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THE EFFECTS OF INTERACTIVITY AND VIVIDNESS OF FUNCTIONAL CONTROL IN CHANGING WEB CONSUMERS' ATTITUDES

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Abstract

The study proposed will investigate the effects of functional control on online consumers' attitude formation. Functional control is an interactive interface feature that allows consumers to virtually try different functions of online products. An attitude formation model for analyzing and assessing the influences of functional control is proposed based on existing theories of vividness and interactivity, which are the two fundamental technological characteristics of functional control. The model suggests that functional control has direct effects on both attitudes toward online product presentation and attitudes toward products themselves, and that attitudes toward different online product presentation partly mediate the effects of functional control on attitudes toward products. A laboratory experiment has been designed to test the model. We expect that the results of the study will identify particular areas deserving attention for applying functional control to improve e-commerce environments.

Keywords: Functional control, interactivity, vividness, attitude change, perceived diagnosticity

Introduction

Recent developments of Internet-based virtual reality technologies allow consumers to “feel, touch, and try” products online (Ryan 2001). Using their mice and keyboards, customers are able to rotate products three-dimensionally to view the products from different angles, to enter product environments (e.g., the interior of a car) and examine them panoramically, to try different functions of products, and to customize products for specific applications and situations. All of these tools and options can be categorized as parts of *virtual product experiences* (Jiang and Benbasat 2003).

The research being proposed focuses on a specific type of virtual product experience: *functional control*. Functional control is an interactive web interface feature that allows consumers to explore and to experience different product functions and behavior virtually (Jiang and Benbasat 2003). For example, users could press the functional buttons of an online sports watch by clicking a mouse to sample the watch's functions in real time, including time setting, alarm, and stopwatch.

The objective of the proposed study is to investigate the effects of functional control on Web consumers' attitudes toward online product presentation and the products themselves by theoretically and empirically examining the contributions of two technology characteristics: *vividness* and *interactivity*.

This paper is organized as follows. The next section reviews prior literature on virtual product experience. The third section discusses the two technological characteristics of functional control, vividness and interactivity. The fourth section proposes an attitude formation model. A laboratory experiment is described in the fifth section, and data analysis methods are suggested in the sixth. The seventh section concludes with a discussion of the contributions and limitations of the proposed study.

Review of Prior Literature

Virtual product experiences employ virtual reality technology to simulate direct product experience. Prior research has investigated virtual product experiences from different perspectives. For example, by tracing the verbal protocols of subjects, Li et al. (2001) found that online consumers paid close attention to and became emotionally engaged in product evaluation when they were offered three-dimensional product experiences. Li et al. (2002, 2003) and Daugherty et al. (2003) compared three-dimensional product experiences to two-dimensional experiences across three product categories: *geometric products*, referring to those whose attributes could be fully understood through vision; *material products*, referring to those that required physical contact to develop understanding; and *mechanical products*, referring to those whose performance was best demonstrated through product behavior. Li et al. (2002) found that both product knowledge and attitudes toward particular brands were significantly increased by three-dimensional experiences for geometric products and material products. However, Li et al. (2003) and Daugherty et al. reported that the three-dimensional technology increased product knowledge for geometric products and mechanical products, but not for material products, and they found that there was no difference in terms of attitudes toward brands between three-dimensional experiences and two-dimensional experiences for all product categories.

Jiang and Benbasat (2003) identified two types of virtual product experience methods: *visual control* and *functional control*. Visual control enables consumers to manipulate Web product images to view products from various angles and distances. Using an integrated perspective of direct manipulation and multimedia, they studied the effects of visual and functional control on perceived diagnosticity and flow. *Perceived diagnosticity* (Kempf and Smith 1998) represents the extent to which shopping experiences help consumers to evaluate products. *Flow* is a subjective psychological experience that characterizes a human-computer experience as playful and exploratory. They found that both visual and functional control were beneficial in enhancing perceived diagnosticity and flow, although functional control was more effective.

Although these previous studies have considerably contributed to an understanding of virtual product experience, the limited research on, and inconsistent results of, the effects of virtual product experience on product attitudes as well as the lack of theories to explain these effects warrant further research on this topic, with a strong foundation in relevant theories. This proposed study will focus on one type of virtual product experience method, functional control, and examine how it affects consumers' attitude formation.

Research Framework

Technological Characteristics of Functional Control

Functional control is supported technologically by virtual reality, "a real or simulated environment in which a perceiver experiences telepresence" (Steuer 1992). Telepresence is the feeling of "being there" (Heeter 1992); it is people's experiences of their own presence in an environment by means of a communication medium (Steuer 1992). According to Steuer, two major determinants of telepresence are *interactivity*, "the extent to which users can participate in modifying the form or content of a mediated environment in real time" (p. 84), and *vividness*, "the representational richness of a mediated environment as defined by its formal features; that is, the way in which an environment presents information to the senses" (p. 81). Specifically, in functional control, the feeling of interactivity is generated when consumers interact with products, typically with a direct manipulation interface, while the feeling of vividness is generated when product information is presented in rich media, such as multimedia.

Attitude Formation Model

A recent study on Web shopping (Koufaris 2002) has suggested that online consumers adopt double identities, as computer users and as shoppers. Accordingly, online consumer attitudes will be investigated from these two perspectives: attitudes toward Web interfaces (specifically, online product presentation) and attitudes toward products. It is important to study the formation of consumers' attitudes, because they will directly influence consumer behavior, i.e., whether consumers will return to particular Websites and whether they will purchase online (theory of reasoned action and theory of planned behavior).

An attitude formation model is shown in Figure 1.

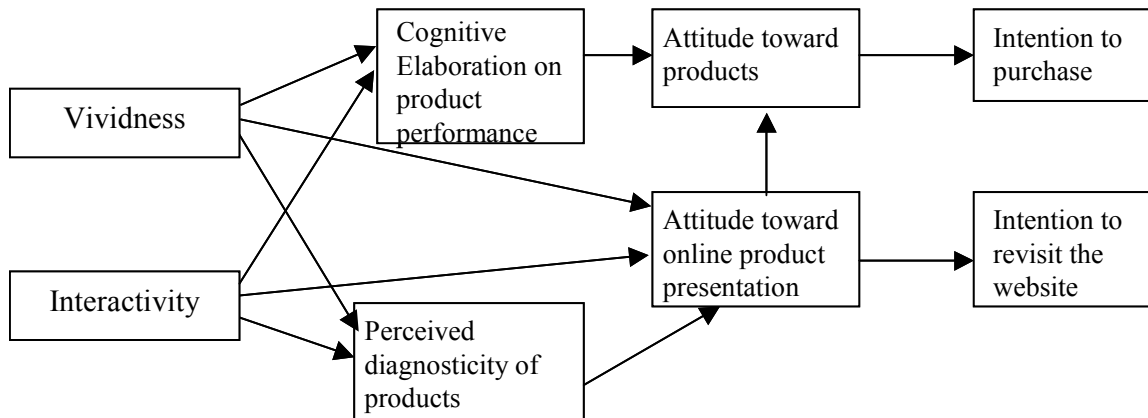


Figure 1. An Attitude Formation Model

Inasmuch as the key characteristics of functional control technology are vividness and interactivity, it is expected that the joint effects of these two characteristics will enhance perceived diagnosticity. It is because a vivid presentation is able to portray product attributes more concretely, with more information cues, and likely through more sensory channels than a relatively pallid presentation (Nisbett and Ross 1980). Additionally, interacting with functional control interfaces allows consumers to effectively match available information to their specific learning needs (Ariely 2000), thereby facilitating their understanding of products. Therefore, we propose:

H1a: Vividness positively affects the perceived diagnosticity of online products.

H1b: Interactivity positively affects the perceived diagnosticity of online products.

Vividness is emotionally interesting, concrete, and imagery-provoking; therefore, it is expected that people tend to form positive attitudes toward vivid media (Nisbett and Ross 1980). Supporting this assertion, Coyle and Thorson (2001) manipulated the levels of vividness of Websites by adding audio and animation to Web interfaces that contained only text, hypertext, and images. They found that increased vividness led to more positive and enduring attitudes toward Websites. Therefore, we propose:

H2a: Vividness positively affects consumers' attitudes toward online product presentations.

Kettanuark et al. (2001) argued that a high level of interactivity provides users with autonomy in determining the material they examined and the pace with which they wanted to proceed. Greater autonomy and increased flexibility give users a sense of control and compel them to develop a more positive attitude toward an information system (Kinzie 1990). For example, Teo et al. (2003) compared Websites with three different levels of interactivity. They found that higher levels of interactivity enhance Websites' effectiveness and efficiency in delivering relevant information, and increase users' satisfaction with and perception of the value of the Websites, which in turn facilitate a more favorable attitude toward Websites in general. Hence, the following hypothesis is proposed:

H2b: Interactivity positively affects consumers' attitudes toward online product presentation.

A higher perceived diagnosticity means consumers perceive that they have a better understanding of a particular product. In the context of online product evaluation, a better understanding means that people can make more informed and therefore wiser product choices and that the system is likely to be perceived as more *useful* in conveying product information. According to the technology acceptance model (Davis et al. 1989), the perceived usefulness of functional control will induce consumers to form positive attitudes toward the system.

H3: Perceived diagnosticity partly mediates the effects of vividness and interactivity on consumers' attitudes toward online product presentations.

The relationships connecting vividness, interactivity, and perceived diagnosticity to attitudes toward online product presentations are further explained by McKinney et al.'s (2000) study on Web customers' satisfaction. According to this study, consumers' overall satisfaction with a Website arises from two distinctive sources: satisfaction with the site's information content (i.e., information quality) and satisfaction with the site's system performance in delivering information (i.e., system quality). McKinney et al. developed an instrument to measure Web information quality, including relevance, understandability, reliability, adequacy, scope, and usefulness, and system quality, including access, usability, entertainment, hyperlinks, navigation, and interactivity. It is argued that perceived diagnosticity corresponds to two sub-constructs of information quality, i.e., understandability and usefulness, and that vividness and interactivity correspond to two sub-constructs of system quality: entertainment and interactivity, respectively. Therefore, these three variables (i.e., perceived diagnosticity, vividness, and interactivity) jointly contribute to Web consumers' satisfaction, and are likely to improve consumers' attitudes toward online product presentations (Teo et al. 2003).

The effect of vividness on attitudes toward products is based on the availability-valence hypothesis (Kisielius and Sternthal 1984, 1986). This hypothesis suggests that vivid information is likely to engage people in cognitive elaboration of the object of advocacy, which in turn affects people's judgment of the object, although the direction of attitude change depends on the *favorableness* of the information (i.e., whether the information indicates that the object is good or bad). In addition, interactivity is also expected to enhance consumers' cognitive elaboration of products. This is because interactivity requires consumers to try products virtually by themselves; therefore consumers have to think about product performance and how to interact with products carefully. Hence, we propose:

- H4a:** Vividness enhances consumers' cognitive elaboration on product performance.
- H4b:** Interactivity enhances consumers' cognitive elaboration on product performance.
- H5:** If product information is favorable, the cognitive elaboration on product performance will positively affect consumers' attitude toward products.

We hypothesize that consumers' attitudes toward product presentations may positively influence their attitudes toward products. This prediction is based on two mechanisms: *direct affect transfer* and *inferential belief formation* (Kim et al. 1996). In their study, Kim et al. investigated the mediating mechanisms through which *unconditioned stimuli* (e.g., pictures or visual images) affect consumers' attitudes toward *conditioned stimuli* (e.g., products). They argued that, on the one hand, when unconditioned stimuli provoke a positive or negative affect, the systematic pairing of unconditioned stimuli and conditioned stimuli causes a transfer of affect from unconditioned stimuli to conditioned stimuli (direct affect transfer); on the other hand, people might infer expectations about the performance of conditioned stimuli based on their beliefs on unconditioned stimuli (inferential belief formation). The two mechanisms were attested by two experiments, suggesting that advertising could participate in shaping consumers' brand attitudes by affecting consumers' affective and cognitive responses toward advertising.

While using functional control tools, if consumers form positive attitudes toward online product presentations, the cognitive and affective responses elicited by the product presentation may positively influence their attitudes toward advocated products. Hence, we propose:

- H6:** Attitudes toward online product presentations positively affect attitudes toward products.

According to the theory of reasoned action (Ajzen 1991), people's attitudes are one of the direct determinants of their behavioral intentions, which in turn affects their actual behavior. Therefore, we hypothesize the following:

- H7a:** Consumers' attitudes toward online product presentation positively affect their intentions to revisit Websites.
- H7b:** Consumers' attitudes toward online products positively affect their intentions to purchase those products.

Research Method

Experimental Websites

The research model will be tested by comparing three different Websites: **a base condition, a video condition, and a functional control condition**. Two products are displayed in the Websites: a PDA (personal digital assistant) and a sports watch. The base condition is an interface where product function is represented by using only static images in addition to text and hypertext. The video condition is an interface where product function is represented by video files so that subjects can passively view video demonstrations. The functional control condition, then, is an interface where subjects can virtually try various product functions, e.g., use a mouse as a PDA stylus to click the PDA screen to try the Palm Pilot Operating System or press the watch's buttons to see display changes and hear alarm sounds. Information contents will be kept consistent across the three conditions.

These three presentation conditions are widely used in current commercial Websites and differ in degree of vividness and interactivity. A video condition increases the level of vividness over a base condition. A functional control condition maintains the same level of vividness as, but increases the level of interactivity over, a video condition. In other words, we will investigate the effects of the progressive increase of vividness and interactivity on consumers' attitude formation and decision priorities, taking functional control as the high-end condition. A pretest will be conducted to attest that functional control-demonstrated product information is favorable so as to test hypothesis 5. Otherwise, we will adjust the product information accordingly.

Experimental Procedures

In the actual experiment, 300 subjects will be recruited from a university residential area, including students, faculty, staff, and their adult family members. A pretest will be conducted to divide subjects into three categories: those who already have PDAs or sports watches; those who do not own PDAs or sports watches but are interested in acquiring these products; and those who do not own PDAs or sports watches and are not interested in buying them. Based on the categorization, the subjects will be randomly assigned to the three conditions, with about 100 in each group. The subjects will be asked to individually examine the PDA and the sports watch as if they were shopping on the Websites. The product exposure sequence will be randomized. A questionnaire will be administered immediately after the subjects examine each product to measure all variables. Also, as a manipulation check, we will question subjects about *perceived vividness* and *interactivity* of the product presentations.

After subjects examine online product presentations, they will be given samples of the real physical products and asked to evaluate the products themselves. Subsequently, they will be asked similar questions as previously, and hence the virtual product experiences can be compared to physical product experiences. Also, to increase subjects' motivation, they will be asked to make purchase recommendation and the top third of people who make the best-justified recommendation will be offered \$50 toward the purchase of the product they select.

Measurements

Most measurement instruments are borrowed or adapted from prior related research; some others are created for this study (see Appendix A).

Data Analysis

First, a manipulation check will be conducted to attest that both the functional control and video conditions are perceived to be more vivid than the base condition and that the functional control condition is perceived to be as vivid as, but more interactive than the video condition. An exploratory factor analysis will be conducted to further prove that vividness and interactivity load on two different factors. After the initial checks are completed, structured equation modeling will be used to test the research model. ANOVA will also be used to compare each online presentation format with the real product experience. Similar statistical tests will be run separately for each subject group as identified in the pretest (i.e., those already in possession of PDAs or sports

watches; those interested in acquiring them; and those with no interest in them) to examine whether subjects' ownership or interest in these two particular products moderate the effect of functional control.

Contributions and Limitations

Compared to other studies on investigating the effects of various Web interface characteristics on consumer behavior, (e.g., Agarwal and Venkatesh 2002; McKinney et al. 2002; Palmer 2002), this proposal anchors on a specific Web interface feature, functional control, which allows Web consumers to try and sample products online virtually. Previous research in this area has yielded inconsistent and questionable results regarding consumers' attitudes. The proposed study can thus contribute to the information systems literature by justifying the effects of functional control based on theories of vividness and interactivity, and further empirically examining the relative contributions of these two technological characteristics.]

In the proposed research model, vividness and interactivity, the two characteristics that belong to of functional control system quality (McKinney et al. 2002) are two driving forces of consumer beliefs and attitudes. Perceived diagnosticity, viewed as a surrogate for perceived usefulness (McKinney et al. 2002), and cognitive elaboration, viewed as an indication of product involvement (Koufaris 2002), partly mediates the vividness and interactivity on consumer attitudes. This model also highlights the difference and the relationship between consumer attitudes toward Websites and those toward products, which often has been neglected in previous information systems literature. Insights into individual effects of vividness and interactivity are valuable for designing functional control because designers can then know to what extent each of the two characteristics are effective and, hence, can accurately estimate how to apportion the design resources (e.g., time, effort and money) on each, based on cost-benefit analyses.

According to Jiang and Benbasat (2003) and Li et al. (2001), there are different virtual product experience methods. Since this proposal only examines one method, functional control, the findings will be best applied to this particular virtual product experience and the corresponding product category, i.e., those products that are associated with functions or behaviors. Future research is, therefore, warranted to examine the research model across different virtual product experience methods and product categories.

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Appendix A

Measurement Instruments (all based on 7-point scales)

1. **Perceived Vividness:** Four items are selected from the vividness scale by Kelly et al. (1989):
drab/rich, abstract/concrete, confusing/clear, not descriptive /descriptive
2. **Perceived Interactivity:** Three items are created for this study:
 - “To what extent were you able to manipulate the product on this Website?”
 - “To what extent do you think the information about the product was responsive to your manipulation on the Web interface?”
 - “To what extent do you think you could acquire product information in an interactive way?”
3. **Perceived Diagnosticity:** One is adapted from Kempf and Smith (1998). The other item is created for this study:
 - “To what extent do you think the Web interface was helpful for you to evaluate the product?”
 - “To what extent do you think you were able to judge this product?”
4. **Cognitive Elaboration**

After examining each product, subjects will be asked to write down their thoughts about the product. Two judges will code their thought protocol. Two indices will be used to represent the degree of cognitive elaboration: first, the number of units of thoughts; second, the number of words used by subjects to describe their thoughts (see McGill and Anand 1989).
5. **Attitude:** A three-item measurement has been borrowed from Kempf and Smith (1998).
Bad/Good, Dislike/Like, Unfavorable/Favorable
6. **Intention to Return:** A three-item measure has been borrowed from Coyle and Thorson (2001):
 - It is very likely that I will return to this site.
 - I will return to this site the next time I need a (product).
 - Suppose that a friend called you last night to get your advice in his/her search for a (product). Would you recommend him/ her to visit this Web site?

7. **Intention to Purchase Products**

Coyle and Thorson (2001) used a four-item measure to assess online consumers' purchase intentions. We dropped one item, i.e., “I will definitely try (brand),” because to try a product does not mean to purchase it. Therefore, a three-item measure will be used:

- It is very likely that I will buy (the product).
- I will purchase (the product) the next time I need a (product).
- Suppose that a friend called you last night to get your advice in his/her search for a (product). Would you recommend him/her to buy (this product)?