ORIGINAL ARTICLE

Augmented reality in delivering experiential values: moderating role of task complexity

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Abstract

This study examined if greater experiential values are provided when shopping via an AR mobile app compared to shopping via a general mobile website without AR. The mediating role of experiential values between the two shopping methods and customer loyalty as well as the moderating effect of task complexity between the two shopping methods and experiential values were further investigated. An exciting eyewear retailer's mobile site and mobile app embedded with AR features were used. A total of 302 usable respondents participated in the study. Shoppers exposed to an AR function perceived greater aesthetics, escapism, enjoyment, and efficiency than those exposed to a non-AR mobile site. Also, compared to shoppers exposed to a general non-AR mobile site, shoppers exposed to an AR mobile app showed greater customer loyalty through the four experiential values. Task complexity modified the effects of AR on consumers' perceived escapism and efficiency experiential values. This research fills the gap in the literature by investigating AR's experiential values in connection with customer loyalty by comparing an AR-embedded mobile app with a general mobile site without an AR feature. The additional examination of task complexity also contributes to a complete understanding of AR experiential benefits considering consumers' perceptions about AR operation task complexity.

Keywords Augmented reality · Experiential value · Customer loyalty · Task complexity

1 Introduction

With the fast advancement of digital technology and its impact on consumer behavior, the retail industry is facing the serious challenge of keeping up to date. Due to the pervasive use of smartphones, the distinction between digital and physical has become increasingly blurred (Retail Dive 2022). Emerging technologies such as Augmented Reality (AR), Virtual Reality (VR), Mixed Reality, (MR) and the Metaverse open up new avenues for retailers and revolutionize the way consumers shop and interact with products (BairesDev, n.d.; Schultz 2020).

AR is an enhanced technology that changes the way people interact with products and enhances the consumer shopping experience. Compared to traditional ways of exploring products, AR allows consumers to virtually explore and try on products in a real setting (Papagiannis 2020). Many brands such as IKEA and Amazon have employed AR to create a unique immersive experience for their customers (Econsultancy 2021). Since AR superimposes virtual products onto a live view of a real physical environment, users are better able to visualize how the products would fit in the physical world (Tan et al. 2021). For instance, Gucci employed an AR feature in its mobile app to help customers visualize how a pair of shoes would look in a realistic setting (Williams 2019). Beauty retailers such as Ulta Beauty have adopted AR to enable consumers to virtually try makeup products on their face to have a realistic sense of how the makeup affects their appearance. Due to the enhanced experience through the device, AR-embedded features such as "virtual try-on" seem to be a necessary tool on a digital site.

The rich and lifelike images of products presented through AR are truly more effective in examining products in comparison to 2D static images (Hilken et al. 2022). Aside from these functional benefits, considering the current

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market trends towards experiential marketing and the growing popularity of AR, employing AR technology seems to have significant implications for future retailing in connection with fun, memorable, exciting experiential shopping experiences by enabling customers to visibly interact with virtual products by combining the boundaries between the physical and the digital environments.

Holbrook and Hirschman (1982) defined the term 'experiential' in relation to consumer consumption as the involvement of a constant flow of fantasies, feelings, and fun through playful activities, sensory pleasure, esthetic enjoyment, and emotional responses. Based on Holbrook and Hirschman's perspective, the current study focuses on a more nuanced understanding of the potential experiential benefits of AR over conventional digital shopping in consumers' shopping experiences and the consequential impact of AR on consumer patronage behavior. From an experiential value standpoint, AR is not just a functional tool that provides a service to consumers. It can more widely be viewed as a source of memories that offers hedonic aspects and enjoyment. Hence, this study is aimed to explore if greater experiential values are provided when shopping via an AR mobile app compared to shopping via a general mobile website without AR and the sequential influence of AR on consumer loyalty.

This study also considers task complexity as a moderating factor in affecting the experiential values of AR on the consumer shopping experience. Consumers' opinions on the hedonic aspects of AR might differ based on the consumers' perceived task complexity level. Previous research indicated that task complexity is a vital component in influencing consumer decision processing (Huang et al. 2021), performance (Tang 2020), and experiential value perception (Holbrook and Hirschman 1982). The operational challenges of using AR might hinder some consumers' perceptions of its experiential values and intention to adopt. To fully understand the experiential value of AR in connection with consumers' individual differences, the evaluation of task complexity is imperative.

The study's findings are expected to provide valuable implications to academia and practitioners in understanding the impact of AR in enhancing consumer experiential values beyond its technological and functional aspects. By doing so, this study extends retailers' current comprehension of AR and opens the door to more opportunities for reshaping customer experience and behavior in the digital platform.

2 Literature review and hypothesis development

2.1 Augmented reality (AR)

AR is a technology that overlays virtual elements onto physical environments, thus blending the real world with virtual objects (Watson et al. 2020). AR is often used with VR or MR; the three technologies are sometimes used interchangeably (Volersystems, n.d.). There are essential differences among them. VR is a fully immersive environment simulated by a computer (Tremosa 2023). Via a head-mounted display, a user can manipulate objects while experiencing computer-generated images and sounds (Park et al. 2021). MR indicates a blend of physical and virtual worlds where physical and virtual elements can interact (Tremosa 2023). Through MR users can see their surroundings and at the same time interact with the virtual environment via their headset (Park et al. 2021).

Since AR mixes virtual objects with a real situation, it allows users to interact with virtual elements in the real world and creates immersive consumer experiences (Kumar 2021a, b). Due to this benefit, it has been utilized in various fields such as medical training, education, military, travel, retail, engineering, and the entertainment industry (Dhar et al. 2021; Paine 2023). For example, AR is often used for medical and surgical training to deliver immersive learning experiences. It is also used in architecture and construction and enables interior designers to visualize their final products during the creative process.

According to Statista (2022), the AR consumer market in the U.S. hit 12.45 billion dollars in 2021. Due to the rich sensory depth and immersive experience created, this technology has become one of the most promising technologies in the digital retail sector (Kumar 2021a, b). The rapid growth of the use of smartphones has also led to the rising adoption of AR in mobile apps (Chen et al. 2022; Dacko 2017). For the retail sector, building a strong bond with customers through the formation of experiential value in connection with the emotional hedonic aspects of technology (Park et al. 2013) is strongly emphasized as a central strategy to survive in today's digital world.

Several studies provided the utilitarian (e.g., Chiu et al. 2021; Hoffmann et al. 2022) and the financial benefits of AR (e.g., Berman and Pollack 2021; Chandra and Kumar 2018). Many of the AR studies were conducted in beauty product retail settings (e.g., Tan et al. 2022; Watson et al. 2020) and some in the furniture market (e.g., Ozturkcan 2021; Kim et al. 2023). However, little attention has been given to the eyewear industry. Eyewear is one of the riskiest items to inspect digitally due to the inability to try-on and assess product fit accurately. Exploring eyewear through

an AR feature seems to provide diverse hedonic values to consumers.

2.2 AR and experiential value

Compared to other innovative tools, AR has received a greater amount of attention from retailers as a more effective way of engaging with products to provide superior experiences to consumers (Watson et al. 2020). Several research studies emphasized the importance of AR application in delivering experiential values beyond simply utilizing it as a functional technology (Poushneh and Vasquez-Parraga 2017). Experiencing products through AR is more hedonic than utilitarian due to the interactive and immersive experiences in the real world (e.g., Watson et al. 2020). Previous research defined experiential value as the value created by customers through their experiences (Flint 2006; Park et al. 2013); it involves more than mere interaction with a product. It entails the whole shopping experience. Thus, through consumers' perceived experiential value, their holistic retail experience can be evaluated (Watson et al. 2020). According to several pieces of research, the experience value created by customers is personal and context dependent (Holbrook 1996) and includes sensory, emotional and cognitive stimulations that aid consumers' purchase decision making (Jeong et al. 2009).

In association with the experiential aspect of consumer consumption phenomena, Holbrook and Hirschman (1982) described the experiential aspects of consumer experience in connection with multisensory and psychophysical characteristics comprising fantasies, feeling, and fun that include various hedonic consumer experiences such as sensory pleasures, esthetic enjoyment, and emotional responses. By expanding Holbrook and Hirschman's (1982) concept, Mathwick et al. (2001) proposed seven dimensions of experiential values in the online and catalog shopping environments: visual appeal, entertainment, escapism, enjoyment, efficiency, service excellence, and economic value. Their seven dimensions of experiential value are widely used to measure consumer perceptions of experiential value in various contexts (e.g., Norris et al. 2023; Varshneya et al. 2017).

The seven experimental value dimensions suggested by Mathwick et al. (2001) include a functional concept as well as a hedonic concept of experiential value. They have a somewhat broader scope than the experiential aspects addressed in Holbrook and Hirschman (1982). The first five dimensions (i.e., visual appeal, entertainment, escapism, enjoyment, efficiency) are hedonic values that align well with fun and playfulness of an experience addressed by Holbrook and Hirschman (1982). Visual appeal and entertainment refer to the visual elements of the retail environment and the entertaining aspects of the service performance (Mathwick et al., 2001). Escapism is the playful aspect that

lets the customer momentarily get away from the routine of everyday life. Enjoyment is the playful exchange behavior that comes from engaging in activities. Efficiency indicates the value gained on investment of time and effort.

The last two dimensions (i.e., service excellence and economic value), however, are associated with utilitarian values tied to task completion, rather than an experience itself. Service excellence shows how well a retailer delivers the value promised to its consumers, and economic value is related to the quality and price value of products. The current research applies Mathwick et al. (2001) first five dimensions of experiential value to examine experiential responses accomplished through overall experience with AR since the study's focus is to assess the relationship between consumers' perception about the technological feature of AR and the hedonic aspects of experiential values.

According to experiential value related research, product views and zoomed images deliver experiential value to customers by providing them effective sensory or aesthetic information (e.g., Jeong et al. 2009; Peters 2005). Jeong et al. (2009) discovered that compared to basic product images, complex product images (e.g., zoom in and out) in an online apparel setting generate a higher level of experiential value since richer product presentation features enable consumers to better fantasize themselves wearing a product and thus increase consumers' enjoyable cognitive experiences. In a similar vein, Huang and Liu (2014) shows that, compared to a traditional online setting, viewing products through AR enables consumers to virtually try products on their bodies or surroundings, thus enriching consumer enjoyment. Based on the prior research, it is possible to propose that exploring products via AR compared to exploring products through static images on mobile apps creates greater experiential value. Thus, the following hypothesis is developed.

H1 Mobile commerce shoppers who are exposed to an AR function will perceive greater experiential value than those who are exposed to a general website in mobile commerce.

2.3 Customer loyalty

Customer loyalty is commonly described as either a behavior or an attitude. Behavioral loyalty is associated with purchase intention, patronage, and actual purchase behavior. Attitudinal loyalty is customers' commitment to the organization (Kim and Kim 2020; Savelli et al. 2017). Customer loyalty addressed in this study is related to customers' behavioral devotion including purchase repetition and repeat patronage. According to previous research, consumer experiential value plays an important role in increasing customer loyalty (Echchakoui 2016; Park et al. 2013). Providing experiential value enhances consumer assurance in shopping and thus

increases purchase intention (Huang and Liu 2014). Therefore, the following hypothesis is proposed.

H2 Perceived experiential value will positively influence customer loyalty.

2.4 Moderating role of task complexity

Task complexity has been explored in various areas such as education (e.g., Tremblay et al. 2023), healthcare (e.g., Koebele et al. 2021), business (e.g., Swait and Adamowicz 2001), and training (e.g., Koumaditis et al. 2020). In these areas, task complexity is often considered as a negative factor that increases cognitive workload. For instance, Sun and Kim (2022) found a negative impact of task complexity on students' procrastination and academic performance. That is, students procrastinated more when completing high-complexity tasks than low-complexity tasks and received lower grades on high-complexity tasks. Bejjanki et al. (2020) similarly indicated that young children's behaviors in tasks and cognitive control are all moderated by task complexity.

Task complexity is perceived as either subjective or objective perspectives (e.g., Sasangohar et al. 2021; Zhou 2021). Subjective task complexity refers to the level of task complexity perceived by a user (Li et al. 2011), while objective task complexity indicates features directly connected to the task and independent of the task performers (Zhou 2021). The idea of subjective task complexity is similar to Campbell's (1988) concept of task complexity as a psychological experience. Task complexity as a psychological experience is related to a user's perception of the task significance and the task identity; it is associated with the subjective reaction of the user to the task rather than the characteristics of the task itself (Campbell 1988; Frank

1994). In the current research, task complexity is regarded as subjective (i.e., perceived) and defined as users' perceptions about the task complexity of the AR feature. According to Men and Jia (2021), actual objective task complexity might lead to biased results and subjective perceived task complexity explains consumer behavior more strongly.

Task complexity is a critical factor that affects consumer decision value and performance (Tang 2020). People have limited cognitive ability in terms of short-term memory and thus they process a limited amount of information all at once (Sweller 2011; Tang 2020). According to prior task complexity research, when the amount of information processing exceeds a certain level people (1) get overwhelmed and cannot learn effectively or (2) simplify their task execution strategies and sacrifice their task performance (Jiang and Benbasat, 2007; Todd and Benbasat 1999). To support this notion, Jiang and Benbasat (2007) showed that different types of product presentations (static images vs. video formats) had no distinct impact in acquiring product knowledge under high task complexity. The study revealed that consumers were more likely to give up trying different product presentation modes when the task became highly complex. For complex tasks, people are more likely to depend on themselves rather than a system, which in turn affects people's pleasantness and faith towards the system (Huang et al. 2021).

In connection with experiential aspects of consumer behavior such as enjoyment, fun, and feelings, Holbrook and Hirschman (1982) indicated the impact of task complexity and individual differences in affecting consumer experiential view. It is presumable that the more advanced the employed technology is, the more informative and superior the product presentation will be. However, the effect of the technology application on consumer experiential value perception might differ based on the consumers' task complexity level. If experiencing products with AR
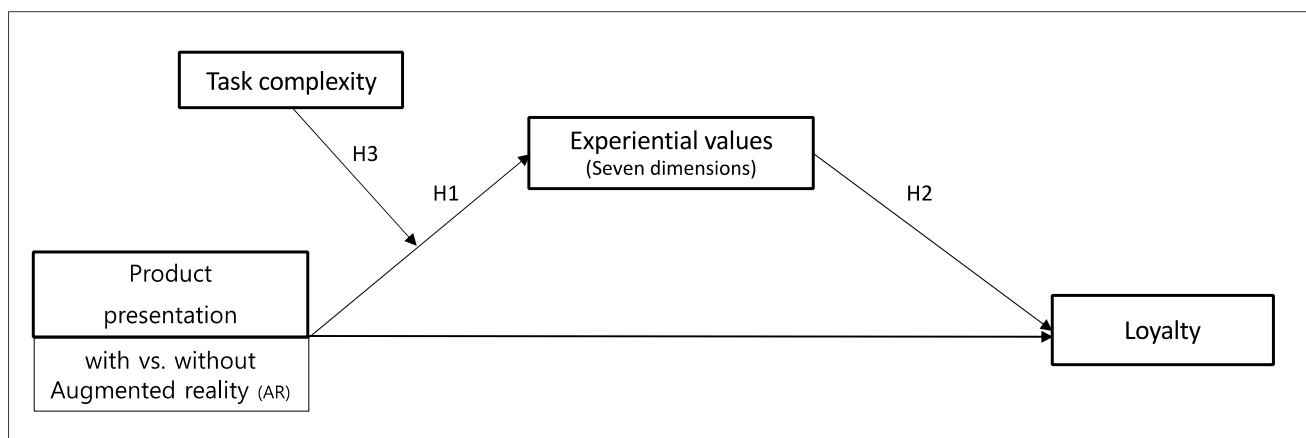

Fig. 1 Proposed model

feels highly demanding and challenging, consumers may reduce their reliance on the tool. Therefore, it is plausible to expect that consumers' perceived experiential value towards static images and AR features may differ based on their perceived task complexity. Thus, the following hypothesis is developed.

H3 Task complexity will moderate the effect of product presentation on experiential value.

Figure 1 shows a proposed model of the study.

3 Method

3.1 Participants and procedure

A market research agency in South Korea was utilized to recruit participants and conduct the data collection. South Korea was chosen because the country plays a leading role in implementing advanced technologies such as AR in the retail industry (Global Economics 2021; Switzerland Global Enterprise 2019) and was named the most innovative country in the world in the Bloomberg Innovation Index in 2021 (The Korea Herald 2021).

For the current research, an existing eyewear retailer's mobile website and mobile app embedded with an AR function were utilized. The research agency distributed a study invitation email which indicated a concise introduction of the study and the procedures that needed to be followed. Participants were randomly assigned to either the mobile app that had an AR function or the mobile website that did not have an AR function. The participants assigned to the mobile app with AR were instructed to install the retailer's mobile app into their smartphone and browse the app for a pair of eyeglasses using the AR function. Then they were asked to take a screenshot of themselves wearing a pair of glasses selected using the AR feature and submit the picture through the survey link to verify that they experienced the AR function on the app. The participants assigned to the mobile website without AR were asked to browse the website to shop for a desirable pair of eyeglasses. Then they were asked to take a screenshot of the glasses they preferred and submit the picture through the survey link.

After submitting the picture, participants were directed to the main survey questionnaire link. Those who did not upload relevant pictures were excluded from the main data analysis. Several previous AR studies employed existing retailers' mobile apps that had AR features for their empirical studies (e.g., Smink et al., 2020; Watson et al. 2020). This study was conducted in accordance with the ethical principles of research in terms of protecting participant confidentiality, obtaining informed consent, anonymity, and minimizing harm. The protocol of the study

Table 1 Profile of respondents (n = 302)

Variable	Category	Number	%
Gender	Male	153	50.7
	Female	149	49.3
Age	20–30	150	49.7
	31–40	152	50.3
Education level	High school	51	16.9
	College	216	71.5
	Graduate school and above	35	11.6
Marital status	Single	202	66.9
	Married	100	33.1
Occupation	Full-time	196	64.8
	Student	67	22.2
	Housewife	18	6
	Self-employed	5	1.7
	Others	16	5.3

was approved by an Institutional Review Board (IRB), and participants' confidentiality and data sharing were strictly maintained throughout the study.

3.2 Instruments

Scales used for the study were from existing literature. Experiential value was adopted from Mathwick et al. (2001)'s study and slightly modified for the AR and mobile site contexts. The original experiential value scale includes seven dimensions: visual appeal, entertainment, escapism, enjoyment, service excellence, efficiency, and economic value. Since the current study focuses on hedonic experiential values attained through users' interaction with AR, the service excellence and economic value dimensions tied to utilitarian values that are achieved from task completion were not included. Customer loyalty was measured by a three-item patronage intention scale used in Kwon and Lennon (2009). Task complexity was adapted from Gupta et al. (2013)'s study, revised for the AR and website contexts, and measured with three items. All items were measured on a seven-point Likert-type scale; previous research reported appropriate reliabilities (Cronbach's alphas were greater than 0.70).

The original scales were composed in English. For use in this study, the scales were translated into Korean by a professional translation service and then assessed for accuracy of the translation by two of the researchers. Afterward, two bilingual experts in the retailing field pre-tested the scales for precision and correctness.

4 Results

4.1 Participant characteristics

A total of 302 usable respondents (AR condition: 149; non-AR condition: 153) participated in the study (M = 50.7%; F = 49.3%; Mean age = 30.04). The survey was similarly disseminated agewise among 20 s (49.7%) and 30 s (50.3%). Most of the respondents were college-educated (71.5%), 11.6% had a post graduate education level, and 16.9% had a high school education level. Approximately 67% of the respondents were single and about two thirds reported working full-time (see Table 1).

4.2 Confirmatory factor analyses

To assess the factor structure of the five-dimension experiential value and to verify the extent to which items making up each construct hold the same structure as the original seven-dimension experiential value scale, a confirmatory factor analysis (CFA) using AMOS 23 was conducted. The measurement model fit well to the data: $\chi^2(106) = 249.35$, $p < 0.001$, GFI = 0.91, AGFI = 0.87, NFI = 0.93, TLI = 0.95, CFI = 0.96, RMSEA = 0.07. The measurement model is closely equivalent to the original experiential value scale proposed by Mathwick et al. (2001) except for the visual appeal and entertainment dimensions. The visual appeal and entertainment dimensions were combined into one factor and labeled aesthetics. Thus, the final experiential values used for the current study include four dimensions: aesthetics, escapism, enjoyment, and efficiency (see Table 2). Aesthetics is related to perceived visual appeal and entertainment delivered through the mobile website and app. Escapism is associated with the feeling of a temporary escape from daily life and reality. Enjoyment addresses intrinsic playfulness derived from engaging in shopping activities. Efficiency addresses the effectiveness of the mobile website or app experience in exchange time and effort invested.

All factor loadings ranged from 0.60 to. 96. The critical ratio (C. R.) values of the factor loadings revealed that convergent validity was satisfied. Reliability was achieved because all Cronbach's alpha values were higher than 0.7. In addition, average variance extracted (AVE) values were higher than squared correlations values and above 0.5 indicating discriminant validity (see Table 3).

4.3 Hypotheses testing

To test the proposed hypotheses, the PROCESS macro for SPSS was used. The PROCESS macro has several advantages including a robustness against violation of normal

distribution (Schaarschmidt and Stol 2018), the use of multiple intermediating variables simultaneously, and output options for visualizing and proving an interaction (e.g., Gebre and Taylor 2022; Yucel and Fan 2023). It allows for the examination of the relationships among independent, intermediating, and outcome variables concurrently when there are multiple intermediating variables, as in the current study (Yucel and Fan 2023). Therefore, the program makes it easier to assess the effect of the four experiential values in between AR presentation mode and customer loyalty, not just the direct effects of AR on experiential value. According to Hayes et al. (2017), PROCESS and SEM calculation yield similar results.

Relationships among product presentation methods, experiential value, and customer loyalty (H1 and H2). To test hypotheses 1 and 2, the PROCESS Macro Model 4 (bootstrap $N = 10,000$) suggested by Hayes (2013) was employed. The results revealed that mobile commerce shoppers exposed to product presentation with AR functions showed significantly higher scores on all factors of experiential values than those exposed to product presentation without AR functions. As compared to product presentation without AR functions, product presentation with AR functions was estimated to differ by 0.93 unites (β_1) in perceived aesthetics [$t = 9.27$, $p < 0.001$, 95% CI (0.731, 1.126)], by 0.49 units (β_2) in perceived escapism [$t = 3.82$, $p < 0.001$, 95% CI (0.238, 0.745)], by 0.35 units (β_3) in perceived enjoyment [$t = 2.57$, $p < 0.05$, 95% CI (0.082, 0.619)], and by 0.52 units (β_4) in perceived efficiency [$t = 4.16$, $p < 0.001$, 95% CI (0.275, 0.769)]. Therefore, H1 was supported (see Fig. 2). The results also revealed the positive effects of perceived experiential value on customer loyalty: perceived aesthetics [$\beta_5 = .36$, $t = 5.56$, $p < 0.001$, 95% CI (0.223, 0.491)], perceived escapism [$\beta_6 = 0.20$, $t = 3.50$, $p < 0.001$, 95% CI (0.087, 0.309)], perceived enjoyment [$\beta_7 = 0.12$, $t = 2.50$, $p < 0.05$, 95% CI (0.025, 0.207)], and perceived efficiency [$\beta_8 = 0.20$, $t = 3.75$, $p < 0.001$, 95% CI (0.093, 0.300)] all positively influenced customer loyalty. Therefore, H2 was supported (see Fig. 2).

The PROCESS Macro output additionally displays the mediating roles of perceive experiential values on the relationship between product presentation methods and customer loyalty. The results show positive mediating roles of perceived aesthetics [indirect effect = . 33, SE = 0.08, 95% CI (0.178, 0.501)], perceived escapism [indirect effect = 0.10, SE = 0.04, 95% CI (0.025, 0.188)], perceived enjoyment [indirect effect = 0.04, SE = 0.08, 95% CI (0.001, 0.101)], and perceived efficiency [indirect effect = 0.10, SE = 0.04, 95% CI (0.035, 0.194)] on the relationship between product presentation methods and customer loyalty. That is, as compared to mobile shoppers exposed to product presentation without AR functions, shoppers exposed to AR functions showed greater levels of esthetics, escapism, enjoyment,

Table 2 CFA results

	Standardized factor loadings	C.R	Cronbach's α
Aesthetics			.89
(AE1) The way the mobile app embedded with AR features/the mobile website displays products is attractive	.60	10.92	
(AE2) The method of product presentation in the mobile app embedded with AR features/the mobile website is aesthetically pleasing	.66	12.19	
(AE3) I like the way the product presentation looks	.71	13.70	
(AE4) I think the product presentation method in the mobile app embedded with AR features/the mobile website is very entertaining	.78	15.39	
(AE5) The feel of the product presentation method in the mobile app embedded with AR features/the mobile website is engaging, it energizes me	.83	16.89	
(AE6) The mobile app embedded with AR features/the mobile website does not just sell products, it entertains me	.83	17.01	
Escapism			.84
(ES1) Shopping using the product presentation method in the mobile app embedded with AR features/the mobile website "gets me away from it all."	.74	14.31	
(ES2) Shopping using the product presentation method in the mobile app embedded with AR features/the mobile website makes me feel like I am in another world	.78	15.44	
(ES3) I get so involved when I shop using the product presentation method in the mobile app embedded with AR features/the mobile website that I forget everything	.90	18.89	
Enjoyment			.78
(EN1) I enjoy shopping using the product presentation method in the mobile app embedded with AR features/the mobile website for the sake of it, not just for the items I may purchase	.80	13.51	
(EN2) I shop using the product presentation method in the mobile app embedded with AR features/the mobile website for the pure enjoyment of it	.79	13.29	
Efficiency			.84
(EF1) Shopping using the product presentation method in the mobile app embedded with AR features/the mobile website is an efficient way to manage my time	.69	13.05	
(EF2) Shopping using the product presentation method from the mobile app embedded with AR features/the mobile website makes my life easier	.86	17.70	
(EF3) Shopping using the product presentation method in the mobile app embedded with AR features/the mobile website fits with my schedule	.87	18.00	
Loyalty			.96
I will patronage the mobile app embedded with AR features/the mobile website in the future			
(LY1) Unlikely/likely	.92	20.89	
(LY2) Improbably/probably	.96	22.56	
(LY3) Not possible/possible	.94	21.59	

$\chi^2(106) = 249.35$, $p < .001$, GFI = .91, AGFI = .87, NFI = .93, TLI = .95, CFI = .96, RMSEA = .07

Table 3 Mean, SD, and discriminant validity

	Mean	SD	Aesthetics	Escapism	Enjoyment	Efficiency	Loyalty
Aesthetics	5.29	.99	**.55**				
Escapism	4.55	1.14	.55[a]/.31[b]	**.66**			
Enjoyment	4.60	1.20	.40[a]/.16[b]	.46[a]/.23[b]	**0.64**		
Efficiency	4.83	1.12	.49[a]/.24[b]	.52[a]/.27[b]	.30[a]/.09[b]	**.66**	
Loyalty	4.93	1.14	.61[a]/.37[b]	.55[a]/.30[b]	.41[a]/.17[b]	.51[a]/.26[b]	**.89**

Diagonal values in bold represent the AVE

[a]Correlations of variables/[b]Squared correlations of variables
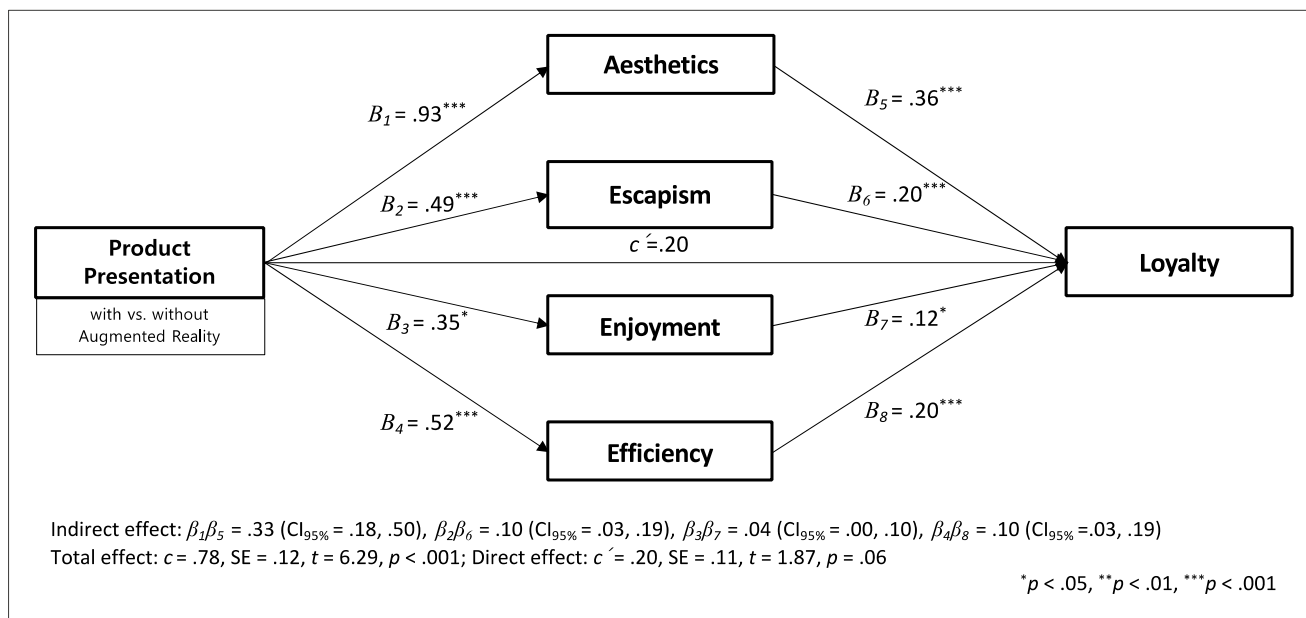
Fig. 2 PROCESS macro results (Hypotheses 1 and 2)

and efficiency which in turn resulted in increased customer loyalty (see Fig. 2).

Moderating effect of task complexity (H3). To test the moderating role of task complexity on the effect of product presentation method on experiential value, SPSS PROCESS Macro Model 7 (bootstrap $N = 10,000$) (Hayes, 2013) was utilized. Task complexity was divided into three levels, low (16th percentile $= 2.00$), medium (50th percentile $= 3.00$), and high (84th percentile $= 5.00$) by applying the pick-a-point approach. The pick-a-point approach involves plotting and testing the conditional effect of X on Y at designated levels of the moderating variable (i.e., low, medium, and high) (Bauer and Curran 2005; Chen 2019). This approach is the most popular post hoc probing technique for three-way interactions (Cao and Yang 2020). The PROCESS Macro for SPSS automatically implements the pick-a-pint approach to probing the moderation and the regions of significance (Hayes 2017).

The PROCESS results revealed that (1) the effect of product presentation with an AR function (over product presentation without an AR function) on perceived escapism was significant at low [$\beta = 0.82$, $t = 4.57$, $p < 0.001$, 95% CI (0.474, 1.191)] and medium [$\beta = 0.59$, $t = 4.43$, $p < 0.001$, 95% CI (0.328, 0.854)] levels of task complexity, but not at the high level of task complexity [$\beta = 0.11$, $t = 0.54$, $p = 0.59$, 95% CI (-0.287, 0.506)] and (2) the effect of product presentation with an AR function (over product presentation without an AR function) on perceived efficiency was significant at low [$\beta = 0.80$, $t = 4.51$, $p < 0.001$, 95% CI (0.453, 1.155)] and medium [$\beta = 0.60$, $t = 4.59$, $p < 0.001$, 95% CI (0.344, 0.859)] levels of task complexity, but not at the high

level of task complexity [$\beta = 0.20$, $t = 0.99$, $p = 0.32$, 95% CI (-0.193, 0.583)]. The results also revealed that the indirect effect of product presentation on customer loyalty through perceived escapism and perceived efficiency were moderated by task complexity because the indices of moderated-mediation were significant [$\beta_{escapism} = -0.05$, $SE = 0.03$, 95% CI (-0.107, -0.005); $\beta_{efficiency} = -0.04$, $SE = 0.02$, 95% CI (-0.089, -0.004)]. However, task complexity did not moderate (1) the effect of product presentation methods on perceived aesthetics and perceived enjoyment and (2) the indirect effect of product presentation on customer loyalty through perceived aesthetics and perceived enjoyment. That is, when perceived task complexity was in the low to medium range, the mobile app with an AR feature was more strongly related to escapism and efficiency than the mobile website without AR, which in turn influenced customer loyalty. However, when the perceived task complexity was high, no differences between the mobile app with an AR feature and the mobile website without AR in impacting escapism and efficiency were found. Thus, H3 was partially supported. Figure 3 shows interaction plots for the moderating effect of task complexity between product presentation and escapism and between product presentation and efficiency.

5 Conclusions and implications

By utilizing Mathwick et al. (2001)'s experiential value scale, this study examined if shopping via an AR mobile app provides greater experiential values compared to shopping via a general mobile website without AR. The four
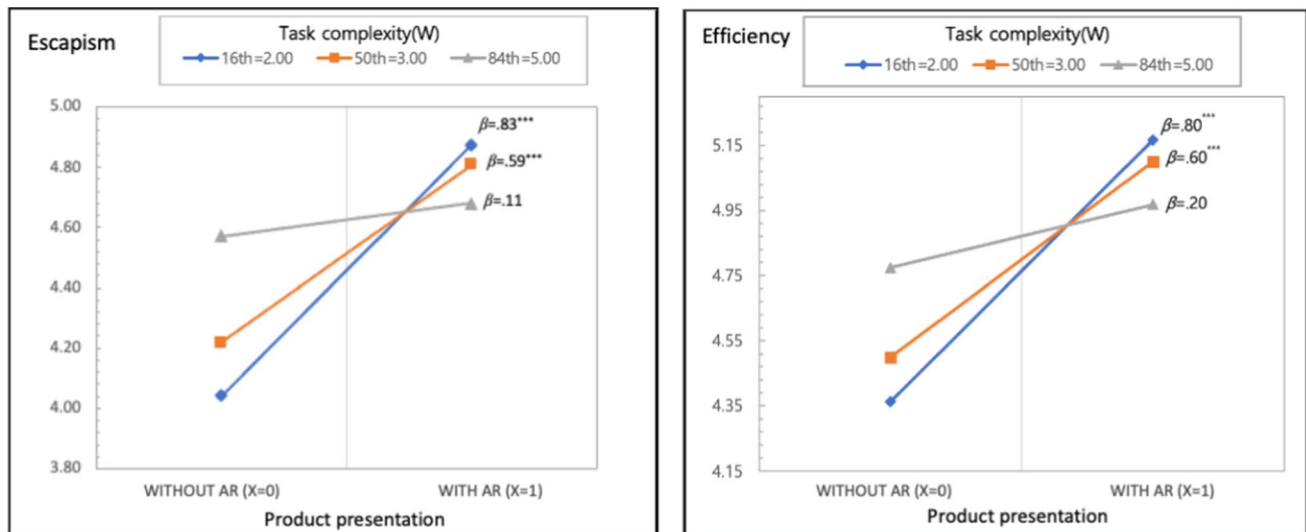
Fig. 3 Interaction plot for the moderating role of task complexity (hypothesis 3)

experiential values employed for the study were aesthetics, escapism, enjoyment, and efficiency. The moderating effect of task complexity between the two presentation methods and the four experiential values were further investigated.

The findings of the study prove that an AR feature positively influences all four experiential values. Shoppers exposed to an AR function on an eyewear mobile app perceived greater aesthetics than those exposed to a general eyewear mobile site without an AR function. Compared to a general non-AR eyewear mobile site, an AR-embedded eyewear mobile app enabled consumers to engage with a product and thus helped them better visualize the appearance of a product with detailed product features such as shape, color, and texture. This unique attractive interface with AR makes the users' shopping experience more visually appealing and entertaining. According to previous research, AR increases consumer sensory perceptions by blending virtual worlds with reality (Watson et al. 2020). This exceptional augmentation ability of AR brings more aesthetic enjoyment to consumers (Milgram et al., 1994; Watson et al. 2020). Also, shoppers exposed to an AR-powered eyewear mobile app perceived greater escapism than those exposed to a non-AR mobile site. AR technology creates a multisensory flow experience (i.e., the creation of a sense of touch) in the immersive environment (Huang and Liao, 2017). AR's ability to create flow enables consumers to feel that they are located within the virtual image (Watson et al. 2020). This immersive shopping experience further makes consumers imagine that they are consuming the product at a desired place (Zarantonello and Schmitt 2023) or feel as if they are in another world escaping from their mundane everyday life (Verhagen et al. 2011). Moreover, compared to shoppers exposed to a non-AR mobile site, shoppers exposed

to a mobile app using AR showed greater enjoyment and efficiency. Since AR allows consumers to modify the virtual object to fit in the physical environment, the consumers transition from spectators to active participants (i.e., co-producers of value) (Mathwick et al., 2001). This role shift brings playful intrinsic enjoyment to consumers. Also, AR allows consumers to overlay products virtually onto the actual physical environment in real time using their own digital devices to have a clearer idea of how the product would look, feel, and/or perform. Therefore, the AR shopping experience provides better financial and temporal efficiency.

The findings of the current study also support the influence of the four experiential values on customer loyalty. Compared to shoppers exposed to a general non-AR mobile site, shoppers exposed to a mobile app with AR showed greater experiential value which eventually influenced customer loyalty. These results suggest that retailers need to see AR as more than a functional tool and consider it as a must for a mobile app to provide fun and engaging interaction for consumers and build a strong long-term relationship with them.

An additional notable result of the study is that task complexity modifies the effects of AR on consumers' perceived escapism and efficiency experiential values. When consumers perceive AR operation task as low or medium complex, browsing products using AR generates greater escapism and efficiency than browsing products via a general non-AR mobile website. However, such a relationship was not found for high task complexity. When consumers perceive AR operation task as highly complex, they might not feel that an AR feature is efficient or gives an escapism shopping experience. According to a recent report, most U.S. adults have not used AR (Laningham 2022). Unfamiliarity with the

technology may increase perceived task complexity (Chen and Koufaris 2020) and make consumers hesitate to use the app or end up having a poor user experience and fail to see the benefits of AR (Wedel et al. 2020). According to previous task complexity related research, unfamiliarity with the usage of a device requires more cognitive effort in learning and may eventually lead to emotional anxiety (Chen and Koufaris 2020). Successively, the emotional pressure may drain a user's mental workload (Teunissen et al. 2007) and increase the perceived complexity of the device use (Chen and Koufaris 2020). To reduce unfamiliarity and hesitation, retailers can implement AR technology in their physical stores and train sales associates to help customers become familiar with AR and see its advantages. Another solution to lower consumers' perceived task complexity is to post a short tutorial video of how to use AR on the mobile app.

As digital technologies play an increasingly significant role in today's world, AR has become a popular research topic in diverse fields such as medicine, education, automotive industry, tourism, and healthcare (Boboc et al. 2022). However, most AR studies focused on its functional/technological benefits (Caboni and Hagberg 2019) and employed the application of AR from technology innovation and acceptance behavior perspectives. The experiential and hedonic aspects of consumer consumption that originated from Holbrook and Hirschman (1982) have been emphasized for many years, yet the hedonic aspects of AR and/or fun and enjoyment connected with AR have been overlooked. A notable contribution of this study is that the findings ascertain the experiential value of AR and its numerous hedonic benefits to the end users. The experiential and hedonic aspects of AR are expected to be applied in other research fields to understand its benefits comprehensively and generalize the findings of the current research to different fields.

5.1 Practical implications

Retail is evolving at a rapid pace due to advances in technology, and accordingly these technological advancements have changed consumer behaviors dramatically (Grewal et al. 2017). In today's digital world, retailers need to pay close attention to how they efficiently utilize various technologies such as AR to provide superior experiential shopping experiences and eventually make a strong connection with customers. Today consumers do not simply visit shopping sites for utilitarian basic needs. They also look for memorable and enjoyable experiential shopping experiences (SMS Strategies 2022). Any platform or touchpoint retailers utilize to engage with consumers should be experience-focused, and the experience that consumers encounter should be fun, exciting, and enjoyable.

According to a recent book written by Kotler et al. (2021), in today's marketing the application of technological

innovation is not to improve a product or service but to provide values to customers in order to engage with them and secure customer retention. Retailers need to be attentive in recognizing how they apply AR mobile apps to enhance consumer shopping experiences and create value for customers. As the current study shows, AR-enhanced mobile apps can provide massive positive shopping experiences to consumers by providing enhanced sensory visual appeal, excitement, enjoyable, and effective shopping experiences. These hedonic positive experiences help retailers build long term relationships with customers. Some retailers have already implemented AR as a fun and exciting experiential tool that provides hedonic experiences. For instance, ZARA introduced an AR app to provide memorable fun experiences to their customers. Zara customers can download the Zara app into their mobile phones and simply point their phones at the shop windows or a package delivery. Then they can see different AR images of real international fashion models wearing Zara's latest collection. Customers can purchase the collection from the app (WBR Insights 2022). Another example is Burberry's AR pop-up store. In early 2021, Burberry held a pop-up store in Harrods, London to offer an AR immersive experience to its customers by allowing them to see various statues and have the world of Olympia come to life around them through AR in alignment with the celebration of the brand's signature Olympia bag (8th Wall 2021). The brand also assisted consumers to order a limited-edition collection of the bags through AR (Fashion Network 2021). An additional example is the online fashion brand BoohooMan's AR campaign for Black Friday (Zarantonello and Schmitt 2023). The brand embedded an AR QR code on billboards and fly posters. The AR QR code offered a thrilling experience where a hacker "Robin" comes to life and provides high percentage discounts that customers could use with the brand's on-site promotions (The Industry Fashion 2021). These AR embedded experiences are superb examples of how AR technology can be used as an experiential value tool.

Providing thrilling experiential values to the users through AR need not be limited to retailing. Fun and enjoyable multisensory and psychophysical characteristics can be considered in the development of an AR app for education, training, health care, tourism, etc. For instance, visually appealing AR content can help patients understand the procedures of a surgery more clearly. People can check their wellness tracking statistics and weather reports through high quality 3D AR graphics (Future Business Tech 2022; IBM, n.d.). Furthermore, with the advancement in technologies, gamification becomes an important element in many areas to improve engagement, participation, and to motivate student learning. The use of AR in combination with gamification can be another way to enhance consumer experiential values and provide meaningful and memorable experiences.

Several research studies indicated that AR will play a critical role in the future of retail (e.g., Grewal et al. 2017; Watson et al. 2020) by adding enormous value to the consumer shopping journey (Harvard Business Review, 2020). An imperative matter that retailers should consider when implementing AR as an experiential value is their target customers' perception about AR task complexity. If customers feel that AR task is too complex and browsing products using AR is bothersome then the experience might negatively impact their loyalty to the brand. AR application designers and developers need to anticipate users' desire for simplification of an AR experience. For instance, the requirement of multiple enlarging and diminishing a virtual object to fit the real environment can be simplified by designing the application to respond to a simple tap at each end of the object when it marches the real environment then AR will automatically adjust the size and fit of the virtual object.

5.2 Limitations and suggestions for future research

This study has several limitations. First, the study employed young consumers in their 20 s and 30 s. Considering *statista* report (2021) which stated that millennials aged 24–34 are the largest group of digital buyers, the respondents employed for the current study are deemed to be suitable target customers, but the results cannot be generalized to different age groups. Therefore, to improve the generalizability of the findings, a wider population should be considered in future studies. Examining the moderating effect of task complexity by incorporating a larger population sample with more age variety as a further study would provide a comprehensive understanding of how AR and its operation complexity impact consumers' experiential values across different age groups. Second, in this study, the impact of AR on experiential value was investigated in the context of eyewear. According to a recent report (Owens 2022), consumers prefer to shop from sites that include AR technology. Considering this fact, it is expected that more and more retailers will implement this technology to satisfy consumers. To fully understand the experiential value of AR, future AR research should be employed in various environments. Third, the translation of the original scale into another language should be addressed as another limitation. In this study, the original scales written in English were translated into Korean and checked by experts for translation precision and correctness. According to previous research, translation might alter the meaning of the items and impact the result of CFA (e.g., Fenn et al., 2020). To ensure the validity and reliability of the measures used for the study, it is recommended that a future study re-evaluates the proposed model with the original scale.

References

BairesDev (n.d.) A thorough introduction to the Metaverse, AR, and VR as disruptive technologies. https://www.bairesdev.com/blog/metaverse-ar-vr-as-disruptive-technologies/. Accessed 11 May 2023.

Bauer DJ, Curran PJ (2005) Probing interactions in fixed and multi-level regression: inferential and graphical techniques. Multivar Behav Res 40(3):373–400. https://doi.org/10.1207/s15327906mbr4003_5

Bejjanki VR, Randrup ER, Aslin RN (2020) Young children combine sensory cues with learned information in a statistically efficient manner: but task complexity matters. Dev Sci 23(3):1–13. https://doi.org/10.1111/desc.12912

Berman B, Pollack D (2021) Strategies for the successful implementation of augmented reality. Bus Horiz 64(5):621–630

Boboc RG, Bắutu E, Gîrbacia F, Popovici N, Popovici D-M (2022) Augmented reality in cultural heritage: an overview of the last decade of applications. Appl Sci 12(19):9859. https://doi.org/10.3390/app12199859

Caboni F, Hagberg J (2019) Augmented reality in retailing: a review of features, applications and value. Int J Retail Distrib Manag 47(11):1125–1140

Campbell DJ (1988) Task complexity: a review and analysis. Acad Manag Rev 13(1):40–52. https://doi.org/10.2307/258353

Cao Y, Yang F (2020) Objective and subjective dementia caregiving burden: the moderating role of immanent justice reasoning and social support. Int J Environ Res Public Health 17(2):455. https://doi.org/10.3390/ijerph17020455

Chandra S, Kumar KN (2018) exploring factors influencing organizational adoption of augmented reality in E-commerce: empirical analysis using technology-organization- environment model. J Electron Commer Res 19(3):237–265

Chen S (2019) Chinese adolescents'' emotional intelligence, perceived social support, and resilience-The impact of school type selection. Front Psychol 11:1–11

Chen C-W, Koufaris M (2020) "Multi-device use: understanding the motivations behind switching between multiple devices during a task. Int J Hum Comput Interact 36(12):1178–1193

Chen R, Perry P, Boardman R, McCormick H (2022) Augmented reality in retail: a systematic review of research foci and future research agenda. Int J Retail Distrib Manag 50(4):498–518

Chiu CL, Ho H-C, Yu T, Liu Y, Mo Y (2021) Exploring information technology success of augmented reality retail applications in retail food chain. J Retail Consum Serv. https://doi.org/10.1016/j.jretconser.2021.102561

Dacko SG (2017) Enabling smart retail settings via mobile augmented reality shopping apps. Technol Forecast Soc Chang 124:243–256

Dhar P, Rocks T, Samarasinghe RM, Stephenson G, Smith C (2021) Augmented reality in medical education: students' experiences and learning outcomes. Med Educ Online 26(1):1953953. https://doi.org/10.1080/10872981.2021.1953953

Echchakoui S (2016) Relationship between sales force reputation and customer behavior: role of experiential value added by sales force. J Retail Consum Serv 28:54–66

Econsultancy (2021) 14 examples of augmented reality brand experiences. https://econsultancy.com/14-examples-augmented-reality-brand-marketing-experiences/. Accessed 15 April 2023

8th Wall (2021) Burberry invites customers into the world of Olympia with its latest augmented reality experience. https://www.8thwall.com/blog/post/46456311639/burberry-invites-customers-into-the-world-of-olympia-with-its-latest-augmented-reality-experience. Accessed 7 June 2023

Fan X, Chai Z, Deng N, Dong X (2020) Adoption of augmented reality in online retailing and consumers' product attitude: a cognitive perspective. J Retail Consum Serv. https://doi.org/10.1016/j.jretconser.2019.101986

Fashion Network (2021) Burberry launches international opo-ups for Olympia bag, starts with Harrods. https://ww.fashionnetwork.com/news/Burberry-launches-international-pop-ups-for-olympia-bag-starts-with-harrods,1300356.html. Accessed 7 June 2023

Flint DJ (2006) Innovation, symbolic interaction and customer valuing: thoughts stemming from a service-dominant logic of marketing. Mark Theory 6(3):349–362. https://doi.org/10.1177/1470593106066796

Frank JB (1994) Designing the user interface: considering the concept of complexity. University of New Mexico, Albuquerque

Future Business Tech (2022) The future of augmented reality: 10 awesome use cases. https://www.futurebusinesstech.com/blog/future-of-augmented-reality-10-awesome-use-cases. Accessed 25 May 2023

Gebre A, Taylor RD (2022) The association between facebook use and student involvement: the moderating role of shyness. J Stud Aff Res Pract 59(1):1–15. https://doi.org/10.1080/19496591.2020.1784749

Global Economics (2021) South Korea is now a key player in VR with the 'metaverse' launch. https://www.theglobaleconomics.com/2021/07/14/south-korea/. Accessed 10 June 2022

Grewal D, Roggeveen AL, Nordfält J (2017) The future of retailing. J Retail 93:1–6

Gupta A, Li H, Sharda R (2013) Should I send this message? Understanding the impact of interruptions, social hierarchy and perceived task complexity on user performance and perceived workload. Decis Support Syst 55(1):135–145

Harvard Business Journal (2020) How AR is redefining retail in the pandemic. https://hbr.org/2020/10/how-ar-is-redefining-retail-in-the-pandemic. Accessed 24 Jan 2022

Hayes AF (2017) Hacking PROCESS for estimation and probing of linear moderation of quadratic effects and quadratic moderation of linear effects. file:///Users/jhkim/Downloads/quadratichack%20(1).pdf. Accessed 1 June 2023

Hayes AF, Montoya AK, Rockwood NJ (2017) The analysis of mechanisms and their contingencies: PROCESS versus structural equation modeling. Aus Market Journal 25(1):76–81

Hilken T, Chylinski M, Keeling DI, Heller J, Ruyter K, Mahr D (2022) How to strategically choose or combine augmented and virtual reality for improved online experiential retailing. Psychol Mark 39(3):495–507. https://doi.org/10.1002/mar.21600

Hoffmann S, Joerß T, Mai R, Akbar P (2022) Augmented reality-delivered product information at the point of sale: when information controllability backfires. J Acad Mark Sci 50(4):743–776

Holbrook MB (1996) Customer value—a framework for analysis and research. Adv Consum Res 23(1):138–142

Holbrook MB, Hirschman EC (1982) The experiential aspects of consumption: consumer fantasies, feelings, and fun. J Consum Res 9(2):132–140. https://doi.org/10.1086/208906

Huang T-L, Liao S-L (2017) Creating e-shopping multisensory flow experience through augmented-reality interactive technology. Internet Res 27(2):449–475. https://doi.org/10.1108/intr-11-2015-0321

Huang H, Rau P-LP, Ma L (2021) Will you listen to a robot? Effects of robot ability, task complexity, and risk on human decision-making. Adv Robot 35(19):1156–1166

Huang T-L, Liu FH (2014) Formation of augmented-reality interactive technology's persuasive effects from the perspective of experiential value. Internet Res 24(1):82–109

IBM (n.d.) What augmented reality graphics can do for your business. https://www.ibm.com/products/max-reality#:~:text=Augmented%20reality%20can%20be%20used,the%20impact%20and%20stay%20engaged. Accessed 30 Aug 2023

Jeong SW, Fiore AM, Niehm LS, Lorenz FO (2009) The role of experiential value in online shopping: the impacts of product presentation on consumer responses towards an apparel web site. Internet Res 19(1):105–124

Jiang Z, Benbasat I (2007) The effects of presentation formats and task complexity on online consumers' product understanding. MIS Q 31(3):475–500

Kim J-H, Kim M (2020) Conceptualization and assessment of e-service quality for luxury brands. Serv Ind J 40(5–6):436–470

Kim J-H, Kim M, Park M, Yoo J (2023) Immersive interactive technologies and virtual shopping experience: differences in consumer perceptions between augmented reality (AR) and virtual reality (VR). Telemat Inform 77:101936

Koebele SV, Quihuis AM, Lavery CN, Plumley ZMT, Castaneda AJ, Bimonte NHA (2021) Oestrogen treatment modulates the impact of cognitive experience and task complexity on memory in middle-aged surgically menopausal rats. J Neuroendocrinol 33(9):1–18. https://doi.org/10.1111/jne.13002

Kotler P, Pfoertsch W, Sponholz U (2021) H2h marketing: the genesis of human-to-human marketing. Springer, Berlin

Koumaditis K, Chinello F, Mitkidis P, Karg S (2020) Effectiveness of virtual versus physical training: the case of assembly tasks, trainer's verbal assistance, and task complexity. IEEE Comput Graph Appl 40(5):41–56. https://doi.org/10.1109/MCG.2020.3006330

Kumar H (2021a) Augmented reality in online retailing: a systematic review and research agenda. Int J Retail Distrib Manag. https://doi.org/10.1108/IJRDM-06-2021-0287

Kumar TS (2021b) Study of retail application with virtual and augmented reality technologies. J Innov Image Process 3(2):144–156

Kwon WS, Lennon SJ (2009) What induces online loyalty? Online versus offline brand images. J Bus Res 62:557–564

Laningham A (2022) Americans are interested in AR, VR, and the metaverse. The Harris Poll, available at https://theharrispoll.com/briefs/future-of-ar-vr-metaverse/. Accessed 1 June 2023

Li H, Gupta A, Luo X, Warkentin M (2011) Exploring the impact of instant messaging on subjective task complexity and user satisfaction. Eur J Inf Syst 20(2):139–155. https://doi.org/10.1057/ejis.2010.59

Mathwick C, Malhotra N, Rigdon E (2001) Experiential value: conceptualization, measurement and application in the catalog and Internet shopping environment. J Retail 77(1):39–56

Men C, Jia R (2021) Knowledge-oriented leadership, team learning and team creativity: the roles of task interdependence and task complexity. Leadersh Org Dev J 42(6):882–898

Milgram P, Takemura H, Utsumi A, Kishino F (1994) Augmented reality: a class of displays on the reality-virtuality continuum. Telemanip. Telepresence Technol. 2351:282–292. https://doi.org/10.1117/12.197321

Norris CL, Russen M, Taylor S Jr (2023) Expanding the experiential value scale to predict independent restaurant dining intent. J Hosp Tour Insights 6(2):613–631

Owens B (2022) Augmented reality (AR) in e-commerce and retail: What's next for brands?. Ryderecommerce, https://whiplash.com/blog/augmented-reality-in-ecommerce/#:~:text=Over%20half%20of%20consumers%20(61,have%20been%20quick%20to%20adopt. Accessed 11 June 2022

Ozturkcan S (2021) Service innovation: using augmented reality in the IKEA Place app. J Inform Technol Teach Cases 11(1):8–13

Paine J (2023) 10 real use cases for augmented reality. Inc., https://www.inc.com/james-paine/10-real-use-cases-for-augmented-reality.html. Accessed 13 May 2023

Papagiannis H (2020) How AR is redefining retail in the pandemic In: Harvard business review, https://hbr.org/2020/10/how-ar-is-redefining-retail-in-the-pandemic. Accessed 24 Jan 2022

Park H, Lim H, Kim Y-K (2013) Experiential value: application to innovative consumer technology products. J Cust Behav 12(1):7–24

Park S, Bokijonov S, Choi Y (2021) Review of microsoft HoloLens applications over the past five years. Appl Sci 11(16):7259. https://doi.org/10.3390/app11167259

Peters K (2005) Anthropologie uses rich media to build customer relationships. Digitalcommerce 360, https://www.digitalcommerce360.com/2005/06/09/anthropologie-uses-rich-media-to-build-customer-relationships/. Accessed 12 Dec 2021

Poushneh A, Vasquez-Parraga AZ (2017) Discernible impact of augmented reality on retail customer's experience, satisfaction and willingness to buy. J Retail Consum Serv 34:229–234

RetailDive (2022) 3 disruptive retail trends, and why retailers must adapt. https://www.retaildive.com/spons/3-disruptive-retail-trends-and-why-retailers-must-adapt/631755/. Accessed 9 May 9 2023

Sasangohar F, Ade N, Quddus N, Peres SC, Kannan P (2021) Identifying step-level complexity in procedures: Integration of natural language processing into the complexity index for procedures—step level (CIPS). Int J Ind Ergon 85:103184

Savelli E, Cioppi M, Tombari F (2017) Web atmospherics as drivers of shopping centres' customer loyalty. Int J Retail Distrib Manag 45(11):1213–1240

Schaarschmidt M Stol K-J (2018) Company soldiers and gone-natives: role conflict and career ambition among firm-employed open source developers. Forthcoming conference, ICIS 2018, San Francisco, 13–16 December

Schultz B (2020) VR, AR, and MR will be the most disruptive technologies of the next decade. Construction Technology, https://www.forconstructionpros.com/construction-technology/news/21205827/idtechex-vr-ar-and-mr-will-be-the-most-disruptive-technologies-of-the-next-decade. Accessed 1 May 1 2023

Smink AR, van Reijmersdal EA, van Noort G, Neijens PC (2020) Shopping in augmented reality: the effects of spatial presence, personalization and intrusiveness on app and brand responses. J Bus Res 118:474–485. https://doi.org/10.1016/j.jbusres.2020.07.018

SMS Strategies (2022) Is gamification the key to delivering entertaining shopping experiences? https://www.attentivemobile.com/blog/gamification-and-entertaining-shopping-experiences. Accessed 7 July 2022

Statista (2021) U.S. digital buyer distribution 2020, by age group https://www.statista.com/statistics/469184/us-digital-buyer-share-age-group/. Accessed 24 June 2022.

Statista (2022) "Mobile augmented reality (AR) market revenue worldwide from 2021 to 2026". https://www.statista.com/outlook/amo/ar-vr/ar-software/united-states. Accessed 21 April 2023

Sun T, Kim J-E (2022) The effects of online learning and task complexity on students' procrastination and academic performance. Int J Hum Comput Interact. https://doi.org/10.1080/10447318.2022.2083462

Sweller J (2011) Cognitive load theory. Psychol Learn Motiv 55:37–76

Swait J, Adamowicz W (2001) The influence of task complexity on consumer choice: a latent class model of decision strategy switching. J Consum Res 28(1):135–148. https://doi.org/10.1086/321952

Switzerland Global Enterprise (2019) "Korea: rapidly evolving VR, AR, and AI technologies in the home shopping industry". https://www.s-ge.com/en/article/global-opportunities/20191-cs-korea-home-shopping-iudustry. Accessed 10 May 2022

Tan Y-C, Chandukala SR, Reddy SK (2021) Augmented reality in retail and its impact on sales. J Mark 1–19. https://doi.org/10.1177/0022242921995449

Tan Y-C, Chandukala SR, Reddy KR (2022) Augmented reality in retail and its impact on sales. J Mark 86(1):48–66

Tang F (2020) The more interactivity the better? Investigating interactivity, task complexity, and product knowledge in online purchase decisions. Inf Technol Manage 21(3):179–189

Teunissen S, De Graeff A, Voest E, de Haes J (2007) Are anxiety and depressed mood related to physical symptom burden? A study in hospitalized advanced cancer patients. Palliat Med 21(4):341–346

The Korea Herald (2021) S. Korea tops list of world's most innovative countries. https://www.koreaherald.com/view.php?ud=20210203000994. Accessed 15 June 2022

The Industry Fashion (2021) BoohooMAN unveils first augmented reality campaign for Black Friday. https://www.theindustry.fashion/boohooman-unveils-first-augmented-reality-campaign-for-black-friday/. Accessed 12 Nov 2022

Todd P, Benbasat I (1999) Evaluating the impact of DSS, cognitive effort, and incentives on strategy selection. Inf Syst Res 10(4):356–374

Tremblay M, Rethans J, Dolmans D (2023) Task complexity and cognitive load in simulation-based education: a randomised trial. Med Educ 57(2):161–169. https://doi.org/10.1111/medu.14941

Tremosa L (2023) Beyond AR vs. VR: What is the difference between AR vs. MR vs. VR vs. XR? Interaction Design Foundation. https://www.interaction-design.org/literature/article/beyond-ar-vs-vr-what-is-the-difference-between-ar-vs-mr-vs-vr-vs-xr

Varshneya G, Das G (2017) Experiential value: multi-item scale development and validation. J Retail Consum Serv 34:48–57. https://doi.org/10.1016/j.jretconser.2016.09.010

Verhagen T, Feldberg F, van den Hooff B, Meets S, Merikivi J (2011) Satisfaction with virtual worlds: an integrated model of experiential value. Inform Manag 48:201–207

Volersystems (n.d.) What is the difference between augmented reality vs. virtual reality vs. mixed reality. https://www.volersystems.com/blog/what-is-the-difference-between-ar-vr-vs-mr. Accessed 8 May 2023

Watson A, Alexander B, Salavati L (2020) The impact of experiential augmented reality applications on fashion purchase intention. Int J Retail Distrib Manag 48(5):433–451

WBR Insights (2022) Zara's augmented reality app brings virtual models to life in stores. Worldwide Business Research, https://futurestoreseast.wbresearch.com/blog/zara-augmented-reality-app-virtual-model-strategy. Accessed 18 June 2022

Wedel M, Bigné E, Zhang J (2020) Virtual and augmented reality: advancing research in consumer marketing. Int J Res Mark 37(3):443–465. https://doi.org/10.1016/j.ijresmar.2020.04.004

Williams R (2019) Gucci adds AR sneaker try-ons to its mobile app. MarketingDive, https://www.marketingdive.com/news/gucci-adds-ar-sneaker-try-ons-to-its-mobile-app/557838/. Accessed 21 Apr 2023

Yucel D, Fan W (2023) Workplace flexibility, work-family interface, and psychological distress: differences by family caregiving obligations and gender. Appl Res Qual Life. https://doi.org/10.1007/s11482-023-10164-1

Zarantonello L, Schmitt BH (2023) Experiential AR/VR: a consumer and service framework and research agenda. J Serv Manag 34(1):34–55. https://doi.org/10.1108/JOSM-12-2021-0479

Zhou Y (2021) Cognitive requirements of accounting tasks: A task analysis in Chinese vocational school textbooks. wbv Medai GmbH & Company KG, Bielefeld