

## Intention to Use Mobile Augmented Reality in the Tourism Sector

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Received: 26 October 2020; Accepted: 16 December 2020

**Abstract:** This article examines the main variables that influence the intention to use Augmented Reality (AR) applications in the tourism sector in Jordan. The study model has been constructed based on the unified theory of acceptance and the use of technology2 (UTAUT2), by incorporating a new construct (aesthetics) to explore the usage intention of Mobile Augmented Reality in Tourism (MART). A questionnaire was used and distributed to a sample of 450 participants. Data were analyzed using the Smart PLS version 3.0. for testing 12 hypotheses. 29 measurement items were carefully reviewed based on previous studies that were selected to assess the research hypotheses. The findings revealed that the proposed model elucidates 35.7% of the variance in the users' intention to use MART. The results also showed that both performance expectancy and aesthetics were found to be the most significant factors at level (0.001). Four variables, respectively, were at level (0.01) which consisted of social influence, facilitating conditions, hedonic motivation, and price value. The weakest effect was effort expectancy at level (0.05). As the use of AR has become important for tourists, this study establishes a research base that can be built upon for future researchers. MART developers can benefit from the results of this research to design and deliver this service successfully and to ensure that its adoption by users is achieved.

**Keywords:** Intention to use; UTAUT2; aesthetics; performance expectancy; augmented reality; social influence; effort expectancy; MART; AR

### 1 Introduction

With the continuous and rapid advancements in the technology sector, AR applications have emerged as a medium that allows companies to interact with consumers in an innovative and easy method [1–3]. AR has been defined as “a visualization technique that superimposes computer-generated data, such as text, video, graphics, GPS data, and other multimedia formats on top of the real-world view, as captured from the camera of a computer, mobile phone, or other devices. AR can augment one's view and transform it with the help of a



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computer or a mobile device, and thus enhance the user's perception of reality and the surrounding environment" [4]. As such, AR applications seek to connect the real world augmented with virtual objects [5,6]. It can be said that the successful emergence of AR applications in the last decade is due to the prevalence and use of smartphones which have the capabilities necessary to be operated in the tourism sector [7,8]. Using AR applications in the tourism sector, will in the future become inevitable for companies to remain competitive in this business [9,10]. Although AR applications are still at an early stage of commercialization, the amount of technology spending is large [11]. Concerning the latest statistics, AR's launching revenues are expected to rise globally from 5.91 billion US dollars to 198 billion US dollars by 2025 [12]. AR users are estimated to reach 1 billion in 2020. Those numbers strongly confirm the potential impact of AR on the tourism sector [13].

AR applications are now applied in many fields, e.g., games [3,14], arts [15], education and learning [16–18], health [19], and others. In the tourism context, AR application possesses great capabilities by improving the tourist experience (TX) and providing important information to tourists [20], thus obtaining more details regarding their tourism destination, as well as the high level of entertainment throughout the process [21,22]. The information this application provides to customers is up-to-date and based on their both needs and requirements [23]. In Jordan, Interest is beginning to appear in the application of AR within educational and academic institutions. For example, SAE Institute which is the pioneer center in innovative media sectors at the global level it has branches in 27 countries and is represented on 53 campuses that offer a bachelor's program in "virtual reality and augmented reality." DAAD also launched a project in October 2018 entitled "Creating Digital Access to Islamic Arts and Culture" [24]. It contains the application of Augmented Reality / Projection Mapping- video for the first time in Jordan. The project is performed by the 3 team members at Jordan University of Science and Technology (JUST) [25]. In the tourism domain, King Abdullah II is optimistic regarding the implementation of AR in the context of tourism in Jordan, he indicated that the diffusion of the newest of technologies representing by AR. During AR technology, tourists can wear a special headgear to see a mixture of the country's physical reality with holograms, to make a worldly tourist experience. He said, "I think you are going to see augmented-reality tourism in Jordan earlier than you might expect" [26].

However, the subject of AR within the tourism context yet has not been studied extensively [6]. Given the rapid expansion of using AR applications in travel, it is very necessary to understand its importance for tourists and for users who have the intention to use such applications as well as users who have less incentive to use [27]. As a result, more research to help develop the application of AR for travel will help in understanding the requirements of tourists, so this study came to shed light on what affects the customer's intention to adopt this service [28,29]. The present study intends to combine UTAUT2 [30], with aesthetics to understand MART adoption. Using this integrated model provides a comprehensive view of the significance of MART for the tourism context.

## 2 Literature Review

Researchers and scientists have recently been interested in examining and exploring the intention of users to adopt AR globally [31–33]. Using various methods, and depending on several theoretical foundations, the researchers tried to explain how the intention is formed by the customer to use these applications [34–36]. In the tourism context more specifically in urban heritage tourism, based on a qualitative study (focus group) conducted by [37], system quality, information quality, recommendations, costs of use, risk, personal innovativeness, perceived usefulness, facilitating conditions, and perceived ease of use were vital factors in influencing attitude and intention of customer to adopt mobile AR. Likewise, [35] claimed that Malaysian user's intentions towards using mobile AR for heritage preservation in UNESCO world heritage sites were significantly impacted by 3 factors of UTAUT which

include performance expectancy, effort expectancy, and facilitating conditions, and a new external variable which is perceived playfulness. In a comparative study between South Korea and the Republic of Ireland in the context of adopting mobile AR at cultural heritage tourism sites, [7] found that perceived usefulness was significant with both aesthetics of AR and ease of use. Aesthetics and enjoyment were able to predict the ease of use. Enjoyment was predicted by aesthetics. Intention to use was predicted by 4 constructs namely, usefulness, ease of use, social influence, and enjoyment. Another research by [28], concluded that not all of the UTAUT2 constructs have direct effects on the intention to use MART, where the results are found that performance expectancy, facilitating conditions, hedonic motivation, and the habit was significant in explaining intention to use MART. In contrast, effort expectancy, social influence, and price value were not significant.

As a conclusion from these studies, although these studies provide a theoretical basis in the literature on the use of mobile AR in tourism, important aspects must be clarified as follows: First, all previous studies were conducted in countries different from Jordan's environment, so it is difficult to generalize the findings of these studies to the tourism sector in Jordan. Second, mobile AR is a novel and modern technology and still in the infancy stage in Jordan, so this study focuses on the user's intention to adopt mobile AR, while previous studies focused more on users who have already adopted these applications.

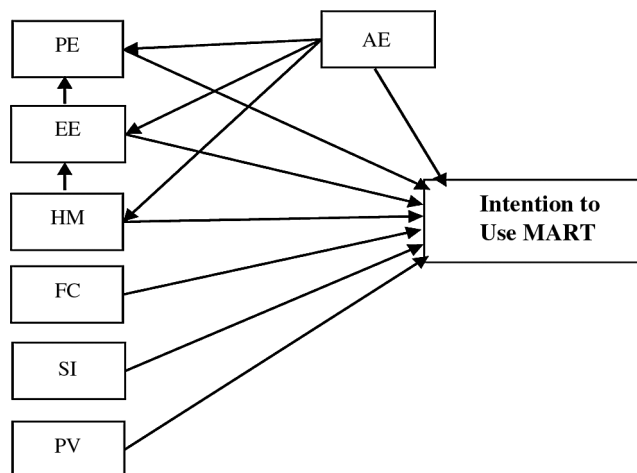
### 3 Tourism in Jordan

Jordan is an important tourist destination in the Middle East, it has many historical places and natural landscapes, and it is one of the countries considered relatively safe, and therefore tourists from all over the world visit it. It has a lot of attractions to visit like Petra (in 2007 selected as the second world wonder), Ajloun Castle, Church of the Map - Madaba, the Dead Sea, Jerash, Nebo Mountain, Um Qais and Al-Maghtas (Immersion or Baptism) in the Jordan Valley [38]. From this standpoint, tourism can play an important role in the Jordanian economy [39]. The total contribution of travel and tourism to GDP was USD 7,63 billion, accounting for 18.7% of Gross Domestic Product (GDP) in 2017, and is estimate to increase by 8.1% in 2018 [40]. Currently, the Jordanian government decided to invest in the tourism aspect to develop the overall economy through a strategic plan that runs from 2018 to 2022 [41]. Therefore, it is a good opportunity for tourism companies to apply mobile augmented reality in Jordan, especially after the Corona pandemic, and to compensate for the severe economic damage caused by this pandemic [42].

### 4 Research Model

To find a suitable model that covers almost all the variables that explain the intention of the Jordanian to use mobile AR, UTAUT2 was study choice as the theoretical basis for the proposed model in this research as presented in Fig. 1. A total of six independent variables from the UTAUT2 which are used: performance expectancy, effort expectancy, social influence, hedonic motivation, facilitating conditions, and price value were determinants of users' intention to use mobile AR. Contrary to what has been suggested by [30], the habit has not included in our study. That is because users do not have experience in using MART. Moreover, mobile AR has not yet been introduced by Jordanian tourism companies, which need more time by users to shape habitual behavior to use this application. Adoption behavior was also excluded because there was no experience in using MART among users. This study examines the intention of users about implementing MART in tourism in Jordan. Based on a recent study by [7] in adopting mobile AR at cultural heritage tourism sites, aesthetics was found to have a direct relationship on three constructs: perceived usefulness (similar to performance expectancy), perceived ease of use (similar to effort expectancy) and perceived enjoyment (similar to hedonic motivation). Besides that, perceived enjoyment has a positive impact on perceived ease of use and the intention to use. Hence, the

decision was made to include aesthetics and perceived enjoyment as external factors along with UTAUT2 constructs. This is as suggested by authors of UTAUT2 [30] to extend their model with new factors and other environments.



**Figure 1:** Research model (based on UTAUT2)

#### 4.1 Performance Expectancy

According to [43], PE has been defined as “the degree to which an individual believes that applying the technology will help him or her to attain gains in job performance”. Users, in general, accept to use the new technology if they find it useful in carrying out their daily activities [44,45]. Performance expectancy is a strong antecedent towards intention to use technology [46,47]. [7] found that performance expectancy is positively affecting the intention to use MART. MART has been commonly recognized as an effective method that allows visitors and/or travelers to be more creative and leverage their experience [48]. In this respect, the following hypothesis is therefore suggested:

H1: Performance expectance is significantly affected the user’s intention to use MART.

#### 4.2 Effort Expectancy

EE is conceptualized “as the extent of ease connected with the use of a system” [43]. Ref. [44] indicated that raising the user’s incentive to accept the new technology depends largely on the degree of ease in using this technology, in other words, the easier it is to use and require less effort, this will raise the rate of acceptance among users. Depending on this, given the nature of MART, which needs a certain degree of knowledge and skills, it is expected that effort expectancy will have an important role in the customer’s intention to accept such application [7]. This role that effort expectancy plays in its impact on the customers’ intention has been documented in various contexts and many previous studies [49–51]. Thus, this research articulates the following:

H2: Effort expectance is significantly affecting the user’s intention to use MART.

H3: Effort expectance is significantly affecting the performance expectancy of MART.

#### 4.3 Hedonic Motivation

Hedonic motivation has been defined by [52] as “fun or pleasure derived from using technology.” It is similar to perceived enjoyment based on [53]. In fact, regarding studies in the areas of technology acceptance and information systems, hedonic motivation (perceived enjoyment) plays a major role in raising the

intention of customers to adopt new technological systems, e.g., mobile banking, mobile health, and mobile augmented reality, etc. [54]. This important role is more apparent in smart and enjoyable systems that are characterized by a high level of inventiveness, such as mobile augmented reality applications in the tourism sector [48,55]. The role of hedonic motivation on the intention of customers to use has been verified in many prior studies [46,56]. Consequently, this study proposes that:

H4: Hedonic motivation is significantly affecting the user's intention to use MART.

H5: Hedonic motivation is significantly affecting the effort expectancy of MART.

#### **4.4 Facilitating Conditions**

Facilitating conditions are characterized as “the degree to which an individual believes that an organizational and technical infrastructure exists to support the use of the system” [43]. Facilitating conditions are conceptualized as perceived behavioral control in the theory of planned behavior (TPB) [57], it reflects the impact of technical infrastructure in supporting the use of MART [28]. Using any new technology or innovation generally need a certain type of expertise (e.g., skill and familiarity) and resources (e.g., internet connection) [58]. Therefore, if the customer is provided with assistance in terms of resources and service support as well, if the customer has the skills, the intention to adopt MART will rise. From a theoretical perspective, several researchers confirmed the positive relationship between facilitating conditions and intention to use technology [59]. Accordingly, this study posits the following hypotheses:

H6: Facilitating conditions is significantly affecting the user's intention to use MART.

#### **4.5 Social Influence**

Social influence is defined as “the extent to which an individual perceives that important others believe he or she should apply the new system” [43]. It is similar to the subjective norms of the Theory of Reasoned Actions (TRA) [60]. The SI reflects the role of environmental factors in influencing the user's intention to adopt technology such as friends, family members, and co-workers [47]. Several studies have concluded a significance and positive impact of family members, co-workers, reference groups, friends, and elders on users' intention to use a technology [61,62]. It is expected that SI will play a dynamic role in the intention to use MART in Jordan, therefore, the current study strives to test the next hypothesis

H7: Social influence is significantly affecting the user's intention to use MART.

#### **4.6 Performance Expectancy**

According to [43], PE has been defined as “the degree to which an individual believes that applying the technology will help him or her to attain gains in job performance”. Users, in general, accept to use the new technology if they find it useful in carrying out their daily activities [44,45]. Performance expectancy is a strong antecedent towards intention to use technology [46,47]. Ref. [7] found that performance expectancy is positively affecting the intention to use MART. MART has been commonly recognized as an effective method that allows visitors and/or travelers to be more creative and leverage their experience [48]. In this respect, the following hypothesis is therefore suggested:

H1: Performance expectance is significantly affected the user's intention to use MART.

#### **4.7 Price Value**

Price value refers to “the consumer's cognitive tradeoff between the perceived benefits, and their monetary cost” [63]. For the user, the PV is acceptable when he finds that the benefits of using technology are higher than the costs [30]. Therefore, a greater positive level of price value leads to a greater incentive for the user to intend to use the technology [64]. In a study by [65] in a museum tour

application context, the result presented price value as an important dimension that required to be included to enhance tourism acceptance among tourists. The role of price value on the intention of customers to use has been verified in many prior studies [66,67]. So, the following hypothesis was proposed:

H8: Price value is significantly affecting the user's intention to use MART.

#### 4.8 Aesthetics

Aesthetics, in general, are the beauty of "the pleasing appearance of things" Which gives attractive emotions that affect the experience [68]. According to Collingwood the English philosopher, historian, and archaeologist, Aesthetics, or Magic art help to better interact with the real world [69]. This viewpoint is in line with the enhancing aesthetic experiences of the tourist in finding the authentic world. Aesthetic experiences can be defined "as being indulged in the environment and feature consumers' passive participation and immersion" [70,71]. The role of aesthetics has become important in the domain of Information Systems (IS) [72]. Prior studies repeatedly explained the potential effect of aesthetics, and their impact on several determinants such as perceived credibility, trust, and performance [73,74], and increase satisfaction [72,75]. For example, Ref. [76] found that mobile restaurant service has a "powerful entertainment and enjoyment functionality that contributed to the user's experience of enjoyment" or in the broader sense in this paper tourist's experience of enjoyment, therefore enjoyment enhances tourist experience. [77] claimed that the hedonic systems "affected positively the users' experience." Thus, the enjoyment (hedonic component) is found as a crucial element in the acceptance of mobile services, which can also apply to the tourist experience. Ref. [76] concluded that design aesthetics have a positive effect on three constructs namely; usefulness, perceived ease of use, and enjoyment. In this regard, to create an enjoyable user experience with mobile devices, it is necessary to include both aesthetics and usability.

When the user interface is professionally designed in mobile tourism applications, this will increase customer satisfaction. As it is the first thing that the customer sees when running the application, therefore the first impression plays a major role in influencing the intention to use, whether negatively or positively [78,79]. More importantly, design aesthetics can raise understanding and learning, therefore improving and quickening the process of using technology [80,81]. Building on the previous discussion, dimensions of aesthetics have a potential impact on tourist experience as well as aesthetics can affect other determinants of the proposed framework (i.e., performance expectancy, effort expectancy, and hedonic motivation) to boost the intention to use MART. This study suggests that:

H9: Aesthetics is significantly affecting the user's intention to use MART.

H10: Aesthetics is significantly affecting the performance expectancy of MART.

H11: Aesthetics is significantly affecting the effort expectancy of MART.

H12: Aesthetics is significantly affecting the hedonic motivation of MART.

### 5 Methodology

To get the data necessary to investigate the validity of the model and test associated hypotheses, this study devoted 650 survey questionnaires to gain an answer from tourists concerning their intention to use MART using convenience sampling methodology. The questionnaires were sent in the most common tourism places in Jordan in March, and April 2020 such as Petra, Ajloun Castle, Madaba, the Dead Sea, Jerash, Nebo Mountain, Um Qais, and Al-Maghtas. Since most tourists did not use augmented reality applications in advance, they were provided with a printed copy detailing the usefulness of this application and how it is used in tourist sites. The printed version was of great benefit to tourists to understand the exact nature of these application's work before answering the questionnaire. [Appendix A](#) shows 29 measurement items that were selected to assess the hypotheses in the proposed model. In



general, determinants of UTAUT2; PE, EE, HM, FC SCI, PV, and INT have been assessed similarly to [30] in original UTAUT2 with little modifications to fit MART context. Aesthetics in MART were assessed by 5 items adapted from [7]. To assess the participant's answers on mentioned items, this study adopted the five-point Likert scale with anchors ranging from (5) "strongly agree" to (1) "strongly disagree." Six questions were allocated for personal information: age, gender, income, education level, Internet experience, and familiarity with mobile applications. The questionnaire was created in English and translated into Arabic (the main language of respondents). This was done by using the back translation method [82]. Finally, the data were analyzed using smartPLS Version 3.0 by performing the PLS algorithm. A total of 550 questionnaires were valid for further statistical analysis. The descriptive statistics show that 57.8% were male and the rest of the respondents were female (54.5%). As for the ages of the participants, the largest percentage was for the age group 20–35 (57.3%), then the age group from 36–50 (36.4%). Relating to the education level, more than two-third of the participants were holders of a Bachelor's degree (67.5%).

## 6 Measurement Model

This study used Harman's single-factor by employing exploratory factor analysis (EFA) to check common method bias (CMB) [83,84]. The results showed that 8 variables loaded highly on their items with eigenvalues higher than 1 for each construct. Considering that no signs the one variable accounting for more variance, and hence no problems with CMB. The validity of content for the questionnaire items was achieved because all items were adopted and validated by related studies. As shown in Tab. 1, convergent validity was tested by 3 analyzes; Cronbach's alpha, composite reliability (CR), and the average variance extracted (AVE) [85]. CR (higher than 0.7) [86], Cronbach's alpha (higher than 0.7) [87], and AVE (higher than 0.5) were assured, indicated that all the variables in this study fulfilled the conditions. Hence, convergent validity was achieved.

**Table 1:** Reliability analyses

Factor	a	CR	AVE
PE	0.841	0.904	0.759
EE	0.885	0.920	0.743
HM	0.832	0.899	0.749
FC	0.892	0.925	0.754
SCI	0.888	0.923	0.749
PV	0.868	0.919	0.790
AE	0.918	0.938	0.753
INT	0.906	0.941	0.842

For discriminant validity, every item loads greatly on its variable and not greatly on other variables, and every factor shares high variance with its measures than it shares with other factors. Invariance analysis, the square root of every AVE is much higher than any correlation among any pair of latent constructs as presented in Tab. 2. Discriminant validity was therefore confirmed herein [88].

**Table 2:** Correlation analyses

AE	0.868							
EE	0.197	<b>0.862</b>						
FC	0.191	0.224	<b>0.868</b>					
HM	0.144	0.235	0.225	<b>0.865</b>				
INT	0.369	0.284	0.314	0.28	<b>0.918</b>			
PE	0.213	0.167	0.177	0.195	0.417	<b>0.871</b>		
PV	0.184	0.252	0.234	0.18	0.287	0.16	<b>0.889</b>	
SCI	0.265	0.204	0.297	0.187	0.356	0.255	0.269	<b>0.865</b>

## 7 Structural Model

PLS algorithm and bootstrapping techniques were conducted to test and evaluate 12 hypotheses of the research model formulated in this study. The finding reveals all path coefficients were positive and significant. Performance expectancy was significantly associated with aesthetics ( $\beta = 0.188, p < 0.001$ ) and effort expectancy ( $\beta = 0.130, p < 0.01$ ) which accounted 0.62% of performance expectancy variance. Hence, H2 and H10 were accepted. Effort expectancy has a positive influence on both hedonic motivation ( $\beta = 0.211, p < 0.001$ ) and aesthetics ( $\beta = 0.167, p < 0.001$ ), which accounted 0.83% of effort expectancy variance. Therefore, H5 and H11 were accepted. The hedonic motivation was statistically and positively associated with aesthetics ( $\beta = 0.144, p < 0.001$ ), which accounted 0.21% of hedonic motivation variance. Hence, H12 was also accepted. Intention to use was successfully related to seven constructs i.e. performance expectancy ( $\beta = 0.266, p < 0.001$ ), effort expectancy ( $\beta = 0.094, p < 0.05$ ), hedonic motivation ( $\beta = 0.107, p < 0.01$ ), facilitating conditions ( $\beta = 0.120, p < 0.01$ ), social influence ( $\beta = 0.132, p < 0.01$ ), price value ( $\beta = 0.101, p < 0.01$ ), and aesthetics ( $\beta = 0.202, p < 0.001$ ). These 7 significant predictors accounted for 35.7% of the variance of intention to use mobile augmented reality. Therefore, H1, H2, H4, H6, H7, H8, and H9 were all accepted.

## 8 Discussion and Conclusion

When reviewing the findings, it was confirmed that the model used in the context of this study is robust and that prediction ability was acceptable, especially since no previous studies in Jordan dealt with studying UTAUT2 in the context of augmented reality. Besides, this study successfully incorporated aesthetics along with UTAUT2 variables where the  $R^2$  value extracted in intention to use has been reached 35.7%. As expected, the empirical results clearly showed that performance expectancy is the most important factor affecting the intention of respondents to use MART. This indicates that the utilitarian values are a critical issue for users in shaping the intention to use MART. Noticeably, most of the previous studies that used UTAUT or UTAUT2 have found that performance expectancy is a very important factor in determining the intention of users to use technology [46,47].

Statistical results also indicated that the relationship between effort expectancy and the intention of visitors to use MART is significant. This confirms that the level of ease or difficulty in using technology is a vital issue for the user. This relationship can be explained by the fact that mobile applications, in general, need the user to have a certain degree of knowledge and familiarity, and therefore the user uses this application personally and without the help of others. Theoretically, vast studies in the area of IS documented a significant relationship between ease of use (effort expectancy) and perceived usefulness (performance expectancy) [49–51]. Effort



expectancy was found to be positive in affecting performance expectancy. This implies that if users observe that not much effort and difficulty in using technology, this, in turn, will make them observe that using technology is more useful and be advantageous in performing tasks [44].

As suggested, hedonic motivation did positively predict the intention to use MART. This relation reflects that in the case of hedonic systems which is attributed to novelty and uniqueness different aspects, e.g., entertaining, joy, enjoyment, and pleasure in using such innovation increase the likelihood of adopting among users [52,53]. Jordan is an important tourist destination in the Middle East, it has many historical places and natural landscapes, and it is one of the countries considered relatively safe, and therefore tourists from all over the world visit it. It has a lot of attractions to visit as well as it has grown in the mobile and telecommunication industry; using MART is considered an added value for people in terms of modernity and distinction. Relevant literature in IS/IT, e.g., Ref. [46,56] strongly confirmed the critical impact of perceived enjoyment and hedonic motivation in predicting the intention to use. The hedonic motivation was found to be positive in affecting effort expectancy. This means that if users note that technology is enjoyable, they will find this technology is easy to use and does not need much effort in performing tasks.

As for the impact of facilitating conditions, findings approved the effect of facilitating conditions on the intention to use MART. This illustrates that participants consider those different aspects of facilities (i.e., requirements, skills and resources are crucial in using MART. In other words, mobile applications in the tourism sector require several facilities such as (e.g., Internet access, smartphones, Wi-Fi, secured applications, 4G services). This finding is consistent with other findings where it was asserted that facilitating conditions has a direct influence on the intention to use technology [58,59].

Regarding the social influence, the result was consistent with what was suggested in this study where social influence has a relationship with the intention to use MART. This means that users in Jordan appear to have more interested in the recommendations and attitudes of their reference groups (i.e., friends, family members, co-workers, and colleagues) in shaping their intention to adopt MART. From a theoretical perspective, related studies in the domain of IS have approved the significance and positive role of family members, co-workers, reference groups, friends, and elders on user's intention to use a technology [61,62].

Hypothesis H8, the hypothesized relationship between price value and intention to use MART has been affirmed as significant. Consequently, respondents consider price value to be important when deciding whether to accept or reject technology. Differently, when increasing the benefits and facilities observed in MART in proportion to the financial cost paid to use these systems, the customer is more likely to be eager to approve the MART. This opinion supports the view of the original UTAUT, which thought that users will consider using the technology if the benefits of using such technology are higher than the costs [30]. The role of price value on the intention of customers to use has been verified in many prior studies [65–67].

Findings show that aesthetics have a significant impact on the intention to use MART. Besides, aesthetics is positively influencing performance expectancy, effort expectancy, and hedonic motivation. We can observe that aesthetics plays a major role in exciting the user to use MART and in formulating the impression to use MART as a more creative and innovative application. The results of this study matched with the results of previous researches on the ability of aesthetics to influence the intentions of users and shape their perceptions towards this technology [80,81]. The role of aesthetics in affecting performance expectancy (perceived usefulness), effort expectancy (perceived ease of use), and hedonic motivation (perceived enjoyment) has been consistent with a study by [65] in a museum tour application context.

## 9 Theoretical Contribution and Managerial Implications

The current study supports several contributions at the theoretical level. This is a rare study exploring the impact of the UTAUT2 model and aesthetics on the use of AR applications. Referring to previous studies,

there is a small number of research on the topic of augmented reality applications and their impact on tourism [65]. Moreover, there is little AR-related research applied by UTAUT2 in the tourism context. The current research closed the potential gaps in the limited research mentioned previously. Also, incorporating aesthetics into UTAUT2 added perfectly to the current body of knowledge. This study discovered the important role of aesthetics in affecting performance expectancy, effort expectancy, and hedonic motivation in the context of MART. This is considered a scientific contribution by incorporating UTAUT2 in a new theoretical horizon.

The importance of AR design is the first managerial implication where the tourism sector and augmented reality application developers and designers can benefit from the results of this study regarding the design and implementation of augmented reality applications. On the global level, the aesthetics of augmented reality is a decisive factor for the user and helps to form a positive perception and thus raise the intention to use this application. Accordingly, designers and developers of augmented reality applications must consider this aspect to succeed in the implementation of the MART and quick diffusion for use among users. Moreover, constructs of the proposed research model e.g. performance expectancy, hedonic motivation, and effort expectancy should be considered in their endeavor to encourage users to use MART. Besides that, this study has concluded that different aspects of facilities (i.e., requirements, skills, and resources are crucial in using MART). Finally, it can be concluded from this study that respondents consider price value to be an important factor when deciding whether to accept or reject technology. When increasing the benefits and facilities observed in MART compared with the financial cost paid to use these systems, the customer is more likely to be eager to approve the MART [89,90].

## 10 Future Research and Limitations

Several limitations cannot be ignored in this article. The first of these limitations is that this study was accomplished in one country, which is Jordan, and therefore its results cannot be generalized to other countries. Therefore, this study recommends conducting comparative studies between Jordan and other countries. This study is also concerned with examining one type of application (i.e., MART), so more research is required to apply the model of this study in other contexts e.g. mobile learning, mobile shopping, and mobile health. Moreover, most of the respondents were from the highly educated class and had a very good experience in using mobile applications as well as they had a great desire to know-how augmented reality applications work. This makes it difficult to represent the sample appropriately since the respondents did not represent different cultures [91]. Given that the use of augmented reality applications in the tourism sector in Jordan is still in a preliminary stage, it is natural that the habit was not formed by them. Therefore, the habit has not been included in the study model, however, in the case of the application of augmented reality to the tourism sector in Jordan in the future, it is necessary for future researches in including the habit when examining the intention of users to use this application where the habit is a very important factor in determining intention to use technology.

**Funding Statement:** The authors received no specific funding for this study.

**Conflicts of Interest:** The authors declare that they have no conflicts of interest to report regarding the present study.

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## Appendix A.

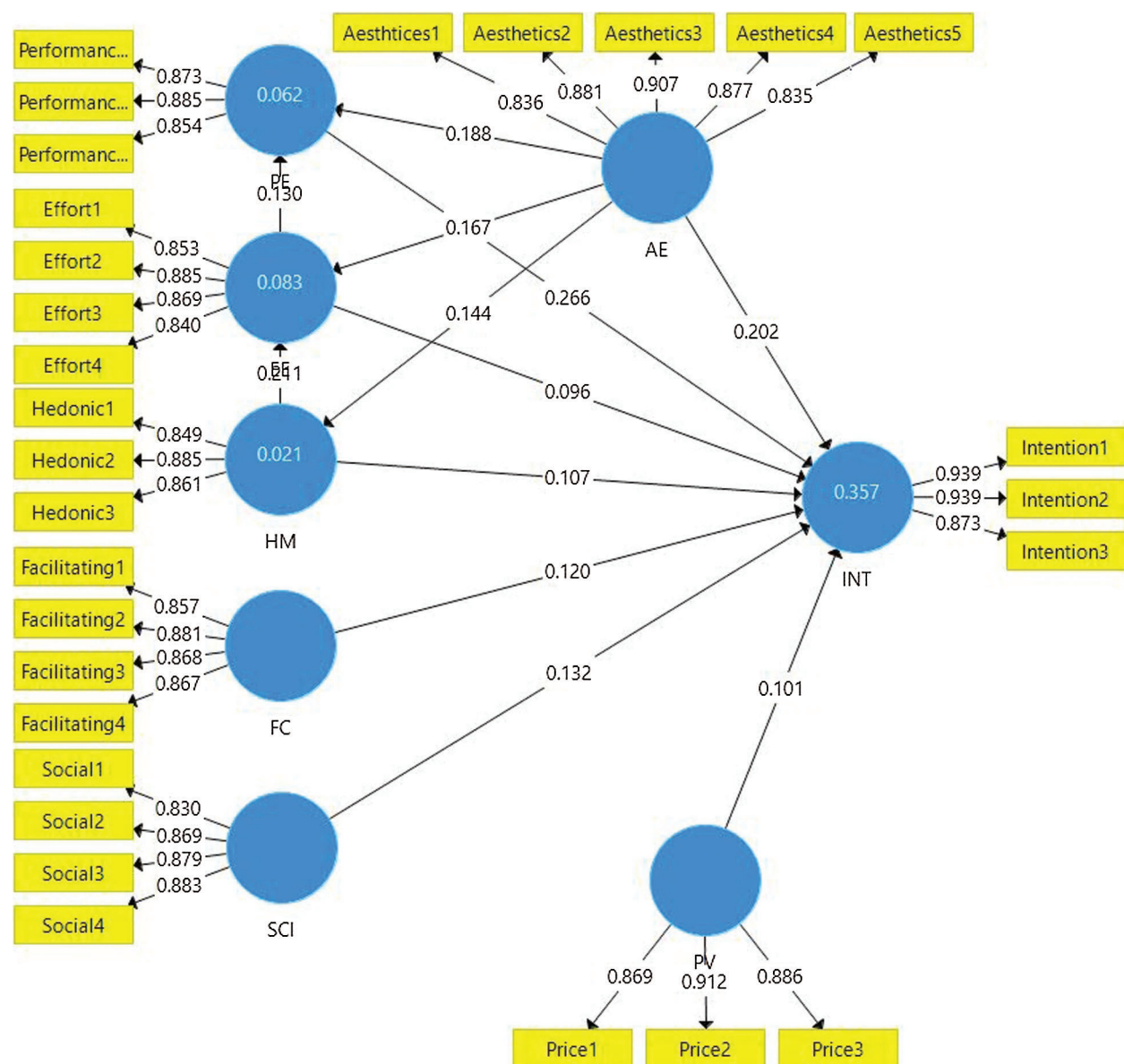
**Table A1:** Items for all constructs

Constructs	Items	Origin
Performance expectancy	<p>"I think the mobile internet will be useful in my tourist activities.</p> <p>I think that the mobile internet will increase my chances of achieving things that are important to me in my tourist activities.</p> <p>I think using the mobile internet will enable me to conduct tourist activities more quickly."</p>	[30]
Effort expectancy	<p>"Learning how to use mobile internet for tourist activities will be easy for me.</p> <p>My interaction with mobile internet in touristic activities will be clear and understandable.</p> <p>I think mobile internet easy to use in tourist activities.</p> <p>It is easy for me to become skillful at using mobile internet in tourist activities."</p>	
Hedonic motivation	<p>"Using mobile internet in tourist activities will be fun.</p> <p>Using mobile internet in tourist activities will be enjoyable.</p> <p>Using mobile internet in touristic activities will be very entertaining."</p>	
Facilitating conditions	<p>"I have the necessary resources to use mobile internet in tourist activities.</p> <p>I have the necessary knowledge to use mobile internet in tourist activities.</p> <p>Mobile internet in tourist activities is compatible with other technologies I use.</p> <p>I think I can get help from others when I have difficulties using mobile internet in tourist activities."</p>	
Social influence	<p>"People who influence my behavior think that I should use mobile internet in my touristic activities.</p> <p>People who are important to me think that I should use the mobile internet in my tourist activities.</p> <p>People in my environment who use mobile internet services in tourist activities have more prestige than those who do not.</p> <p>Having mobile internet services in touristic activities is a status symbol in my environment."</p>	
Price value	<p>"Mobile internet for touristic activities is reasonably priced.</p> <p>Mobile internet for touristic activities is a good value for the money.</p> <p>Mobile internet for touristic activities provides a good value."</p>	
Intention to use	<p>"I intend to continue using mobile internet in touristic activities in the future.</p> <p>I will always try to use the mobile internet in my touristic life.</p> <p>I plan to continue to use mobile internet frequently in touristic activities."</p>	

(Continued)

Table A1 (continued).		
Constructs	Items	Origin
Aesthetics	“If I use the AR app, I will feel a real sense of harmony. If I use the AR app, just to be here is very pleasant. If I use the AR app, the setting is not bland. If I use the AR app, the setting showed attention to design detail. If I use the AR app, the setting pleased my senses.”	[7].

## Appendix B.



**Figure B1:** Path analysis for the research model