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The determinants of recommendations to use augmented reality technologies: The case of a Korean theme park

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HIGHLIGHTS

- Tourists' augmented reality perception was measured by the lens of modified DeLone & McLean's Model.
- The higher level of personal innovativeness, the more important the role of AR system quality.
- The lower level of personal innovativeness, the more important the role of AR contents quality.
- Our findings explain which quality factors are important for AR satisfaction and loyalty.

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ABSTRACT

The increased availability of smartphone and mobile gadgets has transformed the tourism industry and will continue to enhance the ways in which tourists access information while traveling. Augmented reality has grown in popularity because of its enhanced mobile capabilities. In tourism research, few attempts have been made to assess user satisfaction with augmented reality applications and the behavioral intention to recommended them. This study uses a quality model to test users' satisfaction and intention to recommend marker-based augmented reality applications. By applying process theory, this study also investigates the differences in these constructs between high- and low-innovativeness groups visiting a theme park in Jeju Island, South Korea. Questionnaires administered to 241 theme park visitors revealed that content, personalized service, and system quality affect users' satisfaction and intention to recommend augmented reality applications. In addition, personal innovativeness was found to reinforce the relationships among content quality, personalized service quality, system quality, and satisfaction with augmented reality.

1. Introduction

The development of mainstream computers and laptops into mobile gadgets and the transformation of surfaces and physical unconnected items into “displays” and interaction interfaces have been pushed by intense research over the last 20 years (Olsson, Lagerstam, Kaerkkaeinen, & Vaeaenaenen, 2013). Stationary desk-based computer interaction through single-screen environments with little connectivity has been replaced by mobile multi-screen and multi-connectivity-enabled devices, providing an “always on” ubiquitous computing experience (Olsson et al., 2013). Recently, significant attention has been directed to the potential of augmented reality (AR) to change users' view of their environment (Wang, Kim, Love, & Kang, 2013; Wasko, 2013). Within the tourism industry, enhanced mobile and smartphone capabilities have changed the ways in which tourists gather and access information while on vacation. Traditionally, orientation at a destination was given by tour guides, directional signs, or online maps. However, the popularity of smartphones with built-in cameras, global positioning system (GPS), and Internet connections has increased the availability of AR applications that enable destinations to construct a personal and context-aware tourism experience (Chou & Chanlin, 2012; Yovcheva, Buhalis, & Gatzidis, 2013). AR is particularly valuable to the tourism industry because it can create an interactive online environment in which tourists who have little knowledge of

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the area can realistically and naturally experience unfamiliar places (von der Pütten et al., 2012). However, introducing AR applications at tourism destinations and attractions does not automatically bring positive experiences (Yovcheva et al., 2013).

Haugstvedt and Krogstie (2012) concluded that little research has been conducted to identify the extent to which users are willing to accept AR applications. Snyder and Elinich (2010) explored AR within science museum exhibitions and discovered that the usage of site-based AR can overcome some of the key barriers associated with AR. Site-based AR is developed on computers; therefore, visitors are not required to use their own smartphone or glass devices, further enhancing the ease of use of site-based AR (Snyder & Elinich, 2010). In addition, Snyder and Elinich (2010) found that users with limited technological experience can use site-based AR. According to Mascioni (2012), several theme parks including Walt Disney World's Magic Kingdom in Orlando have integrated mobile devices. At the same time, some theme parks have started to incorporate on-site AR into their indoor attraction rides by projecting pictures or ghosts onto what looks like a mirror (a computer screen) in front of the visitors. The animations enter the visitors' real space and enhance their experience (Mascioni, 2012). Nevertheless, there is limited research on indoor theme park visitors' satisfaction with the quality of site-based AR and their intention to continue using and recommending it. Thus, the aim of this research is to examine the relationship between the perceived quality (content, system, and personalized service) of AR applications and tourist satisfaction to predict tourists' behavioral intentions to recommend AR application. Furthermore, personal innovativeness is considered an important determinant of users' willingness to accept or reject the usage of new technologies such as AR (Mazman & Usluel, 2009). Therefore, this research will explore how personal innovativeness moderates the relationship between perceived quality and AR satisfaction.

2. Literature review

2.1. AR in tourism

Danado et al. (2003, p. 1) defined AR as "a technology that allows the superimposition of synthetic images over real images, providing augmented knowledge about the environment in the user's vicinity which makes the task more pleasant and effective for the user, since the required information is spatially superimposed over real information related to it." Consequently, the emergence of AR applications has changed the way tourists can experience a destination, leading to more interactive and diversified experiences (Fritz, Susperregui, & Linaza, 2005). Due to enhanced smartphone capabilities such as integrated GPS, Internet connections, and cameras, tourism destinations and businesses can deliver tourists an enjoyable, personalized, and context-aware tourism experience (Chou & Chanlin, 2012). The capability to superimpose images enables tourism destinations to present tourists with historic buildings or events, making the entire tourism experience more interesting and enjoyable. In addition, destinations can differentiate themselves from each other (Tsiotsou, 2012). According to Martínez-Graña et al. (2013), AR applications are particularly valuable for the tourism industry because they increase social awareness of the immediate surroundings and unknown territory. In addition, AR applications help tourists gain a deeper understanding of the origins of geological heritage (Martínez-Graña, Goy, & Cimarra, 2013). Casella and Coelho (2013) acknowledged that AR has become a popular tool for the education of museum visitors due to the availability of applications such as Layar. Benyon, Quigley, O'Keefe, & Riva (2013) agreed that AR applications have become popular ways to present historic events and introduce tourism destinations. They also concluded that AR will be used by the mass market, making it even more likely that the tourism industry will engage with these new and developing applications.

AR is considered a tool to provide content and enhance tourists' and theme park visitors' experience (Casella & Coelho, 2013; Martínez-Graña et al., 2013). However, AR could also become the main reason to visit theme parks and experience new and innovative technologies. Dong, Weng, Xu, Dong Li, & Wang (2011) examined the popularity of AR based-games as theme park attractions and reviewed an AR game that has become an interactive tourist attraction in the Chinese theme park "Joy Land." In addition, Disney theme parks are investing in the development of projection-based AR attractions to offer this novel experience to their visitors. The creators of the Walt Disney attraction aimed to bring old movies to life by augmenting their characters, thus providing visitors with a unique experience (Mine, van Baar, Grundhöfer, Rose, & Yang, 2012). These examples show that AR can be used to enhance existing attractions through the overlaying of content and that theme park attractions can be created around an AR experience.

2.2. Marker-based AR applications

AR applications can be classified into marker-less and marker-based. Cheng and Tsai (2013, p. 451) stated that marker-based AR "requires specific labels to register the position of 3D objects on the real-world image." A specific marker such as a QR code is used to overlay an object onto scenery (Lee, Lim, & Chun, 2013). According to Siltanen (2012, p. 39), marker-based AR adds an "easily detectable predefined sign in the environment and uses computer vision techniques to detect it." As a result, marker-based applications are ideally applied indoors. In contrast, marker-less AR applications do not require codes; they can detect specific features from the area-based GPS locations and can thus be used in outdoor environments. In addition, marker-less applications are considered more interactive than static marker-based applications, which depend on a certain object (Lee et al., 2013; Patkar, Singh, & Birje, 2013). Jung, Kim, and Kim (2013) acknowledged that marker-less AR applications are resource-intensive and that marker-based applications are expected to perform and recognize objects more accurately, particularly within indoor environments. This was confirmed by Kapoor, Ghufran, Gupta, & Agarrwal (2013, p. 604), who acknowledged that "marker-based capture systems are quite popular due to efficiency and accuracy but are highly costly, require laboratory setup and restrict the movement of the actor." As a result, much future research and development will focus on using marker-less AR applications. Nonetheless, for the current state of technology, marker-based applications are considered more reliable and are therefore often used to enhance the visitors' experience within indoor theme parks.

2.3. Perceived quality

The importance of perceived quality was confirmed within the DeLone and McLean information system success model in 1992. DeLone and McLean concluded that information system success can be measured through "the system quality, the output information quality, consumption (use) of the output, the user's response (user satisfaction), the effect of the IS on the behavior of the user (individual impact), and the effect of the IS on organizational performance (organizational impact)" (Wu & Wang, 2006, p. 729). Later on, an updated model of information system success introduced three perceived quality constructs: system, service, and content/information quality (DeLone & McLean, 2003). According to Bigné, Sánchez, and Sánchez (2001, p. 608), perceived quality is