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Examining User Adoption of Mobile Augmented Reality Applications

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ABSTRACT

As an emerging service, mobile augmented reality (AR) applications have not received wide adoption among users. This may affect the successful implementation of AR. Integrating both perspectives of the unified theory of acceptance and use of technology (UTAUT) and flow theory, this research examined user adoption of mobile AR applications. The results indicated that performance expectancy and the flow experience consisting of perceived enjoyment, attention focus and perceived control significantly affect usage intention, which in turn affects actual usage behaviour. The results imply that service providers need to improve the perceived utility and user experience in order to facilitate user adoption of mobile AR applications.

KEYWORDS

Augmented Reality, Flow Theory, Mobile AR applications, UTAUT

INTRODUCTION

Mobile internet has been developing rapidly in the world. Specifically, the application of the fourth generation (4G) technologies and smart terminals has accelerated mobile internet development. For example, a recent report indicated that the number of mobile internet users in China has exceeded 753 million, accounting for 97.5% of its internet population (CNNIC, 2018). In US, about 89% of adults accessed internet through their cell phones (Pew Research Center, 2015). Attracted by the great market, service providers have released rich mobile applications and services, such as mobile instant messaging, mobile payment and mobile games. They expect users to widely adopt and use these services. Then they can acquire advantages in the intense competition. Otherwise, they cannot recover costs and achieve success.

As an emerging service, mobile augmented reality (AR) applications integrate virtual worlds with physical environments and deliver a compelling experience to users. This may facilitate their adoption and usage. AR can display digital information over people's real-time view of objects and spaces in the physical world (Scholz and Smith, 2016). Different to virtual reality (VR) that presents pure virtual space, AR added real scenes elements into virtual worlds. This may enrich user experience. Due to its advantage, AR has received great attention from enterprises, such as Google and Facebook. It is estimated that the global market value of mobile AR will reach 83 billion US dollars in 2021 (Digi-capital, 2017). AR has been widely applied in various industries, such as e-commerce, games, tourism, healthcare and education. Typical examples of mobile AR applications include Pokémon Go,

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which is a popular AR game. Alipay, the largest mobile payment company in China, has issued AR red envelop, which combines AR with mobile payment. Baidu Map, a leading mobile map product in China, has allotd users to view real scene maps. However, due to a few reasons such as high costs and complex operations, users have not widely adopted and used AR technologies (Huang and Liao, 2015). This may impede the successful implementation of AR.

Extant research has examined AR in various contexts, such as e-commerce (Yim et al., 2017), advertisements (Wafa and Hashim, 2016), education (Wang, 2017), tourism (Jung et al., 2015; Dieck and Jung, 2017), and library (Huang et al., 2016). However, it has focused on the business model and technological aspects, and has seldom identified the determinants of mobile AR applications adoption. In other words, how to facilitate user adoption and usage remains a question. This research tries to fill the gap. We draw on both the unified theory of acceptance and use of technology (UTAUT) and flow theory as the theoretical bases. On one hand, mobile AR applications represent an emerging information technology. Thus, we can explain user behaviour based on UTAUT, which is developed by Venkatesh et al. (2003) and has received considerable attention in the information systems research. UTAUT proposes that performance expectancy, effort expectancy, social influence and facilitating conditions are the four factors determining user adoption of an information technology (Venkatesh et al., 2003). On the other hand, mobile AR applications integrate virtual worlds with real scenes and bring an engaging experience to users. This may promote their behaviour. Thus, we adopted the flow theory to examine the effect of flow experience on user usage. Flow experience includes three factors: perceived enjoyment, perceived control and attention focus (Koufaris, 2002). By combining UTAUT and flow experience, we expect to provide a complete understanding of mobile AR applications user behaviour from both perspectives of technological perceptions and user experience.

RESEARCH MODEL AND HYPOTHESES

Previous Research on AR

As an emerging technology, AR has attracted attention from researchers. They have examined AR from a business model perspective. Dieck and Jung (2017) explored the value of AR implementation in the museum context using a stakeholder approach. They found that AR has economic, experiential, social, epistemic, cultural and educational value from stakeholders' perspective. Wafa and Hashim (2016) examined mobile AR advertisements adoption by brands in Malaysia. Scholz and Smith (2016) provided some guidance on how to execute AR programs in the marketplace and enhance consumer engagement.

A few researchers examined the technological aspects of AR. Yim et al. (2017) noted that interactivity and vividness affect the effectiveness of AR as an e-commerce tool. Wang (2017) found that AR-based writing support system helps high school students improve their writing performance. Huang et al. (2016) reported that AR and indoor positioning technology can help navigation inside a library and solve the problems of spatial and learning domain unawareness.

Previous research also found that user experience is a significant factor affecting usage behaviour. Rauschnabel et al. (2017) found that hedonic, emotional, and social benefits affect users' reaction toward Pokémon Go. Huang and Liao (2017) reported that three psychological factors, which include sense of body ownership, sense of ownership control and self-explorative engagement, influence flow experience in an e-shopping using AR. Kim et al. (2016) argued that information quality and perceived enjoyment affect AR continuance. Huang and Liao (2015) suggested that aesthetics, playfulness and ease of use affect consumers' behaviour of using AR interactive technology.

As evidenced by these studies, AR has been examined from multiple perspectives, such as business model, technological aspects and user experience. However, we still have a limited understanding of the determinants of AR user behaviour. On one hand, AR applications represent an emerging technology. Thus, an individual user's behaviour may be influenced by his or her technological perceptions such

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