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How to evoke consumer approach intention toward VR stores? Sequential mediation through telepresence and experiential value

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Abstract

This study explores the roles of vividness and interactivity—two technological dimensions of virtual reality mediums—for consumers' approach intention toward immersive virtual reality stores. In addition to telepresence, a well-established variable in explaining the effectiveness of virtual mediums, this study proposes experiential value as the second mediator that can lead to successful consumer experiences in commercial virtual environments. We recruited 101 volunteers who were willing to experience a virtual reality store with head-mounted displays. The results show that participants who perceive higher vividness and interactivity of an immersive virtual reality store tend to show stronger approach intentions, and that such positive influences are serially mediated by perceived telepresence and experiential shopping value. In multiple-step mediation analysis, the perceived experiential shopping value is found to be the key determinant in evoking consumers' approach intention. The study concludes that virtual reality stores should be built in a way that provides experiential value by utilizing strong telepresence to achieve positive consumers' approach intention. Suggestions for further research and practical applications are also discussed.

Keywords: Immersive virtual reality, Virtual reality store, Vividness, Interactivity, Telepresence, Experiential shopping value, Approach intention

Introduction

VR (abbreviated from virtual reality) has been considered as the “next big computing platform,” (Goldman Sachs 2016) as well as one of the “emerging technologies for business” (Gartner 2017). It has gained rapid popularity in various fields, including the retail industry. With developments in technology, the price of computer-based immersive VR systems, such as Oculus and HTC Vive, has fallen, while affordable mobile-based devices such as Samsung Gear VR and Google Cardboard are available in the market. As consumer accessibility of VR technology has improved, marketers now face the new challenge of developing innovative ways to reach consumers by using VR (Van Kerrebroeck et al. 2017).

The retail industry expects to achieve a quantum leap through the use of VR. While online shopping environments offer high accessibility and a convenient way to

make purchases, the lack of direct experiences has been pointed out as a major limitation. This is especially true of products in the fashion industry, where multisensory experiences play a key role in the evaluation of products (Blázquez 2014; Merle et al. 2012). Fashion products account for almost half the total number of online purchases (Nielsen 2016) and consumers look for integrated experiences across channels (Zhang et al. 2010). VR offers an environment where a perceiver can experience a sense of being physically present (Steuer 1992), and thus, could be an effective means of providing shopping experiences that are consistent across online and offline channels. Global leading companies are actively investing in and supporting the development of VR shopping platforms with the expectation that VR will stimulate consumption by maximizing shopping experiences. However, the impact of the VR environment, as a shopping channel, on consumer response is still unclear.

Several studies have attempted to examine consumer responses to 3D virtual stores developed as prototypes for experiments using desktop computer and monitor display (Lee and Chung 2008; Shin and Shin 2011). However, there are limitations in understanding consumer behavior in the current VR store through the results of past studies. VR stores are far more realistic today than they were 10 years ago. They are currently offered in a form that allows consumers to experience them anywhere, at any time. In addition, VR can be classified into two types, based on the level of immersion: immersive and non-immersive VR (Mills and Noyes 1999). As opposed to the non-immersive VR, which uses a typical flat screen, immersive VR uses HMDs (abbreviated from head-mounted displays) that allow users to enjoy more realistic experiences by completely blocking visibility and synchronizing body movements. Considering that the immersive VR experience has more influence on the user's perception and behavior than the non-immersive experience does (Alshaer et al. 2017; Gorini et al. 2011), shopping experiences may also have a greater impact on consumer behaviors in immersive VR stores than non-immersive ones.

The purpose of this study is to explore consumer responses toward immersive VR stores, by focusing on the role of technological dimensions of media. Vividness and interactivity are the two main features of VR and important determinants of users' virtual experience (Steuer 1992). These two variables play a key role in the formation of telepresence, which is the core concept of VR experience (Schuemie et al. 2001; Steuer 1992). In the present study, we aim to investigate the association among these well-established variables in VR experience, namely, vividness, interactivity, and telepresence, and retail experience variables, so as to understand consumers' VR experience in the retail context. To predict consumer responses to retail offerings, the shopping value that an immersive VR store provides to consumers should also be taken into consideration. This study examines the roles of vividness and interactivity for the consumers' approach intention, with the sequential mediation effect of telepresence and experiential shopping value perception. The result of the present study is obtained from consumers' actual experience of an immersive VR store by wearing mobile-based HMDs. The findings have useful implications for the application of VR technology to the retail market in fashion, based on the understanding of consumer responses.

Literature review

Vividness and interactivity: caused of telepresence

Telepresence is the essence of a VR experience. Steuer (1992) defined VR as an environment where perceivers can experience telepresence (Steuer 1992, p. 7). Telepresence refers to the extent to which an individual feels presence, that is, perceives himself or herself, to be present in a medium-mediated environment as if they were in the real world (Steuer 1992). Telepresence is considered both, a cognitive process and a subjective experience, as the user is immersed in a virtual environment (Witmer and Singer 1998). When it comes to indirect experiences through a medium, experiencing telepresence is especially vital for users to be immersed in the mediated environment. Thus, a stream of research has actively explored the relationship between the media's capabilities and telepresence in the field of communication research (Sheridan 1992; Slater and Usoh 1993; Steuer 1992; Witmer and Singer 1998).

Steuer (1992) suggested the determinants of VR experience that contribute to telepresence in two dimensions, namely, vividness and interactivity. A lot of research has covered the variables that can create telepresence, and they have been identified as the main causes of telepresence (Fortin and Dholakia 2005; Jiang and Benbasat 2007; Schuemie et al. 2001; Steuer 1992). These two dimensions are used as key technological variables that affect virtual experiences and determine the properties of the stimuli conveyed to users (Coyle and Thorson 2001; Klein 2003; Vonkeman et al. 2017).

Vividness is defined as the extent to which mediated environments can convey information to users' senses, that is, the expressive abundance of environments (Steuer 1992). The types of sensory information vary and as the quality of information, such as definition or visibility rises, rich information is transferred vividly. In the context of online marketing, Coyle and Thorson (2001) demonstrated that consumers showed more positive attitudes toward websites, and for longer periods of time, when vividness was high. Jiang and Benbasat (2007) proved that vividness had a positive influence on consumer attitude and behavioral intentions toward retail websites and their products. When it comes to virtual product experiences in advertising, vividness was shown to positively affect consumer attitude toward the products (Klein 2003).

Interactivity can be defined as the degree to which a user can influence the form or content of mediated environments (Steuer 1992). Interactivity is determined by: the technological structure of a medium, such as the response speed of the system, the degree to which users are allowed to transform virtual environments; and the way of reflecting on user behavior to virtual world. Many studies have identified that interactivity in online shopping channels have a positive influence on affective response, attitude toward the retailer (Lee et al. 2010), shopping involvement, approach intention (Kim et al. 2007), purchase intention (Huang and Huang, 2013), and satisfaction (Ballantine 2005).

There is an accumulated wisdom on the strong relationships between vividness and interactivity and telepresence in mediated environments (Coyle and Thorson 2001; Li et al. 2001, 2002; Suh and Chang 2006; Van Kerrebroeck et al. 2017; Vonkeman et al. 2017). In the following section, findings from these past studies are discussed in detail.

Mediating role of telepresence

Schuemie et al. (2001) reviewed the causes and consequences of telepresence with the consideration of the effective influences of VR on human psychology and behavior. In this review, users' emotional/behavioral responses were discussed as results of telepresence in VR, which is caused by characteristics of the system. In the consumption context, many empirical studies examined the critical role of telepresence on consumer responses in mediated environments (Coyle and Thorson 2001; Li et al. 2001, 2002). Shih (1998) discussed the role of telepresence in consumer experience in virtual contexts and recognized that telepresence is caused by sensory information and interactivity, produced by technological characteristics of a medium. Shih emphasized the consequences of telepresence, and the experiential results caused by the users' recognition of telepresence.

Suh and Chang (2006) showed that product presentation using VR interface (i.e., interface with high vividness and interactivity) in online stores provided users with a higher level of telepresence than photos and videos, and that telepresence positively affected consumers' product-related knowledge, attitude, and purchase intentions. Vonkeman et al. (2017) also demonstrated the mediating role of telepresence between vividness and interactivity of online product presentations and intention to impulsive buying, using online stores where VR technology is applied in product presentation. In the context of 3D advertising, Li et al. (2001, 2002) confirmed that telepresence experienced by users differed according to the medium's characteristics, and telepresence improved consumers' product knowledge, brand attitudes, and purchase intentions, by providing rich consumption experiences. In a recent study using immersive VR advertising, participants in an immersive VR condition with high vividness showed more positive attitudes and purchase intention of advertised products via telepresence than participants in a non-immersive condition with relatively low vividness did (Van Kerrebroeck et al. 2017). Specifically, immersive VR systems reflect the user's physical movements in the virtual environment in real time, to create telepresence for the users, and to increase their preferences for stimuli (Ahn and Bailenson 2011). Based on the discussions above, it is expected that the vividness and interactivity of immersive VR stores will have a positive influence on consumers' approach intention with the mediating role of telepresence.

Experiential shopping value

Although there are many findings that show the mediating role of telepresence in the effect of VR experience on consumer responses, several studies suggest that telepresence alone may not be sufficient to elicit optimal consumer attitudes and behaviors. Schuemie et al. (2001) discussed that it is needed to identify other constructs that affect human psychology in the VR experience. Mollen and Wilson (2010) also argued that there may be another structure that plays a mediator role in the relationship between telepresence and consumer responses during shopping experiences.

In the shopping process, consumers seek hedonic value from attractive environments and services, as well as utilitarian value from the product purchased (Holbrook 1994; Babin et al. 1994; Wolfinbarger and Gilly 2001). When these values are met during the shopping experience, positive responses, consumer satisfaction, loyalty,

re-patronage intentions, and word-of-mouth follow (Babin et al. 1994; Jones et al. 2006; Shiv and Huber 2000). As experiential value perceived by consumers also affects the preference toward specific shopping channels, one should place emphasis on experiential value in designing retail environments (Andrews et al. 2007; Kim 2002; Mathwick et al. 2001, 2002).

Holbrook (1994) and Mathwick et al. (2001) defined experiential value as the degree of benefit perceived by consumers under each of the following four dimensions: playfulness, aesthetics, CROI (abbreviated from customer return on investment), and service excellence. Playfulness occurs owing to the perception of entertaining joyfulness via participation in the shopping process. Aesthetics are perceived on the basis of the inherent attractiveness of shopping environments, as well as entertaining and dramatic experiences. CROI refers to the utility perception of economic effects derived from financial, time, psychological and behavioral investments, or exchange efficiency. Service excellence dimension reflects the perception of expertise knowledge and task-related achievements provided by services and overall service quality (Holbrook 1994, 2000; Maghnati and Ling 2013; Mathwick et al. 2001).

Research on consumer response based on perception of experiential shopping value has been actively carried out under varying conditions. Perceptions of experiential shopping value were demonstrated to have positive effects on consumers' behavioral intentions while using smartphones and websites to shop (Keng et al. 2007; Maghnati and Ling 2013; Okazaki 2008). In the context of online fashion retail, Fiore et al. (2005) and Song et al. (2007) discovered that telepresence in online stores had an indirect effect on consumer responses, such as store visit intentions, by delivering hedonic shopping value to users in the form of entertaining experiences and fantasies, as well as utilitarian value. Fiore et al. (2005) uncovered the effect of interactivity (the technological characteristic of images provided to consumers of fashion) on consumer response, and noted that the perception of telepresence and shopping value played a critical mediating role. Specifically, telepresence had a positive influence on consumer response, which was mediated by the direct effect of perceived shopping value. Moreover, Song et al. (2007) identified the paths that affect consumer purchase intentions toward online fashion retailers and the results they presented supported their previous research, which showed that telepresence affects consumer response via experiential value.

This study explores the influence of mobile-based immersive VR media as shopping channels on consumers. Thus, experiential shopping value is expected to play a critical role in consumer response. Taking into account the previous discussion, the effects of vividness and interactivity on consumers' approach intention will be mediated by telepresence and experiential shopping value. In addition, telepresence is expected to have an indirect effect on consumer response through its direct effect on experiential value perception. Thus, the following hypothesis is proposed:

H1 The influence of perceived vividness on consumer approach intention toward an immersive VR store will be mediated serially by perceived telepresence and experiential shopping value.

H2 The influence of perceived interactivity on consumer approach intention toward an immersive VR store will be mediated serially by perceived telepresence and experiential shopping value Fig. 1.

Methods

Stimulus

To study the effects of VR store usage experience on store approach intention, an actual VR store using mobile-based HMDs was used as stimulus to measure consumer response. Mobile-based HMDs are highly accessible to consumers due to their simple structure and affordable price (Ye et al. 2018). Thus, various types of VR contents are provided for mobile experience. In addition, since the VR stores that are currently being built are also provided through online sites or mobile applications, mobile-based VR stores have been selected as stimuli for this study considering consumers’ accessibility to VR contents and devices. The selected VR store was “Hyundai.com,” operated by the Korean retailer, Hyundai Department Store. The VR store provided customers with the feeling of being physically present at the actual store and was characterized by an accurate representation of the products on display at Hyundai Department Store’s Pangyo branch. The VR store used in this research was Nike. It could be explored in 3D, with 360-degree view, through a mobile app and VR device. Brief information on displayed products is provided. The Nike VR store deployed advanced technologies that were unprecedented, to provide a whole new level of the store experience for consumers. This study explores the roles of vividness and interactivity on approach intention toward new store environments, as well as consumer cognition through VR store experiences using HMDs.

Participants were given user instructions for the Nike VR store before they wore the HMDs. As in the physical Nike store, the participant entered the store from the main entrance. They could then approach different sections in the store, such as men’s wear, men’s shoes, women’s wear, and women’s shoes. If the participants stared at the arrows on the VR screen to indicate the direction in which they wanted to head, they could do so. If they stared at a specific item, its name and other details related to it were displayed. The stimuli examples in the Nike VR store are presented in Fig. 2.

Participants and procedure

The participants in this study were young consumers, aged between 20 and 30, who were relatively familiar with VR technology. A total of 101 participants recruited through

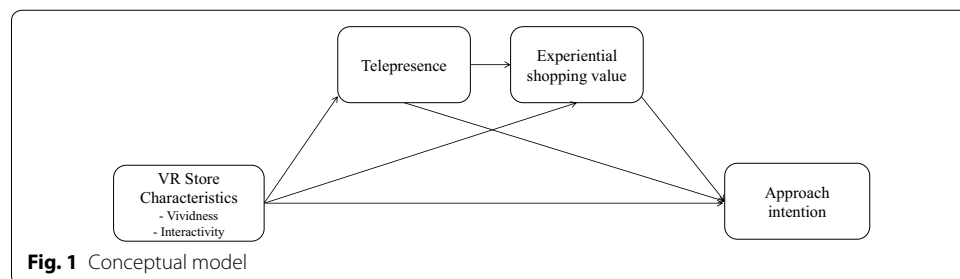


Fig. 1 Conceptual model

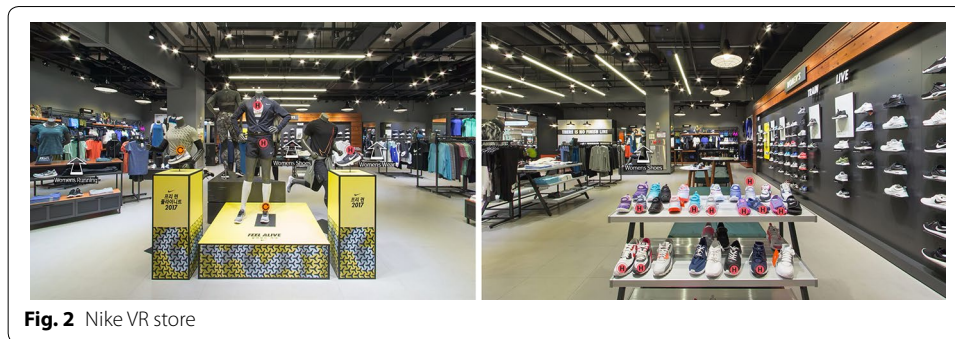


Fig. 2 Nike VR store

internal advertising at Seoul National University took part in the study. The ratio of male to female participants was nearly 1:1, with 50 male (49.5%), and 51 female participants (50.5%). People in their twenties—90 participants in all (89.1%)—constituted the majority of the respondents, while 11 (10.9%) were in their thirties. There were 61 students pursuing their bachelor's degrees (60.4%) and they constituted the majority of the respondents; they were followed by 2 university graduates (2.0%) and 38 graduate school students (37.7%).

Before the experiment, the participants were required to fill in pre-experiment questionnaires about their prior experiences with VR, and their brand preferences. Next, participants were given instructions on VR store shopping with the HMDs, after which they were fitted with the HMDs to proceed with the experiment. The HMDs used in the experiment were “VR Box,” which is highly accessible to consumers, because it is affordable and can be equipped with various types of mobile devices without expensive VR system. This experiment was conducted in a controlled lab environment, where the participants' VR experiences were not disturbed. Each participant stood up, and experienced the VR store for as long as he or she wanted. When they had finished their shopping, the researcher was informed. After the VR shopping experience, the participants were asked to fill in the main questionnaires.

Measures

In order to identify consumers' visit intention with respect to the VR store experience, vividness and interactivity, which are the main variables, were measured. By measuring telepresence and experiential shopping value, we were able to investigate their effects on the approach intention to a VR store.

Vividness was measured using items used from Choi and Taylor (2014) and the items for interactivity were adapted from Shim et al. (2017). Telepresence perceived through the VR store experience was taken from Schubert et al. (2001) and Ryu and Yu (2016). Items related to experiential shopping value were revised and complemented based on the items from Maghnati and Ling (2013). According to prior studies confirming the scale's unidimensionality (Mathwick et al. 2001; Okazaki 2008), the mean value of the measured scales of each sub-question was used to calculate the experiential shopping value. Specifically, the current study focused on a VR store. Thus, items related to approach intention to VR stores were revised based on the items drawn from the store environment study by Fiore et al. (2005). All items used in the present study were

Table 1 Measurements’ reliability and descriptive statistics

Construct	Items	Cronbach’s α	Mean (SD)	Range
Vividness	The VR store was helpful in imagining the situation where I’m shopping	.91	3.71 (.86)	4.00
	The VR store was helpful in visualizing the situation where I’m shopping			
	The VR store was helpful in imagining the situation where I’m seeing the product while shopping			
Interactivity	In the VR store, I can freely choose what I want	.70	3.41 (.82)	3.00
	The VR store is controllable by the user			
Telepresence	While using the VR store, I felt like I was actually at the store	.81	3.39 (.74)	3.60
	While using the VR store, I felt that the visible scene was part of the actual store			
	While using the VR store, I could easily recognize the atmosphere of the store			
	While using the VR store, I felt like I could touch the products and things in the store			
	While using the VR store, I felt things in VR stores were real			
Experiential shopping value	I think the service of the VR store is excellent	.83	3.22 (.73)	3.92
	I think the VR store offers expert service			
	The VR store is aesthetically appealing			
	I like the visual design of the VR store			
	Using the VR store is enjoyable			
	I feel happy when I experience the VR store			
	Using the VR store makes me cheerful			
	Using the VR store is helpful for shopping			
	Using the VR store enhances shopping effectiveness			
Approach intention	I would enjoy shopping in this VR store	.90	3.17 (.80)	3.67
	I like this VR store environment			
	I would avoid visiting this VR store. (reversed)			
	I would like to spend time browsing in this VR store			
	I want to avoid looking around or exploring the VR store. (reversed)			
	This VR store is likable			

measured using a 5-point Likert scale. The collected data was analyzed by SPSS 20.0 for descriptive statistics, frequency analysis, reliability test, and correlation tests. To validate mediated effects, a PROCESS SPSS Macro (Hayes 2013) was used.

Results and discussion

Reliability and validity test

The internal consistency of all scales was found to be statistically acceptable with Cronbach’s α coefficients from .70 to .91 (Nunnally and Bernstein 1994). The reliability coefficients, means, standard deviations and range are reported in Table 1. In the present experiment, all participants experience the same stimuli, the Nike VR store, and therefore, the realized vividness and interactivity of the stimuli are not variables but

Table 2 Correlation coefficient (*r*) between the main variables

	1. Vividness	2. Interactivity	3. Telepresence	4. Experiential shopping value	5. Approach intention
1. Vividness	1	.176 [†]	.654**	.661**	.566**
2. Interactivity		1	.194 [†]	.196*	.230*
3. Telepresence			1	.638**	.595**
4. Experiential shopping value				1	.750**
5. Approach intention					1

** $p < .01$, * $p < .05$, † $p < .1$

constants. What we tested as explaining variables are subjectively perceived vividness and interactivity. Even for the same stimulation, subjective perceptions in VR experience can be greatly heterogeneous according to individual differences (Steuer 1992). As we find sufficient variances of perceived vividness and interactivity, we continue to the next step analysis for hypothesis tests.

Correlation test

Before validating the hypothesis, a Pearson’s correlation analysis was conducted to identify the correlations between the main variables. As in Table 2, the correlation coefficients (*r*) were significant in the range between .176 and .750. More specifically, the independent variables—vividness and interactivity—were proven to have marginally significant correlations. Therefore, to test the hypotheses, two mediation analysis on each independent variable was conducted separately.

Hypothesis test

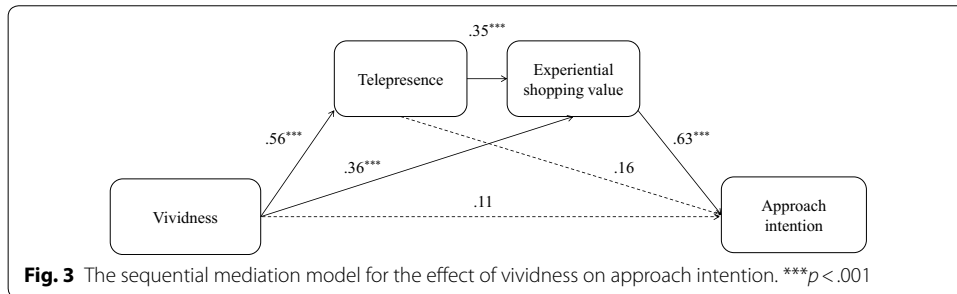
To test the role of vividness and interactivity on telepresence and experiential value, and the mediated effects of telepresence and experiential value on approach intention, multi-step mediation analyses were conducted using model 6 in PROCESS SPSS Macro (Hayes 2013). The PROCESS Macro program has been developed and used as a statistical tool for elaborately examining various types of path models, such as multiple and sequential mediation models, using bootstrapping (i.e., resampling methods). When the bootstrap method is used, the null hypothesis that “there is no indirect effect” is rejected if the zero is excluded between the minimum and maximum values of the confidence interval. In this study, the confidence interval was set to 95% and the number of resamples was set to 5000 (Hayes 2013; Preacher and Hayes 2004). A series of path model analyses were conducted with each of the independent variables.

Effect of vividness on approach intention

As a result of the sequential mediation model analysis for the effect of perceived vividness on approach intention, the direct path of the vividness effect on approach intention was not significant ($\beta = .11$, $SE = .09$, 95% $CI = [-.06$ to $.29]$, $p = .198$). However, the indirect effect of the mediating path (in which perceived vividness affecting approach intention was mediated by telepresence and experiential shopping value) was significant ($\beta = .12$, $SE = .05$, 95% $CI = [.05$ – $.24]$). Thus, hypothesis

Table 3 Model coefficients of the sequential mediation model: the effect of vividness on approach intention

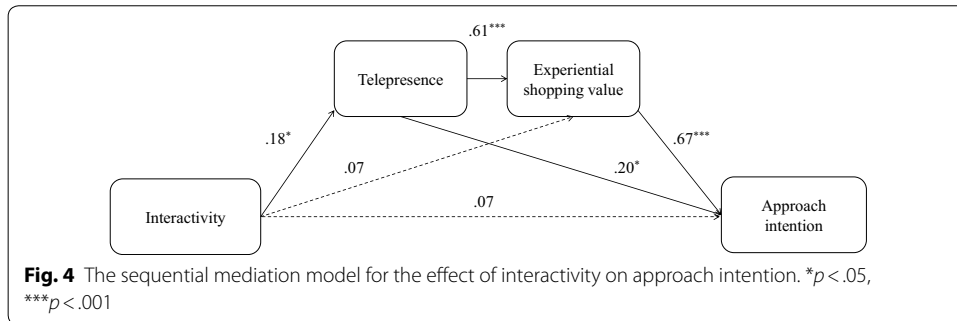
Antecedent	Consequent								
	M1 (telepresence)			M2 (experiential shopping value)			Y (approach intention)		
	Coeff.	SE	p	Coeff.	SE	p	Coeff.	SE	p
X (vividness)	.563	.065	<.001	.361	.079	<.001	.113	.087	.198
M1 (telepresence)				.353	.092	<.001	.160	.099	.109
M2 (experiential shopping value)							.629	.101	<.001
Constant	1.300	.249	<.001	.688	.258	<.01	.181	.267	.500
	$R^2 = .428$			$R^2 = .511$			$R^2 = .593$		
	$F(1, 99) = 74.027, p < .001$			$F(2, 98) = 51.093, p < .001$			$F(3, 97) = 47.096, p < .001$		
Direct effect of X on Y (vividness → approach intention)					$B = .11, SE = .09, 95\% CI = [-.06 \text{ to } .29], p = .198$				
Indirect effect									
Vividness → telepresence → approach intention					$B = .09, SE = .06, 95\% CI = [-.02 \text{ to } .22]$ (insignificant)				
Vividness → telepresence → experiential shopping value → approach intention					$B = .12, SE = .05, 95\% CI = [.05 \text{ to } .24]$ (significant)				
Vividness → experiential shopping value → approach intention					$B = .23, SE = .07, 95\% CI = [.12 \text{ to } .41]$ (significant)				



1 was supported. As vividness of VR store increases, consumers perceive a higher level of telepresence, and telepresence has a positive effect on the approach intentions by increasing consumers’ experiential shopping value. The indirect effect of the path that only includes the first mediating variable, telepresence, was proven insignificant ($\beta = .09, SE = .06, 95\% CI = [-.02 \text{ to } .22]$), but the indirect effect of the path that includes the second mediating variable, experiential shopping value, was significant ($\beta = .23, SE = .07, 95\% CI = [.12-.41]$). The results are presented in Table 3. The vividness of the VR store allows consumers to perceive experiential shopping value and increases the approach intention to stores. Hence, the perception of consumers’ experiential shopping value plays an important role in approach intention to the VR store. The sequential mediation effects of telepresence and experiential shopping value between vividness and approach intention are shown in Fig. 3.

Table 4 Model coefficients of the sequential mediation model: the effect of interactivity on approach intention

Antecedent	Consequent								
	M1 (telepresence)			M2 (experiential shopping value)			Y (approach intention)		
	Coeff.	SE	p	Coeff.	SE	p	Coeff.	SE	p
X (interactivity)	.177	.090	.051	.067	.071	.347	.071	.065	.276
M1 (telepresence)				.613	.078	<.001	.202	.091	<.05
M2 (experiential shopping value)							.674	.093	<.001
Constant	2.789	.314	<.001	.920	.325	<.01	.069	.310	.825
	$R^2 = .038$ $F(1, 99) = .0889, p = .051$			$R^2 = .412$ $F(2, 98) = 34.315, p < .001$			$R^2 = .591$ $F(3, 97) = 46.709, p < .001$		
Direct effect of X on Y (interactivity → approach intention)					$B = .07, SE = .07, 95\% CI = [-.06 \text{ to } .20], p = .276$				
Indirect effect									
Interactivity → telepresence → approach intention					$B = .04, SE = .03, 95\% CI = [-.01 \text{ to } .11]$ (insignificant)				
Interactivity → telepresence → experiential shopping value → approach intention					$B = .07, SE = .04, 95\% CI = [.01 \text{ to } .16]$ (significant)				
Interactivity → experiential shopping value → approach intention					$B = .05, SE = .05, 95\% CI = [-.05 \text{ to } .15]$ (insignificant)				



Effect of interactivity on approach intention

Next, as a result of the sequential mediation model analysis for the effect of perceived interactivity on approach intention, the direct path of the interactivity’s effect on approach intention was not significant ($\beta = .07, SE = .07, 95\% CI = [-.06-.20], p = .276$). However, the indirect effect of the mediating path through telepresence and experiential shopping value was shown to be significant ($\beta = .07, SE = .04, 95\% CI = [.01-.16]$), so hypothesis 2 was supported. To elaborate further, as interactivity of the VR store increases, consumers perceive a higher level of telepresence. Telepresence leads to an increase in consumers’ experiential shopping value, thereby positively affecting approach intentions.

The indirect effect of the path that only includes the first mediating variable, telepresence, proved to be insignificant ($\beta = .04, SE = .03, 95\% CI = [-.01 \text{ to } .11]$), and the indirect effect of the path that includes the second mediating variable, experiential shopping value, was insignificant as well ($\beta = .05, SE = .05, 95\% CI = [-.05 \text{ to } .15]$).

The results are presented in Table 4. The sequential mediation effects of telepresence and experiential shopping value between interactivity and approach intention are shown in Fig. 4.

Additionally, the suggested path model was also analyzed using structural equation modeling (SEM) techniques to explore the relationships for all variables including vividness and interactivity in one model. The results of confirmatory factor analysis (CFA) showed that the model fit was acceptable ($\chi^2 = 359.181$, $df = 262$, $p < .001$; CFI = .940, TLI = .932, RMSEA = .061). The standardized coefficient of all the measured items of each construct was significant at the level of $p < .001$, satisfying the construct validity of each concept. The calculated composite reliability (all exceeded .08) and average variance extracted values (all exceeded .047) were also found to be satisfactory. Convergent and discriminant validity for each measurement variable were also confirmed.

Next, the SEM analysis was performed for the hypothesized model specification, and the path model exhibits an acceptable fit ($\chi^2 = 369.315$, $df = 267$, $p < .001$; CFI = .937, TLI = .929, RMSEA = .062). The results of the SEM analysis showed that the degree of perceived vividness increased, and the degree of perceived telepresence also increased ($\beta = .78$, $p < .001$). The experiential shopping value perception increased as the degree of telepresence perception increased ($\beta = .82$, $p < .001$), and the positive effect of the perceived experiential shopping value on approach intention was significant ($\beta = .94$, $p < .001$). Thus, hypothesis 1 was also supported by SEM analysis. However, the effects of the perceived interactivity on telepresence perception were insignificant ($\beta = .13$, $p = .107$). These results may be due to the existence of a correlation between vividness and interactivity. As the Pearson's correlation test had found a marginally significant correlation between the two independent variables ($r = .176$, $p < .1$), the SEM analysis showed the significant covariance between vividness and interactivity ($p = .05$).

Conclusions

This study identified the influence of VR on consumers' approach intention and the underlying mechanism by using an actual immersive VR store. The participants wore mobile-based HMDs and experienced VR shopping environments. Vividness and interactivity have indirect effects on consumers' approach intentions, and the influences are sequentially mediated by perceived telepresence and experiential shopping value. As consumers perceived higher levels of vividness and interactivity, perceived telepresence was higher, leading to higher perceived experiential shopping value and an overall positive influence on approach intentions to a VR store.

In sequential mediation model analysis, the direct path of vividness and interactivity directly affecting approach intentions and the path mediated by telepresence were not significant. The technological dimensions of VR had positive impacts on consumers' approach intentions only with the path mediated by experiential value. Most past studies on the effect of VR focused on the telepresence as a core mediator that affects users' responses, even in the shopping context (Van Kerrebroeck et al. 2017; Vonkeman et al. 2017). However, as Schuemie et al. (2001) and Mollen and Wilson (2010) pointed out the need for other constructs that play a role between telepresence and consumer responses, the findings indicate that enabling the feeling of presence with VR technology itself will not attract consumers to shopping channels. Further, it indicates that

experiential value, which allows consumers to perceive benefits through the retail environment, should be provided to consumers in shopping contexts. This result is consistent with studies by Fiore et al. (2005) and Song et al. (2007) that reported a critical mediating role of experiential shopping value between telepresence and online fashion consumers' behavioral intentions. Therefore, while establishing VR-dependent shopping channels at retail stores, it is critical to make consumers appreciate the significant experiential value of shopping, rather than just relying on the level of technology. Recently, the general populace has also come to experience advanced vividness and interactivity by accessing virtual environments. This has built a foundation for consumers to experience an unprecedented level of telepresence in a shopping trip. However, if one fails to communicate experiential shopping value, consumers will be turned away despite the strong presence of telepresence.

Specifically, fashion products involve symbolic, experiential, and hedonic properties (Crowley et al. 1992), further, fashion consumers' mood plays a key role in the choice of shopping channel (Nicholson et al. 2002). Using immersive VR technology, fashion retailers can create a fantasy-like store environment that does not exist in the real world, and can effectively communicate emotional fashion information with vibrant and fantastic 3D images and sounds. However, technical limitations in delivering utilitarian value, such as communicating detailed product information or establishing payment systems, still remain. The stimuli we used in this research, the immersive VR store, and the commercialization stage of the technology employed were still not sufficiently mature to allow a close look at the product with the HMDs on, or to proceed with payment.

Concerning the results of this study, several issues regarding the roles of vividness and interactivity of VR should be noted. While vividness perception in a VR store not only evokes the sense of telepresence, but also experiential shopping value perception, the role of interactivity perception for consumers' shopping experience is found relatively weak in this study. The vividness is influential enough to affect experiential shopping value directly. In the SEM analysis, which included vividness and interactivity in one model, the unbalanced effect size of vividness and interactivity were more apparent. In this model, interactivity did not play a role to evoke telepresence experience.

This may be due to the relatively low level of interactivity of the VR store stimulus used in the experiment. The result of the paired samples t test of vividness and interactivity, the mean value of perceived interactivity was significantly lower than the mean value of perceived vividness ($M_{\text{interactivity}} = 3.71$ vs. $M_{\text{vividness}} = 3.41$; $t(100) = 2.86$, $p < .01$). This implies that technological advancement of the interactivity in VR environments is needed to provide an optimal shopping experience to consumers. At present, VR stores or other VR contents in commerce provide high level of vividness but limited interactivity in most cases (Van Kerrebroeck et al. 2017). More investigations on the effects of interactivity on VR experiences with various levels and interaction types are required.

The discussion on correlation between vividness and interactivity should also be noted. Vividness and interactivity are two of the most important variables in the VR experience. Therefore, most relevant studies have used these as the main independent variables, but did not consider the relationship between them. Past studies provide a clue that there might be a correlation between these two variables (Cheng et al. 2014). The more the perceived vividness of the stimulus presented, the more likely the user tended to perceive

the stimulus as interactive (Coyle and Thorson 2001; Fortin and Dholakia 2005). Cheng et al. (2014) empirically confirmed the causal relationship between interactivity and vividness in the VR environment context, and the results found that interactivity is affected by vividness. The path in the opposite direction (i.e., from interactivity to vividness) was not verified in their research.

Van Kerrebroeck et al. (2017) discussed that stimulating a variety of human senses such as touch, the increased interactivity may make the users perceive the VR experience more vividly. Alternatively, users may perceive the interactivity of the stimulus to be higher when the vividness is higher than when it is low. Sohn (2011) asserted that vividness is necessary but insufficient to perceive the stimulus as interactive, thus, further empirical research on the relationship between sensory information and interactivity is needed.

According to the media richness theory (Daft and Lengel 1986), the most positive result can be expected when the richness of information provided by shopping channels matches the consumers' expectation levels (Jahng et al. 2001; Werthner and Klein 1999), and therefore, different outcomes can be obtained depending on consumers' shopping objectives, and the purchase item categories. In future research, researchers can identify optimal ways to deliver utility to target consumers using immersive VR technologies in the context of fashion shopping.

Abbreviations

CROI: customer return on investment; HMDs: head-mounted displays; VR: virtual reality.

Authors' contributions

JJ designed the study and developed the theoretical framework, besides analyzing data. JJ and HH participated in the experiment design, data collection, analyses, and writing of the manuscript. HC guided the development of the theoretical framework, hypotheses, results, and conclusion. All of the authors contributed to the formatting and editing of the manuscript. All authors read and approved the final manuscript.

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Competing interests

The authors declare that they have no competing interests.

Availability of data and materials

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