



## **Research Exposé:**

# **SMART TOURISM: Tourism apps usage on Augmented Reality**

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## ABSTRACT

**Background:** The way people interact with their surroundings has been transformed by advanced mobile technology. Recent studies have examined the potential of augmented reality (AR) as a means to enhance users' experiences by allowing them to interact with the real environment. Nevertheless, there is still a lack of research on user acceptability of AR in the tourism context. Therefore, the technology acceptance model (TAM) will be implemented in this study.

**Aim:** This research aims into how augmented reality apps affect tourists' travel experiences and, as a result, their desire to use them again.

**Methodology:** The paper will be carried out using an online questionnaire that will be circulated throughout Europe; respondents will have the opportunity to interact with an augmented reality application before beginning to fill out the survey.

**Contributions:** This study will contribute to the literature research regarding users' experiences with augmented reality applications and their intention to use them when travelling in the future.

**Keywords:** Augmented Reality; Smart tourism; Travel apps; Mobile augmented reality; TAM; Google maps.

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## LIST OF ABBREVIATIONS

AR	Augmented Reality
AV	Augmented Virtuality
TAM	Technology Acceptance Model
MAR	Mobile Augmented Reality
UNWTO	United Nations World Tourism Organization
e.g.	Exempli gratia
i.e	Id est
ICT	Information and Communication Technology
QR	Quick Response
ARSG	Augmented Reality Smart Glasses
UK	United Kingdom
GPS	Geographic Coordinate System
UNESCO	United Nations Educational, Scientific and Cultural Organization
SOR	Stimulus, Organism, Response
iOS	iPhone Operation System
SJR	Scimago Journal and Country Rank
PAD	Pleasure, Arousal, Dominance
IDT	Innovation Diffusion Theory
TRA	Theory of Reasoned Action
TPB	Theory of Planned Behavior
UTAUT	Unified Theory of Acceptance and Use of Technology
AE	Authentic Experience
PE	Perceived Enjoyment
PI	Perceived Interactivity
PU	Perceived Usefulness
PEOU	Perceived Ease of Use
BITU	Behavioral Intention to Use
PLS	Partial Least Squares
CFA	Confirmatory Factor Analysis
MR	Mixed Reality
CPU	Central processing unit

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# 1. INTRODUCTION

Recent technological advancements have transformed the way individuals interact with their real and virtual environments. This development has led in the increased popularity of augmented reality (AR), which has received significant attention from industry and academia over the last five years, to the point where AR is now considered as "one of the most revolutionary inventions in recent years" (He, Wu and Li, 2018, p.127). One explanation for this surge in popularity is an increasing recognition of its unique potential to provide a filtered impression of the real-world environment by seamlessly merging it with computer-generated material (Han et al., 2019).

The field of Virtual Reality (VR) includes augmented reality. Virtual 3D pictures are merged with the actual environment using computer graphics techniques to create a realistic effect that consumers can experience for themselves (Jin et al., 2017). AR enhances computer-generated sound, video, and images by appending artificial information, as well as adding virtualization technology to the user's senses (Papagiannidis et al., 2017). According to International Data Corporation (2020), global spending on AR is predicted to increase significantly due to the COVID-19 epidemic, from more than \$12.0 billion in 2020 to \$72.8 billion in 2024. These data clearly demonstrate the potential impact of augmented reality on the tourism business.

The tourism domain can benefit greatly from AR (Loureiro et al., 2020; Tussyadiah and Wang, 2016) due to its ability to provide more immersive tourism experiences. Stories and exhibits at sites where AR-based apps are used to help guests explore on their own, decreasing the need for human tour guides. In addition, innovative smartphone apps provide travelers with augmented experiences that aid them plan their trip and establish trust. Although augmented reality is expected to expand in popularity thanks to improvements in technology and studies on usability, adoption, and usefulness, it is critical to establish the basic needs of users to embrace AR (Chopra, Gupta et al., 2020).

The impact of Mobile AR in influencing tourists' intention to visit a specific area has been investigated by numerous studies, both as a mediating role (Wang et al., 2012) and a direct role (Chung et al., 2015; Haugstvedt and Krogstie, 2012; Jung et al., 2015). For tourist locations, Linaza et al. (2012) examined users' opinions on the usefulness of various Mobile AR applications, as well as prospective areas for improvement in the future. Next, Han and Jung

(2018) surveyed 49 travelers to find out what they desired from mobile AR tourism applications that focused on urban heritage. Additionally, Cranmer (2019) investigated how mobile augmented reality tourism apps provide value. Moreover, mobile augmented reality is one of the most rapidly emerging fields of AR research. As a result, the literature on user-mobile AR interaction has grown significantly (De Sa and Churchill, 2013; McLean and Wilson, 2019; Van Krevelen and Poelman, 2010).

TAM has been used in a few studies to determine whether AR is accepted in the tourism industry (Haugstvedt and Krogstie, 2012). There are few studies on the dimensions of AR's perceived value in the tourism sector (Cramner, tom Dieck, and Fountoulaki, 2020). There is a lack of information of how the usability and emotional perceptions of augmented reality applications affect visitors' experiences and intention to use them, and there is a need to further focus on different types of augmented reality apps and evaluate their effects over time. (Stangl et al. 2020). Additionally, the understanding of users' experiences using augmented reality during travel and/or post-trip is still restricted (Chen et al., 2021). No study has been conducted on the topic of localizing augmented reality applications that allow users to easily navigate tourist destinations. Consequently, this study will contribute to the literature regarding users' experiences with augmented reality localization applications during their travels.

The aim of this study is to determine the effect of mobile augmented reality on visitors' decision-making and behavioral processes during their travel using Google maps app. The study will incorporate the TAM theory with a few additional variables relevant to the subject. Other alternative theories are employed to strengthen the statement.

The following will be the structure of the research. The second section will review the theoretical framing, mainly the definitions of smart tourism, tourism and technology, augmented reality, mobile-augmented reality in tourism, and lastly TAM theory and alternative theories in tourism and technology. The third Section will summarize the literature review in a table format. The fourth section will provide an overview of the research model and hypothesis development process. The fifth section will describe the methodology in detail. Finally, the article will discuss the expected contributions.

## **2. THEORETICAL FRAMING**

This section will provide an overview of the study's theoretical framing. It will first explain what smart tourism is, and then move on to the concept of linking tourism and technology. Afterwards, it will go into detail with the most important concept in this research, which is augmented reality, and then it will go into detail in mobile augmented reality in tourism. Additionally, it will explore the TAM theory in relation to tourism. Finally, some alternative theories will be mentioned.

### **2.1. Smart Tourism**

Smart tourism is defined by Hunter, Chung, Gretzel, and Koo (2015) as the use of new technology for travel experience services such as accommodation, transportation, and restaurant reservations. In fact, several vacation destinations have recently attempted to embrace this "smart" concept in order to gain a competitive advantage over other tourism destinations based on product and service distinction and uniqueness (Cornejo, Ortega and Malcolm, 2020). In addition, tourism marketing has experienced significant changes as a result of the idea of smart tourism allowing it to take place everywhere and at any time, reaching millions of customers in the target market group with a single mouse click (Gretzel et al., 2015). For instance, Dubai promotes itself as "Smart Dubai," a city image that facilitates smart travel based on the Smart City concept (Khan et al., 2017). Smart tourism may be described as the tourist marketing industry based on the interactive exchange of information between stakeholders such as travelers and tourism businesses (Li, Hu et al., 2017).

Technology in smart tourism refers to an infrastructure that combines hardware, software, and network technologies to deliver real-time data that allows all stakeholders to make more informed decisions (Gretzel et al., 2015). Mobile technology, in particular the use of smartphones, have had a major impact on the development of smart tourism. The rapid advancement of mobile technology has piqued academic interest, and there is a compelling need for a systematic assessment of pertinent papers. However, the study on smart tourism has been inadequate for a variety of scholarly and practical debates (Hew, Tan et al., 2017). The majority of the research has concentrated on the perspectives of tourist destinations, entertainment, and hotels, as well as the deployment of sophisticated technology platforms and technological difficulties. However, the visitor behaviors associated with smart tourism have



not been well investigated. Additionally, there are limited studies on consumers' views of the negative consequences of traveling with a smart gadget. While utilizing a smart device in a foreign place, sensitive information such as payment and location information may be exposed (Buhalis and Amaranggana, 2015; Huang et al., 2017).

## **2.2. Tourism and Technology**

Tourism is a key contributor to any country's economic development. It is one of the fastest growing industries, assuring sustained growth and diversification, and therefore boosting socioeconomic advancement. The global recognition of tourism has resulted in economic and employment advantages in a number of related businesses. International visitor visits grew by 4.65% to 1,184 million in 2015, earning \$1.5 trillion in export income. By 2030, international tourist arrivals are expected to reach 1.8 billion, according to the UNWTO. (2018). Unfortunately, the Covid-19 epidemic caused damage on many tourist businesses (Gössling et al., 2020; Hall et al., 2020), forcing the industry to close for months at a time. Tourism was recognized as one of the most impacted sectors by the UNWTO (2020a). Indeed, crises are a frequent occurrence in this field (Dolnicar and Zare, 2020; Gossling et al., 2020).

Moreover, technology is changing the travel and tourism sector, impacting tourism firms' strategy and competitiveness (Buhalis and Law, 2008). As Poon (1993) anticipated, "the tourist sector as a whole would be impacted by an entire system of ITs that is growing quickly." To take advantage of recent developments in the technological paradigm, many companies have had to rethink their operational best practices and alter their strategic management and marketing. As tourism locations grow more competitive, technology advancements help them (Buhalis, 2000).

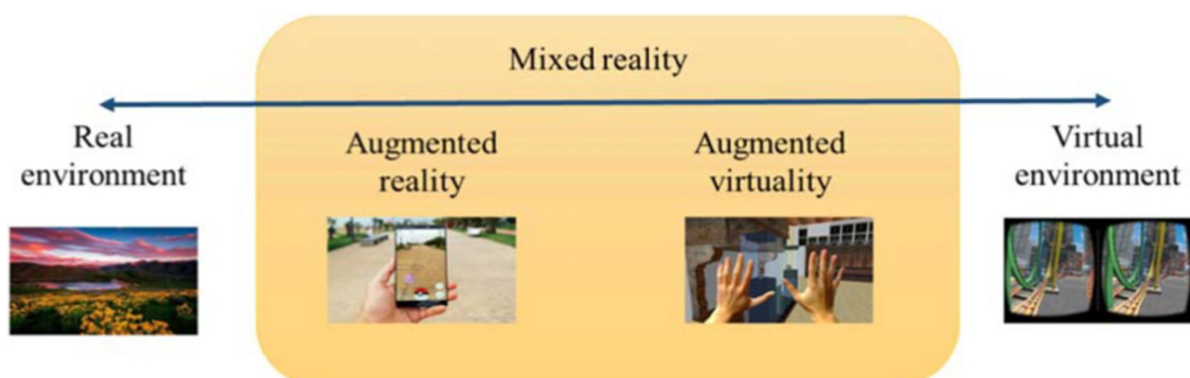
Tourism technology has the potential to significantly improve visitor experiences and promote tourism activities in a variety of ways, including by providing relevant information and encouraging participation, as well as by facilitating interactions among tourism stakeholders for instance tourism operators and visitors (Swart, Sotiriadis, and Engelbrecht, 2019). Mobile apps are a frequently used intelligent tool in tourism, assisting tourists in their decision-making processes by communicating marketing information, safety and emergency information and information about services (e.g., banking, ticketing, booking, and shopping)

(bib, Kennedy et al., 2012; Kennedy-Eden and Gretzel, 2012). These services increase passengers' and tourist providers' accessibility and convenience.

### 2.2.1. Augmented Reality

Although augmented reality was invented in the 1960s, it did not gain broad acceptance until the early 2000s (Billinghurst and Kato, 2002). Numerous augmented reality applications have been discovered in a variety of fields, including entertainment, education (Carlson and Gagnon, 2016; Kysela and Storkova, 2015), retail (Javornik, 2016), medicine (Botella et al., 2005; Li et al., 2020), travel (Loureiro et al., 2020), and military support (Livingston et al., 2011). The capacity of augmented reality to improve what users view in the actual world or to create a completely new environment in which they may see items that do not exist in the concrete world (Kipper and Rampolla, 2012). In other words, computer simulations can easily be integrated into real-world situations by developing an augmented vision that smoothly combines the user's surroundings with digital data, enabling the physical and virtual worlds to cohabit (Flavián, Ibáñez-Sánchez, and Ors, 2019). As shown in Figure 1, augmented reality and augmented virtuality (VR) are both Mixed Reality subcategories (MR). Augmented reality (AR) modifies the user's physical experience by superimposing virtual components (images, videos, and virtual objects) on top of their actual environment (Azuma, 1997; Javornik, 2016; van Krevelen and Poelman, 2010; Yim, Chu, and Sauer, 2017). Following the Pokémon Go video game, the popularity of augmented reality (AR) has taken the world by storm (Rauschnabel, Rossmann, and tom Dieck, 2017), showing the technology's potential to deliver new experiences to consumers (Jung, Chung and Leue, 2015; Yaoyuneyong, Foster and Johnson, 2016).

**Figure 1.** *Reality - Virtuality continuum (Source: Milgram and Kishino, 1994)*



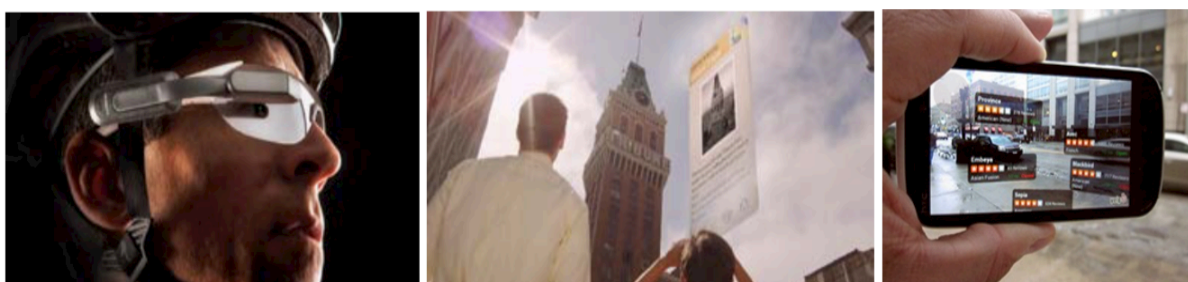
AR devices may be fixed (e.g., interactive displays in museums), mobile (e.g., augmented reality smart glasses), or wearable (Rauschnabel, Felix, and Hinsch, 2019). Google Glass was one of the first smart glasses for augmented reality to be created for the tourist sector, allowing non-invasive, hands-free improvements (Han, tom Dieck, and Jung, 2019). Despite its early success, Google Glass development has stalled, owing mainly to technological limitations like as cumbersome and bulky technology (tom Dieck et al., 2016). As a consequence, more recent use cases investigate the possibilities afforded by intuitive technology like as Microsoft Hololens (Hammady and Ma, 2019). Due to the capacity of Microsoft Hololens to integrate virtual information into the user's immediate field of vision through a glass-like device, they are classed as Augmented Reality Smart Glasses (ARSG) (Kalantari and Rauschnabel, 2018). By realistically integrating the 3D information device into the actual environment, users may interact with it through hand movements, gaze, and voice commands. By making the environment the user interface for mobile augmented reality, users may engage with the virtual material in the same manner they would interact with a physical item (Kipper and Rampolla, 2012), encouraging diverse interactions and altering access to information at the grassroots level (Hammady and Ma, 2019).

While augmented reality may be seen on a number of devices and advanced wearables seamlessly integrate digital content with the real world, the smartphone continues to be the most popular augmented reality device owing to its broad availability and simplicity of use (Wang et al., 2016). The present popularity and acceptability of AR may be linked to the proliferation of smartphones and the development of a diverse array of apps (Han et al., 2019; Jung and tom Dieck, 2017). Smartphones are minimally intrusive, socially acceptable, easy to use, and ubiquitous (Biseria and Rao, 2016). Furthermore, advancements in smartphone cameras, gyroscopes, solid-state compasses, accelerometers, CPUs and graphics, touch screens, and integrated sensors enable the creation of improved augmented reality experiences (Billinghurst and Duenser, 2012). Enhanced geolocation accuracy and precise position recognition through smartphone camera viewers, for example, enable augmented reality apps to offer context-sensitive information about the user's immediate surroundings (Yovcheva, Buhalis, and Gatzidis, 2013). Using the camera on the device, augmented reality pictures, videos, or sounds are superimposed in actual time over the user's view of the real world (Biseria and Rao, 2016). Smartphones have been selected as the perfect augmented reality platform for the tourist sector owing to its simplicity of use, cheap cost, dependability, and capacity to run complex augmented reality applications (Chung, Han, and Joun, 2015).

### 2.2.2. Mobile - Augmented Reality in tourism

According to Ramos et al. (2018), augmented reality is a developing business that plays a critical part in defining traditional tourism, and that the data shown on visitors' mobile devices becomes more interesting via the overlay technique. The application aims to improve visitors' tourism experiences and levels of enjoyment, as well as to help travelers in obtaining their information and increasing their understanding of the destination's attractions (Kounavis et al., 2012). AR apps present unknown areas as tourist activities in a fun and engaging manner, and as their use grows, they give a chance to enhance the visitor experience at destinations and tourism companies (Dieck and Jung, 2015). Han et al. (2014) suggest that many locations be modified to stay competitive and appealing to visitors, including the usage of the new kind of AR, which is steadily growing in popularity. However, he acknowledges that although it has not yet reached the intended and prospective population, it will become a critical technology in the future, and the tourist sector should capitalize on this opportunity. Moreover, several augmented reality (AR) apps for tourism have been developed (Figure 2), with Google Translate, Apple Maps: AR flyover, HolloMaps, and Hudway being just a few of the most popular. There are also MAR apps that are unique to a city; for example, Tuscany+, an iOS-based augmented reality application that acts as a digital tourist guide for Tuscany. Basel AR (Azuma et al., 2001) is another example of an augmented reality travel guide devoted to Basel's content; it is available through the Layar AR browser and includes information on Basel's tourist sites, lodging, and restaurants.

**Figure 2:** *Examples of the navigation and tourism application.*



Mobile tourism apps (Gavalas, Kenteris, et al. 2011) enable users to get information about a destination while traveling through it. Location-based applications (Noguera, Barranco, Segura, and Martínez., et al 2012), social networking sites such as mobile guides (Viana,

Miron, Moisuc, Gensel, Villanova-Oliver, and Martin., et al 2011), and navigation maps as Google maps all offer data that enables users to travel around. This data is merged to create digital maps that are realistic representations of the actual world, making them ideal for on-the-go tourists. By incorporating MAR (Kounavis, Kasimati, Zamani, and Giaglis., et al., 2012) into tourism, tourist agencies, government agencies, and resorts may provide critical information interactively rather than through a dedicated website. With the availability of MAR, tourist locations may enhance their marketing efforts while also improving visitors' travel experiences by providing an overview of the place they plan to visit without having to leave their present position. Additionally, numerous studies have been conducted demonstrating the potential for augmented reality to improve the tourism experience in small towns (Han et al., 2013), Asian theme parks (Weng et al., 2011), Disney World (Mine et al., 2012), UNESCO-recognized museums in the United Kingdom (Cranmer, 2019), and urban heritage tourism sites (Mine et al). (Boboc et al., 2019; Han and Jung, 2018). Numerous recent studies have also focused on identifying specific characteristics of applications that improve the tourist experience (Dangkham, 2018; Ocampo, 2019; Ramtohul and Khedo, 2019).

Augmented reality is a useful method for meeting the needs of tourists who want fast access to extra information, entertainment, and guidance at any time and from any location, allowing tourism companies to build strong relationships with mobile consumers. In fact, augmented reality aims to bridge the gap between consumer expectations and digital tactics used by companies. This may also occur throughout the advertising or product sales process. Any item or picture in a consumer's surroundings that has a unique visual profile, such as logos, catalogs or brochures in general, as well as hotel catalogs or brochures, magazine covers or pages, posters, billboards, shop displays, business cards, signs, symbols, and tickets, may be enhanced (Carmigniani et al, 2011; Berryman, 2012). Advanced information systems assist visitors get the most out of their trips by offering entertainment choices in addition to delivering essential and valuable information about a tourist attraction or area (Kounavis et al, 2012). AR may also offer tourists with materials and services that are customized to their particular requirements. To put it another way, when visitors visit a destination's attractions, augmented reality may show content depending on pre-requests. Users may add additional degrees of realism to their experience using mobile augmented reality apps, making it more dynamic and interactive. Because these applications are often found on mobile devices with GPS capabilities, visitors may take advantage of extra services and alter their itinerary by leaving comments on the places they visit (Carmigniani et al, 2011, Kounavis et al, 2012).

### **2.2.3. TAM in tourism and technology**

Tourist attitudes about the usage of new technology have gotten a lot of attention from academics who specialize in tourism (Obeidy et al., 2017). Several theories have been propounded to illustrate how visitors' attitudes about technology usage are affected (Van Winkle et al., 2019). Ad one of the more widely used models, which is the technology acceptance model (TAM), has been widely used to describe an individual's technology adoption behavior. The TAM highlights the correlation among customers' perceptions of usefulness, ease of use, attitude toward new technology, and willingness to utilize it. Several experts in the area have said that augmented reality technology has the potential to have a major effect on the tourist industry and serve as a catalyst for tourism innovation (Gutierrez et al., 2015; Han et al., 2019; T. Jung et al., 2016; Loureiro et al., 2020). Despite its significance, there have been surprisingly few studies on the true value of AR in the tourist industry.

TAM has recently been expanded to include other acceptability variables, such as subjective standards, in a range of research settings (McLean and Wilson, 2019; Scherer et al., 2019). The behavioral intention of visitors to utilize new technology has long been seen as a key subject of academic study and as a goal of the tourist industry. Thus, extended TAM theory may be utilized to elicit more information on visitors' attitudes, subjective norms, and behavioral intentions throughout the decision-making process linked with the usage of augmented reality technology. For instance, subjective norms may be regarded a factor influencing visitors' behavioral intentions, such as tourists' willingness to utilize augmented reality technology may be increased if they perceive a higher-level subjective norm (Bilgihan et al., 2016). On the basis of the above, the study's second aim was to evaluate if a subjective norm may affect an individual's willingness to utilize augmented reality technology in tourism.

### **2.2.4. Alternative theories**

This study's theoretical framework is derived from prior theories of technology adoption. Innovation diffusion theory (IDT) was one of the first studies of the acceptance and rejection of new technologies and has been applied in a variety of disciplines to examine the adoption and spread of technical improvements. While Rogers (1996) shown that people accept innovations only if they appear to be adventurous, the favorable impression of wearable

gadgets is hypothesized to be based on greater connection and better usefulness for a variety of purposes. Rogers' IDT (1996) demonstrated that relative advantage, compatibility, and complexity, as well as other qualities such as observability and trialability, all had a consistent effect on the amount of innovation. Regarding the theory of reasoned action (TRA), Ajzen and Fishbein (1975) evolved one of the first theories directly linked to technical breakthroughs. TRA assumes that social attitudes and influences affect behavioral intentions to embrace a technology. Adding the perception of behavioral control to the formula, Ajzen (1985) generated the theory of planned behavior (TPB). TAM was later modified to become Models 2 and 3 (TAM2 and TAM3), or the United Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh, Morris, Davis, and Davis, 2003). These early ideas were primarily concerned with organization; nevertheless, they have been applied to a variety of sectors, including tourism. In practice, these ideas broadly resemble each other, and the concepts are often employed interchangeably when examining technological adoption in a variety of settings. For instance, the most notable distinction existing between UTAUT and prior theories is the incorporation of the notions of anticipation and enabling circumstances.

### 3. LITERATURE REVIEW

This section analyzed eleven publications considered pertinent to the thesis's subject. They were identified in Publish or Perish, a software program for collecting and evaluating academic citations. It incorporates a variety of data sources, including Google Scholar and Microsoft Academic Search. The articles were found using the keywords "*augmented reality*", "*smart tourism*", and "*augmented reality and tourism*". Once the publication was found, SJR was used to determine its credibility. The papers selected were mainly published in journals devoted to tourism or education. Additionally, publications in computer science and engineering were excluded. Table 1 summarizes the literature review of the selected papers based on the sample and method used, the circumstances in which AR applications were used, the theories used to conduct the analysis, and lastly, the contributions made to the literatures.

**Table 1:** *Literature review table*

#	References	Sample and methods	Context	Theory used	Contribution
1	HN Do, W Shih, QA Ha (2020). Effects of mobile augmented reality apps on impulse buying behavior: An investigation in the tourism field. <i>Heliyon</i>	Online questionnaire 479 valid sample	AR app intention purchase during travel	TAM, S-O-R and Flow theory	Mobile AR apps play a key function in regulating tourists' unplanned shopping behavior. In fact, the utilities, ease of use, and interactivity of apps increase as perceived enjoyment and user satisfaction increases.
2	S Park, B Stangl (2020). Augmented reality experiences and sensation seeking. <i>Tourism Management</i>	Sample of 1042 participants	AR in tourism	TAM and Flow theory	Sensory-seeking and boredom-susceptibility are key elements to classify travel groups in the context of augmented reality (AR) applications.
3	SHY Hsu, HT Tsou, JS Chen (2021) “Yes, we do. Why not use augmented reality?” customer responses to experiential presentations of AR-based applications. <i>Journal of Retailing and Consumer Services</i>	Online survey of 437 participants	YouCam Makeup AR app in beauty market in Taiwan	S-O-R	Experiential features of augmented reality (AR) apps have a greater positive impact on hedonic value than utilitarian value.
4	IP Tussyadiah, TH Jung, MC tom Dieck (2017). Embodiment of Wearable Augmented Reality Technology in Tourism Experiences, <i>Journal of Travel Research</i>	Convenient sampling. 211 field surveys	Art gallery with wearable devices in UK	Technology embodiment	This paper analyzes the embodiment of wearable augmented reality technology in a tourist attraction. It substantiates the concept of technology withdrawal and challenges the relationship of subjectivity and intentionality between humans and technology.
5	P Kourouthanassis, C Boletsis, C Bardaki, D Chasanidou (2015). Tourists responses to mobile augmented reality travel guides: The role of emotions on adoption behavior. <i>Pervasive and Mobile Computing</i>	Convenient sampling. 105 field surveys	CorfuAR travel guide app for Corfu city in Greece	S-O-R and PAD (Mehrabian and Russel, 1974)	This is the first study to test the relationship between system functional characteristics and consumer emotions.
6	EE Cranmer, MC tom Dieck, P Fountoulaki (2020). Exploring the value of augmented reality for tourism. <i>Tourism Management Perspectives</i>	Qualitative and exploratory approach. 15 interviews with tourism experts	AR in tourism	None	Different perspectives on the value of augmented reality (AR) provide important implications for strategy development, AR implementation, and tourist experience design.



7	B Stangl, DC Ukpabi, S Park (2020). Augmented Reality Applications: The Impact of Usability and Emotional Perceptions on Tourists' App Experiences. <i>Information and Communication Technologies in Tourism</i> pp 181-191	Questionnaire of 796 respondents	LayAR app in travel context	TAM	Action experience has little or no impact on users' intent to use the app, a study shows.
8	X Zhuang, X Hou, Z Feng, Z Lin, J Li (2021). Subjective norms, attitudes, and intentions of AR technology use in tourism experience: the moderating effect of millennials. <i>Leisure Studies</i> 392-406.	Cross-sectional survey and 224 valid responses	AR applications in Guangdong Provincial Museum, China	TAM	Tourists' attitude toward augmented reality (AR) technology is significantly and positively affected by perceived usefulness and ease of use, while perceived danger does not significantly influence their intention to use it. There are strong positive correlations between attitudes toward and subjective rules of AR technology and tourists' intentions to use it.
9	DID Han, MC tom Dieck, T Jung (2019). Augmented Reality Smart Glasses (ARSG) visitor adoption in cultural tourism, <i>Leisure Studies</i> .	Qualitative, Thematic analysis, 28 interviews	ARSG in tourism, UK art gallery	IDT, TRA, TPB, TAM, UTAUT	Social norms, including social acceptability and social interaction, are of great concern for tourists using technology around peers. The adoption of ARSG depends in large part on its perceived value and its relation to visitors' resistance factors, including cost. In particular, the value to visitors needs to be clearly understood to ensure successful implementation.
10	MC tom Dieck, T Jung (2018). A Theoretical Model of Mobile Augmented Reality Acceptance in Urban Heritage Tourism. <i>Current Issues in Tourism</i>	Qualitative investigation, 44 participants	AR applications in Dublin's historic urban tourism	TAM	Similar to the original TAM, the AR acceptance model proposes a positive influence of perceived ease of use on perceived usefulness and proclivity to use. According to the suggested model, the perceived ebb and flow of AR application usage is influenced by information resource ownership, system quality, cost of use, directions, human innovativeness, risk, and enabling circumstances.

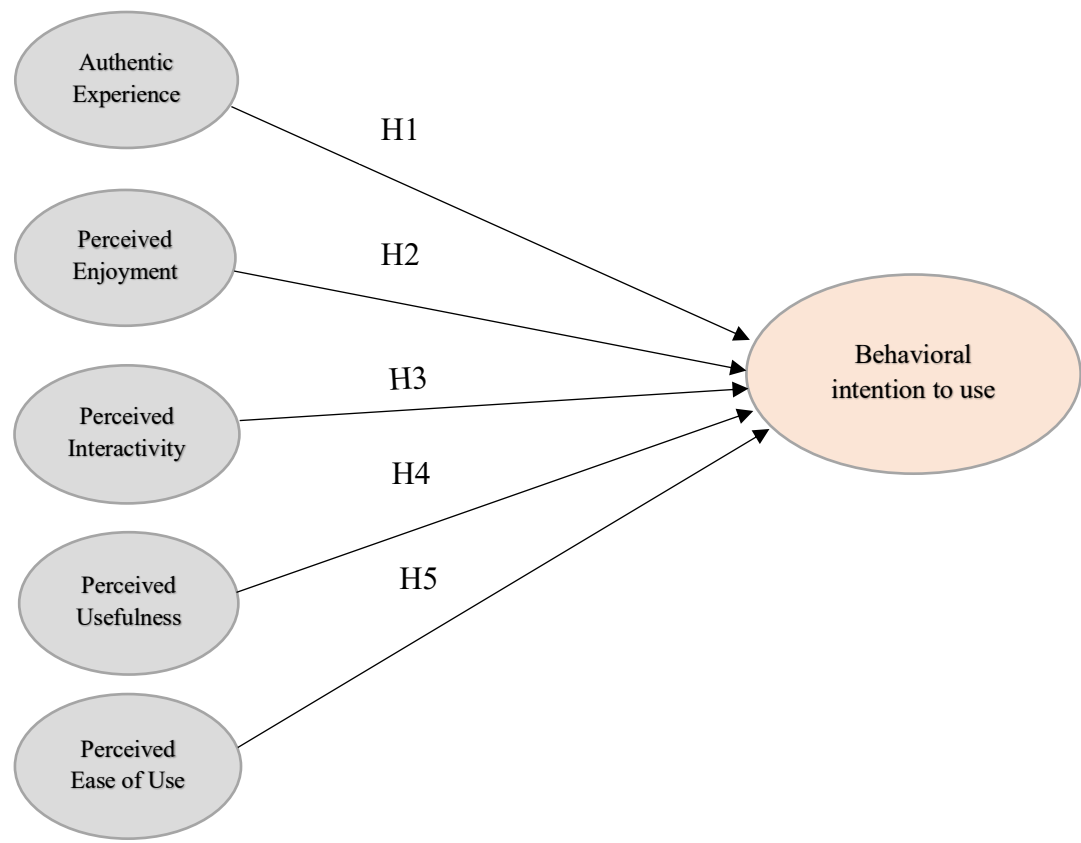
11	H Qin, DA Peak, V Prybutok (2021). A virtual market in your pocket: How does mobile augmented reality (MAR) influence consumer decision making? Journal of Retailing and consumer Service 58	Sample of 162 participants	MAR Apps purchasing in USA	S-O-R theory	That study highlighted the fact that if consumers receive the MAR app as fun, useful, and conducive to information acquisition, they are likely to have a more favorable emotional response than those who do not use the app if they view it negatively.
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#### 4. RESEARCH MODEL AND HYPOTHESES

The framework for this research (**Figure 1**) was created integrating information from the literature on augmented reality and the associated technological acceptability model. Both theoretical and empirical research support the case for developing hypotheses for this approach. From this vantage point, augmented reality and the technological acceptance model have a direct influence on customer behavioral intent to use.

This section aims to explore the main construct behind the study. When analyzing the topics, hypotheses will be presented and defined.

**Figure 2:** *Research Model*



## **4.1. Authentic Experience**

Gilmore and Pine (2007) defined authenticity as "a new consumer sensibility focused on the sense of the degree to which experiences, services, or goods" are novel, genuine, unique, or exceptional. Authenticity-related variables such as knowledge, external information seeking, and the perception of authenticity all influence slow-trip consumer behavior (Meng and Choi, 2016). Additionally, genuine encounters with technologies have a favorable effect on consumers' behavioral intention to use in tourism (Kim, Bonn, and Lee 2017), suggesting that authentic experience has an effect on cognition. As a result, it is thought that authentic experience is intimately connected to the impulse to utilize technology. Consumer behavior is thought to be affected by the authenticity of the experience for people who travel and utilize mobile computing technologies (Kim et al., 2017). As a result of the present research, the following hypothesis was developed:

***H1.** Authentic Experience has a positive impact on Behavioral intention to use AR apps.*

## **4.2. Perceived Enjoyment**

Enjoyment is a mental state that is induced by the interplay of an individual's experience and his or her surroundings. Consumers' emotional experiences, according to Sohn and Lee (2017), have a substantial and positive impact on their impulsive behavior. Thus, it can be inferred from the present study that visitors who experience a greater degree of enjoyment when interacting with a Mobile AR application are more inclined to continue doing so in the future. Due to the development of internet networks, the importance put on pleasure as an external attribute has grown considerably in recent years (Lee et al., 2012; Lin and Lu, 2011). When it comes to mobile apps, personal innovativeness (Zarmpou et al., 2012) and advantages (Lopez-Nicolas et al., 2008) have been demonstrated to influence behavioral intention to use. Additionally, Ha and Stoel (2009) examined the role of fun in defining the TAM characteristics of new technologies, finding that fun had a particularly strong impact on consumers' perceptions of augmented reality app usage. Similarly, Haugstvedt and Krogstie's (2012) TAM study on cultural heritage applications showed that enjoyment is a key factor in deciding app acceptance (or rejection). On the basis of a prior assessment of the literature, this research suggests the bellow hypothesis:

***H2.** Perceived Enjoyment has a positive effect on Behavioral intention to use AR apps.*

### **4.3. Perceived Interactivity**

The interactivity of augmented reality technology improves the quality of search by assisting users in obtaining the information they need, thus increasing utilitarian value (Kim and Forsythe, 2008). Additionally, highly interactive experiences foster a sense of fun, tying interaction to the hedonistic component of augmented reality technology (Huang and Liao, 2015). As a result, when consumers engage with an augmented reality app, the app stores prior login information and promptly delivers pertinent personal information, fostering an amazing user experience and a favorable impression of the app (Fang, 2017). Moreover, interactivity and virtuality have been recognized as the main defining characteristics of augmented reality applications and as the fundamental ideas of virtual media by information scientists (Javornik, 2016). Interactivity in augmented reality applications improves the user experience. Additionally, interactivity enhances the customer experience by allowing them to engage with and modify the virtual world and its modules in real time (Zhao et al., 2020). Virtuality, on the other hand, mixes physical and virtual components through immersion or telepresence in a computer-generated world. Virtuality has a major role in eliciting cognitive or emotional responses in consumers (Suh and Prophet, 2018). As a result, this research suggests interactivity and virtuality as technological stimuli that have an effect on user experiences and performance. The perception of interactivity is a critical element in establishing perceived ease of use of an internet location marketing and reservation system in the travel industry (Herrero and San Martín, 2012; Park and Gretzel, 2007). Moreover, Pantano et al. (2017) found that interaction substantially improves the consumer's perceived ease of use of the augmented reality glasses testing system. In light of this, the following theories are advanced in this study:

***H3.** Perceived interactivity has a positive impact on Behavioral intention to use AR apps.*

### **4.4. Perceived Ease of Use and Perceived Usefulness**

Perceived usefulness refers to an individual's belief that a certain technology or information system may help them perform better (Davis, 1987). In other words, it is the degree to which users of a system believe that the technology will increase their productivity and effectiveness at daily tasks (Rouibah and Abbas, 2006; Mou, Shin, and Cohen, 2017). As a result, users' intentions are influenced by their impression of the system's utility (Sharma and Yadav, 2011). Additionally, many researchers have shown that an individual's behavioral intention to utilize

a new technology or system is strongly influenced by perceived utility. Perceived ease of use refers to the degree to which a system's user thinks that utilizing it is easy (Davis, 1989). In basic words, perceived ease of use refers to the user's perception of the system as being very simple to use. As a result, it is thought that when a system is simple to use, users' behavioral intention improves. Numerous researches have been performed in this area to determine the substantial impact of perceived ease of use on electronic system usage. Moreover, perceived usefulness and perceived ease of use are the two major independent variables that affect an individual's behavioral intention to utilize a new technology, according to Davis et al. (1989). If users can engage with a technological system more readily, it implies that their perceived efficacy toward (Bandura, 1982) and capacity to manage (Lepper, 1985) the system is extremely good, and they are therefore more competent to utilize the new technology. As a result, the following two assumptions are proposed in this study:

*H4. Perceived Usefulness has a positive impact on Behavioral intention to use AR apps.*

*H5. Perceived Ease of Use has a positive impact on Behavioral intention to use AR apps.*

#### **4.5. Behavioral Intention to Use**

Several prior researches have shown that intention is critical in determining actual behavior (Venkatesh and Davis, 2000). Additionally, since consumers may quickly switch to comparable mobile services, service providers must concentrate on customers' ongoing use intentions to guarantee the software's long-term viability in this competitive market. Usage intentions reflect an individual's degree of deliberate engagement in a specific activity. Where people have a higher use intention, the chance that they will actually participate in that activity increases, and as a consequence, use intention and actual behaviors exhibit a strong direct connection. The greatest predictor of an individual's conduct is his or her desire to use (Ajzen et al., 1980). Moreover, intentional behavior can serve as a substitute for actual action (Fishbein and Ajzen, 1975). Additionally, real experience obtained through the usage of a particular technology enhances a user's behavioral intention (Dueholm and Smed, 2014; Guttentag, 2010; Kim et al., 2017; Mura et al., 2017; Yung and Khoo-Lattimore, 2019). Specifically, the real experience associated with mobile computing technologies improves travel consumers' propensity to reuse mobile technologies (Kim et al., 2017).

## **5. METHODOLOGY**

The following chapter will discuss the technique for conducting the research that will be implemented in order to achieve the study's goals. It will begin by explaining the research approach and method utilized, followed by a description of the selected sample. Finally, the procedures of data collection and analysis.

### **5.1. Research design**

The current research will be done in a quantitative format. This method is most suitable for this research since it allows for replication of Davis et al. (1989)'s TAM and the inclusion of variables from other studies and theories. Furthermore, a quantitative framework enables for additional investigation into the research item just as it allows for future replication of the study.

### **5.2. Target sample characteristics**

The aim of this research is to determine the impact of mobile Augmented Reality on tourists' decision-making and behavior when it comes to AR applications while on vacation. Accordingly, only respondents who have traveled within the past five years and who have had at least one prior encounter with mobile Augmented Reality applications are chosen. The questionnaire will be distributed across Europe and will be gender neutral, with a preference for sample balance and weight. Additionally, only individuals of age of majority are considered.

### **5.3. Data collection and procedures**

After identifying eligible respondents, data will be collected directly from them through online questionnaires. Although online surveys frequently lack random sampling due to the prevalence of convenience sampling, this method does have some advantages, including the ability to select appropriate respondents regardless of their geographic location, which facilitates faster response and lowers the survey's cost. The questionnaire will be created and sent using Sphinx Declic software. The survey's content will be provided in both English and

Italian to enable response from European respondents and to guarantee that the questions are not misconstrued. The questionnaire will begin with an explanation of Augmented Reality and its uses. Following that, respondents will be asked to download the Google Maps application on their smartphones, if they do not already have it. After typing a location's address, responders must click on the live option on the right side of the page and then follow the on-screen instructions. Essentially, responders must demonstrate adjacent facilities in order for the system to learn about them. After recognizing these buildings, the app will give instructions through augmented reality arrows.

The survey will be divided into four sections:

**First section:** Introduction to the concept of augmented reality and how to utilize Google Maps live.

**Second section:** Prior knowledge and experiences with augmented reality.

**Third section:** Inquired about their experience with Google Maps and whether they intended to use it again in the future. In this section they will be used the following constructs that are attributed to the research model:

- a. Authentic experience
- b. Perceived enjoyment
- c. Perceived interactivity
- d. Perceived usefulness
- e. Perceived Ease of Use

**Fourth section:** Demographic questions.

The items of the questionnaire will be adapted from past studies and will be measure on a five-point Likert-scale, with 1 being “*strongly disagree*” and 5 being “*strongly agree*”. The scale will be as follow:

- 1. Strongly disagree
- 2. Disagree
- 3. Neither agree nor disagree
- 4. Agree
- 5. Strongly agree.

The items are listed below:

**Table 2: Items and questions**

Constructs	#	Items	Source
Authentic Experience (AE)	AE1 AE2 AE3	<ul style="list-style-type: none"> <li>Using Google map AR app provided me authentic experience</li> <li>Using Google map AR app provided me genuine experience</li> <li>Using Google map AR app provided me exceptional experience</li> </ul>	(Kim, Lee and Jung, 2020)
Perceived Enjoyment (PE)	PE1 PE2 PE3	<ul style="list-style-type: none"> <li>Using Google maps app is one of my favorite activities when travelling</li> <li>Using Google maps app is enjoyable for me while travelling</li> <li>Using Google maps app would make me feel good while travelling</li> </ul>	(Hai, Wurong and Quang, 2020)
Perceived Interactivity (PI)	PI1 PI2 PI3 PI4	<ul style="list-style-type: none"> <li>The information shown when I interacted with the Google maps app was relevant</li> <li>The information shown when I interacted with Google maps app met my expectations</li> <li>The information displayed when I interacted with Google maps AR app was appropriate</li> <li>The information displayed when I interacted with Google maps AR app was useful</li> </ul>	(Hai, Wurong and Quang, 2020)
Perceived Usefulness (PU)	PU1 PU2 PU3	<ul style="list-style-type: none"> <li>Using Google maps while travelling allows me to easily find my destination</li> <li>Using Google AR apps while travelling enables me to access more information about the destination of my trip</li> <li>The indication of the destination while travelling is clear and understandable</li> </ul>	(Zhuang, Hou, Feng and Li, 2021)
Perceived Ease of Use (PEOU)	PEOU1 PEOU2 PEOU3 PEOU4	<ul style="list-style-type: none"> <li>Learning how to use Google maps would be easy for me.</li> <li>My experience with Google maps AR apps while traveling is clear and understandable</li> <li>It would be easy for me to become comfortable using Google maps AR apps</li> <li>I find the Google maps AR apps easy to use</li> </ul>	(Zhuang, Hou, Feng and Li, 2021)
Behavioral Intention to Use (BITU)	BITU1 BITU2 BITU3	<ul style="list-style-type: none"> <li>I think I will use Google maps or other AR apps in the future</li> <li>I will always try to use Google maps in daily life</li> <li>I recommend to others to use Google maps AR</li> </ul>	(Hsu, Tsou and Chen, 2021)



## **5.4. Data analysis procedures**

Before it will be widely circulated, the questionnaire will be tested to discover any flaws and to establish its length and readability. It will be enhanced in light of the findings. Following this step, the survey will be promoted through social media channels (Instagram, WhatsApp, Facebook, LinkedIn, and Twitter). Snowball sampling will be used, which entails spreading an internet link to the survey and dispersing it after it is finished. The survey is entirely confidential and should take no more than a few minutes to complete. To pique participants' interest, the study goal will be briefly explained, interaction with an augmented reality app will be shown, and the prototype will be displayed. Employing partial least squares (PLS) estimation, the structuring equation model will be utilized to evaluate measurement and structural models. This strategy was selected because it combines principle component analysis (CFA) and regression to estimate both measurement and structural models concurrently (Hair et al., 1998). Smart-PLS 2.0 will be utilized, since it is a great tool for analyzing formative measures and moderating associations (Barnes, 2011).

## **6. EXPECTED CONTRIBUTIONS**

### **6.1. Scholarly Contributions**

The purpose of this article is to contribute to the existing of literature by analyzing the connections between authentic experience, perceived enjoyment, perceived interactivity, usefulness, and ease of use, and future intention to use an augmented reality app in a travel environment. Furthermore, this study will contribute also to the theoretical research on the TAM model by presenting a framework for tourists' use of augmented reality technology that incorporates additional internal and external aspects. The purpose of this study is to make three contributions to the tourism promotion literature. To begin, this study's primary theoretical contribution is an expansion of the scope of TAM theory in tourist research. For example, according to TAM theory, two internal variables (ease of use and usefulness) and three exterior ones (enjoyment, interactivity, and authentic experience) all contribute to visitors' intention to utilize augmented reality technology apps in tourism.

## **6.2. Implications for Business and Society**

This study could contribute in the creation of strategy in practice when organizations attempt to enhance visitors' on-site experience with augmented reality technology. While most events and locations aim to enhance visitors' experiences rather than replace them with VR (Cheong, 1995), this analysis provides an overview for organizations interested in employing AR to enhance visitors' experiences. The findings of this research will provide useful assistance for marketing managers and developers of augmented reality applications in the tourist sector. This discovery will benefit the creation of augmented reality navigation systems in particular. Usefulness and customer experience are critical for customers to embrace augmented reality apps, which must clearly benefit passengers in order to be approved. Moreover, the app's features should be enjoyable and amusing for users. To be successful in the future in terms of passengers' desire to use the app, the emphasis must be on the user's emotional experience. Indeed, this knowledge must be beneficial to mobile technology designers and content creators for mobile consumers. With the advancement of mobile technology, cellphones may serve as a catalyst for tourists to simply utilize an augmented reality app. In this way, AR material that elicits emotional responses has the potential to not only inspire adoption behaviors but also to amplify AR's effect on users' travel experiences giving more features and information about monuments and localizations. In practice, this study will assist tourism managers in identifying crucial implications for AR implementation methods and the need for more research on AR's tourist marketing potential and capacity to boost enterprises. This article explores the behavior of customers who use augmented reality applications while traveling and the ways in which augmented reality may be utilized to provide value.

## **7. CHAPTERS OVERVIEW**

The final thesis will be presented following the structure below:

Abstract

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## 8. WORK PLAN

**Table 3:** *Work plan*

Date	Activity	Status
01.09 – 03.10	Exposé research and writing	Complete
23.10	Exposé submission	Complete
25.10 – 31.10	Questionnaire design	To follow
01.11 – 08.11	Questionnaire test and improvements	To follow
08.10 – 22.11	Data collection	To follow
23.11 – 13.12	Data analysis	To follow
14.12 – 03.01	Thesis writing	To follow
04.01– 12.01	Thesis review	To follow
13.01	Thesis submission	To follow
14.01 – 18.01	Thesis presentation	To follow

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