

Effects of Visual Control and Graphical Characteristics of 3D Product Presentations on Perceived Trust in Electronic Shopping

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Abstract

The importance of online trust lies at its ability to predict users' adoption of electronic shopping. However, little is known about the role of three dimensional (3D) product presentations in enhancing online trust based on graphical characteristics (GC) and visual control (VC). Therefore, this paper discusses the effects of different levels of visual control and graphical characteristics on perceived trust. While visual control allows users to manipulate 3D product images (to view products from various angles and distances), graphical characteristics allows consumers to experience different colours and 3D motions of presented products. The individual and joint effects of visual control and graphical characteristics were investigated in a laboratory experiment. Our results showed that visual control and graphical characteristics increased users' perceived trust. Furthermore, we find an interaction effect of graphical characteristics on perceived trust of the 3D product presentation only when visual control of the 3D product presentation is high.

Keywords: e-tailing, three dimensional (3D), virtual product experience, virtual control, graphical characteristics, e-commerce, perceived trust

1. Introduction

Product experience often classified into three areas; direct product experience, indirect product experience and virtual product experience (VPE). Previous research (Hoch & Deighton, 1989; Kempf & Smith, 1998) on direct product experience (i.e., product trial) has argued the importance of this type based on the following reasons. (i) Direct experience generates a vivid and informative presentation of products due to users' ability to employ multiple sensory cues (i.e., vision, tactile feelings, smell, sound, and taste). (ii) Direct experience motivates customers to evaluate the products, and thus it attracts their attention and engagement. (iii) Customers attained all the product information directly by themselves, and therefore possess the highest credibility and trustworthiness.

The importance of VPE, which enhance users interaction with three-dimensional (3D) virtual models, appears as a result of the 3D product presentation ability to enrich users' learning processes (Klein, 2003; Jiang & Benbasat, 2005), to reflect simulated offline retailer (Algharabat & Dennis, 2010a, 2010b, 2010c; Li et al., 2001, 2002, 2003), to convey relevant information (Algharabat & Zamil, 2013; Jiang & Benbasat, 2007), to evaluate the quality of presented products (Algharabat & Abu-ElSamen, 2013; Algharabat & Shatanawi, 2014; Jiang & Benbasat, 2005) and to enhance consumer's thinking and emotional responses (Kim and Forsythe, 2007, 2008; Park et al., 2008). Furthermore, 3D product presentations are often helpful to consumers to form a clear understanding of product functionality and performance (Algharabat & Abu-ElSamen, 2013; Jiang & Benbasat, 2007). Particularly, a vivid and interactive 3D product presentation is often used to impress consumers with the illustrated product features and to enhance customers' intentions (Algharabat & Dennis, 2010b).

Despite the previous efforts in this area, we noticed that previous research linked the notion of 3D product presentation with online trust (Algharabat & Abu-ElSamen, 2013; Algharabat & Zamil, 2013) based on investigating the impact of 3D product presentation on online trust. However, most of previous studies (Algharabat & Abu-ElSamen, 2013; Algharabat & Zamil, 2013) have treated the relationship between 3D product presentation and online trust as a black box, without investigating the effects of different levels of 3D product presentation antecedents (such as visual control and graphical characteristics) on online perceived trust. Therefore, the present study identifies two antecedents of 3D perceived trust, namely, visual control (VC) and graphical characteristic (GC), and investigates their individual and joint effects on perceived trust. A controlled experiment is employed to

test empirically whether VC and GD lead to higher perceived trust. Therefore, we aim to answer the following research questions:

How does visual control and graphical characteristics impact perceived trust?

Is there any interaction effect between visual control and graphical characteristics?

In the following sections, we investigate the effects of 3D visual control and graphical characteristics on perceived trust, as well as the definitions of perceived trust, derived from navigating 3D product presentation, and then consider how these notions can help 3D websites to operate effectively.

2. Research Model and Hypotheses

2.1 Antecedents of 3D Virtual Product Experience

Algharabat and Abu-ElSamen (2013) assert that VPE often helps users' to perceive the 3D product as actual objects. Furthermore, the authors posit the ability of 3D products to reflect proper information to users and thus help them to evaluate the quality and performance of the presented 3D products. Algharabat and Abu-ElSamen (2013) identify interactivity and vividness as the main antecedents of an effective 3D presentation. The authors assert that while interactivity related to easily navigating a 3D product presentation, vividness related to demonstrating 3D products with different colours. Algharabat and Dennis (2010a) identified users' ability to control the 3D website (i.e., to rotate, and zoom in or out on the 3D virtual model) and their ability to test the 3D products and see them with real colours (vividness) as the main antecedents of 3D product experience.

Jiang and Benbasat (2005) assert that visual control (i.e., zoom in and out and rotate the 3D product presentation) and functional control (i.e., getting functional information about the presented product) are the main determinants of VPE. Schlosser (2003) argued that object interactivity (product features) should be considered as the main antecedent of VPE. Ariely (2000) defined control as users' abilities to customise and choose website contents. Previous research (Urban & Weinberg, 1996; Urban et al., 1997) posit that vivid multimedia often lead to more accurate market predictions. Previous studies (e.g., Fortin & Dholakia, 2005; Shih, 1998) assert the significant role of high-quality online animated colours.

2.2 Visual Control, Graphical Characteristic and Trust

Visual control often allows users to manipulate 3D product images, i.e., to zoom in and out on a product's image, move and rotate, enlarged in size and to view it from different angles. Furthermore, visual control provides information about the look of the product (Jiang & Benbasat, 2005). Jiang and Benbasat (2005) posit that virtual control is significant to emulate offline product experience. In other words, when users interact with 3D virtual products, VPE enables them to feel, and try the presented products virtually (Ryan, 2001). Li et al. (2003) posit the ability of VPE to simulate offline product experience. The authors stated that both direct experience and virtual experience are interactive in nature.

Janig and Benbasat (2005) postulated that visual control is a function of objects direct manipulation. Therefore, direct manipulation of objects often allows users to control objects of their interest (Shneiderman, 1983). Furthermore, according to Hutchins et al. (1986, p. 99) direct manipulation often enhances users' feeling of being translated into physical place, and thus "manipulating a representation can have the same effects and the same feel as manipulating the thing being represented". Previous researches on direct manipulation (Benbasat, I., & Todd, 1993; Eberts & Bittianda, 1993; Hutchins et al., 1986; Jordan, 1992; Morgan, Morris, & Gibbs 1991) asserts the importance of direct manipulation in creating strong feelings of control over the object of interest, improving users' performance and efficiency, enhancing affective engagement, and it is positively evaluated by users.

Algharabat and Zamil (2013, p.322) define 3D trust as "users' feelings of trustworthiness about information quality and system quality". The authors posit that 3D product presentation which is easy to use, user friendly, well designed to navigate and convenient to access often enhance users' trust. Koufaris and Hampton-Sosa (2004) posit that users' ability to customise products is often important to build online trust. Briggs et al. (2004) find a positive relationship between personalisation and trust. Algharabat and Abu-ElSamen (2013) find a positive relationship between 3D product presentation and trust. Vance et al. (2008) assert the positive relationship among visual appeal, navigational structure and trust. Thus, ease of controlling a 3D product presentation (i.e., zoom in or out and having a vivid images for the 3D product often enhance trust (Algharabat & Zamil, 2013; Algharabat & Abu-ElSamen, 2013). McKnight et al. (1998) posit the importance of user's knowledge for the trust assumption. Furthermore, previous research on the impact of perceived quality of website on trust (e.g., McKnight et al., 2002; and Belanger et al., 2002) asserts the significant relationship between web vendors' quality and web-based trust.

Kim and Moon (1998) examine the relationship between an online banking website's graphical characteristics (by

manipulating clip arts and colours) and trust. The authors find that using a 3D dynamic clipart with colorful layout often aroused feelings of trustworthiness. In the same context, Algharabat and Zamil (2103) posit that 3D product presentation which provides users with accurate and complete information often enhance their trust. Furthermore Algharabat and Abu-ElSamen (2013) assert that 3D product presentation which is highly vivid (i.e., consumers can change the colour of the product) often enhance product demonstration which leads to building more trust on the website. Karvonen and Parkkinen (2001) assert the importance of employing real photographs with high-quality to build consumer trust. According to Stanford Persuasive Technology Lab (2002) visual design of a site (i.e., colours) enhances credibility of a website.

Therefore, we hypothesize that consumers will report higher perceived trust in shopping websites with 3D product presentation which includes high levels of visual control and graphical characteristics, compared to regular 3D websites which includes low levels of visual control and graphical characteristics. This prediction is based on the following two arguments. First, depending on the direct manipulation technology, compared to a regular 3D website interface which rotates by itself, 3D with virtual control interface allows consumers to interact with and to control 3D presented products. Therefore 3D with visual control is expected to enhance consumers' abilities to explore and to understand the product information. Second, through the graphic characteristics, 3D with manipulated colours is expected to contain richer and more vivid product information for consumers to evaluate. Inasmuch as the above arguments can be applied to both visual control and graphical characteristics, the following hypotheses are drawn:

H1: Perceived trust will increase as the levels of visual control in a 3D interface increase.

H2: Perceived trust will increase as the levels of graphical characteristics in a 3D interface increase.

As we hypothesized, visual control or graphical characteristics can increase overall perceived trust, hence it is expected that an interface with neither feature will perform least effectively. However, it is not expected that the existence of both features will necessarily increase overall perceived trust to the extent of the sum of the individual effects of visual control and graphical characteristics. Therefore, 3D product presentations where both visual control and graphical characteristics are available are not expected to perform most optimally. Hence,

H3: For 3D products associated with both visual control and graphical characteristics, there will be an interaction effect between graphical characteristics and visual control in terms of consumers' perception of trust.

Beldad, Jong, and Steehouder (2010) criticise the Kim and Moon's (1998) study which was conducted only on online banking. Furthermore, the authors claim that researchers should be alert in generalising the impact of colours on online trust. However, previous research (Algharabat & Abu-ElSamen, 2013; Algharabat & Dennis, 2010a, 1020b, 2010c) highlighted the importance impact of colours on building proper 3D product presentations. Therefore,

H4: Users consider the impact of graphical characteristics on the perceived trust of the 3D product presentation only when visual control of the 3D product presentation is high; however, when visual control of the 3D product presentation is low, users ignore the impact of graphical characteristics.

3. Dependent Variable

The present study examines the effects of virtual control and graphical characteristics on one dependent variable: 3D trust.

Algharabat and Abu-ElSamen (2013, p. 249) define 3D trust, which is derived from 3D product presentation, as: the users' feelings of trustworthiness derived from 3D information quality and graphical characteristics. In the same context, Algharabat and Zamil (2013) define 3D trust based on the impact of information and system quality on consumers' feelings of trustworthiness. Thus ease of navigating a 3D product presentation (zoom in or out, seeing the information regarding the product) and having very clear images for the product might enhance trust (Algharabat and Dennis, 2010c).

To measure perceived trust, within the context of 3D product presentation, participants used seven-point Likert scales to indicate their agreement or disagreement with the following three items designed by Algharabat and Zamil (2013) and Algharabat and Abu-ElSamen (2013):

1. I feel that the 3D presentation is dependable;
2. I feel that the 3D presentation is reliable;
3. I feel that the 3D presentation is realistic;

4. Research Design

4.1 Stimuli and Interface Design

In order to test the proposed hypotheses, we designed a hypothetical retailer's website with four stimuli which were illustrated as 3D laptops. Furthermore, to test the impact of perceived trust on different levels of VC and GC, we designed four conditions in a 2 (VC: high vs. low) \times 2 (GC: high vs. low) between-subjects design. Please see Appendix A for screen shots of the 3D virtual models. The first 3D flash represents a laptop that participants could zoom in or out, rotate (high VC) and change the colour of the 3D product presentation (high GC). The second 3D flash represents a laptop that participants can only rotate (low VC) and they can change its colour (high GC). The third 3D model represents a laptop that participants can zoom in or out and rotate (high VC) but they cannot change its colour (low GC). The fourth flash represents a laptop which simply rotated on its own (low VC) with a sole colour (low GC).

4.2 Participants and Procedure

One hundred and forty convenience undergraduate students participated in this study to test the proposed hypotheses. Students were recruited through universities in Jordan Middle East. Subject's age ranged between 19-28 years of age (47% female) and 100% reported having had prior online shopping experience. Accordingly, university students considered a proper sample to our study because they are; computer-literate (Algharabat & Dennis, 2010b), shoppers of tomorrow (Algharabat & Dennis, 2010c) and they are potential candidates for online shopping research (Algharabat & Dennis, 2010a; Fiore et al. 2005; Kim et al. 2007).

Before starting with the main study, participants were given an introductory explanation about the use of the 3D sites. Furthermore, we inform students that the purpose of the study was to evaluate their perceived trust in different 3D websites. Therefore, a rehearsal was given to students to explain how to rotate, zoom in or out and to change colours of the virtual models. After this, we assigned participants randomly to the experimental conditions. Each participant then asked to explore one site and then to answer the attached questionnaire. After conducting back translation (English-Arabic, then Arabic-English), we used paper-based questionnaire to test the proposed hypotheses. The questionnaire was pretested with a small Jordanian students sample before field implementation. In determining the proper examination times, we followed Zajonc's (2001) study in determining the limit exposure for five minutes.

4.3 Manipulation Checks

This study ran a pre-test to develop the study materials. Respondents were asked to rate several 3D models based on visual controllability and graphical characteristics dimensions (a 7-point Likert scale). For visual control, participants explored two 3D flashes; (i) one which participants can control: a 3D flash which participants can zoom in and out and rotate, and (ii) one which participants cannot control: a 3D flash that zoomed in and out and rotated on its own. After exploring each 3D flash, we asked participants about the level of the visual controllability: To what extent do you consider that the 3D flash is controllable? (Algharabat & Dennis, 2010a). Results show that the differences between the high VC and low VC was significant (VC high = 4.96 versus VC low = 3.25, $F_{1, 138} = 21.65$, $p < .001$)

For graphical characteristics, participants explored two 3D flashes; (i) one which participants can change colours of the laptop, and (ii) one which participants cannot change the colour of the laptop. After exploring each 3D flash, we asked participants about the level of the graphical characteristics: To what extent do you consider that the 3D site is colourful? (Algharabat & Dennis, 2010a). Results show that the differences between the high GC and low GC was significant (GC high = 5.73 versus GC low = 3.83, $F_{1, 138} = 48.65$, $p < .001$)

5. Results

Results show that the items of perceived trust yielded a Cronbach alpha of .93. Furthermore, using factor analysis, to test unidimensional scale, we find that the three items loaded on only one factor with an eigenvalue greater than one.

As we hypothesised in H1, results of ANOVA exposed a significant main effect of visual control on perceived trust ($F_{1, 136} = 392.36$, $p < .001$, $\eta^2 = .74$). Participants agreed that their perceived trust of 3D product presentation is higher when navigating a 3D product with high visual control ($M = 5.04$) in comparison to their perceived trust when navigating a 3D product presentation with low visual control ($M = 2.47$).

As we hypothesised in H2, results of ANOVA exposed that perceived trust of 3D product presentation to be higher ($M = 4.63$) when using high graphical characteristics than when navigating a 3D product with low graphical characteristics ($M = 3.21$). Therefore, ANOVA showed a significant main effect for graphical characteristics on

perceived trust ($F(1, 136) = 39.36, p < .001, \eta^2 = .22$).

As we hypothesised in H3 (Figure 1), ANOVA test revealed a significant interaction effect between visual control and graphical characteristics on perceived trust of the 3D product presentation ($F(1, 136) = 22.96, p < .001, \eta^2 = .144$).

To test H4, we conducted T-test for equality of means, results of the test showed that when using low visual control (regardless of the level of the graphical characteristics: low-and high conditions: $M = 2.39$ vs. $M = 2.49, [t(40) = .97, p > .05]$) participants perception of 3D trust was low and thus no significant differences. Notwithstanding, we find that only when visual control is high, participants perceived higher trust when the graphical characteristics was high rather than low: $M = 5.57$ vs. $M = 4.29 [t(41) = 6.15, p < .05]$. Thus H4 was supported

To confirm the above result, we run a regression analyses to test the relative magnitudes of the impact of VC and GC as predictors on perceived trust as the dependent variable. Results showed that VC and GC have significant effect on perceived trust [(VC) $\beta = .80, p < .001, (GC) \beta = .27, p < .001$]. Furthermore, we find that the magnitude effect of VC is three times larger than GC.

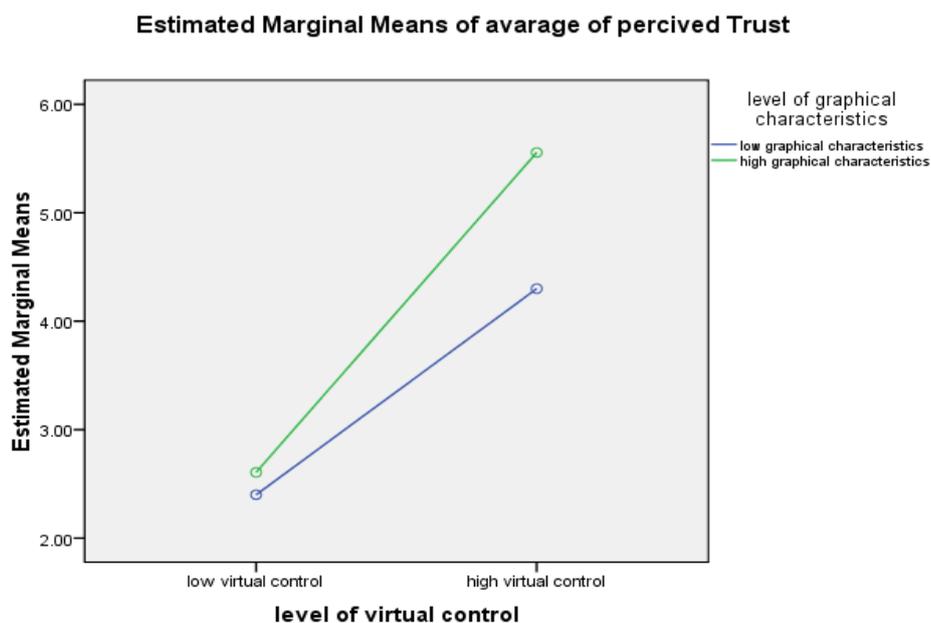


Figure 1. Interaction effect

6. Discussion and Implications

This study aims at investigating the effects of different levels of 3D visual control and graphical characteristics on perceived trust. Perceived trust derived from navigating a 3D product presentation represent the extent to which designing a 3D website often enhance users' trust of the content and form of the 3D product (Algharabat & Abu-ElSamen, 2013; Algharabat & Zamil, 2013). Algharabat and Zamil (2013) argue that the information produced by the 3D product presentation is important to build trust because perceived trust can create positive attitude toward the product, strengthen consumers' purchase intention, and thus enhance their confidence in their product decisions.

In the online environment, consumers' capability to build trust on websites appears even more critical than in the physical shopping environment. Therefore, information provided to consumers by 3D visual control and graphical characteristics are expected to enhance users' perceived trust on the 3D product presentation. In other words, one can view visual control as a personal "decision support system" to make better and more informed purchase decisions.

We found that high levels of visual control and graphical characteristics have significant impact on formulating perceived trust on electronic shopping retailers which use 3D product presentation. Therefore, if marketers intend to enhance 3D virtual experience they should increase the levels of visual control and graphical characteristics.

Users' ability to control the visual aspects of a 3D product and their ability to manipulate graphical characteristics often simulate their offline experience and thus increase perceived trust in 3D product visualisation. This result answered the first research question and support H1 and H2 regarding the effect of the high levels of control and graphical characteristics on perceived trust.

Results of the impact of different levels of visual control and graphical characteristics on perceived trust showed that high levels of visual control and graphical characteristics resulted in having a high level of 3D perceived trust. Most importantly, we found that for the interaction effect the level of graphical characteristics, whether high or low, does not impact perceived trust if visual control is associated with the low level. This result supports Beldad et al.'s. (2010) findings which investigated the impact of colours on perceived trust. Therefore, 3D product presentation can enhance perceived trust only when visual control is high and graphical characteristics is high as well. These results answered the second research question and support H3 and H4 regarding the interaction effect of control and graphical characteristics on perceived trust.

This research adds empirical findings to the internet shopping literature regarding the relationships among visual control, graphical characteristics and 3D perceived trust. The current literature (Algharabat & AbuElsamen, 2013; Algharabat & Zamil, 2013) on 3D trust investigated the relationships between antecedents and consequences of 3D trust. Whoever, this research focused on manipulating the different antecedents of 3D perceived trust and their impact on 3D perceived trust.

Therefore, website designers should focus on the interaction level between high visual control, in which users can manipulate the images (zoom in and out, rotate), and high graphical characteristics, moving colours of the presented products, to enhance users' perceived trust. Therefore, we advise marketing managers and website developers to take care of this aspect because of its importance in building a particular type of trust.

7. Conclusions and Recommendations

Using 3D product presentation virtual model which allows users to see how laptops look and work, this study aims to examine the effect of progressive levels of visual control and graphical characteristics on perceived trust. Our results show significant support for the study hypotheses; the results show that high levels of visual control and graphical characteristics have positive impact on perceived trust. Therefore, designing 3D virtual model with a high quality often allows users to find the proper information.

We recommend future studies to focus on investigating the impact of social presence, customization and personalization (tailoring products, services, and transactional environments, according to Srinivasan, Anderson, & Ponnnavolu, 2002) on 3D perceived trust. Moreover, future studies can investigate the impact of the moderating role of gender and involvement on our model.

8. Limitations

Touliatos & Compton (1988) posit that a laboratory experiment is often of advantages because of it allows researchers to control the surrounding environment, to create uniformity of procedures and to manipulate different constructs. However, our study has some limitation. For example, the artificial nature of our experiment might impact participants' responses. Furthermore, the limited time for browsing each condition and motivation to participate in our study (extra marks) might reduce reality in the shopping situation.

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Appendix



Condition 3



Condition 4



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