Using Authentic 3D Product Visualisation for an Electrical Online Retailer

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Abstract

This study aims to investigate the effects of authentic three dimensional (3D) product visualisation on consumers' virtual experience. Particularly, we investigate the antecedents and consequences of authentic 3D product simulation. A hypothetical retailer website presents a variety of laptops which allow participants to control the content and form of the 3D flash. The 3D flash permits participants to change the colour of the laptop and see it with animated colours. Also it allows them to get actual and perceived information about the laptop features and attributes. Our definition and measurement scale of 3D authenticity construct is suitable and convenient for academics and practitioners interested in using 3D simulation in the online retail context. Control and animated colours represent the main antecedents of authenticity. Moreover, experiential and instrumental values represent the main consequences of 3D authenticity. The proposed conceptual model achieves acceptable fit and the hypothesised paths are all valid.

-Key words: Control, animated colours, telepresence, authenticity, values, virtual experience.

-Paper type: Research paper.

INTRODUCTION

According to Steuer (1992, p.78) virtual reality (VR) is "*a real or simulated environment in which a perceiver experiences telepresence*". In contrast, virtual experience derives from VR and can be defined as "*psychological and emotional states that consumers undergo while interacting with a 3D environment*" (Li et al., 2001, p. 14). A three-dimensional (3D) presentation enables consumers to interact with products, enriches their learning processes, and creates a sense of being in a simulated real world. Furthermore, direct and virtual experiences combine within VR, such that the latter enhances and enriches the overall experience because consumers use almost all of their senses when interacting with a 3D product visualisation (Klein, 2003; Li et al., 2001, 2002, 2003). Despite widespread discussions and various definitions of VE, we notice that previous scholars, within the online retail context, consider different definitions and operationalisations for the notion of 3D

telepresence to measure consumers' virtual experience. However, the telepresence and presence constructs are not necessarily wholly appropriate concepts for marketers since they represent a process of being mentally transported into other areas or being immersed into an illusion environment. Such notions may not be particularly helpful for marketers and website designers who are concerned with 3D product visualisation of real products. Instead, we propose the authenticity construct, which refers to simulating a real product authentically online. We therefore first discuss the notions of telepresence or presence and their antecedents in the immersive virtual reality (IVR) environment then proceed to explain applications of non-immersive virtual realties (NIVR i.e., an online retailer context). We also offer a new definition and measurement scale for the construct of authenticity, its antecedents and consequences focusing on a fictitious electrical retailer, which offers, the focal product, laptops. Finally, we develop and test a structural model (Figure 1) proposing relationships between control, animated colours, authenticity, and consumer value variables.

THEORETICAL BACKGROUND

3D in the Immersive Virtual Realities

The first appearance of VR terminologies starts with the emergence of IVR devices, such as head-mounted display, which allow users to interact with virtual environments and to visualise different objects (Suh and Lee, 2005). As a result, the notions of telepresence or presence come to surface. Notwithstanding, previous literature in the IVR area has provided readers with different classifications and conceptualisations of VR. For example, Steuer's (1992, p. 76) definition of VR focuses on human experience, not technological hardware, and differentiates between presence and telepresence. Whereas presence refers to "*the experience of one's physical environment; it refers not to one's surroundings as they exist in the physical world, but to the perception of those surroundings as mediated by both automatic and controlled mental processes*", telepresence is "*the experience of presence in an environment by means of a communication medium*". In turn, Sheridan (1992) distinguishes between virtual presence and telepresence, such that presence relates to the sense of being in a computer-mediated environment, whereas telepresence indicates a sense of being in any real remote location. To that end, Bioccca and Delaney (1995) argue that the definition of VR depends on technological hardware and software. The authors define VR as perceptual immersion presence. This type of presence depends on sensory immersion in virtual environments. To extend prior literature, Lombard and Ditton (1997) identify six taxonomies

of VR presence: social richness, realism, transportation, immersion, social actor within medium and medium as social actor.

Previous research on 3D virtual experience (e.g., Biocca, 1997; Heeter, 1992; Lombard and Ditton, 1997; Sheridan, 1992) thus reveals several key findings. First, researchers from different fields (e.g., communication, business, psychology, and HCI) use different terms (e.g., presence, telepresence, virtual presence, immersion, mediated presence) to describe the same concept. However, some debate remains regarding definitions of presence and telepresence. Second, previous research uses presence and telepresence to explain VR experience, though these conceptualisations have depended on the level of technology (e.g., Biocca, 1992; Steuer, 1992; Sheridan, 1992). Whereas in the past researchers used display interface technologies such as goggles, head-mounted visors, data gloves, joysticks, head trackers and televisions to identify and measure presence (e.g., Biocca, 1992; Heeter, 1992; Lombard and Ditton, 1997; Sheridan 1992; Steuer, 1992; Witmer and Singer, 1998), more recent technological developments can "transport" users to other places, where they can see and interact with other intelligent beings (e.g., avatars in Second Life, chat rooms, online communities), without forcing them to wear technological devices. Therefore, neither using the above terminologies, nor their definitions could help marketers to understand how using 3D product visualisation may help consumers to understand the effect of 3D product visualisation on consumers' experience. To address this issue, 3D online retail literature introduces the NIVR environment and explains using 3D in computers or laptops.

3D in the Online Retailer Studies (Non-Immersive Virtual Realities)

Notwithstanding, Lombard and Ditton's (1997) classification of VR presence, only two types are identified in the NIVR area, which allows users to interact with e-retailers websites and products using desktop or laptop computers (Suh and Lee, 2005). The first is telepresence, or the illusion of being in a place far from the physical body (Biocca, 1997; Heeter, 1992). This conceptualisation of telepresence relates to transporting a user, self, or place, to another place. The second form is telepresence in a social sense, such that other beings exist in the VR world with whom users can interact (e.g., avatars). Authors such as Heeter (1992) and Lombard and Ditton (1997) empirically test this concept, and McGoldrick and colleagues (2008) emphasise the avatar's role in enhancing virtual personal shopper capabilities. Scholars have empirically tested the influence of 3D on consumers' experiences. For

example, in conceptualising consumer experiences in cyberspace, Shih (1998) posits that the vividness of the information (operationalised as multi-sensory information, i.e. breadth and depth) that a consumer receives in cyberspace and the interactivity of the cyberspace technology (operationalised as control, speed and feedback) provide the main antecedents of telepresence (i.e., being there). In turn, Coyle and Thorson (2001) investigate the effects of progressive levels of interactivity and vividness on Web marketing sites by manipulating levels of interactivity (number of choices and presence of a clickable image) and vividness (audio and animation). They find that high levels of interactivity and vividness increase participants' feelings of "being there" (i.e., telepresence). Fortin and Dholakia's (2005) empirical research reveals the direct and indirect impacts of interactivity (degree of control, response time) and vividness (breadth and depth of the message, colours, graphics, quality and resolution) on social presence (i.e., being there). High levels of interactivity and vividness have significant impacts on perceived social presence. According to Klein (2003) Macromedia's Authorware© 3.0 and 4.0, represents simple technology and thus provides another means to examine the effects of telepresence (being transported into another area) on consumer responses. Moreover, Klein (2003) finds that interactivity (user control) and media richness (depth and breadth of sense channels) emerge as the main antecedents of telepresence, with significant positive influences on its creation. To that end, Lee (2004) revises all the previous definitions of telepresence or presence and argues that none of the previous definitions could be used to tap the concept of using virtual environment to reflect the consumer experience. The author posits two ways for an experience to become a virtual. First, using "Para-authentic objects" in which the users interact with objects in which they can find in real life aspects such as clothing. Secondly, using "Artificial objects", which simulates objects that do not exists in real life. On that basis, we claim that 3D telepresence and its abstract antecedents are not the suitable terminologies that marketers should use because they reflect a feeling of being transported, immersed and deluded into an inaccessible environment. Instead, we propose the notion of 3D authenticity and its antecedents (control and animated colours), reflecting the authentic representation of real products.

AUTHENTICITY CONSTRUCT

None of the previous definitions of virtual experience that use 3D virtual models can tap consumers' virtual experiences though. Based on Lee's (2004) theoretical study and Klein's (2003) study a 3D virtual experience should be an authentic representation of the direct

(offline) experience. We therefore propose a new notion that relates to the simulation of online products and virtual experience, namely, the authenticity of the product visualisation. Telepresence and presence are not particularly well suited to the online retail context, because they reflect illusion and transportation to other places. In contrast, the concept of 3D authenticity of the product visualisation implies that ability to simulate the product experience in bricks-and-clicks contexts. We propose the following definition of perceived authenticity in a computer-mediated environment: Authenticity is a *psychological state in which virtual objects presented in 3D in a computer-mediated environment are perceived as actual objects in a sensory way*.

Authenticity Antecedents

Interactivity and vividness may represent the main determinants of telepresence within IVR (Biocca and Delany, 1995; Heeter, 1992; Lombard and Ditton, 1997; Sheridan, 1992; Steuer, 1992; Witmer and Singer, 1998) Interactivity appears particularly of interest since the appearance of new communication channels such as the World Wide Web, for which it represents a critical concept and primary advantage (Morris and Ogan, 1996; Rafaeli and Sudweeks, 1997). Considerable research investigates and empirically tests the construct, but there is little agreement on the definition or operationalisation of the interactivity construct (e.g., Ariely, 2000; Klein, 2003; Liu and Shrum, 2002; McMillan and Hwang, 2002). For example, Steuer (1992) classifies it into three elements: speed, mapping and range. Rafaeli (1988) and Rafaeli and Sudweeks (1997) argue interactivity relates to the communication process, and Ariely (2000) defines it on the basis of the control construct (the narrowest definition). Wu (1999) relies on the self efficacy construct, whereas Rowley (2008) focuses on information interactivity. Still other scholars (e.g., Downes and McMillan, 2000; Lui and Shrum, 2002; McMillan, 2002; McMillan and Hwang, 2002) argue that definitions of interactivity cannot be restricted to messages, human interactions or communications but rather should include multidimensional aspects. Thus speed, responsiveness and communications represent the main elements to define and measure interactivity antecedents. In contrast, vividness, according to Steuer (1992, p. 81) is "*the way in which an environment presents information to the senses*". Steuer explains that vividness is stimulus driven and depends completely on the technical characteristics of a medium. In turn, it represents a product of two important variables: sensory breadth, and sensory depth. Most scholars use this definition of vividness.

We use the control construct to represent interactivity in an online retail context. Ariely's (2000) definition of control refers to users' abilities to customise and choose Web site contents to achieve their goals. We focus more on consumers' ability to control and easily interact with the 3D virtual model. Therefore, we define control as *users' abilities to customise and choose the contents of the virtual model (i.e., 3D product visualisation), rotate, and zoom in or out on the product in the virtual model and the ability of the virtual model (3D) to respond to participants' orders properly.* In turn, we hypothesise:

> *H1a: A high level perceptions of control of 3D product visualization increases authenticity.*

Some 3D product visualisations, in the online retailer, require visual and auditory channels for facilitating consumers' vividness; others manifestly need only visual aspects. We focus on one aspect of vividness, namely, breadth, while holding depth constant. Specifically, we focus on one aspect of vividness breadth, namely, animated colours. Animated coloured pictorial images used in this study to represent consumers' ability to see 3D products with different animated skins. High-quality online animated colours may enhance consumers' authenticity perception (e.g., Fortin and Dholakia, 2005; Klein, 2003; Shih, 1998) and we hypothesise:

> *H1b: A high level perceptions of 3D animation increases perceived authenticity.*

Specifically, we consider vividness of the visual imagery, such that consumers can see online products with different colours (skins) just as they would see them in person. Media richness may lead to a true virtual experience, according to research on online shopping (Klein, 2003; Schlosser, 2003). Moreover, consumers' ability to change the animated colours of the 3D product might help them sense control over the product. We therefore hypothesise:

> *H2: A high level perceptions of 3D animation increases control.*

Authenticity Consequences

Scholars (e.g., Fiore and Jin, 2003; Fiore et al., 2005a; Kim et al., 2007; Klein, 2003; Li et al., 2001; 2002, 2003; Suh and Chang 2006) explain the importance of using 3D product visualisations in enhancing consumers' understanding of product attributes, features and characteristics. 3D visualisation increases consumers' involvement and encourages them to seek more information about the products (Fiore et al., 2005a). Suh and Lee (2005) posit a positive relationship between higher levels of 3D product visualisation and seeking more information about the products' characteristics and features. Suh and Chang's (2006) empirical research of the influence of 3D product visualisation and product knowledge reveals a positive relationship between 3D and perceived product knowledge. Using 3D product visualisation helps consumers to imagine how a product may look and it gives them more details about the products' characteristics (Fortin and Dholakia, 2005; Klein, 2003; Shine, 1998). Many scholars in the communication field (e.g., Heeter, 1992; Lombard and Ditton, 1997; Song et al., 2007) report the importance of enjoyment as a consequence of using 3D. Based on the above, we hypothesise:

> *H3a: 3D authenticity in a retailer website will positively affect website use for experiential value.*

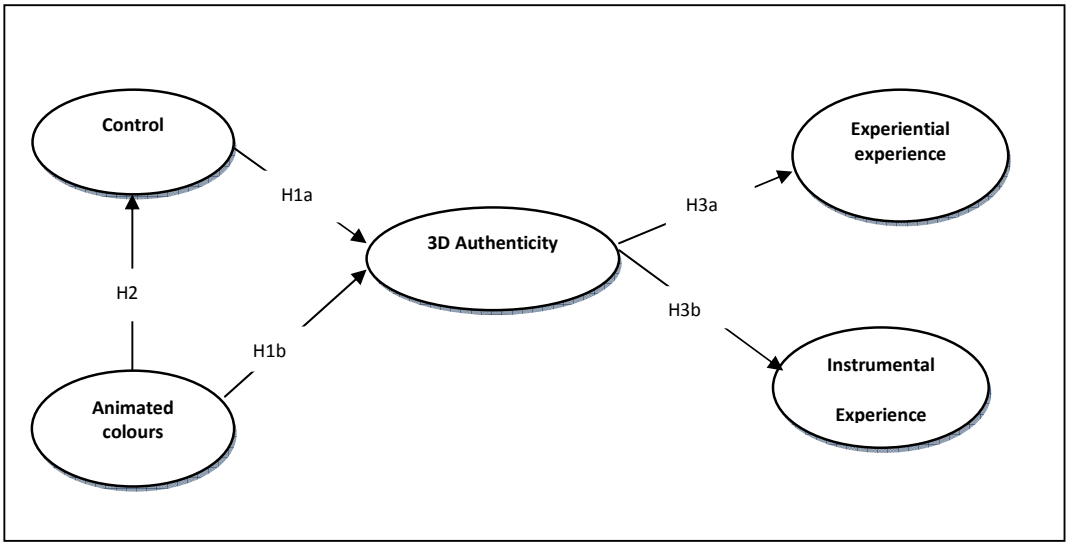
Scholars (Fiore et al., 2005b; Kim and Forsythe, 2007; Lee et al., 2006; Schlosser, 2003) report the importance of 3D product visualisation in enhancing the experiential aspects of a virtual shopping. The above researchers find the ability of 3D product visualisation to produce hedonic values for shoppers greater than its ability to produce utilitarian values. Fiore et al. (2005b) assert hedonic value, which image interactivity technology produces, is highly correlated with consumers' emotional pleasure and arousal variables. Fiore et al. (2005a) posit the importance of virtual models in boosting hedonic value (enjoyment). Fiore et al. (2005a) report the importance of a high level of image interactivity technology in comparison to a low level of image interactivity technology (in the high level conditions, consumers could only enlarge the static picture of cloths) in producing more hedonic value. Many scholars in the communication field (e.g., Heeter, 1992; Lombard and Ditton, 1997; Song et al., 2007) delineate the importance of enjoyment as a consequence of using 3D. Consumers use 3D product visualisation to have more fun, enjoyment and entertainment (Kim and Forsythe, 2007). Such sources of fun or enjoyment come from consumers' ability to rotate, and zoom in or out on the product (Fiore et al., 2003), seeing different animated

coloured pictorial images that may enhance their mental pleasure when using 3D sites. Therefore, we hypothesise:

> *H3b: 3D authenticity in a retailer website will positively affect website use for instrumental value.*

CONCEPTUAL FRAMEWORK

Figure 1: conceptual framework (source: the authors).



METHODS

Stimuli

A retailer's website with one stimulus was custom-designed for this study. The stimulus was illustrated in 3D product visualisation sites in which participants can see, the focal product, laptops from different angles; they can rotate it and zoom it in or out. The 3D stimulus is designed to help consumers to imagine the product in appropriate and relevant ways and it enhances consumers' virtual experiences (Li et al., 2001).

Interface Design

We designed one stimulus, a 3D flash (site), for testing the proposed hypotheses. The site allows participants to control the content and form of the 3D flash. For example, participants

can zoom in or out on the product, rotate it and can see different parts of the product when clicking on it. The 3D flash permits participants to change the colour of the laptop and see it with animated colours. Also the flash allows participants to get actual and perceived information about the laptop features and attributes. Moreover, our site enhance participants' fun and enjoyment values by enabling them to control (i.e., to zoom in or out on and rotate), to change the colour of the laptop and to see more information about the product (see Appendix A). In designing this interface, we consider a comprehensive site to visualise an electrical online retailer to surpass actual experience. Moreover, this study adds more features and cases to the ones that might be found in real sites. For example, none of the national sites that sell laptops (e.g., Sony and Dell, to the best of the authors' knowledge) has a flash combining both 3D and information about laptops. We decided to design a fictitious electrical retailer based on the Image Marketing Retailer Group (IMRG, 2008) Capgemini e-Retail Sales Index, which shows that both electricals and clothing are the favourite purchases among U.K. shoppers, with 38 per cent and 32 per cent share of revenues respectively.

Experimental Design

The Web site we created for this study was not previously known to users, nor did users have any knowledge of the fictitious brands on the site. Thus, we eliminated any impact of previous experiences or attitudes (Fiore et al., 2005a). The site offers a wide variety of laptops, similar to those that many college-aged women and men currently buy and use. Therefore, site provides a suitable context for the present sample.

Sample

Student samples have often been used in online shopping research (e.g., Li et al., 2002; 2003; Fiore et al., 2005a ; Kim et al., 2007; Balabanis and Reynolds, 2001) this is justifiable as students are computer-literate, having few problems in using new technology. Students are potential consumers of electrical goods (Jahng et al., 2000). We employed a sample 312 students for our experiment. The sample was gender balanced, consisting of 47% women and 53% men, and 90% of the sample ranged from 18 to 30 years of age. Approximately 94% reported having had prior online shopping experience

Time

Time exposure to a stimulus influences users' end responses (Zajonc, 2001), so several studies attempt to determine the appropriate time exposure to an online stimulus (e.g., Fiore and Jin, 2003; Fiore et al., 2005a; Kim et al., 2007). We followed these studies and set a time limit on the exposure in each experiment of five minutes. After viewing the stimuli for this time, the subjects completed a questionnaire.

Instrument

Participants were informed that this study pertained to consumers' evaluations of an electrical retailer's Web site. The questionnaire contained five-point Likert-type scales, anchored by "strongly disagree" and "strongly agree".

To measure the control construct, we developed a five-item scale that centres on users' ability to rotate and zoom in the virtual model. Specifically, the items asked "After surfing the 3D sites…", "I felt it was very easy to zoom in/out the laptops", "I felt that I could choose freely what I wanted to see", "I felt that I had a lot of control over the content of the laptop's options", "I felt it was easy to rotate the laptop the way I wanted", and "I felt I could control the laptop movements".

To measure animation, we developed a four-item animation scale based on Klein's (2003) and Steuer's (1992) studies. The items tap how closely the simulated sensory information reflects the real product, so respondents indicated "After surfing the 3D site, I think…", "it provided me with accurate visual information about the laptops", "Multicolour in the 3D laptop let me easily visualize what the actual laptop is like", "Colours brightness of the 3D laptop let me visualize how the real laptop might look", and "There are lots of colours on the 3D laptop websites". To measure authenticity, we could not find an existing scale to measure authenticity so we developed a new five-item scale. We submitted the items to evaluations by academics (lecturers in online retailing and Ph.D. students); these respondents considered the items relevant for measuring the authenticity construct. We followed Churchill's (1979) procedures for developing a marketing construct scale and adopted for developing a scale for the online context. Each item began with "After surfing the 3D sites", and then obtained responses to the following: "3D creates a product experience similar to the one I would have when shopping in a store", "3D let me feel like if I am holding a real laptop and rotating it (i.e. virtual affordance)", "3D let me feel like I am dealing with a salesman who is responding to my orders", "3D let me see the laptop as if it was a real one", and "Being able to zoom

in/out and rotate the laptop let me visualise how the laptop might look in an offline retailer". To measure experiential values, we adopted a modified version of Babin and colleagues (1994) scale. We based the study on 4 of the 11 items, each item began with "If I were actually to shop for laptops online, shopping with 3D sites" and then obtained responses to the following: "Was like an escape", "Was truly enjoyable", "Enjoyable for its own sake, not just for the items I may have purchase", "I enjoyed being immersed in an existing new product". To measure the instrumental values, we adopted a modified version of Fiore and colleagues (2005a) scale. Each item began with "After surfing the 3D site with the information and If I were actually shopping for a laptop online, this 3D site would create a shopping experience that would", and then obtained responses to the following: "Give me more information about the product", "Help me make a better decision about the product", "Help me buy the right product", "Aid me in evaluating the laptop items", "Help me in finding what I am looking for", "Help me to accomplish what I want" (see Table 1 for the refined items).

RESULTS

Experiment 1

Measurement Model

AMOS 16 was used to test the overall goodness of fit of the conceptual model using 312 participants. The measurement model includes 19 indicators, and we provide its results in Table 1, including the standardised factor loading (λ), standard error, critical ratio (CR), average variance extracted and composite reliability for each construct. The composite reliabilities for animated colours (.70), control (.81), authenticity (.88), instrumental value (.86) and experiential value (.86) all are acceptable (Hair et al., 1998). Figure 3 illustrates path coefficients and R^2 for the effects of control, animated colours and authenticity on values, all the paths are valid.

Figure 3: showing structural path coefficients and R^2 for the effects of control, animated colours and authenticity on values.

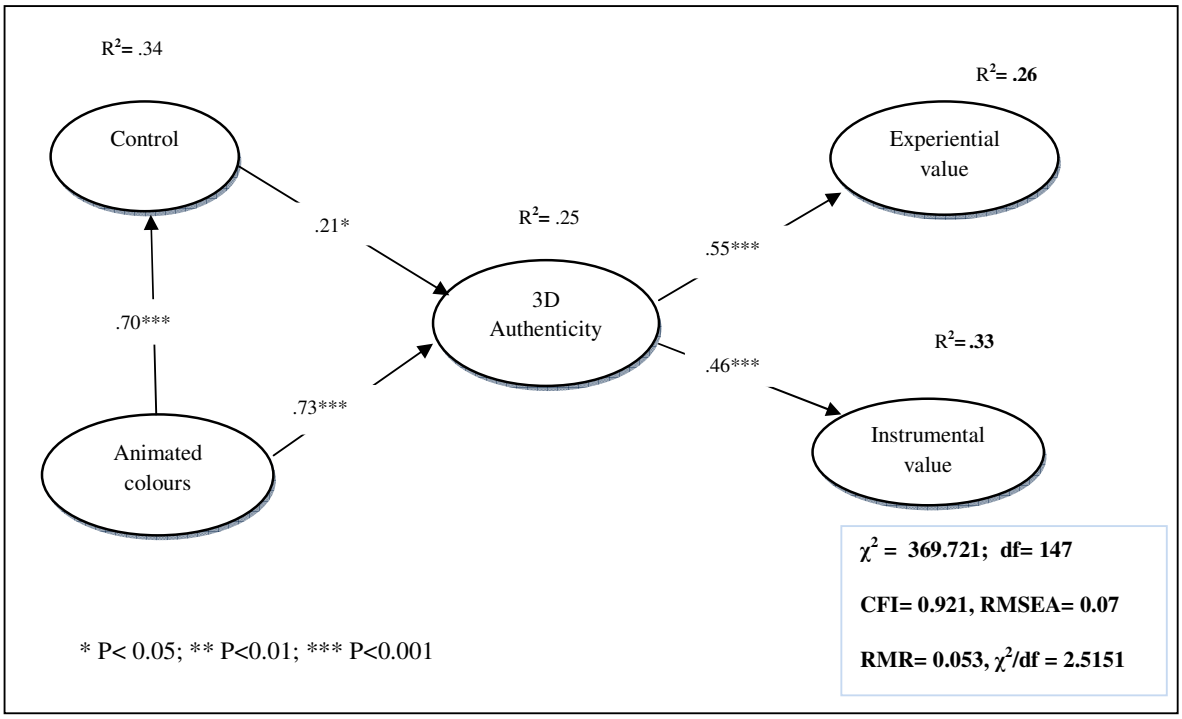


Table 1: measurement model results for hypothetical model with new factor structures.

Construct indicator	Standardized factor loading(λ)	S.E	C.R	Average Variance extracted	Squared multiple correlation	Composite reliability
η1 (control)						
- I felt that I could choose freely what I wanted to see	.777	-		0.5224	0.37	0.81
- I felt that I had a lot of control over the content of the laptop's options (i.e. angles and information)	.781	0.077	12.018		0.51	
- I felt it was easy to rotate the laptop the way I wanted.	.710	0.077	9.924		0.51	
- I felt I could control the laptop movements.	.610	0.072	8.882		0.60	
η2 (animated colours)				0.40		
-There are lots of colours on 3D laptop websites.	.714	-			0.21	0.70
- Colours brightness of the 3D laptop let me visualize how the real laptop might look.	.655	0.104	8.552		0.43	
- The laptop illustrated by 3D was very colourful	.500	0.081	6.335		0.51	
η3 (Authenticity)						
- 3D Creates a product experience similar to the one I would have when shopping in a store.	.764	-		0.643	0.66	0.88
- 3D Let me feel like if I am holding a real laptop and rotating it (i.e. virtual affordance)	.761	0.078	13.706		0.74	
- 3D Let me feel like I am dealing with a salesman who is responding to my orders.	.862	0.080	15.360		0.58	
- 3D let me see the laptop as if it was a real one.	.815	0.078	14.580		0.58	
η3 (Experiential value)				0.615		
- Would be like an escape.	.706	-			0.68	0.86
- Would be truly enjoyable	.741	0.076	12.125		0.68	
- Would be enjoyable for its own sake, not just for the items I may have purchase.	.823	0.090	12.746		0.55	
- Would let me enjoy being immersed in an existing new product.	.822	0.090	12.682		0.50	
η4 (instrumental value)				0.611		
- Help me make a better decision about the product.	.786	-			0.62	0.86
- help me buy the right product.	.766	0.062	13.750		0.60	

- Aid me in evaluating the laptop items.	.776	0.066	12.859		0.59	
- Help me in finding what I am looking for	.786	0.072	13.229		0.62	

Structural Equation Model

The adequacy of the hypotheses was assessed by using CFI, RMSEA and RMR to test the overall goodness of fit of the proposed conceptual model. The results of structural equation modelling obtained for the proposed conceptual model revealed a chi-square of 369.721 (df = 147), goodness of fit index (GFI) of .90, comparative fit index (CFI) of .921, root mean square residual (RMR) of .053. Indicating a good model fit (Byrne, 2001; Hair et al., 1998). All hypotheses of the conceptual model were statistically supported ($p < .05$). Figure 3 shows that control and animated colours had significant positive effects on authenticity (H_{1a}: CR = 2.426; H_{1b}: CR= 6.069). Moreover, animated colours exhibited a significant positive effect on control (H_2: CR = 6.738). Finally, as hypothesized, 3D authenticity has a significant positive effect on experiential and instrumental values (H_{3a}: CR = 8.852; H_{3b}: CR = 7.537).

DISCUSSION, CONCLUSION AND IMPLICATIONS

We highlight the importance of our new definition and measurement scale of 3D authenticity construct. Our scale is suitable and convenient for academics and practitioners interested in using 3D to simulate real products in the online retail context. In addition, we posit that whereas previous definitions of 3D telepresence consider 3D product visualisation as an illusion or a sense of being transported to another place, our authenticity definition refers to the ability to imagine a virtual object as real. In regard to 3D authenticity antecedents, researchers should focus on certain real elements of interactivity and vividness rather than on the abstract constructs when investigating 3D authenticity antecedents. Whereas Heeter (2000, p. 75) describes interactivity as "*an overused and underdefined concept*", we posit that control and animated colours represent the main antecedents of 3D authenticity. For example, we narrow our conceptualisation of interactivity to consumers' ability to control the content and form of 3D flashes, and we find that control provides a useful representation of the interactivity of 3D virtual models in the online retail context, in support of previous research (Ariely, 2000; Coyle and Thorson, 2001). Furthermore, whereas prior research defines vividness according to sensory breadth and depth, we argue that research might benefit from a tighter focus on specific aspects of vividness through illustration, as we have.

Results of this research (authenticity consequences) support the past research that reports the ability of 3D to provide customers with more information and fun (e.g., Fiore et al., 2005a; 2005b). Moreover, the way that we designed the 3D flashes and the authenticity of the flashes in simulating a real laptop gives this research more validity in providing consumers with more information. In contrast, as a result of focusing on the illusion construct, previous research has focused on the importance of the experiential value that consumers can gain from navigating 3D products more than the instrumental value (e.g., Schlosser, 2003; Fiore et al., 2005b; Lee, et al., 2006; Kim and Forsythe, 2007).

Managerial implications

E-tailers should pay more attention to the 3D authenticity antecedents, i.e., control and colour when designing their 3D virtual models. Including real colours and flashes that consumers can control easily will lead to more virtual experiences. The positive effect of experiential and instrumental values is only achieved when both are used together and not by either one in isolation. Therefore, retail website designers can contribute to enhancing consumers' virtual experience by focusing on both the experiential and instrumental values that consumers can gain when navigating a 3D virtual model. Any 3D flash should include the essential information that consumers seek rather than just a pretty picture. For example, consumers should be able to click on any part of the 3D flash to get access to information about it. Given that the importance of utilitarian value in the 3D context, online marketing researchers should focus more on designing 3D sites to reflect the essential information that consumers need and seek. Previous researchers focused on 3D's ability to reflect general information to the audience such as the overall appearance of the products but did not provide extra, specific detailed information at the same time (e.g., Fiore *et al*., 2005a). Finally, based on the Social Issues Research Centre (SIRC, as cited in Herrod, 2007) study it is expected that "by 2020 virtual commerce (v-commerce) will replace e-commerce", the development of proper 3D virtual models (such as 3D virtual shopping mall) will be leading the whole industry by 2020. All the above advantages will help users to get more tangible online shopping experiences.

On the bases of our results, we recommend that website developers should pay more attention to simulating 3D animated colours to reflect the real products more authentically. Moreover, they should work to create an environment in which consumers sense that they can feel the online products when they navigate the site. Further research should consider whether adding

auditory cues to the 3D flashes influence behavioural intentions. Further research should consider whether authenticity, experiential and instrumental constructs have direct effects on behavioural intentions. We recommend research efforts to extend the generalisability of our findings to other contexts and samples since we designed and collected the data using a mock up retail website (which might consider as one of this research limitation). Finally, although the generalisability of the results is limited by the student sample, we argue that students are computer literate and have few problems using new technology; students also are likely consumers of electrical goods and they represent the shoppers of today and tomorrow (Balabanis and Reynolds, 2001).

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Appendix A:

Experiment1: