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# INVESTIGATING THE ROLES OF VIRTUAL EXPERIENCE IN CONSUMER'S ONLINE PURCHASING DECISIONS

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## **Abstract**

*Prior research in the field of electronic commerce argued that virtual experience (VE) could facilitate consumer's product learning by mitigating the constraints that resulted from the lack of direct experience in an online environment. However, little is known with respect to the effect of VE on consumer's purchasing behaviour. This paper investigates two roles that VE plays in consumer's purchasing decision. First, VE elicits consumer's positive attitude toward a product. Second, VE boosts consumer's purchasing intention only when consumers' attitude toward the product is favourable. An empirical study was conducted and the data demonstrated support to the proposed model. This study contributes to academia by providing a parsimonious model explaining consumers' irrational purchasing behaviours in the online context. Also this study contributes to practice by emphasizing that VE is a double sided sword that must be utilized appropriately in product demonstrations.*

## **Keywords**

*Virtual reality, virtual experience, consumer behavior, decision making, attitude*

## Introduction

It is perhaps remarkable to observe the growing use of web-based Virtual Reality (henceforth, VR) technologies to add an experiential dimension to online consumption of products and content. Hardly do we find manufacturer and retailer sites that do not succumb to the use of rich content delivery mechanisms. With the increasing popularity of online commerce, it is well documented 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 et al. 2002). Intuitively, 2D 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 2D to a 3D space is growing popular. More and more business websites flaunt content using Quicktime VR (QTVR) and Flash to post 360-degree views and 3D rendition of their wares- aimed at increasing virtual experience and inducing consumers' towards a purchase decision. For example, even automobile manufacturers such as the Mini Cooper use VR interfaces to describe model features and offer customization in an attempt to reduce distance between the virtual and the real world of experiential products. In fact, a survey conducted by Adobe found that Flash, Java, and Shockwave were pervasive software platforms for displaying web content, with levels of penetration at 96%, 87.3%, and 49.8% respectively (Adobe 2006). Noting that a well-designed VR interface can positively influence consumer purchase decisions online, Walsh and Pawlowski (Walsh 2003) bemoan that "little is reported about [such]... behavioural...areas where there is pressing need to understand better how these [VR] technologies might impact business"

In vein of existing realities, the objective of this study is to understand how consumer perceptions from interacting with VR interfaces indeed trigger purchase behaviour. The primary purpose of VR technologies is to elevate virtual experience (Walsh 2003; Wang et al. 2005). The question therefore is: does a heightened virtual experience positively induce online purchase behaviour? In doing so, the paper inquires a critical issue faced by organizations investing considerable funds for VR-based web development to induce consumer purchase, thus trying to confirm and disconfirm their beliefs. Recently, it has been debated if VR-based websites overload online shoppers and negatively affects buyer attitudes and intentions. For example, Matthewson mentions a site called Boo.com that tried to appeal to consumers through Java avatars and Flash content but ended up reducing consumer experience, ultimately contributing to the web site's demise (Matthewson 2002). It thus becomes both relevant and important to understand and acknowledge whether espoused notions virtual experiences from web-based VR interfaces do indeed play an important role in inducing purchase attitudes and intentions. Combining factor and process models, this research-in-progress paper proposes an initial transaction framework that traces consumer purchase behaviour in VR based e-commerce experiences.

## Literature review and model development

### *Virtual experience*

Human experience can be generally categorized into two types: direct experience and indirect experience. 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 facilitated by a communication medium that provides people with a sense of being present in an environment. 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 can be conveyed through indirect experiences.

The emergence of virtual reality (VR) technologies enables revolutionary representations of the world. People perceive immersive experiences commonly embodied by high-speed data streams, 3D 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). Such experience as psychologically and emotionally simulating the real world through a separate virtual environment via rich VR media is referred to as virtual experience. In IS literature, virtual experience is also termed as virtual product experience (Jiang et al. 2004) or telepresence (Biocca 1992; Steuer 1992). 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).

Virtual experience can be understood in terms of four properties (Li et al. 2001; Walsh 2002; Wang et al. 2005): virtual involvement, virtual affordance, virtual presence, and virtual enjoyment. Virtual involvement is the level of closeness that consumers feel to a product or service in a VR application environment (Li et al. 2001; Walsh 2002). Virtual affordance defined as consumers' expectations of experiencing a product or service in a VR application environment. (Li et al. 2001).

Virtual presence is a core concept in defining virtual reality which emphasizes human experience rather than technological hardware (Steuer 1992). Virtual enjoyment is the extent to which consumers are satisfied with the virtual environment compared with the real world. Increasing virtual enjoyment will potentially impact consumers' attitude and behaviour and facilitate decision making process (Li et al. 2001).

### ***Attitude towards product***

Consumer's attitude toward a product is contingent on two dimensions: their cognitive 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 VR applications, 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' acquired knowledge about a product must be positively associated with the level of their perceived virtual experience.

The affective dimension represents the extent to which consumers' perception toward the product is influenced by particular stimuli (McKenzie et al. 1989). If a consumer were to experience a product from all angles rather than one particular angle, their affective perception will be more likely to increase because of the exposure to intensive stimuli. The same view is echoed by Suh and Lee (2005) who find that consumers' facing VR environments are likely to develop a more informed purchase attitude in comparison with static application environments. Therefore, we hypothesize:

*H1: Consumer's favourable virtual experience is positively associated with their favourable attitudes toward the product*

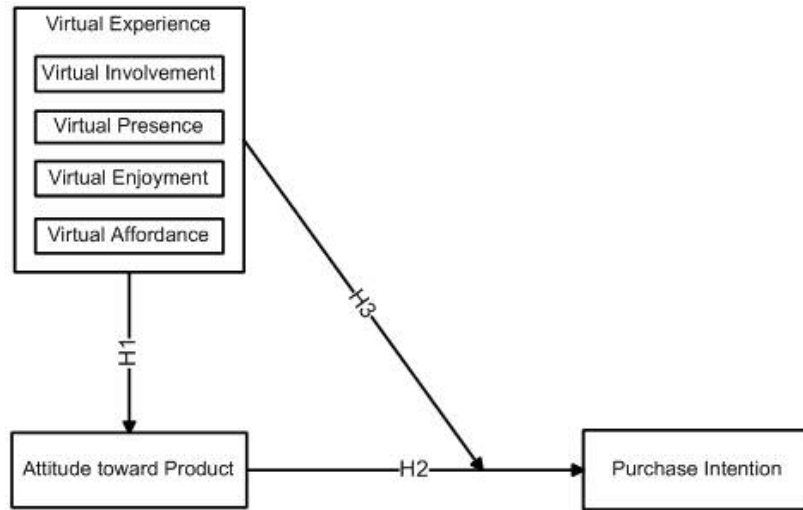
### ***Purchase intention with technology***

The theory of reasoned action (TRA) separates decision making into beliefs, attitudes, intentions and behaviours, where attitudes shape intention (Fishbein et al. 1975). It is well documented that consumers' favourable attitudes toward a product will lead to their positive intention toward purchase (Jarvenpaa et al. 2000; Suh et al. 2005). Therefore, we hypothesize:

*H2: Consumers' favorable attitudes toward the product is positively associated with their favorable purchase intentions with the use of VR technology*

We also contend that virtual experience has a moderating effect on the relationship between consumers' attitude toward product and their purchase intentions. The theory of planned behaviour (TPB) (Ajzen 1985) suggests that consumers may be willing to purchase a product based on their beliefs on the purchasing process which includes the product, the interface, and the participants (the seller). Studies show that in the online context consumers' purchase intention is simultaneously influenced by product characteristics and interface characteristics (Schlosser 2003; Suh et al. 2005). When seller's characteristics are controlled, consumers with favourable attitudes toward a product are more likely to be influenced by the interface than those with unfavourable attitudes. Therefore, we hypothesize:

*H3: For consumers with a certain level of attitude toward the product, favourable virtual experience will enhance their favourable purchase intentions with the use of VR technology*



*Figure 1. Research Model*

## Research method

### *Data collection*

An experiment was employed to empirically validate the proposed model. Stock VR renditions of automobile GPS devices using Macromedia Flash were used alongside GIF images created for the same automobile GPS devices. The GIF images offered a lower level of product representation vis-à-vis Macromedia Flash based renditions. For hypotheses testing, our experimental design offered manipulations in virtual experience (low VE vs. high VE).

Data were collected from students certified to the college of business in a large public university in the U.S. Bonus credits were announced to encourage participation and motivate completion of the experiment. Participation was entirely voluntary. A total number of 205 students participated in the experiment, of which 203 sets of usable responses were collected. One student quit the experiment half way through due to technical issues. Another student's data were dropped because of incomplete answers. The majority of participants were between the age of 21 and 25 and 70% of the participants were male (c.f. Table 1). Student participants were deemed acceptable as candidates for studying online consumer behaviour mainly due to the low possibilities of systematic differences between students and online shoppers (Everard and Galetta 2005)

Participating students were asked to complete an initial pretest that captured demographic and individual differences (age, gender, etc.). Subsequently, they were randomly assigned into two groups of different VE levels and asked to browse a web demonstration of an automotive GPS product – Garmin's Qwest™. The high VE interface utilized 3-D Macromedia Flash technology<sup>1</sup> 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 VE 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).

*Table 1. Participant Demographics*

Demographic Characteristics	Frequency (n=203)	Percentage (%)
<b>Age</b>		
15-20	34	16.7
21-25	147	72.4
26-30	12	5.9
31-35	2	1.0
36-40	4	2.0

<sup>1</sup> [http://www.garmin.com/products/quest/productShowcase/flash\\_content/Template-Main.swf](http://www.garmin.com/products/quest/productShowcase/flash_content/Template-Main.swf)

older than 40	4	2.0
<b>Gender</b>		
Male	143	70.4
Female	59	29.1

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

### *Instrument*

The research variables were measured using pre-validated scales adapted from prior research. Items for virtual experiment were partially adapted from Cho and Park (Cho et al. 2003), Kim and Biocca (Kim et al. 1997), Slater and Usoh et al (Slater et al. 1994), and Slater and Usoh et al (Slater et al. 1995); items for attitudes toward product were adapted from Venkatesh et al (Venkatesh et al. 2003) and Davis et al. (Davis 1993; Davis et al. 1989); items for transaction intention towards the technology 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).

SPSS version 13 for Windows was used for the exploratory factor analysis (EFA). All factors are loaded on their respective constructs with loadings no less than .75 which signifies good convergent validity. No crossing loading exceeds .40 therefore divergent validity is verified. Cronbach's Alpha was used to assess item reliability. According to Nunnally (1994), a minimum value of 0.70 is recommended for the test of composite reliability. All construct and items demonstrated internal consistency in the reliability test (c.f. Table 2).

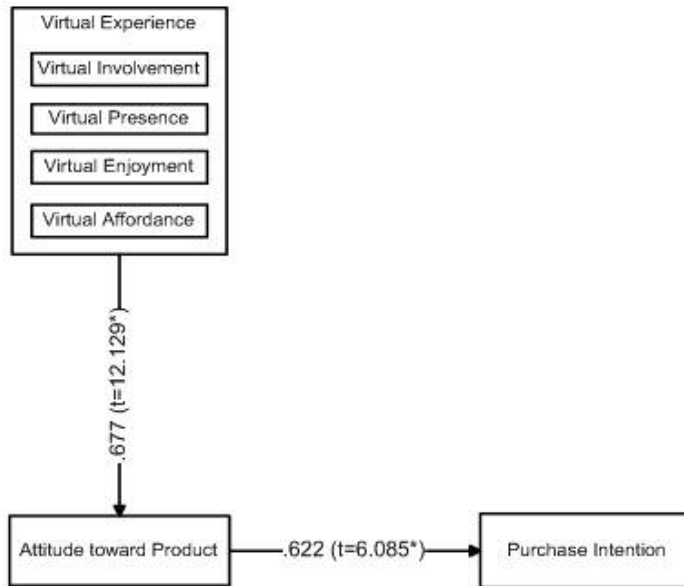
*Table 1. Reliability Test*

	Item	Factor 1	Factor 2	Factor 3	Cronbach's Alpha
Virtual Experience	VE1	<b>0.800</b>	0.111	0.399	0.897
	VE2	<b>0.774</b>	0.282	0.107	
	VE3	<b>0.830</b>	0.169	0.312	
	VE4	<b>0.788</b>	0.200	0.365	
Attitude toward product	ATT_P1	0.277	0.270	<b>0.750</b>	0.863
	ATT_P2	0.399	0.184	<b>0.813</b>	
	ATT_P3	0.256	0.226	<b>0.818</b>	
Intention to purchase	ITN1	0.255	<b>0.841</b>	0.227	0.911
	ITN2	0.142	<b>0.864</b>	0.328	
	ITN3	0.193	<b>0.909</b>	0.108	

### *Data analysis*

The first step of data analysis is to test the measurement model using EQS 6.1 software package (Bentler 2004). The measurement model analysis indicates comparative fit index (CFI) equals .982 and RMSEA equals 0.060 with 90% confident interval between .031 and .087. The fit indices suggested decent fit between the collected data and the proposed model.

The second step involved structural equation regression to test the links between constructs in the proposed model. As indicated in the path diagram (Figure 2), two significant paths were revealed: one is between the virtual experience and user's attitude toward product (H1), and the other is between the attitude and user's purchase intention (H2). These two significant paths provide support to H1 and H2 respectively.



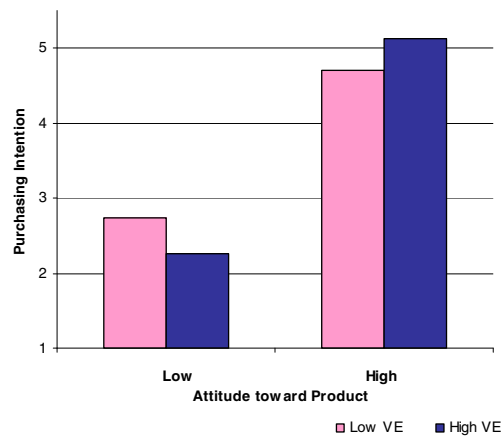
**Figure 1. Path Diagram (\* significant at 0.05 level)**

A linear regression was employed to assess the moderating effect of the virtual experience. Pursuant to the steps suggested by Carte and colleagues (Carte et al. 2003), we are reporting the effect size in the form of  $\Delta R^2$  in addition to the interaction term VE&ATT\_P. As illustrated in Table 5, entering VE&ATT\_P to the regression equation significantly increases  $\Delta R^2$  therefore H3 is supported.

**Table 3. Linear Regression Output Table**

Step	Enter	Beta	Sig.	R Square	R Square Change	F Change	Sig. F Change
1	ATT_P	0.316	0.018	0.364	0.364	115.554	0.000
2	VE	-0.331	0.085	0.366	0.002	0.553	0.458
3	VE*ATT_P	0.082	0.023	0.382	0.016	5.282	0.023

The moderating effect of VE can be more apparently illustrated in Figure 3. When consumers' attitude toward product is favourable, high perception of VE increases consumers' intention to purchase the target product. When consumers' attitude toward product is unfavourable, however, high perception of VE decreases consumers' intention to purchase the product.



**Figure 2. The moderating effect of Virtual Experience**

## Discussion

There is no dearth of anecdotal evidence on how virtual experience can contribute towards online purchases. As a greater number of vendors employ novel technology for VR renditions of content, it is crucial that they realize the potential of their investments. The results offer some interesting pointers.

Supporting the general trend towards deploying web-based VR interfaces in promise of increased online purchases, the data finds that high virtual experience does directly contribute to a more positive attitude towards the product. Indeed, virtual experience owing to a richer interface may help consumers' deliberate on certain product features and functions otherwise missing in general text and image-based renditions. For example, participants felt more at ease with interfaces that enhanced their experience because they were able to tap into information about the product. Being able to examine the product at varying degrees of detail contributed to a positive outlook towards the product. Interestingly though, the direct role of virtual experience in specifying buyer behaviour is limited to a positive shift in attitudes only. Results pointed that while an increase in virtual experience did have a significantly large direct effect on buyer attitudes, virtual experience from VR technologies did not contribute towards any purchase intention. Seemingly enough, buyer intentions to purchase a product are captive to positive attitudes towards and not on the richness of experience offered by the delivery and rendition of the content.

The moderating effects point towards two key behavioural aspects in consumer decision-making. Altogether, virtual experience from rich VR technologies marginally contributes towards purchase intentions. Specifically, a heightened virtual experience positively influences purchase intentions for products enjoying a positive attitude. For example, if a customer perceives the SONY PlayStation®3 positively, they are likely to welcome a rich demonstration of its features before making a purchase. However, for consumers possessing a negative attitude towards a product, interfaces that heighten their virtual experiences are often considered to be an unnecessary distraction, further lowering their purchase intention. Intuitively, online shoppers who are indifferent or have negative perceptions towards certain experiential products would most likely prefer not to be subject to a rich demonstration of the same.

While this research is a preliminary attempt at understanding the direct and indirect influences on VR-based virtual experiences on buyer behaviour, it suffers from a few limitations. *First* and foremost, we feel that the use of student participants may lead to a biased view of buyer behaviour. While our choice of undergraduate students as informants has received justification in prior literature (e.g. Everard and Galetta (Everard et al. 2005)), we acknowledge that the use of students for an imaginary purchase is not without caveats. Students may not be as involved as consumers transacting in electronic markets; given an imaginary purchase, their sense of uncertainty may differ from consumers involved in electronic market transactions. While systematic efforts were made towards making sure that student participants were involved and cognizant of online shopping, it remains to be seen if their perceptions are essentially different from other consumer segments. Future attempts at validating the model should expand the sample to encompass different consumer segments. Future research could try to empirically validate the proposed model across different samples. *Second*, it would be extremely helpful to trace buyer behaviour in light of a variety of different VR-based technologies across multiple products. For example, how would different VR-based technologies contribute to virtual experiences among consumers? Would their experiences also be shaped by the type of products they planning to purchase?

Despite the aforementioned limitations, we feel that the paper offers an important step towards explaining behavioural outcomes in face of current organizational trends in offering rich content through the use of web-based VR technologies. As a research-in-progress, our thesis tries to empirically substantiate the degree to which end-objectives of deploying web-based VR technologies are met.

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## Appendix – Instrument

Item	Question
	<b>Virtual Experience</b>
VE1	The virtual environment was very involving (Involvement)
VE2	The virtual environment felt real to me (Virtual Presence)
VE3	The virtual world was enjoyable (Virtual Enjoyment)
VE4	The virtual environment offered me a sense of collaboration and/or participation (Virtual Affordance)
	<b>Attitude toward the technology</b>
ATT_P1	I believe that the VR application truly represents the product
ATT_P2	I believe that the VR application accurately represents the product
ATT_P3	I believe that the VR application is able to completely represent the product
	<b>Purchase Intention with the technology</b>
ITN1	I intend to use virtual reality technology to make online purchases in the future
ITN2	I predict that I actually will plan to use virtual reality technology in the future for online purchases
ITN3	I plan to use virtual reality, wherever available, in the future to make online purchases