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From distance shopping to virtual shopping

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The distance shopping system has a long history of development from the traditional mail-order catalogue to the interactive online shopping platform of today. However, developing a new form of distance shopping does not mean digitizing product catalogues or uploading product information online, retailers and marketers should pay attention to the effective use of virtual technologies, in particular to enhance consumers' experiences of telepresence and enjoyment. This paper discusses the use of virtual reality, in particular telepresense experience, for distance fashion shopping. A pilot virtual shop is introduced to describe the use of advanced virtual technologies in virtual shopping.

Keywords: telepresence, distance shopping; virtual shopping; virtual reality; fashion retailing

1 Introduction

To understand and forecast the development of distance shopping in fashion retailing in the future, it is wise to look beyond the retailers' and marketers' perspectives, and put ourselves into the consumers' shoes. This is because fashion retailers and marketers always try to respond to customers' preferences and behaviours. Tracing the history back to the 1960s and 1970s, the notion of consumption has been redefined progressively from initially being practical and based only on the products' use value. Modern consumers no longer only consume the products or services; they also consume the products' meanings and images. When the aestheticism of everyday life penetrated into the field of consumption in the 1980s, scholars, researchers and marketers then began to see consumers as emotional human beings looking for sensorial experiences as they go shopping, where they interact with the products and services. In other words, consumers now shop for identities and not only necessities, and they focus not only on the product itself but also bring hedonistic values and individual subjectivity to the shopping experience. Fashion retailers and marketers have worked hard to product or co-produce pleasant shopping experiences for consumers in the new form of distance shopping in the virtual world, for example the experiences of telepresence and enjoyment. Distance or mobile shopping systems are a new trend that can potentially provide consumers with unique shopping experiences that can be highly personalized and autonomous, anytime and anywhere. However, with eCommerce transactions breaking their own records year after year, virtual stores for tangible goods like fashion apparel have always fallen short in the experiential factor, and this has been an important obstacle for managers in the fashion businesses. Aware of the problem, many online retailers

have incorporated image and interactivity technology into their websites, aiming to improve the "experience design" for their distance customers. However, these acts of "digitalizing mail-order catalogues" cannot possibly bring our consumers to a new form of distance shopping. Thus, this paper aims to discuss the use of virtual reality and telepresence in creating a new distance shopping system. I n the latter part of this paper a pilot virtual shop with augmented virtual technology suggests the use of telepresence in virtual fashion retailing.

2 A brief review on the development of distance shopping systems

To begin discussing the distance shopping businesses especially in virtual space, we shall start with its earliest form – the mail-order catalogue. At the very beginning of the mail-order business, the concept was based on providing rural citizens with a more convenience-shopping channel by using catalogues and deliveries through the mail. For example in the United States (US), according to Wilson during the 1870s the population was still mainly rural.[1] Since shopping was not convenient for people who lived in rural areas, one of the pioneering companies in the developing mail-order system, Montgomery Ward & Co., was established in 1872 in Chicago to meet people's needs. Montgomery Ward's first mail order catalogue was only a single sheet with an illustrated price list and ordering instructions.[2] Montgomery Ward tried to convince rural consumers to buy a variety of goods, including clothing, furniture, and hardware, through the mail-order system at a lower price. Moreover, this company also strengthened the consumers' confidence by guaranteeing refunds and returns for every purchase. All of these factors contributed to Montgomery Ward's success, leading its catalogue to expand quickly from only single page in 1872 to nearly 1000 pages in less than 30 years, by which time the company had more than one thousand employers and annual sales reaching $7 million.[3]

Montgomery Ward's success contributed to the enlargement of the mail-order business. Another essential pioneer was the Sears Company, which established a general mail-order company similar to Montgomery Ward. After only a few years, Sears overtook Montgomery Wards' as the leading mail-order company. In 1905, Sears had about 9 thousand employees, and an annual sale of almost $50 million. By 1914 the company's annual sales had ballooned to over $100 million and it had opened new branches in Dallas and Seattle in addition to its central operation centre in Chicago.[4] The prime time of the mail-order business actually occurred between the 1890s and the 1910s; and it was dominated by Montgomery Ward and Sears just prior to the explosion of the electronic commerce era. The mail-order system in later times acted more like a marketing tool complementing the retail business. According to the article written by Gattuso (1993) who studied the cases from various brands that used mail-order as a marketing channel, pointed out that a growing number of companies were discovering that, with well-positioned retailing and a catalogue program, they could build better-than-expected results.[5] Successful companies are developing a '*synergy*' in mail order and retailing, helping one another out rather than being competitors in sales. Such a use of marketing channels is named "direct marketing". Nowadays, direct marking has a variety of forms, such as direct mail, mail-order, direct response marketing (e.g. coupons), telemarketing, and database marketing. In the past, direct mailing was the most common of these, but in recent years,

1 Wilson, M.R. (2005). Mail Order. The Electronic Encyclopedia of Chicago [www.encyclopedia.chicagohistory.org/pages/779.html]

2 Rips, R.E. (1938). An Introductory Study of the Mail Order Business in American History 1872–1914, University of Chicago

3 Wilson, M.R. (2005). ibid

4 ibid

5 Gattuso, G. (1993). Taking Care of Business, Journal of Direct Marketing, 6, 20-22

due to the Internet's popularity, electronic direct mail has already become the major taken form of direct marketing.[6] However, most of the electronic direct mailings are used as promotional tools rather than ordering systems. Even worse, most of this mail is treated as spam and possibly never viewed by potential consumers. Thus, retailers and marketers are continuously looking for new channels for expanding their markets and sales via electronic platforms. Online shopping could be one of the new concepts that foster distance shopping, or we might say mobile shopping, over the Internet and cell phone.

With the arrival of the Internet, globalization allows information to be exchanged effortlessly and at a much faster speed, and this has had a significant effect on the approach to fashion retailing as well. In spite of the aggressive growth rate in eCommerce, it has become increasingly evident that consumers find text and static pictures unsatisfactory when it comes to feeling, trying and touching a product. When consumers cannot examine or try on the product physically before making their purchase decision, this will hinder their intention to purchase because they will have experienced less product-shopper interaction compared to the direct product experience they could have in a brick-and-mortar store.[7] [8] [9] Hence, numerous major online retailers have already introduced different types of Image Interactivity Technology (IIT) platforms providing three-dimensional computer simulations of products and shopping environments. This technology suggests a different online shopping experience, which is referred to as a virtual experience.[10] Despite some researchers having criticized the effectiveness of virtual shopping models, for example My Virtual Model,[11] the virtual shopping models like Virtual Try-on could enhance the entertainment value of consumers' shopping experiences in virtual worlds.[12] However, creating consumers' virtual experiences through online and interactive platforms does not mean transforming traditional types of distance shopping to an interactive catalogue in a virtual world. A virtual shopping experience is a completely new research area that effectively uses advanced technologies to carry out virtual retailing and shopping.

3 Do virtual reality and telelpresence experiences help in distance shopping?

Tracing the history back to 1956, the world's first mechanical virtual display device, Sensorama, was created using electronics by the film maker Morton Heilig, and this was when computers were still in the early stages of development. The term "virtual reality" was first coined by Sutherland in 1963 and he also designed the prototype head mounted display (HMD) for rendering visual stimuli. This was the time when the technical, artistic and psychological study of virtual environments (VE) began to develop, such as the invention the 'CAVE'- a type system that projected scenes on the surrounding walls of a room, and the various definitions and names that evolved for virtual reality. Even now, "virtual reality" and "virtual environments" remain as the most generally accepted and commonly used names. However, the definitions of these terms can have different focuses, depending on one's interest. Some researchers have defined virtual reality as a technology.[13] [14] For instance: "Virtual Reality is an alternate world filled with computer-generated images that respond to human movements. These simulated environments are usually visited with the air of an expensive data suit which features stereophonic video goggles and fiber-optic data gloves".[15] Other researchers (e.g. Steuer, 1992; Seidel, Chatelier & NATO Defense Research Group,

6 Diamond, W. and **Oppenheim, M.R.** (2004). Chapter 10: Direct Marketing and E-Com-merce Sources, Journal of Business & Finance Librarianship, 9:4, 221-236

7 Li, H. et al (1999). The impact of perceived channel utilities, shopping orientations, and demographics on the consumer's online buying behavior, Journal of Computer-mediated Communication, 5:2. [www.ascusc.org/jcmc/vol5/issue2/hairong.html]

8 Swinyard, W.R. & **Smith, S.M.** (2003). Why people (don't) shop online: a lifestyle study of the internet consumer, Psychology & Marketing, 20:7, 567-597

9 Monsuwe et al (2004). What drives consumers to shop online: a literature review, International Journal of Service Industry Management, 15:1, 102-121

10 Li, H. et al (2001). Characteristics of virtual experiences in electronic commerce: a protocal analysis, Journal of Interactive Marketing, 15:3, 13-29

11 Nantel, J. (2004). My Virtual Model: Virtual Reality Comes into Fashion, Journal of Interactive Marketing, 18:3, 73-86

12 Kim, J. & **Forsythe, S.** (2008). Adoption of Virtual Try-on Technology for Online Apparel Shopping, Journal of Interactive Marketing, 22:3, 45-59

13 Heim, M. (1998). Virtual realism, Oxford University Press, New York

14 Strangman, N. & **Hall, T.** (2003). Virtual reality/simulations [www.cast.org/publications/ncac/ncac_vr.html]

15 Greenbaum, P.

1997; Riva, 1999; Fitzgerald & Riva, 2001) have defined it as a human experience; in other words, it is a unique experience between the participant and the virtual environment.[16] [17] For instance, Seidel et al defined virtual reality is a multi-dimensional human experience that can be created totally or partially by computer;[18] while Steuer defined it as "a real or simulated environment in which a perceiver experiences telepresence".[19] Fitzgerald and Riva pointed out that it commonly occurred in a computer synthesized three dimensional graphical environment with visual and auditory output devices;[20] while Li et al considered virtual experience as the simulation of a real or physical experience that occurs within a computer-mediated environment.[21] From the definitions we can see that, with these systems, users can experience an *immersive virtual environment* as if they were being there. This blurring of physical and simulated environments has given rise to the concept of presence in virtual reality. Slater highlighted that the concept of presence is crucial for virtual environments to be effective.[22]

He emphasized that this concept of presence should hold "a strong sense of being there in the electronic simulated environment to an extent where the virtual environment becomes the prevailing one and to participants who undertake the virtual environment experience, should remember it as if visited a place rather than just seeing images created by a computer".[23] Such psychological and emotion states can only be accomplished in highly immersive virtual environments. This is because only the sense of presence can make users more confident about the information presented by the computer, and hence reach a better level of immersion.[24]

To be specific, Fiore et al pointed out that the sense of presence, also known as telepresence, is affected by the quality and quantity of simulated sensory information presented about the product as well as the simulated interaction with the real product in a brick-and-mortar store.[25] [26] According to Yoon et al this quality and quantity of sensory information and interaction with the product can be characterized into terms such as "promptness of response",[27] [28] "vividness",[29] "media richness",[30] "quality of image",[31] "level of interactivity"[32] and "ease of interaction".[33] Moreover, it is important to note that interactivity is correlated with few of these terms, because theoretically the interactive and vivid nature of virtual product visualization stimulates mental imagery within consumers. Such imagery can evoke past memories and feelings,[34] thus the more interactive and vivid the virtual product experience the richer the mental imagery evoked.

"Interactivity" typically refers to the product examining and interaction within a virtual environment, which provides a stronger sense of control to consumers and proves increasing the telepresence experience.[35] In other words, a virtual shopping environment is a simulated space that allows users to experience the same features when positioned in a brick-and-mortar store with telepresence mediating the swaying impact.[36] Hence, virtual reality is actually a computer-mediated medium that generates the most convincing sense of presence that brings human interaction via the computer into a new era of human-to-human communication.[37] [38] In this case, a new form of distance shopping, we believe, is focusing on developing consumers' telepresence experiences within any virtual forms of marketing and retailing.

(1992). The lawnmower man, Film and Video, 9:3, p. 60

16 Steuer, J.S. (1992). Defining virtual reality: Dimensions determining telepresence, Journal of Communication, 42, 73-93

17 Riva, G. (1999). From technology to communication: Psychosocial issues in developing virtual reality environments, Journal of Visual Language and Computing, 10:1, 87-97

18 Seidel, R.J., Chatelier, P.R. & **NATO Defense Research Group** (1997). Virtual reality, training's future? Perspectives on virtual reality and related emerging technologies, Plenum Press, New York

19 Steuer, J.S. (1992). ibid

21 Li, H. et al (2001). ibid

22 Slater, M. (1999). Measuring presence: A response to the Witmer and Singer Presence questionnaire, Presence, 8:5, 560-565

23 op cit p.562

24 Kim, T. & **Biocca, F.** (1997). Telepresence via television: Two dimensions of telepresence may have different connections to memory and persuasion, Journal of Computer-Mediated Communication, 3:2. [www.ascusc.org/jcmc/vol3/issue2/kim.html]

25 Fiore, A.M. et al (2005b). Effect of image interactivity technology on consumer responses toward the online retailer, Journal of Interactive Marketing, 19:3, 38-53

26 Fiore, A.M. et al (2005a). For fun and profit: Hedonic value from image interactivity and responses toward an

4 A new form of distance shopping: Creating virtual and telepresence experiences

A virtual experience is a simulation of a real or physical experience which occurs within a computer-mediated environment, and in the context of consumer learning it is conceptualized to be between direct (e.g. trial, inspection) and indirect (e.g. catalogue, advertisements) experiences.[39] In some recent work Li, et al concluded that the virtual experience can be treated as an alternative consumer experience by providing distinctive characteristics that differentiate virtual experience from indirect and direct experiences.[40] Furthermore, the results have also shown that combining virtual experience with a direct or indirect experience can result in a better product experience than undergoing any of them alone. By enhancing the eCommerce virtual reality technology, a virtual experience can benefit retailers by enriching consumers' product knowledge, affecting brand attitude, and raising purchase intention.[41] Even though eCommerce is credited with providing various benefits for consumers, such as ease of access, greater time and cost efficiency, steady and reliable service, and a wider range of product/service choices than traditional stores,[42] [43] it has gradually become clear that text and static pictures are insufficient for delivering rich product information, particularly for experience attributes such as the "feel, try and touch" of a product. [44] When a shopper cannot physically examine or try on the product it limits the product shopper's interactions compared to a direct shopping experience in a brick-and-mortar store.[45] This inability to experience the product directly creates a barrier in the shopper's buying process and will limit the intention to purchase online (Li, Kuo & Russell, 1999; Swinyard & Smith, 2003).[46] [47] Research has also shown that the lack of richness in online product presentation is a major hindrance to eCommerce.[48]

Acknowledging the areas where online apparel business were falling short, marketers, and retailers began to incorporate Image Interactivity Technology (IIT), a kind of virtual reality, to address the lack of an experiential factor in eCommerce. IIT offers an advanced way to envisage the product; demonstrate its characteristics; and model an imitated product experience in a virtual world. The varieties of IITs offered can be differentiated by the level of interactivity. A single 2D lifelike image of the product that can be clicked on to enlarge is an example of lower level interactivity IIT whereas a higher level of interactivity often allows the user more control over the manipulation of the product image including mix-and-match features, zoom-in function etc. In fact, there are increasing uses of a relatively new form of IIT which is a 3D virtual model technology offering an even higher level of interactivity. This form of IIT allows the customer to customize the product combinations on the body and view them from different angles and distances. For example Guess.com incorporated Mix & Match and Lands' End.com introduced applications such as My Virtual Model. Fiore and Jin pointed out that the IITs of apparel retailers provide consumers with more active processes that allow the consumer to take control of selecting products, developing body forms, and deciding whether the product combination looks nice and coheres with the imagination before "trying it on" virtually using IIT.[49] Thus a stronger sense of control is formed, which enhances the consumers' decision-making process.[50] Sam Taylor, vice president of eCommerce for Lands' End provided real-life business statistics to support these ideas. He announced a 34%

online store, Psychology & Marketing, 22, 669-694
27 Yoon, S.Y. et al (2008). Understanding Usability and User Experience of Web-Based 3D Graphics Technology, International Journal of human-computer interaction, 24:3, 288-306
28 Li, H. et al (2001). ibid
29 Steuer, J.S. (1992). ibid
30 Klein, L.R. (2003). Creating virtual product experiences: The role of telepresence, Journal of Interactive Marketing, 17, 41–55
31 Nunez, D. & **Blake, E.** (2006). Learning, Experience, and Cognitive Factors in the Presence Experiences of Gamers: An Exploratory Relational Study, Presence, 15:4, 373-380
32 Steuer, J.S. (1992). ibid
33 Weghorst, S. & **Billinghurst, M.** (1993). Spatial perception of immersive virtual environments. University of Washington, Seattle
34 Yuille, J.C. & **Catchpole, M.J.** (1977). The role of imagery in models of cognition, Journal of Mental Imagery, 1, 171-180
35 Schubert, T. et al (2000). Real and illusory interaction enhance presence in virtual environments, Presence (3rd International Workshop)
36 Daugherty, T. et al (2001). Consumer Learning and 3-D Ecommerce: The Effects of Sequential Exposure of a Virtual Experience Relative to Indirect and Direct Product Experience on Product Knowledge, Brand Attitude and Purchase Intention, Paper presented at the Experiential Ecom-

increase in the rate of conversion of shoppers to buyers, along with increased apparel purchases, after providing the virtual model technology used on 'Landsend.com'.[51] Nonetheless, the virtual experiences used in the current fashion retailing online platforms are still at a pilot stage offering rather elementary functions given the current technology developments. They are not highly immersive offering the consumer a limited telepresence. Daugherty et al suggested that research and development of virtual shopping environments could start with examining the affordance first, these being the types of expected interactions between consumers and products in direct experience.[52] [53] By examining these interactions, the required affordances can be generated, thus providing a better constitution of virtual and telepresence experiences. In other words, the key to success in designing effective interfaces stems from creating the appropriate affordances that a user expects in any advanced form of computer-mediated environment.[54] Reeves and Nas noted that large images in online shopping environments are more likely to be arousing, better remembered and better liked than small images.[55] This finding has highlighted the potential impact of zooming in a 3D IIT. Therefore the study of affordances can definitely justify the potential impact of interfaces in a virtual eCommerce environment.[56]

5 The challenges of creating hedonic virtual shopping experience through telepresence

One of the key issues in creating a telepresence experience in virtual retailing is how to provide our consumers with a hedonic virtual shopping experience. An effective strategy for carrying out virtual shopping leans on complicated relationships between the consumers' shopping experiences and the hyper realistic stimulations. Thus it is essential for retailers and marketers to understand the correlations among these factors and elements in order to improve the experiential design in any digital medium. At different times, product knowledge, brand attitude and purchase intention may have different stimulating features, which means that factors creating favourable product knowledge and brand attitude are not necessarily the same factors that can convince consumer to purchase the product. When consumers are undergoing the decision-making process involved in purchasing a product, they tend to run mental simulations of themselves performing certain behaviours with that product, and therefore purchase intention relies strongly on imagery processing.[57] [58] This explains the reason why researchers have been examining the correlation between virtual experience and purchase intention using variables like vividness, interactivity, and telepresence. Schlosser expressed the belief that being able to manipulate the virtual object directly enables consumers to generate more vivid images in their mental simulations of product use, thus resulting in higher purchase intentions. This can have significant effects for the less imaginative consumers.[59] Schlosser's research results supported this belief, leading him to conclude that, due to the prominent role of imagery processing in consumers' decision making processes, product manipulation power in the virtual environment is correlated positively with consumers' vivid mental imagery which is also as part of their immersion into the virtual world, and their purchase intentions were proven to be much higher compared to the traditional storyboard format.[60] This supports Holbrook and Hirschman's assertion that hedonic elements of consumption (fantasy, feelings and fun)

merce Conference, Michigan State: Michigan State University

37 Biocca, F. (1992). Communication Within Virtual Reality: Creating a Space for Research. Journal of Communication, 42:2, 5-22

38 Biocca, F. (1997). Progressive embodiment in virtual environments, Journal of Computer Mediated Communication, 3:2

39 Daugherty, T. et al (2001). ibid

40 Daugherty, T. et al (2008). Consumer Learning and the Effects of Virtual Experience Relative to Indirect and Direct Product Experience, Psychology & Marketing, 25:7, 568 – 586

41 ibid

42 Then, N. & **DeLong, M.** (1999). Apparel shopping on the web. Journal of Family and Consumer Sciences, 91:3, 65-68

43 Monsuwe et al (2004). ibid

44 Nelson, P. (1974). Advertising as Information, Journal of Political Economy. 82:2, 729-754

45 Monsuwe et al (2004). ibid

46 Li, H. et al (1999). ibid

47 Swinyard, W.R. & **Smith, S.M.** (2003). ibid

48 Rose, G. et al (1999). Current Technological Impediments To Business-To-Consumer Electronic Commerce, Communications of the AIS, 1, Article 16

49 Fiore, A. & **Jin, H.J.** (2003). Influence of image interactivity on approach responses towards on online retailer, Internet Research: Electronic Networking Applications and Policy. 13, 38-48

50 Katz, J. & **Aspden, P.** (1997). Motivations for

deserve to be studied for their importance in the consumer's buying process.[61]

Despite the well known advantages of virtual environments on consumer experience Kim and Forsythe received mixed opinions from their interviewees about using Virtual Try-on for online apparel shopping, with a few interviewees even finding it confusing.[62] One interviewee pointed out that confusion about one's own measurements made it difficult to create the appropriate body form. In addition a few interviewees complained that the appearance of the clothing was not realistic enough. Nevertheless, both male and female interviewees found Virtual Try-on to be entertaining and said they would visit online shopping sites where it was offered, and would also recommend it to others. The majority of the interviewees agreed that Virtual Try-on technology was more entertaining than functional, since most of them thought that the clothes looked unrealistic on the model, and as a result was not very helpful in showing what the garment would be like when they actually wore it.[63] Moreover, the final stage of the buying process is not just making the purchase decision; it is the post-purchase feeling (Kotler & Armstrong, 1997) that completes the process.[64] In other words, the buying process is not considered as complete until the product has been used and has resulted in the satisfaction or dissatisfaction of the original need/desire. Moreover, it is essential to ensure that consumers receive the appropriate product information, and are not confused by the vivid nature of the virtual environment. Confusion is often caused by the sequences of reaction when one is exposed to vivid images which will, in turn, evoke stimuli, thus improving memory.[65] [66] [67] Yet, such memories may contain some false ones that are imagined by consumers instead of actually perceived in the vivid virtual environment. Schlosser supported this argument by demonstrating how interactivity increases false positives object proportionally. This can ultimately lead to customer dissatisfaction and hence failure to achieve the final stage of the buying process.[68]

Another challenge we are facing here is that different shoppers using the virtual shopping tools may have different needs and concerns. Research done by Fiore et al used the framework of Holbrook's Consciousness-Emotion-Value model for the consumption experience and examined the effects of emotions and hedonic value, as well as consumer characteristics on the users' responses to online IIT platforms.[69] [70] Theoretically the population of shoppers can be divided into two main categories based on their shopping characteristics, namely recreational shoppers and economic shoppers. Recreational shoppers are those who will shop around a store or mall non-purposively; they usually enjoy the shopping experience itself and may not have a fixed checklist of products to get.[71] On the other hand, economic shoppers usually have a fixed checklist of products and so they are usually convenience seekers and are concerned about the image quality of the products presented online. Therefore recreational shoppers are different from economic shoppers in terms of their preferences for experiential attributes in shopping environments as well as product and promotional presentation. The population of shoppers can also be categorized further in terms of buying impulsiveness. This refers to the consumer's tendencies to be unthoughtful, spontaneous, or to engage in immediate buying behaviour. Highly impulsive buyers are more likely to be excited by the experience and to make a purchase decision spontaneously, and because they have more flexible shopping lists they react more openly to sudden, unexpected shopping ideas. In fact, higher impulsive

and barriers to Internet usage: Results of a national public opinion survey, Internet Research: Electronic Networking Applications and Policy, 7, 170-188

51 DesMarteau, K. (2004). Online apparel sales see double-digit growth. Apparel Magazine, 45:11, 30-32

54 Karat, J.M. et al (2000). Affordance, motivations, and the design of user interfaces: Creating tools that enable rather than restrict add value to the product and loyalty from the customer, Communications of the ACM, 48:8, 49-51

55 Reeves, B. & **Nass, C.** (1996). The media equation. Cambridge, UK: Cambridge University Press

56 Daugherty, T. et al (2001). ibid

57 Anderson, C. (1983). Imagination and Expectation: The Effect of Imagining Behavioral Scripts on Personal Influences, Journal of Personality and Social Psychology, 45, 293-305

58 Schlosser, A.E. (2006). Learning through Virtual Product Experience: The Role of Imagery on True versus False Memories, Journal of Consumer Research, 33, 377-383

59 ibid

60 ibid

61 Holbrook, M.B. & **Hirschman, E.C.** (1982). The experiential aspects of consumption: Consumer fantasies, feelings, and fun, Journal of Consumer Research, 9, 132-140

62 ibid

63 ibid

64 Kotler, P. & **Armstrong, G.** (1997). Marketing An Introduction

buyers tend to go through these purchasing stages more quickly; hence it is logical to deduce that purchasing environments that help consumers go through the buying process more quickly will be more favourable to higher impulsive buyers.[72] This suggests that, for IIT to satisfy all types of shoppers, it should consist of high levels of sensory and emotional stimulation, as well as adequate imagery evocation tailored for recreational shoppers; while also providing detailed and useful information to satisfy the needs of the economic shopper; while at the same time smooth and prompt real time responses are essential for impulsive consumers.[73] This constitutes a challenge to the virtual environment generators as well as the online retailers when they have to strike a balance between the investment and the expected outcome.

6 Using the telepresence experience as a retailing strategy for enhancing consumers' hedonic experience

Interactive and virtual technologies have been changing the way that retailers, marketers and designers interact with consumers. Virtual shopping systems, such as Sainsbury's eCommerce system in the UK and the My Virtual Model and the BrandME systems, facilitate the consumer's entire shopping process and create a personal shopping experience in a virtual environment. However, the successful launching of any virtual shopping system involves complicated relationships between the study of consumers' shopping experiences and the effective use of virtual technologies. The power of these technologies provides one-to-one personal service to consumers. This sense of personal experiences is fundamentally creating a sense of telepresence and hedonic shopping experiences during the shopping process; however, the hyper realistic virtual environment is also a crucial factor in providing consumers with a sense of immersion and enjoyment. Nonetheless, using telepresence as a marketing strategy for enhancing consumers' hedonic experiences should start from understanding their virtual behaviours during the shopping process. In relation to this, Anderson proposed that people's expectancies about their own behaviours depend in part on their ability to imagine themselves performing the behaviour.[74] Therefore, it is suggested that, before building a virtual retailing environment, the retailers and marketers have to examine the affordance that is the type of expected interaction between consumers and products in the direct experience.[75] An examination of these interactions can help to generate the affordances needed to establish a compelling virtual experience within any digital medium. This is a crucial factor in determining the success of the virtual shop since it has a direct effect on the sense of presence and ease of information collection in virtual environment which determines the immersion of users and their decision making processes.[76]

Based on the assumptions discussed above, a pilot virtual shop (Figures 1 and 2) was developed through the use of augmented virtual technology and hyper realistic simulation. These two technologies aim to enhance consumers' telepresence and hedonic experiences in virtual shopping.

To enter this virtual shop, the consumer has to wear a head-mount display device, a hand-held remote control and a foot sensitive device to immerse into the virtual shop and perform shopping activities (Figure 3).

This pilot virtual shop provides a strong sense of telepresence and hedonic experiences, consumers can be involved actively in creating multisensory and

(4th ed.), New Jersey: Prentice Hall International

65 Paivio, A. (1971). Imagery and Verbal Processes, New York: Rinehart & Winston

66 Lutz, K.A. & **Lutz, R.J.** (1977). Effects of Interactive Imagery on Learning: Application to Advertising, Journal of Applied Psychology, 62:4, 493-498

67 Childers, T.L. & **Houston, M.J.** (1984). Conditions for a Picture-Superiority Effect on Consumer Memory, Journal of Consumer Research, 11, 643-654

68 Schlosser, A.E. (2006). ibid

70 Holbrook, M.B. (1986). Emotions in the consumption experience: Toward a new model of consumer behavior, In Peterson, R.A., Hoyer W.D. & Wilson, W.R.E. eds, The role of affect in consumer behavior: Emerging theories and applications, Lexington, MA, 17-52

71 Gehrt, K.C. & **Carter, K.** (1992). An exploratory assessment of catalog shopping orientations: The existence of convenience and recreational segments, Journal of Direct Marketing, 6, 29-39

72 Lee, B.C.Y. (2007). Consumer attitude towards virtual stores and its correlates, Journal of Retailing and Consumer Service, 14, 182-191

73 Fiore, A. & **Jin, H.J.** (2003). ibid

74 Anderson, C. (1983). ibid

75 Schuemie, M.J. & **Mast, C.V.** (1999). Presence: Interacting in VR? The 20th Workshop on Language Technology, 15

76 ibid

highly interactive experiences by being able to change the visual and spatial senses of the space autonomously. In other words, consumers are allowed to customize their shopping experiences during the virtual shopping process. In this pilot study, selected consumers are invited to participate in virtual shopping in this virtual shop. They are encouraged to use their previous shopping experience in physical store to compare with this new virtual shopping experience. In views of providing immersive, interactive, and sensory feedback to enhance consumers' sense of telepresence, our system allows consumers to use three different sensory devices (Figure 4), namely head-mounted display for creating sense of immersion, hand-held controller for interacting with the environment and products, and a stepping board for navigation. The head-mounted display device supports 3-D visualized images and real-time navigation, and the hand-held controller provides consumers with a user-friendly and interactive shopping experience by allowing them to select their purchase items freely. The hand-held controller also allows consumers to zoom in and rotate the purchase items in able to view the products from different angles (Figure 5). The stepping board is essential in this system; it offers consumers a chance to 'walk' around the virtual store. This experience could enhance their sense of telepresence. In addition, consumers can adjust the lighting of the store as well as changing the background music up to their needs. It is because, to enhance consumers' sense of telepresence in virtual reality, has to impart them with realistic experience. In this case, the incorporation of music and lighting is helpful.

Figure 1 The pilot virtual shop

Creating hedonic virtual experience for consumers is the major concern of our project team. The 3-D virtual shop and other sensory devices provide consumers with high level of interactions and sense of immersion. Therefore, this pilot virtual shop is designed to explore consumers' virtual shopping experiences in an augmented virtual reality by providing them with hyper realistic 3-D simulation and a sense of telepresence. This project is still under development, and the initial feedback from selected consumers indicates their virtual shopping experiences in the virtual shop are innovative, fun and exciting. These hedonic virtual

shopping attitudes create a positive shopping experience for consumers and finally changing them to become purchasers. Nonetheless, although this pilot study is not able to provide a proof of how to design a successful virtual shop in virtual reality, however, this attempt indicates the use of advanced virtual technologies for creating telepresence experiences for future fashion retailing and interactive markets.

Figure 2 The pilot virtual shop

Figure 3 Consumer entered the virtual shop with special devices

Figure 4 The system devices

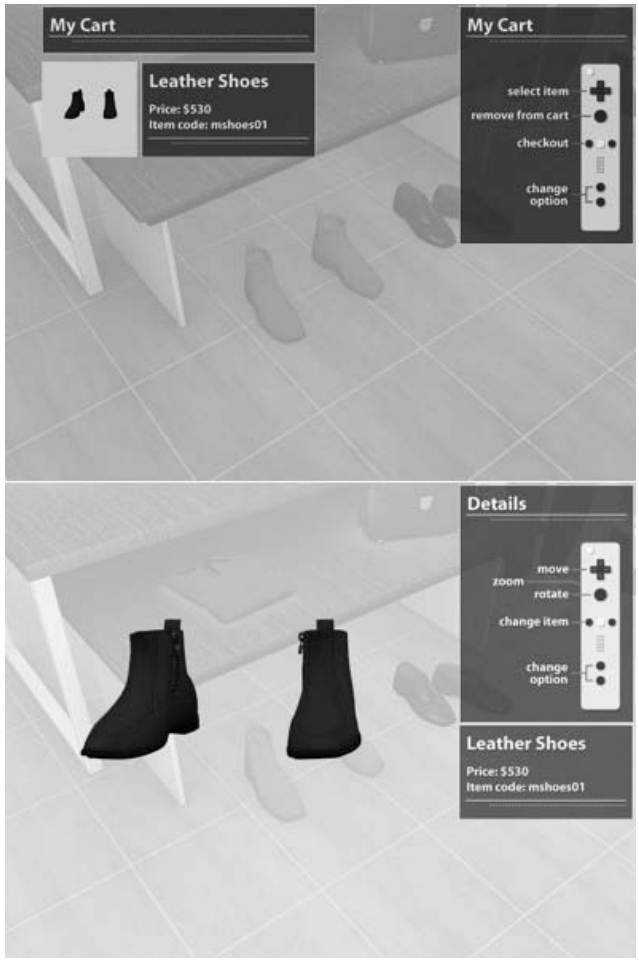

Figure 5 The decision-making system

7 Conclusions

In this paper, we have addressed the types of virtual stores widely accepted by consumers ranging from the earlier form of distance shopping in the 19th century to the latest 3D image interactive technology in virtual retailing stores. Due to our interest in the use of virtual reality in the fashion business, we examined the history and development as well as the latest research findings from various

scholars regarding virtual reality in correlation with the consumer experience and consumer learning. Virtual reality has certainly been gaining positive feedback about its ability to provide vivid product images; high interactivity and greater control by the users, and as a result its enhancement of the consumers' immersion; evoking of vivid mental imagery; improvement of consumer learning; increased enjoyment in virtual shopping and raising of purchase intention. During the development of the pilot virtual shop, consumers' hedonic shopping experience is enhanced by using virtual technologies in particular to the use of telepresence. However, predominant unknowns still exist in the experiential design of this highly immersive virtual reality. There is still much to be learned about how such an environment will affect consumer behaviour, for instance in enhancing consumers' experiences of telepresence and enjoyment. It is therefore necessary for professional retailers, marketers and designers to deepen their understanding of the use of telepresence in virtual shopping. With the modern consumers increasingly emphasizing the importance of experiential factors in their daily lives, there is no doubt that, the virtual shopping experience will continue to be the trend in distance fashion shopping.

Despite the focus of using advanced virtual technologies and high level of interactivity to create a sense of telepresence for consumers, human touch is always in the centre of retailing services. "Fashion has lost a bit of its human touch. The revival of handmade and custom design is a reaction to too much technology and information". This is a comment made by Tom Ford about fashion and it is a reminder to use technology in a humane way. We can apply this to other businesses as well. For instance, the success of Nintendo's hand-held Wii gaming device appears to reflect Tom Ford's comment, since it is a perfect example of merging technology with the human factor.[77] Hence no matter how much technology advances in the future, the human touch is still an important factor for consumers and deserves more in-depth experimentation. In fashion business, human factor like shopping motivation, has a strong potential to be used as a basis for the development of marketing strategies in retailing,[78] as it is one of the important concepts in research on consumer shopping behaviour.[79] Hirschman and Holbrook described consumers as either the problem solvers or the consumers seeking fun, fantasy, arousal, sensory stimulation, and enjoyment when they are shopping.[80] This means that decisions to shop in a physical shop or an online one are influenced by both functional motives (making a good choice) and hedonic motives (enjoyment of shopping process) (Childers, Carr, Peck & Carson, 2001).[81] This is a valuable insight for virtual fashion retailers and program developers who are keen to take on aggressive development in the advanced technology used in eCommerce. The initial feedback of the pilot project echoes this insight. However, further investigation must include researching consumers' motives in virtual shopping environments.

Arguably, the economy, consumer behaviour, technology and a whole lot of other events around the globe greatly affect fashion retailing. Fashion retailers have to strive constantly to provide better and more efficient shopping experiences for consumers in order to succeed in this competitive and fast moving industry. It is necessary to upgrade the traditional distance shopping experience to a new form of virtual shopping which emphasizes hedonic virtual shopping experience and human touch. Therefore, the paper suggests the need for further

77 Holburt, J. (2007). Return of the human touch? [www.enterprise-innovation.net]

78 McGoldrick, P. (2002). Retail Marketing (2nd ed), McGraw-Hill, Maidenhead

79 Wagner, T. (2007). Shopping motivation revised: a means-end chain analytical perspective International, Journal of Retail & Distribution Management, 35:7

80 Hirschman, E.C. & **Holbrook, M.B.** (1982). Hedonic consumption: emerging concepts, methods and propositions, Journal of Marketing, 46:3, 92-101

81 Childers, L. et al (2001). Hedonic and utilitarian motivations for online retail shopping behaviour, Journal of Retailing, 77, 511-535

studies in order to explore remaining unanswered questions to identify how to make the best use of this potential powerful environment.

Bibliography

Anderson, C. (1983). Imagination and Expectation: The Effect of Imagining Behavioral Scripts on Personal Influences, Journal of Personality and Social Psychology, 45, 293-305

Biocca, F. (1992). Communication Within Virtual Reality: Creating a Space for Research. Journal of Communication, 42:2, 5-22

Biocca, F. (1997). Progressive embodiment in virtual environments, Journal of Computer Mediated Communication, 3:2

Childers, L., Carr, C.L., Peck, J. and **Carson, S.** (2001). Hedonic and utilitarian motivations for online retail shopping behavior, Journal of Retailing, 77, 511-535

Childers, T.L. and **Houston, M.J.** (1984). Conditions for a Picture-Superiority Effect on Consumer Memory, Journal of Consumer Research, 11, 643-654

Daugherty, T., Li, H. and **Biocca, F.** (2001). Consumer Learning and 3-D Ecommerce: The Effects of Sequential Exposure of a Virtual Experience Relative to Indirect and Direct Product Experience on Product Knowledge, Brand Attitude and Purchase Intention, Paper presented at the Experiential Ecommerce Conference, Michigan State: Michigan State University

Daugherty, T., Li, H. and **Biocca, F.** (2008). Consumer Learning and the Effects of Virtual Experience Relative to Indirect and Direct Product Experience, Psychology & Marketing, 25:7, 568 – 586

DesMarteau, K. (2004). Online apparel sales see double-digit growth. Apparel Magazine, 45:11, 30-32

Diamond, W. and **Oppenheim, M.R.** (2004). Chapter 10: Direct Marketing and E-Commerce Sources, Journal of Business & Finance Librarianship, 9:4, 221-236

Fiore, A. and **Jin, H.J.** (2003). Influence of image interactivity on approach responses towards on online retailer, Internet Research: Electronic Networking Applications and Policy. 13, 38-48

Fiore, A.M., Jin, H.J. and **Kim, J.** (2005a). For fun and profit: Hedonic value from image interactivity and responses toward an online store, Psychology & Marketing, 22, 669-694

Fiore, A.M., Kim, J. and **Lee, H.H.** (2005b). Effect of image interactivity technology on consumer responses toward the online retailer, Journal of Interactive Marketing, 19:3, 38-53

Fitzgerald, M. and **Riva, G.** eds (2001). Telemedicine Glossary, European Commission-DG INFSO

Gattuso, G. (1993). Taking Care of Business, Journal of Direct Marketing, 6, 20-22

Gehrt, K.C. and **Carter, K.** (1992). An exploratory assessment of catalog shopping orientations: The existence of convenience and recreational segments, Journal of Direct Marketing, 6, 29-39

Greenbaum, P. (1992). The lawnmower man, Film and Video, 9:3, 58-62

Heim, M. (1998). Virtual realism, Oxford University Press, New York

Hirschman, E.C. and **Holbrook, M.B.** (1982). Hedonic consumption: emerging concepts, methods and propositions, Journal of Marketing, 46:3, 92-101

Holbrook, M.B. (1986). Emotions in the consumption experience: Toward a new model of consumer behavior, In Peterson, R.A., Hoyer W.D. & Wilson, W.R.E. eds, The role of affect in consumer behavior: Emerging theories and applications, Lexington, MA, 17-52

Holbrook, M.B. and **Hirschman, E.C.** (1982). The experiential aspects of consumption: Consumer fantasies, feelings, and fun, Journal of Consumer Research, 9, 132-140

Holburt, J. (2007). Return of the human touch? [www.enterpriseinnovation.net]

Karat, J.M., Karat C. and **Ukelson, J.** (2000). Affordance, motivations, and the design of user interfaces: Creating tools that enable rather than restrict add value to the product and loyalty from the customer, Communications of the ACM, 48:8, 49-51

Katz, J. and **Aspden, P.** (1997). Motivations for and barriers to Internet usage: Results of a national public opinion survey, Internet Research: Electronic Networking Applications and Policy, 7, 170-188

Kim, J. and **Forsythe, S.** (2008). Adoption of Virtual Try-on Technology for Online Apparel Shopping, Journal of Interactive Marketing, 22:3, 45-59

Kim, T. and **Biocca, F.** (1997). Telepresence via television: Two dimensions of telepresence may have different connections to memory and persuasion, Journal of Computer-Mediated Communication, 3:2 [www.ascusc.org/jcmc/vol3/issue2/kim.html]

Klein, L.R. (2003). Creating virtual product experiences: The role of telepresence, Journal of Interactive Marketing, 17, 41–55

Kotler, P. and **Armstrong, G.** (1997). Marketing An Introduction (4th ed), New Jersey: Prentice Hall International

Lee, B.C.Y. (2007). Consumer attitude towards virtual stores and its correlates, Journal of Retailing and Consumer Service, 14, 182-191
Li, H., Daugherty, T. and **Biocca, F.** (2001). Characteristics of virtual experiences in electronic commerce: a protocal analysis, Journal of Interactive Marketing, 15:3, 13-29
Li, H., Daugherty, T. and **Biocca, F.** (2003). The Role of Virtual Experience in Consumer Learning, Journal of Consumer Psychology, 13:4, 395-405
Li, H., Kuo, C. and **Russell, M.G.** (1999). The impact of perceived channel utilities, shopping orientations, and demographics on the consumer's online buying behavior, Journal of Computer-mediated Communication, 5:2. [www.ascusc.org/jcmc/vol5/issue2/hairong.html]
Lutz, K.A. and **Lutz, R.J.** (1977). Effects of Interactive Imagery on Learning: Application to Advertising, Journal of Applied Psychology, 62:4, 493-498
McGoldrick, P. (2002). Retail Marketing (2nd ed), McGraw-Hill, Maidenhead
Monsuwe, T., Dellaert, B. and **Ruyter, K.** (2004). What drives consumers to shop online: a literature review, International Journal of Service Industry Management, 15:1, 102-121
Nantel, J. (2004). My Virtual Model: Virtual Reality Comes into Fashion, Journal of Interactive Marketing, 18:3, 73-86
Nelson, P. (1974). Advertising as Information, Journal of Political Economy. 82:2, 729-754
Nunez, D. and **Blake, E.** (2006). Learning, Experience, and Cognitive Factors in the Presence Experiences of Gamers: An Exploratory Relational Study, Presence, 15:4, 373-380
Paivio, A. (1971). Imagery and Verbal Processes, New York: Rinehart & Winston
Reeves, B. and **Nass, C.** (1996). The media equation. Cambridge, UK: Cambridge University Press
Rips, R.E. (1938). An Introductory Study of the Mail Order Business in American History 1872–1914, University of Chicago
Riva, G. (1999). From technology to communication: Psychosocial issues in developing virtual reality environments, Journal of Visual Language and Computing, 10:1, 87-97
Rose, G., Khoo, H. and **Straub, D.W.** (1999). Current Technological Impediments To Business-To-Consumer Electronic Commerce, Communications of the AIS, 1, Article 16
Schlosser, A.E. (2003). Experiencing Products in the Virtual World: The Role of Goal and Imagery in Influencing Attitudes versus Purchase Intentions, Journal of Consumer Research, 30, 184-198
Schlosser, A.E. (2006). Learning through Virtual Product Experience: The Role of Imagery on True versus False Memories, Journal of Consumer Research, 33, 377-383
Schubert, T., Regenbrecht, H. and **Friedmann, F.** (2000). Real and illusory interaction enhance presence in virtual environments, Presence (3rd International Workshop)
Schuemie, M.J. and **Mast, C.V.** (1999). Presence: Interacting in VR? The 20th Workshop on Language Technology, 15
Seidel, R.J., Chatelier, P.R. and **NATO Defense Research Group** (1997). Virtual reality, training's future? Perspectives on virtual reality and related emerging technologies, Plenum Press, New York
Slater, M. (1999). Measuring presence: A response to the Witmer and Singer Presence questionnaire, Presence, 8:5, 560-565
Steuer, J.S. (1992). Defining virtual reality: Dimensions determining telepresence, Journal of Communication, 42, 73-93
Strangman, N. and **Hall, T.** (2003). Virtual reality/simulations [www.cast.org/ publications/ncac/ncac_vr.html]
Swinyard, W.R. and **Smith, S.M.** (2003). Why people (don't) shop online: a lifestyle study of the internet consumer, Psychology & Marketing, 20:7, 567-597
Then, N. and **DeLong, M.** (1999). Apparel shopping on the web. Journal of Family and Consumer Sciences, 91:3, 65-68
Wagner, T. (2007). Shopping motivation revised: a means-end chain analytical perspective International, Journal of Retail & Distribution Management, 35:7
Weghorst, S. and **Billinghurst, M.** (1993). Spatial perception of immersive virtual environments. University of Washington, Seattle
Wilson, M.R. (2005). Mail Order. The Electronic Encyclopedia of Chicago [www.encyclopedia.chicagohistory.org/pages/779.html]
Yoon, S.Y., Laffey, J. and **Oh, H.** (2008). Understanding Usability and User Experience of Web-Based 3D Graphics Technology, International Journal of human-computer interaction, 24:3, 288-306
Yuille, J.C. and **Catchpole, M.J.** (1977). The role of imagery in models of cognition, Journal of Mental Imagery, 1, 171-180

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> **Beckett K.L.** and **Shaffer D.W.** (2004). Augmented by Reality: The Pedagogical Praxis of Urban Planning as a Pathway to Ecological Thinking, University of Wisconsin, Madison
> **Djenidi H., Ramdane-Cherif A., Tadj C.** and **Levy N.** (2004). Generic Pipelined Multi-Agents Architecture for Multimedia Multimodal Software Environment, Journal of Object Technology, 3:8, pp. 147-169
> **Gorard, S.** and **Selwynn, N.** (1999). Switching on to the learning society? Questioning the role of technology in widening participation in lifelong learning, Journal of Education Policy, 14:5, 523-534
> **Blackman, D.A.** (2001). Does a Learning Organisation Facilitate Knowledge Acquisition and Transfer? Electronic Journal of Radical Organization Theory, 7:2 [www.mngt.waikato.ac.nz/Research/ ejrot/Vol7_1/Vol7_1articles/blackman.asp]
> **World Bank** (2002). Social assessment as a method for social analysis, World Bank Group [www.worldbank.org/gender/resources/assessment/samethod.htm]

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