



Research on the Influencing Factors of Tourists' Use Behavior of AR Tourism APP Based on UTAUT2 Model Take the “West Lake in the Palm” as an Example

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Abstract. As an emerging technology, AR technology has shown its unique advantages in combination with tourism, and the launch of AR tourism APP provides a broader space for the development of tourism. In order to explore the influencing factors of tourists' use of AR tourism APP, this paper uses the UTAUT2 model, taking the “West Lake on the palm” as an example, and collects 227 valid questionnaires. Confirmatory factor analysis is used to test the validity, and structural equation analysis is used to test the research hypothesis. The study found that convenience of use and personal usage habit are the key factors that affect users' use behavior.

Keywords: UTAUT2 model · AR Travel APP · Intention of use · Usage behavior

1 Introduction

Augment Reality (AR) technology can facilitate the collection of tourism information and enhance the sense of travel experience, so its application in the tourism industry is becoming more and more extensive. The “Augmented Reality” was first proposed by Boeing employee Caudell in 1992 [1]. AR technology is mainly used to project the generated text, images, effects and other virtual information about the real world through the graphics calculation and rendering capabilities of the computer, so as to realize the idea that the real world and the virtual information contents are displayed on the same screen or space [2]. AR technology has created an online interactive environment for tourists due to its special interactive mode, which has become greatly attractive to tourists. For example, the museum in Rome in Dali uses AR technology to accompany all aspects of tourists' tour, such as explanation and guidance, making the tour process full of fun.

The launch of AR tourism APP has played an important role in improving the overall travel experience [3]. The smart museum guide app “Cloud View Expo” created by the virtual interaction of AR technology shows the two-dimensional plane information in the three-dimensional space, and presents the specific information of each cultural relic on the mobile phone of tourists in an intuitive and detailed manner, so that tourists can fully

understand [4]. The AR Tourism APP makes the relationship between AR and tourism closer, and makes the use of AR technology in the tourism industry more popular.

At present, most of the research on the AR tourism APP focuses on the technology development and introduction to AR tourism APP. There are fewer research on the use of AR tourism APP based on tourist perspectives. Research on the application effect of AR technology products is also very important. Based on this, this study takes AR Tourism APP as the research object and uses UTAUT2 (Unified Theory of Acceptance and Use of Technology) as the theoretical basis to explore the influencing factors of people's willingness to use the AR tourism APP.

2 Literature Review and Research Hypothesis

2.1 UTAUT Model

UTAUT model is an important model built by many scholars on the basis of 8 models such as Technology Acceptance Model (TAM), which can reflect users' willingness to use technology and their adaptation level of behavior, and can better predict the individual's adoption of new technologies. The UTAUT model includes four key variables that directly affect the use intention and use behavior: performance expectation, effort expectation, social impact and convenience, and four adjustable variables: age, gender, experience and voluntariness. The studies show that the explanation ability of UTAUT model to user's use intention has reached 70%, and it is a commonly used tool to study user behavior. In 2012, Venkatesh et al. [5] improved the UTAUT2 model based on the UTAUT model, adding three variables, namely, hedonic motivation, value price and habit. Its ability to explain the user's behavior intention and behavior has been significantly improved.

2.2 Research Hypothesis

This study used the UTAUT2 model of Gupta et al. [6] for reference. It believes that the factors that affect the willingness to use are seven variables of performance expectations, effort expectation, social impact, facilitating conditions, hedonal motivation, price value and habits [7].

Performance expectations, Effort expectation, Social influence and Behavior intention

Performance expectation refers to the extent to which users think that using a certain technology or system can improve their work efficiency [8]. Many studies have confirmed that performance expectation can be able to affect behavior intention [9, 10].

Effort expectation reflects the degree to which users feel easy to use a certain system or technology [11]. Effort expectation is also a common indicator used by scholars when exploring factors affecting use intention [12, 13].

Social influence refers to the personal behaviors and attitudes to users under the influence of important family members and friends around them. The attitude to individual users to behavior will be affected by external factors. If people around us use or

recommend AR travel APP, tourists will have a good impression on the APP and tend to use it [14, 15].

As a result, this study proposes the following assumptions:

H1: Performance expectations positively affects the Behavior intention of tourist AR travel APP.

H2: Effort expectation positively affects the Behavior intention of tourist AR tourism APP.

H3: Social impact positively affects the Behavior intention of tourist AR tourism APP.

Hedonic motivation, Price value, Facilitating conditions, and Habit Behavior intention

Hedonic motivation is defined as the happiness or pleasure gained from using a technology. When a user is interested in a certain technology, his behavior will be more intense [16].

Price value refers to the trade-off between the money, time and other costs paid by tourists when using AR tourism APP and the perceived value. When the value perceived by the user is greater than the cost spent, the user will feel that the technology is cost-effective and will be more willing to use [5, 15].

Facilitating conditions means the objective conditions that supports consumers to use new technologies or new systems. The popularity of mobile Internet and intelligent communication equipment has provided convenient conditions for tourists to use AR and other technologies, and greatly enhanced their willingness to use AR tourism APP [16].

Habit refers to a person's stable active behavior, which is produced by learning and repetition [17]. Previous studies have shown that repetitive behaviors in the past are one of the main antecedents of current actions [15, 16].

Therefore, the following assumptions are proposed to this study:

H4: Hedonic motivation positively affects the Behavior intention of tourist AR tourism APP.

H5: The Price value has a positive impact on the Behavior intention of tourist AR tourism APP.

H6: Facilitating conditions positively affects the Behavior intention of tourist AR tourism APP.

H7: Habits positively affects the Behavior intention of tourist AR tourism APP.

Behavior intention, Facilitating conditions, Habit and Actual use

Behavior intention refers to the subjective willingness of individuals to use technologies or systems, and Actual use refers to actions taken by individuals driven by Behavior intention [18]. According to the planned behavior theory, the user's behavior intention is the direct factor that generates individual behavior [19].

Facilitating conditions can affect Actual use, because when the basic conditions for using AR travel APP are different, it will directly affect the behavior of tourists using the travel app [16, 18].

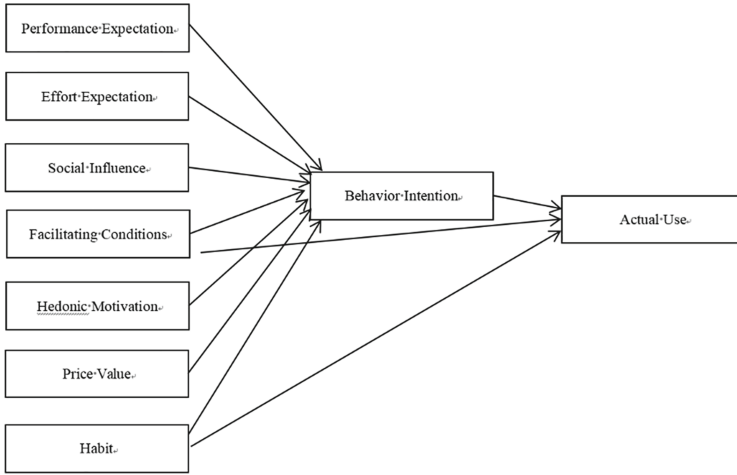


Fig. 1. Research conceptual model (Image source: self-drawn by the author)

Many studies have shown that: the habits formed by users can not only affect their behavior intention, but also affect their behavior [9, 15].

As a result, this study proposes the following assumptions:

H8: Tourists’ Behavior intention positively affects their Actual use of AR tourism APP.

H9: Facilitating conditions positively affects Actual use of AR tourism APP.

H10: Habits positively affects Actual use of AR tourism APP.

Based on the above assumptions, a theoretical model of AR tourism app uses intention is constructed (as shown in Fig. 1).

3 Research Design

3.1 Settings Design

This paper collects data onto the form of a questionnaire, and designs an AR tourism APP use intention scale (as shown in Table 1) with reference to the research scale of Venkatesh [5] and Gupta [6]. The scale contains 9 variables and 29 items in total. The scale of this study is in the form of Likert’s five level scale. Each item is set with five options, i.e. “very disagree”, “relatively agree”, “neither agree nor disagree”, “relatively agree” and “very agree”. These five options correspond to “1–5” scores respectively. The respondents need to choose according to their actual situation.

3.2 Data Collection

In this study, taking the “palm West Lake app” as an example, the online questionnaire form was adopted. The data collection time was in the middle of March 2022. Through the small Wechat program of the questionnaire star, the questionnaire was distributed over the social platforms such as Weibo and post bar, where the information about

tourism was gathered (such as Weibo). A total of 252 questionnaires were obtained. After excluding the questionnaires with no AR travel APP use experience and no more than 30 s of filling time, the final effective questionnaires were 227, and the effective rate of the questionnaires was 90.1%.

4 Study Results

4.1 Reliability Analysis

Reliability analysis refers to the consistency of the measurement results obtained by repeated measurement of the same questionnaire with the same method. In order to test the reliability of the sample data obtained by the questionnaire, this study uses SPSS26.0 software to analyze the reliability of the sample data. Due to Cronbach's α of EE4, FC3 and PV3 is low, so these three items are excluded. Then the reliability analysis of each variable is carried out, and the results are shown in Table 1. The Cronbach's α of all variables is all between 0.658 and 0.864, most of which are greater than 0.7, indicating that the modified sample data have good internal consistency.

4.2 Validity Test

Validity test refers to the effectiveness of measurement, which can reflect the similarity between the measured variables and the actual situation.

Convergence validity

The AVE value and CR values are calculated through the CFA. The standardized factor load of all latent variables in this study is greater than 0.5, and the CR value of 8 potential variables is greater than or close to 0.7. The AVE values of 7 potential variables are close to or greater than 0.5, except for hedonic motivation of 0.444. Most AVE values are greater than 0.5, which meet the basic requirements of the test, indicating that the scale has good convergence.

Discrimination validity

The discrimination validity reflects the degree of correlation and difference between the measured variables. If the correlation coefficient between the variable and other variables is less than the AVE square root value of the variable, the discrimination validity of the scale is better. The AVE square root values of all variables in this study are greater than the correlation coefficients between the other variables, which meet the basic requirements of the test, indicating that the scale has good discriminative validity.

Table 1. Reliability analysis of the scale (Table source: self-drawn by the author).

Variable	PE	EE	SI	FC	HM	PV	HT	BI	AU	Overall
Number of Questions	4	3	3	2	4	2	3	3	2	26
Cronbach's α	0.792	0.749	0.757	0.658	0.747	0.681	0.756	0.864	0.741	0.926

4.3 Structural Equation Model Analysis

In this study, Amos24.0 software was used to construct structural equation model and test the relationship between these variables. On the basis of the conceptual model, the structural equation model to be tested is constructed. After the data is substituted, the complete structural equation model is obtained (as shown in Fig. 2). In this section, the maximum likelihood method is used to analyze the sample data, and the fitting index and path coefficient of the research model can be obtained.

Fitting index test

After the construction of the structural equation model, the following commonly used fitness indicators are selected for evaluation. The evaluation results are shown in Table 2. It can be seen that the model has good adaptability to the survey data.

Test results of research hypothesis

AMOS is used to analyze the significance of each path of the model, and the results are shown in Table 3. It can be seen that hypothesis 1, hypothesis 2, hypothesis 3, Hypothesis 4, Hypothesis 5, hypothesis 6, Hypothesis 7 and Hypothesis 8 are refused, Facilitating conditions ($\beta = 0.346, P < 0.05$) has a significant positive impact on Actual Use of AR travel APP. Assuming H9 is Accepted, the habit ($\beta, 0.438, P < 0.05$). It has a significant positive impact on Actual Use of AR travel APP. H10 is Accepted. It can be known that the Actual Use of AR travels APP depends on Habit and Facilitating Conditions.

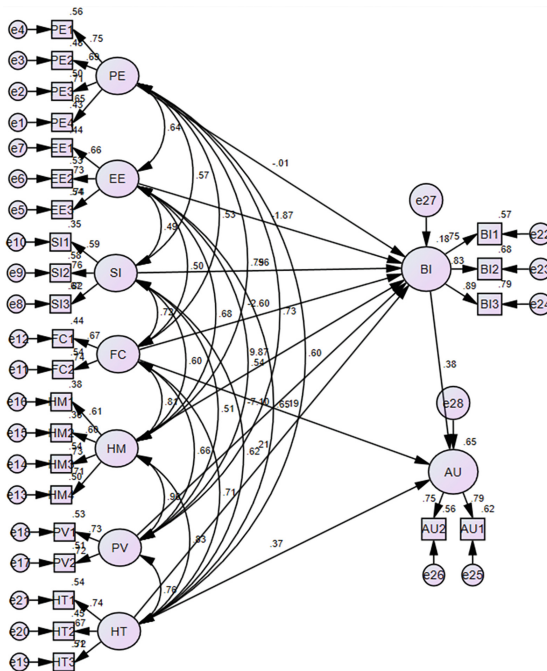


Fig. 2. Structural equation model (Image source: self-drawn by the author)

Table 2. Overall fitting coefficient (Table source: self-drawn by the author)

Index	Study Model	standard	Conclusion
CMIN	497.469	The smaller the better	
DF	263	The smaller the better	
CMIN/DF	1.823	<3 excellent; <5 acceptable	Good fitting
GFI	0.864	>0.8 acceptable; >0.9 well fit	Acceptable
AGFI	0.818	>0.8 acceptable; >0.9 well fit	Acceptable
RMSEA	0.06	<0.08 excellent; <0.1 acceptable	Good fitting
CFI	0.917	>0.9	Good fitting
IFI	0.919	>0.9	Good fitting

Table 3. Model path analysis results (Table source: self-drawn by the author)

Hypothesis	Path	T Value.	Significant	β	Result
H1	Performance Expectation--->Behavior Intention	-.004	.997	-.020	Refuse
H2	Effort Expectation--->Behavior Intention	-.046	.963	-2.295	Refuse
H3	Social Influence--->Behavior Intention	.066	.948	1.001	Refuse
H4	Hedonic Motivation--->Behavior Intention	-.039	.969	-2.795	Refuse
H5	Price Value--->Behavior Intention	.043	.966	13.842	Refuse
H6	Facilitating Conditions--->Behavior Intention	-.045	.964	-9.094	Refuse
H7	Habit--->Behavior Intention	.039	.969	.270	Refuse
H8	Behavior Intention--->Actual Use	1.213	.225	.185	Refuse
H9	Facilitating Conditions--->Actual Use	4.183	***	.346	Accept
H10	Habit--->Actual Use	2.572	.010**	.438	Accept

*** represents $P < 0.001$, ** represents $0.001 \leq P < 0.01$, * represents $0.01 \leq P < 0.05$

5 Research Conclusions and Discussion

5.1 Research Conclusion

Based on the application of AR technology in tourism and the related theories of UTAUT model, this paper analyzes the research status of AR tourism technology, and takes "palm West Lake APP" as the research object, and builds the model of AR tourism APP use intention according to UTAUT2 model. After questionnaire design, investigation and data processing, spss26.0, amos24.0 and other software are used to analyze the reliability,

validity and structural equation model of sample data, And the following conclusions are drawn:

Facilitating conditions has a significant positive impact on the actual use of tourists' AR travel APP

This conclusion is consistent with the research conclusion of San [16] and Gollwitzer [17], that is, when tourists use AR tourism APP, the perceived available support conditions can affect their willingness to use the APP. These support conditions include the resources and conditions that tourists can use when using AR tourism APP, and the knowledge and skills of using AR tourism APP. According to the 49th statistical report on China's Internet development, as of December 2021, China's network users reached 1.032 billion, and the proportion of people using mobile phones to access the Internet reached 99.7%. Therefore, convenience is an important factor influencing the willingness to use AR travels APP.

Habits have a significant positive impact on the actual use of tourists' AR travel APP

Because AR technology can transcend reality and combine with the virtual world to bring immersive and unique tourism experience to users, tourists will not miss using AR tourism APP during the tourism process, and may even experience it many times. That is to say, AR tourism APP has certain user stickiness, and thus shows the behavior of using AR tourism APP during the tourism process, which is similar to that of Venkatesh [5], Gupta [15] coincides with each other. Therefore, habit is an important factor that affects the willingness to use AR travel APP.

5.2 Suggestions

According to the conclusions of the study, this paper puts forward the following suggestions for the development and optimization of AR tourism APP:

Provide convenient conditions for tourists to use AR tourism APP

The design of AR travel APP interface should be simple and easy to understand, and provide page operation guidance of users that use the product of the first time; Introducing artificial intelligence technology into the development of tourism app, including using AI algorithm to accurately record user travel data, and using recommendation algorithm to provide personalized AR travel scheme; The customer service system is also an important part of the tourism APP, in order to improve the comprehensive service level, enterprises can introduce artificial intelligence dialogue technology to establish robot customer service, and invest more resources in the recruitment and training of artificial customer service; Set up a special tourism knowledge popularization section to provide users with scientific tourism knowledge.

Adapt to tourists' habit of using APP

Reduce the time cost and thinking cost for new users to learn and operate the APP, and let users form the habit of using AR travel APP when traveling; Different types of services are developed for different user groups to meet the special tourism needs of

office workers, students, young groups and elderly groups. On the premise of obtaining the user's consent, a questionnaire will be issued to collect the users' habits of daily use of the APP, and personalized services will be launched according to the users' habits. In addition, new functions cannot be blindly pursued during system update, and user experience should be taken into account in product update iteration.

5.3 Research Deficiency and Prospect

This study is aimed at the research on the influencing factors of the use intention of AR tourism APP. Based on the relevant theoretical knowledge and research methods such as AR tourism, tourism APP and UTAUT model, this paper puts forward some suggestions for the development and optimization of AR tourism APP.

In the research process, there are deficiencies in personal knowledge and ability, data collection and data analysis. At the beginning of the study, the number of items was not enough, which led to the need to delete some items, and then there were only two items in some variables, which led to the result may not be rigorous enough; This paper selects "palm West Lake APP" as the research object. Whether the research conclusions formed can be used for the construction and optimization of other types of AR tourism APP still requires further investigation and research.

Issues to be further discussed in the future: some studies using the UTAUT model will add new variables to the research content. Whether the sustainable use intention of AR tourism APP is also affected by other variables needs further discussion and research; In this study, the influencing factors of AR tourism APP have been studied. Whether it is necessary to study AR APP of different industries and types to improve the universality of the research conclusions; When using the UTAUT model, although the maturity scale is cited, no regulatory variables are set. Whether the variables with regulatory effects need further discussion and confirmation.

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