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Examination of the adoption of augmented reality: a VAM approach

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ABSTRACT

Despite the growing importance and popularity of augmented reality (AR) technologies in hospitality and tourism, little research to identify the degree of user adoption, particularly in the business travel sector, has been conducted. Based on a questionnaire administered to 161 stakeholders attending two international conferences in Hong Kong, user experiences and adoption intention were examined and analyzed through structural equation modeling. Adoption was explored using a value-based adoption model. AR adoption is affected by its perceived value to which the benefits of usefulness and enjoyment contribute, along with newly identified components of technicality and captivating inputs.

KEYWORDS

Augmented reality; business travel; conventions and events; mobile app; ICT; Hong Kong; VAM; Adoption intention; SEM; AR app

Introduction

Recent technologies have transformed the travel experiences of tourists through the contributions of tools such as three-dimensional (3D) displays, Global Positioning System mapping, bar code scanners, digital compasses, Wi-Fi, accelerometers, mobile phones, smart-phone applications (apps) and augmented reality (AR) (Craig, 2013; Samardzija, 2015, p. 130). Tourism, as one of the most productive economic activities worldwide, could benefit considerably from AR technology. Mobile-driven apps enhance tourists' experiences through real-time information network, lavish multimedia AR, and widely covered social communication, all of which are transforming tourism consumption (Dickinson et al., 2014; Kim & Law, 2015; Wang, Park, & Fesenmaier, 2012). AR was first applied in the mobile setting in the mid-1990s, when users' interactions with their actual environment were enhanced through the display of extra digital information (Olsson, Lagerstam, Kärkkäinen, & Väänänen-Vainio-Mattila, 2013). Mobile AR technology has recently been applied to tourism in tour guiding (Kourouthanassis, Boletsis, Bardaki, & Chasanidou, 2015), geotagging points of interests (Trojan, 2016), and promoting heritage sites (Chung, Han, & Joun, 2015; Jung & Han, 2014), museums (He, Wu, & Li, 2018; Jung, tom Dieck, Lee, & Chung, 2016), and theme parks (Jung, Chung, & Leue, 2015), thereby resulting in improved visitor satisfaction and engagement.

Meetings, incentives, conferences and conventions, and exhibitions or MICE represent a sector of tourism concerned with business events and involve business travelers. MICE has grown tremendously and is now truly global (Lau & Wong, 2010; Weber & Chon, 2002). A conference is a large event often extended to several days and includes a social program (Lawrence & McCabe, 2001). A convention gathers people with common objectives, structures for the exchange of thoughts, opinions, and information on the group's shared interests (McCabe, 2001). Participants travel to and attend conferences and conventions to learn new topics and connect with others with similar interests (Lau & Education Bureau, 2016; Lau & Wong, 2010; Weber & Chon, 2002).

The MICE market is an important sector for business tourism in Hong Kong. According to the International Congress and Convention Association (ICCA), the number of conferences worldwide doubled in the last decade from under 6,000 in 2006

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to over 12,000 in 2016 (ICCA, 2017). In 2016, Hong Kong ranked 19th in the world in terms of the number of conferences it held (ICCA, 2017). In the last two decades, Hong Kong's MICE arrival figures increased by 457%, from 339,000 in 1997–1.89 million in 2016 (HKTB, 2003, 2017c). In 2016, while overall tourist arrivals dropped by 4.5% to 56.65 million, the number of overnight visitor arrivals for MICE increased by 9.9% to 1.89 million (HKTB, 2017a, 2017c), of which 46% were business travelers (HKTB, 2017c). The spending of MICE visitors per capita also exceeded HK$8,400 (USD1,077), 16% higher than that of other visitors (HKTB, 2017b). With full commitment to develop the high-yield MICE sector, the Chief Executive set up a Working Group on Convention and Exhibition Industries and Tourism to strengthen Hong Kong's appeal as the "Trade Fair Capital of Asia" (HKTB, 2017a; Office of the Chief Executive, 2013).

The application of advanced technologies has the potential to facilitate further the smooth running of events and enrich attendees' experiences. Despite the growing importance and popularity of AR applications, limited research has been conducted to identify the extent to which AR technology is used (Haugstvedt & Krogstie, 2012; Jung et al., 2015). More developments in AR technologies are expected in the coming years and the ability to utilize them more effectively will no doubt bring tremendous benefits. Research into AR in MICE tourism is scarce (tom Dieck, Jung, & Rauschnabel, 2017). This study is the first to examine the use and application of AR in conventions and events. We aim to develop and validate a theoretical model of the adoption intention of AR technologies in business travel.

Augmented reality in tourism

Unlike virtual reality (VR), which is a reality simulation that enables users to be immersed in an imagined world, AR overlays virtual 3D graphics in reality to enable interaction with virtual graphics. AR links high-level, abstract ideas with physical and actual environments by overlaying information onto learning, which assists learners in constructivist learning (Johnson, Becker, Estrada, & Freeman, 2015). This link allows people to interact with both physical and digital environments (Ohta & Tamura, 2014). AR can provide additional visual and auditory information to users and even provide sense information, including aroma, palate, and touch. tom Dieck and Jung (2018, p. 154) stated that "development has led to the increasing popularity of AR applications to project augmented information on objects or users' immediate surroundings."

Azuma, Billinghurst, and Klinker (2011) defined mobile AR as the emergent and widespread updating of powerful smart-phone tools that can assist AR features effortlessly. With the fast development of technology, electronic tools, such as smartphones and tablets are combined with powerful processors and other hardware such as cameras, which make them ideal devices for enhancing user experiences (Samardzija, 2015). One of the pioneering AR tourism applications is MARS, that features 3D graphical tours through which users can visualize and obtain information (Wei, Ren, & O'Neill, 2014). CorfuAR was a mobile AR tour guide for Corfu island in Greece which supported personalized recommendations (Kourouthanassis et al., 2015). A general belief is that tourism experience through AR usage on the mobile to access to relevant content can enhance visitor satisfaction and add hedonic and utilitarian value, while improving loyalty and altering tourists' interpretations and intentions. Thus, they contribute to a positive authentic experience at the destination (Kim & Law, 2015; Peres, Correia, & Moital, 2011; Yovcheva, Buhalis, Gatzidis, & van Elzakker, 2014). Many cultural heritage organizations have their own visitor AR systems, such as those in the Berlin Wall in Germany, the Museum of London in the UK, and Sydney's Powerhouse Museum in Australia.

Through this integration, travel applications can now be equipped with AR technology, to increase the interactions with users, to enable tourists for instance, to select the camera function on their smart device to point to items they are interested in. Extra information will then be provided them, overlaid on the physical world, allowing them to interact with what they are seeing (Craig, 2013). With the assistance of AR, a positive and more memorable travel experience can be created for tourists (Jung et al., 2016). Although VR has the ability to display high-quality images, sounds, and so on, it provides a completely synthetic environment that blocks the users from seeing through to the actual environment and interacting with it (Craig, 2013).

Augmented reality use in events

AR technology was first applied to conventions and events in the 1990s. In their Mobile Assistant Project, Nishibe et al. (1998) installed 100 handheld computers

with mobile phones at the International Conference on Multiagent Systems (ICMAS '96). This system presented conference timetable and tourist information with social filtering based on attendees' queries. Community activities such as searching for other attendees with similar interests were supported by the system. Feiner, MacIntyre, Höllerer, and Webster (1997) developed a context-aware tour guide for the Columbia University campus; the systme integrated AR with mobile computing and guided attendees when visiting the event venues. The Classroom 2000 project featured an augmented venue where videos, audios, and websites browsed were recorded with whiteboard activities to assist attendees on note-taking (Abowd et al., 1998).

The Conference Assistant, developed in 1999, is an AR work that included components, such as registration, location, content, and presentations that support conference attendees in a variety of settings and connects other users in the location to promote interactions (Dey, Salber, Abowd, & Futakawa, 1999). Although this, Recent applications for events have included mobile AR for use in art and science festivals (tom Dieck et al., 2017), and are composed mainly of animation and AR presentation features. Existing research on events AR focuses mainly on application design, user experience, and satisfaction (Dey et al., 1999; tom Dieck et al., 2017).

AR stimulates sensory feedback and audio-visual and kinesthetic appeal, offering the possibilities for "frictionless learning," that is, decreasing participants' cognitive load and "roaming" risks for not involving URL prompts (Bloxham, 2013). AR technology utilizes "curiosity, mystery, and intrigue" to attract even unenthusiastic participants into an activity, and through the initial "gimmick" attraction it then provides a serious way for participants to engage (Bloxham, 2013; Johnson et al., 2015; Luckin & Fraser, 2011; Vygotsky, 1978). Integrating these unique AR features can enhance events further.

To run the free Aurasma (now renamed HP Reveal) app, access to a smart device (iOS or Android) is essential, along with access to its browser-based platform Aurasma Studio (studio.aurasma.com, the free online platform). Access to this browser-based platform enables the development of more advanced AR content, campaign management, and channel creation through mainstream social media, such as Facebook, Twitter, Instagram, LinkedIn, and Weibo to reach a global audience and disseminate information and instructions to conference delegates, particularly on the use of AR during the face-to-face period of conference activities.

The focus of Aurasma shifted to the content and the design and implementation of "Auras," which is a term used to describe AR content that composed of a trigger image and an overlay. When a smart device running the Aurasma app is pointed at a trigger image, it triggers the start of an overlay. A trigger image can be a designed image or a photograph of a portion of an object, machinery, equipment, location, or person (Avila, 2017). An overlay can be a video, a 3D model, a Web page or another image, and is essentially the engaging component of the Aura (Cheah, Quah, Wong, & Zainon, 2014).

All Auras created and developed by the conference planners in these projects are original. The conference stakeholders involved must also give consent for the events to use these images, videos, audios, and creations when they register. The planners of the two researched conferences sourced their triggers and overlays before adding them as assets to Aurasma Studio. These multimedia conference-themed overlays consisted of the following components: (1) Program: schedule and post-conference tour; (2) Speakers: plenary and panel speaker introductions; (3) Sponsors' messages; (4) Venue: maps, floor plan, and layouts.; and (5) Menus (see sample photos of the overlays). Figures 1–3.

Research model and hypotheses

The objective of this study was to develop conference stakeholders' adoption intention of the AR app for conferences using the value-based adoption model (VAM). In addition to conference delegates, conference organizers, sponsors, exhibitors, media representatives, staff, volunteers, and invited speakers were also major stakeholders who engaged in the events (Lau & Wong, 2010). The adoption intention of mobile technologies is a common dependent variable found in many studies in hospitality and tourism discipline. In these prior research studies, the technology acceptance model (TAM) is a popular theoretical framework for technology adoption explanation. In TAM, the use of the intended system use is affected by perceived ease of use and perceived usefulness. Many subsequent research studies have identified other variables and added them to the original TAM model. For example, Kim, Lee, and Law (2008), Oh, Kim, Lee, Shim, and Park (2009), and Morosan (2014) examined various factors such as technology

Figure 1. Sample photo of the AR use in showing venue with photo overlay on the floorplan.

experiences, trip experiences, and performance expectation in determining smartphone usage intention by tourists. Morosan and DeFranco (2016) focused on the mobile apps used in hotel operations and reservations. Originally, the TAM was developed with the aim of predicting the adoption of new technology in an organization. However, the model has been criticized for its inability to explain consumer adoption intention in voluntary non-organizational settings, where the individuals' influence has been ignored. Moreover, TAM did not consider the consumers' value perspective (Kwon & Seo, 2013).

Based on the cost–benefit paradigm in behavioral decision theory, Kim, Chan, and Gupta (2007) proposed a VAM model that stated that the technology adoption intention of individuals is the result of perceived value evaluated by the cognitive trade-off between benefits ("get" factors) and sacrifice ("input" factors) associated with technology use. The perceived benefits items included usefulness and enjoyment, while the perceived sacrifice features are technicality and perceived fee. Thus, VAM combines the theory of TAM (Davis, Bagozzi, & Warshaw, 1989) and the perceived value of Zeithaml (1988) to better explain

Figure 2. Sample photo of the AR use in showing sponsors with video overlay on a logo.

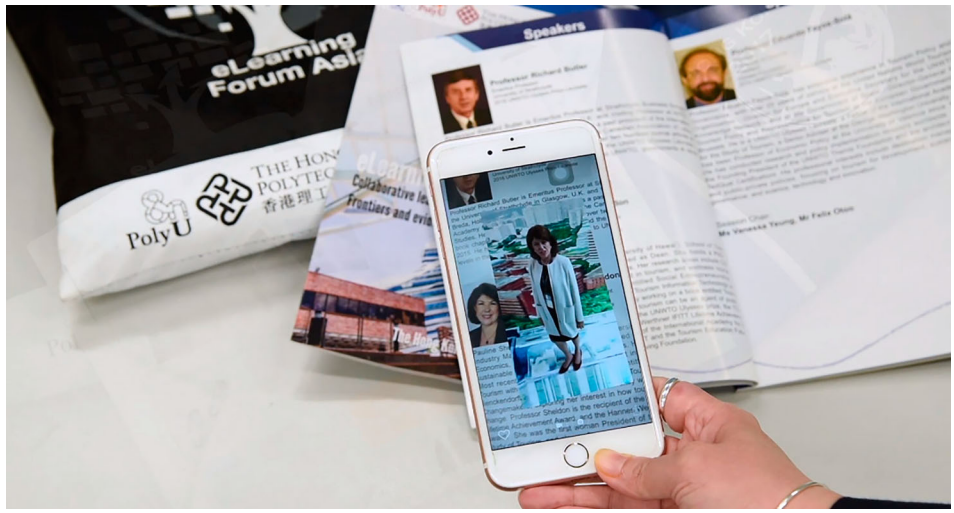

Figure 3. Sample photo of the AR use in showing speakers with video overlay on a personal portrait.

technology adoption in today's constantly advancing technological environment.

Perceived value is defined as the overall assessment by a consumer on the utility of a service or product evaluated from the perception of what is received (get factors) and what is given (input factors) (Zeithaml, 1988). Such value perception is likely to vary between customers, particularly for product/service adopted on a voluntary basis. Therefore, the VAM approach is more realistic in comparison with TAM model because it includes the "input" component instead of mainly "get" components as in the TAM model (Lin, Lee, & Lin, 2010). This approach has often been observed as being able to explain better technology adoption by examining individual perceived values (Chan & Lu 2004; Kim et al., 2007). Considering the voluntary use of the AR app by the conference participants and their varied individual backgrounds and because they play dual roles of technology users and service consumers rather than employees in an organizational setting, it is believed VAM is more appropriate for use as a theoretical framework in explaining technology adoption intention in this study (Kleijnen, De Ruyter, & Wetzels, 2007).

In this study, it is proposed that the perceived usefulness and perceived enjoyment by conference delegates are the major extrinsic benefits obtained through AR app usage. They are regarded as the major "get" components of perceived value. With reference to Davis et al. (1992), perceived usefulness in here is defined as the degree to which a person believes that using the AR app would enhance his or her work performance. Meanwhile, perceived enjoyment refers to the extent to which the usage of AR app is regarded to be enjoyable in its own right regardless of its expected performance consequence. Excitement and fun are generally included in the evaluation of the enjoyment component. Such constructs have been used extensively and have been found to be two of the most crucial predictors for perceived values which in turn determines subsequent varieties of IT adoptions. Yu et al. (2017) explored media tablet adoption intention and found that both perceived usefulness and perceived enjoyment have significant effects on the adoption intention of media tablets. Other related studies include the acceptance of mobile internet technology (Wiratmadja et al., 2012), the adoption of electronic mobile wearable devices (Yang et al., 2016) and the adoption of Internet of Things (IoT) (Kim, Park, & Choi, 2017). The findings from these studies revealed perceived usefulness and perceived enjoyment have significant positive effects on adoption intention through perceived value. Therefore, it is hypothesized that:

H1a. Perceived usefulness will have a positive effect on perceived value.

H1b. Perceived enjoyment will have a positive effect on perceived value.

Perceived inputs from technology use are normally divided into monetary and non-monetary aspects (Zeithaml, 1988). For conference attendees and stakeholders, the registration fees already include the use of the associated app; hence, this division is not applicable in the current study. For the non-monetary

aspect, ease of use has been viewed generally as one component of technicality, and refers to the extent to which the technical features and functions of the system meet the physical and mental needs of the user (Kim et al., 2007). In terms of the AR app, these technicality needs would include aspects, such as conference content engagement, learning, audio-visuals requirements, and kinesthetic appeal. A number of prior studies have found that technicality has significant effect on mobile internet adoption (Kim et al., 2007), internet protocol television (Lin, Wu, Hsu, & Chou, 2012), IoT smart home service (Kim et al., 2017) and mobile internet service (Roostika, 2012) via perceived value. In addition to the technical aspects, other proposed captivating inputs such as the ability to meet the needs of curiosity, mystery, and intrigue are also highly relevant to our study and have been found to be the antecedent of perceived value (Johnson & Witchey, 2011; Luckin & Fraser, 2011; Vygotsky, 1978; Zhu, Sangwan, & Lu, 2010). Therefore, we hypothesize thefollowing:

H2a. Perceived technicality will have a positive effect on perceived value.

H2b. Perceived captivating inputs will have a positive effect on perceived value.

Adoption intention is defined as "a person's subjective probability that he will perform some behavior" (Fishbein & Ajzen, 1975, p. 288). As mentioned previously, the VAM model is based on the input-benefit analysis of technology use. Conference stakeholders' overall judgments of the perceived value of the app are reached by comparing benefits and "inputs" resulting from the app's usage, which determine subsequently its adoption intention. This relationship has received strong empirical support in the mainstream literature of general marketing and information systems (Curran & Meuter, 2005; Kim et al., 2007; Venkatesh, Morris, Davis, & Davis, 2003). Therefore, we hypothesize as follows and the proposed model is depicted in Figure 4.

H3. Perceived value will have a positive effect on adoption intention.

Instrument design and data collection

A quantitative approach was adopted in this study. Based on the Aura created for conferences, conference stakeholders were asked questions on their experience of AR, as well as their conference experience and user acceptance based on the VAM constructs. (See questions and domains to be analyzed in Table 1.) The survey items for each construct in the questionnaire were either taken or adapted from previous empirical studies with sound reliability and

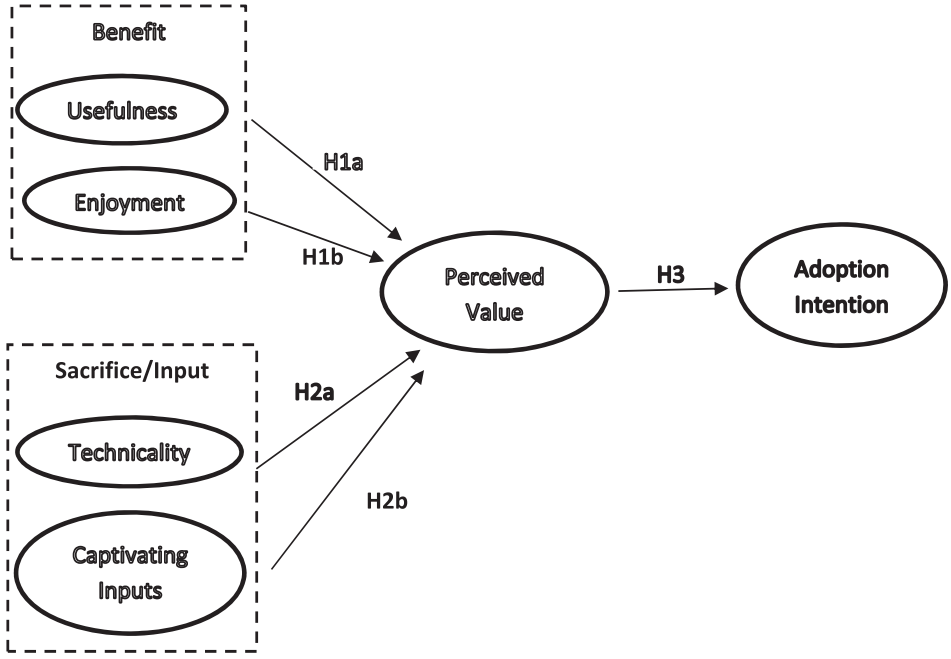

Figure 4. Value based adoption model of AR conference app.

Table 1. Questions and domains.

Question	Domain	Caption	Mean	SD
Using AR App bridges the learning gap between abstract descriptions and the real world phenomena	Technicality	T1	3.90	0.87
It leads me to participate in actively engaging with content	Technicality	T2	3.93	0.71
It links higher level, abstract concepts with tangible real world environments	Technicality	T3	3.94	0.81
It fits with constructivist learning	Technicality	T4	3.98	0.72
It acts as scaffolding for users	Technicality	T5	3.99	0.75
It stimulates sensory feedback	Technicality	T6	4.03	0.79
It stimulates audio-visual appeal	Technicality	T7	4.16	0.75
It stimulates kinesthetic appeal	Technicality	T8	3.93	0.81
It utilizes curiosity to draw users into the activity	Captivating Input	CI1	4.13	0.78
It utilizes mystery to draw users into the activity	Captivating Input	CI2	3.96	0.86
It utilizes intrigue to draw users into the activity	Captivating Input	CI3	3.96	0.80
The initial "gimmick" attraction begins to give way to a serious way to engage user	Captivating Input	CI4	4.02	0.78
It focusses on something different	Enjoyment	E1	3.94	0.81
Using the AR conference App makes me better informed and obtained about the conference-related information	Usefulness	U1	3.96	0.93
Using AR conference App enhances my conference-related information search effectiveness	Usefulness	U2	3.93	0.90
Using AR conference app enables me to search and obtain conference-related information more quickly and easily	Usefulness	U3	3.94	0.88
Using AR conference App is useful in searching and obtaining conference-related information	Usefulness	U4	3.94	0.87
The AR conference App is clear and understandable	Perceived Value	PV1	4.01	0.76
The AR conference App is easy to get to do what I want it to do	Perceived Value	PV2	3.99	0.77
The AR conference App does not require a lot of mental effort	Perceived Value	PV3	3.98	0.82
The AR conference App is easy to use	Perceived Value	PV4	4.01	0.82
Using the AR conference App provides me with a lot of enjoyment	Enjoyment	E2	3.98	0.78
Using the AR conference App provides me with a lot of fun	Enjoyment	E3	3.92	0.84
Using the AR conference App provides me with a lot of excitement	Enjoyment	E4	3.89	0.81
It is a pleasant experience in using the AR conference App	Enjoyment	E5	4.06	0.78
It is an interesting experience in using the AR conference App	Enjoyment	E6	4.13	0.76
I plan to use the AR conference App in future conferences	Adoption Intention	AI1	3.91	0.87
I intend to use the AR conference App in future conferences	Adoption Intention	AI2	3.89	0.83
I predict that I would use AR conference App in future conferences	Adoption Intention	AI3	4.03	0.88

Note: A 5-point Likert scale was used to rank the respondents' agreement with each description, ranging from 5 (strongly agree) to 1 (strongly disagree).

validity. For usefulness and enjoyment, we adapted instruments from (Davis, 1989) and Van der Heijden (2004). For technicality and perceived value, the items were adapted fromKim et al. (2007). For captivating inputs, the items were adapted from Luckin and Fraser (2011). Finally, for adoption intention, the items were adapted from Agarwal and Karahanna (2000). All stakeholders in the two conferences held in Hong Kong were approached to complete a questionnaire. The two conferences were the Third Global Tourism and Hospitality Conference (GTHC), held in Hong Kong on June 5-7, 2017, and the eLearning Forum of Asia (eLFA) 2017, held in Hong Kong SAR on June 15-17, 2017.

The GTHC was attended by over 400 delegates from 31 countries, and involved 110 volunteers. It served as a good networking platform for educators, students as well as industry leaders to disseminate and exchange views connected to innovations, trends, opportunities, and challenges of global tourism and the hospitality industry (Ngan, 2017). Taking the theme "Innovation-Research-Education," the conference aimed to provide a unique platform to foster the discussion on innovation and trends in global tourism and hospitality through the presentation of recent research and current industry thinking by educators, thought leaders, researchers, industry executives, and hospitality and tourism students (GTHC, 2017).

The eLFA was attended by over 250 international delegates from over 15 countries. This eLFA in 2017 marked the 12th anniversary of eLFA, which featured innovations in e-learning in Asia and beyond (eLFA, 2017). The conference theme, "Collaborative learning with technology: Frontiers and evidence," aimed to expose new possibilities of upcoming higher education (eLFA, 2017).

Results

Background of respondents

A total number of 205 questionnaires were collected with 161 valid responses. Among the respondents,

42.9% participated in the conference as delegates while 24.4% were organizers, 9.6% were sponsors, 9.0% were exhibitors, 4.5% were invited speakers, and 9.6% were others. There were 45.5% male and 54.5% female. More than one-third of the respondents (39.1%) were between 18 and 25 years old, 23.1% between 36 and 45, 19.9% between 36 and 45 years old, and 18.0% were aged 46 or above. The majority had at least college education: 3.2% were sub-degree holders, 40.4% of respondents claimed that an undergraduate degree was their highest educational attainment while 49.4% had a postgraduate degree. Meanwhile, 7.0% of the respondents were graduates of secondary school or below.

Perceived technology adoption and experience in AR

Although the respondents tended to accept new technology, the majority had their first AR experience in these conferences. Over half of the respondents identified themselves as innovators (8.3%), early adopters (31.2%), and the early majority (24.9%), while 57.5% had experienced AR for the first time and 75% used Aurasma for the first time. At the conference, 39.8% of the respondents used the AR program overlay, 37.9% used the speakers' overlay, 29.2% employed the sponsors overlay, 23.6% used the venue overlay, and 7.5% viewed the menu overlay (see Table 2.).

Table 2. Respondent Profile.

N = 161	%
First AR experience	57.5
First time using Aurasma	75
Specific aspect(s) of AR used in this conference (multiple answers)	
Programme	39.8
Speakers	37.9
Sponsors	29.2
Venue	23.6
Menu	7.5
Conference participation as	
Delegates	42.9
Organizers	24.4
Sponsors	9.6
Exhibitors	9.0
Invited speakers	4.5
Others	9.6
Age group	
18–25	39.1
26–35	23.1
36–45	19.9
46 or above	18.0
Final education level	
Secondary or below	7.0
Sub-degree	3.2
Undergraduate	40.4
Post-graduate	49.4
Conference attended	
ELFA	29.8
GTHC	70.2
Gender	
Male	45.5
Female	54.5
Perceived technology adoption	
Innovator	8.3
Early Adopter	31.2
Early Majority	24.9
Late Majority	9.8
Laggard	2.0

Model tested

Anderson and Gerbing (1988, 1992)'s two-step approach to structural equation modeling was adopted in the analysis. AMOS 23 was used to analyze the data on the 161 respondents. Estimation of means and intercepts were used to handle missing values.

In the first step, confirmatory factor analysis (CFA) was conducted to examine the measurement model and clarify the factorial structure, as shown in Figure 5. The maximum likelihood method was used to estimate the parameters and test the factorial structure of variables. The results of the various CFA indices of fit suggested that the measurement model reached the desired threshold with good explanatory power for all variables (CMIN/df = 1.724, RMSEA = .067, CFI = .931, IFI = .933, NFI = .853). The CFA established the measurement validity of the model and the rationality of the progressive statistical analysis. The results of the reliability test also confirmed that all scales used in the study had high levels of internal consistency: usefulness (Cronbach's alpha = .927), enjoyment (Cronbach's alpha = .919), technicality (Cronbach's alpha = .909), captivating input (Cronbach's alpha = .850), perceived value (Cronbach's alpha = .899), and adoption intention (Cronbach's alpha = .907). The measurement model is good. All estimates are significant and the factor loadings are all larger than 0.6. Average Variance Extracted (AVE) for all constructs are larger than 0.5 and the construct reliability for all constructs are above 0.7. Hence, all scales have good convergent validity. Table 3.

A second-order model is employed in the analysis because correlated constructs with multiple items are used as measurement instruments. The second-order factor model can provide a more parsimonious and interpretable model from putting a structure on the pattern of covariance between the correlated first-order factors and separate variance because of

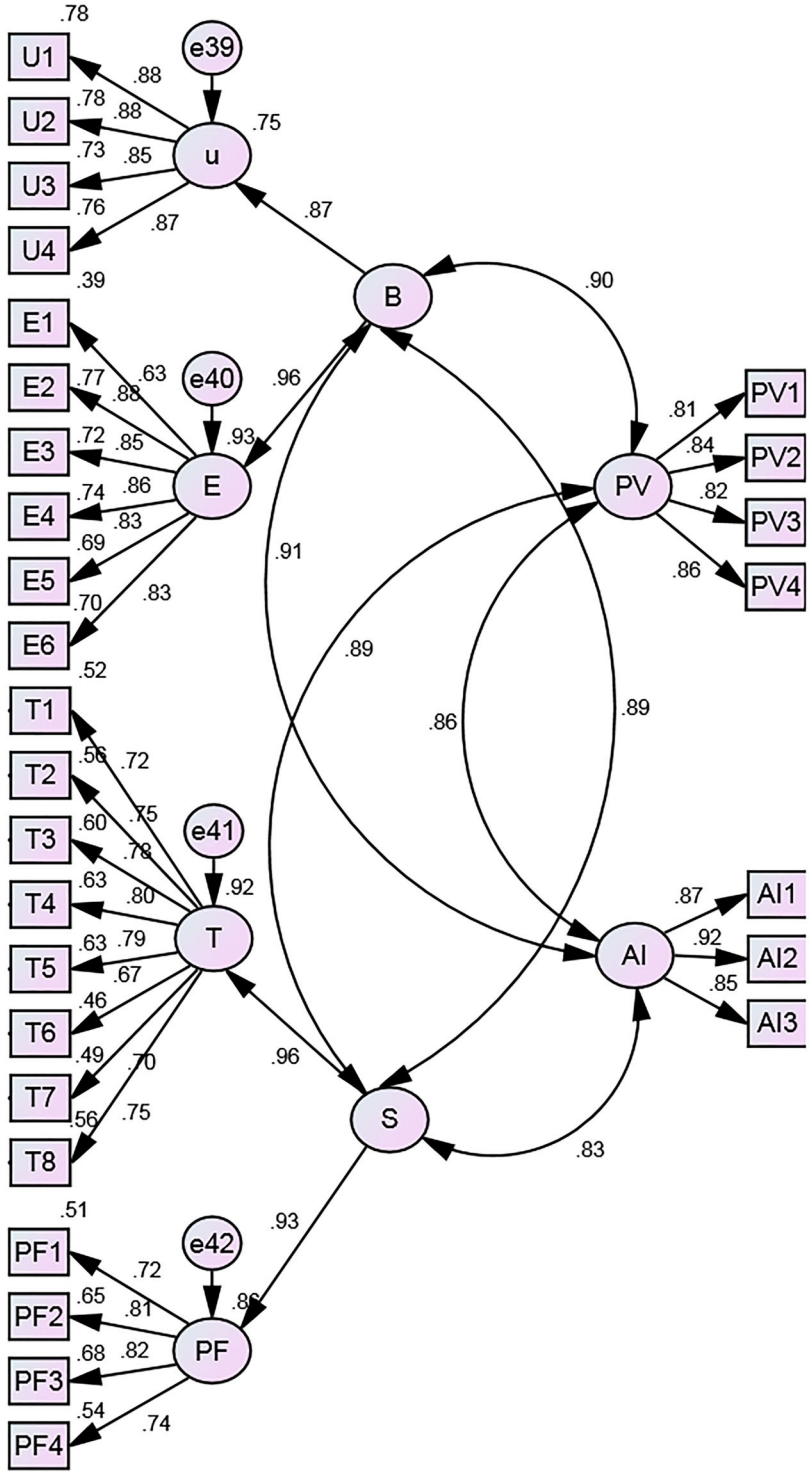

Figure 5. Factorial Structure. Caption of the figures: u = Usefulness, E = Enjoyment, T = Technicality, CI = Captivating Input, B = Benefit, I = Inputs, PV = Perceived Value, AI = Adoption Intention.

Table 3. Reliability and convergent validity.

			Estimate (Factor loadings)	Estimate Squared	Sum of Squared loadings	AVE	Delta	Sum of loadings	Sum of loadings Squared	Sum of Delta	CR Denominator	CR	Cronbach's Alpha
U4	←	u	0.875	0.766			0.234						
U3	←	u	0.853	0.728			0.272						
U2	←	u	0.881	0.776			0.224						
U1	←	u	0.882	0.778	3.047	0.762	0.222	3.491	12.187	0.953	13.140	0.927	0.927
E6	←	E	0.833	0.694			0.306						
E5	←	E	0.829	0.687			0.313						
E4	←	E	0.858	0.736			0.264						
E3	←	E	0.854	0.729			0.271						
E2	←	E	0.876	0.767			0.233						
E1	←	E	0.629	0.396	4.010	0.668	0.604	4.879	23.805	1.990	25.795	0.923	0.919
T8	←	T	0.751	0.564			0.436						
T7	←	T	0.699	0.489			0.511						
T6	←	T	0.675	0.456			0.544						
T5	←	T	0.799	0.638			0.362						
T4	←	T	0.800	0.640			0.360						
T3	←	T	0.771	0.594			0.406						
T2	←	T	0.744	0.554			0.446						
T1	←	T	0.713	0.508	4.443	0.555	0.492	5.952	35.426	3.557	38.983	0.909	0.909
PF4	←	PF	0.739	0.546			0.454						
PF3	←	PF	0.83	0.689			0.311						
PF2	←	PF	0.806	0.650			0.350						
PF1	←	PF	0.708	0.501	2.386	0.596	0.499	3.083	9.505	1.614	11.119	0.855	0.850
PV1	←	PV	0.806	0.650			0.350						
PV2	←	PV	0.838	0.702			0.298						
PV3	←	PV	0.818	0.669			0.331						
PV4	←	PV	0.864	0.746	2.768	0.692	0.254	3.326	11.062	1.233	12.295	0.900	0.899
AI1	←	AI	0.866	0.750			0.250						
AI2	←	AI	0.915	0.837			0.163						
AI3	←	AI	0.85	0.722	2.310	0.770	0.278	2.631	6.922	0.690	7.6125	0.909	0.907

specific factors from the measurement error (Chen, Sousa, & West, 2005).

In the second step, the goodness of fit of the structural model was examined. The structural model explains the estimated construct covariances to clarify the association between the variables. Based on the user acceptance model of the VAM system, usefulness and enjoyment are predictors that combined to form a second-order factor, benefit, and technicality and captivating input are another set of predictors that combined to form another second-order factor, input. Perceived value is the intervening variable whereas adoption intention is the dependent variable. We hypothesize that benefit and input will affect the perceived value and enhance adoption intention.

The results of the analysis shown in Figure 6 indicate that all causal paths in the structural model were statistically significant and the predictive power of the model was confirmed. The results support all three hypotheses: "benefit" is related positively to "perceived value" (beta = .787, $p < .001$), "input" is related positively to "perceived value" (beta = .491, $p < .001$), and "perceived value" is associated positively with "adoption intention" (beta = .864, $p < .001$). The results from different fit indices demonstrate that the model has an acceptable fit (CMIN/df = 2.176, RMSEA = .076, CFI = .908, IFI = .890, NFI = .913).

The results of the study confirmed that usefulness, enjoyment, technicality, and captivating input formed two second-order factors, namely, benefit and input. The latter two factors predicted indirectly adoption intention via perceived value.

Discussion

Core vs. peripheral aspects used

Although all aspects of AR contents were used multiple times by the conference stakeholders, tiers still exist. The core aspects include the program and speakers. Speakers are the main contributors to the program, and should thus be the focus of a conference. Conference stakeholders used the AR app mainly to gain more understanding of the program and the speakers. They also used the app to obtain more details on the sponsors and the venue. However, the "food menu" item provided in the app was a peripheral feature. Conference stakeholders did not focus on the food and beverages offered at the event. Conference planners and managers can utilize the AR app to provide other interesting and useful information to engage conference delegates, such as the transportation available from the conference venue to various nearby city attractions.

New to technology-ready groups

AR is still a new technology in the MICE sector. Conference stakeholders, particularly attendees and speakers, typically have a higher education backgrounds due to the context of the research. With the themes of the two conferences focusing on innovation and technology, stakeholders were expected to have backgrounds or be interested in new technologies. These stakeholders were also open to new ideas, because two-thirds of them claimed that they were in the innovator, early adopter, and early majority groups. The results confirmed users who favor innovation are more likely to be early adopters and feel more at ease with new technology (Chung et al., 2015). However, AR technologies are still new to these technology-ready groups because over half of them indicated they had their first AR experience in these conferences and were first-time users of Aurasma.

Perception of AR app

Business travelers enjoy the AR conference app particularly its technicality and captivating feature. An earlier study also found urban tourists had a very positive attitude towards the technology and liked the idea of augmenting their environment with information despite being unfamiliar with AR (Yovcheva et al., 2014). The results indicated that respondents agreed with all of the descriptions of the AR conference app with all means close to 4, ranging 3.89–4.16 (see Table 1) where "it stimulates audio-visual appeal" (mean = 4.16), "it is an interesting experience in using the AR conference app" (mean = 4.13), and "it utilizes curiosity to draw users into the activity" (mean = 4.13) had the highest mean. Sponsors can make good use of a variety of audio-visual and sensory overlays as gimmicks to showcase their products and services and capture conference delegates' curiosity and attract them to engage.

Adoption intention of AR

The proposed model was confirmed with empirical results showing that the benefit and input contributed to the perceived value, which in turn affects adoption intention. The results indicated the conference

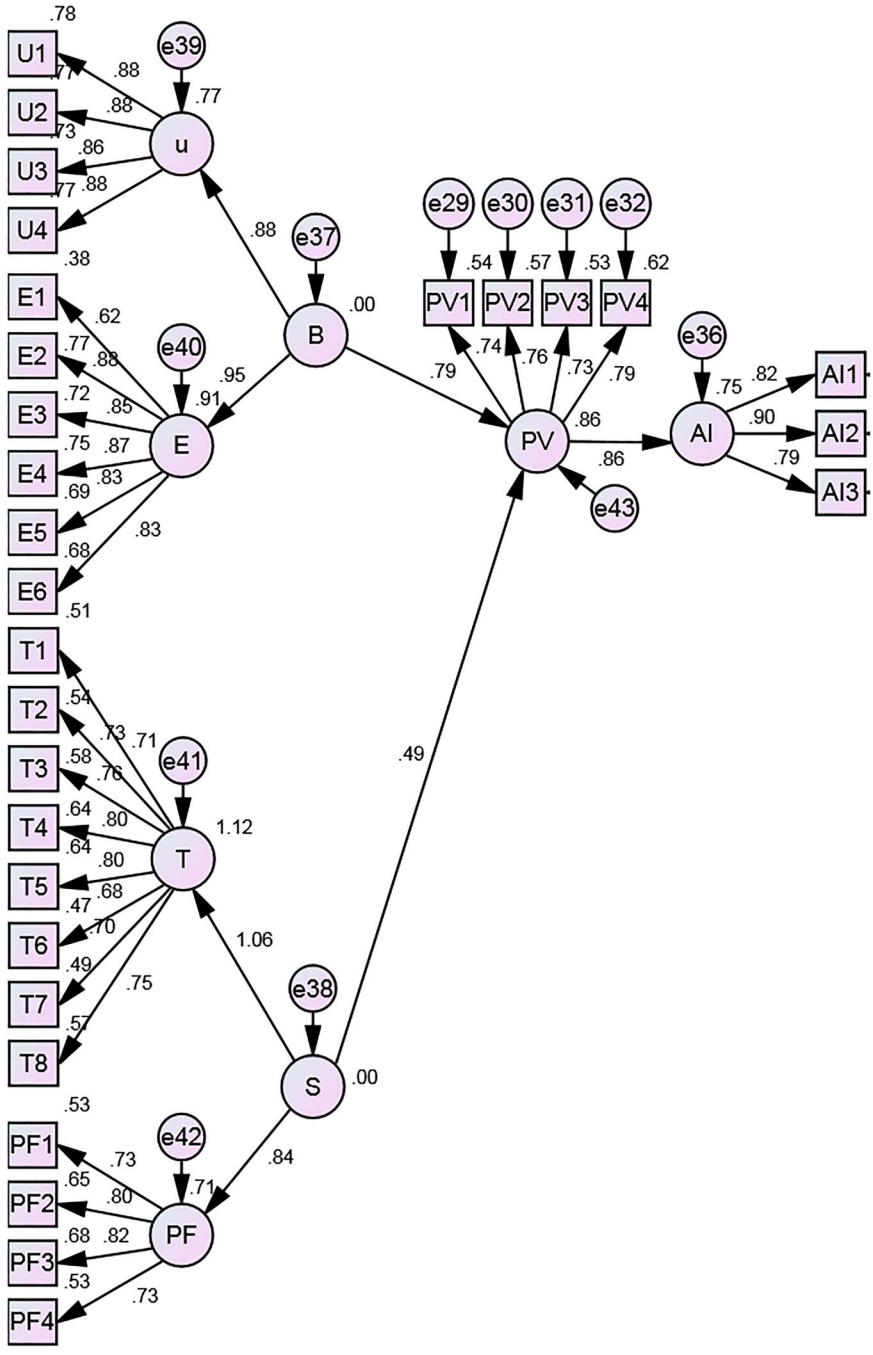

Figure 6. Results of SEM Analysis. Caption of the figures: u = Usefulness, E = Enjoyment, T = Technicality, CI = Captivating Input, B = Benefit, I = Input, PV = Perceived Value, AI = Adoption Intention.

stakeholders considered the AR conference app in this study technically easy to use, clear and understandable, easy to get to do what the users want it to do and does not call for a lot of mental effort. Consequently, the value delivered from usage experiences contributed to their intention to adopt the conference AR app at the time and in the near future. The findings also suggest that usefulness and enjoyment are the two major elements that users considered as benefits that could be obtained from the AR app.

Our proposed model also confirmed that benefit and input are indeed related positively to perceived value, which will then contribute to adoption intention.

Users found the app useful in helping them to search for and obtain related information and they were better informed about the latest conference-related news in a timely manner. Users also found the AR app provided them with enjoyment, including fun and excitement, and enabled them to focus on something different (mean = 3.94), offering a pleasant and interesting experience. Such perceived benefits have a much higher effect on the perceived value of the AR app and far outweigh the inputs required from the end users.

Newly identified components

The model also identified new components in technicality and captivating inputs to the existing VAM approach. The empirical results identified that the input associated with AR app usage consists of technicality and captivating input. The AR conference app therefore requires a certain level of technical knowledge combined with users' curiosity before they can appreciate fully the values that can be delivered from using it. While using the AR conference app not only bridges the gap of learning between abstract descriptions and reality, it also leads users to engage actively with the conference by enabling them to interact with speakers via the app before the conference starts. The AR conference app links higher level, abstract concepts with tangible real-world environments in a lively situation. Users can experience and tour the venue, which is better than imagining the environment solely by reading the provided venue names and numbers. Hence the AR app can simultaneously enable constructivist learning, act as a support, and stimulate sensory feedback and audio-visual and kinesthetic appeal. With overlays such as images and videos, the AR app also utilizes curiosity, mystery, intrigue, and gimmick to draw users into conference activities and engage them with information in an innovative way, which otherwise would be a tedious experience.

Alliance with destination vendors

Business travel operators, event managers, and convention and visitor bureau and destination marketing organizations can benefit from this case and develop AR apps that target business travelers who attend events at a given destination. Through overlaying interactive content, these travelers can explore the destination further, obtain event information for planning pre- and post-event activities, browse the event program, and build connections with other event stakeholders. Linking to different related hospitality and tourism products, forming an alliance with tourism vendors such as event-planning consultants, venue managers, and hotel and tour operators would be worth considering. This linking allows the sharing of useful information that could improve further the work efficiency of the business traveler.

Conclusion and further research

This study was the first to examine AR adoption intention using the VAM approach. The focus was on conference stakeholders. With the aim of developing and validating a theoretical model, three hypotheses were proposed and the hedonic approach to AR app adoption analyzed. The results of this study confirmed the proposed hypotheses and model. AR adoption is affected by its perceived value, to which the benefits of usefulness and enjoyment contribute, along with newly identified components of technicality and captivating inputs. The model can be adapted further to other AR apps in the different areas of hospitality and tourism.

However, this study is limited by its small sample. The respondents had very high levels of education, due to the nature of the conference attendees and of business travel. The respondents of this study were predominantly young, with 39% under the age of 25, and 62% under the age of 32. This factor likely biased the results because younger people are more likely to be technology adopters. Hence, further research with a larger sample could be conducted to test the model, thereby generalizing the findings to a wider population. This study focused on the adoption of the AR app and took a quantitative approach. Further studies could also use qualitative methods to find out why users adopt AR and what kind of information and gimmicks users would be interested to see in the future. This research and other studies have focused mainly on users' adopting AR as groups of innovators, early adopters, and an early majority. Further research into the late majority and laggards can cover research gaps on tourists' technology use and their readiness to accept AR.

Disclosure statement

No potential conflict of interest was reported by the authors.

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References

Abowd, G. D., Atkeson, C. G., Brotherton, J., Enqvist, T., Gulley, P., & LeMon, J. (1998). *Investigating the capture, integration and access problem of ubiquitous computing in an educational setting*. Paper presented at the The SIGCHI Conference on Human factors in Computing Systems, Los Angeles, California, USA.

Agarwal, R., & Karahanna, E. (2000). Time flies when you're having fun: Cognitive absorption and beliefs about information technology usage. *MIS Quarterly*, *24*(4), 665–694.

Anderson, J. C., & Gerbing, D. W. (1988). Structural equation modeling in practice: A review and recommended two-step approach. *Psychological Bulletin*, *103*(3), 411.

Anderson, J. C., & Gerbing, D. W. (1992). Assumptions and comparative strengths of the two-step approach: Comment on Fornell and Yi. *Sociological Methods & Research*, *20*(3), 321–333.

Avila, S. (2017). Implementing augmented reality in Academic Libraries. *Public Services Quarterly*, *13*(3), 190–199.

Azuma, R., Billinghurst, M., & Klinker, G. (2011). Special section on mobile augmented reality. *Computers and Graphics*, *35*(4), vii–viii.

Bloxham, J. (2013). Augmented reality in education: Teaching tool or passing trend. *The Guardian*, p. Learning and Teaching. Retrieved from https://www.theguardian.com/higher-education-network/blog/2013/feb/11/augmented-reality-teaching-tool-trend

Chan, S., & Lu, M. (2004). Understanding internet banking adoption and use behavior: A Hong Kong perspective. *Journal of Global Information Management*, *12*(3), 21–43.

Cheah, M. S., Quah, Y. P., Wong, P. E., & Zainon, W. M. N. W. (2014). Augmented reality: A review on its issues and application in teaching and learning. *International Journal of Computer and Information Technology*, *3*(2), 269–274.

Chen, F. F., Sousa, K. H., & West, S. G. (2005). Testing measurement invariance of second-order factor models. *Structural Equation Modeling*, *12*(3), 471–492.

Chung, N., Han, H., & Joun, Y. (2015). Tourists' intention to visit a destination: The role of augmented reality (AR) application for a heritage site. *Computers in Human Behavior*, *50*, 588–599.

Craig, A. B. (2013). *Understanding augmented reality: Concepts and applications*. Waltham, MA: Elsevier.

Curran, J. M., & Meuter, M. L. (2005). Self-service technology adoption: Comparing three technologies. *Journal of Service Marketing*, *19*(2), 103–113.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, *13*(3), 319–340.

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). Extrinsic and intrinsic motivation to use computers in the workplace. *Journal of Applied Social Psychology*, *22*(14), 1111–1132.

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science*, *35*(8), 982–1003.

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1992). Extrinsic and intrinsic motivation to use computers in the workplace. *Journal of Applied Social Psychology*, *22*(14), 1111–1132.

Dey, A. K., Salber, D., Abowd, G. D., & Futakawa, M. (1999). *The conference assistant: Combining context-awareness with wearable computing*. Paper presented at the The Third International Symposium on Wearable Computers, San Francisco, CA, USA.

Dickinson, J. E., Ghali, K., Cherrett, T., Speed, C., Davies, N., & Norgate, S. (2014). Tourism and the smartphone app: Capabilities, emerging practice and scope in the travel domain. *Current Issues in Tourism*, *17*(1), 84–101.

eLFA. (2017). Welcome message. Retrieved 28th December, 2017, from http://shtmhk2017.wixsite.com/hongkong2017/welcome-speech.

Feiner, S., MacIntyre, B., Höllerer, T., & Webster, A. (1997). A touring machine: Prototyping 3D mobile augmented reality systems for exploring the urban environment. *Personal Technologies*, *1*(4), 208–217.

Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention, and behaviour: An introduction to theory and research*. Reading, MA: Addison - Wesley.

GTHC. (2017). Welcome Message. Retrieved 28th December, 2017, from http://shtmhk2017.wixsite.com/hongkong2017/welcome-speech.

Haugstvedt, A.-C., & Krogstie, J. (2012). *Mobile augmented reality for cultural heritage: A technology acceptance study*. Paper presented at the 2012 IEEE International Symposium on Mixed and Augmented Reality (ISMAR).

He, Z., Wu, L., & Li, X. R. (2018). When art meets tech: The role of augmented reality in enhancing museum experiences and purchase intentions. *Tourism Management*, *68*, 127–139.

HKTB. (2003). *A statistical review of Hong Kong tourism 2002*. Hong Kong: Hong Kong Tourism Board.

HKTB. (2017a). Power Up Hong Kong: Hong Kong Tourism Board Annual Report 2015/16 (pp. 134).

HKTB. (2017b). A Statistical Review of Hong Kong Tourism 2016 (pp. 70). Hong Kong.

HKTB. (2017c). *Statistics on MICE arrivals 2016*. Hong Kong: Hong Kong Tourism Board.

ICCA. (2017). 2016 ICCA Statistics Report Country & City Rankings Publiac Abstract: International Congress and Convention Assosication.

Johnson, L., Becker, S. A., Estrada, V., & Freeman, A. (2015). *NMC Horizon Report: 2015 Library Edition*. Austin, Texas: The New Media Consortium.

Johnson, L. F., & Witchey, H. (2011). The 2010 horizon report: Museum edition. *Curator: The Museum Journal*, *54*(1), 37–40.

Jung, T., Chung, N., & Leue, M. C. (2015). The determinants of recommendations to use augmented reality technologies: The case of a Korean theme park. *Tourism Management*, *49*, 75–86.

Jung, T., & Han, D.-I. (2014). Augmented reality (AR) in urban heritage tourism. *e-Review of Tourism Research*. (ISSN: 1941-5842).

Jung, T., tom Dieck, M. C., Lee, H., & Chung, N. (2016). *Effects of virtual reality and augmented reality on visitor experiences in museum*. Paper presented at the International Conference 2016, Bilbao, Spain.

Kim, H. W., Chan, H. C., & Gupta, S. (2007). Value-based adoption of mobile internet: An empirical investigation. *Decision Support Systems*, *43*(1), 111–126.

Kim, H. H., & Law, R. (2015). Smartphones in tourism and hospitality marketing: A literature review. *Journal of Travel & Tourism Marketing*, *32*(6), 692–711.

Kim, T. G., Lee, J. H., & Law, R. (2008). An empirical examination of the acceptance behaviour of hotel front office systems: An extended technology acceptance model. *Tourism Management*, *29*(3), 500–513.

Kim, Y., Park, Y., & Choi, J. (2017). A study on the adoption of IoT smart home service: Using value-based adoption model. *Total Quality Management*, *28*(10), 1149–1165.

Kleijnen, M., De Ruyter, K., & Wetzels, M. (2007). An assessment of value creation in mobile service delivery and the moderating role of time consciousness. *Journal of Retailing*, *83*(1), 33–46.

Kourouthanassis, P., Boletsis, C., Bardaki, C., & Chasanidou, D. (2015). Tourists responses to mobile augmented reality travel guides: The role of emotions on adoption behavior. *Pervasive and Mobile Computing*, *18*, 71–87.

Kwon, H. K., & Seo, K. K. (2013). Application of value-based adoption model to analyze SaaS adoption behavior in Korean B2B Cloud market. *International Journal of Advancements in Computing Technology*, *5*(12), 368–373.

Lau, C. K. H., & Education Bureau. (2016). *Meetings, Inventives, Conventions and Exhibitions (MICE)*. Hong Kong: Personal, Social and Humanities Education Section, Education Bureau, The Government of Hong Kong Special Adminstrative Region.

Lau, C. K. H., & Wong, S. C. K. (2010). The value of conventions and events: Perspectives and experiences of industry leaders at international convention and expo summit 2009. *Journal of Convention & Event Tourism*, *11*(3), 234–246.

Lawrence, M., & McCabe, V. (2001). Managing conferences in regional areas: A practical evaluation in conference management. *International Journal of Contemporary Hospitality Management*, *13*(4), 204–207.

Lin, T. C., Lee, C. L., & Lin, J. C. (2010). Determinants of Enterprise 2.0 adoption: A value-based adoption model approach. Information Society (i-Society), *International Conference on. IEEE*, pp. 12-18, 2010.

Lin, T. C., Wu, S., Hsu, S. C., & Chou, Y. C. (2012). The integration of value-based adoption and expectation-confirmation models: An example of IPTV continuance intention. *Decision Support Systems*, *54*, 63–75.

Luckin, R., & Fraser, D. S. (2011). Limitless or pointless? An evaluation of augmented reality technology in the school and home. *International Journal of Technology Enhanced Learning*, *3*(5), 510–524.

McCabe, V. (2001). Career paths and labour mobility in the conventions and exhibitions industry in eastern Australia: Results from a preliminary study. *International Journal of Tourism Research*, *3*(6), 493–499.

Morosan, C. (2014). Toward an integrated model of adoption of mobile phones for purchasing ancillary services in air travel. *International Journal of Contemporary Hospitality Management*, *26*(2), 246–271.

Morosan, C., & DeFranco, A. (2016). It's about time: Revisiting UTAUT2 to examine consumers' intentions to use NFC mobile payments in hotels. *International Journal of Hospitality Management*, *53*(1), 17–29.

Ngan, P. 3rd Global Tourism & Hospitality Conference hosted by School of Hotel and Tourism Management to celebrate PolyU's 80th Anniversary. Hotel Technology Next Generation. Retrieved from http://htng.hsyndicate.com/news//4083178.html.

Nishibe, Y., Waki, H., Morihara, I., Hattori, F., Ishida, T., Nishimura, T., … Gotoh, T. (1998). Mobile digital assistants for community support. *AI Magazine*, *19*(2), 31.

Office of the Chief Executive. (2013). *The 2013 Policy Address: Seek Change, Maintain Stability, Serve the People with Pragmatism*. Retrieved from https://www.policyaddress.gov.hk/2013/eng/pdf/PA2013.pdf

Oh, S. H., Kim, Y. M., Lee, C. W., Shim, G. Y., & Park, M. S. (2009). Consumer adoption of virtual stores in Korea: Focsing on the rolw of trust and playfulness. *Psychology & Marketing*, *26*, 652–668.

Ohta, Y., & Tamura, H. (2014). *Mixed reality: Merging real and virtual worlds*. Springer Publishing Company, Incorporated.

Olsson, T., Lagerstam, E., Kärkkäinen, T., & Väänänen-Vainio-Mattila, K. (2013). Expected user experience of mobile augmented reality services: A user study in the context of shopping centres. *Personal and Ubiquitous Computing*, *17*(2), 287–304.

Peres, R., Correia, A., & Moital, M. (2011). The indicators of intention to adopt mobile electronic tourist guides. *Journal of Hospitality and Tourism Technology*, *2*(2), 120–138.

Roostika, R. (2012). Mobile internet acceptance among University students: A value-based adoption model. *International Journal of Research in Management & Technology*, *2*(1), 21–28.

Samardzija, A. C. (2015). *Mobile augmented reality interactive systems for urban tourism*. Paper presented at the Central European Conference on Information and Intelligent Systems.

tom Dieck, M. C., & Jung, T. (2018). A theoretical model of mobile augmented reality acceptance in urban heritage tourism. *Current Issues in Tourism*, *21*(2), 154–174.

tom Dieck, M. C., Jung, T., & Rauschnabel, P. A. (2017). Determining visitor engagement through augmented reality at science festivals: An experience economy perspective. *Computers in Human Behavior*, *82*, 44–53.

Trojan, J. (2016). Integrating AR services for the masses: Geotagged POI transformation platform. *Journal of Hospitality and Tourism Technology*, *7*(3), 254–265.

Van der Heijden, H. (2004). User acceptance of hedonic information systems. *MIS Quarterly*, *28*(4), 695–704.

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, *27*(3), 425–478.

Vygotsky, L. (1978). Interaction between learning and development. *Readings on the Development of Children*, *23*(3), 34–41.

Wang, D., Park, S., & Fesenmaier, D. R. (2012). The role of smartphones in mediating the touristic experience. *Journal of Travel Research*, *51*(4), 371–387.

Weber, K., & Chon, K. (2002). Trends and key issues for the convention industry. In K. Weber & K. Chon (Eds.), *Convention tourism: International research and industry perspectives* (pp. 203–212). New York: The Haworth Press.

Wei, S., Ren, G., & O'Neill, E. (2014). *Haptic and audio displays for augmented reality tourism applications*. Paper presented at the Haptics Symposium (HAPTICS), 2014 IEEE.

Wiratmadja, I. I., Govindaraju, R. & Athari, N. (2012). *Management of Innovation & Technology (ICMIT)*. 2012 IEEE International Conference.

Yang, H., Yu, J., Zo, H., & Choi, M. (2016). User acceptance of wearable devices: An extended perspective of perceived value. *Telematics and Informatics*, *33*(2), 256–269.

Yovcheva, Z., Buhalis, D., Gatzidis, C., & van Elzakker, C. P. (2014). Empirical evaluation of smartphone augmented reality browsers in an urban tourism destination context. *International Journal of Mobile Human Computer Interaction*, *6*(2), 10–31.

Yu, J., Lee, H., Ha, I., & Zo, H. (2017). User acceptance of media tablets: An empirical examination of perceived value. *Telematics and Informatics*, *34*(4), 206–223.

Zeithaml, V. A. (1988). Consumer perceptions of price, quality, and value: A means-end model and synthesis of evidence. *Journal of Marketing*, *52*(3), 2–22.

Zhu, G., Sangwan, S., & Lu, T.-J. (2010). A new theoretical framework of technology acceptance and empirical investigation on self-efficacy-based value adoption model. *Nankai Business Review International*, *1*(4), 345–372.