Comparison of User Intent for Mixed Reality and Augmented Reality in Hedonistic Shopping Experiences

Lingyao Jin[1][0009-0004-5343-6526]

[1] Lancaster Institute for the Contemporary Arts, Lancaster University, Lancaster, UK
L.jin11@lancaster.ac.uk

Abstract. A mismatch between user-technology usage and a lack of user acceptance hinders the adoption and diffusion of technology. In this research paper, we focus on the differences in how mixed reality (MR) and augmented reality (AR) impact user adoption. We also examine the importance of user intentions in relation to MR and AR for purchase behaviour. A survey (n=801) was conducted in the UK in May 2022 to investigate the relationship between AR and MR technologies and compare their compatibility for various intentions, including intent to use (9 factors), intent to experience (7 factors), and intent to purchase (7 factors). The results indicate that MR shows more promise than AR in the retail industry. MR significantly and positively affected five elements, such as shopping, while AR was primarily used for gaming. This study provides practical insights that can aid in technology adoption and evaluation. It also emphasises the importance and feasibility of incorporating product customisation functionality into MR retail purchase applications, which has inspired our subsequent development of the MR user interface.

Keywords: Augmented Reality, Mixed Reality, Shopping, User Intents, Consumer-machine Matching

1 Introduction

The rising research and adoption of augmented reality (AR) and mixed reality (MR) technologies have brought substantial benefits to the retail industry [1–5]. In the retail market, augmented reality is already being used in customer purchases to enable a better user experience, whilst a more comprehensive range of retailers is constantly observing or embarking on experimentation [6, 7]. The quality of matching users to emerging technologies can influence users' adoption of the technology or affect the efficiency of their implementation [8]. Consumer satisfaction with and adoption of technology are factors that drive the adoption of technology by retailers [9, 10]. Therefore, brands' decisions on technology selection need to consider the match between technology and consumer groups. Their needs and preferences for technology can also influence consumers' decision-making. Some retailers expressed concerns about the uncertainty of investing in technology [11]. Therefore, preliminary research on user groups, user environment preferences, and technology matching needs to establish to provide recommendations to stakeholders for matching and investing in technology.

This study proposed a comparison study of the intentions of augmented reality and mixed reality for shopping use. Both technologies' visual representations resemble as they rely on the real world for most of their existence, in contrast to virtual reality, which brings complete immersion and virtual environments [12]. Moreover, the vertigo-inducing effect of virtual reality technology on several users limits and diminishes the user experience [13]. Apart from this, multiple implementations of augmented reality shopping case studies validate its feasibility [14–16]. Research on mixed reality shopping relatively restrict [17] and is not yet broadly utilised in the marketplace as a selling medium. Accordingly, this paper seeks to compare the relationship between AR and MR for user adoption, providing usage directional guidance for situating and matching technologies for MR and AR developers, retailers, designers, and investors.

2 Related Work

As mentioned prior, AR in retail has been underpinned by a massive number of practical projects and research outputs, whereas MR has only been underpinned by restricted research and is barely available to the public for use in industry. In order to compare the research output of MR and AR in retail in academic research, we conducted a search in three large academic research databases in July 2023, by searching the keywords "mixed reality" and "retail", "augmented reality" and "retail" in all fields and years (see Table 1). Our findings indicate that there is less research on integrating MR with retail compared to AR. Apart from the financial incentives of technology investment and return, consumer technology acceptance and preference play an invaluable role in affecting the actual adoption of technology. Therefore, this paper focuses on comparing the two technologies primarily through consumer research. The mismatch between consumer expectations and the practical implementation of the technology should also be addressed. We will review various application cases that have been deployed and are being explored in brick-and-mortar retailing to identify their research gaps and limitations and contribute recommendations and inspirations for stakeholders.

Academic Research Database	***"Mixed Reality" and "Retail"***	***"Augmented Reality" and "Retail"***
Web of Science	36 Results	272 Results
Scopus	50 Results	284 Results
IEEE Xplore	14 Results	108 Results

Table 1. Key Words Search Results in Three Databases

AR has been familiarised and utilised by consumers in retail practices comparatively wider than MR. AR has been used in multiple retail segments, delivering it more conveniently and rapidly through access to smart devices (e.g., smartphones, computers). Home furnishing category AR appeared, such as Dulux launched an app called Dulux

Paint Expert: Decorator, which allows customers to see paint colours appear on their wall by tapping on the screen and generates portfolios to let shoppers compare different schemes. Apps from IKEA, Wayfair [18] and Target enable customers to see how furniture products can be placed in their homes from their smartphones (see Fig. 1).

Fig. 1. Wayfair AR Shopping App. Photography by Power, 2019

Skincare and beauty category AR Apps, for instance, Sephora's AR Makeup Match, which tries out make-up products through facial recognition technology. L'Oréal and Lancôme also offer AR lipstick products for facial colour trials. Fashion category apps like Nike and Gucci's AR Shoe fitting, where customers can see a digital product with a 360-degree coverage of their feet. Eyewear retailers Specsavers and Vision Express offer AR try-on frames. Tiffany & Co's jewellery try-on lets customers visualise how a ring will fit on their hands. AR try-on has increased online conversions and reduced returns for branded companies [19] and can also help retailers optimise the utilisation of warehouse space and navigation within warehouses [20]. During the pandemic in 2020, clothing sales fell by 21.5%, according to the UK Office for National Statistics (ONS), online sales rose to a historic peak of 33.9% of all retail expenditure [21]. Lockdown complicates retailers' routine operations, with clothing retailer ASOS developing See My Fit's app, digitally mapping each product onto the model, to help models keep social distance to avoid the necessity of entry to their studio to change clothes.

Compared to the established performance of AR, the application of MR in retail is a fairly young research phenomenon yet presents a rapidly growing interest. MR accomplishes the experience using optical see-through head-mounted displays. [3]Dou and Tanaka (2020) presented an MR Fashion Shop system that automatically layouts and decorates the interior through spatial recognition and responsive layouts and provides a virtual shop assistant for communication (see Fig. 2 left). [22]Fuchs et al. (2019) proposed a package recognition system for vending machines employing HoloLens. Retail packaged products tend to rely on barcode recognition, they evaluated the potential of multiple convolutional neural network (CNN) architectures in recognising product packages, providing an alternative to barcode recognition. Similarly, (see Fig. 2 right) regarding product identification and information provision, a system called MR Shopping Assistant for identifying information about groceries products and assisting in purchasing [23].

Fig. 2. MR Shop System. Dou and Tanaka, 2020 (Left); MR Shopping Assistant System. Jain et al., 2021 (Right).

However, these MR retail system studies mainly research and develop from the perspective of technological innovation, this study tries to innovate the user interface design and functionality from a designer's point of view. Leveraging this preliminary research draws a guideline for comparing user intentions against MR and AR.

3 Concepts and Research Questions

This study reports a preliminary partial quantitative dataset results intended to analyse and compare the match between MR and AR for consumers. It highlights the feasibility and necessity of product customisation functionality in MR retail purchase applications. It empirically demonstrated the applicability of MR technology to the user interface design of customised jewellery. In addition, it is propounded that the compatibility and development potential of MR in the retail sector is a superior match to its user preferences. As such, it is matching users and machines for ongoing mega projects, and validating the feasibility of future research orientations.

The theory for this study draws on theoretical research from several models [8, 24, 25]. The study addresses two main measurement domains. a) identifying consumer preferences for augmented reality and mixed reality technologies. b) describing user factors for both technologies in adoption and the complement environment. This research uses a mixed method to design a survey and raise three research questions.

RQ1. What are the associations between AR and MR on intent to use?

RQ2. What are the correlations between AR and MR on intent to experience, controlling for shopping?

RQ3. What are the correlations between AR and MR on intent to purchase, controlling for shopping?

4 Methodology

4.1 Research Framework and Methods

This study is an exaction of a pilot study on an ongoing large project. The entire project is based on empirical research, utilising mixed methods, including qualitative and

quantitative research. In the early stages of the research, quantitative questionnaires were used to target our potential user groups and match applicable technologies. User testing is now underway to analyse user behaviour patterns and optimise user interface design and user experience. Subsequently, we will use qualitative in-depth interviews and iterative design to optimise the design proposals and software implementation. Ultimately, the study anticipates quantitative evaluation and feedback from users wearing HoloLens 2 and experiencing the mixed reality purchasing user interface we have developed. The final output of the study is expected to be an MR product customised user purchase interface app.

4.2 Questionnaire Design

This questionnaire was divided into introduction, user persona and user preference related questions. In the first section, the purpose of the questionnaire was briefly summarised and then the definitions and example pictures of the three technologies of extended reality (XR) were introduced. The participants began to complete the questionnaire with a fundamental cognition of the three different technologies of XR.

This complex questionnaire contains single-choice, scales, and multiple-choice interspersed with short text response arranged in the order of the questions. There are 17 questions with two logic jumps. There are four scale questions which designed on the five-point semantic scale of Likert (1932)[26]. The four scale questions' Cronbach α is 0.83, indicating that the questions data is of high-reliability quality. Nevertheless, we have only selected some multiple-choice questions to analyse in this paper.

4.3 Data Collection

A total of 878 data were collected which includes digital and paper. The questionnaires were culled to eliminate invalid questionnaires. Questionnaires with a response rate of less than 70% were removed and only retained those with a response rate of 70% or more. Removed those filled in indiscriminately, such as chose B for all of the options, or half for A and half for B. Removed the questionnaires were randomly filled in, meaning that respondents chose their answers randomly or gave incoherent or perfunctory answers to the previous and subsequent questions. After the screening, 807 samples remained in the complete data pooled. Data pooled collected in May 2022. We conducted in the UK, and distribution sites mainly focus on UK and China. Volunteers are recruited primarily through Qualtrics online questionnaire platform, offline distribution of questionnaires, snowballing and posters. Offline volunteers will be given a small packet of sweets as an incentive.

5 Results

5.1 Result 1: The Association Between AR and MR on Intent to Use

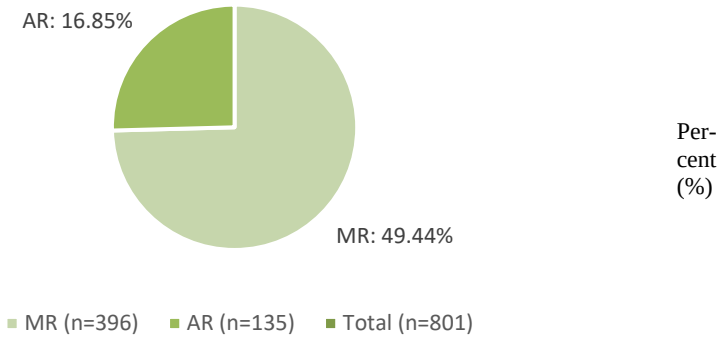

Fig. 3. Mixed Reality and Augmented Reality User Preferences

The original question for the above figure was the preference for technologies in extended reality. The reasons for comparing AR versus MR have already been articulated in existing research, so only the statistics for AR and MR are shown in the figure above. MR is distinctly preferable (see Fig. 3).

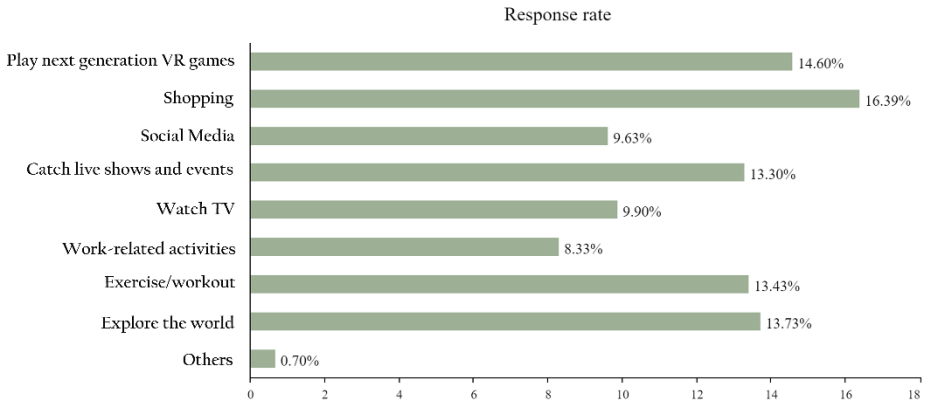

Fig. 4. Response Rate in Intent to Use

The response rate illustrates the percentage of each option. Shopping was the most popular, followed by playing VR games. Cross-tabulate it with AR and MR in the contingency table below (see Fig. 4).

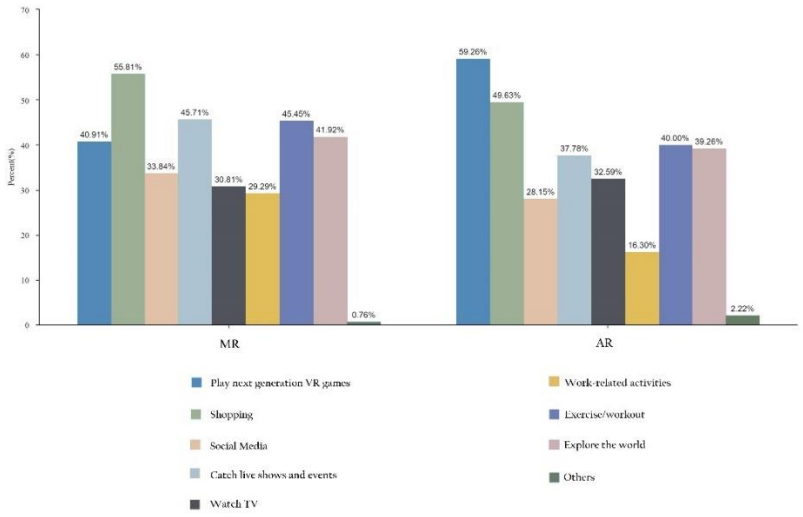

Fig. 5. MR Versus AR in Intent to Use

MR is preferred for shopping, while AR is preferred for playing games (see Fig. 5).

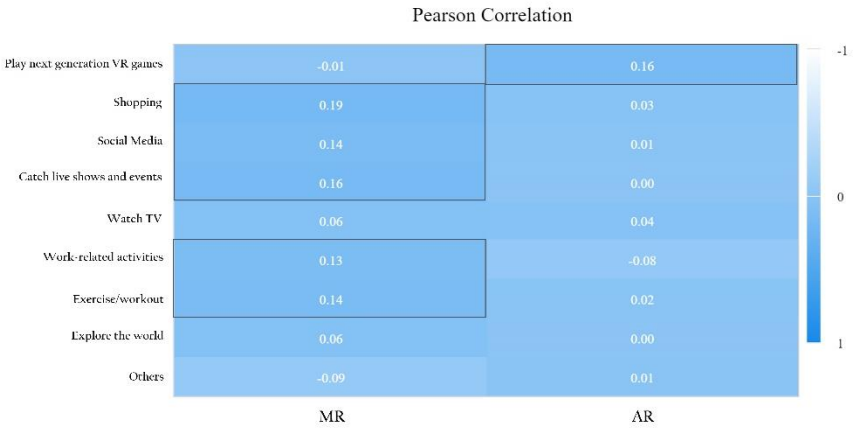

Fig. 6. Correlation in MR Versus AR in Intent to Use

Fig. 6 boxed out factors imply a significant positive effect. MR evidently has a positive effect on multiple use intentions, whereas AR, apart from playing games, most factors have barely effect and negatively affect work-related activities.

Items	Categories	Augmented Reality (%)		Total (N)	χ^2	*p*
		0.0	1.0			
Play next-generation VR game	0.0	62.16	40.74	469	21.224	0.000**
	1.0	37.84	59.26	332		
Total		666	135	801		
Shopping	0.0	54.20	50.37	429	0.663	0.415
	1.0	45.80	49.63	372		
Total		666	135	801		
Social media	0.0	72.67	71.85	581	0.038	0.846
	1.0	27.33	28.15	220		
Total		666	135	801		
Catch live shows and event	0.0	62.31	62.22	499	0.000	0.984
	1.0	37.69	37.78	302		
Total		666	135	801		
Watch TV	0.0	72.67	67.41	575	1.536	0.215
	1.0	27.33	32.59	226		
Total		666	135	801		
Work-related activities	0.0	74.92	83.70	612	4.798	0.028*
	1.0	25.08	16.30	189		
Total		666	135	801		
Exercise/workout	0.0	62.01	60.00	494	0.192	0.661
	1.0	37.99	40.00	307		
Total		666	135	801		
Explore the world	0.0	60.96	60.74	488	0.002	0.962
	1.0	39.04	39.26	313		
Total		666	135	801		
Others	0.0	98.05	97.78	785	0.042	0.838
	1.0	1.95	2.22	16		
Total		666	135	801		

* $p<0.05$ ** $p<0.01$

Table 2. The Association Between Augmented Reality and Intent to Use (Selected=1, Unselected=0)

The Chi-square analysed the relationship between augmented reality on the nine factors of intention to use. Users who preferred AR have a relatively positive acceptance of VR games which showed a significant association ($p<0.05$). Instead, AR and work-related activities had a significant negative relationship (see Table 2).

Therefore, it is suggested that the user group playing VR games is highly likely to be a potential AR user group. Regarding response rates, AR is not applicable to the content of a pragmatic nature and is more beneficial for range of hedonistic activities.

Items	Categories	Mixed Reality (%)		Total (N)	χ^2	*p*
		0.0	1.0			
Play next-generation VR game	0.0	58.02	59.09	469	0.094	0.759
	1.0	41.98	40.91	332		
Total		405	396	801		
Shopping	0.0	62.72	44.19	429	27.622	0.000**
	1.0	37.28	55.81	372		
Total		405	396	801		
Social media	0.0	78.77	66.16	581	15.966	0.000**
	1.0	21.23	33.84	220		
Total		405	396	801		
Catch live shows and event	0.0	70.12	54.29	499	21.363	0.000**
	1.0	29.88	45.71	302		
Total		405	396	801		
Watch TV	0.0	74.32	69.19	575	2.601	0.107
	1.0	25.68	30.81	226		
Total		405	396	801		
Work-related activities	0.0	81.98	70.71	612	14.102	0.000**
	1.0	18.02	29.29	189		
Total		405	396	801		
Exercise/workout	0.0	68.64	54.55	494	16.832	0.000**
	1.0	31.36	45.45	307		
Total		405	396	801		
Explore the world	0.0	63.70	58.08	488	2.659	0.103
	1.0	36.30	41.92	313		
Total		405	396	801		
Others	0.0	96.79	99.24	785	6.151	0.013*
	1.0	3.21	0.76	16		
Total		405	396	801		

* $p<0.05$ ** $p<0.01$

Table 3. The Association Between Mixed Reality and Intent to Use

Mixed reality showed statistically significant similarity with six factors of intention to use. MR significantly associated with shopping, social media, catching live shows and events, work-related activities, and exercise/workout ($p<0.05$). As the option Others are text response, we do not consider it in statistical analysis. The remaining factors showed a consistency ($p>0.05$). Of these five options, the rate of those who chose MR increased compared to those who did not select MR. This implies that this MR positively impacted these five usage intentions (see Table 3).

Hence, in contrast to Fig. 2, MR is explicitly more broadly adaptable than AR. Furthermore, our former findings suggest that prior experience with XR influenced users' preference for the technology that AR was not as high-intent to return to use as MR after being used [27]. Therefore, this study suggests that AR can be a good return for retail stakeholders with purely hedonic intentions at a relatively low cost. And for stakeholders with more financial commitment, MR can be used for both work and

entertainment purposes, making it a promising technology investment. Notably, the main areas of implementation for MR nowadays, namely education, construction, healthcare and the military, also support the pragmatic nature of MR [28, 29].

5.2 Result 2: The Correlations Between AR and MR on Intent to Experience, Controlling for Shopping

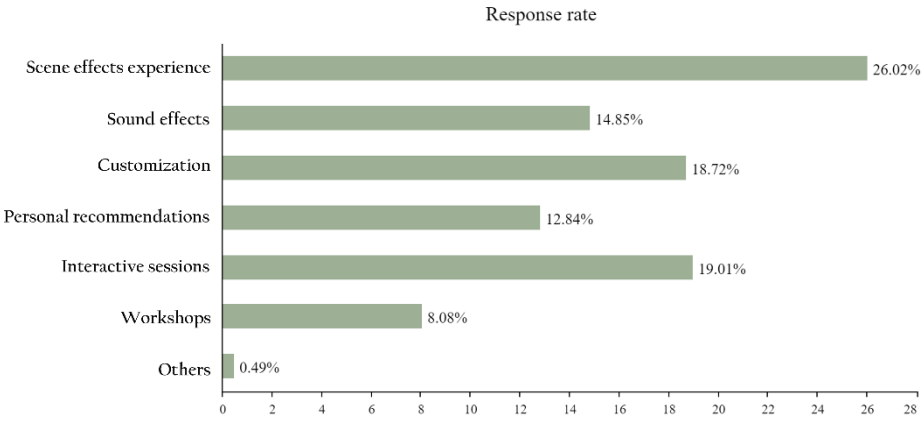

Fig. 7. Response Rate in Intent to Experience

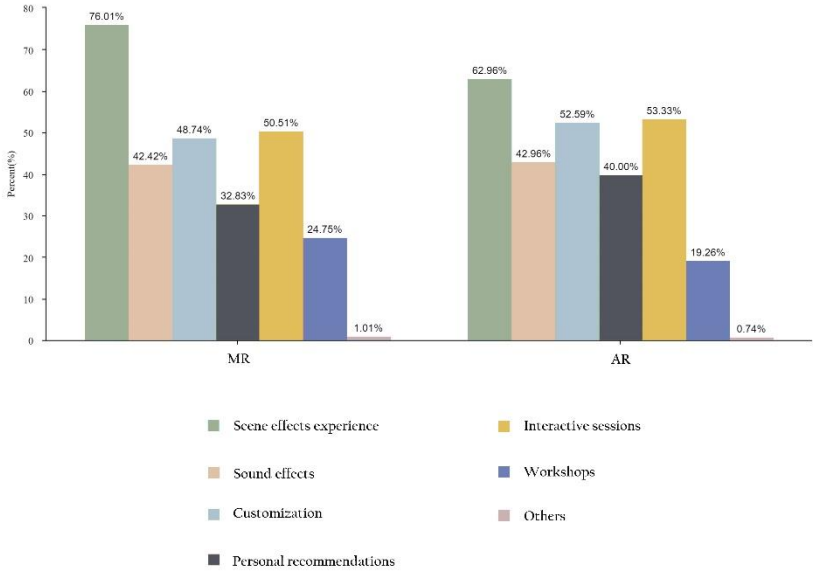

Fig. 8. MR Versus AR in Intent to Experience

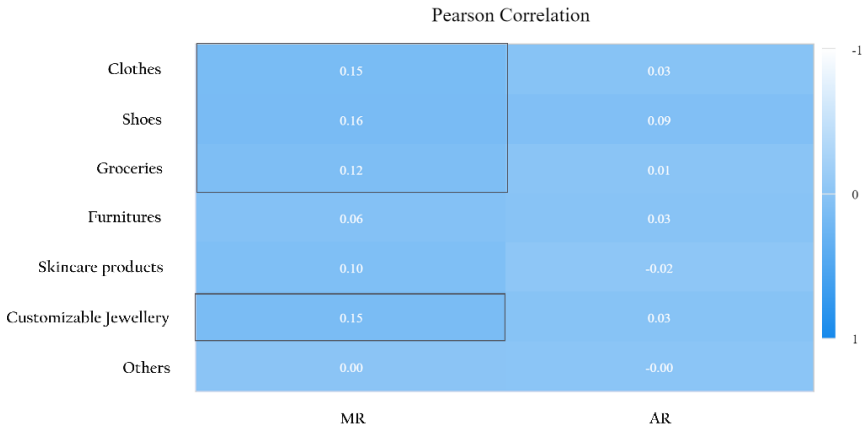

Fig. 9. Correlation in MR Versus AR in Intent to Experience

Fig. 8 demonstrates that scenarios, customisation and interaction are the three most anticipated experiential intentions in MR and AR. Fig. 9 shows four factors positively influencing MR adoption, while these six are nearly neutral for AR.

Parameter Estimates (*n*=801)

	Model 1					Model 2				
	B	Std. Error	*t*	*p*	*β*	*B*	Std. Error	*t*	*p*	*β*
Constant	0.159**	0.018	8.763	0.000	-	0.147**	0.028	5.223	0.000	-
Shopping	0.022	0.027	0.814	0.416	0.029	0.006	0.029	0.210	0.834	0.008
Scene effects						-0.037	0.030	-1.207	0.228	-0.046
Sound effects						0.041	0.031	1.336	0.182	0.053
Customisation						0.022	0.029	0.752	0.452	0.029
Personal recommendations						0.052	0.031	1.686	0.092	0.064
Interactive sessions						0.025	0.028	0.871	0.384	0.033
Workshop						-0.051	0.036	-1.405	0.160	-0.055
Others						-0.061	0.121	-0.508	0.612	-0.018
R^2	0.001					0.013				
Adj R^2	-0.000					0.003				
F value	*F* (1,799) =0.662, *p*=0.416					*F* (8,792) =1.320, *p*=0.230				
$\triangle R^2$	0.001					0.012				
$\triangle F$ Value	*F* (1,799) =0.662, *p*=0.416					*F* (7,792) =1.413, *p*=0.196				

Dependent Variable: Augmented Reality
* $p<0.05$ ** $p<0.01$

Table 4. Hierarchical Regression of AR Shopping Relationship on Intent to Experience

Shopping had almost no correlation with AR (R^2=0.001, p>0.05). F value increased after including the intent to purchase factors, which showed the model improved but did not show significance (F=1.413, p=0.196>0.05). Intent to experience has no statistically significant explanatory affected on AR shopping (see Table 4).

Parameter Estimates (*n*=801)

	Model 1					Model 2				
	B	Std. Error	*t*	*P*	*β*	*B*	Std. Error	*t*	*p*	*β*
Constant	0.408**	0.024	17.177	0.000	-	0.318**	0.037	8.706	0.000	-
Shopping	0.186**	0.035	5.342	0.000	0.186	0.151**	0.037	4.068	0.000	0.151
Scene effects						0.172**	0.039	4.391	0.000	0.163
Sound effects						0.007	0.040	0.177	0.860	0.007
Customisation						-0.022	0.038	-0.594	0.552	-0.022
Personal recommendations						-0.023	0.040	-0.587	0.557	-0.022
Interactive sessions						-0.021	0.037	-0.570	0.569	-0.021
Workshop						0.086	0.047	1.831	0.067	0.069
Others						0.021	0.156	0.137	0.891	0.005
R^2	0.034					0.068				
Adj R^2	0.033					0.058				
F value	*F* (1,799) =28.537, *p*=0.000					*F* (8,792) =7.192, *p*=0.000				
$\triangle R^2$	0.034					0.033				
$\triangle F$ Value	*F* (1,799) =28.537, *p*=0.000					*F* (7,792) =4.034, *p*=0.000				

Dependent Variable: Mixed Reality

* *p*<0.05 ** *p*<0.01

Table 5. Hierarchical Regression of MR Shopping Relationship on Intent to Experience

The F-test (F=28.537, p<0.05) indicates that shopping influences the relationship on MR, and the model equation is:

$$\text{Mixed Reality} = 0.408 + 0.186 * \text{Shopping} \quad (1)$$

In model 1, shopping revealed a statistically significant relationship with MR (t=5.342, p=0.000<0.01), producing a significant positive correlation on MR. The model 2 changes in F-value showed statistical significance in intent to experience (p<0.05). Scene effects showed a significant positive correlation on MR (t=4.391, p=0.000<0.01). The remaining factors did not show statistical significance, implying that they do not have correlations with MR (see Table 5).

Accordingly, result 2 shows that MR is a technology that is applicable to retail purchases, while AR does not show significant relevance. Among the experience factors,

scene effects such as environment, user interface and spatial interaction contribute to the user's adaptation to MR. Therefore, visual presentation and environmental design represent a crucial dimension of MR adoption.

5.3 Result 3: The Correlations Between AR and MR on Intent to Purchase, Controlling for Shopping

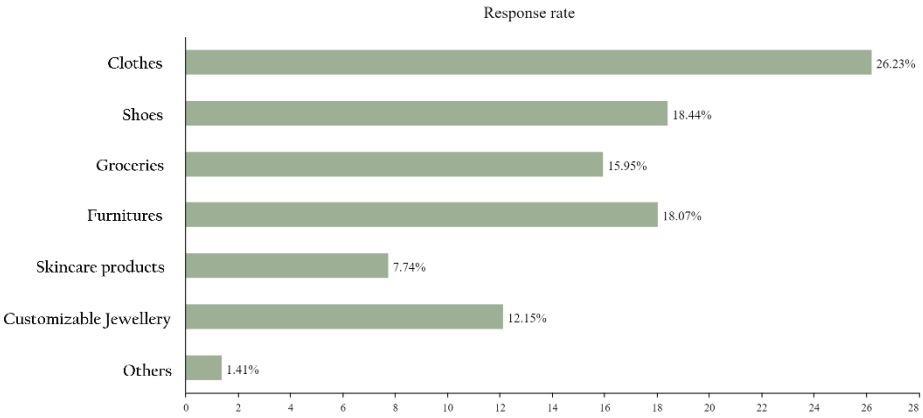

Fig. 10. Response Rate in Intent to Purchase

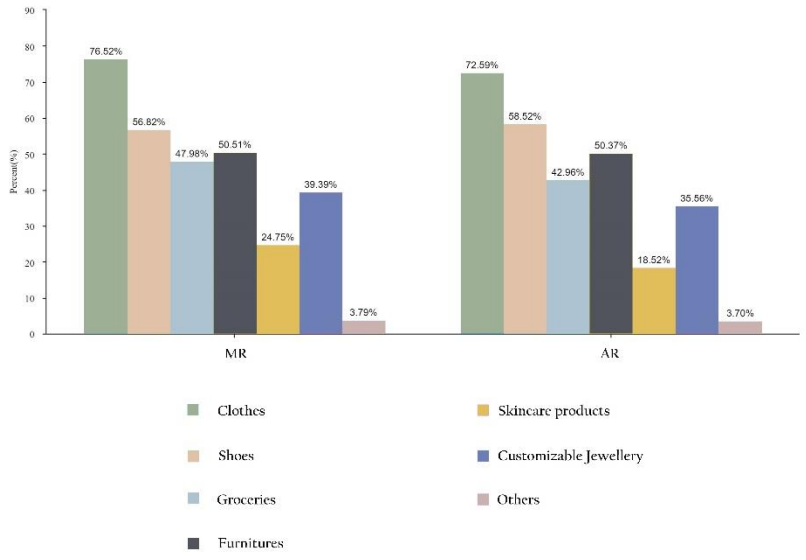

Fig. 11. MR Versus AR in Intent to Purchase

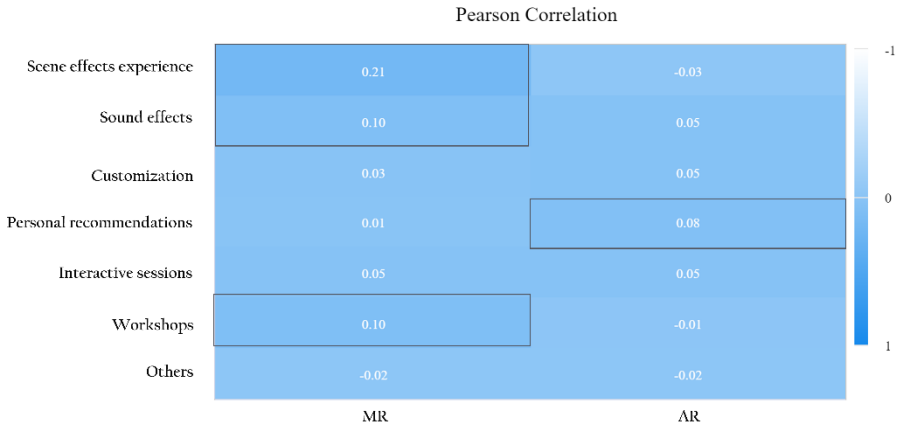

Fig. 12. Correlation in MR Versus AR in Intent to Purchase

MR and AR resemble in their purchase intentions (see Fig. 11). Scenes, sound effects and workshops positively influence the adoption of MR, whereas AR only has personalised recommendations (see Fig. 12).

Parameter Estimates (n=801)

	Model 1					Model 2				
	B	Std. Error	*t*	*p*	*β*	*B*	Std. Error	*t*	*p*	*β*
Constant	0.159**	0.018	8.763	0.000	-	0.142**	0.028	5.131	0.000	-
Shopping	0.022	0.027	0.814	0.416	0.029	0.011	0.030	0.347	0.729	0.014
Clothes						-0.014	0.035	-0.403	0.687	-0.017
Shoes						0.078*	0.033	2.382	0.017	0.105
Groceries						0.002	0.030	0.054	0.957	0.002
Furniture						0.004	0.029	0.131	0.896	0.005
Skincare Products						-0.056	0.037	-1.514	0.130	-0.061
Customisable Jewellery						0.008	0.032	0.239	0.811	0.009
Others						-0.002	0.071	-0.035	0.972	-0.001
R^2	0.001					0.011				
Adj R^2	-0.000					0.001				
F value	*F* (1,799) =0.662, *p*=0.416					*F* (8,792) =1.087, *p*=0.370				
$\triangle R^2$	0.001					0.010				
$\triangle F$ Value	*F* (1,799) =0.662, *p*=0.416					*F* (7,792) =1.148, *p*=0.331				

Dependent Variable: Augmented Reality
* p<0.05 ** p<0.01

Table 6. Hierarchical Regression of AR Shopping Relationship on Intent to Purchase

In model 2, F value changes after including the intention to purchase factors did not show significance (F=1.148, p=0.331>0.05), implying that these seven factors had no statistically significant explanatory on AR shopping (see Table 6).

Parameter Estimates (*n*=801)

	Model 1					Model 2				
	B	Std. Error	*t*	*p*	*β*	*B*	Std. Error	*t*	*p*	*β*
Constant	0.408**	0.024	17.177	0.000	-	0.318**	0.036	8.839	0.000	-
Shopping	0.186**	0.035	5.342	0.000	0.186	0.113**	0.039	2.860	0.004	0.112
Clothes						0.069	0.046	1.510	0.131	0.063
Shoes						0.054	0.043	1.262	0.207	0.054
Groceries						0.083*	0.039	2.133	0.033	0.082
Furniture						-0.043	0.038	-1.129	0.259	-0.043
Skincare Products						0.002	0.048	0.039	0.969	0.002
Customisa-ble Jewellery						0.102*	0.041	2.475	0.014	0.096
Others						0.046	0.092	0.507	0.613	0.018
R^2	0.034					0.061				
Adj R^2	0.033					0.051				
F value	*F* (1,799) =28.537, *p*=0.000					*F* (8,792) =6.381, *p*=0.000				
$\triangle R^2$	0.034					0.026				
$\triangle F$ Value	*F* (1,799) =28.537, *p*=0.000					*F* (7,792) =3.140, *p*=0.003				

Dependent Variable: Mixed Reality
* $p<0.05$ ** $p<0.01$

Table 7. Hierarchical Regression of MR Shopping Relationship on Intent to Purchase

The F-test (F=28.537, p<0.05) indicates that shopping influences the relationship on MR, and the model equation is:

$$\text{Mixed Reality} = 0.408 + 0.186 * \text{Shopping} \quad (2)$$

Shopping produced a significant positive correlation on MR (t=5.342, p=0.000<0.01). Clothes, shoes, furniture, and skin care products are almost unrelated to MR. Groceries show a significant positive correlation on MR (t=2.133, p=0.033<0.05). Customised jewellery presented a significant positive correlation on MR (t=2.475, p=0.014<0.05) (see Table 7).

Therefore, result 3 demonstrates a positive influence of MR on shopping and purchase intention, whereas AR is not significantly correlated with it. Bespoke jewellery and groceries positively influenced MR adoption, with bespoke jewellery having a more positive influence than groceries. This revealed that the hedonistic-premised use purpose was more favourable to the masses than the pragmatic-premised experience purpose in the user experience of MR retail purchases.

6 Conclusion

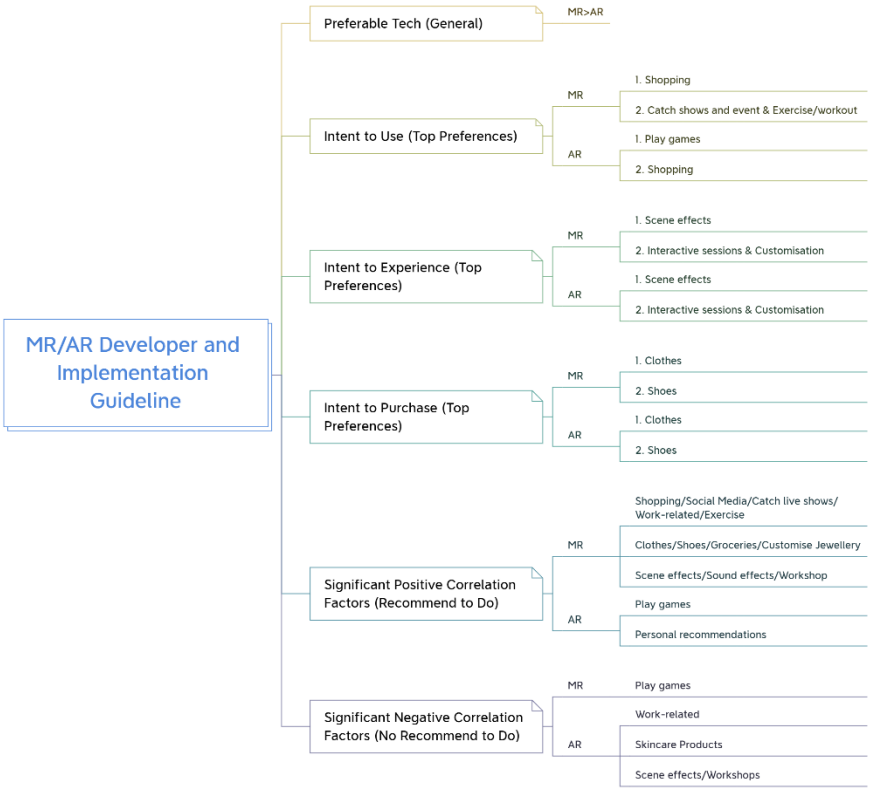

Fig. 13. MR/AR Developer and Implementation Guideline

This study emphasises that MR holds more comprehensive promise compared to AR in the retail industry. In the retail market, utilising MR encompasses both hedonic and pragmatic intentions, whereas VR is more hedonic in nature. In particular, customised products like jewellery is a research gap that requires further investigation. As a pragmatic approach adapting MR into high-retention and high-value products. The Findings affirm the feasibility of the our future orientation of the research proposal. Therefore, a more in-depth exploration of customised jewellery function development in retail implementation will be undertaken.

7 Discussion and Future Work

In our study, we extracted a subset of data from a comprehensive survey and examined it from various perspectives. In this paper, we highlight the differences in the impact of

mixed reality and augmented reality on user adoption and the relevance of user intent to MR and AR for purchase behaviour. Additionally, we revealed the strong relevance of MR in retail purchases. These findings have influenced our decision on which technology to utilise in ongoing large-scale projects. We also investigated the disparities in technology preferences and attitudes among consumers who have and have not experienced extended reality (XR) and modelled the influence of age and gender on technology acceptance [27]. The results helped to target user demographic.

This paper targeted the technology we intend to use, however, using questionnaires alone is insufficient to understand users' behaviour, psychology, and cognition. Therefore, further research will include in-depth interviews to analyse user behaviour towards psychological factors. Additionally, we will consider stakeholders' perspectives, such as retailers' attitudes towards accepting the technology and insights from user experience designers and experts. Furthermore, we also believe that the user interface and spatial environment directly impact user engagement and that the users should be afforded embodied spaces and embodied human-computer interactions. Taking a multidisciplinary perspective, we will also explore the relationship between spatial typology and MR interfaces. Our goal is to develop a customised approach that promotes the transformation of human-product intrinsic relationships and innovative interaction by gaining user feedback through the usage of HoloLens 2 and hand tracking.

References

1. Hilken, T., de Ruyter, K., Chylinski, M., Mahr, D., Keeling, D.I.: Augmenting the eye of the beholder: exploring the strategic potential of augmented reality to enhance online service experiences. J. of the Acad. Mark. Sci. 45, 884–905 (2017). https://doi.org/10.1007/s11747-017-0541-x.
2. Meegahapola, L., Perera, I.: Enhanced in-store shopping experience through smart phone based mixed reality application. In: 2017 Seventeenth International Conference on Advances in ICT for Emerging Regions (ICTer). pp. 1–8. IEEE, Colombo (2017). https://doi.org/10.1109/ICTER.2017.8257810.
3. Dou, H., Tanaka, J.: A Mixed-Reality Shop System Using Spatial Recognition to Provide Responsive Store Layout. In: Chen, J.Y.C. and Fragomeni, G. (eds.) Virtual, Augmented and Mixed Reality. Design and Interaction. pp. 18–36. Springer International Publishing, Cham (2020). https://doi.org/10.1007/978-3-030-49695-1_2.
4. Chai, J.J.K., O'Sullivan, C., Gowen, A.A., Rooney, B., Xu, J.-L.: Augmented/mixed reality technologies for food: A review. Trends in Food Science & Technology. 124, 182–194 (2022). https://doi.org/10.1016/j.tifs.2022.04.021.
5. Tan, Y.-C., Chandukala, S.R., Reddy, S.K.: Augmented Reality in Retail and Its Impact on Sales. Journal of Marketing. 86, 48–66 (2022). https://doi.org/10.1177/0022242921995449.

6. Paige J.: How AR is becoming the new standard in retail: Poplar Studio, https://www.retail-insight-network.com/features/how-ar-is-becoming-the-new-standard-in-retail-poplar-studio/, last accessed 2023/05/30.
7. GlobalData: Augmented Reality (AR) in Retail and Apparel - Thematic Research, https://www.globaldata.com/store/report/ar-in-retail-and-apparel-theme-analysis/, last accessed 2023/05/30.
8. Scherer, M.J., Craddock, G.: Matching Person & Technology (MPT) assessment process. TAD. 14, 125–131 (2002). https://doi.org/10.3233/TAD-2002-14308.
9. Alnawas, I., Aburub, F.: The effect of benefits generated from interacting with branded mobile apps on consumer satisfaction and purchase intentions. Journal of Retailing and Consumer Services. 31, 313–322 (2016). https://doi.org/10.1016/j.jretconser.2016.04.004.
10. Foroudi, P., Gupta, S., Sivarajah, U., Broderick, A.: Investigating the effects of smart technology on customer dynamics and customer experience. Computers in Human Behavior. 80, 271–282 (2018). https://doi.org/10.1016/j.chb.2017.11.014.
11. Williams, R.: 52% of retailers feel ill-prepared to support emerging mobile tech, study says, https://www.marketingdive.com/news/52-of-retailers-feel-ill-prepared-to-support-emerging-mobile-tech-study-s/560947/, last accessed 2023/05/30.
12. Schubert, T.W.: A New Conception of Spatial Presence: Once Again, with Feeling. Communication Theory. 19, 161–187 (2009). https://doi.org/10.1111/j.1468-2885.2009.01340.x.
13. Viirre, E., Ellisman, M.: Vertigo in Virtual Reality with Haptics: Case Report. Cyberpsychology & behavior : the impact of the Internet, multimedia and virtual reality on behavior and society. 6, 429–31 (2003). https://doi.org/10.1089/109493103322278826.
14. Zhu, W., Owen, C., Li, H., Lee, J.-H.: Personalized In-store E-Commerce with the PromoPad: an Augmented Reality Shopping Assistant. 1(3), (2004).
15. Cruz, E., Orts-Escolano, S., Gomez-Donoso, F., Rizo, C., Rangel, J.C., Mora, H., Cazorla, M.: An augmented reality application for improving shopping experience in large retail stores. Virtual Reality. 23, 281–291 (2019). https://doi.org/10.1007/s10055-018-0338-3.
16. Baytar, F., Chung, T., Shin, E.: Evaluating garments in augmented reality when shopping online. Journal of Fashion Marketing and Management: An International Journal. 24, 667–683 (2020). https://doi.org/10.1108/JFMM-05-2018-0077.
17. Jain, S., Werth, D.: Current State of Mixed Reality Technology for Digital Retail: A Literature Review. In: Nah, F.F.-H. and Siau, K. (eds.) HCI in Business, Government and Organizations. eCommerce and Consumer Behavior. pp. 22–37. Springer International Publishing, Cham (2019). https://doi.org/10.1007/978-3-030-22335-9_2.
18. Power, D.: How Augmented Reality Is Driving the Evolution of Brands Like Wayfair, https://www.uschamber.com/co/good-company/launch-pad/augmented-reality-transforming-wayfair, last accessed 2023/07/11.
19. Dacko, S.G.: Enabling smart retail settings via mobile augmented reality shopping apps. Technological Forecasting and Social Change. 124, 243–256 (2017). https://doi.org/10.1016/j.techfore.2016.09.032.
20. Program-Ace: Using Augmented Reality in Warehouse for Superior Logistics, https://program-ace.com/blog/augmented-reality-warehouse/, last accessed 2023/07/12.
21. Office for National Statistics: Impact of the coronavirus (COVID-19) pandemic on retail sales in 2020,

https://www.ons.gov.uk/economy/grossdomesticproductgdp/articles/impactofthecoronaviruscovid19pandemiconretailsalesin2020/2021-01-28, last accessed 2023/07/12.
22. Fuchs, K., Grundmann, T., Fleisch, E.: Towards Identification of Packaged Products via Computer Vision: Convolutional Neural Networks for Object Detection and Image Classification in Retail Environments. (2019). https://doi.org/10.1145/3365871.3365899.
23. Jain, S., Schweiss, T., Bender, S., Werth, D.: Omnichannel Retail Customer Experience with Mixed-Reality Shopping Assistant Systems. Presented at the International Symposium on Visual Computing (2021).
24. Davis, F.D.: Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. MIS Quarterly. 13, 319 (1989). https://doi.org/10.2307/249008.
25. Vijayasarathy, L.R.: Predicting consumer intentions to use on-line shopping: the case for an augmented technology acceptance model. Information & Management. 41, 747–762 (2004). https://doi.org/10.1016/j.im.2003.08.011.
26. Likert, R.: A technique for the measurement of attitudes. Archives of Psychology. 22 140, 55–55 (1932).
27. Jin, L., Dalton, R., Fagan, D.: Extended Reality (XR) Survey: A Consumer Technology Acceptance Preference Study on Retail. Presented at the 8th Colloquium on European Research in Retailing (CERR) June 22 (2023).
28. Hughes, C.E., Stapleton, C.B., Hughes, D.E., Smith, E.M.: Mixed reality in education, entertainment, and training. IEEE Computer Graphics and Applications. 25, 24–30 (2005). https://doi.org/10.1109/MCG.2005.139.
29. Rokhsaritalemi, S., Sadeghi-Niaraki, A., Choi, S.-M.: A Review on Mixed Reality: Current Trends, Challenges and Prospects. Applied Sciences. 10, 636 (2020). https://doi.org/10.3390/app10020636.