Modelling 3d Product Visualisation for Online Retail Atmospherics

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Abstract

Purpose: The Stimulus (S) Organism (O) Responses (R) paradigm has been extensively studied in conventional retailing but has received little attention in the online context. This study aims to investigate the effects of an online retailer atmospheric using three dimensional (3D) product visualisation.

Design/methods/approach: We operationalise 3D antecedents, the main online atmospheric cues, as the "stimulus" (S) that attracts consumers' attention towards the online retailer, authenticity of the 3D, hedonic and utilitarian value as the "organism" (O) part, and consumers' behavioural intention as the "responses" (R) part. A hypothetical retailer Web site presents a variety of laptops using 3D product visualisations.

Findings: The control and animated colours represent the main stimuli (S). Furthermore, 3D authenticity, hedonic and utilitarian values are the main determinants of behavioural intentions. The proposed conceptual model achieves acceptable fit and the hypothesised paths are all valid.

Practical implications: Retail website designers can contribute to enhancing consumers' virtual experience by focusing more on utilitarian and hedonic value. Any 3D flash should include the essential information that consumers seek and consumers should be able to click to any part of the 3D flash to access further information.

Originality/values: To the best of the authors' knowledge, this research is the first in the U.K. that uses a U.K. sample to investigate the effects of using 3D product visualisation on consumers' perceptions and responses. Our research makes an important contribution to the online atmospheric literature by providing a rich explanation of how authenticity of the 3D virtual models adds more information, fun and enhances consumers' responses towards the online retailer.

-Key words: control; animated colours; 3D authenticity; values; consumer responses.

-Article Type: Research paper

Introduction

The concept of a retailer's environment has evolved and established from the area of environmental psychology (Turley and Milliman, 2000). Originally the S-O-R model was established by Mehrabin and Russel (1974) who investigates the effects of the physical environment on human behaviour using three-dimensions: Pleasure, Arousal, and Dominance (PAD). The authors introduce the PAD concept to suit different environments. Related to environmental psychology is the concept of atmospherics which was introduced by Kotler (1973-1974. p. 50) as "*the conscious designing of space to create certain buyer effects, specially, the designing of buying environments to produce specific emotional effects in the buyer that enhance purchase probability*". To that end, Donovan and Rossister (1982) discover the impact of the retail atmosphere on various psychological and behavioural shopping outcomes via testing empirically the S–O–R framework in retail store environments. The authors examine Mehrabin and Russel's (1974) scale, which presents a theoretical model for studying the effects of the physical environment on human behaviour, using three-dimensions: Pleasure, Arousal, and Dominance (PAD). Donovan and Rossister's (1982) findings posit that retail environmental stimuli (S) impact consumer emotional states (O), which result in approach or avoidance behaviours (R) in respect of the store. In the field of online shopping many researchers (e.g., Eroglu et al., 2001; 2003; Richard 2005; Sautter et al., 2004) use the S-O-R framework and focus on the overall online store environment especially atmospheric qualities. Dailey (2004, p. 796) defines Web-atmospherics as "*the conscious designing of web environments to create positive effects in users in order to increase favourable consumer responses*". With respect to the previous studies on this area, few have tested the influence of one stimulus alone. Previous studies investigate the impact of the whole environment (using many stimuli) on consumers' responses. To our knowledge this is the first study to use only a single stimulus, namely, 3D laptop product visualisation to investigate its impacts on consumers' perceptions and responses using the online S-O-R paradigm.

Theoretical Background

Using the S-O-R framework, Eroglu et al. (2003) investigate the effect of online atmospheric cues (S) on shoppers' emotional and cognitive states (O) which then affect their shopping outcomes (R). The authors classify online environmental cues into high task relevant (i.e., utilitarian cues) and a low task relevant (i.e., hedonic cues). In the organism state the authors test the affective and cognitive variables and find that Mehrabian and Russell's (1974) PAD does not capture the range of organismic reaction to shopping environments in an online context. To that end, Sautter et al. (2004) critically analyze Eroglu's et al. (2001; 2003) framework and argue that the Eroglu et al. (2003) study simplifies the structure of online cues and fails to integrate important contributions from other areas of online research. Sautter et al. (2004) extend Eroglu's et al. (2001; 2003) framework and introduce the concept of dual environment, which includes; (i) the online store environment (i.e., the online social element and symbolism environment) and (ii) the operator environment (i.e., human-computer-interaction environment). The authors identify vividness (i.e., information presented to human senses), interactivity (i.e., control and navigation), symbolism (i.e., traffic counter) and social elements (i.e., shopping agents, and online communities) as the main stimuli that online atmospherics provide to users. In the organism part (O), the authors suggest telepresence, affective and cognitive constructs. In line with Sautter et al. (2004), Manganari et al. (2009) theoretically investigate the effects of online store atmosphere on consumer behaviour. The authors' conceptual framework reveals that virtual layout & design (grid layout, free-form layout, and racetrack layout), virtual atmospherics (background colour, colour scheme, percentage of white space, background music, fonts, and scent appeal), virtual theatrics (animation techniques, images, vividness and interactivity), and virtual social presence (Web counter, comments from other visitors, and crowding) are the main stimuli that an online retailer should have to enhance the online store environment. In the Organism part, Manganari et al. (2009) suggest using the Mehrabian and Russell's (1974) pleasure and arousal construct. In the Responses part, Manganari et al. (2009) propose approach or avoidance behaviours as the main shopping outcomes. Unfortunately, both Sautter's et al. (2004) and Manganari's et al. (2009) models were not empirically tested and there is no clear cut opinion about the nature of the proposed relations or how they might impact each other. For example, the authors did not explain the process by which telepresence or social presence influence the internal state (i.e., the affective and cognitive).

Richard (2005) extends Eroglu's et al. (2003) model and classifies stimuli (S) for the health care sector into high task relevant and low task relevant. The former includes: navigation, informativeness (i.e., useful site), information content effectiveness (i.e., information is up-to-date/accurate), site structure (i.e., well organized), and organization (i.e., not confusing). However, the low task relevant includes entertainment sites (i.e., exiting/imaginative). Richard classifies the organism part (O) into two categories: cognition, (measured by exploratory behaviour), site involvement and affective, (measured by site attitude). Mummalaneni (2005) carries out an online study using the S-O-R framework. The author classifies Web site characteristics (i.e. design and ambient factors), of online apparel and footwear stores, as the stimulus part (S). In the organism (O) part, Mummalaneni (2005) uses only the emotion construct and applies Mehrabian and Russell's (1974) pleasure and arousal scale (but not dominance). With respect to Mummalaneni's (2005) study, many authors in the online environment (e.g. Sautter et al., 2004; Richard, 2005; Demangeot and Broderick, 2007) have focused on the important role of cognition in the organism state (O). Other scholars such as Eroglu et al. (2003) posit that the PAD theory does not properly fit into the online S-O-R context.

The previous literature on online S-O-R frameworks concerns mainly investigations of the effect of whole Web site atmospherics on consumers' responses. Previous scholarly literature on the effects of specific elements on the Web site atmospherics does not apply the S-O-R framework. For instance, Lee and Benbasat (2003) posit that fidelity and motion of images keeps customers for longer in a Web site. McKinney (2004) asserts that atmospheric variables such as graphics and photos influence customers' satisfaction. To address this issue, Kim et al. (2007) investigate the effects of different levels of image interactivity technology (IIT) on consumers' approach responses. The authors find that a high level of IIT (3D virtual model) enhances users' responses towards the online retailer (i.e., desire to stay and patronage intention to the online retailer). The 3D virtual model provides participants with high levels of enjoyment, involvement and online store perceptions in comparison to image enlargement technology (a low level of IIT). Building upon Kim's et al. (2007) study, we investigate the effect of 3D product visualisation on a Web site atmospheric. The addition of a new notion, namely, 3D authenticity to the organism part (O) and the antecedents of 3D authenticity (the main parts in the stimulus part) distinguish our study from previous research that has studied the impact of a specific cue such as music, graphic, photos, and product presentation on a Web site atmospherics. Moreover, building upon Sautter's et al. (2004) and

Manganari's et al. (2009) theoretical models, we felt that it is important to measure how consumers, within the online retail context, could imagine that 3D presented products. Particularly, we introduced our new construct, namely, 3D authenticity to reflect customers' virtual experience, where customers can feel the authenticity of the 3D products. We expect that this addition will help to explain customers' hedonic and utilitarian values within the organism part of the online S-O-R model.

Authenticity Construct

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. Sautter's et al. (2004) study focuses on the notion of telepresence which is not particularly well suited to the online retail context, because it reflects 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*.

Conceptual Framework and Hypotheses

This study proposes that 3D product visualisation is one of the main cues that attract consumers' attentions towards using an online retailer's Web site, which enhances consumers' perception towards the online retail atmospherics. Building on previous research (e.g., Fiore et al., 2005a; Fiore, et al. 2005b; Klein, 2003; Li et al., 200l, 2002, 2003) that illustrates the importance of 3D product visualisation in online retailers' Web sites, it can be predicted that interactivity and vividness are the main environmental cues that enhance a consumer's virtual experience on a retailer's 3D Web site (see Figure 1).

Please Take in Figure 1

Stimulus: Control and Animated Colours

Eroglu et al. (2001, p. 179) define the stimulus as *"the sum total of all the cues that are visible and audible to the online shoppers"*. Eroglu et al. (2003) operationalise atmospheric cues on the online retail site as the main stimuli that attract customers' attention towards the online retailer. We classify interactivity and vividness (media richness) of the 3D as the main cues that affect online retailer atmospherics. More specifically, 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, which may enhance an authenticity perception of the 3D. 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:

> *H_{1a}: There is a positive relationship between controlling the 3D product visualisation and 3D authenticity.*

Notwithstanding that techniques for facilitating vividness can also include auditory alongside visual channels, we focus only on visual and specifically on one aspect of vividness, namely, breadth, while holding depth constant. Moreover, we focus on one aspect of breadth, namely, animated colours. Animated coloured pictorial images are 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 therefore hypothesise:

> *H_{1b}: There is a positive relationship between 3D animated colours and 3D 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 sense of perceiving the 3D product as a real one, according to research on online shopping (Klein, 2003; Schlosser, 2003). Moreover, consumers' ability to change the

colours of the 3D product might help them sense control over the product. We therefore hypothesise:

> *H_2: There is a positive relationship between users' ability to change the virtual model colours and controlling the 3D product visualisation.*

Organism: 3D authenticity, hedonic and utilitarian value

According to the online S-O-R paradigm, the organism part (O) consists of affective and cognitive states which mediate the relationship between the stimulus (S) and response (R) (Richard 2005; Kim et al., 2007). Moreover, most of the work on online environmental psychology has focused on Mehrabian and Russell's (1974) Pleasure, Arousal, and Dominance scale to measure the affective state (e.g., Eroglu et al., 2003; Mummalaneni, 2005). However, Eroglu et al. (2003) find that Mehrabian and Russell's (1974) PAD does not capture the full range of organismic reactions to shopping environments. We propose three variables for the organism state (O): (i) 3D authenticity; (ii) the utilitarian; and (iii) hedonic value. Authenticity reflects consumers' psychological states of perceiving the 3D objects as actual or authentic objects in a sensory way. Utilitarian value reflects the cognitive perception that authenticity of 3D product visualisation can enhance. Finally, hedonic value reflects the affective perception of authenticity that 3D product visualisation can boost.

Effects of 3D Authenticity on Utilitarian Value

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; Shih, 1998). Therefore, we hypothesise

H_{3a}: *3D authenticity in a retailer Web site will positively affect website use for utilitarian value purposes.*

Effects of 3D Authenticity on Hedonic 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 that the ability of 3D product visualisation to produce hedonic values for shoppers is greater than its ability to produce utilitarian values. Fiore et al. (2005b) assert that image interactivity technology produces hedonic value, which 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) also report the importance of a high level of image interactivity technology in comparison to a low level of image interactivity technology (in the low level conditions, consumers could only enlarge the static picture of clothing) in producing more hedonic value. 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. 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., 2005a), seeing different animated coloured pictorial images that may enhance their mental pleasure when using 3D sites. Therefore, we hypothesise:

H_{3b}: *3D authenticity in a retailer Web site will positively affect website use for hedonic value purposes.*

Response: Behavioural Intention

Effects of 3D Authenticity, Utilitarian and Hedonic Value on Behavioural Intention

The role of 3D product visualisation in enhancing behavioural intentions appears well supported; 3D utilitarian and hedonic values improve willingness to purchase from an online retailer (Fiore et al., 2005a, 2005b), intention to buy (Schlosser, 2003) and purchase intentions (Li et al., 2001; 2003). Moreover, 3D realism improves users' beliefs and attitudes towards an online store (Klein, 2003). Therefore, we hypothesise:

H_{4a}: The relationship between hedonic value and behavioural intention is positive.

H_{4b}: The relationship between utilitarian value and behavioural intention is positive.

H_{3c}: The relationship between 3D authenticity and behavioural intention is positive.

Methods

Stimuli

We designed a retailer's Web site with one stimulus for this study. The stimulus is illustrated on 3D product visualisation sites that allow participants to view the focal product, laptops, from different angles; they also can rotate the products and zoom in or out on them, change the colour and get information about features and attributes. The 3D stimulus is intended to help consumers imagine the product in appropriate and relevant ways and thus enhance their virtual experiences (Li et al., 2001).

Interface and Experimental 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 (utilitarian) 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, and add more features and cases to the ones that might be found in real online retailers (sites) to surpass an actual experience.

Sample

Student samples are well suited to online shopping research (e.g., Balabanis and Reynolds, 2001; Fiore et al., 2005; Kim et al., 2007; Li et al., 2002, 2003), because they are computer literate and have few problems using new technology. Students also are likely consumers of electrical goods (Jahng et al., 2000). A total of 300 under-graduate and post-graduate students from a London (U.K.) university participated in this study. The sample consisted of 48% women and 53% men, and 90% of the sample ranged from 18 to 30 years of age. Approximately 90% 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 in setting a time limit on the exposure in our experiment of five minutes. After viewing the stimulus 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 or out the virtual model based on Liu's (2003); McMillan and Hwang's (2002) and Song and Zinkhan's (2008) studies. To measure animated colours, we developed a four-item animated colour scale based on Fiore and colleagues (2005a), Klein's (2003), Steuer's (1992) studies. The items tap how closely the simulated sensory information reflects the real product. 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 Christodoulides and colleagues (2006) procedures 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 hedonic values, we adopted a modified version of Babin and colleagues (1994) scale. We based the study on 4 of the 11 items. To measure utilitarian values, we adopted a modified version of Fiore and colleagues (2005a) scale. To measure Behavioural intention, we used a modified version of Fiore and colleagues (2005a) scale.

Results

Measurement Model

We evaluated the measurement and structural equation models using AMOS 16. The measurement model includes 23 indicators, and we provide its results in Table 1, including the standardised factor loading, standard error, t-values, average variance extracted and composite reliability for each construct. The standardised factor loadings (λ) are all greater than .60. The composite reliabilities for animated colours (.78), control (.8), authenticity (.86), utilitarian (.85), hedonic (.86) and behavioural intention (.88), all are acceptable (Hair et al., 2006). Moreover, average variance extracted by each construct exceeds the minimum value recommended by Hair et al. (2006), (i.e., exceed .5), indicating convergent validity. The square roots of the average variance extracted by each construct exceed the correlation between them (Table 2), demonstrating discriminant validity. Thus, our instrument had satisfactory construct validity (Anderson and Gerbing 1988).

Please Take in Table 1

Structural Equation Model

The hypothesised model achieves a chi-square of 350.225 (df = 219), with a goodness-of-fit index (GFI) of .911, comparative fit index (CFI) of .965, root mean square residual (RMR) of .038 and root mean square error of approximation (RMSEA) of .044, normed fit index (NFI) of .912, relative fit index (RFI) of .9, incremental fit index (IFI) of .965, and χ^2/df = 1.599. These results indicate a good fit of the data to the model (Byrne, 2001; Hair et al., 2006). Furthermore, the structural equation model confirms that control and animated colours have significant positive effects on authenticity (H_{1a} t = 2.098; H_{1b} t = 7.951). Moreover, animated colour exhibits a significant positive effect on control (H_2 t = 7.888). Finally, as we hypothesized, authenticity, hedonic and utilitarian values have positive effect on behavioural intention (H_{3c}: 2.465, H_{4a}: t = 2.216, H_{4b}: t= 2.454).

Please Take in Table 2

Test of the Hypotheses

Behavioural intention was predicted by utilitarian value (standardized path coefficient, β = .18, $p < .05$), hedonic value (β = 0.20, $p < .05$) and authenticity constructs (β = .25, $p < .05$) and these constructs together explained 29% of the behavioural intention (coefficient of determination, $R^2 = 0.29$). As a result, hypotheses H_{3c}, H_{4a} and H_{4b} were supported. Authenticity was predicted by control (β = 0.16, $p < .05$) and animated colours (β = 0.71, $p < .001$). These constructs explained 67% of the 3D authenticity construct ($R^2 = 0.67$). As a result, hypotheses H_{1a} and H_{1b} were supported. Control was predicted by animated colour (β = 0.61, $p < .001$) and explained 37% of the control construct, supporting hypothesis H_2. Finally, utilitarian (β = 0.58, $p < .001$) and hedonic values (β = .68, $p < .001$) were predicted by authenticity (34% of utilitarian values explained by authenticity and 50% of the hedonic values explained by authenticity), supporting hypotheses H_{3a} and H_{3b}. In sum, all the hypothesized paths are supported ($p < .05$), see Figure 2.

Please Take in Figure 2

Decomposition of Effects

Decomposition of effects analysis was conducted to assess the indirect effects of the predictor constructs on participants' behavioural intention. Table 3 reports the direct, indirect, and total effects of the predictor variables (i.e., animated colour, control, authenticity, hedonic and utilitarian value) on behavioural intention. The animated colour had significant indirect effects on behavioural intention, suggesting mediating effects of the 3D authenticity, utilitarian and hedonic constructs. The proposed conceptual model explained a moderate amount of the variance in behavioural intention ($R^2 = .29$). For behavioural intention, authenticity had the strongest direct effect (.246) followed by hedonic value (.202). Animated colours had the strongest indirect effect (.399) followed by authenticity (.249). Authenticity had the strongest total effect on behavioural intention (.405), followed by animated colours (.399). Finally, control had the weakest total effect on behavioural intention (.077). The hedonic, utilitarian and authenticity constructs are full mediation between control, animated colours and behavioural intention (i.e. no new paths indicated by Modification Indices and other direct paths are non significant), see Table 2.

Please Take in Table 2

Discussion

In a highly competitive environment, e-retailers need to find ways of attracting and retaining customers (Mummalaneni, 2005). A proper design of a website atmospherics (e.g., colour, animation and control) enhances online shoppers' internal states (hedonic and utilitarian value), which contributes to positive outcomes. For instance, a pleasant store atmosphere can entice online shoppers to visit the online retailer (Manganari et al., 2009), builds a positive attitude towards the online retailer (Childers et al., 2001; Coyle and Thorson 2001; Fiore et al., 2005a), and boosts shoppers' behavioural intentions (Richard, 2005). A Web site with an authentic 3D atmosphere is an important stimulus that could help e-retailers to find success. Our results reveal the usefulness of the online S-O-R framework in understanding the relationships among the control, animated colours (S), 3D authenticity, hedonic, utilitarian value (O) and the behavioural intention (R). Our experiment results provide a strong evidence of the influence of control and animated colours on 3D authenticity. In accordance with Klein (2003) we find that control and animated colours are the main tools that enhance consumers' virtual experience. 3D authenticity enables consumers to experience online products without directly inspecting them and provides consumers with a sense of having a direct experience (Coyle and Thorson, 2001). The direct impact of 3D authenticity on behavioural intention demonstrates an important role for 3D authenticity in enhancing consumers' responses within the online retail context.

Our research makes a contribution to the online atmospheric literature by providing a rich explanation of how authenticity of the 3D virtual models adds more information and fun; and enhances consumers' responses towards the online retailer. 3D authenticity has a significant, positive impact on hedonic and utilitarian values. Our results support conclusions of past research that posit that advanced technology, such as 3D, provides consumers with enriched product information (Fiore and Jin, 2003; Fiore et al., 2005b; Li et al., 2001) and hedonic value of the shopping experience (Li et al., 2003). In line with Childers et al. (2001), Eroglu et al. (2003) and Richards (2005), we find that the hedonic value of 3D positively affects behavioural intention. Supporting to Ballantine (2005), we find that a high level of information (provided by 3D) enhances behavioural intention. These results support the importance of designing 3D product visualisation to increase hedonic and utilitarian value. Our results also support the theoretical ideas of Sautter et al. (2004) and Manganari et al. (2009), emphasising the importance of adding virtual theatrics to the online store environment.

The above experiment casts light on the underlying process by showing that the authenticity, hedonic and utilitarian values fully mediate the relationships between control, animated colours and behavioural intention. The importance of 3D authenticity as part of the perception process should be taken into consideration when designing an online virtual model. Previous research (e.g., Eroglu et al., 2003; Richards, 2005) has focused only on the emotional and cognitive aspects as components of the perception process.

This paper addresses Eroglu's and colleagues' (2003) call to focus on specific aspects of the online retailer atmosphere. The results show the importance of focusing on a single stimulus, namely, 3D and the significance of this stimulus in enhancing consumers' perceptions and virtual experiences. Web site developers should take advantage of technological advancements to develop and update online retailers' 3D flashes. Pechtl (2003) asserts a positive relationship between perceived innovation attributes and online adoption behaviour. Managers and Web sites designers should work together to ensure that the 3D product visualisation provides customers with the complete and accurate information they need. In addition, marketers should decide what information (or knowledge) to focus on before developing 3D flashes. It should be accepted that developing 3D flashes is not a money-free issue. Nevertheless, many companies have already claimed to have improved their sales as a result of designing and using 3D flashes. For example, J.C. Penny, eBags and Wal-Mart claimed that their online sales have increased 10% to 50% after using rich media such as 3D flashes (Demery, 2003). Moreover, Demery (2006) posits that the numbers of companies who are investing in 3D virtual models is increasing steadily because these companies are seeing the potential of the technology for selling more products. Nantel (2004) asserts that consumers shopping online for clothing are 26% more likely to purchase from the sites that have 3D virtual model than from sites that have not. Moreover, Fiore (2008) posits that media richness is an important way to differentiate retailers. Wagner (2000) asserts that online retailers with 3D product visualisations may reap benefits that extend beyond sales. For example, 3D increases site stickiness: users will spend more time on the online retailer, which leads to more opportunities to learn more about the products, interact with them, build trust and confidence. Finally, according to 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" and the development of 3D virtual models (such as 3D virtual shopping malls) will be leading the whole industry by 2020.

Managerial Implications

3D authenticity, hedonic and utilitarian values are significant determinants of behavioural intention. Retail websites should pay more attention to the antecedents of 3D authenticity i.e., control and animated colours when designing their 3D virtual models. Including real colours and flashes that consumers can control easily will lead to more authentic online experiences. Moreover, retail website designers can contribute to enhancing consumers' virtual experience by focusing more on utilitarian and hedonic value. Any 3D flash should include the essential information that consumers seek and consumers should be able to click to any part of the 3D flash to access further information. On the bases of our results, we recommend that Web site developers should pay more attention to simulating 3D animation 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.

Limitations and Further Research

The applicability of the results is limited by the student sample and cannot be generalised to all online consumers. Nevertheless, we argue that students represent the shoppers of tomorrow (Balabanis and Reynolds, 2001). Further research may investigate our model by using a non-student sample. Moreover, further research could apply our model in a non-electrical context (e.g., clothing industry). Further research could also add an auditory stimulus (real sounds of the laptop) to our model, and investigate how auditory and visual stimuli may influence 3D authenticity. Further studies may manipulate different levels of control, animated colours, utilitarian and hedonic values and measure the effects of the progressive levels of control and animated colours on 3D authenticity; and the effects of the progressive levels of utilitarian and hedonic value on behavioural intention.

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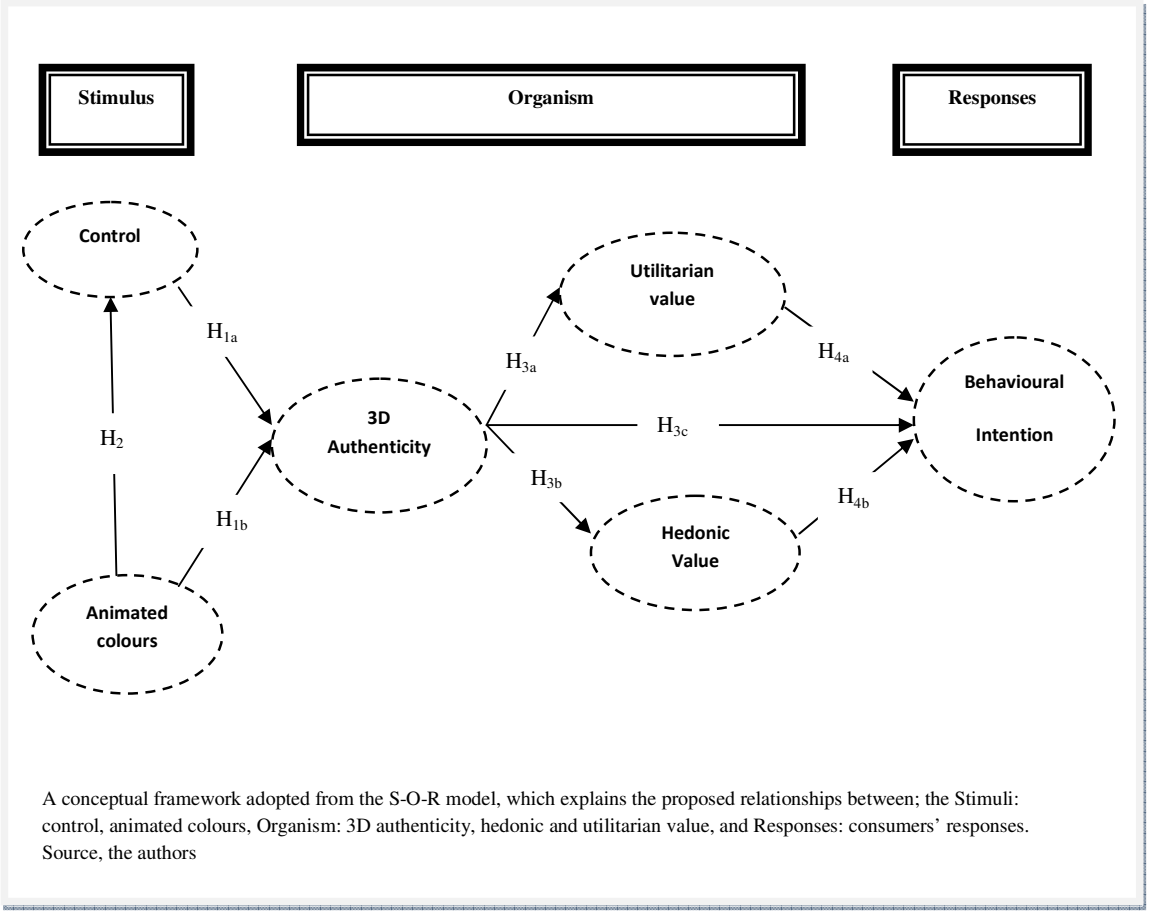
Figure 1, The conceptual Framework



A conceptual framework adopted from the S-O-R model, which explains the proposed relationships between; the Stimuli: control, animated colours, Organism: 3D authenticity, hedonic and utilitarian value, and Responses: consumers' responses. Source, the authors

Table 1. The standardised factor loading, standard error, t-values, average variance extracted and composite reliability

Construct Indicator	Standardized factor loading (λ)	S.E	t-value	Average Variance extracted	Squared multiple correlation	Composite reliability
η1 (control)				0.50		0.80
- I felt that I could choose freely what I wanted to see	.78	-			0.602	
- I felt that I had a lot of control over the content of the laptop's options (i.e. angles and information)	.71	0.077	12.097		0.508	
- I felt it was easy to rotate the laptop the way I wanted.	.71	0.076	10.009		0.503	
- I felt I could control the laptop movements.	.61	0.071	8.916		0.369	
η2 (animated colours)				.502		0.78
-There are lots of colours on 3D laptop websites.	.79	-			0.631	
- Colours brightness of the 3D laptop let me visualize how the real laptop might look.	.71	0.067	11.391		0.499	
- The laptop illustrated by 3D was very colourful	.61	0.064	10.099		0.375	
η3 (Authenticity)				.608		0.86
- 3D Creates a product experience similar to the one I would have when shopping in a store.	.77	-			0.598	
- 3D Let me feel like if I am holding a real laptop and rotating it (i.e. virtual affordance)	.79	0.078	14.093		0.628	
- 3D Let me feel like I am dealing with a salesman who is responding to my orders.	.81	0.078	14.581		0.656	
- 3D let me see the laptop as if it was a real one.	.74	0.076	13.293		0.550	
η4 (hedonic value)				0.59		.86
- Would be like an escape.	.64	-			0.411	
- Would be truly enjoyable	.77	0.105	12.752		0.589	
- Would be enjoyable for its own sake, not just for the items I may have purchase.	.88	0.128	11.987		0.722	
- Would let me enjoy being immersed in an existing new product.	.79	0.144	11.123		0.618	
η5(utilitarian value)				.582		0.85
- Help me make a better decision about the product.	.80	-			0.637	
- help me buy the right product.						

- Aid me in evaluating the laptop items.	.92	0.079	16.179		0.844	
- Help me in finding what I am looking for	.69	0.067	12.481		0.475	
	.61	0.066	11.002		0.375	
η6 (Behavioural intention)				0.631		.88
- After seeing the web site, how likely is it that you would buy a laptop from this online store.	.81	-				
- I would be willing to purchase a laptop through this online store.	.82	0.061	16.151			
- I intend to buy a laptop from this online store.	.82	0.075	15.323			
- I would be willing to recommend this online retailer to my friends.	.72	0.059	13.160			

Table 2. Discriminant Validity

Construct	**Animation**	**Control**	**Authenticity**	**Utilitarian**	**Hedonic**	**Behavioural intention**
Animated Colours	**.708**					
Control	.469(**)	**.707**				
Authenticity	.633(**)	.469(**)	**.774**			
Utilitarian	.397(**)	.360(**)	.449(**)	**.754**		
hedonic	.464(**)	.329(**)	.586(**)	.463(**)	**0.761**	
Behavioural intention	.296(**)	.228(**)	.427(**)	.392(**)	.403(**)	**.8**

(**) ***p*<0.01. The figures under the diagonal are the Pearson (R) correlations between the variables. Diagonal elements are square roots of average variance extracted.**

Figure 2. Structural equation model. The figures on the paths are the standardised path coefficients (β)

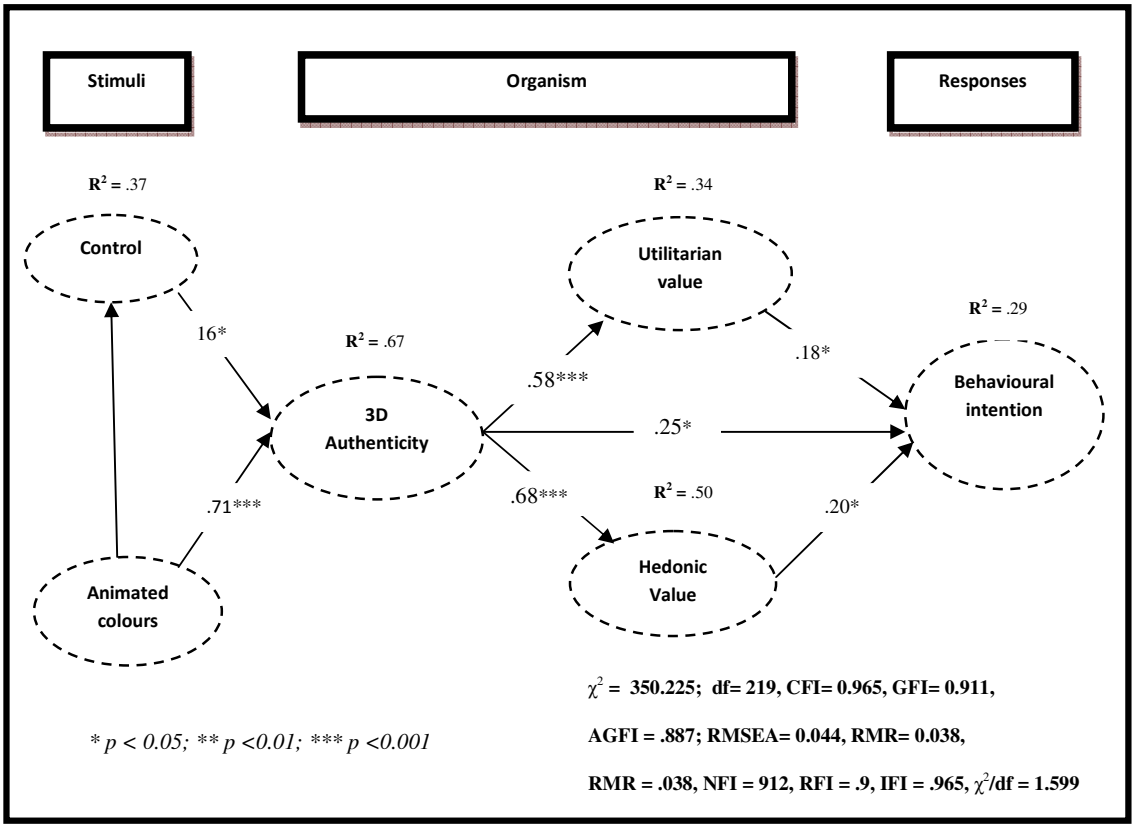


Table 3, Direct, indirect and total effects on behavioural intention.

Predictor variables	Behavioural intention toward the online retailer		
	Indirect effects	Direct effects	Total effects
Animated Colours	.399 **	------	.399 **
Control	0.077	------	.077
Authenticity	.249**	.246**	.495*
Utilitarian value	------	.182*	.182*
Hedonic value	------	.202*	.202*
R^2			**.29**

Note: Standardized path estimates are reported.
** p < 0.05; ** p <0.01; *** p <0.001*

Appendix A

The Stimulus: A laptop 3D product visualisation.