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PERCEIVED COSTS AND VIRTUAL EXPERIENCE:
THE ADDED VALUE OF RICH CONTENT IN
B2C ELECTRONIC COMMERCE

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PERCEIVED COSTS AND VIRTUAL EXPERIENCE: THE ADDED VALUE OF RICH CONTENT IN B2C ELECTRONIC COMMERCE

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ABSTRACT

PERCEIVED COSTS AND VIRTUAL EXPERIENCE: THE ADDED VALUE OF RICH CONTENT IN B2C ELECTRONIC COMMERCE

By

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Many studies have demonstrated the positive effects of virtual experience on B2C e-commerce. However, providing rich content may be a double edged sword for e-Retailers due to inevitable download delays under the current "last mile" Internet infrastructure. Therefore, the goal of this study is to examine the relationships among virtual experience, connection speeds, and product attributes to develop a clearer understanding of how to balance the Web page content and loading time delays across different product categories in B2C e-commerce. An economic model for the added value of rich content was conceptualized to help understand the relationships better.

An experimental research method was used to test the hypotheses. Although the impacts of download delays on the added value of rich content were not clearly explained in this study, the interpretation of the findings and suggestions for future studies were discussed to address guidelines for the dilemma of rich content.

To My Parents

ACKNOWLEDGEMENTS

I would like to thank the fine faculty of the department of Telecommunication at Michigan State University for assisting me in the realization of this project. Especially, I am grateful to my advisor and committee chairperson, Dr. Charles Steinfield, for his guidance and encouragement through this endeavor as well as my entire graduate study. I would also like to extend my gratitude to Dr. Hairong Li for letting me use 3D rendered images designed for his study as well as his helpful advice on my research.

Most of all, I would like to thank my family members. Without their love, trust, and encouragement, I could have not completed this work. I am sincerely grateful to my wife for being next to me always. Finally, I would like to thank God for everything.

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I INTRODUCTION

The resurgence of the U.S. economy in the 1990's coincides with the growing use of the Internet, including the rapid growth of electronic commerce (e-commerce). The web is now considered a mainstream and viable channel for conducting commerce (Amor 2000), and is thereby transforming traditional business and consumer life (ITU, 1999). Despite the collapse of dot-com bubbles, e-commerce is still expanding to banks, stock trading, auction, entertainment, and all other industries. According to the International Benchmarking Study (IBS) 2000, 83% of business is on-line, 26% of business trades on-line in the United States. As a result, many e-commerce merchants are considering turning to 3D product presentations to stand out in such a competitive environment and to provide consumers with a greater sensory experience (Nash, 2000).

In accordance with this trend, many studies have demonstrated the positive effects of virtual experiences (created by 3D environments) on product knowledge and consumer attitude toward the products (Biocca, Li, Daugherty, & Chae, 2001; Hoch & Deighton, 1989; Klein, 2001; Häuble & Figueroa, 2001; Li, Daugherty, & Biocca, 2001). However, most of these studies focus on the relationship between virtual experience and consumer behavior without considering the current Internet infrastructure or connection

speeds. Since dial-up connections are still predominant in most countries[1], these findings may not hold up in the field. The added value of 3D presentation may generally diminish under low connection speeds. In fact, a significant relationship between download delay and the likelihood of aborting a page load has important implications for e-Retailers to balance their page content and download speeds (Rose, Lees, & Meuter, 2001).

Therefore, the goal of the study is to identify significant factors affecting the added value of rich content in business-to-consumer (B2C) e-commerce. Among possible factors affecting B2C e-commerce, virtual experience, connection speeds, and product attributes were selected for this study based on relevant theoretical works. The relationships among virtual experience, connection speeds, and product attributes will be examined to provide a clear understanding of how to balance the Web page content and loading time delays across different product categories in B2C e-commerce. Furthermore, an economic model for the added value of rich content, modified from the value creation model by Brandenburger and Stuart, Jr. (1996) will be conceptualized to help understand the relationships better.

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1 The number of home broadband subscribers was about 24 million, 20% of all Internet users in the U.S. in May 2002 (Surmacz, 2002)

In this paper, I will review relevant theoretical works centered on three key concepts: virtual experience, connection speeds, and product attributes. Then, I will describe a research project and test the hypotheses using an experimental research method.

II LITERATURE REVIEW

There are three key concepts in this paper that need to be explained in order to understand the added value of rich content in B2C e-commerce. As stated, virtual experience created by 3 dimensional (3D) presentation of products may enhance consumers' attitudes toward products in B2C e-commerce. However, inevitable download delays caused by virtual experience under the current last mile Internet infrastructure may lead to negative consequences at the same time. Furthermore, the relationship between virtual experience and connection speeds may vary depending on a product's attributes. A certain type of dominant product attribute can likely be enhanced by virtual experience.

Therefore, this chapter will summarize the basic theoretical concepts underlying virtual experience, connection speeds, and product attributes by reviewing the literature supporting these concepts. Then, an economic model for the added value of rich content will be conceptualized based on the three basic theoretical concepts. Finally, several hypotheses suggested from these concepts will be proposed in next chapter.

B2C E-Commerce

First of all, B2C e-commerce must be defined in advance to any other theoretical concepts for this paper since the definition of e-commerce varies widely. The concept of electronic commerce is not new, and so, there is no one generally accepted definition of e-commerce. Among many definitions by scholars and institutions, the following are definitions used in the study.

- The term electronic commerce refers generally to commercial transactions, involving both organizations and individuals, that are based upon processing and the transmission of digitized data, including text, sound and visual images and that are carried out over open networks (like the Internet) or closed networks (like AOL or Minitel) that have a gateway onto an open network - OECD, 1997
- Electronic commerce means using an electronic network to simplify and speed up all stages of the business process from design and making to buying, selling and delivery - DTI, 1998

As shown above, the definition of e-commerce may differ with respect to the media under consideration. Some focus on the Internet, some include all sorts of direct electronic distribution channels and others include all forms of electronic market places (Schmitz, 2000).

Among various definitions, business activities such as marketing, selection, payment, and delivery, all take place over the Internet to achieve a business goal. This will be used as the definition of e-commerce for this study. In addition, e-commerce will be limited to B2C transactions, which means Business-to-Consumer retail transaction for goods and services.

Virtual Experience

The consumers' best source of product and service information is direct product experience, commonly referred to as trial or usage consumers (Hoch & Deighton, 1989; Hoch & Ha, 1989). Direct experience has been defined as "an experience that stems out of an unmediated interaction between the consumer and the product, with a person's full sensory capacity, including visual, auditory, taste-smell, and orienting" (Gibson, 1966; Edwards & Gangdharbatla, 2001).

This direct experience has several advantages. First, evidence in direct experience is self-generated and thus the most trustworthy for consumers themselves. Second, consumers may manage the way a product is experienced by controlling the focus and pace of an inspection to maximize informational input. Third, such an interaction may result in more effective responses in consumers than indirect experience (Miller & Millar, 1996; Biocca, Daugherty, Li, & Chae, 2001). Therefore, one of the e-commerce marketer's goals is to strive for verisimilitude in indirect communications with consumers in e-commerce business where consumers cannot have direct experience (Klein, 2001).

The Internet has the ability to serve as a more powerful medium than traditional media in the sense that consumers are able to interact with products in 3D environments, thus simulating a new form of experience, virtual experience (Biocca, Daugherty, Li, & Chae, 2001). Virtual experience has been defined as a "vivid, involving, active, and affective psychological state occurring in an individual interacting with three dimensional computer simulation" (Li, Daugherty, & Biocca, 2001). As indicated earlier, many studies support that virtual experience in 3D environments is superior to other mediated forms of experience for facilitating information processing (Edwards & Gangdharbatla, 2001).

Many studies also have demonstrated the positive effects of virtual experience (created by 3D environments) on product knowledge and consumer attitude toward the products (Biocca, Li, Daugherty, & Chae, 2001; Hoch & Deighton, 1989; Klein, 2001; Häuble & Figueroa, 2001; Li, Daugherty, & Biocca, 2001). However, one characteristic of dynamic virtual experience is large data size, which requires a larger bandwidth compared to simple and static 2D display. It may cause traffic problems on the Internet and cannot bring a true virtual experience to consumers. Thus, the added value of 3D presentation may generally diminish under low connection speeds.

Formula 1 is an economic model for the added value of rich content in B2C e-commerce, which has been modified from the formula of value creation by Brandenburger and Stuart, Jr. (1996). Normally, willingness to pay refers to the actual amount of money, for which consumers are willing to pay. But willingness to pay in Formula 1 is conceptualized in terms of time value. Therefore, it represents the level of how much time consumers are willing to spend to get particular information about products on the Web. The concept of opportunity cost is defined in an analogous fashion to willingness to pay and will be explained more detail in Perceived Costs section later.

Formula 1: Added value of rich content in B2C e-commerce

- Added Value of 3D Presentation = α x Willingness to Pay – β x Opportunity Costs
- Where α = index from product attributes. Search goods may have higher index than experience goods
- Where β = index from Internet connection speeds. High connection speeds may have smaller index numbers than low connection speeds
- Where Willingness to Pay = consumers' willingness to spend time to get information about products on the Web. Consumers generally have higher willingness to pay for rich content or information
- Where Opportunity Costs = consumers' perceived time value of getting information on the Web.

Consumers are likely to have higher desire to spend more time to get detailed information about products, which leads to higher willingness to pay for virtual experience in Formula 1. In addition, willingness to pay for virtual experience may vary depending on product categories since some product categories require more direct

experience while others are amenable to both indirect and direct experience. Therefore, virtual experience and product attributes are considered positive factors for the added value of rich content in Formula 1.

Perceived Costs

The concept of perceived costs is similar to opportunity cost in terms of its influence on decision-making. Economists use the term opportunity cost to emphasize that making choices in the face of scarcity implies a cost.

- The opportunity cost of any action is the best alternative forgone. The best thing that you choose not to do – the forgone alternative – is the cost of the thing that you choose to do - Parkin, 1993

Thus, consumers make decisions based on their perception of alternative values, which could be money, time, or anything they prefer. Among these values, this study will primarily focus on time value in consumers' decision making. As a consequence, consumers' opportunity costs are likely to be affected by their Internet connection speeds in B2C e-commerce. Therefore, the combined effects of consumers' opportunity costs

with Internet connection speeds on the consumers' minds, compared to their foregone alternative in terms of time value will be defined as perceived costs in the study. After all, perceived costs will be consumers' opportunity costs for getting information in terms of time value. Formula 2 shows a simple formula for consumers' perceived costs, which is a negative factor for the added value of rich content in Formula 1.

Formula 2: Perceived Costs

- Perceived Costs = β x Opportunity Costs
- Where β = Index based on consumers' Internet connection speeds.
- Where β under high connection speeds < 1
- Where β under low connection speeds > 1

Perceived costs may vary depending on each person's value in his/her own mind, but I assume that longer loading times cause relatively higher perceived costs and shorter loading times cause relatively lower perceived costs to the same person if *Ceteris Paribus*

While there are many factors or values affecting the online consumer experience, download speeds and the reliability of the Web sites directly impact them all. According to Rose and Straub, there are six key technological impediments to e-commerce:

download time, measurement of web application success, security weakness, lack of internet standards, limitations in the interface, and requests for hypermedia (Rose & Straub, 2000). Among the six key technological impediments to e-commerce, Rose, Huoy, and Straub (1999) rank download time as the second most important. In addition, a recent panel of experts in a Delphi study also ranked download delay as the single most worrisome issue (Khosrowpour & Herman, 2000).

Loading time delays are also often cited as the reason for Web site abandonment. In a survey by the Industry Standard, download delay was found to be the leading cause for why consumers leave a site (Lake, 2001). In fact, only 47.3% of consumers are satisfied with the speed of e-commerce Web sites. Even fewer consumers - 34.7% - view the Internet as fast (Pedersen, 2001). According to a study conducted by ZDNet, e-business is estimated to be losing US $362 million a month because visitors will not wait for heavy pages to load, which shows that download time effects profitability. Obviously, consumers with high-speed Internet access will have a different experience than those who access the Internet through a dial-up connection, or narrowband, especially when the Web site requires broadband connections for larger files or heavy content such as 3D graphics.

The load time is measured from the moment when a user clicks on a selection to the point when all the new elements of the page have been downloaded to the user's computer (WebCriteria, 1999). In other word, download time is the time it takes for a Web client to fully receive, process, and display files submitted by a Web server once those files are requested (Rose & Straub, 2000).

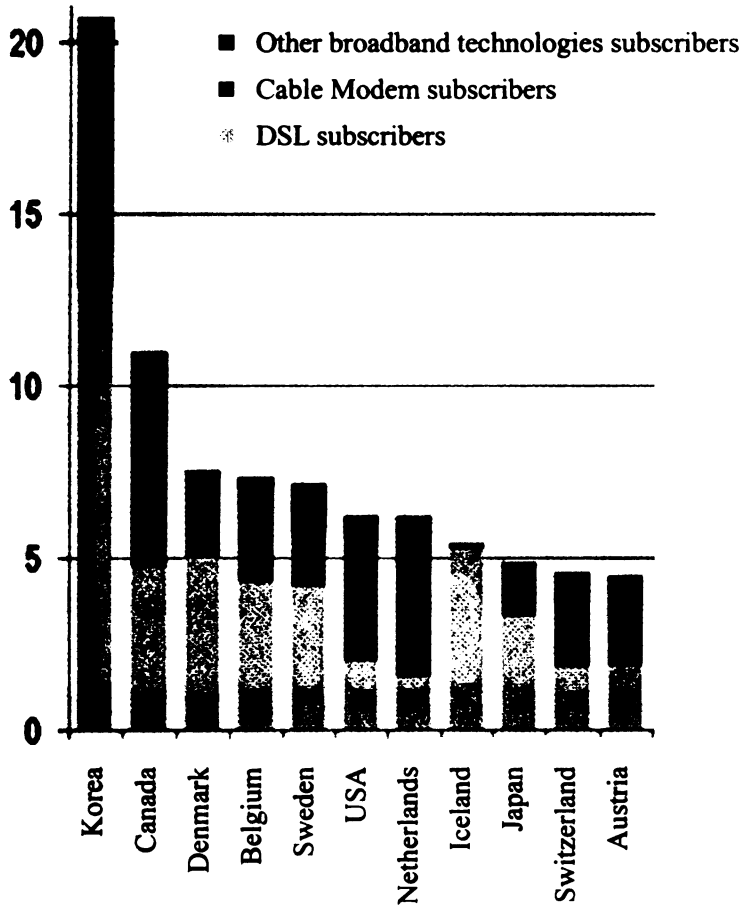
While server side technologies can be improved and are within the control of e-Retailers, client side technologies and last mile infrastructure used for reception of pages and transmission of pages/ requests across the Internet are beyond the control of e-Retailers, (Rose & Straub, 2001). Thus, loading time delays for rich content seem to be inevitable despite the enormous growth of the Internet, since dial-up connection still dominates the Internet infrastructure in the world.

According to the OECD report, just about 4.4 per 100 inhabitants, on average in OECD countries, were subscribers to high speed Internet access in September 2002. Although the United States is the largest market for broadband services in the OECD and was ranked 3rd in terms of overall broadband penetration at the end of 2000 with 3.7 million cable modem subscribers and 2.4 million DSL subscribers, only about 6.2 per 100 inhabitants were subscribers to DSL, cable modem, or other broadband lines[2] in

2 fixed wireless broadband, direct satellite broadband, or fiber to the resident lines

September 2002 (OECD, 2002). Figure 1 shows the broadband penetration rates of OECD countries in September 2002.

Figure 1: Broadband access in OECD countries per 100 inhabitants



(Source: OECD)

There is not any standardized definition about broadband, but definitions vary widely. According to ITU-T Recommendation I.113, broadband means transmission

capacity that is faster than primary rate ISDN (*i.e.* 1.5 or 2 Mbps). The FCC defined 'broadband' as having the capability of supporting, in both the provider-to-consumer (downstream) and the consumer-to-provider (upstream) directions, a speed (in technical terms, 'bandwidth') in excess of 200 kilobits per second (Kbps) in the last mile. In this paper, the FCC definition is used and modified. Thus, broadband will be defined as telecommunication that provides multiple channels of data over a single communications medium with a speed-rate over 200 Kbps in this paper.

Broadband technologies such as cable modem, DSL, or fixed wireless broadband are expected to evolve fast. In fact, the number of residential broadband subscribers was about 24 million, 20% of all Internet users in the United States, in May 2002 according to a recent report by the Pew Internet and American Life Project, a nonprofit research group based in Washington, D.C. (Surmacz, 2002). Although the penetration rate of broadband access is growing fast in spite of technical and economical problems in its early stages, the last mile infrastructure is still not mature enough to support the latest 3D environments due to the predominance of dial-up connections.

Therefore, under the current last mile infrastructure, e-Retailers are likely to reduce their content reluctantly without a clear understanding of its value, just to avoid consumer frustration and the propagation of negative attitudes toward their products and

services. The added value of rich content model might help e-Retailers to understand when to reduce content or when to add more content.

Product Categorization

Product categorization is important in B2C e-commerce because some product categories lend themselves better to brick and mortar (offline) shopping, which requires more experience, while others are amenable to both online and offline shopping (McCabe & Nowlis, 2001).

Nelson defined two types of product attributes, search and experience attributes. Any product can have either one of or both of them (Nelson, 1976; 1981). Search attributes are those features of a product that can be used to evaluate the quality of the product without actual use of the product such as color, price, shape, size, and so on. Good examples of search products can be personal computers or electronics, which are pretty much standardized. On the other hand, experience attributes are those features of a product that cannot be assessed until actual use or through direct experience, such as taste, or texture. Good examples of experience products are music, books or foods (Li, Daugherty, & Biocca, 2002).

Because of these different attributes of products as well as the limitation of information that can be delivered electronically on the Internet, consumers' willingness to spend time to get information about products on the Web could be affected by product categories. For search goods, consumers might be willing to sacrifice more time to get the detailed information of search attributes on the Web, which means higher willingness to pay. On the other hand, consumers might not be willing to spend much time in getting the detailed information of experience attributes on the Web since such information may not be helpful or useful for their decision-making. As a result, consumers' willingness to pay to get information about products would be lower in experience goods than search goods on the Web.

After all, one of the purposes of this study is to find out what type of dominant product attribute is more likely enhanced by virtual experience. Table 1 shows an estimation of consumers' preferences of product presentations under four different conditions based on the concepts summarized earlier in this section.

As stated, consumers are likely to prefer virtual experience to simple information if there were no loading time delays. On contrary, consumers may prefer simple content if loading time delays for virtual experience are intolerable under low connection speeds. However, there is also a chance that consumers still prefer virtual

experience for search goods in spite of loading time delays. For search goods, the α index in Formula 1 could be big enough to make total willingness to pay larger than perceived costs caused by loading time delays.

Table 1: Anticipation of consumers' preferences

	Low Connection Speeds (56.6 kbps or lower)	High Connection Speeds (Broadband connections)
Experience Goods	Simple content	Virtual experience
Search Goods	Virtual experience	Virtual experience

As stated,

III HYPOTHESES

To summarize preceding discussion, consumers are likely to have more positive attitudes toward products and Web sites under 3D environments than under simple 2D environments as supported by many previous studies (Biocca, Li, Daugherty, & Chae, 2001; Hoch & Deighton, 1989; Klein, 2001; Häuble & Figueroa, 2001; Li, Daugherty, & Biocca, 2001). However, these findings may not hold up in the field due to the current Internet infrastructure. In addition, consumers' attitudes toward products in 3D environments may vary depending on the attributes of the products. Therefore, the following hypotheses are formulated. Table 2 shows eight different conditions based on Connection Speeds (high vs. low), Product Categories (Search vs. Experience), and Virtual Experience (3D vs. 2D).

Table 2: 2 X 2 X 2 Between Subject ANOVA design for the study

	3D presentation of product		2D presentation of product	
	Experience Good	Search Good	Experience Good	Search Good
Lower speed	1	2	5	6
Higher speed	3	4	7	8

H1: Consumers' attitudes toward products are higher in the 3D presentation than in the 2D presentation of products under high connection speeds (comparing condition 3, 4 and 7, 8 in Table 2).

Hypothesis 1 was constructed to examine the consumers' overall preferences of virtual experience under the condition where there is no delay in downloading time. This is more like a replication of previous virtual experience studies (Biocca, Li, Daugherty, & Chae, 2001; Hoch & Deighton, 1989; Klein, 2001; Häuble & Figueroa, 2001; Li, Daugherty, & Biocca, 2001) with an assumption of no traffic problems in the last mile Internet infrastructure in the future.

H2: Added value of 3D presentation of products generally diminishes under lower connection speeds (Consumers' attitudes toward the 3D presentation of products are lower under low connection speeds than under high connection speeds: comparing condition 1, 2 and 3, 4).

Hypothesis 2 was constructed to examine if loading time delay affects the added value of rich content. While no studies to date have demonstrated the negative effect of

loading time delays on a consumer's attitudes toward products especially in 3D environments or with rich content, it seems likely that the longer loading time may affect a consumer's perceived costs significantly. The added value of virtual experience likely diminishes or may even result in being negative due to high perceived costs under lower connection speeds, which may lead the consumers to abort the page load.

H3: Consumers' preferences of the 3D presentation of products are higher in search goods than in experience goods (Search goods are more benefited by virtual experience than experience goods: comparing the difference between condition <1, 3 and 5, 7> and <2, 4 and 6, 8>).

Although the positive effects of virtual experience on product knowledge and consumer attitudes toward products have been demonstrated by prior studies, the variable effects of virtual experience across different product categories were not clearly indicated in these studies. Search goods are more likely benefited by virtual experience due to their search attributes, and experience goods are less likely benefited by virtual experience due to their experience attributes. Even if a significant effect of virtual experience on consumers' attitudes toward products is found in general, the amount of the effects would

be different depending on product attributes. Therefore, the difference in consumers attitudes toward products between 3D and 2D environments is likely larger in search goods than in experience goods.

H4: Consumers prefer the 2D presentation of products to the 3D presentation of products for experience goods under low connection speeds (comparing condition 1 and 5 in table 2).

H5: Consumers prefer the 3D presentation of products to the 2D presentation of products for search goods under low connection speeds (comparing condition 2 and 6).

In accordance with hypothesis 3, hypothesis 4 and 5 were constructed to examine the relationship between loading time delay and virtual experience across different product categories. Hypothesis 4 will be tested to see if perceived costs have more significant effects on consumers' attitudes toward products than willingness to pay for experience goods. The α index for experience goods in Formula 1 might be so small that the difference in willingness to pay caused by virtual experience is likely to be

smaller than the difference in perceived costs caused by Internet connection speeds. Thus, the added value of rich content is more likely to be affected by Internet connection speeds rather than by the richness of content itself. On the other hand, hypothesis 5 will be tested to see if willingness to pay has more significant effects on consumers' attitudes toward products than perceived costs for search goods. The α index for search goods might be so big that the difference in willingness to pay caused by virtual experience is likely to be larger than the difference in perceived costs caused by Internet connection speeds. Thus, the added value of rich content is more likely to be affected by the richness of content rather than by Internet connection speeds.

H6: Consumers' attitudes toward products are higher in the 3D presentation of search goods under low connection speeds than the 2D presentation of search goods under high connection speeds (comparing 2 and 8 in table 2).

Hypothesis 6 was constructed to examine the effect of virtual experience on a consumer's attitude toward search goods under different connection speeds. If hypothesis 5 is supported, it means that consumers prefer rich content in spite of loading time delays. However, do rich content with loading time delays appeal better to consumers than

reduced content without loading time delays in B2C e-commerce? This is probably the question that e-Retailers will want to know the most. It may upgrade the current B2C e-commerce if e-Retailers provide dynamic and rich content regardless of a consumer's connection speed for a certain type of products.

IV METHODOLOGY

Research Design

A lab experiment was conducted to test the hypotheses since laboratory experiments were commonly used in nearly all prior download delay and computer response time studies, implying a causal model (Rose & Straub, 2001). Thus, a between-subjects factorial analysis of variance design was used to test the hypotheses (See Table 2 and 3).

There are three independent variables manipulated for the experiment. First, the operational definition for virtual experience was adopted from the work in Li, Daugherty, and Biocca (2002). Three dimensional interactive was operationally defined as users' ability to rotate, zoom-in and out the image of products for inspection. In turn, 2D static was defined as the presentation of a static image of products for inspection.

Second, connection speeds with different download delay treatments were defined as 5 seconds for a near-zero delay representing a high connection speed, 15 seconds for a delay for the 2D presentation of products under a low connection speed, and 30 seconds for the 3D presentation of products under a low connection speed. The delay interval of 15 seconds was adopted from previous delay studies (Rose, & Straub

2001; Rose, Evaristo, & Straub, 2002; Rose, Lees, & Meuter, 2001). A 5 second delay was used for a near-zero delay condition for a realistic setting. A zero second delay could be programmable, but it takes at least a few seconds to load Web pages even under most broadband connections in real world. Although a 30 second delay was used as a moderate delay in the previous delay study (Rose, Evaristo, & Straub, 2002), a 15 second delay was used as a moderate delay in this study since the Internet is getting faster with increasing broadband penetration. Besides, 15 seconds was about the average amount of time to fully download the 2D version of the experiment Web site under a 56 Kbps dial-up connection. Download delay for the experiment was programmatically controlled for an accurate delay interval since delays could differ widely on the Web.

Last, product categorization was operationally defined as search and experience goods based on product attributes (Nelson, 1976; 1981). A camcorder was used to represent a search good while a box of cereal was used as an experience good. Each product has the unique product attribute to represent either an experience or search good, and thus seemed to be appropriate for the study.

Furthermore, consumers' attitudes toward products served as the dependent variable. Product attitudes were measured by asking participants how they felt about the products using a proven six-item seven point semantic different scale common in

advertising effectiveness measurement (Bad/Good, Not Appealing/Appealing, Pleasant/Unpleasant, Unattractive/Attractive, Interesting/Boring) with 7 being the highest and 1 being the lowest scale (Bruner, 1998).

Participants

A total of 232 undergraduate students enrolled at a major Midwestern university participated in the experiment and were randomly assigned to eight different conditions with 29 participants per condition (See Table 3). College students are seen as appropriate in similar studies (Li, Daugherty, & Biocaa, 2002; Rose & Straub, 2001) because prior computer knowledge and Web experience were required. In addition, college students were shown to have the same attitudes and beliefs as compared to typical consumers (Durvasula, Mehta, Andrews, & Lysonski, 1997; Rose & Straub, 2001).

The participants consisted of 157 males (67.7%) and 75 females (32.3%) with an average age of 21 (SD = 2.69). Among 232 participants, 191 participants (82.3%) have some sort of high speed Internet access at home. A large number of participants had broadband access, which is way more than industry average (6.2 per 100 inhabitants: OECD, 2002) since university dormitories provide Internet access via Ethernet LAN. The average Internet usage of participants was 16.62 hours per week (SD = 14.47). Thus,

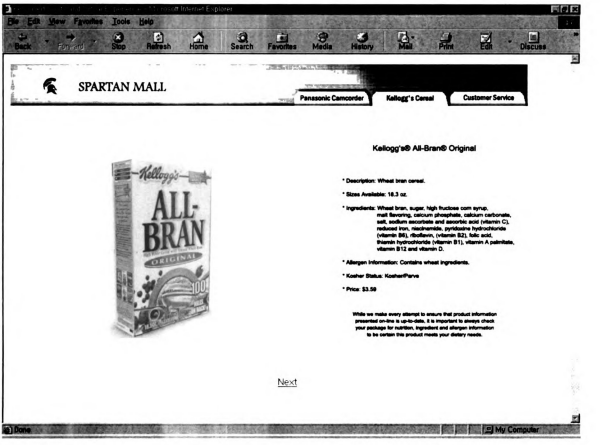
participants were familiar with the Web and possessed required computer skills.

Stimulus

A fictional B2C e-commerce Web site selling tangible products was created in both 3D and 2D environments. The Web site had four different conditions including the 3D presentation of an experience good (a box of cereal), the 2D presentation of the same experience good, the 3D presentation of a search good (a digital camcorder), and the 2D presentation of the same search good (See Figure 2 and 3 for screen shots). These 3D rendered images were created for and used in the previous study of virtual experience (Li, Daugherty, & Biocca, 2002).

To avoid any unnecessary biases, the information about the products and Web site other than 3D and 2D presentations such as product descriptions, message appeal, or the template of the Web site was held constant across all conditions. Therefore, the only difference noticeable for the same product Web page was virtual experience with specific interactive features such as the ability to rotate and zoom-in and out for the 3D Web page.

Figure 2: Screen shot of the experience good (a box of cereal)



The Web site was generated locally on an individual PC to programmatically control loading time delays. The address bar was hidden to prevent participants from noticing that the Web site was not generated from remote servers via the Internet. In fact, exit interviews with 30 randomly selected participants confirmed that they believed to have examined actual Web pages on the Web and no one found any unnatural settings or weird experiences during the experiment.

Figure 3: Screen shot of the search good (a camcorder)

HTML coding was used to make the accurate loading time delays and then to redirect the viewers to go to the actual Web page containing product information. Figure 4 is the page, which participants viewed during the delay. Figure 5 is the actual coding used to create a 30 second delay. An active loading bar was created in a Flash animation to give viewers more realistic settings. The loading bar was filled in as the delay continued.

Figure 4: Screen shot of the loading page with an active loading bar

Figure 5: HTML coding for a 30 second delay

```
<meta http-equiv="Content-Type" content="text/html; charset=euc-kr">
<meta HTTP-EQUIV="REFRESH" CONTENT="30; URL=
cereal/kellogg.htm">
```

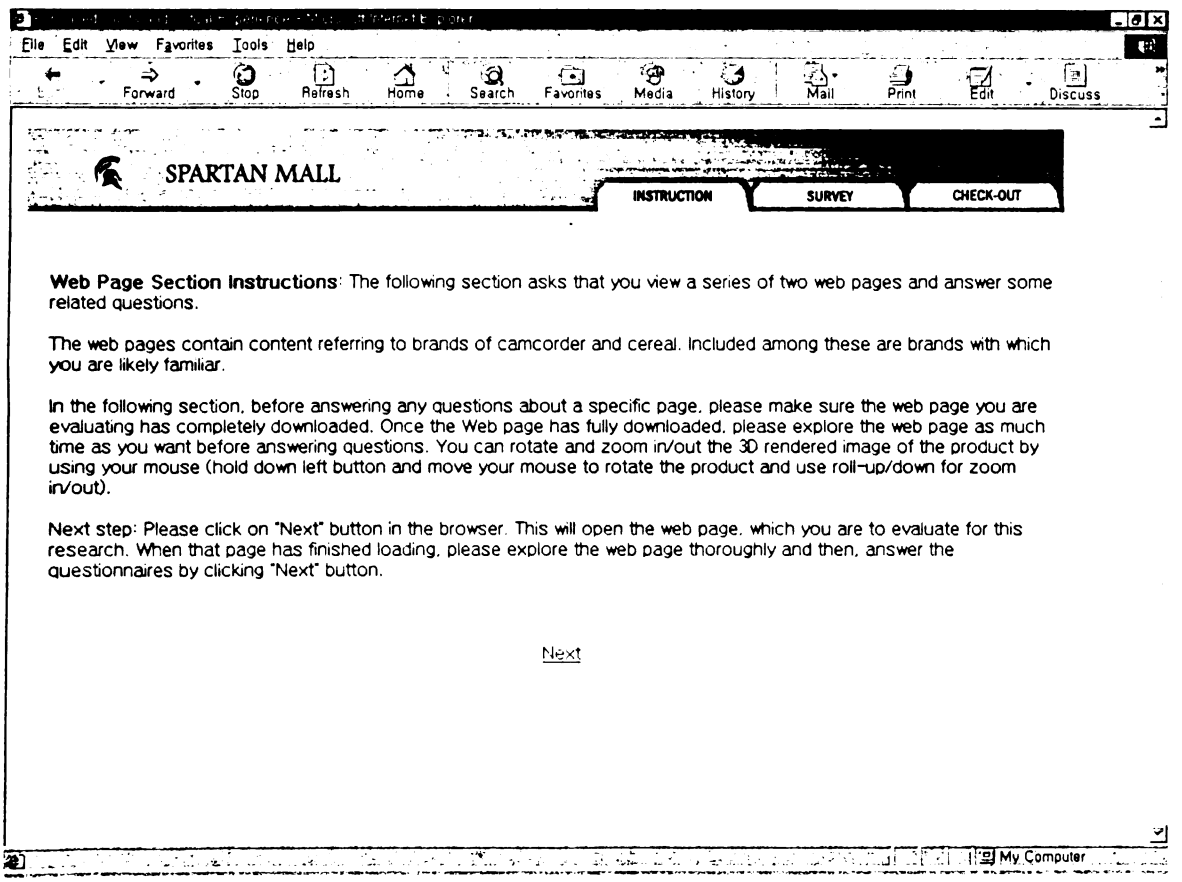
Procedures

Participants were given a large option of time blocks to choose from and were asked to sign up for the date and time when they wanted to participate in the experiment. The experiment continued for two weeks to collect enough data and give participants more time flexibility. Once participants came to the laboratory, they were escorted by a research administrator into a large laboratory where there were 20 personal computers

with seventeen inch monitors. Each participant was randomly seated at a computer station corresponding to the 8 assigned conditions.

Before participants started to examine the Web site, they were given brief instruction including how to navigate the Web site and the purpose of the study. An index page was used to leverage their understanding of how to navigate the Web site, especially for the virtual experience conditions (See Figure 6 for a screen shot of the index page).

Figure 6: Screen shot of the index page



A next button was used to go to the next step or page for easy navigation. Participants were instructed that they needed to wait to evaluate the Web site until the page was fully loaded. Participants with low connection speed conditions were told that their Web connection was dial-up because of network problems in the laboratory.

Participants did not know different conditions and were not allowed to talk to each other. Participants were told to take as much time as they wanted to explore the Web site, and then to click the next button after they finished examination. Finally, participants were told that upon finishing their examination, they would be asked to complete a survey with 15 questions to record their evaluation (See Appendices for questionnaires).

V ANALYSIS

Attitudes toward products were analyzed in a Connection Speed (low vs. high) x Virtual Experience (3D vs. 2D) x Product Categorization (Search vs. Experience) between subjects factorial analysis of variance to test the hypotheses. The results are summarized in Table 3.

Table 3: Overview of descriptive statistics for each experimental condition

		Virtual Experience			
		3D presentation		2D presentation	
		Experience Good	Search Good	Experience Good	Search Good
Connection Speeds	Low	Condition 1 • n = 29 • M = 4.989 • SD = .955	Condition 2 • n = 29 • M = 5.592 • SD = .719	Condition 5 • n = 29 • M = 4.155 • SD = 1.111	Condition 6 • n = 29 • M = 5.190 • SD = 1.031
	High	Condition 3 • n = 29 • M = 4.943 • SD = 1.174	Condition 4 • n = 29 • M = 5.414 • SD = .804	Condition 7 • n = 29 • M = 4.213 • SD = 1.196	Condition 8 • n = 29 • M = 4.644 • SD = .935

In general, the results showed a significant main effect of virtual experience, $\underline{F}$ (1, 224) = 26.94, $\underline{p} < .01$, $\eta^2 = .12$, across different product categories, $\underline{F}$ (1, 224) = 23.23, $\underline{p} < .01$, $\eta^2 = .10$. Participants were more likely to have higher attitudes toward products in 3D environments ($\underline{M}$ = 5.2342, $\underline{SD}$ = .9581) than in 2D environments (M = 4.5503, SD = 1.1375). However, there was not a significant main effect of connection speeds, F (1, 224) = 1.83, $\underline{ns}$.; possible interpretations of which will be discussed later.

In addition, the F_{max} number showed 2.767, which did not exceed the generally accepted guideline of 3. Three is roughly the point beyond which heterogeneity of variance begins to inflate the actual α level beyond acceptable limits (Keppel, 1991). Thus, the homogeneity of variance assumption has not been violated in this study. Furthermore, the results of the hypothesis tests are summarized in Table 4.

Hypothesis 1 predicted participants' attitudes toward products would be higher in 3D environments than in 2D environments under high connection speeds with the assumption of no delay in the last mile Internet infrastructure. In accordance with a significant main effect of virtual experience, hypothesis 1 was supported in the study. Specifically, participants were likely to have higher attitudes toward products in 3D presentations ($\underline{M}$ = 5.178, $\underline{SD}$ = 1.025) than in 2D presentations ($\underline{M}$ = 4.4253, $\underline{SD}$ = 1.091), $\underline{F}$ (1, 224) = 16.20, $\underline{p} < .01$, under the high connection speed.

Table 4: Results of the hypothesis tests

	Short Descriptions of Hypotheses	F	P <	Supported?
H1	The positive effects of virtual experience (3D) under high connection speeds	16.20	.01	Yes
H2	The added value of 3D generally diminishes under low connection speeds	.361	ns.	No
H3	Search goods are more benefited by virtual experience than experience goods	.55	ns.	No
H4	Consumers prefer 2D environments under low connection speeds for experience goods	10.0	.01	No
H5	Consumers prefer 3D under low connection speeds for search goods	2.33	ns.	No
H6	Consumers prefer 3D environments under low connection speeds to 2D environments under high connection speeds for search goods	12.95	.01	Yes

Hypothesis 2 predicted the negative effects of download delays on consumers' attitudes toward the 3D presentation of products under low connection speeds. The results of the hypothesis test found no significant difference in consumers' attitudes toward the 3D presentation of products between the low connection speed ($\underline{M}$ = 5.292, $\underline{SD}$ = 0.8916) and the high connection speed ($\underline{M}$ = 5.1782, $\underline{SD}$ = 1.025), $\underline{F}$ (1, 224) = .36,

ns. As a result, it seems that there is no support of a significant relationship between increases in delay on the Web and changes in attitudes toward the 3D presentation of products.

Hypothesis 3 predicted that the difference in consumers' attitudes between the 3D and 2D presentation of products would be larger in search goods than in experience goods since search attributes are more likely to be enhanced by such visual effects. However, the result showed no interaction effects between virtual experience and product categories, F (1, 228) = .55, ns. Specifically, the difference of mean attitude between the 3D presentation (M = 4.9655, SD = 1.06) and the 2D presentation (M = 4.1839, SD = 1.144) of the experience good was .7816. On the other hand, the difference of mean attitude between the 3D presentation (M = 5.5029, SD =.7612) and the 2D presentation (M = 4.9167, SD = 1.014) was .5862. The difference in consumers' attitudes between the 3D and 2D presentation of products was even larger in the experience good than in the search good unlike the hypothesis although the difference was not statistically significant.

Hypothesis 4 predicted that consumers' attitudes would be higher in 2D presentations than in 3D presentations for experience goods under low connection speeds. Although the result of the hypothesis test found a significant difference in participants' attitudes between the 3D and 2D presentation of the experience good under the low

connection speed, F (1, 224) = 10, p < .01, the finding was quite opposite to the hypothesis. Specifically, participants were likely to have higher attitudes in the 3D presentation (M = 4.989, SD = .955), than in the 2D presentation (M = 4.1552, SD = 1.111) of the experience good under the low connection speed contradictory to hypothesis 3. Ironically, this opposite finding is quite natural and can be expected with the absence of the main effects of connection speeds or loading time delays.

Hypothesis 5 predicted that consumers' attitudes would be higher in the 3D presentation than in the 2D presentation for the search good under the low connection speed. The results showed a non significant difference in participants' attitudes between the 3D and 2D presentation of the search good under the low connection speed, F (1, 224) = 2.33, ns. Although participants' attitudes were higher in the 3D presentation (M = 5.592, SD = .719) than in the 2D presentation (M = 5.190, SD = 1. 031) as anticipated, the finding was not statistically significant.

Hypothesis 6 predicted that consumers' preferences of 3D presentation would be high for search goods regardless of connection speeds. The results of the hypothesis test found a significant difference in participants' attitudes between the 3D presentation of the search good under the low connection speed and the 2D presentation of the search good under the high connection speed, F (1, 224) = 12.95, p < .01. Specifically, participants

were likely to have higher attitudes in the 3D presentation of the search good under the 30 second delay condition (M = 5.592, SD = .719) than in the 2D presentation of the search good under the no delay condition (M = 4.6437, SD = .935).

Possible explanations for the findings as well as limitations of this study will be discussed in next chapter.

VI DISCUSSION AND LIMITATIONS

The value of a scientific finding of no effect can be just as good as an expected significant outcome in a sense that non-published insignificant findings may cause a distorted view of research questions, which is called a "file drawer" problem (Rosenthal, 1979). However, there may be possible explanations or interpretations for non significant findings in the study, which are briefly summarized in Table 5.

Hypothesis 1

In accordance with many previous virtual experience studies, participants' attitudes were higher in 3D than in 2D presentations under the high connection speed. A possible interpretation of this finding is that consumers would prefer rich content in B2C e-commerce if there were no download delays. If this finding is true, then e-Retailers need to develop strategies for adding more relevant, interesting, and informative content on their Web sites. However, no delay condition was assumed in the hypothesis 1 without considering the possible impacts of loading time delays. Therefore, this assumption should be kept in mind when interpreting the result of the hypothesis 1 test.

Table 5: Possible explanations for the findings of this study

	Findings	Interpretation of the findings
H1	Higher attitudes in 3D than in 2D presentations under the high connection speed	• Consumers would prefer rich content in B2C e-commerce if there were no download delays. • e-Retailers need to develop strategies for relevant and sales inducing content
H2	No difference in participants' preference of 3D presentations between the low and high connection speed	• Loading time delay has no impact on consumers' preference of 3D • No lingering effects from loading time delays on e-Retailer success once the page has loaded without being aborted • Opportunity costs were close to zero in the experiment, thus the added value was affected only by willingness to pay • Delay interval of 15 seconds was not appropriate to measure the effects of loading time delays
H3	No significant interaction effect between virtual experience (3D vs. 2D) and product category (Search vs. Experience goods)	• Consumers prefer the 3D presentation of products regardless of product categories • Consumers' willingness to pay to get visual effects by 3D environments is different between search and experience goods • No interaction effect between virtual experience and product category without the effect of connection speeds

	Findings	Interpretation of the findings
H4	Participants preferred the 3D to 2D presentation of the experience good under the low connection speed	• Consumers prefer the 3D presentation of products regardless of loading time delays and product categories • Same interpretations as suggested in hypothesis 2 can be applied
H5	No difference in participants' attitudes between the 3D and 2D presentation of the search good under the low connection speed	• Sample size was not big enough since there was a difference found in attitudes but it was not just statistically significant • Consumers also got necessary information about the camcorder from search attributes other than visual images • Perceived cost was increased due to loading time delay but willingness to pay was also increased for 3D presentation, thereby causing no difference in attitudes
H6	Participants preferred the 3D presentation of the search good under the low connection speed to the 2D presentation of the search good under the high connection speed	• Consumers prefer the 3D to 2D presentation of search goods in spite of loading time delays in 3D environments and no delay in 2D environments • The difference in attitudes was mainly due to the positive effects of virtual experience rather than combined interaction effects

Hypothesis 2

Similarly, Rose and Straub could not find the relationship between download delays and attitudes toward the retailers in their study (Rose & Straub, 2001). There are 4 plausible explanations for the result of the hypothesis 2 test including the one suggested in the work by Rose and Straub. The first possible interpretation is that loading time delays do not have any impact on consumers' attitudes toward products. If so, then e-Retailers need to change their strategies and add relevant, sale-inducing content without counteracting the negative impact of delays on the Web by reducing content. However, anecdotal evidence and previous studies (Rose, Lees, & Meuter, 2001; Rose, Khoo, & Straub, 1999) showed the negative impacts of loading time delays in B2C e-commerce as indicated earlier in the paper. Therefore, it would not be a good idea for e-Retailers to create the Web site without balancing content and its loading time.

The second interpretation is that there may be no lingering effects from loading time delays on e-Retailer success once the page has loaded without being aborted as suggested in the previous study (Rose and Straub, 2001). It is possible that consumers may not form attitudes toward products based on their experience on loading time delays once the page has been successfully loaded. If so, then e-Retailers need to convince consumers to wait until the page has been loaded successfully by giving them incentives

such as e-coupons or credit points, etc. In this case, it is essential to find out the exact time point when visitors on the Web start to abort the page load, not to mention finding many incentives, which appeal to visitors in future studies.

The third interpretation is to use the added value of rich content model suggested in the study. The added value of rich content was defined as α times willingness to pay minus β times opportunity cost where α is related to product categories and β is related to Internet connection speeds. Given the economic model, it is possible that participants' opportunity costs could be close to nearly zero in a laboratory setting. By the time participants had signed up for the experiment, they already decided to devote a certain amount of their time for the experiment. Thus, they might not consider other alternatives to do during the experiment, which could cause zero opportunity cost for them. Internet connection speeds could not affect perceived costs if opportunity cost is nearly zero no matter how much difference the β index shows. If so, then perceived costs become also nearly zero. Therefore, the added value of rich content is pretty much determined by willingness to pay only.

If this interpretation is correct, then the remedy is to replicate the experiment with some options for participations to have an ability to abort the page load or similar. Although participants were allowed to quit at any time during the experiment in the study,

nobody actually quit. Thus, it is hard to say that aborting the page load option was provided in the study. Therefore, at least two options of choice for participants with brief instruction of what they are to see and how long it may take to load the chosen page are suggested for the future study. If a participant chose to see the Web page that had a 3D presentation version with a 30 second delay over a 2D presentation version with a 15 second delay, it would show the participant's preference clearly. It is also suggested for the future study that options for aborting the page load and switching to the different version of product presentations during delays need to be provided. It would improve the reliability of the effects of product attributes if a series of different products were presented to a participant, and then to see how the participant chooses different options for each product.

The fourth interpretation for hypothesis 2 is that delay interval might not be appropriate to measure the effects of delays. A 30 second delay may not be slow enough to cause negative impacts on participants' attitudes toward products. However, the results of attitudes toward delay measure showed a significant difference between the no delay conditions and the 30 second delay conditions, $F(1, 224) = 40.28$, $p < .01$ (See Table 6). Specifically, participants were likely to have more positive attitudes toward delay in the no delay conditions ($M = 3.3707$, $SD = .6919$) than in the 30 second delay conditions (M

= 2.569, SD = .7972). The attitude toward delay measure was adopted from previous studies (Hui & Tse, 1996; Rose, Lees, & Meuter, 2001) with a four-point scale as intolerable delay being number 1, excessive but still tolerable delay, acceptable delay, and no significant delay being number 4 (See Appendices). Thus, the delay seems to be appropriate, and this interpretation cannot be applied to the result of hypothesis 2 test.

Table 6: Attitude toward delays

	No delay	15 second delay	30 second delay
Attitude toward delays	• M = 3.3707 • SD = .6919	• M = 2.6724 • SD = .9250	• M = 2.569 • SD = .7972

Hypothesis 3 and 5

There are two plausible interpretations other than no significant interaction effects for the result of the hypothesis 3 test. The first is that willingness to pay for 3D presentations may vary depending on product categories. I assumed that willingness to pay to get rich information would be the same regardless of product attributes. However, participants might obtain good information for their decision on the camcorder from other search attributes such as price, technical specifications, or size, since visual effects by 3D presentation is one of the search attributes. If so, then participants' willingness to pay for

the 3D presentation of the search good could be lower than willingness to pay for the 3D presentation of the experience good. Thus, the added value of 3D presentations was smaller than expected in search goods probably due to the reduced willingness to pay for visual effects, in spite of relatively higher α index for search goods. Relatively lower willingness to pay and higher α index might negate each other, and thus likely to result in not much difference in participants' preference of 3D presentations between search and experience goods assuming no difference in perceived costs.

If this interpretation is true, it can be also applied to the result of the hypothesis 5 test. Participants received necessary information for their decision about the camcorder from other search attributes in the 2D presentation of the product, which might cause relatively high attitudes even in 2D presentations. Therefore, the difference in attitudes was likely to be insignificant between 3D and 2D presentation of the search good. Other interpretation could be small sample size. The remedy for small sample size is to replicate the experiment with larger sample size.

No significant difference between the 3D and 2D presentation of the search good under the low connection speed could also be considered as natural and significant if there were effects of loading time delays found in the study. Perceived cost could be increased due to loading time delays while willingness to pay could be increased for 3D

presentation. As a result of the increase in both willingness to pay and perceived cost, the final added value of 3D presentation could remain as before, thereby showing no difference in attitudes between the 3D and 2D presentation of the search good.

Hypothesis 4

Without the main effect of delays, the result of the hypothesis 4 test could be considered as natural and consistent with other findings. Only willingness to pay affects the added value of 3D presentation when the impact of connection speeds is ignored. Therefore, consumers are likely to have higher attitudes toward the 3D than the 2D presentation even for experience goods.

Hypothesis 6

It would have been a significant finding if there were a main effect of connection speeds since hypothesis 6 was supported. However, the significant difference found in the result of the hypothesis 6 test is more likely due to the effects of 3D presentations rather than due to interaction effects among connection speeds, virtual experiences, and product categories since loading time delays showed no significant impacts on participants' attitudes in this study. If there were a significant main effect of delays, then this finding

will help e-Retailers do more targeted marketing with dynamic versions of Web services and give a clearer understanding of how to balance their content and loading time delays.

Other consideration and implication for future studies

One more thing needed to be discussed is the main effects of product category. Although participants were likely to have higher attitudes toward products when a search good was presented ($\underline{M}$ = 5.29, $\underline{SD}$ = .9398) than when an experience good was presented ($\underline{M}$ = 4.5747, $\underline{SD}$ = 1.166), $\underline{F}$ (1, 224) = 23.23, $\underline{p} < .01$, $\eta^2 = .10$, it is hard to suggest that the main effect of product categorization was found. Each product has the unique product attribute to represent either an experience or search good. However, these two products are not much equivalent in terms of price, or the level of consumers' involvement. The price gap between a camcorder and a box of cereal was large enough to cause the difference in participants' attitudes, not to mention that college students usually show higher interest in electronics than cereal. Thus, the difference in participants' attitudes found in the experiment is likely due to the difference between a camcorder and a box of cereal rather than product attributes they are to represent.

Besides, participants' pre-existing experience with the products could affect the results since both products are well known brands with relatively high reputations. This

potential prejudice from real experience could affect the results although the questions were designed to ask how the Web site made participants feel about the products.

Therefore, it is suggested to use a series of non-existent products, which are equivalent in terms of price, size, or the level of involvement in future studies. Having a participant examined a series of different products could measure the effect of product categories more accurately. A Latin-Square design, randomly changing the sequence of presentation order, should be used to prevent practice effects or carry-over effects in this case.

For future study, I would like to suggest having more levels in connection speeds with a smaller delay interval, having a series of different products with randomly changed sequence of presenting orders, having abort-like options to choose from with brief instruction of what participants are to see and how long it may take, and providing the actual ability to abort the page load and switch to the different version of product presentation during delays. I also would like to suggest adding more dependent variables to indicate other possible areas rather than attitudes toward products where the factors may affect B2C e-commerce for the future study.

Limitation

A limitation for this study is the experiment conducted in a laboratory setting using college students as samples. Since this type of experiment restricts the external validity, this limitation should be kept in mind when interpreting the results.

Ⅶ CONCLUSION

The purpose of this study was to examine the relationships among virtual experience, connection speeds, and product attributes for a clear understanding of how to balance the Web page content and loading time delays across different product categories in B2C e-commerce. Without clear understanding of the added value of rich content on the Web, both e-Retailers and e-consumers cannot appreciate the maximum benefits of e-commerce using the Internet as a powerful medium.

The positive effects of virtual experience created by 3D environments on product knowledge and consumer attitude toward the products and the negative impacts of excessive download delays on B2C e-commerce seem to be a package deal under the current Internet infrastructure. Unfortunately, since the consequences of delay, as well as the impact of delay on the added value of rich content are still unclear, e-Retailers may not be able to manage their Web sites effectively by adding more relevant and sales-inducing content for targeted marketing. Hopefully, the findings of this study and suggestions for future studies will address guidelines for a clear understanding of the added value of rich content in B2C e-commerce.

If the impacts of delays on the added value of rich content in B2C e-commerce are found in future studies, then e-Retailers can provide more personalized and targeted Web services based on a consumer's choice of products and their connection speeds dynamically. This could maximize willingness to pay and minimize perceived costs in Formula 1 at the same time, thereby maximize the added value of rich content.

In fact, many Web sites already provide visitors with options to choose from text-only Web pages to more graphic oriented Web pages. But since technologies evolve so fast, if server technologies were smart enough to detect a visitor's connection speed automatically, then e-Retailers would not even need to provide such options but could dynamically provide consumers with different versions of product presentation and relevant, sale-inducing content.

Fast-evolving technologies will help e-Retailers achieve their goal of providing dynamic versions of Web pages, once they understand how to balance content and its loading time clearly. In this way, e-Retailers could differentiate their e-commerce from other e-Retailers, thereby standing out in competitive B2C e-commerce environments without facing a price war.

APPENDICES

Survey Questionnaires

Indicate your level of agreement with the following statements by circling the most appropriate number (question 1 through 3).

	Strongly Disagree						Strongly Agree
1. I feel very knowledgeable about the product I just examined.	1	2	3	4	5	6	7
2. If I had to purchase the product today, I would need to gather very little information in order to make a wise decision.	1	2	3	4	5	6	7
3. I feel very confident about my ability to judge the quality of this product.	1	2	3	4	5	6	7

For each of the items below, circle the number that best describes your overall feelings about the product you have evaluated (question 4 through 9).

4. Bad	1	2	3	4	5	6	7	Good
5. Unappealing	1	2	3	4	5	6	7	Appealing
6. Unpleasant	1	2	3	4	5	6	7	Pleasant
7. Unattractive	1	2	3	4	5	6	7	Attractive
8. Boring	1	2	3	4	5	6	7	Interesting
9. Dislike	1	2	3	4	5	6	7	Like

10. Please indicate your attitude toward the download time delay for the page you just viewed (choose one):

[ ] Intolerable delay

[ ] Excessive but still tolerable delay

[ ] Acceptable delay

[ ] Not significant delay

11. What is your PID _____

12. What is your sex? Male [ ] or Female [ ]

13. What is your age? _____ Years (optional)

14. How many hours in a typical week do you spend on the Internet? _____ Hour

15. If you have Internet connection at home, please indicate your connection speed:

Dial-up connection with 64k or lower[ ] High Speed [ ]

(LAN, Cable Modem or DSL, etc.)

BIBLIOGRAPHY

Amor, Daniel (2000), "The E-Business (R)evolution," NJ: Prentice Hall PTR.

Biocca, Frank, Terry M. Daugherty, Hairong Li, and Zoo-Hyun Chae (2001), "Effect of Visual Sensory Immersion on Presence, Product Knowledge, Attitude toward the Product, and Purchase Intention," Paper read at 2001 Experiential E-Commerce Conference, September 27 – 28, at East Lansing, MI.

Brandenburger, Adam M, and Harborne W. Stuart, Jr. (1996), "Value-Based Business Strategy," The Massachusetts Institute of Technology, *Journal of Economics & Management Strategy, Volume 5, Number 1*, Spring 1996, 5 – 24.

Bruner, Gordon C. (1998), "Standardization & Justification: Do and Scales Measure Up?," *Journal of Current Issues and Research in Advertising* 20(1): 1 –18.

Department of Commerce (2000), "Digital Economy 2000 report." [online] Available: http://www.esa.doc.gov/de2000.pdf.

DTI (1998), "Net benefit: The electronic commerce agenda for the UK." [online] Available: http://www.dti.gov.uk/public/frame8.html.

Durvasula, S., S.C. Mehta, J.C. Andrews, and S. Lysonski (1997), "Advertising Beliefs and Attitudes: Are Students and General Consumers Indeed Different?," *Journal of Asian Business* (13:1), pp. 71-84.

Edwards, Steve and Harshavardhan Gangdharbatla (2001), "Separating the Wheat from the Chaff: Understanding the Novelty of Interacting with 3D Products and the Implication of Wearout for e-Commerce," Paper read at 2001 Experiential E-Commerce Conference, September 27 – 28, at East Lansing, MI.

European Initiative in Electronic Commerce (1997), "Communication to the European Parliament, the Council, the Economic and Social Committee and the Committee of the Regions." [online] Available: http://www.cordis.lu/esprit/src/ecomcom.htm.

Gibson, J.J. (1996), "The Senses Considered as Perceptual Systems," Boston: Houghton Mifflin.

Häubl, Gerald and Pablo Figueroa (2001), "Virtual-Reality Product Demos and Buyer Behavior in Electronic Shopping Environments," Paper read at 2001 Experiential E-Commerce Conference, September 27 – 28, at East Lansing, MI.

Hoch, Stephen J. and John Deighton (1989), "Marketing In Hypermedia Computer-Based Environments: Conceptual Foundations," *Journal of Marketing*; 50 – 68.

Hoch, Stephen J. and Young-Won Ha (1986), "Consumer learning: Advertising and the ambiguity of product experience," *Journal of Consumer Research, 13*; 221-233.

International Telecommunication Union (1999), "CHALLENGES TO THE NETWORK: Internet for Development." [online] Available: http://www.itu.int/ti.

Keppel, Geoffrey (1991), "Design and Analysis: a researcher's handbook – 3rd ed.," Prentice-Hall, Inc., p220.

Klein, Lisa R (2001), "Understanding Consumer Response to Virtual Product Experiences: The Role of Telepresence," Paper read at 2001 Experiential E-Commerce Conference, September 27 – 28, at East Lansing, MI.

Hobley, Christopher (2001), "Just Numbers: Numbers on Internet use, electronic commerce, IT and related figures for the European Community," Published by the European Commission's Electronic Commerce Team (Information Society Directorate General).

Hui, Michael K. and David K. Tse (1996), "What to Tell Consumers in Waits of Different Lengths: An Integrative Model of Service Evaluation," *Journal of Marketing, vol. 60, no. 2*, pp. 81 – 90.

Lake, David (2001), "Quick and Easy," *The Industry Standard*, 5 March. [online] Available: http://www.thestandard.com/article/display/0,1151,22342,00.html.

Li, Hairong, Terry M. Daugherty, and Frank Biocca (2001), "Consumer Learning and 3-D Ecommerce: Sequential Exposure to a Virtual Experience Relative to Indirect and Direct Product Experience," Paper read at 2001 Experiential E-Commerce Conference, September 27 – 28, at East Lansing, MI.

Li, Hairong, Terry M. Daugherty, and Frank Biocca (2002), "Effectiveness of 3-D Visualization: The Role of Presence," *The Journal of Advertising, Special Issue on new Media and Advertising.*

McCabe, Deborah Brown and Stephen M. Nowlis (2001), "Information Integration Across Online and Offline Shopping Environments and Its Effect on Consumers' Purchase Decisions," Paper read at 2001 Experiential E-Commerce Conference, September 27 – 28, at East Lansing, MI.

Millar, Murray G. and Karen U. Millar (1996), "The Effects of Direct and Indirect Experience on Affective and Cognitive Responses and the Attitude - Behavior Relation," *Journal of Experimental Social Psychology*, 32: 561 – 579.

Nash, Sharon (2000), "Online Catalogs Will Come To Life And You'll View Merchandise From Every Side," *PC magazine*. [online] Available: http://www.zdnet.com/pcmag/stories/trends/0,7607,2418240,00.html.

Nelson, Phillip (1976), "Economic Value of Advertising," *Advertising and Society*, NY: New York University Press.

Nelson, Phillip (1981), "Consumer Information and Advertising. in Malcolm Galatin and Robert D. Leither (Eds.)," *Economics of Information*, Boston: MA: N. Nijhoff Publishers.

OECD (1997), "Policy Brief, No. 1 on Electronic Commerce." [online] Available: http://www.oecd.org/publications/Pol_brief/9701_Pol.htm.

OECD (2001), "The Development of Broadband Access in OECD Countries, Paris." [online] Available: http://www.oecd.org/pdf/M00020000/M00020255.pdf.

OECD (2002), "Broadband access in OECD countries per 100 inhabitants, September 2002." [online] Available: http://www.oecd.org/EN/document/0,,EN-document-0-nodirectorate-no-4-39262-0,00.html

Parkin, Michael (1993), "Microeconomics –2nd ed," *Addison-Wesley Publishing*, 10 – 11.

Pedersen, Mark (2001), "PERFORMANCE METRICS IN CONTEXT," *GómezPro Brief.* [online] Available: http://a520.g.akamaitech.net/7/520/915/a2687de899c0ca/ images.gomez.com/images/Networks_marketing/MetricsinContext.pdf.

Rose, Gregory M., Roberto Evaristo, Detmar Straub (2002), "Culture and Consumer Responses to Web Download Time; A Four-Continent Study of Mono- and Polychronism," *Special Issue of IEEE Transaction on Engineering Management.*

Rose, Gregory M., John Lees, and Matthew L. Meuter (2001), "A Refined View of Download Time Impacts on E-Consumer Attitudes and Patronage Intentions Toward E-Retailers," *JMM – vol. 3.* [online] Available: http://www.mediajournal.org/netacademy/publications.nsf/all_pk/1946.

Rose, Gregory M, Huoy Khoo, and Detmar Straub (1999), "Current Technological Impediments to Business to Consumer Electronic Commerce," *Communications of the AIS, vol. 1.*

Rose, Gregory M., Detmar W. Straub, John D. Lees (2000), "The Effect of Download Time on Consumer Attitude Toward the Retailer in E-Commerce," *Proceedings of the Sixth Americas Conference on Information Systems*, August, pp. 1352-1354.

Rose, Gregory M., Detmar W. Straub (2001), "The Effect of Download Time on Consumer Attitude Toward the e-Service Retailer," *e-Service Journal, vol. 1, no. 1.*

Rosenthal, R. (1979), "The 'File Drawer Problem' and Tolerance for Null Results," *Psychological Bulletin*, pp. 638 – 641.

Samsung Economic Research Institute (2000), "World Report 3" [online] Available: http://www.seri.org.

Schmitz, Stefan W. (2000), "The effects of electronic commerce on the structure of intermediation," *JCMC*. [online] Available: http://www.ascusc.org/jcmc/vol5/issue3/schmitz.html#ref.

Surmacz, Jon (2002), "Broadband Appeal: Home subscribers vault to 24 million." [online] Available: http://www2.cio.com/metrics/2002/metric392.html

Tchong, Michael (2000), "More concentrated than the leading brand," *ICONOCAST* [online] Available: http://www.iconocast.com/issue/macroview.

WebCriteria (1999), "Max and the Objective Measurement of Web Sites," [online] Available: http://www.inetz.com/work/pdf/objective_measurement.pdf.