The Effects of Presence Induced by Smartphone Applications on Tourism: Application to Cultural Heritage Attractions

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Abstract Increased use of mobile devices in the tourism industry enhances tourist satisfaction by improving their overall experience in particular settings. Presence, in this case, is the state of one's subjective recognition when experiencing in virtual realms beyond realistic physical and tangible spaces. The purpose of the study is to investigate the relationships between the presence brought upon the use of smartphone applications, the touristic experience, and tourism satisfaction, when smartphone applications are applied to cultural heritage attractions. A survey was employed for the data collection at cultural heritage attractions in Korea from tourists who had used smartphone applications during their travels. The study found a significant relationship between presence of smartphone applications and touristic experience, which also significantly affected overall tourist satisfaction. The study contributes to the body of knowledge on the impact and effects of "presence" when smartphone applications are utilized in tourism.

Keywords Smartphone application · Presence · Augmented reality · Mobile technology

1 Introduction

Smartphone applications, a new form of Information Communication and Technology (ICT), have been innovative by enhancing a tourist's interests in cultural heritage sites as well as these applications redesigning tourism resources into a sustainable platform. Cultural heritage tourism offers activities to help

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tourists understand the broad aspects of society, culture, and arts. In that sense, interpretation media plays a crucial role in the level of understanding, interests, and satisfaction of tourists (Kang and Gretzel 2012). Smartphone applications are unique from previous interpretation media. The menus of smartphone applications contain panoramas, videos, interpretation manuscripts, background music, narration, games, AR-based path finding, and SNS connection services (e.g., Facebook, Twitter, Kakaotalk). Of these, augmented reality (AR) is an experimental technique to overcome the physical constraints existing in the current state of cultural tourism at heritage sites. Tourists experience both reality and virtual realms through the innovative techniques of smartphone applications. Hence, interactivity between tourists and the techniques of smartphone applications needs to be addressed.

The idea of "presence" is the state of one's subjective recognition of being in virtual realms beyond realistic physical spaces. Presence induced by mobile devices has been studied in engineering, education, and industrial design where focused on technological aspects of human behaviour and positive or negative impacts of human behaviour on Human–Computer Interaction (HCI). In Korea, the focus of applying digital devices to tourism while experiencing cultural heritage attractions has been an expansion of the services being provided. Tourism is an industry generating tourists' experiences by selling tourism products (Sternberg 1997). In the process, culture, as an object to experience, affects tourists' behaviours. Therefore, cultural experience has been an important factor in expansion of the demand of cultural heritage attractions and tourist satisfaction (Richards 2001; Stamboulis and Skayannis 2003). By applying the concept of presence, the study intends to understand touristic experience and tourist satisfaction, when smartphone applications are employed.

The field of tourism has a scare amount of research when applied to the relationship between tourism and the value of technology. The purpose of the study is to determine if smartphone applications serve as an effective tool for mobile tourists in their experience with cultural heritage sites and artefacts. The study objectives are three fold when smartphone applications are applied to cultural heritage attractions: (1) To identify the dimensions of presence arisen by interactivity between tourists and smartphone applications. (2) To determine the realms of touristic experiences with cultural heritage sites and artefacts. (3) To examine the relationships among the presence induced by smartphone applications, touristic experience, and tourist satisfaction.

2 Theoretical Background

2.1 Presence

Tourism has been a popular area for smartphone based systems. Indeed, smartphones and other mobile devices (e.g., tablet, iPod based system, etc.) becoming more advanced, tourism has been one obvious application area of the mobile

devices (Brown and Chalmers 2003). When a tourist visits new places or unplanned places, Augmented Reality (AR) applications help him/her get information or find locations all around him/her easily. AR is a cutting-edge technology that allows a digitally enhanced view of the real world, connecting tourists to more meaningful contents in tourism destinations as a new city navigation. With the camera and sensors in smartphones or tablets, AR applications superimpose virtual information (e.g., photos, sounds, videos, etc.) in way of 3D or 4D directly onto real world around us (Chi et al. 2013).

Along with the development of mobile devices and a virtual medium and its environment where the mobile devices are played, many scholars have questioned about which medium or technology realistically represent physical and social environment as they are. In this context, researchers have paid attention to the feeling of presence (Lombard and Ditton 1997; Kim and Biocca 1997; Schubert et al. 2001). This concept has become central to theorizing advanced Human Computer Interfaces (HCI), such as virtual reality devices (Lee 2004).

Presence in a virtual environment is formed by virtual reality technologies (Sheridan 1992). Although a number of researchers studied the concept of presence, its definition has been still indefinite (Lee 2004). Witmer and Singer (1998) defined presence as a one's subjective experience of the feeling of belonging to certain places or environments where he/she physically is not. Previous studies summarized presence as the status of one's subjective recognition of being in virtual realms beyond realistic physical spaces, and also the phenomenon arisen from psychological and cognitive process. Object presence, a new type of presence, has appeared since the studies of AR were initiated (Stevens et al. 2002). Augmented reality refers to technologies that enhance the sense of reality allowing the coexistence of digital information and real environments (Azuma 1997). Thus, the concept of object presence is more appropriate when technology is mediated, where users feel a subjective experience of virtual objects in their real environment. The concept is different from the previously suggested type of presence where people feel totally immersed in virtual reality. And Social presence is another type of presence induced by mobile technologies. Durlach and Slater (2000) define social presence as a feeling of being with other people in virtual spaces. Short et al. (1976) refers to it as the feeling of salience with others in the course of interactivity between the user and technologies.

The topic of presence has been studied in the area of education (online education, classroom simulation, virtual campus etc.), entertainment (special effect movie, computer-video games), and communication (teleconferencing, computer-supported collaboration work). As mobile technologies have been gradually applied to tourism, there is a need to research the impact of presence on tourism.

2.2 Experience Economy

Pine and Gilmore (1999) proposed the four realms of experience: entertainment, educational, escapist, and aesthetic experiences, based on two criteria: the level of customer participation and involvement. On the customer participation axis, passive participation of the customer in business (or destination) offerings characterizes the entertainment and aesthetic dimensions, whereas educational and escapist dimensions reflect active participation (Pine and Gilmore 1999, p. 47). The tourist who passively participates in destination activities does not directly affect or influence the performance of the destination (business), whereas an active participant will personally affect the performance or event that becomes part of his or her experience. Along the absorption-immersion axis, the tourist typically "absorbs" entertaining and educational offerings of a destination and "immerses" in the destination environment resulting in aesthetic or escapist experiences. Absorption in this context is defined as "occupying a person's attention by bringing the experience into the mind" and immersion as "becoming physically (or virtually) a part of the experience itself" (Pine and Gilmore 1999, p. 31).

2.3 Tourist Satisfaction

Tourist satisfaction is important to the success in destination marketing, because it influences the choice of destination, the consumption of products and services, and the decision to return (Kozak and Rimmington 2000). Tourist (customer) satisfaction is the psychological status induced immediately from consumption experience (Oliver 1997). Tourist (customer) satisfaction has been identified as primary antecedents of purchase-related attitudes (Oh et al. 2007). Pine and Gilmore (1999) suggested that customers (tourists)' satisfaction increase, as the level of customer experience for the goods and services is higher. Light (1995) suggested that tourism satisfaction can be improved by offering a variety of experience and entertainment activities. Han (2006) showed that the dimensions of touristic experience in cultural heritage sites affected tourist satisfaction by employing the theory of experience economy.

3 Research Design

3.1 Research Model

The study examines the relationships between the presence induced by smartphone applications, the touristic experience and tourist satisfaction, when smartphone applications are applied to cultural heritage attractions. Figure 1 depicts the relations of the variables included in the study.

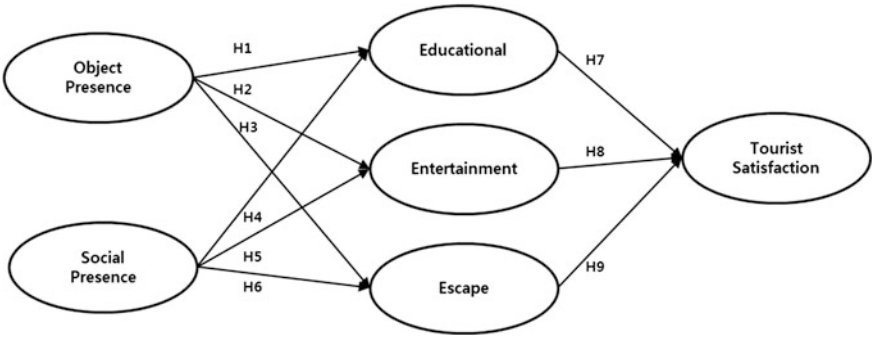

Fig. 1 Research Model

3.2 Hypotheses

Presence of Smartphone Applications and Touristic Experience. Touristic experience, defined as the status of on-site experience and lived experience, refers to the emotional phenomenon induced by the combination of cognitive interaction processes and emotional feeling which results from ones' encountering various physical and abstract objects or phenomena during the travel. The technique of SR induces presence which is the subjective recognition when users feel the existence of virtual objects in their real environment (Witmer and Singer 1998; Stevens et al. 2002). The services provided by smartphone applications, such as interpretation service and SNS connection service, formed social presence, which is the feeling of being with other characters (Stevens et al. 2002; Kang and Gretzel 2012).

Shelton (2003) performed a study in the field of education that AR technology-induced-presence enhances users' learning experiences. Kang and Gretzel (2012) demonstrated that presence induced by iPod based podcasting technology while on tour made a significant positive effect on the travellers' enjoyment experience and escape experience. Lee and colleagues showed that in the field of media, presence generated by feeling three-dimensional and four-dimensional movie improves four realms of experiences of audiences (entertainment, educational, escape and aesthetic) and experiential values. Based on the theory of experience economy suggested by Pine and Gilmore (1999), four realms of experiences were postulated, such as educational, entertainment, escape and aesthetic experiences. For the study context of using smartphone applications at cultural heritage sites, the aesthetic experience was not included due to its passive characteristics, which is not suitable in the mobile technology environment (Graetzel and Jamal 2009; Kang and Gretzel 2012). Thus, the hypotheses about the relationship of the presence induced by smartphone application and three types of touristic experiences (educational, entertainment, escape) have been proposed.

H1: *Object presence induced by smartphone applications will make a positive impact on tourists' education experiences*
H2: *Object presence induced by smartphone applications will make a positive impact on tourists' educational experiences*
H3: *Object presence induced by smartphone applications will make a positive effect on tourists' entertainment experiences*
H4: *Social presence induced by smartphone applications will make a positive effect on tourists' entertainment experiences*
H5: *Social presence induced by smartphone applications will make a positive effect on tourists' escape experiences*
H6: *Social presence induced by smartphone applications will make a positive effect on tourists' escape experiences.*

Touristic Experience and Tourist Satisfaction. A number of researchers suggested a positive relationship between experience domains and tourists' satisfaction, while they found out categories of experience domains from a variety of experience activities and entertainment factors of heritage touristic attractions (Light 1995; Mehmetoglu and Engen 2011; Oh et al. 2007). Previous literature showed that touristic experience has a positive and significant effect on tourist satisfaction. Therefore, the following hypotheses have been proposed.

H7: *Educational experience offered by smartphone applications will make a positive impact on tourist experiences*
H8: *Entertainment experience offered by smartphone applications will make a positive impact on tourist experiences*
H9: *Escape experience offered by smartphone applications will make a positive impact on tourist experiences*

4 Methodology

4.1 Sample and Data Collection

A survey was used as a research instrument in order to collect data as a means of testing the proposed hypotheses. Constructs for the survey were developed based on the literature and modified to fit the study purpose. For an empirical analysis, pre-test and main survey have been conducted in Changdeokgung. The palace reflects the history of Josheon Dynasty for about 500 years including 23 state-designated cultural properties and was designated as UNESCO's World Cultural Heritage in 1997 in Korea. The data from Changdeokgung were collected on site from April 22 to May 13, 2012. Survey was based on both paper and online that included questions

about the respondents' profiles (gender, age, income, educational level, etc.), respondent's mobile devices and usage (model, application name, using time, place to use) and visiting characteristics.

Both the convenience of sampling and a snow ball sampling were applied to the study. The survey participants were limited, who had experienced using smartphone applications '*Changdeokgung Palace Story*' at Changdeokgungin Korea. Before they have started a tour of Changdeokgung, a researcher had informed participants how *Changdeokgung Palace story* downloaded on their smartphone. Of the 460 questionnaires distributed, 222 surveys were included in the data analysis after excluding incomplete surveys.

4.2 Research Instrument

A survey, adopted measures from the previous publications of presence and modified them for the application in the tourism industry. All items in the survey use a five-point Likert-type scale (5 = strongly agree, 1 = strongly disagree). The survey consists of three parts. Part I has nine questions regarding a tourist's presence induced with smartphone applications. Smartphone application's presence is defined as tourist's subjective experience, which induced by a particular virtual object existing in a tourist's environment and is a feeling of being with other human or characters in virtual space when smartphone application mediated. The items, adopted from previous studies (Stevens et al. 2002; Schubert et al. 2001; Kim and Biccoa 1997; Kang and Gretzel 2012), concern the degree to which a tourist has a sense of being with particular object. For participants' understanding, a description was provided on smartphone applications and the particular application, such as AR. Part II includes items as to touristic experiences at cultural heritage sites based on smartphone application. Touristic experiences is defined as emotional phenomenon induced by the combination of cognitive interaction processes and emotional feeling which results from ones' encountering various physical and abstract objects or phenomena at cultural heritage sites. The items are modified from those of Pine and Gilmore (1999), Oh et al. (2007), Kang and Gretzel (2012), and Graetzel and Jamal (2009). Touristic experience was measured by fourteen questions for three sub-dimensions: four items for educational experience, three items for entertainment experience, and four items for escape experience. Part III contains three items for tourist satisfaction. Tourist satisfaction is defined as the summary psychological state arising immediately on the tourism destination from consumption experience (Oliver 1997; Oh et al. 2007). The items are modified from Oliver (1997) and Oh et al. (2007).

4.3 Data Analysis

The obtained data was analysed by using SPSS 18.0 for Windows and AMOS 18.0. Descriptive analyses have been performed on the all variables in the survey. Then, reliability test, exploratory factor analysis, and confirmatory factor analysis were conducted for the validity and reliability of the constructs. Finally, Structural Equation Modelling (SEM) was done to test the hypotheses of the proposed research model.

5 Results

5.1 Profile of Participants

Among the usable 222 respondents, 60.8 % were female and 39.2 % were males. The largest proportion of the participants is 1920s (88.7 %), followed by 1930s (9.9 %), while other groups of ages were minimal. In terms of education, majority (86.0 %) of the respondents had a university education or were attending university. For the marital status, 91.0 % were singles and others were married.

As to the frequency of visiting heritage attractions, about approximately 61.3 % of the respondents visited the cultural heritage attraction for the first time, twice (27.5 %), more than three times (11.3 %). As to the inquiry of time used for smartphone applications during the travel, over 42.8 % of respondents answered that they used smartphone applications for 1 to 1 and half hours, followed by 27.9 % of respondents for hour to thirty minutes, and 17.1 % for 90 min to 2 h.

5.2 Measurement Models

Exploratory Factor Analysis for Presence of Smartphone Applications. Table 1 shows the results of exploratory factor analyses for presence of smartphone applications, the exogenous variable for the study. The two factors whose Eigen values were higher than 1.0 were identified and they were labelled as "object presence" and "social presence" based on previous literature (Stevens et al. 2002; Schubert et al. 2001; Kim and Biccoa 1997; Kang and Gretzel 2012). All the factor loadings were higher than 0.6 (Anderson and Gerbing 1988), and these results explain 72.6 % of the variance in presence of smartphone applications.

Exploratory Factor Analysis for Experience Economy. Table 2 shows the results of exploratory factor analyses for experience economy, the endogenous variable for the study. Eigen values for all the three factors exceeded 1.0. Labels for the three factors were "education", "entertainment" and "escape" based on

Table 1 EFA for presence of smartphone applications

Construct indicators	Factor loading	Communality	Eigen value	% of variance	Cronbach'α (if deleted)
Object presence			4.667	58.343 %	0.823
The smartphone application came to me and created a new world for me, and the world suddenly disappeared when the smartphone apps ended	0.799	0.647			(0.821)
During a tour, I felt I was in the world the smartphone application created	0.809	0.702			(0.768)
During a tour, my body was in real world but my mind was inside the world created by smartphone application	0.723	0.730			(0.739)
During a tour, the smartphone application generated world was more real for me	0.639	0.650			(0.773)
During a tour, I never forgot I was in the middle of smartphone application generated world		Deleted			
Social presence			1.142	14.281 %	0.904
I felt I talked to someone close by me during a tour	0.852	0.764			(0.883)
During a tour, I felt I had involved with someone	0.853	0.786			(0.868)
I felt someone talked to me during a tour	0.820	0.733			(0.889)
I felt close to the others during a tour	0.847	0.798			(0.861)

KMO = 0.882, Bartlett's Test of Sphericity = 1,030.084 (df = 28, sig. = 0.000)
cumulative = 72.624 %, Factor rotation: Varimax

the previous literature (Oh et al. 2007). One item for escape experience (ESC4: I completely forgot about my daily routine) was excluded from the construct in that its factor loading was below 0.6. All factor loadings were higher than 0.6 (Anderson and Gerbing 1988); these results explain 75.2 % of the variance in experience economy.

Confirmatory Factor Analysis. The results of a Confirmatory Factor Analysis (CFA), using a maximum likelihood estimation method, indicate that model has a good fit to the data ($\chi 2 = 466.042$, df = 174, p = 0.000; RMR = 0.057, RMSEA = 0.080, CFI = 0.909; NFI = 0.863). A summary of the findings from CFA appear in Table 1. From construct composite reliability testing, the AVE ranged from 0.909 to 0.978 and CCR range from 0.973 to 0.992, which were above the recommended level of 0.70 (Fornell and Larcker 1981). This finding indicates that items for each construct variables are adequate level, which means each study variables have internal consistency. Discriminant validity is evident in that the squares of correlations between a pair of variables are all less than the AVE values for each of the study' constructs (Fornell and Larcker 1981) (Table 3).

Table 2 EFA for experience economy

Construct indicators	Factor loading	Communality	Eigen value	% of variance	Cronbach'α(if deleted)
Education			2.223	22.227 %	0.806
I learnt a lot during a tour	0.838	0.732			(0.744)
The experience made me more knowledgeable	0.857	0.761			(0.741)
It stimulated my curiosity to learn new things	0.600	0.546			(0.785)
It was a real learning experience	0.714	0.589			(0.760)
Entertainment			4.064	40.637 %	0.923
This activities during a tour were amusing	0.856	0.831			(0.907)
These activities were captivating	0.912	0.876			(0.898)
Activities in this tour were fun	0.911	0.891			(0.863)
Escape			1.234	12.338 %	0.846
I felt I played a different character here	0.845	0.718			(0.843)
I felt like I was living in a different time or place	0.874	0.777			(0.768)
The experience here let me imagine being someone else	0.889	0.800			(0.739)
I completely forgot about my daily routine		Deleted			

KMO = 0.779, Bartlett's Test of Sphericity = 1,239.531 (df = 45, $p = 0.000$)
Factor rotation: Varimax, Cumulative % = 75.202 %

5.3 Structural Model Fit

A Structural Equation Modeling (SEM) with a maximum likelihood, as an estimation method, tests the proposed model, and a summary of the results appears in Table 4. Findings indicate that the model represents the data satisfactorily ($\chi 2 = 422.330$; df = 176; $p < 0.001$; RMSEA = .080; CFI = 0.923; NFI = 0.876). The study's variables explain adequately the outcome variables. Particularly, explanation powers of each endogenous construct are as follows; educational experience (SMC = 0.031), entertainment experience (SMC = 0.059), escape experience (SMC = 0.271), and tourist satisfaction (SMC = 0.713).

As to the testing H1, H2, and H3, the effect of object presence on educational experience (H1: path coefficient $= -0.097$, C.R. $= -0.718$, $p > 0.001$), the impact of object presence on entertainment experience (H2: path coefficient $= -0.149$, C.R. $= -1.201$, $p > 0.001$), and the impact of object presence on escape experience (path coefficient = 0.111, C.R. = 0.958, $p > 0.001$) were not significant. H4, the impact of social presence on education experience (path coefficient = 0.234, C.R. = 1.752, $p > 0.05$) was not significant. For H5, social presence influenced on entertainment experience positively (path coefficient = 0.330, C.R. = 2.772,

Table 3 Assessment of measurement model

Observe	Std. λ	SE	CR[a]	AVE[b]	CCR[c]
Object presence				0.909	0.975
The smartphone application came to me and created a new world for me, and the world suddenly disappeared when the smartphone apps ended	0.585	0.093	8.45***		
During a tour, I felt I was in the world the smartphone application created	0.723	0.09	10.63***		
During a tour, my body was in real world but my mind was inside the world created by smartphone application	0.839	0.098	12.29***		
During a tour, the smartphone application generated world was more real for me	0.779	Fixed	Fixed		
Social presence				0.941	0.984
I felt I talked to someone close by me during a tour	0.811	0.061	15.32***		
During a tour, I felt involved with someone of my presence	0.851	0.061	16.66***		
I felt someone responded my talk during a tour	0.811	0.059	15.32***		
I perceived someone with me during a tour	0.882	Fixed	Fixed		
Educational experience				0.958	0.989
I learnt a lot during a tour	0.758	0.1	9.76***		
The experience made me more knowledgeable	0.756	0.099	9.75***		
It stimulated my curiosity to learn new things	0.659	0.106	8.66***		
It was a real learning experience	0.706	Fixed	Fixed		
Escape experience				0.925	0.973
I felt I played a different character here	0.703	0.069	11.16***		
I felt like I was living in a different time or place	0.827	0.074	13.14***		
The experience here let me imagine being someone else	0.885	Fixed	Fixed		
Tourist satisfaction				0.978	0.992
I am happy with my decision to visit	0.851	0.065	16.81***		
My experience here exceeded my exceptions	0.961	0.056	20.66***		
Overall I am satisfied with my visit	0.861	Fixed	Fixed		

$x^2 = 466.042$ (df = 174, $p = 0.000$), normed-$x^2 = 2.678$, RMR = 0.057, NFI = 0.863, TLI = 0.890, CFI = 0.909, RMSEA = 0.080

CR Critical Ratio = z-value, *CCR* Composite Construct Reliability

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

$p < 0.01$). And H6, social presence influenced positively on escape experience (path coefficient = 0.434, C.R. = 3.809, $p < 0.001$). Hence, H5 and H6 gained supports. For H7 and H8, touristic experiences affected tourist satisfaction positively (H7: educational experience on tourist satisfaction, path coefficient = 0.418, C.R. = 5.193, $p < 0.001$; H8: entertainment experience on tourist satisfaction, path coefficient = 0.522, C.R. = 7.586, $p < 0.001$). However, escape experience on touristic satisfaction (path coefficient = −0.044, C.R. = −0.946, $p > 0.05$) was not significant. Thus, H7 and H8 were all supported.

Table 4 Summary of structural model

Structural path	Standardized path coeff.	SE	CR	Assessment
H1: Object presence → Educational	−0.097	0.092	−0.718	Rejected
H2: Object presence → Entertainment	−0.149	0.120	−1.201	Rejected
H3: Object presence → Escape	0.111	0.143	0.958	Rejected
H4: Social presence → Educational	0.234	0.069	1.752	Rejected
H5: Social presence → Entertainment	*0.330*	*0.089*	*2.722***	*Supported*
H6: Social presence → Escape	*0.434*	*0.107*	*3.809****	*Supported*
H7: Educational → Tourist Satisfaction	*0.418*	*0.119*	*5.193****	*Supported*
H8: Entertainment → Tourist Satisfaction	*0.522*	*0.071*	*7.586****	*Supported*
H9: Escape → Tourist satisfaction	−0.044	0.037	−0.946	Rejected

$x^2 = 422.330$ (df = 176, $p < 0.001$), normed-$x^2 = 2.400$ NFI = 0.876, TLI = 0.908, CFI = 0.923, RMR = 0.058, RMSEA = 0.080 * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

6 Conclusion and Implications

The study discusses the issue of touristic experiences which have been emphasized in the environment of heritage tourism attractions where the use of smartphone applications has been increased. The findings of the study are summarized as follows. First, the types of presence induced by smartphone applications are categorized as object presence and social presence. Object presence did not show any significant effect on any tourism experience, while social presence had positive effects on entertainment and escape experiences. Second, touristic experiences of cultural attractions, excluding escape experience, through the utilization of smartphone applications, affected tourist satisfaction. Among tourists' experiences, educational experience and entertainment experience had positive effects on touristic satisfaction.

The findings of the study offer academic and practical applications. First, the study is innovative in that the relationship between the tourists and the concept of the presence induced by interactive smartphone-based tourism applications had been applied. These concepts have been rarely researched in the field of tourism. Second, it is noted that object presence had no significant effect on any touristic experience, while social presence affected entertainment and escape experience. In particular, the effect of social presence was the greatest on escape experience and on entertainment in the order. The findings correspond with the results from Kang and Gretzel (2012). They revealed, by examining tourists of national parks utilizing pot casts, that social presence induced by pot cast had impacts on escape experience and entertainment experience in the order. Third, when smartphone applications have been used in the heritage attractions, educational and entertainment experiences made significant effects on tourist satisfaction. The effect of entertainment experience on tourist satisfaction was the greatest, whilst educational experience made a positive effect on tourism satisfaction. The findings also support the previous studies which discusses the causal relations between touristic

experiences in heritage attractions (Light 1995; Han 2006). Light (1995) showed the differences in the impacts of interpretive medium of heritage attractions on interests and attention of tourists. That is, he demonstrated that tourists showed more enjoyment when audio medium has been applied, compared to when interpretation media, such as exhibitions and panels, have been used. In the case of smartphone applications, a number of entertainment functions (games, puzzle, foot printing, AR-based photo) included in the devices may enhance the edutainment experience of cultural resources which might be dull and difficult to deal with otherwise However, the study still holds some limitations. The study collected data, by using a convenient sampling method from the tourists who visited cultural heritage attractions that adopted smartphone to enhance the experience. Thus, the study findings may not be generalized to all smartphone tourism applications and users of smartphone applications. However, since the topic of smartphone applications to tourism is at the beginning stage, the study may contribute to the theoretical understanding on the acceptance of a new form of Information Communication and Technology (ICT).

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