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The Influence of Augmented Reality on Consumer Attitudes and Adoption Intent: Exploring Aesthetics, Playfulness, Utility and Trust

The Influence of Augmented Reality on Consumer Attitudes and Adoption Intent: Exploring Aesthetics, Playfulness, Utility and Trust

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Abstract

Global consumer-brand relationships are undergoing significant transformations due to technological advancements. Immersive technologies, particularly Augmented Reality (AR), are increasingly indispensable for enhancing the consumer shopping journey. Employing Partial Least Squares Structural Equation Modelling (PLS SEM), the study utilized a sample size of 178 for analysis. The findings reveal a notable willingness among consumers in Pakistan to embrace AR technology. Furthermore, the study predicts that key AR attributes such as aesthetics, playfulness, and utility have the potential to elevate the traditional shopping experience into a more engaging and immersive one. These AR characteristics exert a positive influence on consumer attitudes, which are pivotal indicators for increased sales, market share, consumer satisfaction, and loyalty. Consequently, the research underscores the allure and feasibility of novel shopping experiences with AR technology for Pakistani users.

Keywords: AR Aesthetics, AR playfulness, AR utility, AR Attitude, Perceived Data Security Trust in AR

Introduction

Business environments have changed especially after the pandemic situation (Lahath, Omar, Ali, Tseng, & Yazid, 2021). Innovative technologies have emerged as a vital aspect of business activities and consumer experiences. There is a potential for novel technologies such as Augmented Reality (AR) and Artificial Intelligence (AI) in online and offline retail settings (A. Butt, Ahmad, Muzaffar, Ali, & Shafique, 2021; Asad H. Butt, Ahmad, Goraya, Akram, & Shafique, 2021). One of the reasons is the pandemic and second consumers demand new experiences that can help them in making better informed decisions. Retailers in online and offline settings are integrating such technologies to attract consumers, increase sales and loyalty (A. Butt, Ahmad, Ali, Muzaffar, & Shafique, 2023). Scholarly work on immersive technologies shows that consumers are keener to shop in those stores that provide such experiences (Ahmad, Butt, & Muzaffar, 2022). Therefore, immersive technologies have functions and benefits that can make users develop positive attitudes and intentions of adoption. Consumer decision-making depends on many factors such as product quality, price, marketing campaign, aesthetics, and service experiences (Karimi, Papamichail, & Holland, 2015).

The current framework focuses on understanding AR aesthetics, playfulness, utility, attitude, adoption intention, and trust. It will help to understand the consumer behaviour of Pakistanis. Consumers in Pakistan are always reluctant to adopt technology quickly. They require time, energy, and more information to adapt to ever-changing technological advancement. This study will help to comprehend how consumers in Pakistan will behave towards

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the adoption intention of AR. Augmented reality has been investigated before by many scholars and provided great insights into its adoption, usage, and experience (Chen, Perry, Boardman, & McCormick, 2021; Poushneh, 2018). Pakistani market dynamics are a little different and require more investigation into the adoption of novel technologies such as AR. The paper will help to bridge the gap between consumer behaviour and technology usage. The research questions that will be addressed are RQ1: What impact of AR technology have on consumer attitudes? and RQ2: Are consumers in Pakistan ready to accept AR technology?

AR technology has been used in many industries such as tourism, education, and shopping (Harley, Poitras, Jarrell, Duffy, & Lajoie, 2016; Rauschnabel, 2018; Voitik & Maslov, 2019). The use and benefits of AR technology are under investigation and require more exploration. AR is being adopted by high-end and low-end brands in both online and offline environments to engage with consumers. The AR experience from the Pakistani perspective needs more investigation such as aesthetics, playfulness, and utility. The visual elements or appearances can attract consumers online and offline (Petit, Javornik, & Velasco, 2022). It can change the mood, create a positive attitude, and give satisfaction. Aesthetics can indulge an individual in the real environment. It will be interesting to see how AR aesthetics can play a critical role in creating a positive impact on consumers' attitudes. Another aspect to look into when investigating AR technology is playfulness.

The concept of playfulness is related to interests, intrinsic motivations, and pleasure that one can have during interactions (Rodríguez-Ardura & Meseguer-Artola, 2018). The interactions can be during learning, shopping, tourism, etc. Therefore, there is a possibility that AR technology may develop playfulness among users while using it. Consumers will be motivated to take part in such experiences that have AR technology integrated within them.

Utility means the overall benefits a product, service, or technology can provide after consumption (Shin, Lee, & Hwang, 2017). Consumers maximize the utility of the products or services available to them. The question here is to understand whether technology can enhance the utility of the product or service. Previous studies have shown that technology plays a vital role in maximising the benefits of a product or service such as e-commerce, banking, and tourism (Jiang, Ahmad, Butt, Shafique, & Muhammad, 2021; Tao, Nawaz, Nawaz, Butt, & Ahmad, 2018; Wang, Butt, Zhang, Ahmad, & Shafique, 2021). The study will also see the perceived trust this technology creates for the consumers. Consumers in Pakistan are reluctant towards new technology usage and one of them factors is trust.

Perhaps, the current framework will provide insights into the AR utility. The study will look into the gaps such as Pakistani consumer's reluctance to use immersive technologies and consumer behaviour adoption intention. AR technology can provide an immersive experience, enjoyment, great benefits, and good aesthetics. Studies have shown that immersive technologies can enhance consumer engagement and satisfaction. These new capabilities in shopping, education, tourism, banking, and medicine can play a key role. These AR characteristics can impact the consumer attitude. Previous studies have shown that aesthetics, utility, and playfulness impact consumers' attitudes (Ross & Harrison, 2016). This shows that this study can help provide useful insights into the AR experience. The adaption of these variables into AR characteristics can be useful and interesting to see how attitude and AR adoption intention will work (Zanger, Meißner, & Rauschnabel, 2022). Another aspect to see when technology Is used, trust is something that consumers look into. Like the use of QR code payments require trust. Therefore, the use of trust will be critical in this study to understand the perceptions of consumers toward AR technology. The rest of the paper follows the literature review, methodology, data analysis and discussion. The study is analysed through PLS 4.

Literature Review
AR Aesthetics

Participation or interactions that indulge a user in a product or a service are known as aesthetics (Hoyer & Stokburger-Sauer, 2012). The aesthetics a consumer can experience are product features, visual elements, and good service experience. They can create a positive impact on the consumer's mind and develop a positive attitude (Crolic, Zheng, Hoegg, & Alba, 2019). From the perspective of technology, a good interface, quick response to

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information, interactions, and engagement can be part of aesthetics (Gilal, Zhang, & Gilal, 2018). AR technology is also playing a critical role in providing an aesthetic sense in tourism and shopping experiences (Chung, Lee, Kim, & Koo, 2018; Odushegun, 2023). AR technology can enhance the existing environment, which means that it can indulge an individual in a more immersive experience. Technology will have physical constraints but as it advances, so will the user engagement. AR applications in online and offline formats can provide such experiences. It can aesthetically enhance consumer engagement in education, tourism, banking, or shopping. Pakistani consumers focus on the aesthetic values of a product or service. Therefore, AR aesthetics adaption in the current study can provide great insights as to who consumers will develop positive attitudes and intentions to adopt. Therefore, we propose that AR aesthetics will play a positive impact on attitude and intention adoption.

H1a: AR Aesthetics has a positive relationship with AR attitude
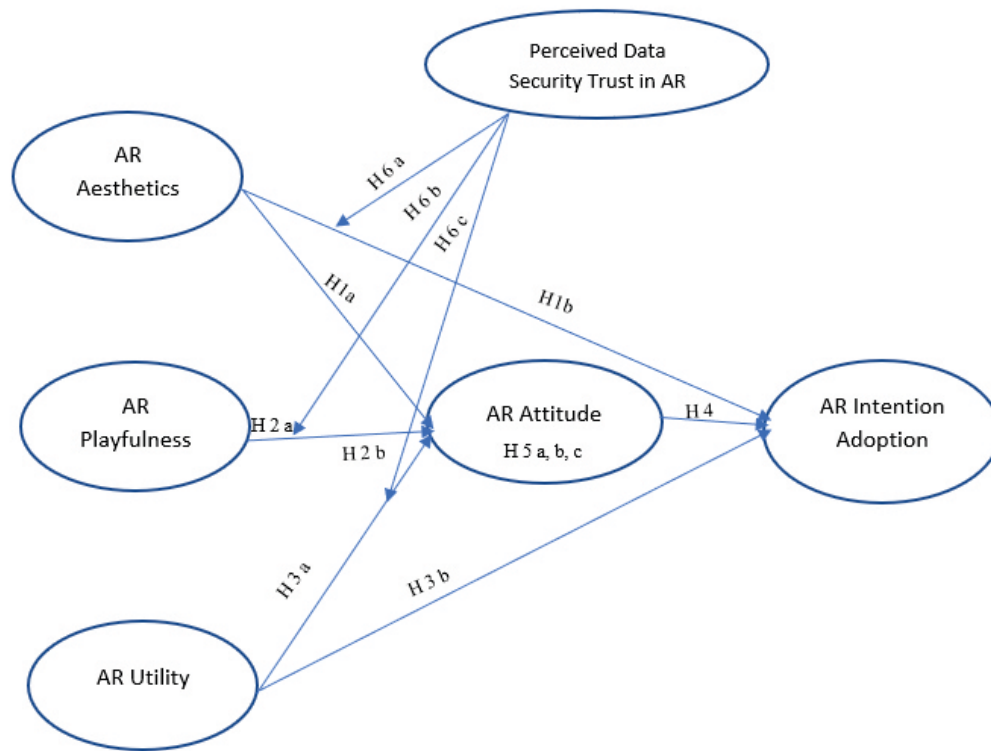H1b: AR Aesthetics has a positive relationship with AR Intention adoption.

AR playfulness

Consumer experience sometimes does not follow the logical flow of responses but emotional aspects such as entertainment or enjoyment take over. Enjoyment, flow, and playfulness have been previously studied by different scholars but there is a difference between them. Aside from the performance of a product or service, the use of a specific system or technology is perceived to be enjoyable in its own right. The situational experiences combined are known to be flow theory rather than individual behaviours. Finally, playfulness is known to be a more intrinsic motivation behaviour that involves interests, psychological stimulations, and individual pleasure. An individual's experience can shape playfulness. Technology plays a major role and previous studies have recorded insights where playfulness impacts consumer attitudes positively. Consumers when experiencing the playfulness of a product service or technology, they are having more intrinsic pleasure than extrinsic rewards. Figure 1 gives details about the conceptual framework of this study. AR technology can transform normal experiences into more immersive and playful experiences. The current framework will give key insights as to how consumers in Pakistan are attracted to AR and how it influences a positive attitude and intention to adopt such technology. Therefore, we propose that AR playfulness will have a positive impact on attitude and intention adoption.

H2a: AR playfulness has a positive relationship with AR attitude
H2b: AR playfulness has a positive relationship with AR Intention adoption

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Figure 1. Conceptual Framework

AR Utility

Utility means taking all the benefits a product or service can give in a particular situation (Wangenheim & Bayon, 2004). Consumers want to maximise the use of a product or service to have better outcomes and experiences (Say, Guo, & Chen, 2021). Technology has shown in previous studies that it can provide benefits, usefulness, and ease of use to consumers (Ahmad, Butt, Khan, Shafique, & Nawaz, 2020; Wang et al., 2020; Wang, Butt, Zhang, Shafique, & Ahmad, 2021). This means that utility is an important factor to comprehend consumer behaviour when engaging in a technology (Butt, Ahmad, & Shafique, 2021; Wang, Haque, et al., 2021). Immersive technologies can also play a key role in defining how consumers behave toward the utility of a product or service. AR technology can transform a product into a whole new experience because of its immersive, playfulness, and aesthetics. AR utility can provide a complete picture of a product even before buying it. It can provide information, through which consumers can make a better decision. Therefore, using AR utility in this study can help the researchers to understand Pakistani consumers. We propose that AR utility will have a positive impact on attitude and intention adoption.

H3a: The AR utility has a positive relationship with AR attitude.
H3b: The AR utility has a positive relationship with AR intention adoption

AR Attitude

The development of evaluated judgments through situation factors and experience is called attitude (Wiederhold & Martinez, 2018). Attitude to the use of technology and other factors do impact consumer behaviour (Cohen, Prayag, & Moital, 2014). Previous studies have shown that technology plays a critical role in developing positive attitudes and intention adoption (Ali, Zhang, Tauni, Butt, & Ahsan, 2023; Paul & Bhakar, 2018). With product usage and engagement, consumers tend to develop positive attitudes. Attitude has been measured in many industries and brands take importance to understand consumer beliefs and motivations. Attitudes can develop from product visuals, price, functionality, usage, utility, and other aesthetics (Gupta, Sachan, & Kumar, 2020; Yeo,

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Goh, & Rezaei, 2017). Therefore, the use of AR technology can develop a positive attitude among consumers and it can lead to the adoption intention. The AR characteristics can surely impact the consumer experience which may lead to a positive attitude towards the brand. As consumers develop expertise in a particular product or service usage, their emotional state of mind can also develop firm beliefs towards it. This may lead to brand satisfaction and loyalty. The use of a particular technology can alter the emotional and cognitive state of mind of an individual. Positive emotion can result in a purchase decision, intention adoption, usage, and loyalty. We can assume that attitude will play a vital role in mediating between AR characteristics and AR intention adoption. Pakistani consumers may develop positive behaviour with the use of immersive technologies. We propose that AR attitude will have an impact on intention adoption and will positively mediate the relationship.

H4: AR attitude has a positive relationship with AR intention adoption
H5a: The AR attitude mediates the relationship between AR Aesthetics and AR intention adoption.
H5b: The AR attitude mediates the relationship between AR playfulness and AR intention adoption.
H5c: The AR attitude mediates the relationship between AR utility and AR intention adoption.

Moderation - Perceived Data Security Trust in AR

The belief and dependency one develops toward others or entities in a particular situation is known as trust (Ariffin & Lim, 2022). The level of trustworthiness expectations of an individual or a company is known as perceived trust (Pappas, 2016). The current framework will focus on the perceived trust and the data involved. Trust issues are always existing when using technology. There have been many cases where data concern situations have risen due to the use of technology. Many other scholarly works have shown that technology can gain perceived trust as well. With trust, an individual can be risk-free from many things. Users can gain trust through operational activities, product aesthetics, and functionality (Bianchi & Andrews, 2012). Individuals develop trust in others through time and experience. Technology can also develop this belief that it will provide unexpected harmfulness with its usage.

The researchers believe that AR technology can also take care of the user's data and create a trust situation (Palmarini et al., 2018). There are many studies, where trust has been used as a moderator and mediator. The current study will look into the moderating effect of AR trust on aesthetics, utility, playfulness, and attitude. It may provide useful insights into consumer behaviour engagement in using immersive technology. The use of trust variables also helps to build a better relationship and greater transparency with the use of a particular technology. We propose that perceived data security will moderate between different relationships.

H6a: Perceived data security trust in AR moderates the relationship between AR aesthetics and AR attitude.
H6b: Perceived data security trust in AR moderates the relationship between AR playfulness and AR attitude.
H6c: Perceived data security trust in AR moderates the relationship between AR utility and AR attitude.

Methodology

This section encircles each variable, its significance and its relevance to the research aims, presenting a comprehensive overview of the variables' results. AR Aesthetics, AR Playfulness, and AR Utility are the independent variables and have been speculated to be highly considerable predictors of AR Attitude and AR intention adoption in the marketing activities of various brands. The data has been collected from various Pakistani consumers who understand AR-based marketing activities happen internationally in malls and other outdoor activities. Convivence sampling has been used and various personals were involved in this collection of data based on personal referrals to approach relevant and critical respondents. The constructs include AR Aesthetics, which refers to the visual appeal and attractiveness of augmented reality (AR) experiences (Chekembayeva, Garaus, & Schmidt, 2023; Jessen et al., 2020; Perannagari & Chakrabarti, 2020). It encompasses elements such as graphics, colours, and overall design aesthetics. This variable plays a crucial role in understanding how the aesthetic appeal of AR influences user perceptions and attitudes. AR Playfulness pertains to the interactive and enjoyable aspects of AR technology (Johnsen, 2022; Piguet, 2019).

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It encompasses features that promote engagement, entertainment, and interactivity, creating a playful user experience. whereas AR Utility focuses on the practical value and usefulness of AR applications. It encompasses the functional benefits and efficiency that AR technology offers, such as information retrieval, task completion, or problem-solving capabilities. The mediator AR Attitude (Alam, Masukujjaman, Susmit, Susmit, & Aziz, 2022; Bansal, Garg, & Singh, 2023; Saprikis, Avlogiaris, & Katarachia, 2020) refers to the individual's cognition and emotions to peruse and use AR technology. This study has attempted to measure the mediating effect of AR Attitude between the aforementioned constructs and AR intentions adoption by consumers (Chekembayeva et al., 2023; Lee, Chiang, & Hsiao, 2018). It acts as a mediator between the independent variables (AR Aesthetics, AR Playfulness, AR Utility) and the dependent variable (AR Intention Adoption). The study also analyses the moderating effect of Perceived Data Security Trust in AR, it represents users' confidence in the security and privacy of their data within AR applications. It acts as a moderator, we speculate that this moderates the relationship between AR Aesthetics, AR Playfulness, AR Utility, and AR Attitude. By considering these variables in our study, we aim to gain a comprehensive understanding of the factors that shape AR-based attitudes and ultimately the intentions.

In our research study, a total of 220 participants were initially collected for data collection using a self-administered survey questionnaire from various parts of Pakistan. We opted for a convenience sampling approach, which involved approaching consumers who had a previous understanding of augmented reality (AR) technology. This involved consumers who have had experience of using AR in different apps as filters for photos and videos. The main apps included Snapchat and Instagram. The respondents had experience of using these apps. Evaluating the responses will help to comprehend the consumer attitudes and adoption towards AR technology in shopping, education, banking etc. This sampling method allowed us to conveniently gather data from readily available individuals who had first-hand experience or understanding of AR and have been traveling in various parts of the world (Sedgwick, 2013). We made sure that only those consumers who understand AR in some way related to any product are approached. We managed to successfully reach almost 220 people. However, during the data processing stage, we had to discard incomplete and skewed data, resulting in a final sample size of 178 participants.

Research Design and Measures

The research is based on the positivist approach, this approach helps collect unbiased data using empirical techniques and then use that to generate fresh facts and identify patterns. Using deductive hypothesis analysis following are the detailed aspects of the methodology used. SEM PLS was used in this article as it gives more robust results (Caballero, 2016). We use SEM-based PLS when the research objective is prediction rather than confirmation of structural relationships. In comparison with CB-SEM results, which can be imprecise, when the assumptions are violated, PLS-SEM helps achieve better results (e.g., Lohmdller 1989; Reinartz, Haenlein, and Henseler 2009; Ringle et al. 2009; Wold 1982).

AR Aesthetics was measured using the 4-item scale Augmented Reality Aesthetics Scale (ARA) of the Environment module. Sample Items are (ARA1) "You like the overall appearance of the Augmented Reality." and (ARA2) "You like the amount of lighting in the Augmented Reality." Augmented Reality Intention Adoption (ARIA) by Bock et al. (2005), its 5-item scale, was used to measure The AR Intention Adoption, the Sample Items are (ARIA1): "I predict that I would adopt Augmented Reality." (ARIA2): "I intend to adopt Augmented Reality." AR Playfulness scale of 7 items by D. Potosky (2002), was used. The Sample Items are "This is innovative and interesting for me." And "This is unimaginable for me." (Potosky, 2002). AR Utility 4 items scale by Kahn and Wansink (2004) was used to measure AR utility for the consumer. The Sample Items are "The product or release met customer expectations of functionality and usability." And "The product/features fit well with the customers' overall environment." (Kahn & Wansink, 2004) The AR Attitude was measured using 4 item scale (Tsai, Lin, & Tsai, 2001) The Sample Items are "Consumer's perceptions about the positive impacts of the AR on individuals and society " and " Assessing Consumers perceptions feeling and anxiety when using the AR" These scales provided were operationalized as per the context of augmented reality for consumers. In factor analysis, the loading values of the items of all variables were analyzed considering 0.7 value as a benchmark. To create analysis rigor, All the values below this threshold were also deleted.

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Demographics

The demographic details of the 178 participants consisted of individuals from diverse backgrounds, representing a range of demographic characteristics. In terms of gender, the participants included 130 males (73%) and 48 females (27%). The ages of the participants varied, with the majority falling within the range of 25 to 40 years (mean age = 32.4 years, SD = 4.8). Regarding educational qualifications, 45 participants (25%) held a high school diploma, 72 participants (40%) had a bachelor's degree, 45 participants (25%) held a master's degree, and 16 participants (9%) had a doctoral degree. In terms of employment status, 65 participants (37%) were employed in the private sector, 52 participants (29%) were self-employed, 38 participants (21%) were employed in the public sector, and 23 participants (13%) were students. Additionally, the participants represented various industries, including education, healthcare, hospitality, etc.

Analysis:
Common Method Bias:

The common method bias problem is faced when the data has biases due to instrument issues or data collection issues. To check this issue VIF value is checked which is supposed to be lesser than 3.3 (Kock, 2015). The results of the VIF value in this study showed no issues and the value was in the acceptable range.

Reliability and Validity

Using smartpls4, the reliability and validity of the data were measured using Cronbach alpha and composite reliability (Black & Babin, 2019; Nunnally, 1994). The loading values of each factor were also identified. The threshold of the Cronbach alpha and composite reliability is 0.7, the acceptable values must be equal and above the threshold. The construct convergent validity AVE was measured as well (Black & Babin, 2019). Table 1 presents the reliability and validity measures for each variable in the study. Reliability was assessed using Cronbach's alpha, while validity was examined through the Average Variance Extracted (AVE) values (Amirrudin, Nasution, & Supahar, 2021). AR Attitude displayed high-level reliability with a Cronbach's alpha coefficient of 0.895. Its AVE is 0.761, indicating good convergent validity. Whereas AR Aesthetics, AR Intention Adoption, AR Playfulness, and AR Utility exhibited good reliability values, as evidenced by Cronbach's alpha values of 0.866,0.843,0.878, and 0.879. The AVE for these variables is 0.713, 0.761, 0.731, and 0.735respectively and are acceptable. The Cronbach alpha of Perceived Data Security Trust in AR is 0.888. with AVE 0.747, suggesting good reliability and convergent validity values

The loading values of the item of the latent constructs are also provided in Table 1. And complete the measurement model with the latent constructs' values in Figure 2.

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Table 1 – Study Loading Values

Item Codes	Constructs and Related Items	Pakistan
		Factor Loading
	AR Aesthetics	
ARA1	Do you like the overall appearance of the Augmented Reality	0.844
ARA2	Do you like the amount of lighting in the Augmented Reality	0.873
ARA3	Do you like the decoration of the interior of the Augmented Reality	0.839
ARA4	Do you like the infrastructure in the Augmented Reality	0.821
	AR Attitude	
ARA1	Consumers' perceptions about the positive impacts of AR on individuals and society.	0.869
ARA2	Assessing Consumer's perceptions feelings and anxiety when using the AR.	0.875
ARA3	Consumer's perceptions of confidence about the independent control of the usage of the AR.	0.879
ARA4	Consumer's perceptions of actual practice and frequency of using the AR.	0.865
	AR Playfulness	
ARP1	This is innovative and interesting for me	0.84
ARP2	This is unimaginable to me	0.881
ARP3	I can play with this in many ways	0.87
ARP4	This is a creative thing for me	0.828
	AR Utility	
ARU1	The product or release met customer expectations of functionality and usability.	0.879
ARU2	The product/features fit well with the customers' overall environment	0.847
ARU3	The product or release met the customers' time window.	0.886
ARU4	Our customers benefited greatly from our product	0.816
	Perceived Data Security Trust in AR	
PDSTAR1	I feel that Augmented Reality technology is honest	0.827
PDSTAR2	I feel that Augmented Reality technology is responsible	0.892
PDSTAR3	I feel that Augmented Reality technology understands its customers.	0.888
PDSTAR4	I feel that Augmented Reality technology works very professionally.	0.85
	AR Intention Adoption	
ARIA1	I predict that I will adopt Augmented Reality	0.869
ARIA2	I intend to adopt Augmented Reality	0.875
ARIA3	I will continue using Augmented Reality	0.879

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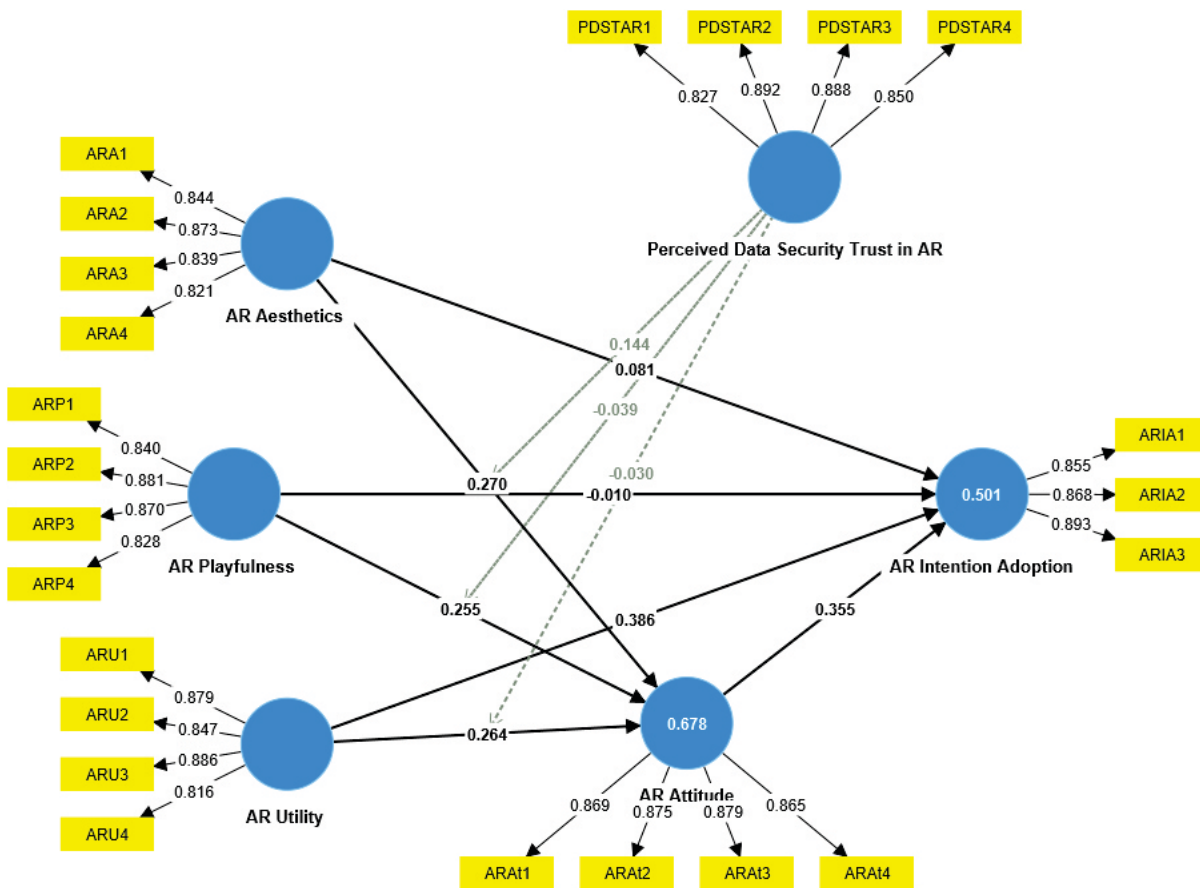Exploring Aesthetics, Playfulness, Utility and Trust

Figure 2. Measurement Model

The goodness of fit index and Coefficient of determination:

Tenenhaus et al. (2005) narrated that the Goodness of fit index (GOF) is a comprehensive parameter and addresses issues with models' fitness by concurrently reflecting the measurement and structural models. The values of SRMR model fitness are 0.069. The coefficients of determination of all the variables were checked which must be between 0 and 1 (Rigdon, 2012), all are in an acceptable range. (Hair et al.,2011; Henseler et al.,2009).

The R^2 values of the AR Attitude and AR intentions Adoption were also calculated, they were 0.678 and 0.501 respectively.

Discriminant Validity:

The discriminant validity helped measure the variance in the constructs while being in the same structural module. The threshold of discriminant validity is 0.85. The values must be equal to or lower than 0.85. Figure 2 shows complete structural equation modelling of the model. The resultant values were within an acceptable range. (Hair et al., 2019). Table 1 shows the factor loading values of the items. Furthermore, Tables 2.1 and 2.2 show the discriminant validity based on HTMT and Fornell - Larcker Criterion.

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Table-2.1 Discriminant Validity – Heterotrait - Monotrait (HTMT)

	1.000	2.000	3.000	4.000	5.000	6.000	7.000	8.000	9.000
AR Attitude									
AR Aesthetics	0.662								
AR Intention Adoption	0.73	0.511							
AR Playfulness	0.75	0.509	0.572						
AR Utility	0.689	0.447	0.733	0.703					
Perceived Data Security Trust in AR	0.726	0.431	0.46	0.723	0.67				
Perceived Data Security Trust in AR x AR Playfulness	0.165	0.135	0.322	0.244	0.508	0.363			
Perceived Data Security Trust in AR x AR Utility	0.31	0.155	0.337	0.458	0.662	0.448	0.757		
Perceived Data Security Trust in AR x AR Aesthetics	0.081	0.054	0.228	0.163	0.218	0.166	0.478	0.372	

Table-2.2 Discriminant Validity – Fornell - Larcker Criterion

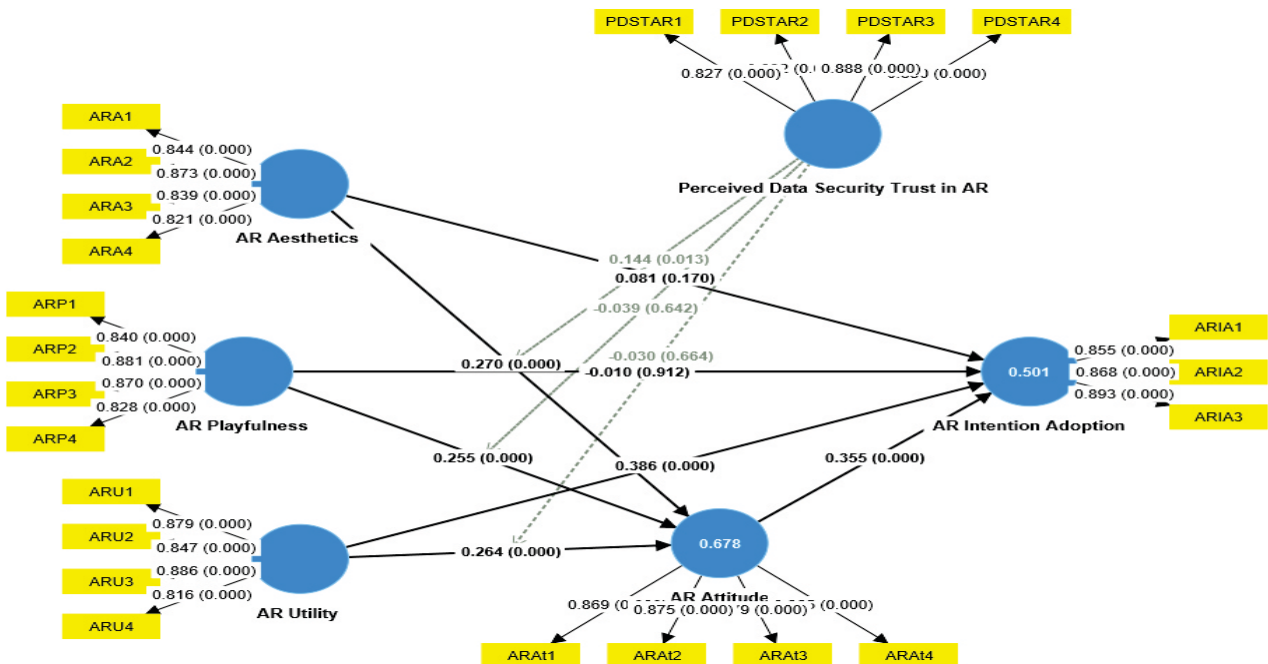|	AR Attitude	AR Aesthetics	AR Intention Adoption	AR Playfulness	AR Utility	Perceived Data Security Trust in AR
AR Attitude	0.872					
AR Aesthetics	0.593	0.844				
AR Intention Adoption	0.636	0.441	0.872			
AR Playfulness	0.673	0.457	0.502	0.855		
AR Utility	0.62	0.399	0.632	0.612	0.857	
Perceived Data Security Trust in AR	0.662	0.394	0.408	0.636	0.597	0.864

Hypothesis testing and results:

The research has been conducted in Pakistan where interest in augmented reality marketing has been witnessed. Based on that data, the following hypothesis of the relationships has been tested. The details of hypothesis testing along with their values are mentioned in Table 3 and Table 4. Smart PLS4 has been used to analysis the hypothesis of the study. Based on the data analyzed, the results of the hypothesis testing, along with their respective beta coefficients and p-values, are presented in Table 3. Initially, the data set of 220 responses underwent data cleaning to ensure accuracy for structural equation modelling. After the cleaning process, 178 responses with the most complete were considered for analysis. The model was further validated through bootstrapping, as depicted in Figure 3.

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Table-3 Hypothesis Testing Results

		β	P value
H1a	**AR Aesthetics -> AR Attitude**	0.27	0.00
H2a	**AR Playfulness -> AR Attitude**	0.255	0.00
H3a	**AR Utility -> AR Attitude**	0.262	0.00
H4	**AR Attitude -> AR Intention Adoption**	0.355	0.00
H1b	**AR Aesthetics -> AR Intention Adoption**	0.081	0.174
H2b	**AR Playfulness -> AR Intention Adoption**	-0.01	0.911
H3b	**AR Utility -> AR Intention Adoption**	0.386	0.00
H5a	**AR Aesthetics -> AR Attitude -> AR Intention Adoption**	0.096	0.002
H5b	**AR Playfulness -> AR Attitude -> AR Intention Adoption**	0.091	0.011
H5c	**AR Utility -> AR Attitude -> AR Intention Adoption**	0.093	0.01
H6a	**Perceived Data Security Trust in AR x AR Aesthetics -> AR Attitude**	0.138	0.014
H6b	**Perceived Data Security Trust in AR x AR Playfulness -> AR Attitude**	-0.036	0.656
H6c	**Perceived Data Security Trust in AR x AR Utility -> AR Attitude**	-0.027	0.678

Table 3 provides the details of the tested hypotheses and their corresponding values. The first set of hypotheses (H1a, H2a, and H3a) proposed positive relationships between AR Aesthetics, AR Playfulness, AR Utility, and AR Attitude. The results revealed significant beta coefficients (ranging from 0.255 to 0.27) with p-values of 0.00, supporting these hypotheses. This establishes a strong fact that these factors are highly related to AR Attitudes. This means that the consumers who enjoy playing, with the aesthetics of AR and feel there is utility in the AR-based product or service, the probability of them being their customers is high as they will be having a strong positive attitude towards AR. Next, the relationship between AR Attitude and AR Intention Adoption (H4) was examined, resulting in a beta coefficient of 0.355 and a p-value of 0.00, indicating a significant positive association. Hypotheses H1b, H2b, and H3b explored the direct relationship between AR Aesthetics, AR Playfulness, AR Utility, and AR Intention Adoption. The results showed that AR Aesthetics and AR Utility had significant positive effects (beta coefficients of 0.081 and 0.386, respectively on AR Intention Adoption, while the relationship between AR Playfulness and AR Intention Adoption was not statistically significant (beta coefficient of -0.01)(Flavián, Ibáñez-Sánchez, & Orús, 2019; Pitkonen Piguet, 2019; Rauschnabel, He, & Ro, 2018). This also establishes that AR aesthetics, playfulness, and utility are the ultimate foundation of consumer AR intentions adoption about the particular brand. Whereas the consumer is not very sensitive about its playfulness.

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Table 4 -Hypothesis Summary

H1a	AR Aesthetics has a positive relationship with AR Attitude.	Accepted
H2a	AR playfulness has a positive relationship with AR Attitude.	Accepted
H3a	The AR utility has a positive relationship with AR Attitude.	Accepted
H4	AR's Attitude has a positive relationship with AR's Intention to Adoption	Accepted
H1b	AR Aesthetics has a positive relationship with AR Intention Adoption.	Rejected
H2b	AR playfulness has a positive relationship with AR Intention Adoption.	Rejected
H3b	The AR utility has a positive relationship with AR Intention Adoption.	Accepted
H5a	The AR Attitude mediates the relationship between AR Aesthetics and AR Intention Adoption.	Accepted
H5b	The AR Attitude mediates the relationship between AR playfulness and AR Intention Adoption.	Accepted
H5c	The AR Attitude mediates the relationship between AR utility and AR Intention Adoption.	Accepted
H6a	The relationship between AR aesthetics and AR Intention Adoption through AR Attitude is moderated by Perceived Data Security Trust in AR. The higher the levels of Perceived Data Security Trust in AR, the stronger the relationship between AR aesthetics and purchase intention will be.	Accepted
H6b	The relationship between AR playfulness and AR Intention Adoption through AR Attitude is moderated by Perceived Data Security Trust in AR. The higher levels of Perceived Data Security Trust in AR, the stronger the relationship between AR playfulness and purchase intention will be.	Rejected
H6c	The relationship between AR utility and AR Intention Adoption through AR Attitude is moderated by Perceived Data Security Trust in AR. The higher the levels of Perceived Data Security Trust in AR, the stronger the relationship between AR utility and purchase intention will be.	Rejected

Figure 3. Bootstrapping Study

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Hypotheses H5a, H5b, and H5c introduced the mediating role of AR Attitude between AR Aesthetics, AR Playfulness, AR Utility, and AR Intention Adoption. The results indicated positive and significant mediation effects (beta coefficients ranging from 0.091 to 0.096) with p-values below 0.05 (Jessen et al., 2020; Perannagari & Chakrabarti, 2020). Mediation proves the strong relationship between AR-based Aesthetics, AR playfulness, and AR utility with the AR intention adoptions and reflecting ultimate the growth of the consumer base. This strongly supports the planned behavior theory and opens a clear avenue for augmented reality-based brands to organize their technology for the future consumer. Furthermore, the interaction effects between Perceived Data Security Trust in AR and the independent variables (AR Aesthetics, AR Playfulness, AR Utility) on AR Attitude (H6a, H6b, and H6c) were analyzed. The results revealed that the interaction between Perceived Data Security Trust in AR and AR Aesthetics had a strong positive impact on AR Attitude (beta coefficient of 0.138, p-value of 0.014), mentioning that if the consumers have more data security trust in the brand (Kowalczuk, Siepmann, & Adler, 2021; Nikhashemi, Knight, Nusair, & Liat, 2021; Saprikis et al., 2020; Smink, van Reijmersdal, van Noort, & Neijens, 2020), Then the probability for the brand is high once the customers experience an aesthetic AR feature of the brand. While the interactions with AR Playfulness and AR Utility were not statistically significant.

In summary, the hypothesis testing results provided significant insights into the relationships between the variables in the augmented reality features. The findings supported several hypotheses, indicating the influence of AR aesthetics, playfulness, utility, attitude, and AR intentions adoption. However, some relationships were found to be non-significant, highlighting the complexity and nuances within the research domain in Pakistan.

Discussion

The study outcomes yield valuable insights into the behaviour of Pakistani consumers. The findings indicate a favourable inclination among consumers toward adopting Augmented Reality (AR) technology. Consistent with prior research highlighting the allure of novel and immersive technologies to consumers (Giovanis, Assimakopoulos, & Sarmaniotis, 2019; Rana, Dwivedi, Williams, & Weerakkody, 2016), most hypotheses are affirmed. Notably, the direct impact of AR aesthetics and AR playfulness on AR intention adoption is not supported, potentially attributed to the novelty of the technology, requiring time for Pakistani consumers to acclimate to technological shifts in their environment. It is conceivable that as AR technology becomes more accessible in the future, the likelihood of AR aesthetics and AR playfulness influencing intention adoption may increase. Nevertheless, these AR characteristics significantly influence consumer attitudes. The moderation effects demonstrate promise, and an expansion of the sample size in subsequent research endeavours could enhance our understanding of the perceived trust in AR.

Theoretical Implications

Initially, AR stands out as an innovative technology, and researchers worldwide have proposed various frameworks. However, a solid theoretical foundation for AR is still lacking. Consequently, scholars examine diverse characteristics, functions, and benefits of AR to comprehensively understand its behaviour. The findings from this study are poised to enrich AR literature and contribute to the formulation of a robust AR theory. This aligns with prior research emphasizing the surge in popularity of immersive technologies among young consumers, leading to their integration into both online and offline retail environments (Kowalczuk et al., 2021; Tan, Chandukala, & Reddy, 2022). Secondly, aesthetics holds significant importance for individuals, particularly in activities they engage in or enjoy. In the context of shopping, aesthetics becomes even more crucial, with factors like quality, information, and price playing pivotal roles (Crolic et al., 2019). The intersection of technology and aesthetics reveals that consumers tend to develop positive attitudes and experience heightened satisfaction (Odushegun, 2023). Given that AR technology provides strong visual elements during its usage, the outcomes of this study contribute meaningfully to the existing AR aesthetics literature.

Thirdly, the inclusion of entertainment and enjoyment enhances the appeal of using a product or service. A consumer's intrinsic valuation of a specific product or service can draw them towards the playful aspect (Johnsen, 2022). The findings of this study align with previous research, demonstrating that AR playfulness fosters a positive attitude. This contributes to the existing literature on the characteristic of AR playfulness. Fourthly, the

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concept of AR utility, derived from the economic utility concept, is a novel addition. AR utility elicits a positive attitude towards the deliberate adoption of this technology, suggesting that AR can maximize the usage of a product or service even before its purchase. These results are consistent with earlier studies where the utility of technology positively influenced consumer attitudes (Rahman, Lesch, Horrey, & Strawderman, 2017). Lastly, consumer behaviour undergoes changes based on situational factors, with technology being a significant influencer in enhancing efficiency, particularly during the shopping experience. Therefore, the incorporation of AR technology in Pakistan can enhance user engagement, activities, and brand loyalty (Butt et al., 2023; Prentice & Nguyen, 2020). Hence, a positive attitude can lead to positive outcomes as stated in previous studies where technology has impacted attitude. The AR attitude shows a positive impact on consumer intention to adopt this immersive technology.

Practical Implications

The study findings hold significance for both academics and managers, providing valuable insights for shaping future strategies in online and offline retail environments. Initially, the results indicate a shifting consumer behaviour in Pakistan, with a readiness to embrace immersive technologies like AR. This underscores the desire of both young and adult demographics to engage in novel shopping experiences featuring such technologies (Pitkonen Piguet, 2019; Watson, Alexander, & Salavati, 2018). This shows that retail brand managers should focus on integrating these technologies within their business environments. Secondly, brands are encouraged to conduct conventions, seminars, and training sessions for both employees and consumers. Employee training is particularly crucial, as it enables them to effectively convey the benefits of AR to end-users. Brands employing these technologies should ensure that their staff is well-versed in the advantages and disadvantages of such devices. Organizing such events is essential for fostering seamless integration of consumers and employees with these technologies. Numerous well-known brands have successfully implemented this approach, providing insightful seminars to equip their employees (Altarteer, Charissis, Harrison, & Chan, 2017; Javornik et al., 2021).

Thirdly, the results show that consumers in Pakistan are willing to adopt these technologies. Therefore, retail brand managers should take advantage of these insights and have the first mover advantage either in an online or offline retail setting environment. Not only launch AR technology within the brand environment but also the technological advancements within this framework should be strong and visually strong. It can attract a lot of young consumers in Pakistan because 60% of the population is young (Wang, Butt, Zhang, Ahmad, et al., 2021). Lastly, large brand outlets that have a bigger spread across Pakistan should integrate these technologies into the physical environment. For example, Pakistani brand outfitters can integrate such technology. Their outlets are mostly big and have a huge variety of product displays. Consumers sometimes have to wait in line to try on the products. Such AR technology within the physical environment can help them to grow and give an overview to the consumers about the product even before buying it. It can save time, energy, and product returns.

Conclusion

In Pakistan, consumers readily embrace innovative technologies, particularly those that offer immersive and captivating experiences. Brands must reconsider their online and offline business strategies, emphasizing the integration of immersive technologies to appeal to both existing and potential customer bases. Internationally, forward-thinking brands are already incorporating essential immersive technologies to ensure their consumers perceive them as contemporary and in tune with the latest trends. Brands that aspire to stay on the cutting edge in Pakistan should reassess their strategies and concentrate on continually captivating and retaining their customer base.

Limitations and Future Directions

The study offers valuable insights into the adoption of AR, yet potential limitations warrant exploration in future research. Expanding the sample size would enhance comprehension of consumer behavior and the adoption of AR technology. Subsequent studies could incorporate a comparative approach, examining multiple nations for a more comprehensive understanding. Additionally, future research endeavors might incorporate various theories,

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including the innovation diffusion theory and the information systems success model. Exploring additional variables such as AR psychological engagement, AR service quality, and AR system quality would provide a deeper understanding of how consumers respond to novel technologies.

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