tourism AR applications is more efficient than QR code based AR application	.731	9.579	.535		
I think I can use GPS-based tourism AR application on my smart phone without needing to be told how it functions	.703	9.203	.494	.975	.846
I believe GPS-based tourism AR application has more advantages than QR code based AR application because services are not limited by location	.709	9.282	.502		
I think I can use GPS-based tourism AR application if there are user manuals available	.732	9.597	.536		
I think I can more freely navigate the tourism contents of GPS-based AR application on my smart phone	.743	9.731	.551		
Perceived Enjoyment					
I would feel that using GPS-based tourism AR Applications is enjoyable	.734	-[a]	.538		
GPS-based tourism AR application would make me feel good	.829	10.576	.687	.951	.829
GPS-based tourism AR application would be interesting	.764	9.817	.583		
I would have fun using GPS-based tourism AR application	.756	9.721	.571		
Trust					
I believe GPS-based tourism AR application is reliable	.729	-[a]	.531	.857	.752
I believe GPS-based tourism AR application is trustworthy	.854	9.976	.729		
Personal Innovation					
Among my peers, I am usually the first to try new information technology	.745	-[a]	.555	.861	.758
I like to experiment with new information technology	.931	8.843	.867		
Perceived Ease of Use					
I think using GPS-based tourism AR Application is easy	.726	8.812	.527		
Overall, I believe that GPS-based tourism AR Application is easy to use	.726	-[a]	.527	.949	.862
I think the process of using GPS-based tourism AR Application is understandable	.679	8.299	.461		
Perceived Usefulness					

I think using GPS-based tourism AR Application can increase the effectiveness of obtaining tourism information	.845	13.003	.714		
Overall, I believe GPS-based tourism AR application is advantageous for my learning	.821	-[a]	.674	.957	.881
GPS-based tourism AR Application is useful for obtaining tourism information	.770	11.528	.593		
Attitude					
I hold a positive evaluation of GPS-based tourism AR application	.740	9.437	.547		
I would like to use GPS-based tourism AR application	.693	8.864	.480	.895	.739
In my opinion, it would be very desirable to use GPS-based tourism AR application	.770	-[a]	.593		
Intention to use					
I intend to use GPS-based tourism AR application frequently	.796	11.121	.609		
In the future, I intend to use GPS-based tourism AR application	.794	11.095	.631	.923	.799
I intend to use GPS-based tourism AR application when it becomes available	.781	-[a]	.609		

Model fit statistics:
$\chi 2 = 420.941$, df = 322, p-value = 0.000, RMR = 0.028, GFI = 0.864, AGFI = 0.829, CFI = 0.963, and RMSEA = 0.041

[a] *This path was fixed to one to identify the corresponding parameters.*

Structural Equation Modelling

Further to exploratory factor analysis and confirmatory factor analysis, Structural Equation Modelling (SEM) was executed to estimate the fitness level of the overall research model. In this analysis, the result met the criteria level of optimal model fit ($\chi 2 = 396.297$, df = 305, p-value = 0.000, RMR = 0.029, GFI = 0.864, AGFI = 0.832, CFI = 0.965, and RMSEA = 0.040). Table 2 shows the result of hypotheses test.

Table 2. Research Model Test Results

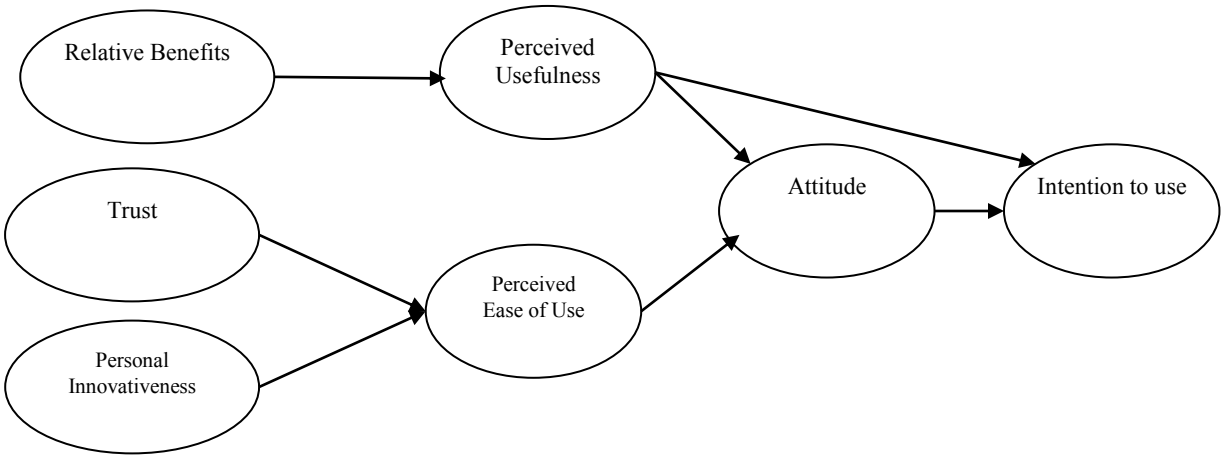
	Paths			Standardised Regression Estimates	Parameter Estimates	S.E	t-value	Supported/ Not supported
H_1	H_{1a}	Relative Benefits	→ Perceived Ease of Use	.094	.084	.098	0.858	Not supported
	H_{1b}	Perceived Enjoyment	→ Perceived Ease of Use	.140	.132	.096	1.376	Not supported
	H_{1c}	Trust	→ Perceived Ease of Use	.625	.655	.120	5.450**	Supported
	H_{1d}	Personal Innovation	→ Perceived Ease of Use	.178	.147	.072	2.054*	Supported
H2	H_{2a}	Relative Benefits	→ Perceived Usefulness	.680	.724	.128	5.651**	Supported
	H_{2b}	Perceived Enjoyment	→ Perceived Usefulness	-.052	-.059	.113	-0.518	Not supported
	H_{2c}	Trust	→ Perceived Usefulness	.216	.271	.210	1.292	Not supported
	H_{2d}	Personal Innovation	→ Perceived Usefulness	-.159	-.158	.089	-1.773	Not supported
H3		Perceived Ease of Use	→ Perceived Usefulness	.070	.083	.236	0.353	Not supported

H4	Perceived Ease of Use	→ Attitude	.354	.399	.108	3.681**	Supported
H5	Perceived Usefulness	→ Attitude	.544	.512	.093	5.500**	Supported
H6	Perceived Usefulness	→ Intention to use	.643	.578	.103	5.603**	Supported
H7	Attitude	→ Intention to use	.300	.287	.104	2.769**	Supported

Note) * $p<0.05$, ** $p<0.01$
Model fit statistics: $\chi 2 = 396.297$, df = 305, p-value = 0.000, RMR = 0.029, GFI = 0.864, AGFI = 0.832, CFI = 0.965, and RMSEA = 0.040

In the first test of hypotheses, the results showed that relative benefits (H1c) and personal innovativeness (H1d) have positive effects on perceived ease of use with significance levels of 1% and 5% respectively. Thus, hypothesis 1 was partly accepted. Also, the results of test of hypothesis 2 showed that relative benefits (H2a) only have a positive effect on perceived usefulness with a 1% significance level. Thus, hypothesis 2 was only partly accepted. However, as shown in Table 2, hypothesis 3 was not supported. Furthermore Hypothesis five to seven were all supported. Based on this, this study suggests the final model with only significant paths as shown in Figure 1.

Figure 1. Final Model



Discussion and Conclusion

The aim of the present study was the examination of tourists' adoption of GPS-based AR applications within Characworld Themepark at Jeju Island. The present study identified and confirmed three external variables, relative benefits; trust; and personal innovativeness that influence tourists' acceptance of GPS-based AR applications. Interestingly, perceived enjoyment was not confirmed as an external variable within the AR acceptance context which contradicts previous studies within the e-commerce context (Ayeh et al., 2013b). The original TAM relationships between perceived usefulness and perceived ease of use towards attitude and intention to use were furthermore confirmed within the AR context. Nevertheless, an interesting result is the insignificant path from perceived ease of use towards perceived usefulness which concurs with research on user acceptance of online platforms by Lee and Lehto (2013). Trust and personal innovativeness were found to only influence perceived ease of use. On the other hand, the positive relationship of relative benefits and perceived

usefulness can be well explained by the similarity of the constructs as discussed by Wu and Wang (2005). Overall, the results have shown that tourists who tried the GPS-based AR application at the themepark intend to use the application in the future. This is particularly true if the application offers advantages, efficiency, effectiveness as well as ease of use as it positively influences the perceived usefulness and attitude and consequently the intention to frequently use.

This empirical study supplements the limited research, acknowledged by Leue et al. (2014), into the adoption of tourism AR applications by investigating the external variables of visitors' acceptance of GPS-based AR applications. Furthermore, the present study is providing practitioners with some guidance on the future usage of AR applications within tourism destinations. The present study focused on the acceptance of AR within a themepark and the results suggest that tourists are likely to form a favourable attitude about the application if they consider themselves highly innovative, consider information trustworthy and received relative benefits by using the AR application. Destinations and attractions should therefore integrate these factors into an AR strategy in order to provide tourists with a seamless experience. This is particularly important considering that AR is a relatively new form of communication and therefore, if well implemented and executed visitors are likely to recommend it to other tourists. Thus, these findings might help practitioners to create and implement an AR strategy in the future.

There are some limitations in this study of which the first is related to the sample size. Although186 respondents were used for the data collection of this study, it cannot be used to generalise the findings. In addition, the model only looked at four external variables that influence the adoption of GPS-based AR application based on previous research. Therefore, further qualitative research could aim to identify external variables based on interviews or focus groups with AR application users. Furthermore, the model has been tested within the South Korean context thus, it would be interesting for future researchers to conduct the research within a Western context in order to confirm the applicability within a different cultural setting and validate the existing factors.

References

Antón, C., Camarero, C. and Rodríguez, J. (2013), Usefulness, Enjoyment, and Self-Image Congruence. The Adoption of e-Book Readers. *Psychology and Marketing*, 30, 372–384.

Ayeh, J., Au, N., & Law, R. (2013a). Towards an Understanding of Online Travllers' Acceptance of Consumer - Generated Media for Travel Planning: Integrating Technology Acceptance and Source Credibility Factors. In L. Cantoni & Z. Xiang (Eds.), *Information and Communication Technologies in Tourism 2013(pp.* 254-267). Heidelberg, Germany: Springer.

Ayeh, J. K., Au, N., & Law, R. (2013b). Predicting the intention to use consumer-generated media for travel planning. *Tourism Management*, 35, 132-143.

Castaneda, J.A., Munoz-Leiva, F., & Luque, T. (2007). Web Acceptance Model (WAM): Moderating effects of user experience. *Information & Management*, 44, 384–396.

Chen, K., Chen, J.V. and Yen, D. (2011). Dimensions of self-efficacy in the study of smart phone acceptance. *Computer Standards and Interfaces*, 33 (4), 422-431.

Choi, H.S., Park, J.W., & Park, S.B. (2011). A Study on the Effect of Mobile Tourism Information Services on Tourist Satisfaction and Continual Reuse. *International Journal of Business Information Technology*, 1 (3), 189-195.

Davis, F. D. (1989). Perceived Usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly,* 13, 319-340.

Gao, T., Rohm, A.J., Sultan, F., & Huang, S. (2011). Antecedents of Consumer Attitudes Toward Mobile Marketing: A Comparative Study of Youth Markets in the United States and China, Thunderbird. *International Business Review.* 54 (2), 211-224.

Gefen, D., Karahanna, E., & Straub, D. W. (2003). Trust and TAM in Online Shopping: An Integrated Model. *MIS Quaterly*, 27, 51-90.

Ha, S., & Stoel, L. (2009). Consumer e-shopping acceptance: Antecedents in a technology acceptance model. *Journal of Business Research, 62,* 565–57.

Hair, J. F., Anderson R. E., Taltam R. L., & Black W. C. (1998). *Multivariate data analysis*. Upper Saddle River. NY: Prentice-Hall.

Han, D., Jung, T., & Gibson, A. (2014). Dublin AR: Implementing Augmented Reality (AR) in Tourism. In: Z. Xiang, & I. Tussyadiah (Eds). *Information and Communication Technologies in* Tourism (pp. 511-523), Wien: Springer Computer Science.

Haustvedt, A.C., & Krogstie, J. (2012, November). Mobile Augmented Reality for Cultural Heritage: A Technology Acceptance Study. Paper presented at the IEEE International Symposium on Mixed and Augmented Reality 2012. Atlanta.

Höllerer, T.H., & Feiner, S.K. (2004). Chapter Nine - Mobile Augmented Reality. In: H Karimi and A. Hammad (Eds.). *Telegeoinformatics: Location-Based Computing and Services*: Taylor & Francis Books Ltd.

Kolodinsky, J.M., Hogarth, J.M., & Hilgert, M.A. (2004).The adoption of electronic banking technologies by US consumers. *International Journal of Bank Marketing, 22*(4), pp.238 – 259.

Lee, H.H., & Chang, E. (2011). Consumer Attitudes Toward Online Mass Customization: An Application of Extended Technology Acceptance Model. *Journal of Computer-Mediated Communication,* 16, 171–200.

Lee, D., & Lehto, M. (2013). User acceptance of YouTube for procedural learning: An extension of the Technology Acceptance Model. *Computer and Educations*, 61, 193-208.

Lee, W., Xiong, L., & Hu, C. (2012). The effect of Facebook users' arousal and valence on intention to go to the festival: Applying an extension of the technology acceptance model. *International Journal of Hospitality Management,* 31, 819-827.

Leue, M.C., tom Dieck, D., & Jung, T. (2014). A Theoretical Model of Augmented Reality Acceptance. *eReview of Tourism Research*, 5, 1-5.

Liang, T.P., & Yeh, Y.H. (2010). Effect of use contexts on the continuous use of mobile services: the case of mobile games. *Personal and Ubiquitous Computing,* 15(2), 187–196.

Liu, Y., & Li, H. (2011). Exploring the impact of use context on mobile hedonic services adoption: An empirical study on mobile gaming in China. *Computers in Human Behavior*, 27(2), 890-898.

Morosan, C. (2012). Theoretical and Empirical Considerations of Guests' Perceptions of Biometric Systems in Hotels: Extending the Technology Acceptance Model. *Journal of Hospitality & Tourism Research*, 36 (1), 52-84.

Nunnally, J.C. (1978) *Psychometric Theory.* (2nd ed.). New York: McGraw-Hill.

Rogers, E. M. (1995). *Diffusion of innovations* (4th ed.). New York, Free Press.

Schepers, J., & Wetzels, M. (2007). A meta-analysis of the technology acceptance model: Investigating subjective norm and moderation effects. *Information and Management*, 44, 90-103.

Shin, D.H. (2007). User acceptance of mobile Internet: Implication for convergence technologies. *Interaction with Computers, 19,* 472-483.

The Jeju Weekly. (2011). Jeju's newest themed attraction is geared to families and kids. Tourism Discover Jeju. Available at: http://www.jejuweekly.com/news/articleView.html?idxno=1423

Van der Heijden, H. (2004). User Acceptance of Hedonic Information Systems. MIS Quarterly, 28(4), 695-704.

Van Krevelen, D. W. F., & Poelman, R. (2010). A survey of augmented reality technologies, applications and limitations. *International Journal of Virtual Reality*, 9(2), 1.

Venkatesh, V., Morris, M., Davis, G., & Davis, F. (2003). User Acceptance of Information Technologie: Towards a Unified View. *MIS Quarterly, 27*(3), 425-478.

Walsh, A. (2011). Blurring the boundaries between our physical and electronic libraries: Location-aware technologies, QR codes and RFID tags. *The Electronic Library*, 29(4), 429 – 437.

Wojciechowski, R., & Cellary, W. (2013). Evaluation of learners' attitude toward learning in ARIES augmented reality environments. *Computers & Education*, iFirst, 1-16.

Wu, J., & Liu, D. (2007). The effects of trust and enjoyment on intention to play online games. *Journal of Electronic Commerce Research*, 8 (2), 128-140.

Wu, J., & Wang, S. (2005). What drives mobile commerce? An empirical evaluation of the revised technology

acceptance model. *Information and Management*, 42, 719-729.
Wu, K., Zhao, Y., Zhu, Q., Tan. X., & Zheng, H. (2011). A meta-analysis of the impact of trust on technology acceptance model: Investigation of moderating influence of subject and context type. *International Journal of Information Management*, 31, 572–581.

Yang, K.C.C. (2005). Exploring factors affecting the adoption of mobile commerce in Singapore. *Telematics and Informatics*, 22(3), 257–277.
Yovcheva, Z., Buhalis, D. & Gatzidis, C. (2012). Overview of Smartphone Augmented Reality Applications for Tourism. e-Review of Tourism Research (eRTR), 10(2).
Zarmpou, T., Saprikis, V., Markos, A. & Vlachopoulou, M. (2012). Modeling users' acceptance of mobile services. *Electronic Commerce Research*, 12, 225-248.
Zhang, J., & Mao, E. (2008). Understanding the Acceptance of Mobile SMS Advertising among Young Chinese Consumers. *Psychology and Marketing*, 25, 787-805.