

2009

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Y. Ken Wang

University of Pittsburgh - Bradford, ykw@pitt.edu

Pratim Datta

Kent State University, pdatta@kent.edu

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Recommended Citation

Wang, Y. Ken and Datta, Pratim, "Decomposition of Virtual Product Experience in Consumer Online Purchasing - A Preliminary Study" (2009). *AMCIS 2009 Proceedings*. 532.

<http://aisel.aisnet.org/amcis2009/532>

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Decomposition of Virtual Product Experience in Consumer Online Purchasing – A Preliminary Study

Y. Ken Wang

University of Pittsburgh at Bradford
ykw@pitt.edu

Pratim Datta

Kent State University
pdatta@kent.edu

ABSTRACT

This paper proposes a model that traces how certain characteristics of 3-D interface influence users' virtual product experience (VPE) and their intention to return to the same website mediated by their attitude towards such interface and online purchasing. Three characteristics, i.e., virtual involvement, virtual affordance, and virtual presence, are investigated and incorporated into the research model. Findings from the empirical study reveal that virtual affordance and virtual presence contribute to user's attitude towards the interface, and virtual involvement and virtual presence contribute to user's attitude towards online purchasing. Users' attitude towards online purchasing is a significant predictor to their intention to return to the website. This paper offers some insights into how interface design can guide consumer decision-making in an online environment.

KEYWORDS

Virtual product experience, virtual involvement, virtual affordance, virtual presence, consumer behavior

INTRODUCTION

Online retail shopping has seen phenomenal growth in recent years. In 2005, consumers spent \$172 billion in online shopping (Levinson 2006), thanks to wide availability of broadband technologies and engaging technologies such as Flash, QuickTime VR (QTVR), Sliverlight, and other multimedia plug-ins - aimed towards enriching and enlivening consumers' online shopping experience (Levinson 2006). In fact, it is well-argued in literature that if consumers' virtual experience of a product or service can match their physical world experiences, the likelihood of purchase increases manifold (Li et al. 2001; Suh et al. 2005; Walsh 2002). Intuitively, 2-D worlds of texts and simple images offer limited tangibility and representational capabilities. However, with faster graphics processors, object-oriented technology, available plug-ins, and platform-independent development of content, the transition from a 2-D to a 3-D space is growing popular.

More and more business websites try to differentiate their content using technologies and plug-ins to post 360-degree views and 3-D renditions of their wares to increase virtual experience and induce consumers' purchase decision. For example, automobile manufacturers such as Land Rover use 3-D interactive interfaces to describe model features and offer customization in an attempt to reduce distance between the virtual and the real world of experiential products. Troy Brown, Senior Director of Timberland, noted that the role of virtual technologies were to "replicate in the virtual world the experiences people have in our stores" (Levinson 2006). Noting that a well-designed 3-D interface can positively influence consumer purchase decisions online, Walsh and Pawlowski (2003: 298) bemoan that "little is reported about [such]... behavioral... areas where there is pressing need to understand better how these [3-D] technologies might impact business."

The objective of this paper is to understand how 3-D interfaces impact consumer purchase-attitude in the context of B2C e-commerce. In particular, we are interested in unraveling the underlying process by which interactions with online 3-D interfaces correspond with consumers' intention to return to the website, which is an important indicator leading to purchase transactions.

In what follows, we begin by integrating prior literature to theorize a factor model of consumers' virtual experience with online 3-D product presentations. The next section describes the research method used to empirically test the proposed model. The results of the data analysis are then presented. The concluding section briefly discusses the results, contributions, and limitations of the study.

LITERATURE REVIEW

Many e-commerce websites have implemented various technologies to enhance the presentation of their products. In addition to text and static images, which were traditionally used to describe the fundamental characteristics of a

product, such as model, size, weight, specifications, price, and service terms, etc., animation technologies, such as video clips and flash applications have been increasingly used in e-commerce websites as supplement to presenting rich product information. Integrating video and audio cues, animation technologies are able to convey dynamic product information as well as experience attributes (Jiang et al. 2004).

Recent development of interactive technologies has advanced to deliver richer content as well as experience to online users. Consumers, through interactive advertising in the form of 3-D visualization and simulation, may experience a close-to-real experience as if they were physically interacting with the product. Such experience has been referred to as virtual product experience (Jiang et al. 2004; Suh et al. 2005), telepresence (Biocca 1992; Steuer 1992), or more generally, virtual experience (Li et al. 2001; Li et al. 2003) in the literature.

Virtual Product Experience

Human experience can be generally categorized into three types: direct experience, indirect experience, and virtual experience (Li et al. 2001). Direct experience is compelling to people for multiple sensory cues, such as vision, sound, physical touch, smell, and/or taste. When we walk into a car dealer, we physically view, hear, touch, and test drive cars demonstrated in the show room. Indirect experience, however, is usually mediated by a traditional communication medium such as catalogues or TV commercials. A typical application of indirect experience is mail advertisement. By sending out finely printed catalogues, advertisers extend their show rooms to the home of their potential customers'. Obviously, only limited information is conveyed with indirect experiences.

Virtual experience refers to an indirect whereas interactive experience that resembles direct experience, such as shopping in a store, when such experience is generated and supported by a 3-D interactive environment (Jiang et al. 2004; Li et al. 2001; Wang et al. 2005). The emergence of multiple 3-D interactive applications has enabled revolutionary representations of the world. People perceive virtual experiences commonly embodied by high-speed data streams, 3-D graphics or animations, and instant interactions in the form of audio, video, and/or physical actions to simulate the real world with computer mediated interactive environments (Bricken et al. 1993; Steuer 1992; Suh et al. 2005; Walsh 2001). Notwithstanding its indirect nature, virtual experience has been found to be closer to direct experience than to indirect experience in terms of effective consumer communications (Li et al. 2001).

It is worth indicating that online consumers are not necessarily shoppers but more likely information searchers (Cho et al. 2001). The Internet provides a convenient and effective shopping environment that allows consumers to search, browse, find, select, compare, and evaluate products through interaction with websites. Consumers' impression on one product may be influenced by its intrinsic characteristics, such as appearance, features, specifications, and warranty policies, or its transactional characteristics, such as price, discount, and shipping rate, or its virtual experiential characteristics, such as the shopping interface, interaction experience, etc. In this paper, we are interested in consumers' psychological state in which they perceive virtual objects and renditions as imitating physical reality. When interacting with virtually presented products, consumers' virtual product experience (VPE) may be understood in terms of three properties: virtual involvement, virtual affordance, and virtual presence (Li et al. 2003; Wang et al. 2005).

Virtual Involvement

Virtual involvement is a consumer's curiosity and joyful perception toward the products presented by virtual media (Li et al. 2001; Walsh et al. 2002; Wang et al. 2005). Interactive interfaces offer varied degrees of involvement, often a function of the richness of the application serving the content. It offers consumers a sense of immersion in the virtual environment. Involvement has been often perceived as a hedonic attribute among consumers, whose interaction with websites often promotes a heightened sense of virtual experience (Gammack et al. 2003). Gammack and Hodkinson (2003) specifically looked at the case of online surfboard sales in Australia. The authors found that 3-D interactive interfaces that raised virtual involvement by the use of surfing clips and beach webcams did enhance virtual experience.

Elements of interaction offered by the interface can arouse multi-sensory perceptions of elation (Li et al. 2001). Heeter (1995) found that 3-D interactive systems engendered markedly higher levels of involvement (Heeter 1995). For example, Levinson (2006) discusses how Timberland indulges customers by allowing customers to drag their mice over color swatches to change the color of a boot and its orientation instantly (Levinson 2006). Through interactive play, 3-D interfaces can cater to the hedonism otherwise lacking in the real world. As Holbrook and Hirschman (1982) contend, incorporating involvement constitutes a truly "experiential view" of consumer consumption, engaging consumers through sensations of hedonism and elation (Holbrook et al. 1982).

Virtual Affordance

Virtual affordance is the actions that can be performed on an object by consumers in an interactive environment (Li et al. 2001; Norman 1998; Wang et al. 2005). An interactive 3-D interface provides consumers with multiple abilities to interact and manipulate products through immersive environment. The ability of visual inspection is one of the most important types of affordance (Li et al. 2001). According to Li et al (2002), virtual affordances are perceptual cues simulated by interactive 3-D interfaces that guide consumers in making a decision about a product. Interactive 3-D interfaces that offer cues typically absent in the real world will increase a consumers' experience with the product of service. For example, if a 3-D interface allows consumers to etch their name onto a ring and immediately view a simulated rendition of the engraving, it offers a cue that mimics reality and thus increases virtual affordance – enhancing virtual product experience.

Virtual Presence

Virtual presence is a core concept in defining virtual reality which emphasizes human experience rather than technological hardware (Steuer 1992). Virtual presence can be described in three aspects: isogeny, resemblance, and approximation. Isogeny refers to users' expectation of replicating their behaviors in the virtual world as in the real world. For example, if a consumer picks one favorite Swiss watch out of 10 watches in the online context, he or she should have been able to make the same decision in the offline context if other settings remain equal.

Resemblance is the extent to which users imagine the presence in the virtual world as a “mirror image” of the real world. An increasing perception of resemblance will enhance users' positive feelings of the virtual presence and potentially influence their virtual enjoyment.

Approximation reveals that although the virtual presence is a close copy of the real world, users may not perceive the equal amount of information as in the real world due to limitations of current communication technologies. For example, olfactory, sensory, and emotional feelings are not able to be directly transmitted. Such feelings have to be ignored or distorted when being converted into communicable information such as textual description or graphic presentation. The extent to which an interface can approximate the physical reality is an important facet of virtual presence.

RESEARCH MODEL

Based on the above review of the literature, we propose that consumers' virtual product experience (VPE) will impact their intention to return to the website. Each component of VPE will have its direct influence on users' attitude towards the interface and online purchasing. Figure 2 illustrates the research model by showing how the components of VPE, i.e., virtual involvement, virtual affordance, and virtual presence, affect users' intention to return to the website through the mediation of their attitude toward interface and online purchasing.

Attitudes

Attitude towards interface

Consumer's attitude towards an interface is contingent on two dimensions: cognitive perceptions of the product and affective perceptions of the product (Suh et al. 2005). The cognitive dimension represents consumers' acquired knowledge about the target product (Bettman et al. 1980). In brick and mortar stores, consumers acquire knowledge through tags, flyers, conversations with the sales assistants, and their physical interactions with the product. In the online context, product information can also be presented in textual, graphic, and audio forms comparable to those in conventional stores. Rich 3-D interfaces, in addition, can simulate consumers' interaction with the product using interactive features. Such interactive operations allow consumers to sample product functions in a distance with a strong perception of virtual experience. Therefore, consumers' attitude towards the interface must be positively associated with the level of their perceived virtual product experience. The same view is echoed by Suh and Lee (2005) who find that consumers' facing 3-D environments are likely to develop a more favorable attitude towards the application environments. Therefore we hypothesize that:

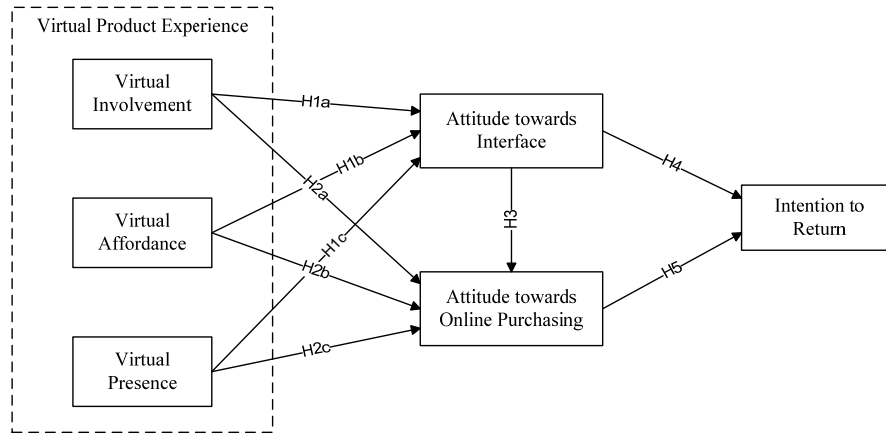


Figure 2 Research Model

H1a: Favorable virtual involvement with a 3-D interactive interface will have a positive effect on a consumer's attitude towards the interface

H1b: Favorable virtual affordance with a 3-D interactive interface will have a positive effect on a consumer's attitude towards the interface

H1c: Favorable virtual presence with a 3-D interactive interface will have a positive effect on a consumer's attitude towards the interface

Attitude towards online purchasing

The affective dimension, on the other hand, represents the extent to which consumers' perception is influenced by particular environmental stimuli (McKenzie et al. 1989). If a consumer better experiences a product by virtue of an interface, the consumer is likely to have affective perceptions towards the shopping experience because the interface allows the consumer to experience the product in ways otherwise missing in a 2-D online world. On the other hand, negative virtual product experience often leads to unfavorable attitude toward online shopping (Constantinides 2004). Therefore we hypothesize that:

H2a: Favorable virtual involvement with 3-D interactive interface will have a positive effect on a consumer's attitude towards online shopping

H2b: Favorable virtual affordance with 3-D interactive interface will have a positive effect on a consumer's attitude towards online shopping

H2c: Favorable virtual presence with 3-D interactive interface will have a positive effect on a consumer's attitude towards online shopping

One can thus argue that, if a consumer were to experience a product from all angles rather than one particular angle, their affective perceptions will likely increase because of the exposure to intensive and experiential stimuli. Moreover, because the 3-D interactive interface better represents a product and allows the consumer to better experience specific features of the product, it is likely the consumer attitude towards the 3-D interactive interface will have a favorable effect on their overall attitude towards online purchasing. Therefore, we thus propose that:

H3: Favorable attitudes towards the 3-D interactive interface will have a positive effect on a consumer's attitude towards online purchasing on that website

Intention to Return

It is well documented that consumers' intention towards a behavior is often influenced by their attitudes (Jarvenpaa et al. 2000; Suh et al. 2005). Intention to return is a common effectiveness measure of the quality of an interface. Studies show that in the online context, when seller's characteristics are controlled, consumers' intentions to return to a website may be influenced by their attitudes towards the interface (Schlosser 2003; Suh et al. 2005). In addition, when consumers establish a positive attitude towards online purchase with a particular website, it is more likely for them to revisit the website for subsequent search and investigation. Therefore, we hypothesize:

H6: Favorable attitudes towards the interface will have a positive effect on a consumer's intention to return to the website

H7: Favorable attitudes towards the online purchasing on a website will have a positive effect on a consumer's intention to return to the website

RESEARCH METHOD

Data Collection

An experiential survey study was employed to empirically validate the proposed model. The data were collected from a group of students enrolled in a business course in a large U.S. public university. The demographic profile of the participants is summarized in Table 1.

Demographic Characteristics	Frequency (n=204)	Percentage (%)
Age		
15-20	34	16.7
21-25	148	72.4
26-30	12	5.9
31-35	2	1.0
36-40	4	2.0
older than 40	4	2.0
Gender		
Male	145	70.4
Female	59	29.1

Table 1 Participant Demographics

The study was conducted in a computer lab during regular class time. The experiment task includes a purchase-related inquiry of an automobile global positioning system (GPS) device. At the beginning of the study, the participants were asked to complete an initial pretest that captured demographic and individual differences such as prior experience with automobile GPS devices. Subsequently, they were randomly assigned into two different VPE level groups and asked to browse a web demonstration of an automotive GPS product – Garmin's Qwest™. The high VPE interface utilized 3-D Macromedia Flash VR application to render the GPS product. Participants could drag a control bar to rotate the product in a 360 degree range and have a complete view of the product from different angles. The low VPE interface represented the same product using GIF images containing the necessary information that participants would need to complete the tasks but the view of the product was limited to only a few angles (front and back).

A manipulation check was conducted to assess the effect of designed manipulation in the experiment. The participants were asked to report their perceived richness about the product. An ANOVA analysis was employed and the result indicated that the participants in the high richness group perceived higher richness of the interface than those in the low richness group ($t=3.685$, $p<.005$). Thus, the effect of designed VPE manipulation is consistent with expected.

Because participants' prior experience (Carlson et al. 1999) with any feature-centric product and different product types (Suh et al. 2005) can unduly confound consumer behavior, controlling for this variable was essential. We measured the participants' prior experiences on automobile GPS devices on a scale of 1 to 7. The mean was 4.07 and the standard deviation was 1.45. We split the participants into two groups (high experiences vs. low experiences) with approximately equal numbers in each group. An ANOVA test on the means of perceived richness indicated non-significant ($F=3.182$, $p=.076$) difference among the two groups. Therefore the sample is considered homogeneous in terms of prior experiences.

Instrument

The research variables were measured using pre-validated scales adapted from prior research. Items for virtual product experience were partially adapted from Cho and Park (Cho et al. 2003), Schubert and Friedmann et al

(Schubert et al. 2001), Kim and Biocca (Kim et al. 1997), Nichols and Haldane et al (Nichols et al. 2000), Slater and Use et al (Slater et al. 1994), and Slater and Use et al (Slater et al. 1995); items for attitudes towards the interface and online purchasing were adapted from Venkatesh et al (Venkatesh et al. 2003), Davis et al. (Davis 1989; Davis 1993; Thompson et al. 1991), and Compeau and Higgins (Compeau et al. 1999); items for intention to return were partially adapted from Venkatesh et al (Venkatesh et al. 2003). All the items were measured using a scale from 1 (strongly not agree) to 7 (strongly agree). Due to the word limit on this paper, the complete instrument will be presented at the conference.

Data Analysis

The data analysis is to test the measurement model using M-plus 4.1 software package (Muthén 2001). Pursuant to Staub et al. (2004), the collected data set first passed a set of mandatory validity checks, including *reliability check*, *convergent validity check*, and *discriminant validity check*.

The collected data were entered to test structural model fit between the collected data and the proposed model. The comparative fit index (CFI) is .904 and the RMSEA is .062, both indicating decent fit between the collected data and the proposed model.

The next step involved structural regression to test the hypotheses between constructs in the proposed model. As indicated in the path diagram, virtual affordance and virtual presence have demonstrated significant relationships with consumers' attitude towards interface (H1b and H1c supported), whereas the relationship between virtual involvement and consumers' attitude towards interface is not significant (H1a not supported). On the other hand, virtual involvement and virtual presence have been tested significantly influencing consumers' attitude towards online purchasing (H2a and H2c supported), however virtual affordance does not indicate significant influence on consumers' attitude towards online purchasing (H2b not supported).

Consistent to the hypothesis, consumer's attitude towards interface has significant influence on their attitude towards online purchasing (H3 supported). Consumers' attitude towards online purchasing is significantly influencing their intention to return, whereas such relationship is not significant between consumers' attitude towards interface and their intention to return (H4 not supported). Table 5 provides a summary of the hypotheses test.

Construct	ID	Mean	Std. Deviation	Skewness	Kurtosis	Loading	Composite Reliability
Virtual Involvement	VIV1	4.534	1.799	-0.505	-0.825	0.746	0.767
	VIV2	3.348	1.787	0.238	-1.141	0.651	
	VIV3	3.941	1.840	-0.109	-1.120	0.769	
Virtual Affordance	VAF1	3.328	1.562	0.248	-0.788	0.750	0.805
	VAF2	3.275	1.623	0.260	-0.788	0.847	
	VAF3	3.284	1.672	0.257	-0.951	0.681	
Virtual Presence	VPR1	4.152	1.446	-0.278	-0.614	0.779	0.869
	VPR2	4.093	1.494	-0.071	-0.731	0.896	
	VPR3	3.838	1.618	0.061	-0.971	0.813	
Attitude towards Interface	ATT_I1	4.833	1.628	-0.820	-0.168	0.844	0.897
	ATT_I2	4.368	1.615	-0.365	-0.689	0.921	
	ATT_I3	4.397	1.662	-0.617	-0.467	0.820	
Attitude towards Purchase	ATT_P1	3.789	1.625	0.081	-0.858	0.844	0.897
	ATT_P2	4.147	1.633	-0.274	-0.783	0.925	
	ATT_P3	4.392	1.641	-0.499	-0.595	0.815	
Intention to Return	INT1	4.588	1.214	-0.266	-0.280	0.802	0.883
	INT2	4.485	1.151	-0.130	-0.122	0.922	
	INT3	4.392	1.184	-0.225	-0.138	0.810	

Table 2 Descriptive Data

	VIV	VAF	VPR	ATT_I	ATT_P	TRST
VIV	0.768					
VAF	0.663	0.761				
VPR	0.632	0.708	0.784			
ATT_I	0.718	0.782	0.644	0.831		
ATT_P	0.795	0.757	0.714	0.726	0.863	
ITN	0.505	0.491	0.453	0.497	0.617	0.847

Table 3 Construct Correlation Table

Note: Diagonal represents the squared root of construct Average Variance Extracted (AVE)

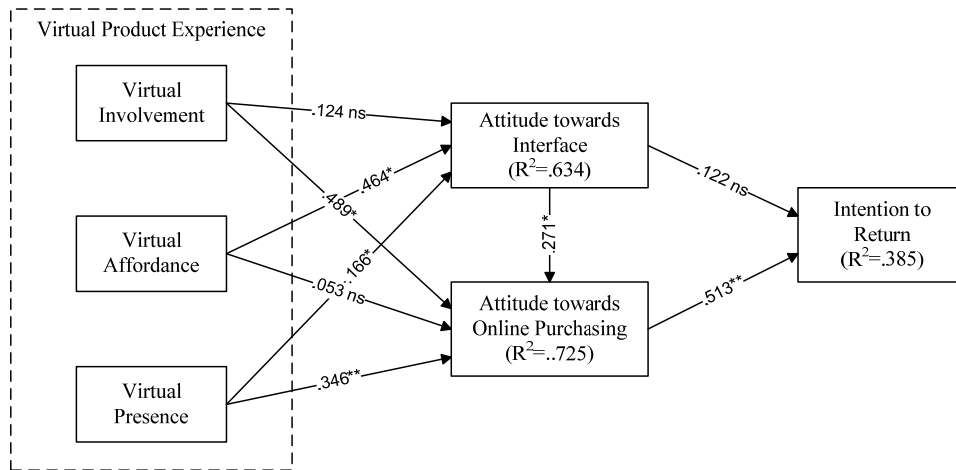


Table 4 Path Diagram (*=significant at .05 level; n.s.=non-significant)

Hypotheses	Description	Supported
H1a	Virtual Involvement -> Attitude towards Interface	No
H1b	Virtual Affordance -> Attitude towards Interface	Yes
H1c	Virtual Presence -> Attitude towards Interface	Yes
H2a	Virtual Involvement -> Attitude towards Online Purchasing	Yes
H2b	Virtual Affordance -> Attitude towards Online Purchasing	No
H2c	Virtual Presence-> Attitude towards Online Purchasing	Yes
H3	Attitude towards Interface -> Attitude towards Online Purchasing	Yes
H4	Attitude towards Interface -> Intention to Return	No
H5	Attitude towards Online Purchasing -> Intention to Return	Yes

Table 5 Summary of Hypotheses

DISCUSSION

The study result may generate some interesting discussions. First, overall, VPE seems to have a greater bearing on the consumer’s attitude towards the interface and the online purchasing. Such a finding is justifiable. A better experience is likely to induce favorable attitudes (Coyle et al. 2001). Intuitively, if consumers feel favorable experience with an interface, they would most likely display a positive predisposition towards the shopping experience.

Second, it is interesting to observe that some of the hypotheses are not empirically supported. For example, the path between virtual involvement and attitude towards interface is not significant. Prior research suggests that involvement may hold some personal relevance (Li et al. 2001). If an interface fails to deliver sufficient personal engagement, users may perceive less reality resulting in decreased level of interest and curiosity toward the interface. Further literature search also suggests that other characteristics, such as virtual enjoyment, may potentially serve as mediators in such relationship (Biocca 2002; Li et al. 2001; Li et al. 2003).

Another unsupported relationship between virtual affordance and users’ attitude towards online purchasing is also worth careful scrutiny. A revisit of the concept of virtual affordance reveals that affordance consist of three levels of simulation: visual simulation, tactile simulation, and behavioral simulation (Li et al. 2001). Virtual affordance is dependent on product experience such that low experiential products (e.g., computer tower case) require less virtual

affordance than do high experiential products (e.g., shoes). Automotive GPS is a feature-centric product, therefore consumers' online purchasing experience may not be directly associated with the level of virtual affordance.

That fact that consumers' attitude towards interface does not demonstrate significant relationship with their intention to return raises a question for researchers and practitioners. Post-hoc analysis shows that such relationship becomes significant when the path between attitude towards interface and attitude towards online purchasing is removed. Therefore, the mediation effect of attitude towards online purchasing between attitude towards interface and intention to return is warranted. Consumers' positive attitude towards an interface may transfer to their positive intention to return subject to their attitude towards online purchasing.

LIMITATIONS AND FUTURE RESEARCH

The proposed model only investigated a few characteristics of VPE, among many other possible candidates, such as virtual enjoyment (Wang et al. 2005) and flow (Jiang et al. 2004). It is believed that other factors, such as the level of perceived richness and interactivity, consumer trust, and information quality may also play a role in the formation of consumers' attitude and intention. Future research may investigate the interaction of VPE and other personal factors and environmental factors on consumers' decision making process in the online shopping environment.

Finally, the study's sample is limited to students in a university setting. Given the general outlook of this study is towards understanding user attitudes and intentions rather than actual purchase, we assume that the participants are representative of the overall population. However, it is a claim that needs further validation. As such, future replications of the model are needed for generalizing our proposed claims in other contexts.

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