INTERACTION OF INFORMATION SEEKING MODE AND WEB ATMOSPHERICS

THE IMPACT OF INFORMATION SEEKING MODE AND WEB ATMOSPHERICS ON CONSUMER PERCEIVED VALUE AND INTERACTION WITH RETAIL WEB SITES

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TITLE: The impact of information seeking mode and Web atmospherics on consumer perceived value and interaction with retail Web sites

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ABSTRACT

This document describes a research study that investigates ways of designing the Web atmospherics of retail shopping sites to better support consumers in their product information seeking. In this regard, the document identifies two significant modes of product information seeking (product browsing and product searching) and concentrates on two specific types of Web atmospherics (information presentation and information focus). Information presentation concerns the format of information displayed on the Web shopping interface, while information focus concerns the granularity of this displayed information. Utilizing these theoretical constructs, this document proposes that: i) matching information presentation to information seeking mode will lead to increased levels of consumer perceived value with Web shopping sites; ii) information seeking mode will influence user preferences for Web page design elements of Web pages with different information focus granularities; iii) information seeking mode will yield distinctive patterns of on-line consumer behavior; and iv) information presentation will impact the extent to which consumers interact with a Web shopping site.

In order to investigate the effects of information presentation and information focus on consumer Web information seeking, this document outlines a randomized experiment. The experiment places subjects into either a browsing or searching mode, and manipulates information presentation within a simulated Web shopping environment. Measured outcomes in terms of perceived hedonic and utilitarian values are used to determine interactions between information seeking mode and information presentation. An analysis of test subjects' usage of the experimental Web site is conducted to assess: i) how information presentation and information seeking mode impact test subjects' preferences for Web pages and Web page design elements of different information focus granularities; and ii) the extent to which analysis of the interactions yield distinctive patterns of on-line behavior.

Findings from the experiment provide support for two distinct behavioral patterns corresponding to searching and browsing information seeking modes: i) searchers and browsers chose to view Web pages and Web page design elements consistent with their information focus; and ii) on-line behavior is moderated by varying the level of information presentation. Specifically, browsing is associated with a more diffuse information focus than is searching; and as predicted, browsers view more pages and click on hyper-links that are of a more diffuse information focus (category-level pages, view related products) than do searchers. Further the moderating role of information presentation is seen in the number of search pages viewed by searchers and browsers at each level of information presentation. The results also indicate that the perceived hedonic and utilitarian value scales are likely not sufficiently sensitive to measure the experimental manipulations in this experiment

In addition to the running of an experiment, a key deliverable of this research is the development of a research tool that simulates a real-life shopping environment where consumers browse and search for product-related information. The tool allows for placement of subjects into experimental treatments that utilize different renderings of the shopping interface. The tool also provides a means of measuring subject responses through a built-in questionnaire and a behavioral tracking mechanism. Through the running of the experiment, the tool is shown to be effective at producing treatment differences and capturing behavioral patterns of users' interactions with the simulated shopping interface.

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1 INTRODUCTION

1.1 Problem Area

This study concerns itself with Web-based retail sites and how they can support consumers in their pre-purchase product information seeking activities. By the very nature of the information seeking process itself, it is argued that product information seeking is a complex and dynamic human activity that necessitates the construction of Web shopping site designs that can handle a vast array of information requirements ranging from wayward, experiential browsing to more specific, goal-directed search. The problem is that, although online consumers are known to engage in dual modes of browsing and directed search (Rowley 2000), many on-line sites primarily support product information search and pay less attention to supporting users in their wayward product browsing activities. Interestingly, even academics have primarily focused on goal-directed search as a research endeavor over that of exploratory search (Janiszewski 1998).

There is some evidence in the literature for the need for retail Web sites to support both browsing and searching, rather than just searching alone. Among the first to identify this problem area were Hoffman and Novak (1996) in their portrayal of the Web as a computer mediated environment. They demonstrated that retail Web sites need to be integrated environments that support both experiential as well as goal-directed searching behavior. The challenge is how to go about designing online shopping environments that support both of these functions as "there has been a lack of genuine knowledge about what contributes to effective interactions with on-line customers" (Novak, Hoffman et al. 2000), though some research has been done in this area. For example, Hearst, Elliott and English (2002) raised the question of how to build Web interfaces that successfully support both browsing and searching, and found that most studies have been inconclusive about how improvements could be made. Of specific interest, Detlor, Sproule and Gupta (2003) found evidence for displaying information differently on retail Web sites in ways which support both product browsing and product searching. Their results imply the need to focus not only on goal-directed search, but also on non-directed browsing; further, these authors argue that adapting the design of retail Web sites to the unique information display requirements of search and browse tasks could help promote more compelling online shopping experiences for consumers. Such evidence highlights the need to support both browsing and searching in Web retail environments. However, very little is known about the specific design elements that contribute to an improved consumer on-line experience.

1.1.1 Why Study Consumer Online Browsing and Searching?

Evidence from the physical retail world suggests that searching and browsing are individually important consumer behaviors. For example, Bloch, Ridgway and Nelson (1991) found that looking around and browsing is a more frequently reported reason to visit a mall than having a specific purchase objective. Moreover, certain stores appear to hold more appeal to people who are browsing than those whose primary intent is goal-directed in nature. Browsers make more impulse purchases than non-browsers in a mall setting (Jarboe and McDaniel 1987), and depending on the product line, 27 - 62% of department store sales are impulse purchases (Bellenger and Korgaonkar 1980). This suggests that the physical mall environment is conducive to browsing as well as searching, and that certain factors in a store's design can be manipulated to support browsing and ultimately trigger an unplanned purchase. It follows that certain attributes of a virtual, electronic Web shopping environment may be more conducive to browsing as well. The importance of catering to browsers was noted by Bloch, Sherrell and Ridgway (1986) who determined that heavy ongoing browsers make significantly higher expenditures in certain product categories, suggesting that Web shopping site designs that facilitate on-line browsing in these product categories may also lead to increased on-line sales.

In contrast to shopping in a retail store, Wolfinbarger and Gilly (2001) reported that on-line shopping is more likely to be goal focused. Specifically, 29% of shoppers in Wolfinbarger and Gilly's study report making their last purchase on the Web while browsing, while the remaining 71% make purchases which are planned. Wolfinbarger and Gilly also found that the average amount of time spent on a retail book Web site is only sufficient to find a book and complete the transaction. Consumers also reported that they were more impulsive when shopping offline. The large discrepancy between the number of browsers and non-browsers in Wolfinbarger and Gilly's study, the short amount of time spent on retail Web sites, and the lower level of impulse buying on the Web, suggest that on-line retail sites may not be supporting browse behavior as well as they could.

Further, statistics show that while over 63% of Americans are currently on-line and 61% of these people had made an actual on-line purchase (Madden 2003), on-line sales only amount to roughly 2.8% of total retail sales in the United States for the third quarter of 2006 (U.S. Census Bureau 2006). Moreover, 83% search for product information on-line (Madden 2003) but make their purchases in an offline retail store. These figures suggest the need to better understand on-line consumer information seeking behavior.

1.2 Research Objectives

The above discussion identifies an opportunity to improve the on-line retail space as a browsing destination. How this might be done, however, is unclear.

What are the best Web shopping site design scenarios to support both browsing and searching? What product information displays are required in each mode? Are they the same or different?

Unfortunately, little theory is available to guide practitioners in this area. For example, Barnard (2000) notes in his review on the use of theory in user interface design, that design tends to follow heuristics, and that for new developments, theory has only been used to implement reduced or local features in interface designs. Similarly, Sutcliffe (2000) asserts that while guidelines and principles for Human Computer Interaction (HCI) design have emerged, the current state of practice remains largely at the level of craft. Marketers face a similar problem in terms of how to utilize the internet. Muyllie (1999) states that theory is lacking, and that marketers are forced to develop internet marketing programs on the basis of intuition and anecdotal evidence. In order for theory to inform design of retail Web sites, it must be amenable to application (Wildemuth 2006). Unfortunately, such theory seems to be lacking. For example, in their survey of mainstream IS journal publications with a Web user focus, Saeed, Hwang and Mun (2003) found that 35 of 42 articles they considered had little to offer practitioners. Typically, predictor or independent variables were specified as latent constructs rather than particular IT design elements that could be manipulated. The practice community however derives greater benefit from research that addresses design at the level of individual design elements. Examples of such studies include investigations of Web design elements with differential impact (Hassanein and Head 2006; Hearst, Elliott et al. 2002; Mandel and Johnson 2002) as well as investigations into Web design elements that are more appropriate in one context relative to another (Detlor, Sproule et al. 2003). As noted by Saeed et al., practice-oriented studies such as these form the minority of research publications. Consequently, the theoretical frameworks that exist, serve primarily as general guidelines rather that actionable specifications for employing design elements to achieve particular objectives.

Further, in addition to a lack of theory in this area to guide practitioners in the design of online shopping sites, another tangible problem is how to go about studying user interactions with consumer shopping sites in ways that control the multitude of variables that could affect peoples' experiences with these sites without compromising the typical experience people have. One solution is to provide researchers with robust tools that facilitate experimental investigations that place subjects in simulated but realistic online shopping environments and measure consumer interactions within these sites.

Recognizing all of the above, the objectives of this research study are three-fold:

1) to address the gap in research on the design of retail Web sites that support both product searching and product browsing;

2) to conduct a theoretically-based research investigation into information seeking and Web atmospherics that is of high relevance to practitioners; and
3) to develop a research tool that allows researchers to conduct experiments concerning consumer interactions with retail Web sites.

1.3 Scholarly and Practical Significance

In terms of scholarly contribution, this project addresses the lack of theory used to inform Web site shopping design. A theoretical model, based on existing literatures, is introduced to investigate the effects of Web atmospheric variables on browsing and searching outcomes (see section 2.4). Hypotheses that are derived from the theoretical model are tested via an on-line shopping experiment using a developed research tool. Results advance knowledge in the areas of Web design, Web pre-purchase information seeking, and on-line consumer shopping. The model is expected to inform future research endeavors in this area. The research tool is expected to be used in future research investigations that wish to utilize experiments to test the effects of different information presentations across different end-user task situations on end-user behaviors.

From a practical perspective, this research provides benefit to on-line retailers who need to understand how Web design elements support specific consumer information seeking behaviors. Recommendations that are based on experimental results identify Web design elements that increase value to consumers with respect to their product information searching and browsing activities. In addition to improved consumer interactions, Web shopping sites that choose to adopt these recommendations may also benefit from increased sales.

1.4 Terminology

In this document, the terms: internet, Web and on-line have the following usage. "Internet" is used when referring to the technology or technical infrastructure of the inter-network. HTML over HTTP is a common internet technology in which to implement a World Wide Web site. "Web" is the short form of referring to this technology. "On-line" is used in the context of a consumer using internet technologies.

1.5 Outline

The remainder of this document is organized as follows. First, background is provided concerning consumer shopping activities, information seeking, retail channels, atmospherics, perceived value and on-line behavior. These areas are discussed broadly at first and then refined to the on-line Web shopping environment. Second, a theoretical model based on this literature review is

proposed. The model frames the study's boundaries of investigation and the derivation of research hypotheses. Third, the experimental methodology that tests these hypotheses is described. Fourth, details of the developed research tool are given. Fifth, research findings from the experiment are presented. Sixth, a discussion of the research findings is presented, along with a description of the study's limitations and future research ideas emanating from this investigation.

2 LITERATURE REVIEW

The purpose of this section is to provide the background material needed for the development of this study's theoretical model and research hypotheses. To that end, consumer shopping activities (with a focus on the browse and search modes of information seeking) are discussed within the context of retail channels (with a focus on Web retail). Atmospherics (especially pertaining to Web retail sites) are identified as having the potential to influence consumer perceived value and on-line consumer behavior. This background was derived from a review of the information systems and consumer behavior literatures.

Overall, this section argues that not all forms of consumer shopping activities are the same. For example, information seeking is just one specific shopping activity (other activities could include product evaluation, product purchase, etc.) a consumer can undertake and this activity comprises both browsing and searching. It is also argued that the consumer shopping experience varies over retail channels (e.g. physical store, catalog, Web, etc.). For example, shopping on the Web likely yields a different experience from that obtained in a different channel such as a physical retail store. Furthermore, retail channels are influenced by atmospherics (design characteristics) that lead to buyer effects. Specifically, in the case of the Web retail channel, the Web atmospherics of information presentation and information focus are expected to impact consumer response in the form of perceived value and on-line behavior.

The position taken in this study is that consumers can perform shopping activities individually or in sequence, and that they can choose the retail channel in which to perform this activity. In fact, consumers make multiple choices when shopping (e.g., choices about product, activity, retailer, channel, etc.). These choices are highly context dependent, and the consumer may only make the determination of his or her preferences and decision-making strategy at the time of the decision (Bettman, Luce et al. 1998).

To address the contingent nature of the consumer buying process, the study adopts an activity-channel lens which describes the consumer shopping process as a series of independent (non-sequential) activities conducted within one or more retail channels. The impact of performing a specific shopping activity within a specific channel can be determined from the consumers' perceived value and on-line behavior.

Figure 2.1 below illustrates the activity-channel lens. The figure shows that the response of a consumer performing a shopping activity within a particular retail channel is moderated by the atmospherics of that channel. It should be noted that the activity-channel lens is a general perspective that can be applied to any shopping activity and retail channel, not just the information seeking shopping activity and the Web retail channel. Thus, the activity-channel lens may be useful as a perspective to adopt in other research investigations.

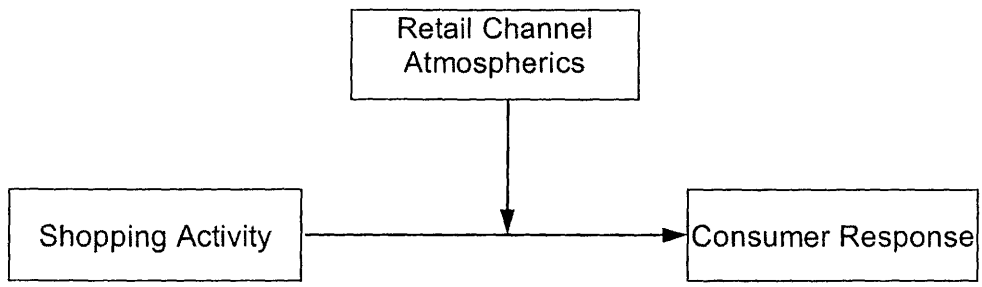

Figure 2.1 The Study's Activity-Channel Lens

The relationship indicates that the consumer response due to performing a shopping activity within a particular channel is moderated by the atmospherics of that channel.

The next sections examine the three components of the activity-channel lens in general (Shopping Activity, Retail Channel Atmospherics, and Consumer Response). The activity channel lens is then instantiated to form the theoretical model used in this study. The instantiation is in the context of the Web, where the shopping activity is specified as information seeking and the retail channel atmospherics are specified as Web atmospherics. In the context of this instantiated model, information seeking and the Web atmospherics of information presentation and information focus are examined.

2.1 Shopping Activities

The consumer buying process is typically described as comprising five discrete stages: 1) need recognition, 2) information search, 3) evaluation of alternatives, 4) purchase decision, and 5) post-purchase behavior (Kotler 1995). *Need recognition* refers to the consumer becoming aware of a need or want. This recognition may be because of an external (e.g., advertising) or an internal (e.g., hunger) stimulus. *Information search* refers to both internal (memory) and external information seeking activities. Having gathered relevant information, the consumer would *evaluate his or her alternatives.* He or she would consider the range of brands, products, retailers or retail channels that are possible solutions to satisfy his or her needs. The process a consumer uses to make an actual *purchase decision* is highly context dependent (Bettman, Luce et al. 1998), and may involve additional factors such as purchase risk, decision complexity, or similarity between products. *Post-purchase behavior* encompasses the actual use of a product or service, routine maintenance or warranty repairs if required, and includes an affective evaluation of the item purchased as well as the buying process. This affective evaluation would result in the level of satisfaction or dissatisfaction felt by the consumer (Babin and Griffin 1998).

While Kotler's model has common usage, modifications to its assumptions and nomenclature are required in order to adapt it for use in this study. The term 'stage' in Kotler's model carries with it an implication of a linear process; thus the term 'activity' is perhaps a more appropriate and accurate term to utilize. The term 'activity' is preferred in that it acknowledges a specific task exists within the consumer buying process, but does not imply the notion of requiring a predefined order in carrying out these tasks. Therefore consumers need not follow the buying process sequentially from start to finish, but may in fact skip stages, backtrack or even retrace steps.

Further modifications are required to address the critique that Kotler's model is inadequate in explaining all types of consumer shopping behavior (Burke 2002). For example, the buying process does not necessarily have a defined outcome. Consumers may browse but not necessarily purchase products or services (Bloch and Richins 1983; Bloch, Sherrell et al. 1986). Further, shoppers who are impulsive or compulsive may not necessarily exhibit all five activities (Babin, Darden et al. 1994). Thus, it is difficult to outline a single, comprehensive shopping process model that adequately describes all consumer behavior. Rather than focusing on a process model, it may be better to consider each shopping activity as a discrete entity that consumers can perform alone or in conjunction with other shopping activities at their own discretion. In this context then, a **shopping activity** is defined as any of the following elements of the consumer buying process: 1) need recognition, 2) information search, 3) evaluation of alternatives, 4) purchase decision, and 5) post-purchase behavior.

2.2 Retail Channel Atmospherics

Having considered shopping activities, this section examines the context in which they occur. The modern consumer typically has a variety of retail channels available. These include traditional channels, such a physical stores and paper catalogs as well as newer electronic media based channels, such as the telephone, television and internet. As part of his or her shopping activities, a consumer makes a number of decisions. These decisions include choices of product, brand and retailer, as well as choosing the particular retail channel in which to perform his or her shopping activity. From a consumer's perspective, retail channels are not the same. For instance, Alba et al. (1997) suggest that consumers make channel choices based on the relative benefit they receive from those channels. Factors that Alba et al. identified relate to the quantity of different products and categories offered, the provision of information and screening of alternatives to form a consideration set, ordering and fulfillment, entertainment, social interaction and personal security. As an example, a physical store would provide a higher opportunity for social interaction (Cox, Cox et al. 2005) and immediate delivery compared to a catalog or Web site (Noble, Griffith et al. 2005). The retail Web site could in turn provide convenience, time saving and a reduction in travel (Teltzrow, Berendt et al. 2003). Zaharia (2005) provides a

succinct view of consumer channel choice when he states that consumers "use the channels that best satisfy their shopping motives in each situation."

Just as consumers are unconstrained by the shopping activities they choose to perform, they are free to choose the retail channel in which to perform their shopping activities. This is emphasized by the recent focus on the strategic importance of the bricks-and-clicks retail model, which assumes that consumers need not complete the buying process within a single channel, but may move between channels as appropriate (Prasarnphanich and Gillenson 2003; Stoltman, Gentry et al. 1990). According to Black et al, (2002) this will mean that consumers will increasingly rely on multiple retail channels. A retailer that supports this channel mobility should therefore gain strategic advantage. Canadian retailers such as Future Shop and Sears, for example have fully integrated on-line and offline channels, where the consumer is able to perform one activity on-line and another offline in a seamless manner (e.g., purchasing on-line and conducting post-purchase behavior, such as a product return, off-line).

It is not clear when the channel choice is made relative to the other choices a consumer would make while shopping. For example, Stoltman, Gentry et al. (1990) have found that the sequence in which a consumer makes choices relative to product, brand, shopping area, store type, specific store or non-store outlet will vary with the shopping task or objective. This implies that for the consumer, channel choice is distinct and separate from product choice.

Given that consumers make real choices concerning the retail channels they utilize, what are the channel attributes most likely to influence whether a particular channel is chosen or not? In the physical retail channel, factors such as the type of merchandise offered, store layout, and product presentation could potentially affect a consumer's purchase behavior. Such factors were termed 'atmospherics' by Kotler (1995) and described as the "conscious designing of space to create certain buyer effects" (Dailey 2004 p.795). Though Kotler can be considered to have initiated this research stream, work in this area predated Kotler's by almost 10 years (Turley and Milliman 2000).

Conceptually, atmospherics could be considered to be a grouping of all of the factors relating to the environment in which a shopping activity takes place, thereby separating out the contribution made by the product and its packaging. Examples of atmospheric variables include: *external variables* such as exterior signage and surrounding buildings; *interior variables* such as music, lighting, layout, design variables (space design and allocation, grouping of merchandise) and ambient odors (Chebat and Michon 2003); *point-of-sale variables* (P-O-P displays, usage instructions); and *human variables* such as employee characteristics, and crowding (Turley and Milliman 2000).

As a well-developed construct, atmospherics (especially music) have been studied extensively in retail stores and shopping malls. For example, Turley and

Milliman (2000) found that product display and retail crowding can impact consumer perceptions and behavior. An earlier study by Areni and Kim (1993) investigated the influence of type of music on shopping behavior. While more recently, Eroglu, Machleit and Chebat (2005) found an interaction between music tempo and retail crowding.

To understand how atmospherics could affect the consumer, the Stimulus-Organism-Response (S-O-R) framework is commonly used (Chebat and Michon 2003; Eroglu, Machleit et al. 2001; Turley and Milliman 2000). In this framework, retail atmospherics are taken to be the *Stimulus* acting upon the *Organism* (consumer), resulting in a behavioral *Response*. While S-O-R speaks of a response, atmospherics can impact both perceptions and behavior, and this impact can occur without the consumer being aware of the stimulus (Turley and Milliman 2000).

2.3 Consumer Response

Two major methods of measuring consumer response due to the impact of Web atmospherics while shopping on-line are: 1) perceptual and 2) behavioral. One prominent perceptual measurement is perceived value, which is an evaluation by the consumer of his or her shopping experience. The behavioral response would consist of a set of behavioral metrics designed to capture the interaction a consumer has with the retail Web site during his or her shopping activity. Utilizing both perceived value and behavioral metrics provides a complementary and fuller measurement of the impact of shopping activity and Web atmospherics. By measuring both the consumer's evaluation and actual behavior during a shopping activity, we avoid the difficulties in attempting to demonstrate an attitude-intention-action linkage (Bagozzi 1992) that is often used in Information Systems research.

The next section examines perceived value against two criteria, as a measure of the consumer shopping experience, and relevance to consumer channel choice.

2.3.1 Perceived Value

To assess the degree to which a retail channel supports a consumer's ability to conduct a shopping activity requires an outcome measure that is sensitive to consumer perceptions of the shopping experience. A suitable choice for such a measure would be perceived value, which Babin, Darden and Griffin (1994, p.647) propose as an "encompassing yet parsimonious" measure of the shopping experience. Babin et al. utilized perceived value to investigate consumer behaviors (such as browsing) that are not amenable strictly to functional explanations. That is, there is more to the shopping experience than rational choices and efficient use of time and resources. As such, perceived

value seems an appropriate outcome measure for investigation of consumer Web-based browsing and searching activity.

The construct of perceived value can be conceptualized as comprising hedonic and utilitarian dimensions (Babin and Darden 1995; Babin, Darden et al. 1994). Hedonic pertains to "having fun or positive affect" with an orientation more towards the process than the outcome (Bloch, Sherrell et al. 1986 p.121). Hedonic shopping motivations can include adventure, social interaction, gratification, generating new ideas, keeping up with fashions, shopping for others (gifts), or bargain hunting (Arnold and Reynolds 2003). In contrast, utilitarian is task-related, rational, and oriented more towards making a purchase (Babin, Darden et al. 1994). Taking the above discussion into account, this study defines **perceived value** as a consumer's overall assessment of his or her shopping experience as measured on hedonic and utilitarian dimensions.

There is a potential point of definitional ambiguity in the literature surrounding the concepts of hedonic and utilitarian benefit versus experiential and goal-oriented behavior. It is not uncommon to see these terms used interchangeably. For example, Hoffman and Novak (1996) describe experiential and goal-directed behavior as being characterized respectively in part by hedonic versus utilitarian benefits. This would imply that hedonic benefit cannot be obtained from goal-orientation behavior and vice versa.

Arnold and Reynolds (2003), however, challenge this implication in their study of motivations for shopping. In their study, a measure of hedonic motivation was developed for six broad categories of shopping: adventure, social, gratification, idea, role, and value (in this instance, value shopping is related to bargain shopping). Their findings indicate that consumers receive hedonic value in both the process and outcomes of value and idea shopping. Their interviews established that consumers who were value shopping "enjoyed hunting for bargains, looking for sales, finding discounts or low prices, almost as if shopping is a challenge to be conquered or a game to be won" (p. 81). Other researchers have reported similar results. Babin et al. (1994) noted that in some situations the actual purchase act can be the source of perceived hedonic value. Cox (2005 p.51), found that bargain hunting is the shopping activity that generates the highest percentage of enjoyment, typified by the statement "I get a thrill out of finding a real bargain." Sweeney (2001) argues that hedonic and utilitarian benefit can arise at the same time, and that value can occur in more than one shopping activity. From these results, it can be seen that consumers may well exhibit goal-oriented behavior, but they are nonetheless able to receive hedonic value from both the process and the outcome.

If consumers can gain hedonic and utilitarian benefit from both the process and the outcome of a shopping activity, it may be more clear to use the terms experiential and goal-oriented to refer to where the value originates (the process or the outcome), and to use the terms hedonic and utilitarian to refer to

the type of value (affective or instrumental) received. By distinguishing between experiential behavior and hedonic value, and between goal-oriented behavior and utilitarian value, we can gain a better understanding of the factors that impact perceived value by considering them both in terms of their source and their type. It may well be that the magnitude of hedonic and utilitarian benefits varies with the shopping activity, and that this in part leads to the ambiguity of hedonic and utilitarian value within experiential and goal-oriented behavior.

Moving beyond the discussion of hedonic and utilitarian benefits of perceived value, it should be noted that the literature is rich in its attempt to define and describe the construct of perceived value. For instance, an early description of perceived value comes from Zeithaml (1988, p.13), who describes four consumer definitions of value as: "low price", "whatever I want in a product", "whatever I get for the price I pay", and "what I get for what I give" . Here, perceived value does not have a single common meaning. To be more useful, Zeithaml combined these four definitions into a definition of perceived value as "the consumer's overall assessment of the utility of a product based on perceptions of what is received and what is given" (p. 14), while recognizing that what is given or received varies across consumers. Zeithmal's definition is important since it offers a conceptualization of how value is determined by the consumer.

As a multidimensional construct, Sheth et al. (1991) identified five components of perceived value: the first being *functional value*; the next three components pertain to hedonic value (*social, emotional and epistemic*); and the fifth, *conditional value*, which says that the previous four components are contingent upon context. It also has been proposed that the hedonic dimension could be composed of six elements: adventure, social, gratification, idea, role and value or bargain shopping (Arnold and Reynolds 2003). It is worth noting that the Sheth et al. conceptualization is single-sided, in that it only identifies what the consumer gets, in contrast to Zeithaml where perceived value is two-sided (give and receive).

Sheth et al. (1991) indicate that even though the construct of perceived value has general applicability, when it is operationalized, specific questions that assess subjects' perceived value will vary across consumer choice situations. The conditional value dimension is likely the source of this result. Babin et al. (1994), recognizing Sheth et al.'s multiple dimensions of perceived value, sought to devise a "complete yet parsimonious survey tool" that addressed the deficiencies of functional theories of consumer behavior (e.g., not explaining browsing, or impulsive or compulsive behavior) by including items such as emotional costs and the benefits of shopping. The result was a survey instrument that measured shopping value along hedonic and utilitarian dimensions. Note that it is possible to reconcile Babin et al.'s two dimensions with Sheth et al.'s five dimensions by recognizing that 'utilitarian' maps to 'functional', and 'hedonic'

maps to 'social, emotional and epistemic', with 'conditional' value being a moderating factor.

Perceived value can also be viewed as a latent construct to explain customer loyalty. For example, Woodruff (1997) used customer value delivery as part of a strategy for building competitive advantage for the retailer or service provider. Parasuraman (1997) built upon Woodruff's work by creating a customer value hierarchy in order to monitor and leverage customer value. Subsequently Parasuraman and Grewal (2000) proposed a pyramid model integrating technology into the quality-value-loyalty chain. What this line of research does is to conceptualize value as a latent construct within a nomological net that has an outcome (e.g., competitive advantage, loyalty) of interest to retailers. Viewing perceived value as a latent construct within a nomological net may be attractive. However, it shifts the focus away from a consumer perspective and does not provide the framework to investigate consumer behavior at the level of detail required by this study.

In addition to being used as an outcome measure, perceived value has also been found to be a motivator of consumer choices. Sheth, Newman et al. (1991) found perceived value motivated consumers in terms of what or what not to buy. Noble, Griffith and Weinberger (2005) evaluated utilitarian value as a motivator of retail channel choice. In their study they found that the internet provided greater information attainment than physical stores and catalogs, that physical stores provided greater price comparison and product possession than the internet, and found no difference in product assortment seeking across channels. Of significance to this study, both utilitarian and hedonic benefits have been shown to influence the choice of retail channel (Alba, Lynch et al. 1997).

Note that the perceptual impact focuses strictly upon perceived value as the impact that retail channel atmospherics have on a shopping activity. This is done even though other outcomes, such as satisfaction, also may be impacted by retail channel atmospherics (Al-Gahtani and King 1999; Frokjaer, Hertzum et al. 2000). While user satisfaction is probably the most studied construct in information systems, it still is not well-defined and does not have a well-articulated theory relating it to information system success (Woodruff and Burg 2002), giving ample room for the development of an IS satisfaction theory (Khalifa and Liu 2004). Comparable comments have been made in the consumer research literature. Szymanski and Henard (2001) report in a meta-analysis of customer satisfaction studies, that while there is a positive correlation between satisfaction and repurchase intent, it is not robust since it is based only on the few studies available in the literature. Heskett, Sasser; and Schlesinger (1997) also note that the link between satisfaction and loyalty to return has not proven reliable in recent research. Because of these difficulties with the construct of satisfaction, it has not been included as an outcome in this study.

In summary, there is good support for the use of perceived hedonic and utilitarian value as a shopping activity outcome measure, and as a factor in consumer channel choice.

2.3.2 On-line Consumer Behavior

In the physical retail setting, consumer behavior has been the most common dependent variable in studies of atmospherics (Turley and Milliman 2000). In spite of this, and several years experience with Web retailing, it is only recently that researchers have begun to model on-line individual consumer behavior (Bucklin and Sismeiro 2003; Charrerjee, Hoffman et al. 2003). As a result, some researchers have characterized the study of on-line consumer behavior as still in the exploratory stage (Ranaweera, McDougall et al. 2005). Part of the motivation for investigating on-line consumer behavior comes from the recognition that retail Web sites are more than a unidirectional communication channel. For example, when a consumer clicks a hyper-link, enters a search term, adds an item to a virtual shopping cart, or purchases an item, he or she is interacting with a software application. If that interactivity is in response to specific elements of the design of a Web page, then the resulting behavior is of particular interest to this study. Other researchers have commented on the importance of interactivity to the internet. From a marketing perspective, the interactivity of new media, such as the internet, is its distinguishing (Peters 1998) and "most interesting and novel attribute" (Stewart, Pavlou et al. 2002, p.25), and makes it more powerful than other media (Hofacker and Murphy 2005). In the context of e-commerce, Palmer (2002) hypothesizes that interactivity leads to more successful Web sites. Having established the importance of interactivity, and its resultant on-line behavior, we can now consider possible sources of behavioral data.

The analysis of Web server log files can typically provide the date, time, and URL of the Web page requested by the user, the Internet Protocol (IP) address and domain name of the computer requesting the page, and in some instances, the previous Web page visited (Hofacker and Murphy 2005). From this data, it is possible to track a user's navigation through a Web site by placing into time sequence the pages visited and the time spent on each page. In general, server logs provide relatively coarse data, with little insight into a user's response to design elements that may be present on a particular Web page. Server log files are normally considered a form of data that is site-centric (Mullarkey 2004) since it best provides information pertaining to the Web site as a whole rather than one particular user's experience with the site. Due to its site-centric nature, analysis of server log files would not be appropriate for the objectives of this study.

At the other end of the spectrum, eye tracking has been suggested as a user-centric method of data capture that avoids problems commonly associated

with self-reporting by the test subject in usability studies (Schiessl, Duda et al. 2003). In an example more closely aligned with the objectives of this study, eye tracking has been used in the study of internet search tasks (Goldberg, Stimson et al. 2002). The strength of eye tracking is that it gives very detailed information of what the test subject views on a page. The major issue with eye tracking is that it requires a laboratory environment with sophisticated instrumentation, which could reinforce on the test subject that they are participating in an experiment in an artificial environment.

Moving to a less intrusive technology, Bucklin et al. (2002) have identified click-stream data as having the potential to help researchers increase their understanding of consumer search. One of the benefits they identified was that in addition to information pertaining to products purchased, click-stream data provides information about products that were examined, but not ultimately purchased. It is possible that this type of data may provide insight into why many consumers search for product information on-line, but do not go on to purchase on-line (Chiang, Dholakia et al. 2005).

Moe (2002) provides an example of the type of analysis that is possible on the click-stream data of on-line customers using retail Web sites. From her cluster analysis of click-stream data she found that: 1) consumers can be categorized as having either a directed or an exploratory search (information seeking) strategy, and 2) that consumers in each category respond differentially to page layout. The cluster that was attributed to the exploratory search (browsing) was characterized by consumers viewing a higher variety of category level pages, compared to the cluster attributed to directed buying. The consumers in the directed buying cluster also viewed a lower variety of pages and the pages viewed tended to be centered upon one product. More recently, click-stream and demographic data was used to examine the relationship between online search and online purchase behavior (Awad, Jones et al. 2006). In that study, the depth and breadth of pre-purchase information seeking was examined, with the findings that increased depth and decreased breadth were associated with increased purchases.

More specific data from the user's interaction with specific design elements of a Web page can be generated using technology developed by the United States' National Institute of Standards and Technology (www.nist.gov/webmetrics). Using the N.I.S.T Web Metrics technology, it is possible to generate click-stream data from all the mouse clicks, and keyboard data entries made as a user interacts with individual design elements, and navigates across pages or a Web site. The N.I.S.T. Web Metrics technology is server based, resulting in remote capture of the click-stream data without modification of the test subject's computer or software installation. Capturing mouse and keyboard interaction data represents a significant enhancement of the data over that available to Moe (2002) or Awad, Jones et al. (2006).

In summary, click-stream data is capable of providing a relatively fine - grained level of data of a user's interaction with a Web site without requiring laboratory instrumentation, or being intrusive on the user.

2.4 Theoretical Model

The activity-channel lens outlined in section 2 above is a general perspective on the consumer buying process and is utilized to shape the structure of this study's theoretical model. Recall that the purpose of this research investigation is to investigate ways of modifying Web atmospherics to better support consumers in their pre-purchase information seeking activities. As such, the shopping activity under investigation is information seeking (browsing and searching) and the retail channel is the Web.

Figure 2.2 illustrates the study's theoretical model. This instantiation of the activity-channel lens is based on the following sections of the literature review that describe how consumers can undergo two broad modes of information seeking (browse and search); how information presentation and information focus are two atmospheric variables of the Web retail channel that influence a person's shopping activity; and how consumer perceived value has both hedonic and utilitarian elements. As an illustration, the figure shows how the value perceived (hedonic and utilitarian) by a consumer searching or browsing a retail Web site is moderated by that site's Web atmospherics (information presentation and information focus).

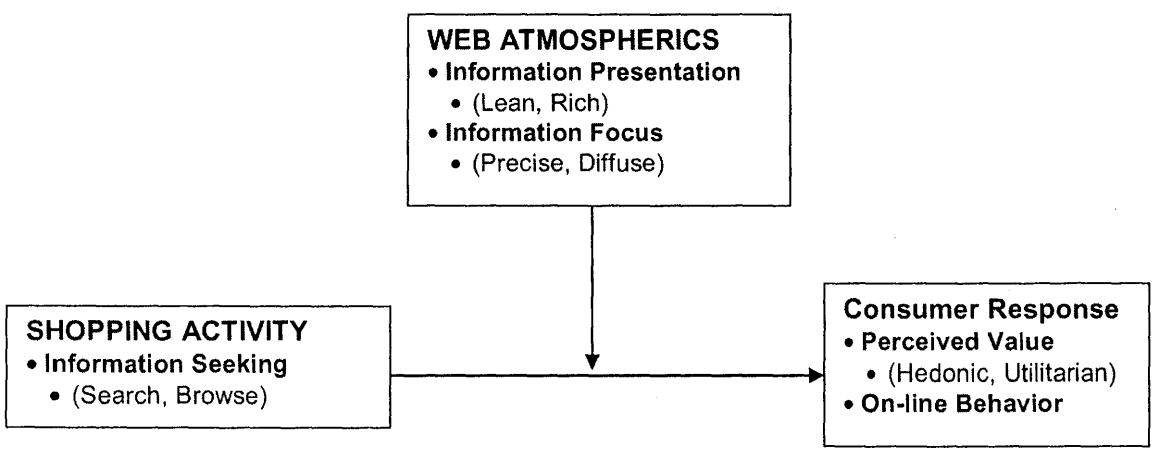

Figure 2.2 The Study's Theoretical Model

The next two sections examine in detail the information seeking activities of browsing and searching, and the Web atmospherics of information presentation and information focus.

2.5 Information Seeking

The focus of this research is on one particular activity in the consumer shopping process: information search. Although 'information search' is a commonly used term in consumer behavior literature, it is perhaps best altered to that of 'information seeking' to better accommodate the distinction between searching and browsing as separate modes of information seeking (Marchionini 1995). Doing so avoids the confusion that may be invoked by the dual meanings of the word 'search' in the context of 'information search' as encompassing both searching and browsing activities.

A further conceptual difficulty arises from Kotler's (1995) consumer buying process model, in that consumer behavior is largely described as goal-directed, and suggesting that information seeking is primarily a directed activity. This description ignores browsing as an activity where the objective is not necessarily the formation of buying intentions, but rather is a form of recreational information seeking (Bloch and Richins 1983). Hence, this study suggests that browsing and searching be viewed as two modes of the consumer pre-purchase information seeking activity. Here, **searching** refers to occurrences when consumers actively seek out product information with a view to make a decision. Shopping in this sense is more goal-oriented or utilitarian in nature (Wolfinbarger and Gilly 2001). In this mode, consumers often know what they are looking for and usually possess some information about the product being sought, such as its brand or manufacturer's name, that can be used as the basis of a specific search (Berthon, Hulbert et al. 1999). In contrast, **browsing** is performed when shoppers have a less precise view of the information that might be available and are not sure of whether or how their requirements can be met (Rowley 2000). A more conceptual view of browsing describes it as an activity in which one gathers information while scanning an information space without an explicit objective (Toms 2000).

A summary of the discriminating characteristics of searching and browsing is presented in Table 2-1 below. As Table 2-1 shows, browsing is composed of a number of observable behaviors, but it is important to recognize that no single characteristic defines browsing completely (Jarboe and McDaniel 1987). The table contrasts searching and browsing across pre-purchase information seeking characteristics.

Table 2-1. Discriminating Characteristics Between Searching and Browsing

Information Seeking Characteristic	Search	Browse
Problem definition	Well-defined	Ill-defined (Marchionini and Shneiderman 1988)
Specificity, or articulation of goal, product preference	Goal definition is important (Marchionini 1995)	General or informal goals may change during browsing (Marchionini 1995); no specific target (Spence 1999)
Motivation or outcome	Pre-purchase information seeking to make better purchase decisions (Bloch, Sherrell et al. 1986)	Recreation, fun, pleasure (Bloch, Sherrell et al. 1986); discover, learn (Marchionini 1995)
Decision criteria	Preference matching; alternative based (Chernev 2003)	Attribute based (Chernev 2003)
Navigation style	Goal oriented, systematic (Marchionini 1995)	Informal, opportunistic (Marchionini 1995)
Timeframe of purchase intention	Immediate or near term	Immediate, later, or not at all (Bloch, Sherrell et al. 1986)
Susceptibility to impulse purchases	"Mission shoppers" 40% of total, no unplanned purchases (Ruiz, Chebat et al. In Press)	Browsers are more susceptible than non-browsers (Jarboe and McDaniel 1987)

To summarize Table 2-1, searching typically occurs when the consumer has a well-defined goal or objective, is planning to make a purchase, and is systematic in his or her information seeking. In contrast, a consumer that is browsing would not necessarily have a goal other than enjoyment; if a purchase is made, it is unplanned, and the consumer is likely opportunistic in his or her information seeking.

While the above discussion gives support for positioning searching and browsing as distinct theoretical constructs, it is worthwhile to ask what value is gained by making this distinction. That is, does expanding the definition of information seeking to comprise both browsing and searching have implications for marketing strategy? One way in which the distinction between browsing and searching could be deemed relevant, is if distinguishing between these two modes would result in two viable market segments. To assist in the determination of whether two viable market segments exist, a set of criteria for assessing market segments can be adapted from Kotler (1995). According to Kotler's criteria, searching and browsing would constitute viable market segments if they

were shown to be: 1) measurably identifiable distinct behaviors; 2) substantial and of value; 3) accessible in terms of being able to effectively reach and serve the target segment; 4) differentiable in terms of consumer reaction to marketing initiatives; and 5) actionable (i.e., they can be reasonably or practicably influenced). Table 2-2 summarizes the criteria needed to segment information seeking into searching and browsing modes, and any direct support found in the literature.

Table 2-2. Criteria for browsing and searching to be considered viable market segments

Criteria	Support
Measurably identifiable behavior	• Able to determine information seeking mode via cluster analysis of types of Web pages viewed (Moe 2002)
Substantial, valuable segment	• 83% of internet users have performed a search for product information on-line (Madden 2003) • Browsers make more impulse purchases (Beatty and Ferrell 1998)
Accessible	• In 2003, 63% of adult Americans were on-line (Madden 2003)
Differentiable	• No direct support found
Actionable	• No direct support found

It is significant that direct support was not found in the literature for the criteria of differentiable or actionable for on-line shoppers. This gap in the literature highlights two of the operational objectives of this study: 1) to determine from the literature those stimuli *likely* to produce a differential effect; and 2) to test these stimuli experimentally on a simulated retail Web site to determine their actual effect. In summary, the first three criteria of market segmentation have been met, and this study seeks to answer the criteria of differentiable and actionable. In doing so, this study demonstrates that searching and browsing are viable segments. By showing that searching and browsing are viable market segments, a contribution to practice can then be inferred.

The next section examines retail shopping channels, and the salient characteristics of the Web retail channel.

Moving from the premise that from the consumers' perspective, retail channels are not equivalent, it follows that shopping activities need to be examined within the context of the retail channel of interest.

2.6 Web Retail Channel

The World Wide Web is a relatively recent consumer channel choice option, that has been suggested as a potential replacement for catalog sales (Ward 2001). Although American Web retail sales for the fourth quarter of 2005 increased by 23.0% over the previous year, Web retail sales were still only 2.8% of total retail sales. On an annual basis, Web retail sales have shown a slow but steady relative increase from less than 1% of total retail sales in 2000, to 2.8% in 2006 (Bureau 2006). These statistics, when viewed in conjunction with the report that 63% of the U.S. adult population were on-line in 2003 (Madden 2003), suggests that there is still a significant opportunity for improvement of the consumer's on-line experience. One possible way to identify areas where the on-line experience can be improved is to look at the factors that might influence the consumer's preference or choice of one retail channel over another.

As noted above, Alba, Lynch et al. (1997) provided one of the earliest, authoritative commentaries on the factors that could impact retail channel choice; since then other researchers have added to the list of potential factors. Devaraj, Fan et al. (2002) propose that preferences for on-line versus conventional retail channels are based on consumers' level of comfort with the use of the technology, the cost of executing the transaction, and the quality of service provided. Black, Locket et al. (2002) propose that channel choices for financial services, which have a long history of multi-channel availability, are influenced by consumer confidence, lifestyle considerations, motivations and emotional responses. Reardon and McCorkle (2002) presented a model in which the relative opportunity costs of consumer time, product price, pleasure from the shopping activity, perceived value of the goods, and perceived risk all influence the choice of a channel. What these studies do not do is suggest a consensus in the factors that influence channel choices, but do demonstrate that consumers perceive differences among retail channels.

Recall the earlier discussion demonstrating support for atmospherics as a viable construct; the next section reviews the translation of atmospherics from the physical retail environment to the internet, in the form of Web atmospherics.

2.6.1 Web Atmospherics

As a retail channel, the Web can be considered a hypermedia computer mediated environment (Hoffman and Novak 1996). As such, what aspects of the Web environment could be considered as Web atmospherics?

Researchers have approached this question from a number of perspectives. Lohse and Spiller (1998; 1999) used categories largely adapted from the physical retail environment, namely merchandise, service, promotion, convenience, checkout, and navigation. Similarly, McKinney (2004) also adapted physical retail atmospheric categories, in this case from Turley and Milliman

(2000). A number of researchers have taken a more abstract approach. Sautter, Hyman and Lukosius (2004) proposed using the categories of vividness, interactivity, symbolism, and social elements. Eroglu, Machleit et al. (2001) introduced a task relevancy taxonomy. Richard (2005) grouped Web atmospherics into those that are central (structure, organization, informativeness, effectiveness and navigational characteristics) with entertainment as a peripheral atmospheric.

It would appear from the above discussion that a consensus has not been reached on the conceptualization of Web atmospherics. One way to get at this challenge is to consider that in the physical retail environment, the study of atmospherics allows you to form the following research question: assuming that the inventory or product catalog available for sale in a retail store is held constant, what other factors can be manipulated to have an impact on consumer perceptions and behavior? To adapt this question specifically to the Web retail channel, recall that as a hypermedia computer mediated environment, all information passes to the consumer via the display device (Hoffman and Novak 1996). Thus, if one considers holding constant the information content displayed on the Web interface (just as the inventory or product catalog were held constant for the above-mentioned scenario), then an investigation of Web atmospherics would rephrase the above question as: assuming that the information content of a Web site is held constant, what are the Web atmospherics that can be manipulated to have an impact on consumer perceptions and behavior (Dailey 2004; Eroglu, Machleit et al. 2001; Eroglu, Machleit et al. 2003)?

If, as suggested, information content is held constant, it could then be argued that two possible Web atmospheric categories would center around: 1) how information is presented, and 2) how information is focused, that is the level of granularity in which information is presented on a Web page. As described in the next section, information presentation generally pertains to how information is presented on a Web page, and information focus pertains to the granularity of information present on a Web page.

2.6.1.1 Information Presentation

Lim and Benbasat (2000), as well as Egoglu et al. (2001; 2003), base their conceptualization of information presentation on media richness theory (Daft and Lengel 1986; Daft, Lengel et al. 1987). Media richness theory asserts that media can be characterized as being high or low in richness based on the capacity of the media to facilitate shared meaning. More specifically, the characteristics of a media that define its richness are the number of cues and channels utilized, and capacity for feedback (Daft and Lengel 1986). While media richness theory was designed to facilitate investigations across multiple media, the needs of the above two research teams required them to adapt media richness theory to varying presentations of information within a single computer-based media

channel. That is, they used information presentation (derived from media richness) to compare different presentations within one media. In addition, both teams chose to use a nomenclature of lean and rich to describe variance in information presentation.

The basis for considering information presentation as a Web atmospheric is derived from the assertion that the format of presented information can impact information evaluation performance, and users' attitudes and behavior when it matches the task (Huang 2003; Vessey 1991).

For this investigation, **information presentation** (IP) is defined as the format in which information is displayed. Using the nomenclature of Lim and Benbasat (2000) and Ergolu (2001; 2003), this investigation proposes that information presentation on a Web retail channel varies from lean to rich. In the Web context, text, formatting of text, icons, images, interaction and response of the Web application all would impact media richness, and therefore contribute to the communication of information between a consumer and the Web application. The information content can be the same, but by using a richer presentation a more nuanced meaning can be communicated. Consistent with the above studies, examples of *lean* information presentation would be plain text, with metadata and query results presented in a simple list format. Examples of *rich* information presentation would be formatted text (e.g., use of font, color, etc.), graphics and images (Hong, Thong et al. 2004), and metadata and query results presented in a multi-dimensional format (i.e., two and three dimensional representations rather than simple lists) (Hearst, Elliott et al. 2002).

Examples of different forms of information presentation have been seen in investigations of the relative impact of graphical versus textual presentations of the same information (Hong, Thong et al. 2004; Jarvenpaa and Dickson 1988; Tan and Benbasat 1993; Vessey 1991).

2.6.1.2 Information Focus

Another consideration beyond information presentation on a Web site is the variety of information that appears on a Web page. This arises from a constraint of Web design, which is that in its current state of implementation is a page-based medium. As with printed catalogs, designers must determine how and what information is assigned to specific pages.

For this investigation, the granularity of the information made available on a Web page is termed **information focus**. This conceptualization of information focus is adapted from MacMullin and Taylor (1984) and Taylor (1986), who define focus as an information trait continuum ranging from 'precise' to 'diffuse' information. Marchionini (1995) states that the representation of information at appropriate levels of granularity is especially critical when browsing. Marchionini provides a document-based example of granularity where a coarse level of granularity (diffuse focus) would be comprised of titles, table of contents,

headings, and reviews, compared to a fine-level (precise focus) which would be full text. It has also been suggested that in the context of making business decisions, that across the various media found in a business environment, it is important to match the appropriate level of information granularity to the type of decision being made (Haag, Baltzan et al. 2006). In terms of on-line information seeking, browsers favored category level maps (a more diffuse focus since it presented multiple categories), where searchers favored simple lists (a more precise focus since it presented only items specific to one category) (Chen, Houston et al. 1998).

Bringing Marchionini's example to the context of the internet, a Web page can therefore be designed to be precise or diffuse in its focus. We can say, for example, that a Web page is more *precise* in focus when it pertains to a single product and provides extensive information about that product, and is more *diffuse* in focus when it provides a broader range of information about a larger number of products, such as category level information. A *category* in this context refers to a group of related products, such as DVD players or digital cameras. A *category-level page* (i.e., more diffuse) would therefore contain information about a number of different brands and models of products, but all belonging to the same product category. A *product-specific page* (i.e., more precise) would provide extensive information about a single product, (i.e., only one specific brand and model). To illustrate information focus as a Web atmospheric, consider the design of a Web page. It would be possible to have two sites with the same overall content, but have differing information focus at the page level, and thus be operationally different.

Although they did not use the term information focus, other researchers have also found it useful to categorize retail Web pages based on whether they pertained to a specific product or a product category. One such categorization grouped pages into administrative, informational, or shopping categories, and further divided the shopping category into whether they were category level or focused on a specific product (Moe 2002).

With the theoretical model fully specified, the next section develops research hypotheses for this study.

3 RESEARCH HYPOTHESES

This section integrates key findings and discoveries from the literature review described in the previous section, resulting in research hypotheses based on the workings of the theoretical model.

3.1 Research Questions

This section outlines the hypotheses in this study. The first sub-section concerns the impact of information presentation and information seeking mode (ISM) on perceived hedonic and utilitarian value. The second sub-section concerns the impact of information focus, information presentation and information seeking mode on on-line consumer behavior. Because the literature does not support the prediction of an interaction among information seeking mode, information presentation, and information focus, no three-way hypotheses are advanced.

Before discussing the hypotheses in detail, there is a need to describe the task-fit model that will aid in the development and justification of this study's hypotheses. The underlying premise of task-fit models is that when there is a fit between the task performed and the characteristic being studied (such as a technological characteristic or cognitive characteristic), the outcome of the task improves. Conversely, when there is a lack of fit, the task outcome declines. Examples of task-fit models are: information format-task (Bettman and Kakkar 1977), task-technology fit (Goodhue 1998; Goodhue and Thompson 1995) and cognitive fit (Umanath and Vessey 1994; Vessey 1991). An example of using cognitive fit to examine the relationship between task type (internet search) and information format was presented as research in progress at a recent conference (Niu and Winter 2006).

From the perspective of a task-fit model, viewing searching and browsing as distinct tasks is consistent with the earlier discussion of the differences between searching and browsing. Taking this perspective, the implication is that it would not be possible to add the functionality needed to support browsing to that required for searching without incurring a negative impact on searching. Support for this perspective is found in studies that show that adding unnecessary functionality leads to cognitive overload (Stanton, Correia et al. 2000), disorientation (Otter and Johnson 2000) and distraction (Mayer, Heiser et al. 2001). That is, the functionality required for browsing may be incompatible with that required for searching.

The application of task-fit theory to this study's hypotheses also provides a symmetrical structure on which to base predictions. For example, for those cases where there is an expected good fit between a task and the experimental

condition, hypotheses will describe a task outcome improvement. Likewise, when fit is poor, task outcome will decline.

3.1.1 Perceived Value Hypotheses

First considering the impact of information presentation and searching on perceived value, this study proposes that as information presentation is varied from lean to rich, the value perceived by an on-line consumer who is searching would decrease.

This prediction emanates from lean information presentation having a good task-fit with searching. Recall from Table 2-1 that searching can be characterized as a behavior where the goal or objective is specified. Empirical results show that when the goal or objective can be specified, leading to an unambiguous decision process, lean information is preferred (Lim and Benbasat 2000).

Subjects have also reported lower satisfaction levels when searching a retail Web site with rich information presentation (Eroglu, Machleit et al. 2003). This lower level of satisfaction suggests a lower level of perceived hedonic value. The link to hedonic value is based on the view that satisfaction is considered an emotion, that results from an appraisal of an experience, (Babin and Griffin 1998) with that appraisal varying along a hedonic continuum (Mano and Oliver 1993).

For the purposes of hypotheses development, Table 3-1 presents the specifications for a lean and a rich Web site. The specifications are consistent with the earlier theoretical definition of information presentation.

Table 3-1. Operationalization of Information Presentation on a Web Site

Web Design Element	Lean Information Presentation	Rich Information Presentation
Text format	Plain text	Text formatting, highlighting, line spacing, bolding, italics, color
Fonts	Single font for all text	Varied font and font sizes
Graphics	No graphics	Extensive usage
Product images	No images	Product images

Accordingly, the following hypotheses are proposed for the interaction between search information seeking mode and information presentation:

H1: On-line consumers who are in a search information seeking mode and use a retail Web site with a lean information presentation, compared to those who use a site with a rich information presentation, will report:

H1a: higher levels of perceived hedonic value;

H1b: higher levels of perceived utilitarian value.

Conversely, when browsing, the opposite outcomes are predicted. This prediction is based on rich information presentation having a good task-fit with browsing. Recall from Table 2-1 that browsing can be characterized as a behavior in which goals and objectives are not specified, and where there are many possible solutions. Empirical results show that a rich information presentation is preferred when the decision process is ambiguous (Lim and Benbasat 2000), and when there are many possible answers to an information seeking task (Woodruff, Rosenholtz et al. 2002).

In the absence of results specifically describing the impact of lean information presentation on browsing outcomes, task-fit theory suggests that those outcomes would be reduced.

Consequently, two additional hypotheses are proposed for the interaction between browse information seeking mode and information presentation:

H2: On-line consumers who are in a browse information seeking mode and use a retail Web site with a rich information presentation, compared to those who use a site with a lean information presentation, will report:

H2a: higher levels of perceived hedonic value;

H2b: higher levels of perceived utilitarian value.

Figure 3.1 summarizes hypotheses 1 and 2, in addition showing that a larger response is expected in hedonic value compared to utilitarian value

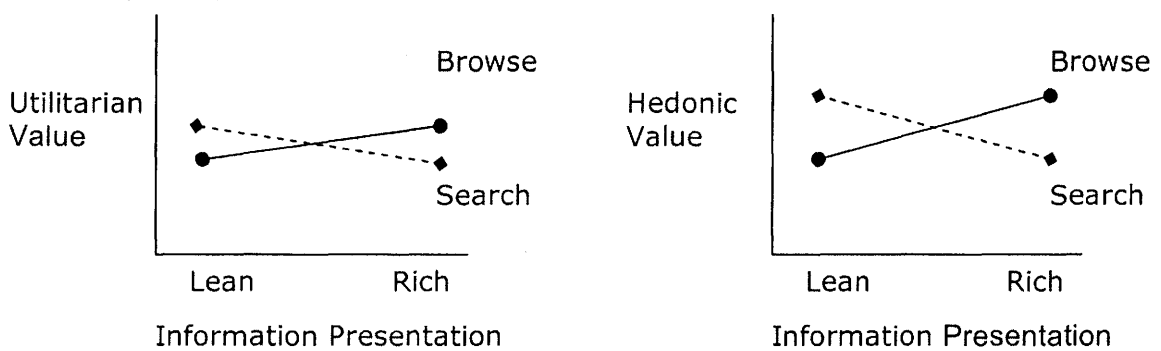

Figure 3.1 Hypothesized Information Presentation Response

There is evidence that in general on-line consumers like graphics, icons, and pictures that provide visual clues with richer information (Fang and Salvendy 2003), which contradicts H1a and H2a. To address this dichotomy a main effect is predicted for information presentation:

H3: On-line consumers will rate a rich Web site higher in hedonic value compared to a lean Web site.

3.1.2 Behavioral Hypotheses

An objective of this study is to provide specific design information to practitioners. To that end, hypotheses are presented relative to specific types of Web pages, and to design elements commonly found on product-specific Web pages. In general, this study proposes that consumers who are browsing compared to consumers who are searching will preferentially choose to view diffuse information focus pages, and utilize diffuse information focus design elements. Conversely, consumers that are searching will preferentially choose precise information focus pages and use precise information focus design elements. These predictions emanate from the task-fit model. Recall from Table 2-1 that consumers who are searching, seek specific information, while browsers lack specific objectives and tend to consider a broad range of information. Also, recall that a diffuse focus Web page contains broad information about a number of products, and a precise focus page contains extensive information about a single page.

Support for these predictions can be found in Marchionini's (1995) document-based example. Marchionini says that an information seeker browsing across documents would examine titles, tables of contents, headings and reviews to determine if a document is of interest. Then, if the information seeker wants to determine if the document contains relevant information, he or she would examine the full text of the document. In other words, when the information seeker is browsing he or she may prefer and use information representations that have a diffuse focus, but switch to representations with a precise focus when searching.

In the context of the internet, Moe (2002) found that consumers who are searching tend to view retail Web pages specific to a particular product with a higher frequency than consumers who are browsing. In addition, consumers who are searching tend to view a lower variety of category level pages than consumers who are browsing. Information focus related consumer behaviors and shopping activities have also been seen in conventional retail settings. For instance, Ivengar and Lepper (2000) showed how a kiosk display in a physical grocery store, which presents all of its information content within a single view in the same manner as a category level Web page does, can influence a consumer's browsing and purchasing behavior. Specifically, when a large number of products within a single category were displayed in the kiosk, more

consumers stopped but fewer purchases were made, implying an increase in browsing behavior due to a broad information focus.

Using the earlier definition (see section 2.6.1.2) of Web shopping pages as product-specific or category-level, it is expected that:

H4: On-line consumers who are in a search information seeking mode, compared to consumers in a browse information seeking mode, will view:

H4a: a higher number of product-specific pages;

H4b: a lower number of category-level pages;

H5: On-line consumers who are in a search information seeking mode, compared to consumers in a browse information seeking mode, will spend:

H5a: a longer amount of time viewing product-specific pages;

H5b: a shorter amount of time viewing category-level pages.

It is common for product-specific Web pages to present the consumer with options to view additional information pertaining to that product, as well as navigational hyper-links to other related products. The literature does not provide empirical results on what behavior a consumer might exhibit when interacting with discrete design elements due to the interaction between information seeking mode and information focus. In this situation, the task-fit model can provide some insight. Three common design elements under consideration are: product features, product reviews and hyper-links to related products. Features and product reviews provide more extensive or a greater depth of information about a specific product, and therefore could be considered to have a more precise information focus. Hyper-links present information about related products, and like category-level pages could be considered to have a more diffuse information focus. Based on these intuitions:

H6: Consumers who are searching, compared to consumers who are browsing, will:

H6a: view the features of a specific product with increased frequency;

H6b: view product reviews of a specific product with increased frequency;

H6c: follow hyper-links to related products with decreased frequency.

In addition to the specific behavioral hypotheses H4, H5, and H6, it is also expected that an overall pattern of behavior due to information seeking mode will be evident when a shopping session is considered in its entirety. Moe (2002) found that consumers can be placed into five categories of shopping activity

based upon the behavioral metrics captured on a retail Web site. Two of these categories were identified as being directed search, and exploratory search (information seeking) strategies. The behavioral metrics used by Moe included: total number of pages viewed, the proportion of pages by page type (product, category, search, informational, and home), number of unique products and categories viewed, number of products and categories that are repeat viewed, the proportion of product and category pages that are unique, the ratio of unique products to unique categories, the maximum number of times any one product was viewed, and average time spent per page (Moe 2002; Moe, Chipman et al. 2003) (See Appendix A for a detailed list of behavioral metrics).

Because Moe's (2002) study was of large commercial Web sites, she did not have access to what motivation a consumer had when exhibiting a specific behavior. As a consequence Moe was only able to attribute the behavior to directed or exploratory search, but was not able to show the direct causal linkage between information seeking mode and behavior. Moe's study points to a difficulty with the study of searching and browsing, namely that when searching and browsing are defined in terms of observed behavior, then when that behavior is observed, it is by that definition searching or browsing. To avoid this circular argument it is necessary to start with the consumers' intention, their information seeking mode, and determine if their intention leads to searching or browsing behavior.

Therefore, in addition to showing that an overall pattern of search and browsing exists, this study extends Moe's work by determining if a causal link exists between information seeking mode and behavior. Adapting and extending the behavioral metrics used in Moe (2002; 2003), it is proposed that:

Proposition 1: With respect to the broad array of behavioural metrics listed above, consumers who are searching will exhibit behavior that is distinct from consumers who are browsing.

Information presentation is also expected to have a main effect on behavior. This hypothesis extends Hypothesis 3. To the extent that graphics and images increase interest and involvement, it is predicted that:

H7: Consumers who are exposed to a rich, compared to a lean Web site will:

H7a: view a higher number of pages,

H7b: have a longer total session time.

Having outlined this study's proposed interactions, the next section will describe the methodology used to experimentally test the above hypotheses.

4 METHODOLOGY

This section details a fixed effects experimental design, and the methodology used to recruit and randomly place test subjects into four experimental treatments. The operationalization of information presentation and information seeking mode is described, followed by the manner in which they are combined into the experimental treatments.

4.1 Population of Interest

Consumers who are experienced internet users and on-line shoppers are the population of interest for this study. These requirements are consistent with this study's objectives since the study does not concern methods for attracting new on-line shoppers from the general population. Test subjects recruited for this study were drawn from the McMaster University student population. Recruiting test subjects from the university population provided a reasonable sample of the population of interest, since over 80% of the 18-29 age group had internet experience, and over 60% of internet users had made at least one on-line purchase (Madden 2003). In terms of this study, the test subjects had higher scores with over 98% having used the internet for more three years, and over 80% having made an online purchase in the last year.

4.2 Randomized Experiments

A randomized experimental design was selected for this study for two reasons. First, because this study aims to develop and test theory that can inform design, it is desirable to show that a causal relationship exists between the constructs under investigation. Given that objective, the experimental method is the preferred research design to show causality (Montgomery 2001; Shadish, Cook et al. 2002). The second factor relates to the idea that the level of understanding in a research area also can influence the selection of a research design (Shadish, Cook et al. 2002). For example, an exploratory research design would be more appropriate in a nascent research area, while a fixed or random effects experimental design would be better suited to a well-established research area. Where this study is concerned, most of the constructs are adapted from the literature; co-relational studies have identified some of the potential relationships between the constructs; and a number of Web site design elements have been identified that could influence the on-line consumer. What has not been shown is whether the causal relationships hypothesized earlier exist, whether Web site design elements identified via questionnaires do have consumer impact, and whether new constructs proposed by this study advance theory. It can be seen, therefore, that an experimental design will improve understanding in this research area.

More specifically, the experimental design that was used was a fixed effects between subjects factorial design since this design provides an efficient method for screening a number of factors experimentally (Montgomery 2001). The experimental design called for the manipulation of both information seeking mode and information presentation. Both perceived value outcomes and behavioral metrics were collected at each experimental run.

4.3 Operationalization of Independent Variables

This section details the operationalization of the experimental factors: information seeking mode and information presentation.

4.3.1 Information Seeking Mode

Recall that information seeking is comprised of two modes: searching and browsing. Test subjects were given pre-test instructions designed to place them into one of these two modes. Invoking the required mode can be problematic as Toms (2000) notes in her work on user browsing and search behavior in on-line contexts. She states that experimental situations trying to emulate browsing scenarios are often invoked by giving test subjects 'fuzzy' questions that are open-ended in nature. Such browsing tasks, like searching, still have identifiable goals, which could result in compromises in the comparisons of the results across an experiment's browse and search tasks. To address this issue, Toms suggests that browse activities should be invoked by giving test subjects process instructions without specific objective outcomes. In contrast, search activities should be invoked by giving test subjects instructions that clearly identify a specific goal or end point.

To invoke the browse activity, participants were told the following:

> "Look through whichever section of the on-line store you find of interest, using whichever of the provided functions of the Web site you find appropriate. You are to browse around the Web site (i.e., window-shop). When you have a good idea of what the Web site offers, or are satisfied that you have browsed the site sufficiently, return to this page (Home) to indicate that you are done shopping".

To invoke the search activity, participants were told the following:

> "Assume your intent is to purchase a camera. Search the on-line store to find a camera that you want to potentially purchase, using whichever of the provided functions of the Web site you find appropriate. When you have identified a camera for potential purchase, or have determined that you do not wish to search further, return to this page (Home) to indicate that you are done shopping".

In view of potential difficulties invoking browsing, an appropriate manipulation check was included in the experimental analysis (see section 6.3)

4.3.2 Information Presentation

Information presentation was operationalized by selecting Web design elements on the basis of their contribution to information presentation. Recall from Table 3-1 that information presentation was operationalized through manipulation of text font, format and color, and the inclusion/exclusion of graphics and images. This operationalization is consistent with the earlier definition of plain unformatted text with minimal use of graphics as a leaner information presentation, and formatted text, use of varied font, colors and graphics as a richer presentation. Due to the conceptual similarity between formatting and product images, these two variables were confounded so that the treatment representing lean information presentation had simple formatting and no product images (see Appendix B - Experimental Web Site Variants), and the rich information presentation had complex formatting and product images (see Appendix B - Experimental Web Site Variants). Confounding text formatting, font, etc. and the use of images is also consistent with common practice on Web sites, and so should not have alerted the test subjects to the experimental manipulation.

4.3.3 Experimental Treatments

The basis of a factorial experiment is that a treatment is created for each of the combinations of factors being manipulated. In this study, there were two factors being manipulated: information seeking mode and information presentation. Each factor had two levels. This resulted in a 2x2 design with four treatments. Information presentation was manipulated on the experimental Web site, giving two variations of the experimental Web site. The variations were comprised of the two levels of information presentation (lean and rich). These two variations of the experimental Web site are summarized in Table 4-1.

Table 4-1. Experimental Web Site Variants

	Information Presentation
Lean	Plain text, no graphics
Rich	Formatted text, varied fonts, and increased graphics

Information seeking mode was manipulated by giving each of the test subjects instructions that placed them into either a browsing or a searching information seeking mode (see section 4.3.1). These two information seeking modes together with the two Web site variants resulted in four experimental treatments. Table 4-2 summarizes the four experimental treatments.

Table 4-2. Factorial Experimental Treatments

Experimental Treatment	Information Seeking Mode	Information Presentation
1	Browse	Lean
2	Browse	Rich
3	Search	Lean
4	Search	Rich

4.4 Operationalization of Dependent Variables

Perceived hedonic and utilitarian value were operationalized using the survey instrument developed and validated by Babin, Darden and Griffen (1994) and Babin and Darden (1995). See Appendix C for the post-test survey questionnaire. Subsequent studies utilizing these two measures have shown acceptable reliability of the scales (Babin and Babin 2001; Babin and Darden 1995; Jin and Sternquist 2004).

Appendix A details the behavioral metrics measured directly, and calculated for each run of the experiment. As noted, the metrics pertaining to the type of page viewed, and variety of pages viewed were from Moe (2002; 2003), with the names of the metrics modified.

4.5 Recruitment of Test Subjects

Test subjects were recruited from the university population at large via notices, email announcements, and class announcements. Inducement to participate was provided in the form of a $10.00 gift certificate.

4.6 Procedure

While the design and implementation of the experimental environment permitted running the experiment remotely, all experimental runs took place in a computer lab located at the DeGroote School of Business at McMaster University. Running the experiment in a lab was for reasons of convenience as well as aiding preservation of test subject anonymity since there would not be a record of the test subject's computer IP address, or the need to collect contact information for the distribution of incentives.

Test subjects were booked at one half hour intervals, with anywhere from one to twelve test subjects participating simultaneously. Computer work stations were logged on with the investigator's user ID, with a randomly generated start page opened in the Web browser.

Test subjects were greeted by the investigator, invited to select any of the open workstations, and instructed that they could start at his or her own time by following the onscreen directions.

Each subject was then guided through the experimental procedure outlined in Section 5.3.3.

At the completion of the experimental procedure, the investigator thanked the test subjects for their participation and presented them with a ten-dollar gift certificate from the University Book Store.

The investigator then cleared the session cookies on the workstation, and reloaded the start page so the workstation was available for the next participant.

4.7 Ethics

Approval was obtained from the McMaster University Research Ethics Board for the use of human participants in an investigation of Web-based product-related information display to support various users' information seeking modes.

5 RESEARCH TOOL

This section details the research tool that was developed to simulate a real-life consumer shopping environment for test subjects to utilize.

The tool facilitates the manipulation of experimental variables and incorporates a reasonable-sized product catalog that mimics a real-life shopping scenario. Further, the measurement systems within the tool are designed to be as unobtrusive as possible. Subjects using the tool are aware that they are participating in a research study but this limitation is offset through the provision of a shopping environment that is closer to a real-life retail experience than most laboratory situations currently provide.

Note that the developed research tool is designed to be reusable and appropriate for any study wishing to experiment with different design elements of a retail Web site. The tool provides a simulated retail shopping environment in which certain interface design elements can be manipulated (turned on or off) thus providing a mechanism for rendering different Web site interfaces to different groups of subjects in an experiment. The research tool also provides a means to give different task instructions to different subjects in terms of what they are asked to do on the site. These two functions together provide an easy way to place subjects in different experimental treatments.

5.1 Need for a Research Tool

While there are a number of resources available for on-line experiments, there does not seem to be any experimental environments suitable for investigations into consumer interactions with retail Web sites. Compounding this situation is the lack of a *complete integrated* experimental environment. To be complete, the experimental environment should include the experimental apparatus, a measurement system, and a method of controlling the progress of the test subject through all of the stages of the experimental procedure.

Of the resources that are available, a search shows that in the fields of psychology and experimental economics there are Web sites that allow researchers to configure and run experiments on-line. One example is the Web Experimental Psychology Lab (http://www.psychologie.unizh.ch/sowi/Ulf/Lab/WebExpPsyLab.html). For the most part, these Web sites are limited in functionality and only provide a method for running *paper and pencil* experiments on-line. It is not uncommon for researchers in HCI and information technology to build specialized Web sites to test specific or novel technologies, but these Web sites are typically custom one-of designs that are not adaptable for modeling a full product line retail Web site. The options are much better in terms of measurement systems, with available systems that are adaptable to the requirements of this study. The available

options for on-line surveys are especially broad, so much so that a small industry seems to have developed around offering this service. Viable on-line behavior capture systems, such as U.S. National Institute of Standards and Testing (NIST) WebMetrics are also available. No evidence of available control systems was found, which is consistent with the lack of experimental full line retail Web sites.

5.2 Design considerations and challenges

The following list outlines the design requirements for the development of a suitable experimental environment or research tool:

- The experimental Web site should be at a minimum comparable to actual small retail Web sites.
- The Web site must provide a reasonable product catalog, and not restrict the test subject's ability to search or browse for a range of products.
- The measurement systems should be as unobtrusive as possible.
- The assignment of test subjects to experimental treatments must be random.
- The test subject must be able to be tracked through the stages of the stages of the experimental procedure: consent form, treatment assignment, capture of behavioral metrics, and post-test questionnaire.
- The system must maintain appropriate levels of anonymity, confidentiality, and security.
- The control system must integrate the experimental Web site and measurement systems.
- The system must be resistant to potential abuse.
- The system must allow for differences and inconsistencies in the behavior and security settings of different Web browsers, and Web browser configurations.
- The responsiveness of the system should be comparable to a small retail Web site. In addition, the Web site should be useable from a dial-up internet connection.
- The system should be usable even if the test subject is behind a firewall or uses a Web proxy.

5.3 The Developed Research Tool

Based on the above requirements, a research tool was developed. Figure 5.1 below provides a screen shot of the first screen a subject would see upon beginning an experiment using the research tool. Subjects are guided through a series of steps:

1) The first gains informed consent.

2) The second presents instructions to subjects about the information seeking task they are asked to carry out.

3) The third presents a survey instrument for subjects to fill out after they have completed their online tasks. The research tool allows for easy modification of questionnaire items to be presented to subjects.

4) The fourth reminds subjects to pick up their participant incentives.

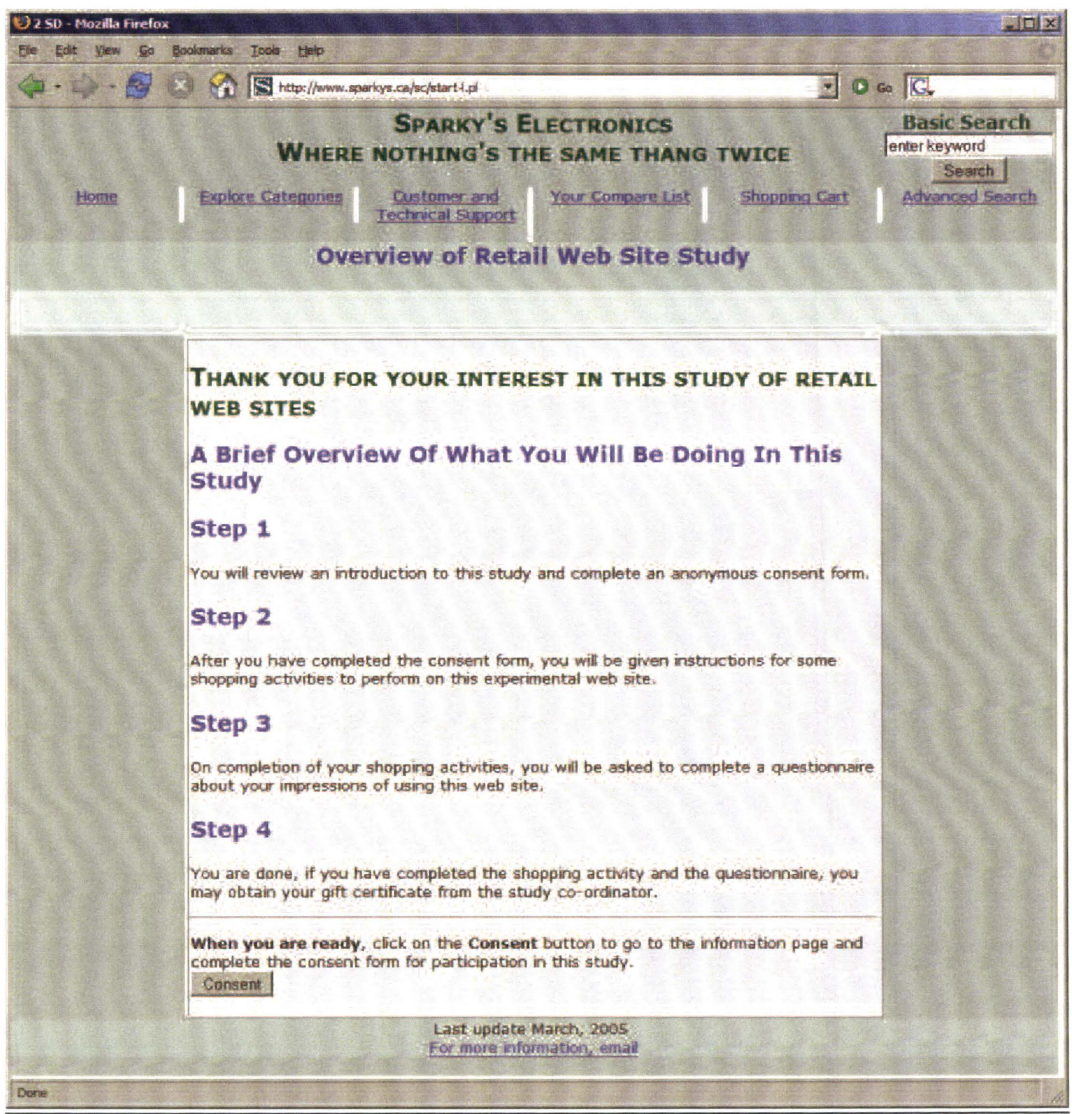

Figure 5.1 First Screen Available in the Research Tool

(Note: the rendering of the format of this page (e.g., color scheme, font size etc.) is contingent upon a subject's experimental treatment (see section 4.3.3); the content displayed, however, is the same across all experimental treatments)

The research tool will now be described in more detail in the context of its three major systems: the experimental apparatus, the measurement system, and the control system.

5.3.1 Experimental apparatus

The experimental apparatus comprises three components: a Web server, a database server, and the user interface.

The Web server is Apache 1.3 on the FreeBSD 4.11 operating system. No customizations were required. All Web pages were generated from Common Gateway Interface (CGI) scripts written in Perl 5.8. The Apace mod_perl module and custom Perl libraries were used to improve performance and responsiveness.

To reduce the possibility of coding errors, and to increase flexibility, all elements on the Web pages were generated from custom library functions. For example, if the example Web pages shown in

Figure 5.2 are compared, they appear quite different. They are in fact the same Web page. The difference occurs when the Web server inspects a cookie containing a code representing the experimental treatment. The Web server then sets the presentation of the generated page to match the treatment. These custom library functions also facilitated the reuse of elements on any page, and therefore enforced consistency.

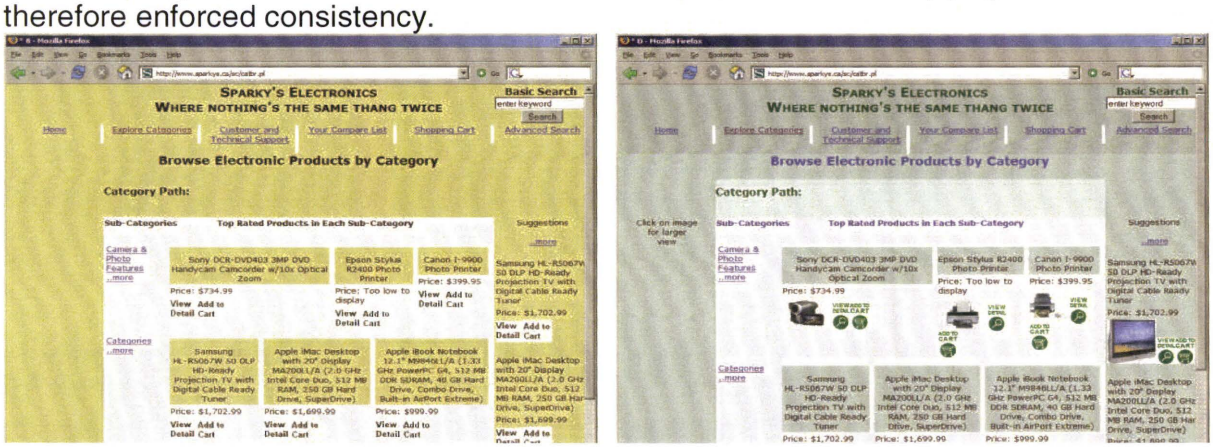

Figure 5.2 Lean and Rich Web Pages

Web services were used extensively in the Web site. The services included retrieving catalogue information from Amazon, providing fast updates to Web pages without complete page reloads, receipt and formatting of user

interaction events, and requesting random numbers from random.org. Using Web Services, it is possible to retrieve product information from Amazon's entire product catalog in XML format. A Web site can then be constructed to display live and cached data using any experimental treatment . Viable commercial Web sites have been developed with Amazon Web services technology demonstrating the functionality of this approach (e.g., www.ontheWeb.com, http://simplest-shop.com/camera).

The Amazon Web service provides a critical element in mimicking an actual retail Web site. By using Amazon's full product catalog, the test subject can search or browse a full range of products, from books and digital media to consumers electronics. This avoids the test subject being locked into just one product category, and avoids having the Web site appear as a "mock-up."

The database server is MySQL 4.1 on the FreeBSD operating system. No customizations were required. The dabatase held cached catalog data, and the results from the post-test survey.

The user interface is a Web browser. Only two browsers were considered in the development of the Web site: Internet Explorer 6.x and Mozilla/Firefox 1.x. This was necessitated by the extensive use of javascript/EMCAscript needed to provide dynamic functionality and to capture the test subject's behavioral interaction.

Figure 5.3 graphically presents the arrangement of the components comprising the technical infrastructure. The use of Amazon Web Services, and placement of the Experimental Web server and Db server on the internet permitted running the experiment either on any remote workstation connected to the internet, or within a computer lab behind a proxy server.

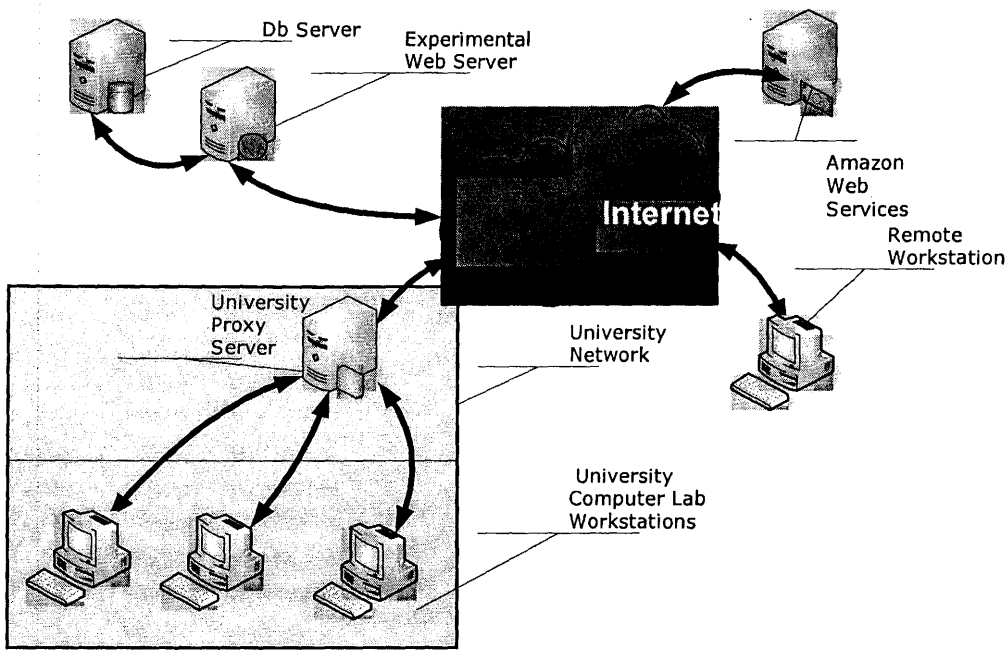

Figure 5.3 Technical Infrastructure

5.3.2 Measurement systems

To better capture the complete shopping experience of an on-line consumer, a questionnaire system and a behavioral measurement system are included in the experimental environment.

5.3.2.1 Questionnaire system

The questionnaire system was adapted from mod_survey 3.2 developed at Mid Sweden University (http://www.modsurvey.org/). Two types of questionnaires are required in the experimental environment. One questionnaire type is for obtaining consent on-line, the other for a post-test questionnaire. The on-line consent process is more complex than a simple questionnaire. The process starts with an information page, and if positive consent is given, a confirmation is required. The confirmation is in lieu of a signature, which is avoided to preserve test subject anonymity. In addition, separate consent forms are required for test subjects performing the experiment in a lab, and for those accessing the experiment remotely. The lab consent process includes an option for the test subject who wishes to withdraw, but does not wish to leave the lab and have others aware of the withdrawal. Dependent upon the test subject's

response to the consent request, he or she would be redirected to the introduction page of the assigned shopping activity, a shopping activity page outside of the experiment, or a thank-you page that excused him or her from the experiment. In contrast, the post-test questionnaire was conventional in design. For reasons discussed under the control system, the questionnaires are required to programmatically receive as input user and treatment codes, and include those codes into the output of the questionnaires.

The challenge of integrating mod_survey into an experimental environment stems from the software package originally being designed as stand alone application. As a consequence, it has only rudimentary capabilities in its Application Programming Interface (API) in relation to management by the control system. The most significant capabilities missing from mod_survey were the ability to accept user and treatment codes from the control system, and write the codes into the survey data, and in the case of the consent form it lacked the page switching logic. The mod_survey software was modified in order to meet the experimental environments requirements, after discussion with the mod_survey developers confirmed that a viable method of meeting the requirements could not be met by the software as originally designed.

5.3.2.2 Behavioral measurement

The behavioral measurement system was adapted from the Web metrics suite developed by the U.S. National Institute of Standards and Testing (NIST) (http://zing.ncsl.nist.gov/WebTools). The NIST software was originally designed to be used with static Web pages, as such it was supplied with a utility that modified a set of static pages by inserting javascript into each page. The javascript in the modified Web pages would send mouse click and keyboard actions to a separate pop-up Web page. The pop-up Web page then transmitted the received click-stream data to the Web server, and was also used by the test subject to initiate and signal completion of the data capture session. At the Web server a CGI application received the click-stream data, and wrote it to a session file for each experimental run.

In its original form, the NIST software was incompatible with the requirements of the experimental environment. Since the experimental Web site was built completely of dynamically generated pages, it was not possible to use the supplied utility to insert the data capture javascript into the Web pages. As a consequence, after discussion with the software developer, the core NIST data capture javascript functionality was removed from the NIST utility, and adapted into a stand alone javascript library. The javascript library could then be called by dynamically generated pages, without any modification to the pages.

The NIST software's pop-up window for the control of the data capture, and relay of click-stream data was also problematic. The pop-up window emphasized to the test subject that he or she was participating in an experiment,

and required the test subject to enter data and follow a prescribed sequence of actions. To resolve these issues, the pop-up window was converted into a hidden iframe, and the control logic was moved to a new custom control system, described later in this section.

The NIST CGI program that received the click-stream data at the Web server was enhanced to organize and capture additional click-stream data. The program originally recorded each page change, mouse or key click as discrete events in the session file. The structure of the session file was simply one record for each event. Such a structure would make this study's behavioral analysis difficult. A new structure for the session file was developed based on Web pages. Now each of the mouse or key clicks would be sub-events within a particular page. The second enhancement increased the data captured with each key or mouse click. Neither the data capture javascript, nor the CGI program were originally designed to capture javascript actions resulting from mouse or key clicks, only the clicks on HTML elements. The need to capture javascript actions is a result of including DHTML functionality in the Web site, such as when the test subject clicks to expand the "Also Looked At" list shown in Figure 5.4. The data capture javascript and the CGI program were both modified to capture and record the additional information respectively, shown in Figure 5.5.

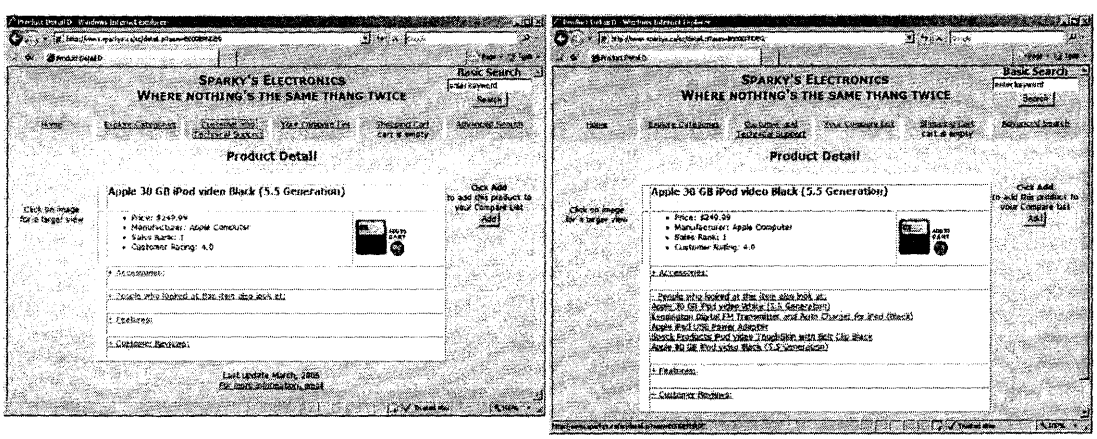

Figure 5.4 Product Detail Page Showing Collapsed and Expanded Design Element

Figure 5.6 shows two separate services running on the server, 1) HTTP, and 2) Web_VIP. Any user action that generates a request for information or a new/refresh of a Web page is processed by the HTTP service, and the request is written to the HTTP log. As noted above, because clicking on a link to expand a design element (as in Figure 5.4) does not generate a request for new information (the information is part of the page, but initially hidden); there would not be a HTTP request or a record written to the HTTP log of this user interaction. The NIST software addresses this gap. The javascript incorporated into each page captures each mouse or key click and transmits the pertinent information to the Web_VIP service, which writes a record in the User Event Log.

The two services provide differing but complementary records of the user's interaction with the experimental environment. The HTTP services provides a record of each page viewed by the test subject from start to finish of the experimental procedure (including consent and post-test questionnaire), and the Web_VIP service provides detailed data regarding the test subject's interaction during the use of the experimental Web site.

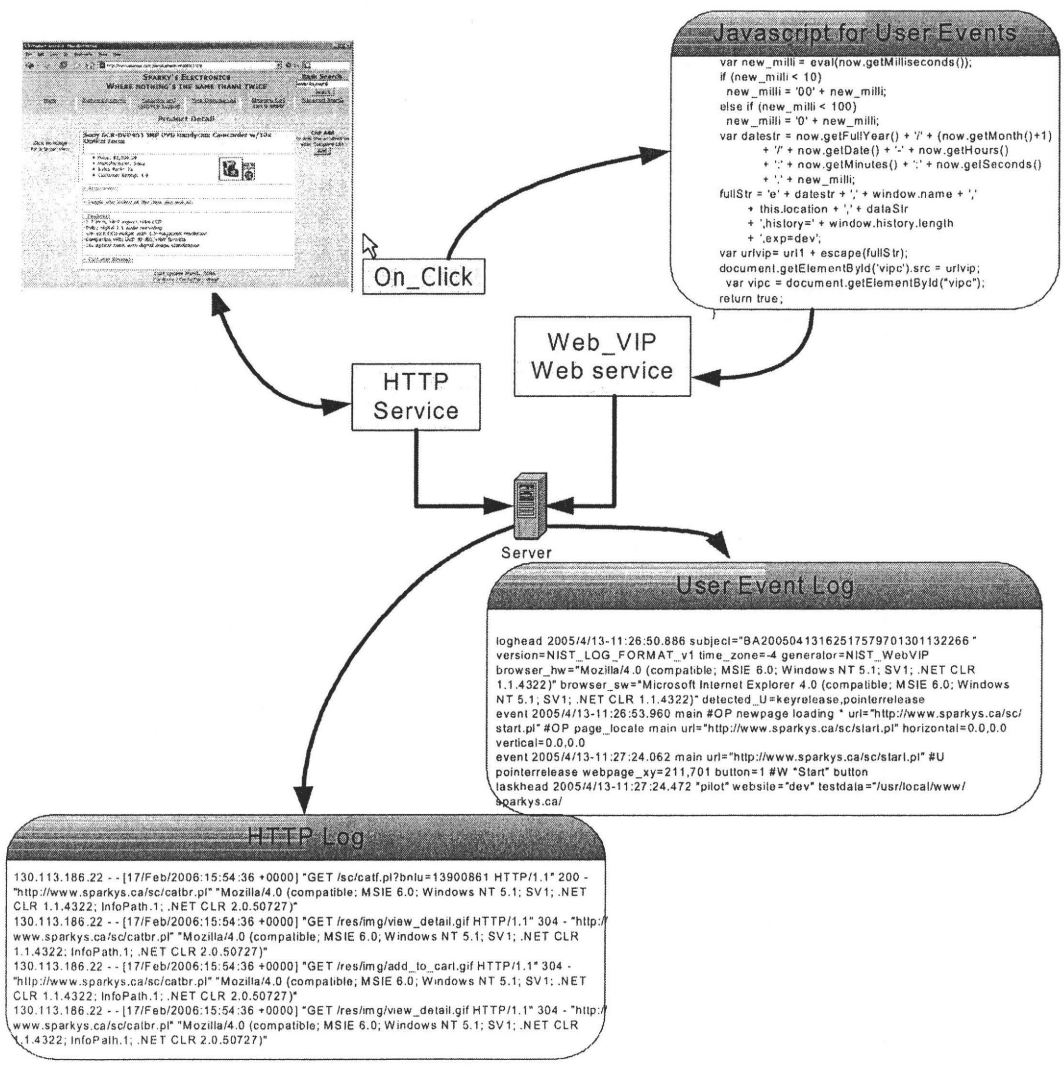

Figure 5.5 Behavioural Data Capture System

5.3.3 Control system

The purpose of the control system is to sequence test subjects through the stages of the experimental procedure, (registration, randomization, consent, introduction, initiation, experimental run, completion, post test questionnaire) and to link each of the functional elements of the experimental environment (on-line consent form, treatment assignment, capture of behavioral metrics, and post-test questionnaire).

Cookies are the critical technology in the control system. By design, HTTP is a stateless protocol, (i.e., the user requests a Web page, the server responds to the request, then the server enters a wait state ready for the next request). The server treats each request independently, and does not carry over any information between requests. The lack of information transfer between requests makes it difficult to track test subjects, sessions, treatments, and the current stage of the experiment for a particular test subject. Cookies are a technology designed to address the problems arising from the stateless HTTP protocol. Cookie technology simply places a small bit of coded information (a cookie) within the test subject's Web browser, which in turn is sent back to the Web server with each subsequent Web page request. The Web server is able to add, modify or delete the cookies placed on the test subject's Web browser, and thereby track test subjects.

In the experimental environment, cookies are used for user information, session information, and session status. These take the form of a random eight-character code uniquely designating the test subject, an experimental treatment code, and a stage code.

The user code and treatment code define an experimental run or session, and are assigned at the first page of the experimental site. These two codes are subsequently inserted into the consent form, behavioral data, and post-test questionnaire. In this way data can be linked across consent, behavioral data and post-test questionnaire. Using a user code avoids having to rely on any potentially identifying characteristics of the test subject. The user code is generated using a software based pseudo-random number generator, which builds an eight character code of mixed upper and lower case alpha-numeric characters. The stage code is initially set at the first page of the experimental site. The test subject is moved through the experimental procedure by reading and incrementing the stage code as each stage (introduction, consent, instructions, run, completion, and post test questionnaire) is completed.

The complete experimental procedure is detailed below, with reference to Figure 5.6.

1. The first page the test subject opens is the Introduction page. On this page is a brief introduction to the experiment. When the page is opened, treatment randomization and assignment of the user code occurs. For treatment

randomization, a random number is requested from random.org. Random.org provides a Web service that makes available random numbers generated from a random physical process. Each time the starting Web page is accessed, a new random number is requested from random.org in real-time, and a new treatment code is generated. Since the presentation of the Web page is part of the experimental manipulation, the start page uses the treatment code to generate its presentation.

2. From the Introduction page, the test subject is directed to the on-line consent form. If consent is given, the test-subject is asked to confirm consent, which if given triggers the initialization of the behavioral data capture system, and directs the test subject to the Instructions page (Instructions-I). The test subject has two options should he or she decline participation: they can leave the experiment immediately, or they can browse through the Web site and not bring attention to his or her non-participation.
3. On the Instructions page, the test subject is given instructions appropriate to his or her assigned treatment (See Appendix B, Figure 3 and Figure 4). When he or she has completed reading the instruction, the test subject clicks a button to start the experimental run. The stage code is advanced, and the test subject is taken directly to the experimental retail Web site. At this point the behavioral data capture starts. Since the stage code has now been incremented, subsequent views of the Instruction page are modified so that the final instruction is changed and the **Start** button is replaced with a **Complete** button.
4. When the test subject determines that he or she has completed the assigned experimental task, they return to the Instructions page (Instructions-II in Figure 5.7) and click the **Complete** button. This advances the stage code, closes the behavioral data capture, and sends the test subject to the post-test questionnaire.
5. On completion of the questionnaire, the test-subject is directed to a thank you page.

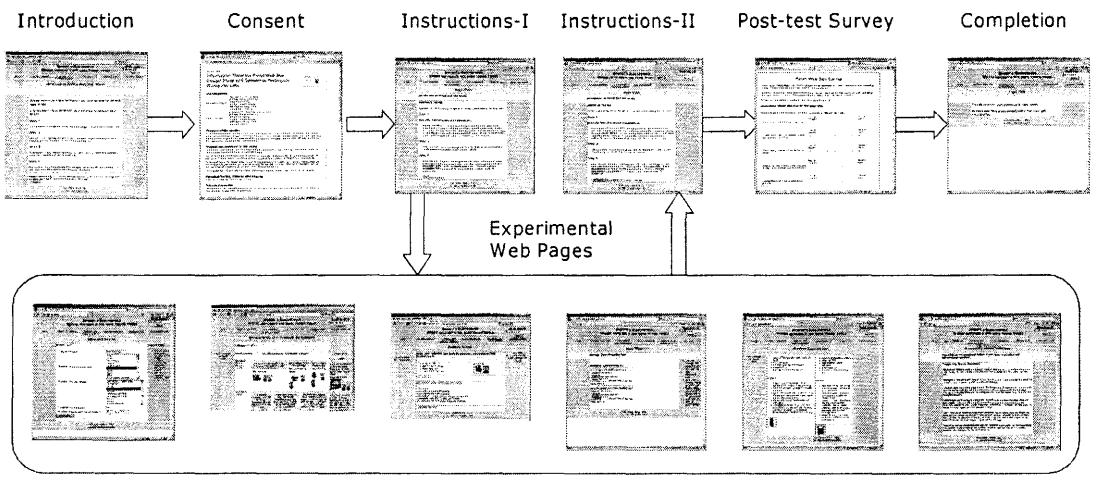

Figure 5.6 Experimental Procedure

The grouping "Experimental Web Pages" shown in Figure 5.7, which is comprised of browse categories pages, advanced search pages, search result pages, product detail pages, and help pages further demonstrate the experimental manipulation. See Appendix B, Figures 1-8. Because the Web pages are generated dynamically, the total number of pages that a test subject could potentially view is extremely large, even though the number of pages shown in Figure 5.7 is small. This is due to the use of the complete Amazon on-line catalog which has over 200, 000 products in over 10,000 categories.

5.4 Pilot Testing of the Research Tool

A pilot test of the research tool was run with 62 test subjects over four sessions. The only significant problem with the experimental environment was encountered during the first session. When more than two test subjects attempted to complete the post-test questionnaire at the same time, one of the test subjects would be blocked from submitting the questionnaire. The problem originated with the survey software, which used the IP address of the test subject's computer to prevent multiple surveys from the same test subject. Because the test subjects were in a university lab, where all computers were required to use a Web proxy to access the internet, only two IP address were being presented to the survey software by the proxy server. After discussion with the survey software developers, a custom modification to the software was made so that the user code was used in place of the IP address.

The pilot test also brought out a point of confusion for a few test subjects. The instruction page initially did not lead the test subject directly into the retail Web site. The instruction Web page originally changed the **Start** button to a

Complete button, and provided instruction for the test subject to start using the retail Web site. It was not clear to some participants how to start using the retail site. For the full experiment, the instruction page was modified to take the test subjects directly into the experimental retail Web site.

From the pilot run results, it was seen that the requirements of a complete integrated experimental environment had been met. By its design, the experimental environment is reusable and is suitable for investigations of consumer interaction with retail Web sites. The design allowed for the straightforward manipulation of variables that could impact consumers, and incorporates measurement capabilities for survey and behavioral data.

This specific implementation required two levels of information presentation as the experimental manipulation. But the experimental environment can be readily adapted to manipulate multiple variables at arbitrary levels, making the research tool reusable in any study of design elements of a retail Web site.

6 RESULTS

6.1 Running of the Experiment

All runs of the experiment took place in the DeGroote School of Business computer lab DSB-B106 across nine different days within a two-month period of time. The lab used was equipped and arranged similarly to undergraduate computer rooms, and would therefore be similar to where a large portion of the participants performed their personal computer and internet activity.

There were no changes made to the experimental procedure, Web site, or questionnaire across any of these sessions.

An estimate of the sample size required for the study was performed using results from the pilot study. Only hedonic and utilitarian value scores were collected in the pilot. Since the difference in means between groups was smallest for hedonic value, this difference and the observed standard deviation was used in the sample size calculation. The sample size calculation used Cohen's method for ANOVA presented by Norman and Streiner (2000). Using the difference and standard deviation from the pilot, setting α=.05 and β=.2, an estimate of 124 test subjects was obtained. A target of 150 test subjects was set to allow for possible withdrawals, incomplete data, and technical failures.

A total of 140 test subjects participated in the experiment. One participant misinterpreted the instructions for the post-test questionnaire. As a result, that participant's questionnaire results were inadmissible. Eight participants were able to bypass the experimental control system and restart the experiment part way through their sessions. By restarting the session they would have been assigned a new treatment, and would have seen the alternate experimental instruction or information presentation. As such, these participants were considered to be "contaminated" and thus were removed from the data set.

Of the 131 good responses, 55% were female and 45% were male. The majority (90.8%) were between 18 and 29 years of age, 8.4% were between 30 and 49, and the remaining 0.8% were between 50 and 64.

The objective of recruiting participants familiar with the internet and online shopping was met: 98.5% of the participants had been using the internet for more than three years; 80.2% had made at least one online purchase in the past year, with 51.1 % making three or more purchase in the past year; 85.5% search daily for information using the internet; and 74.8% search online for information about products or services at least once per week.

The next two sections detail the manipulation checks for the two variables manipulated in this experiment: information seeking mode and information presentation.

6.2 Manipulation Check for Information Seeking Mode

The first stage of the manipulation check for information seeking mode (using items ISM-1 and ISM-2) was designed to determine the extent to which the test subjects perceived they were in a search or browse information seeking mode, and the extent to which the experimental instructions were perceived as being significantly different. The first stage examines the within-subjects, and then the between-groups response to the two survey items. The second stage of the manipulation check (using items ISM-3, ISM-4, ISM-5, ISM-6, ISM-7, and ISM-8) examines discrete aspects of searching and browsing that correspond to the characteristics of searching and browsing presented in Table 2-1.

6.2.1 Within-Subjects

Recall that each test subject was given an experimental assignment (see 4.3.1) to place each person into either a search or browse information seeking mode. At the conclusion of the experiment, the test subjects were asked the following questions in the post-test questionnaire:

"To what extent do you agree or disagree with the following statements:

- ISM-1: When I started shopping, I was searching for a particular type of product, such as a camera.
- ISM-2: When I started shopping, I was just looking around and browsing."

Examining the responses to each question (n=131) as shown in Figure 6.1 and Figure 6.2, there is a suggestion of non-normality, which is confirmed by the Kolmogorov-Smirnov (with Lilliefors significance correction) normality statistic indicating a significant departure from normality ($K\text{-}S_{131} = .231$, $p < .0005$).

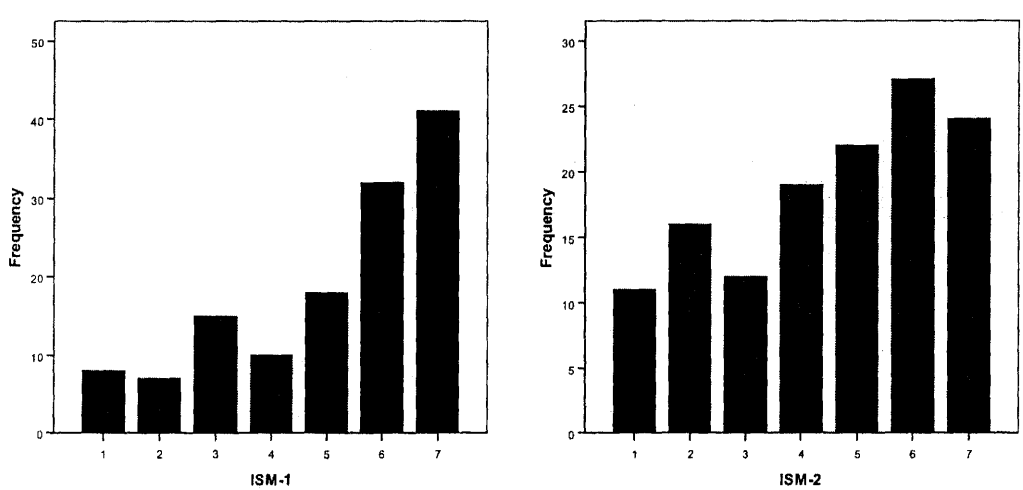

Figure 6.1 Response Histograms

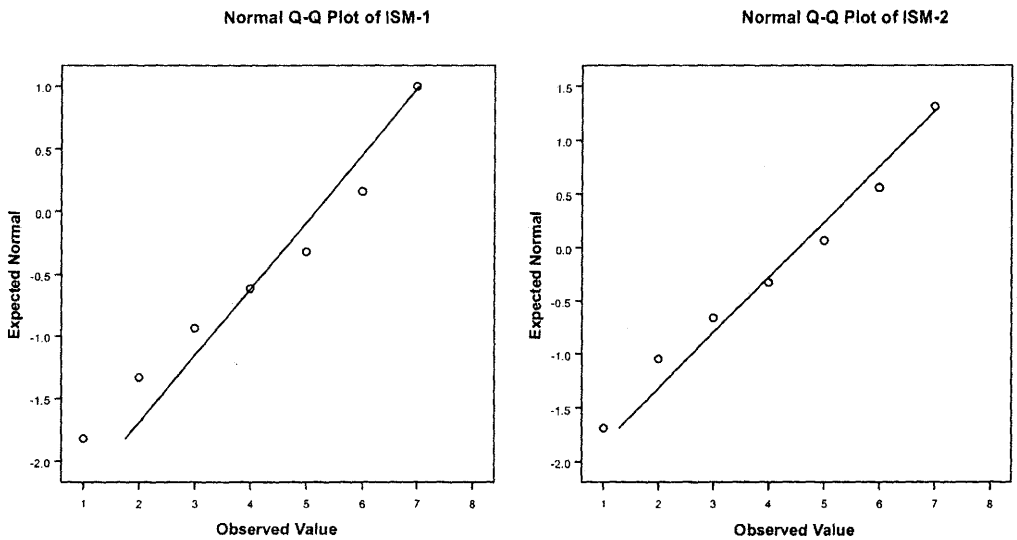

Figure 6.2 Normality Plots

If we consider the within subjects response to the above survey items, an inference can be made as to whether the experimental instructions placed the test subject into the desired browse or search mode. A visual examination of the response histograms for the test subjects given each instruction suggests that the test subjects were able to identify his or her respective instruction.

While non-normality might be problematic in other contexts, given the nature of the survey items under examination, strongly skewed responses are the desired outcome. For example, searchers would be expected to agree strongly with ISM-1, and with the closed ended scale used for the survey item, the response profile should be strongly left skewed.

Figure 6.3 shows that the subjects who were given the search instruction had responses skewed towards strongly agreeing with question ISM-1 (the manipulation check for searching), but showed an almost random response to question ISM-2 (the manipulation check for browsing). Note: the scales of the two charts are different.

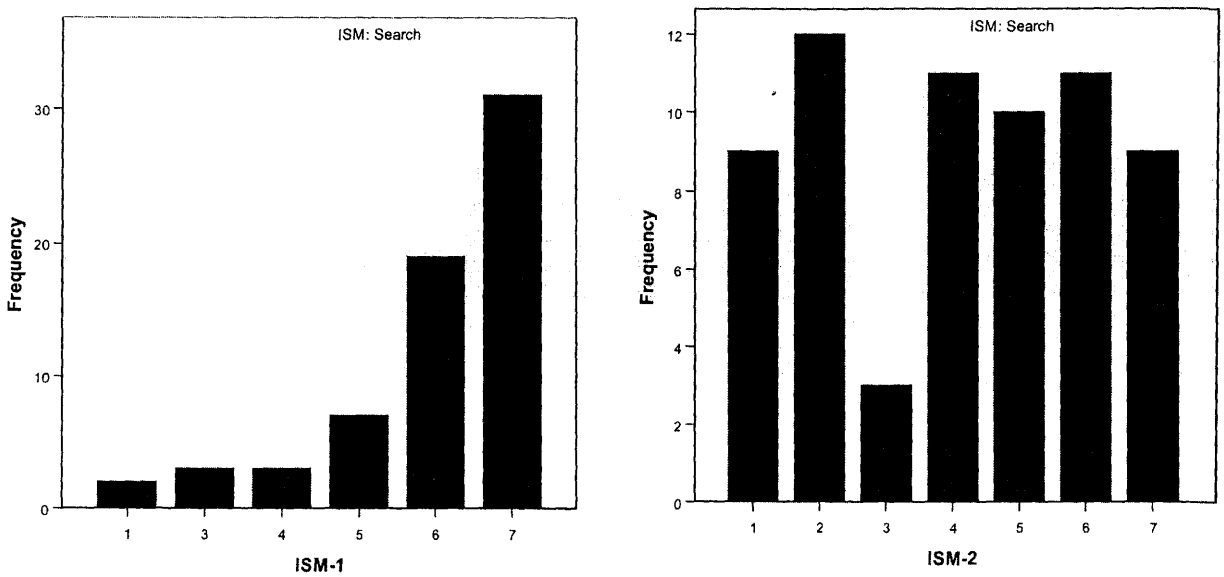

Figure 6.3 Response histograms of *Search* test subjects

Figure 6.4 Response histograms of *Browse* Test Subjects

shows that the test subjects who were given the browse instruction had responses skewed towards strongly agreeing with question ISM-2 (the manipulation check for browsing), but no discernable pattern of response to question ISM-1 (the manipulation check for searching). Note: the scales for each chart are different.

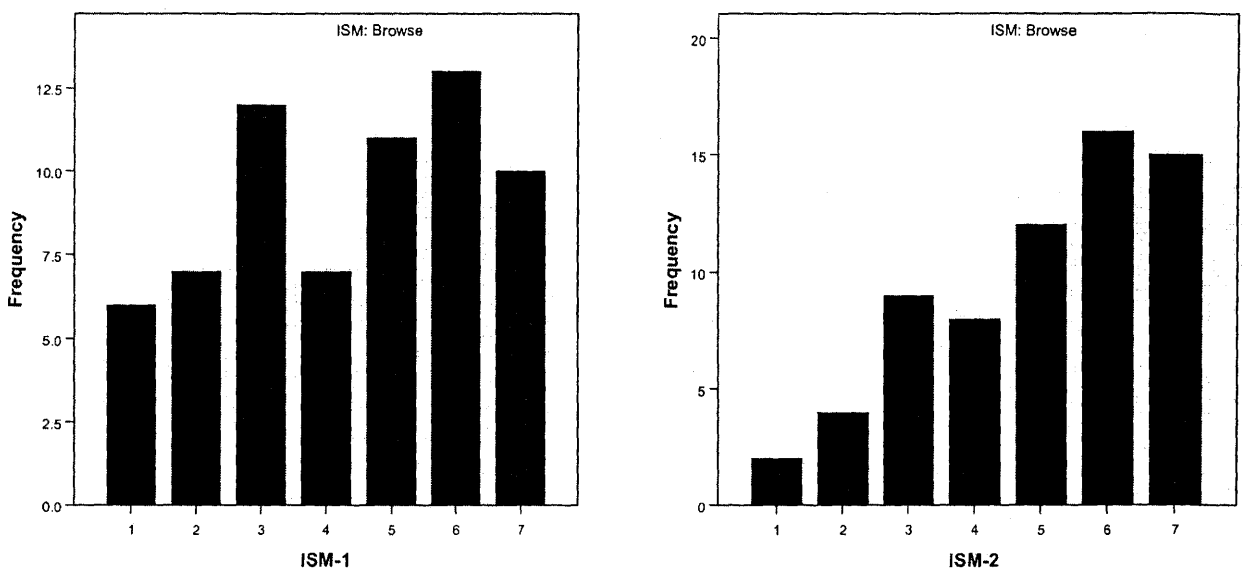

Figure 6.4 Response histograms of *Browse* Test Subjects

Continuing the analysis of within-subject responses, for those test subjects given the search instruction, the mean response to question ISM-1 was 5.98, compared to 4.08 for question ISM-2 which is a significant difference in a paired samples t-test (t_{64}=5.298, p<.0005). In spite of the mean response giving an insight into a test subject's perceptions, the lack of normality of the responses to the survey questions suggested that a non-parametric statistical analysis was more appropriate. To compare within-subject responses of ISM-1 to ISM-2, the Wilcoxon test was selected. Applying a Wilcoxon signed ranks test yielded a Z=-4.423, p<.0005, implying that the median responses for the ISM-1 and ISM-2 were not the same.

For those test subjects given the browse instruction, the mean response to question ISM-1 was 4.35, compared to 5.00 for question ISM-2, which was marginally significant (t_{65}=-1.735, p=.087). Applying a Wilcoxon signed ranks test yielded Z=-1.708, p=.088, indicating that the median responses were not significantly different.

To summarize the above, the parametric and non-parametric analyses suggest similar conclusions, where the question corresponding to the assigned experimental instruction had a higher response than the opposing question. It is also interesting that the response to the search instruction was highly significant (p<.0005) while the response to the browse instruction was marginally significant at p=.088. This is consistent with the experimental instructions, which were specific for those assigned to searching and ambiguous for those assigned to

browsing. It also suggests that browsers as a group perceived that they had a wider range of shopping objectives.

6.2.2 Between-Groups

By examining the response for each question between-groups, an inference can be made as to whether there was a significant difference between perception of the experimental instructions given to invoke each mode. Due to exhibited non-normality of the responses, both parametric and non-parametric methods were used. For question ISM-1, the mean response for searchers was 5.98, compared to 4.35 for browsers, which was a significant difference (t_{119}=5.572, p<.0005). Question ISM-2 had a mean response from searchers of 4.08, compared to 5.00 for browsers, which was a significant difference (t_{124}=-2.810, p=.006). For both questions, Levene's test for equal variances was significant, which could be expected with the non-normal responses. As a result, the t-tests were made assuming unequal variances.

For the non-parametric analysis, the Mann-Whitney U test statistic was selected. The mean rank of the responses to question ISM-1 for those given the search instruction was 82.88, compared to 49.37 for those given the browse instruction. The Mann-Whitney U was 1047.5 (Z=-5.184, p=.001). The mean rank of the responses to question ISM-2 for those given the search instruction was 57.42 compared to 74.45 for those given the browse instruction. The Mann-Whitney U was 1587.0 (Z=-2.602, p=.009). These results indicate that for question ISM-1, searchers reported the question as matching their information seeking mode more closely than did browsers. The opposite response was seen for question ISM-2. That is, browsers perceived ISM-2 as more closely matching their information seeking mode than searchers. Moreover, the responses for searchers and browsers were statistically significantly different. These results were consistent with the assigned experimental instructions.

6.2.3 Searching and Browsing Characteristics

As was noted in Table 2-1, browsing and searching can be described using a number of characteristics, with no one characteristic defining the information seeking mode. To investigate this assertion further, the following survey items were designed to reflect the characteristics of browsing and searching as presented in Table 2-1; the resulting statistics are tabulated in Table 6-1.

"To what extent do you agree or disagree with the following statements:

- ISM-3: I felt as though I was shopping for fun or pleasure.
- ISM-4: When I started shopping, I only had a general idea of what I was looking for.

- ISM-5: I did not intend to make a purchase when I started shopping.
- ISM-6: I wanted this shopping experience to be as efficient as possible.
- ISM-7: When I started shopping I knew exactly what I was looking for.
- ISM-8: While I was shopping I wanted to be able to explore different products."

Table 6-1 Information Seeking Mode Characteristics

Question	ISM	Mean Rank	M-W U	Z	p	Mean	t	df	p
ISM-3	Browse	67.11	2072.0	-.343	.732	4.05	-.511	129	.610
	Search	64.88				4.20			
ISM-4	Browse	68.07	2008.5	-.645	.519	4.83	-1.194	129	.235
	Search	63.9				5.17			
ISM-5	Browse	76.03	1483.0	-3.105	.002	4.06	-3.304	129	.001
	Search	55.82				5.05			
ISM-6	Browse	62.05	1884.5	-1.243	.214	5.77	1.12	129	.265
	Search	70.01				5.50			
ISM-7	Browse	53.98	1351.5	-3.709	.0005	4.35	3.923	129	.0005
	Search	78.21				3.21			
ISM-8	Browse	61.33	1837.0	-1.468	.142	5.78	1.687	129	.094
	Search	70.74				5.38			

The results from Table 6-1 show a significant difference in response between searchers and browsers for ISM-5 and ISM-7, with the remaining questions giving consistent but non-significant results. These results indicate that searchers reported a higher intention to purchase, and had a clearer shopping objective than browsers, which was consistent with the experimental instruction given to each group.

In summary, the between-subjects results give strong support for the test subjects understanding the experimental instructions, with searchers perceiving the instructions differently from browsers, and each group reporting significantly higher agreement with questions that matched their experimental instruction.

6.3 Manipulation Check for Information Presentation

The manipulation check for information presentation first measured the test subject's perception of the level of information presentation of the experimental Web site based on a comparison to two external Web sites. This was followed by an examination of subjects' perceptions of the specific experimental manipulations.

The comparison to external Web sites was by way of a sample screen shot of MSN.ca and Google.ca (see Appendix D) followed by this survey item:

"If we define a Lean Web site as one with limited use of fonts, font sizes, colors, and graphics, and a Rich site as one that makes extensive use of fonts, font sizes, colors and graphics, then MSN.ca would be considered an example of a Rich site and Google.ca would be considered an example of a Lean site."

- IP-1: Using the above definition, how would you rate this study's Web site on a scale of Lean to Rich?"

As shown below in Figure 6.5 there is a suggestion of non-normality, which is supported by a significant Kolmogorov-Smirnov statistic (K-S_{131} =.197, p<.0005) implying that the distribution is significantly different from normal. Therefore, as in the previous manipulation check, both parametric and non-parametric analysis are presented in case there is a discrepancy between the results due to non-normality.

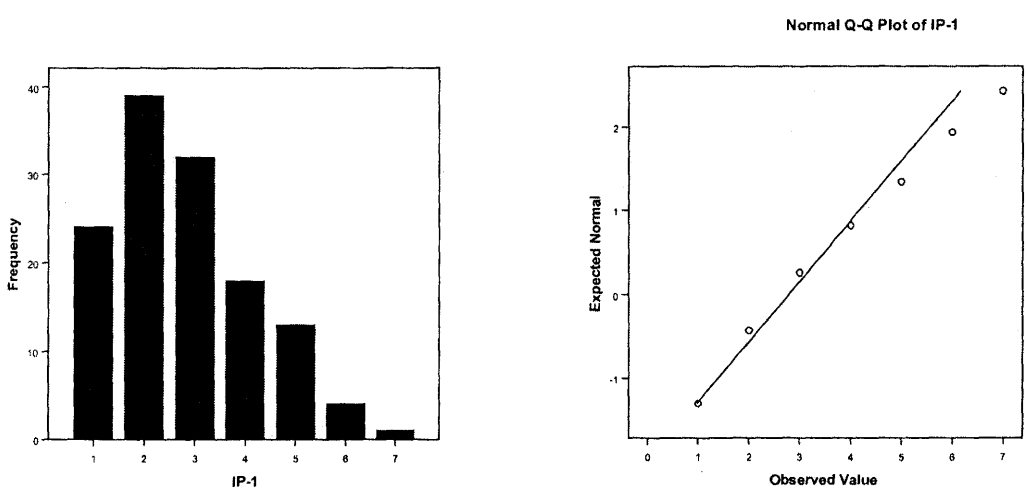

Figure 6.5 Response Histogram and Normal Q-Q Plot for IP-1

The average response for the lean information presentation was 2.38, compared to 3.24 for the rich information presentation. The difference in mean response was significant (t_{129}=-3.668, p<.0005). A confirmatory result was obtained by non-parametric methods, where the mean rank of the response to question IP-1 (Very Lean = 1, Very Rich = 7) for those presented with a lean site was 55.32 compared to 77.53 for those presented with a rich site. The Mann-Whitney U was 1415.5 (Z=-3.435, p=001). These results are consistent with the experimental treatment.

The above question (IP-1) provides insight into the test subject's understanding of the construct of information presentation. To provide evidence of construct validity, two questions were included in the post-test questionnaire

that asked for the test subject's perception of the specific experimental manipulation:

"To what extent do you agree or disagree with the following statements:

- IP-2: I felt that the Web site used only a limited amount of fonts and font sizes and only had a small amount of color and graphics.
- IP-3: I felt that the Web Site made extensive use of text formatting, used different fonts and font colors and had a large amount of graphics and images."

As has been seen with previous questions, the responses to both questions are non-normal, with significant Kolmogorov-Smirnov statistics (IP-1: $K\text{-}S_{131}$ =.241, p<.0005; IP-2: $K\text{-}S_{131}$ =.241, p<.0005).

For those test subjects presented with a lean Web site, the mean response to IP-2 was 6.31, compared to 5.38 for those presented with a rich Web site. The difference in mean response was significant (t_{109}=3.926, p<.0005). The non-parametric analysis confirmed these results. For those test subjects presented with a lean Web site, the mean rank of the response to question IP-2 was 78.31, compared with 52.71 for those presented with a rich Web site. The Mann-Whitney U was 1305.0 (Z=-4.090, p=.001).

Turning to IP-3, the mean response for those presented with a lean Web site was 1.75, compared to 2.78 for those presented with a rich Web site. The difference was significant (t_{109}=-4.504, p<.0005). Non-parametric analysis provided consistent results. For those test subjects presented with a lean Web site, the mean rank of the response to question IP-3 was 52.63, compared with 80.44 for those presented with a rich Web site. The Mann-Whitney U was 1232.5 (Z=-4.385, p=.001). The similarity of the statistics suggest that test subjects viewed IP-2 and IP-3 as mirrored questions.

The above results indicate that test subjects perceived a statistically significant difference in the two levels of information presentation (Lean and Rich). In addition, it was also shown that test subjects perceived a significant difference in the definition of lean and rich information presentation.

6.4 Potential Impact of Information Presentation on Information Seeking Mode

Hypotheses 3 and 7 predict that increasing information presentation would impact hedonic value and increase number of pages viewed and time viewing the Web site, which is suggestive of browsing behavior. It would be consistent with H3 and H7 to consider that information presentation may have had an impact on the test subject's information seeking mode. In the case of browsers, for both questions (ISM-1, ISM-2), there was not a significant difference in response between the levels of information presentation using either parametric (ISM-1:

t_{64}=.96, p=.340; ISM-2: t_{64}=-.144, p=.886) or non-parametric techniques (ISM-1: M-W U=469, Z=-.926, p=.355; ISM-2: M-W U=505.5, Z=-.453, p=.651). Searchers, on the other hand, showed a significant difference in response to question ISM-1 between levels of information presentation. The results for ISM-1 showed a mean response of 5.56 for the lean presentation and 6.39 for the rich presentation (t_{44}=-2.448, p=.018). The non-parametric results confirmed this result (M-W U=387.0, Z=-1989, p=.047). For ISM-2, the mean response for the lean information presentation was 4.56 and 3.61 for the rich presentation, which was not a significant difference (t_{62}=1.926, p=.059). The non-parametric result was significant (M-W U=376.0, Z-2.02, p=.043). While it can be seen that changes in level of information presentation did have an impact on searchers' perceptions of their information seeking mode, it does not appear that changes in information presentation level induced browsing.

Having determined that test subjects were aware of the experimental manipulations (information seeking mode and information presentation), the next section examines the remaining results from the post-test questionnaire.

6.5 Survey Outcome Measures

The first three hypotheses have perceived value as the outcome. The perceived value scales were developed, validated and used in a physical retail setting (Babin and Babin 2001; Babin, Darden et al. 1994; Jin and Sternquist 2004). Since the perceived value scales used in this study have not been validated in the context of the Web, they required a confirmatory factor analysis (CFA).

A principal components factor analysis using the covariance matrix with a direct oblimin rotation was run in SPSS 15.0 (SPSS 2006). Table 6-2 displays the resultant rescaled pattern matrix. Within each column, bold font is used to indicate the construct to which the loadings pertain.

Examination of Table 6-2 shows that most items loaded highly on their respective construct, as indicated by a loading greater than 0.6 (Hair, Anderson et al. 1998). In addition, all items loaded highest on their specified construct, suggesting that none of the items were mis-specified.

Table 6-2 Rescaled Pattern Matrix

	Loading	
Survey Item	Hedonic Value	Utilitarian Value
Hed-1	**.596**	.352
Hed-2	**.604**	.149
Hed-3	**.618**	.214
Hed-4	**.784**	.133
Hed-5	**.723**	-.107
Hed-6	**.734**	.078
Hed-7	**.619**	.200
Hed-8	**.750**	-.094
Hed-9	**.742**	-.142
Hed-10	**.842**	-.157
Hed-11	**.571**	.074
Util-1	.054	**.625**
Util-2	-.014	**.813**
Util-3	.062	**.657**
Util-4	-.033	**.762**
Reliability*	.919	.811

* Fornell and Larcker (1981)

To determine whether to retain the two items with loadings below 0.6 (Hed-1 and Hed-11), Norman and Streiner (2000) suggest retaining only those items that are statistically significant. To that end they derive a formula that calculates a critical value based on the desired level of significance and sample size. For a level of significance of 0.01 and sample size of 131, the resulting critical value is 0.454, indicating that all items should be retained.

The reliabilities for hedonic value (0.919) and utilitarian value (0.811) are both above 0.7 and therefore acceptable for confirmatory research (Straub, Boudreau et al. 2004).

In summary, according to the results, the items have acceptable loadings and reliabilities, are loading correctly, and therefore the hedonic and utilitarian scales in their current form are appropriate for use in this study.

The next section examines construct validity given that an acceptable level of overall fit has been achieved.

6.5.1.1 Construct Validity

The perceived hedonic and utilitarian shopping value scales used in this study were originally developed in order to respond to the need to have a measure that captured a complete evaluation of the consumer shopping experience in a retail shopping mall (Babin, Darden et al. 1994). From that original work, reliability scores of 0.93 for hedonic value and 0.8 for utilitarian value were obtained. Subsequent studies utilizing these two measures have shown acceptable reliability of the scales: 0.91 for hedonic value and 0.76 for utilitarian value (Babin and Darden 1995), 0.83 for hedonic value, and 0.73 for utilitarian value (Babin and Babin 2001).

Discriminant validity, where evidence is provided that the constructs being observed are different (Shadish, Cook et al. 2002), is required to show that perceived hedonic value and perceived utilitarian value are distinct constructs. At the time of the development of the scales, the validation study of the survey instruments resulted in a correlation coefficient between perceived hedonic and utilitarian value of 0.16, with the variance extracted for each factor of 0.55 and 0.50 respectively (Babin, Darden et al. 1994). Since the variance extracted was greater than the square of the estimated correlation (0.03), evidence was provided of discriminant validity (Fornell and Larcker 1981).

With the results of the prior studies in mind, Table 6-2 reports the results for the survey items from the confirmatory factor analysis performed in this study. With only two exceptions (Hed-1, Hed-11), all items have a standardized regression weight greater than 0.6. Of the two exceptions, neither are below 0.4, which would be indicative of poor loading (Hair, Anderson et al. 1998). The resulting reliabilities were comparable to prior results (hedonic = 0.919, utilitarian = 0.811). The average variance extracted was 0.540 for hedonic value and 0.526 for utilitarian value; the results were similar to prior results.

The correlation between hedonic and utilitarian value was 0.403, which was considerably higher than results obtained by other researchers noted above. The resulting squared correlation (see Table 6-3), although higher than the results noted above by other researchers, was still less than the average variance extracted. Based on the criteria of Fornell and Larcker (1981), these results provide support for hedonic and utilitarian value as distinct constructs for the purposes of further analysis

Table 6-3 Correlation and Squared Average Variance Extracted

	Hedonic Value	Utilitarian Value
Hedonic Value	**.540**	
Utilitarian Value	.162	**.526**

The diagonal elements in bold are the average variance extracted.
The element at the intersection of hedonic and utilitarian value is the squared correlation between those constructs.

6.5.2 Dependent Measures

The numeric value of the hedonic and utilitarian value scales were originally calculated by summing the scores for each of the construct's constituent items (Babin, Darden et al. 1994). As an interpretative aid, the scores for hedonic and utilitarian value in this study were calculated as averages of their respective constituent items. Based on the confirmatory factor analysis above, hedonic value was based on Hed-1, Hed-2, Hed-3, Hed-4, Hed-6, Hed-7, Hed-8, Hed-9, Hed-10, and Hed-11 (reverse scored). Utilitarian value was based on Util-1, Util-2 (reverse scored), Util-3, and Util-4 (reverse scored).

6.6 Covariates and Perceived Value Hypotheses

As the following literature review suggests, there are a number of potential covariates that are relevant to this study, including sex, previous internet use behavior, age, and product experience (see Table 6-4 for covariate data that was collected). Where potential covariates are present, analysis of covariance (ANCOVA) is a recommended statistical technique (Montgomery 2001). By including covariates in the analysis of covariance, the error term is reduced and differences in the response of the dependant variable are easier to detect (Montgomery 2001), thereby avoiding a Type II error.

There is evidence in the literature to suggest that each of the proposed covariates could have an impact on this study's outcome measures. In terms of sex, there are possible correlations between gender-related shopping motivations and shopping activities performed on-line. Dittmar, Long and Meek (2004) found that men were more functional or utilitarian in their attitude to shopping and use of the internet, while women were more motivated by pleasure. That women do not find on-line shopping as convenient (Rodgers and Harris 2003), and perceive more risk buying on-line than men (Garbarino and Strahilevitz 2004) could introduce gender based differences in the outcome measures. In terms of information search strategies, sex differences for Christmas gifts have also emerged (Laroche, Saad et al. 2000).

In terms of internet usage and age, the 2003 Pew Internet and American Life research report (Madden 2003) showed that internet usage was negatively

correlated with age. The report also indicated that increased levels of on-line experience predicted ease in making on-line purchases, which in turn led to increased purchase probability.

With respect to product experience, product involvement generally stimulates a desire to browse in that product category (Bloch and Richins 1983; Bloch, Sherrell et al. 1986). This would imply that a consumer without experience with a particular product or category likely has little ongoing involvement or interest in that product category, and is less likely to gain any value from browsing that category.

Table 6-4 Covariates

Covariate	Survey Question
SEX	Your Sex
AGE	Your Age
Internet Exp	How long have you been using the internet?
Online purch	How many purchases have you made online in the past year?
Product Search	On average how frequently do you search for any type of information on the internet?
Info Search	On average how frequently do you search for information about products or services on the internet?
Camera Famil	I am familiar with cameras and have an understanding of the difference between conventional and digital cameras.
Electronic Famil	I am familiar with electronic devices, such as DVD players, MP3 players.

As can be seen, some of the covariates are categorical, may not be related to the dependent variable, and as such may not covary with the dependent variable, though there may be a difference in response between categories. The covariates were examined individually to determine if they should be handled as categorical/nominal variables in the SPSS UNIANOVA procedure rather than the default of treating them as continuous variables. The examination showed that using the SPSS defaults would not materially impact the results or conclusions of the analysis.

6.6.1 Hypotheses Tests

Hypotheses 1 and 2 predict the impact on hedonic and utilitarian value of searchers and browsers due to changes in level of information presentation. Specifically, searchers are expected to report higher levels of hedonic and utilitarian value when using a lean information presentation Web site compared to when using a rich information presentation Web site. Browsers, on the other hand, are expected to report lower levels of hedonic and utilitarian value when using a lean information presentation Web site compared to when using a rich information presentation Web site.

To test these hypotheses, an ANCOVA analysis with the information seeking mode and information presentation factors was conducted with the covariates identified above.

6.6.1.1 Hedonic Value

Table 6-5 shows the ANCOVA results for hedonic value (as per H1b, H2b, and H3). The interaction terms and main effects for information presentation and information seeking mode were not significant. The covariate Product search was significant, and was therefore carried over to the subsequent ANCOVA shown in Table 6-6.

Table 6-5 Tests of Between-Subjects Effects

Dependent Variable: Hedonic Value

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	21.531(a)	11	1.957	1.516	.134
Intercept	6.581	1	6.581	5.097	.026
SEX	.078	1	.078	.060	.806
AGE	1.226	1	1.226	.949	.332
Internet Exp	2.000	1	2.000	1.549	.216
Online Purch	3.720	1	3.720	2.881	.092
Product Search	6.764	1	6.764	5.238	.024
Info Search	.812	1	.812	.629	.429
Camera Famil	.002	1	.002	.002	.968
Electronic Famil	.319	1	.319	.247	.620
IP	.259	1	.259	.200	.655
ISM	.949	1	.949	.735	.393
IP*ISM	.099	1	.099	.077	.782
Error	153.661	119	1.291		
Total	2012.099	131			
Corrected Total	175.192	130			

a R Squared = .123 (Adjusted R Squared = .042)

Table 6-6 shows that the covariate Product Search was still significant, and the interaction and main effects for information presentation and information seeking mode were not significant.

Table 6-6 Tests of Between-Subjects Effects

Dependent Variable: Hedonic Value

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	11.533(a)	4	2.883	2.220	.071
Intercept	203.571	1	203.571	156.728	.000
Product Search	10.427	1	10.427	8.028	.005
IP	.462	1	.462	.356	.552
ISM	.171	1	.171	.131	.718
IP*ISM	.009	1	.009	.007	.935
Error	163.659	126	1.299		
Total	2012.099	131			
Corrected Total	175.192	130			

a R Squared = .066 (Adjusted R Squared = .036)

Table 6-7 shows that without any covariates, the interaction and main effects due to information presentation and information seeking mode still were non-significant. The F scores for the interaction and main effects terms showed little change between Table 6-6 and Table 6-7 due to the removal of the covariate, indicating that the covariate did not materially impact the interaction and main effect terms.

Table 6-7 Tests of Between-Subjects Effects

Dependent Variable: Hedonic Value

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1.106(a)	3	.369	.269	.848
Intercept	1832.659	1	1832.659	1336.970	.000
IP	.738	1	.738	.538	.465
ISM	.299	1	.299	.218	.642
IP*ISM	.011	1	.011	.008	.929
Error	174.086	127	1.371		
Total	2012.099	131			
Corrected Total	175.192	130			

a R Squared = .006 (Adjusted R Squared = -.017)

The non-significant results for the interaction terms indicate a lack of support for either H1b (searchers report higher hedonic value for lean IP) or H2b (browsers report higher hedonic value for rich IP). The non-significant main effect

for IP indicates a lack of support for H3 (a rich Web site will be rated higher in hedonic value).

6.6.1.2 Utilitarian Value

Table 6-8 shows the ANCOVA results for utilitarian value with all covariates included. None of the covariates were significant, but the main effect due to information seeking mode, and the IP*ISM interaction were significant.

Table 6-8 Tests of Between-Subjects Effects

Dependent Variable: Utilitarian Value

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	29.908(a)	11	2.719	1.622	.101
Intercept	9.667	1	9.667	5.768	.018
SEX	.034	1	.034	.020	.887
AGE	3.814	1	3.814	2.275	.134
Internet Exp	4.463	1	4.463	2.663	.105
Online Purch	.259	1	.259	.154	.695
Product Search	1.505	1	1.505	.898	.345
Info Search	1.962	1	1.962	1.171	.281
Camera Famil	.018	1	.018	.011	.918
Electronic Famil	.326	1	.326	.195	.660
IP	.442	1	.442	.264	.608
ISM	7.491	1	7.491	4.469	.037
IP*ISM	7.313	1	7.313	4.363	.039
Error	199.442	119	1.676		
Total	2544.813	131			
Corrected Total	229.350	130			

a R Squared = .130 (Adjusted R Squared = .050)

Figure 6.6 graphically shows the impact on utilitarian value for searchers and browsers for each level of information presentation. The results suggest that browsers reported higher utilitarian value for lean IP than rich IP, but it was not significant (t_{64}=1.90, p=.062). The difference in utilitarian value for searchers between rich IP and lean IP was not significant (t_{63}=-.652, p=.517). The difference in utilitarian value between searchers and browsers was not significant for the lean information presentation (t_{66}=.267, p=.790), but was significant for the rich information presentation (t_{61}=2.563, p=.013), as a main effect the difference in utilitarian value between searchers and browsers was significant (t_{129}=2.028,

p=.045). These results do not support H1b (searchers report higher utilitarian value for lean IP) or H2b (browsers report higher utilitarian value for rich IP).

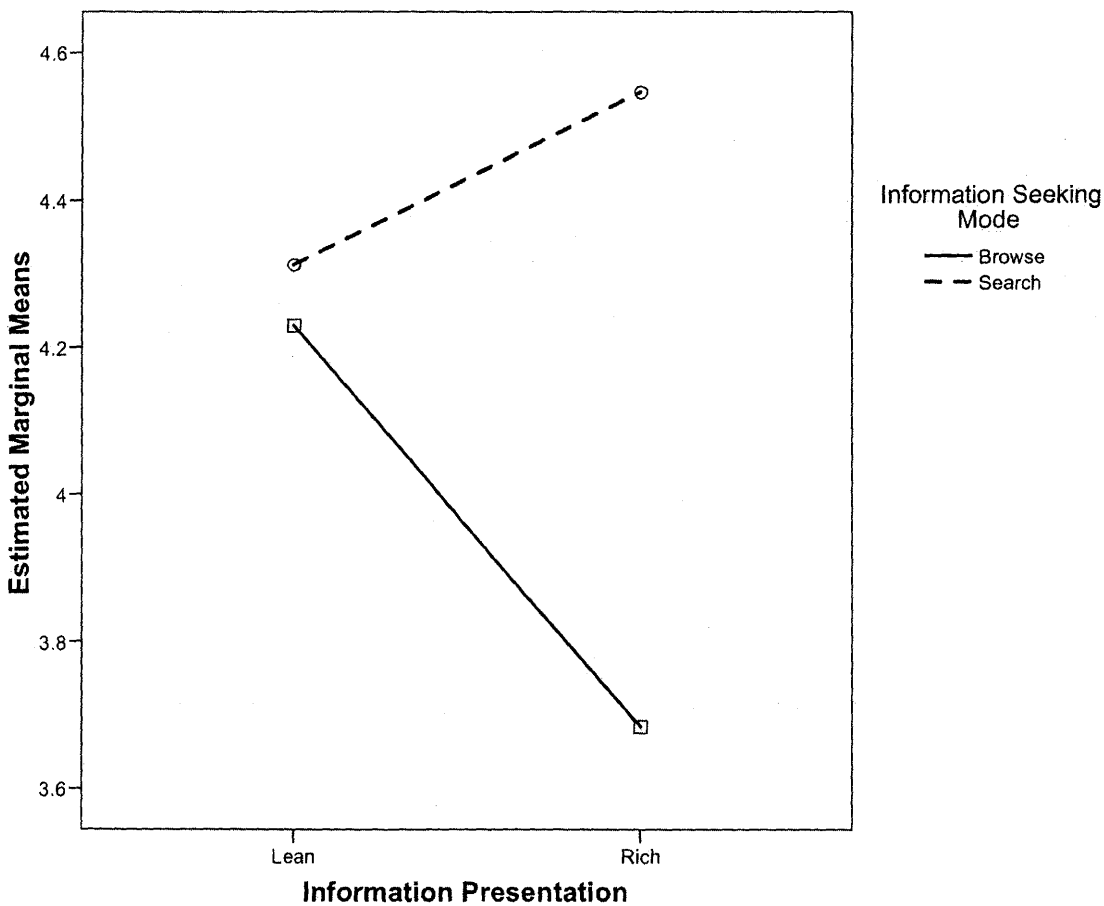

Figure 6.6 Estimated Marginal Means of Utilitarian Value

Table 6-9 summarizes the results for the perceived value hypotheses.

Table 6-9 Summary of Perceived Value Hypotheses

Hypothesis	Statistical Test	Result
H1a : Searchers report higher hedonic value for lean IP than for rich IP	ANCOVA	Not supported
H1b: Searchers report higher utilitarian value for lean IP than for rich iP	ANCOVA	Not supported
H2a: Browsers report higher hedonic value for rich IP than for lean IP	ANCOVA	Not supported
H2b: Browsers report higher utilitarian value for rich IP than for lean IP	ANCOVA	Not supported
H3: Test subjects report higher hedonic value for rich IP than for lean IP	ANCOVA	Not supported

6.7 Behavioral Hypotheses and Proposition

Hypotheses 4 and 5 predict that searchers and browsers will tend to view pages, and spend a longer time viewing pages that have an information focus consistent with their respective information seeking mode. Product-specific pages are judged to be of precise information focus; therefore searchers would view a greater number (H4a), and spend a longer time (H5a) viewing product-specific pages than browsers. Category-level pages are judged to be of diffuse information focus, therefore browsers would view a greater number (H4b), and spend a longer time (H5b) viewing category-level pages than searchers. Hypothesis 6 predicts that within product-specific Web pages, searchers and browsers will click on hyper-links that have an information focus consistent with their respective information seeking mode; searchers will click on hyper-links with an increased frequency to view features (H6a), view product reviews (H6b), and with decreased frequency to view related product (H6c) than browsers. Where Hypotheses 4, 5, and 6 make specific behavioral predictions regarding searching and browsing, proposition 1 predicts that an overall pattern of searching or browsing behavior can be discerned when considering a broad range of measures. This section concludes with Hypothesis 7, which predicts a main effect for information presentation such that those exposed to a rich information presentation will view a greater number of pages, and have a longer total session time than those exposed to a lean information presentation.

With 37 behavioral variables measured, analyzing them all in a structured manner was required. The results for page views are presented first, followed by the results for time viewing pages.

6.7.1 Effect of Information Seeking Mode and Information Presentation on Page Views by Page Type

The experimental Web site comprised 12 different pages, which can be grouped into five page types: product pages, category level pages, search pages, information pages and a home page. Thus the total number of pages

viewed (TNPV) can be subdivided into a metric for each page type: number of product pages (NPP), number of category level pages (TNCATP), number of search pages (TNSP), number of information pages (NINFP) and number of home pages (NHP).

The structure of the analyses follows the structure of the Web site, starting with the top level: total number of pages viewed, followed by page types. Most of the outcomes in this section were count data, and non-normal in their distribution, which placed restrictions on the statistical techniques that were considered.

The total number of pages viewed (TNPV) for all test subjects ranged from 3 to 88, with an average of 22.32, and variance of 248.00. The response distribution was non-normal ($K\text{-}S_{131}$=.142, p=.005), right skewed (skewness=1.603), and leptokurtic (kurtosis=3.118), suggesting a generalized linear model statistical approach.

Generalized linear models (GZLM) provide a way of dealing with non-normality and inequality of variance of the dependent variable's response. GZLM was introduced by Nelder and Wedderburn (1972), with further detail provided by McCullagh and Nelder (1989). Like the general linear model, GZLM allows for regression modeling. Unlike the general linear model, GZLM is not restricted to having the response distributed normally; instead responses can be distributed as any member of the exponential family. The exponential family includes normal, poisson, negative binomial, binomial, exponential, Bernoulli, and gamma distributions (Montgomery 2001). To relate the response mean to the linear predictor, a link function is used. Examples of link functions are identity, log, logit, and probit. As an example, choosing the normal distribution with the identity link gives an ordinary linear regression model (Montgomery 2001), in essence showing that the general linear model is part of GZLM.

For count data, poisson or negative binomial distributions are indicated. The negative binomial distribution is a generalization of the poisson that includes a dispersion parameter to address the poisson distribution's difficulty in handling overdispersion (Byers, Allore et al. 2003). By definition, a poisson distribution has the variance equal to the mean, and therefore a quick check of overdispersion (where variance is greater than the mean) simply compares the sample mean and variance of the dependent variable (Cameron and Trivedi 1998). Examination of Table 6-15 shows that all three outcomes exhibit overdispersion based on the criteria of Cameron and Trevedi, leading to the conclusion that negative binomial is the preferred distribution. The GZLM calculations were performed in SAS 9.1 (2006), which uses log as the canonical link function for the negative binomial distribution.

A GZLM was performed with the models terms ISM (Information Seeking Mode), IP (Information Presentation), and the interaction between ISM and IP on TNPV (Total Number of Page Views). Table 6-10 shows that in terms of overall model fit, only ISM had a significant effect. Table 6-11 shows the estimated least

squares mean (estimated mean of the linear predictor) from SAS. As an aid to interpretation a calculated response mean is included. A log (natural log) link transform was used, therefore the calculated response mean was e^x of L.S. Mean.

Table 6-10 Wald Statistics for TNPV

Effect	DF	X^2	p
ISM	1	5.10	.024
IP	1	.88	.348
ISM*IP	1	1.29	.257

Table 6-11 Estimated Means for TNPV*

Effect	ISM	IP	L.S. Mean	Calc. Resp. Mean	Std. Err	X^2	p	Lower C.L.	Upper C.L.
ISM	Browse		3.213	24.857	.078	1675.6	<.001	3.059	3.367
ISM	Search		2.960	19.303	.080	1374.9	<.001	2.804	3.117
IP		Lean	3.139	23.088	.077	1641.1	<.001	2.987	3.291
IP		Rich	3.034	20.783	.081	1409.9	<.001	2.876	3.193
ISM*IP	Browse	Lean	3.329	27.917	.105	1002.1	<.001	3.123	3.535
ISM*IP	Browse	Rich	3.097	22.133	.117	706.07	<.001	2.869	3.326
ISM*IP	Search	Lean	2.949	19.094	.114	671.17	<.001	2.726	3.172
ISM*IP	Search	Rich	2.971	19.515	.112	704.34	<.001	2.752	3.191

*df=1, α=.05

The next three tables display the difference between the reference treatment (Ref) and the comparison treatment (Co); all differences are between L.S. Means. For example, the first row of Table 6-12 shows the mean for browsers was higher than searchers, with a difference in means of 0.253. Multiple comparisons are reported in Table 6-14, which required adjusting the p values using the stepdown Sidak method. Stepdown Sidak has been described as being less conservative (SAS 2006) than the overly conservative but commonly used Bonferroni correction (Norman and Streiner 2000).

Table 6-12 Difference of TNPV Least Squares Means Due to ISM*

Effect	Ref-ISM	Co-ISM	Diff.	Std. Err	X^2	p	Lower C.L.	Upper C.L.
ISM	Browse	Search	.253	.112	5.102	.024	.033	.472

*df=1, α=.05

Table 6-13 Difference of TNPV Least Squares Means Due to IP*

Effect	Ref-IP	Co-IP	Diff.	Std. Err	X^2	p	Lower C.L.	Upper C.L.
IP	Lean	Rich	.105	.112	.882	.348	<.001	.325

*df=1, α=.05

Table 6-14 Difference of TNPV Least Squares Means due to ISM*IP Interactions*

Effect	Reference	Comparison	Diff.	Std. Err	X^2	p	Adj. p	Lower C.L.	Upper C.L.
ISM*IP	Browse-Lean	Browse-Rich	.232	.157	2.187	.139	.527	<.001	.540
ISM*IP	Browse-Lean	Search-Lean	.380	.155	6.007	.014	.108	.076	.684
ISM*IP	Browse-Lean	Browse-Rich	.358	.154	5.433	.020	.130	.057	.659
ISM*IP	Browse-Rich	Search-Lean	.148	.163	.822	.365	.819	<.001	.467
ISM*IP	Browse-Rich	Search-Rich	.126	.162	.607	.436	.819	<.001	.443
ISM*IP	Search-Lean	Search-Rich	<.001	.160	.019	.891	.891	<.001	.291

*df=1, α=.05

The results tabulated above showed that only ISM had a significant impact on the total number of pages viewed, where browsers viewed 24.857 pages compared to 19.303 pages for searchers. Therefore no support was seen for H7a, which predicted that increasing information presentation would increase the total number of pages viewed. The next set of analyses examines how the total number of pages viewed was distributed among the page types.

The page types of interest in this section are product pages (NPP), category level pages (TNCATP) and search pages (TNSP). As information pages or home pages are not of central interest to this study, they were not examined. Table 6-15 shows that the number of pages views for each type was non-normal (significant Kolmogorov-Smirnov statistics), right skewed, and leptokurtic.

Table 6-15 Descriptive Statistics

Page Type	Mean	Variance	Kolmogorov-Smirnov (df=131)	Skew	Kurtosis
NPP	3.53	17.144	.197, p<.0005	2.108	6.256
TNCATP	8.23	36.993	.156, p<.0005	1.549	3.245
TNSP	3.4	50.104	.315, p<.0005	3.962	19.115

Examining each page type in turn, the next five tables display the results for number of product pages (NPP). The results show that only ISM had a significant impact on the number of product pages viewed. On average, browsers viewed 4.280 product pages compared to 2.752 product pages for searchers, which is opposite to the result predicted by H4a.

Table 6-16 Wald Statistics for NPP

Effect	DF	X^2	p
ISM	1	4.61	.032
IP	1	.27	.603
ISM*IP	1	.51	.475

Table 6-17 Estimated Means for NPP*

Effect	ISM	IP	L.S. Mean	Calc. Resp. Mean	Std. Err	X^2	p	Lower C.L.	Upper C.L.
ISM	Browse		1.454	4.280	.142	105.36	<.001	1.176	1.731
ISM	Search		1.012	2.752	.149	46.086	<.001	.720	1.305
IP		Lean	1.287	3.620	.142	82.387	<.001	1.009	1.564
IP		Rich	1.180	3.254	.149	62.655	<.001	.888	1.472
ISM*IP	Browse	Lean	1.434	4.194	.191	56.134	<.001	1.059	1.809
ISM*IP	Browse	Rich	1.474	4.367	.209	49.796	<.001	1.065	1.883
ISM*IP	Search	Lean	1.139	3.125	.209	29.677	<.001	.729	1.549
ISM*IP	Search	Rich	.886	2.424	.213	17.339	<.001	.469	1.3

*df=1, α=.05

Table 6-18 Difference of NPP Least Square Means Due to ISM*

Effect	Ref-ISM	Co-ISM	Diff.	Std. Err	X^2	p	Lower C.L.	Upper C.L.
ISM	Browse	Search	.441	.206	4.605	.032	.038	.845

*df=1, α=.05

Table 6-19 Difference of NPP Least Square Means Due to IP*

Effect	Ref-IP	Co-IP	Diff.	Std. Err	X^2	p	Lower C.L.	Upper C.L.
IP	Lean	Rich	.107	.206	.270	.603	<.001	.510

*df=1, α=.05

Table 6-20 Difference of NPP Least Square Means Due to ISM*IP Interactions*

Effect	Reference	Comparison	Diff.	Std. Err	X^2	p	Adj. p	Lower C.L.	Upper C.L.
ISM*IP	Browse-Lean	Browse-Rich	<.001	.283	.020	.887	.887	<.001	.515
ISM*IP	Browse-Lean	Search-Lean	.294	.283	1.078	.299	.775	<.001	.850
ISM*IP	Browse-Lean	Search-Rich	.548	.286	3.672	.055	.293	<.001	1.109
ISM*IP	Browse-Rich	Search-Lean	.335	.296	1.281	.258	.775	<.001	.914
ISM*IP	Browse-Rich	Search-Rich	.588	.298	3.897	.048	.293	.004	1.173
ISM*IP	Search-Lean	Search-Rich	.254	.298	.725	.395	.778	<.001	.839

*df=1, α=.05

The next five tables examine the results for number of category pages viewed (TNCATP). Table 6-21 indicates that both ISM and IP had significant effects (see Figure 6.7).

Table 6-21 Wald Statistics for TNCATP

Effect	DF	X^2	p
ISM	1	22.53	<.0001
IP	1	4.80	.028
ISM*IP	1	.23	.628

Table 6-22 shows that on average browsers viewed significantly more category pages (10.241 vs. 5.992) than searchers (see Table 6-23), giving support to H4b. In terms of the impact of IP, those test subjects assigned to a lean IP viewed significantly more category pages (8.865 vs. 6.922) than for the rich IP (see Table 6-24).

Table 6-22 Estimated Means for TNCATP*

Effect	ISM	IP	L.S. Mean	Calc. Resp. Mean	Std Err	X^2	p	Lower C.L.	Upper C.L.
ISM	Browse		2.326	10.241	0.076	929.48	<.001	2.177	2.476
ISM	Search		1.790	5.992	0.083	462.28	<.001	1.627	1.954
IP		Lean	2.182	8.865	0.077	806.95	<.001	2.032	2.333
IP		Rich	1.935	6.922	0.083	545.94	<.001	1.772	2.097
ISM*IP	Browse	Lean	2.423	11.278	0.101	569.84	<.001	2.224	2.622
ISM*IP	Browse	Rich	2.230	9.300	0.114	382.83	<.001	2.007	2.453
ISM*IP	Search	Lean	1.941	6.969	0.115	283.35	<.001	1.715	2.167
ISM*IP	Search	Rich	1.639	5.152	0.120	186.19	<.001	1.404	1.875

*df=1, α=.05

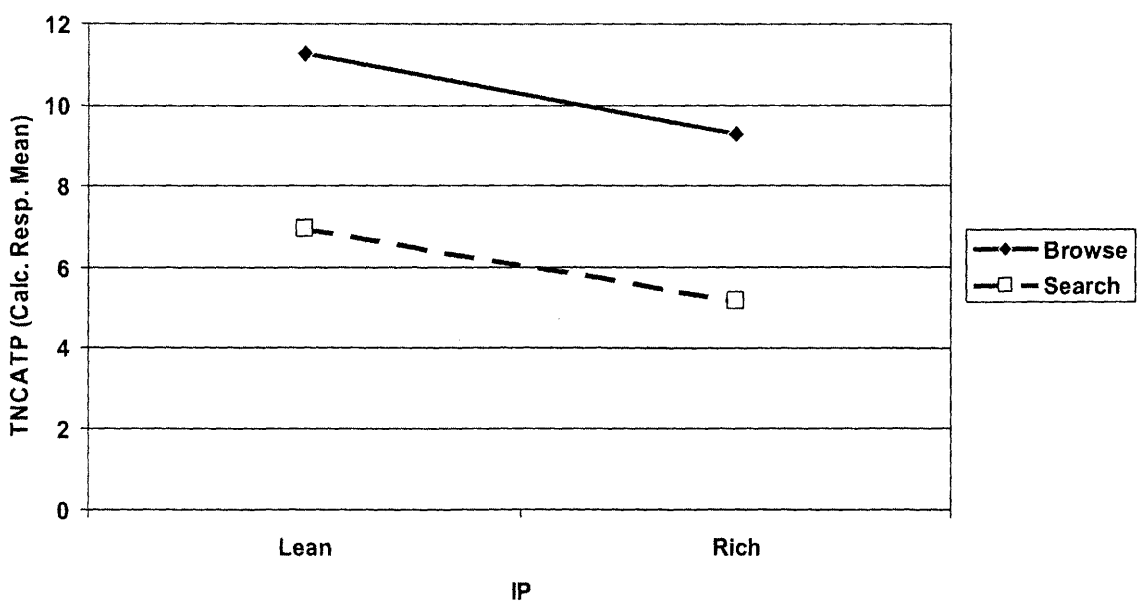

Figure 6.7 Calculated Response Mean of TNCATP Due to ISM and IP

Table 6-23 Difference in TNCATP Least Squares Mean Due to ISM*

Effect	Ref-ISM	Co-ISM	Diff.	Std Err	X^2	p	Lower C.L.	Upper C.L.
ISM	Browse	Search	.536	0.113	22.526	<.001	0.315	.757

*df=1, α=.05

Table 6-24 Difference in TNCATP Least Squares Mean Due to IP*

Effect	Ref-IP	Co-IP	Diff.	Std Err	X^2	p	Lower C.L.	Upper C.L.
IP	Lean	Rich	0.247	.113	4.801	.028	.026	.469

*df=1, α=.05

Table 6-25 Difference in TNCATP Least Squares Mean Due to ISM*IP Interactions*

Effect	Reference	Comparison	Diff.	Std Err	X^2	p	Adj. p	Lower C.L.	Upper C.L.
ISM*IP	Browse-Lean	Browse-Rich	.193	.153	1.596	.206	.206	<.001	.492
ISM*IP	Browse-Lean	Search-Lean	.481	.154	9.818	.002	.009	.180	.783
ISM*IP	Browse-Lean	Search-Rich	.784	.157	24.821	<.001	<.001	.475	1.092
ISM*IP	Browse-Rich	Search-Lean	.289	.162	3.167	.075	.195	<.001	.606
ISM*IP	Browse-Rich	Search-Rich	.591	.166	12.725	<.001	.002	.266	.915
ISM*IP	Search-Lean	Search-Rich	.302	.167	3.292	.070	.195	<.001	.6

*df=1, α=.05

The next five tables examine results for the number of search pages viewed. Table 6-26 shows that while there is not a main effect for either ISM or IP, there is a significant interaction effect. The interaction between ISM and IP is shown graphically in Figure 6.8. It should be noted that the only significant difference is between Browse-Rich and Search-Rich (see Table 6-30). The results due to the interaction effects suggest that in terms of number of search pages viewed, IP has a differential effect on searchers and browsers.

Table 6-26 Wald Statistics for TNSP

Effect	DF	X^2	p
ISM	1	2.86	.091
IP	1	.02	.875
ISM*IP	1	10.58	.001

Table 6-27 Estimated Means for TNSP*

Effect	ISM	IP	L.S. Mean	Calc. Resp. Mean	Std Err	X^2	p	Lower C.L.	Upper C.L.
ISM	Browse		.734	2.084	.245	9.013	.003	.255	1.214
ISM	Search		1.309	3.704	.237	30.649	<.001	.846	1.773
IP		Lean	1.049	2.853	.233	20.170	<.001	.591	1.506
IP		Rich	.995	2.705	.247	16.169	<.001	.510	1.480
ISM*IP	Browse	Lean	1.314	3.722	.316	17.304	<.001	.695	1.934
ISM*IP	Browse	Rich	.154	1.167	.373	.170	.680	<.001	.886
ISM*IP	Search	Lean	.783	2.187	.344	5.184	.023	.109	1.457
ISM*IP	Search	Rich	1.836	6.273	.325	31.930	<.001	1.199	2.473

*df=1, α=.05

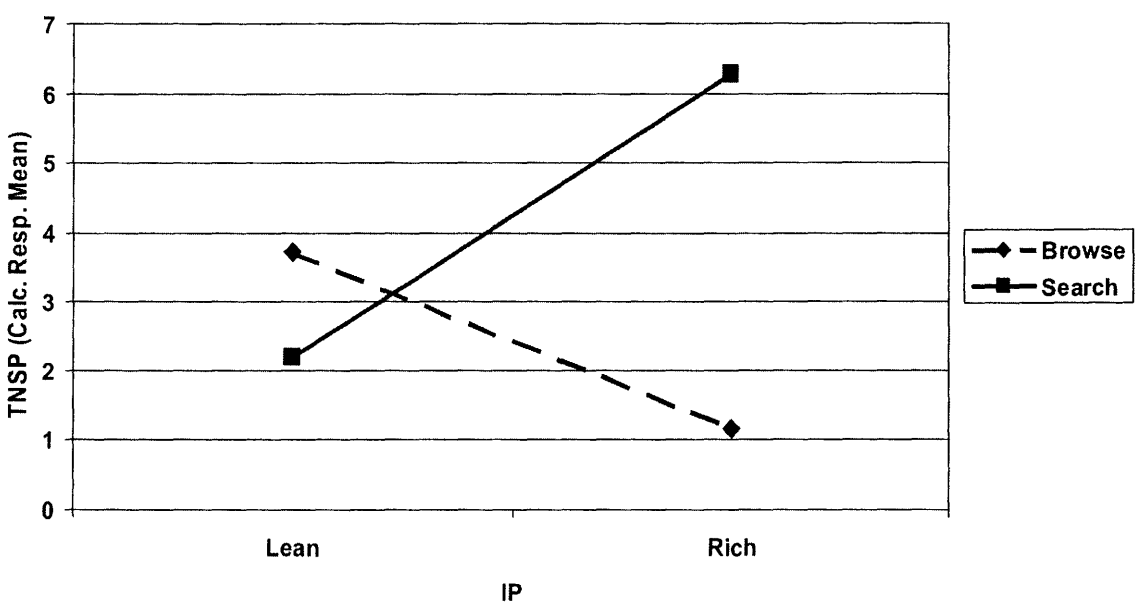

Figure 6.8 Calculated Response Mean of TNSP Due to ISM and IP

Table 6-28 Difference in TNSP Least Square Mean Due to ISM*

Effect	Ref-ISM	Co-ISM	Diff.	Std Err	X^2	p	Lower C.L.	Upper C.L.
ISM	Browse	Search	<.001	.340	2.859	.091	<.001	.092

*df=1, α=.05

Table 6-29 Difference in TNSP Least Square Mean Due to IP*

Effect	Ref-IP	Co-IP	Diff.	Std Err	X^2	p	Lower C.L.	Upper C.L.
IP	Lean	Rich	.053	.340	.025	.875	<.001	.720

*df=1, α=.05

Table 6-30 Difference in TNSP Least Square Means Due to ISM*IP Interactions*

Effect	Reference	Comparison	Diff.	Std Err	X^2	p	Adj. p	Lower C.L.	Upper C.L.
ISM*IP	Browse-Lean	Browse-Rich	1.160	.489	5.626	.018	.117	.202	2.119
ISM*IP	Browse-Lean	Search-Lean	.532	.467	1.296	.255	.621	<.001	1.447
ISM*IP	Browse-Lean	Search-Rich	<.001	.453	1.326	.250	.621	<.001	.366
ISM*IP	Browse-Rich	Search-Lean	<.001	.508	1.534	.216	.621	<.001	.366
ISM*IP	Browse-Rich	Search-Rich	<.001	.495	11.548	<.001	.005	<.001	<.001
ISM*IP	Search-Lean	Search-Rich	<.001	.473	4.959	.026	.146	<.001	<.001

*df=1, α=.05

The next section analyses the impact of ISM and IP on time viewing pages.

6.7.2 Effect of Information Presentation on Time Viewing by Page Type (ISM Pooled)

The time spent viewing the Web site (TST) by all test subjects ranged from 34 seconds to 31 minutes 25 seconds, with an average of 7 minutes 50.81 seconds and a variance of 1693 minutes 3.6 seconds. The response distribution was non-normal ($K\text{-}S_{131}$=.142, p=.005), right skewed (skewness=1.543), and leptokurtic (kurtosis=3.278), which suggested a non-parametric statistical approach since TST is a continuous variable. The analyses will first examine the impact of IP, followed by the impact of ISM.

Table 6-31 presents the results in terms of the impact of lean and rich levels of IP with information seeking modes pooled. The statistics showed that IP had no effect on total session time, and therefore not providing support for H7b.

Table 6-31

	IP	N	Mean Rank	Sum of Ranks	Statistics	
TST	Lean	68	70.29	4780.00	Mann-Whitney U	1850.0
	Rich	63	61.37	3866.00	Z	-1.345
	Total	131			Asymp. Sig. (2-tailed)	.179

In terms of the time spent viewing each type of page, Table 6-32 presents time viewing product pages (TPP), category pages (TTCATP), and search pages (TTSP). The results indicate that IP had no effect on the amount of time viewing each type of page.

Table 6-32

	IP	N	Mean Rank	Sum of Ranks		
TPP	Lean	68	71.26	4846.00	Mann-Whitney U	1784.00
	Rich	63	60.32	3800.00	Z	-1.664
	Total	131			Asymp. Sig. (2-tailed)	.096
TTCATP	Lean	68	71.19	4841.00	Mann-Whitney U	1789.00
	Rich	63	60.40	3805.00	Z	-1.626
	Total	131			Asymp. Sig. (2-tailed)	.104
TTSP	Lean	68	66.74	4538.50	Mann-Whitney U	2091.00
	Rich	63	65.20	4107.50	Z	-.250
	Total	131			Asymp. Sig. (2-tailed)	.803

6.7.3 Impact of Information Seeking Mode on Time Viewing by Page Type

Table 6-33 displays the impact of search and browse information seeking modes (ISM) on the total session time. It can be seen that there was not a significant difference between searchers and browsers in total session time.

Table 6-33

	ISM	N	Mean Rank	Sum of Ranks	Statistics	
TST	Search	65	61.42	3992.00	Mann-Whitney U	1847.0
	Browse	66	70.52	4654.00	Z	-1.372
	Total	131			Asymp. Sig. (2-tailed)	.170

Breaking down the Total Session Time into each page type, it can be seen from Table 6-34 that browsers spent more time viewing category pages than searchers, which is consistent with the earlier findings of the number of category pages viewed. These results support H5b (searchers spend less time viewing category pages), but not H5a (searchers spend more time viewing product pages).

Table 6-34

	ISM	N	Mean Rank	Sum of Ranks	Statistics	
TPP	Search	65	64.32	4181.00	Mann-Whitney U	2036.00
	Browse	66	67.65	4465.00	Z	-.506
	Total	131			Asymp. Sig. (2-tailed)	.613
TTCATP	Search	65	55.94	3636.00	Mann-Whitney U	1491.00
	Browse	66	75.91	5010.00	Z	-3.011
	Total	131			Asymp. Sig. (2-tailed)	.003
TTSP	Search	65	66.91	4349.00	Mann-Whitney U	2086.00
	Browse	66	65.11	4297.00	Z	-.292
	Total	131			Asymp. Sig. (2-tailed)	.770

The following analysis examines whether the above results hold within each level of information presentation. From examination of Table 6-35 it can be seen that given a lean IP, browsers viewed category pages for a significantly longer time than searchers.

Table 6-36 shows that given a rich IP, that while there is a suggestion that browsers spent more time viewing category pages, it was not significant.

Table 6-35 Lean Information Presentation

	MODEN	N	Mean Rank	Sum of Ranks	Statistics	
TPP	Search	32	35.13	1124.00	Mann-Whitney U	556.000
	Browse	36	33.94	1222.00	Z	-.246
	Total	68			Asymp. Sig. (2-tailed)	.805
TTCATP	Search	32	28.95	926.50	Mann-Whitney U	398.500
	Browse	36	39.43	1419.50	Z	-2.181
	Total	68			Asymp. Sig. (2-tailed)	.029
TTSP	Search	32	31.56	1010.00	Mann-Whitney U	482.000
	Browse	36	37.11	1336.00	Z	-1.235
	Total	68			Asymp. Sig. (2-tailed)	.217

Table 6-36 Rich Information Presentation

	ISM	N	Mean Rank	Sum of Ranks	Statistics	
TPP	Search	33	30.18	996.00	Mann-Whitney U	435.000
	Browse	30	34.00	1020.00	Z	-.844
	Total	63			Asymp. Sig. (2-tailed)	.399
TTCATP	Search	33	27.85	919.00	Mann-Whitney U	358.000
	Browse	30	36.57	1097.00	Z	-1.886
	Total	63			Asymp. Sig. (2-tailed)	.059
TTSP	Search	33	35.44	1169.50	Mann-Whitney U	381.500
	Browse	30	28.22	846.50	Z	-1.688
	Total	63			Asymp. Sig. (2-tailed)	.091

It is of interest that in the context of rich IP, browsers did view more category pages than searchers, but the time spent viewing the category pages was not significantly longer. This could be due to either browsers skimming the pages, searchers viewing the pages in more depth, or both.

6.7.4 Detail Page Design Elements

Data was also captured of each test subject's interaction with specific design elements on the product detail Web page, specifically: the number of times a test subject clicked a link to view the detail of a specific product (NDFC), the number of times a test subject clicked a link to view a related product (NALC), and the number of times a test subject clicked a link to view a review of

the specific product (NCRC). The results presented in Table 6-37 and Table 6-38 show that neither ISM nor IP had an impact on clicking a link to view product details (NDFC) or reviews (NCRC), thereby not supporting either H6a or H6b.

The results presented in Table 6-39 and Table 6-41 indicate that browsers were more likely to follow links to view a related product (NALC), giving support to H6c. No effect was seen for either IP or the ISM*IP interaction.

Table 6-37 Wald Statistics for NDFC

Effect	DF	X^2	p
ISM	1	2.31	.1284
IP	1	.88	.3489
ISM*IP	1	.51	.4752

Table 6-38 Wald Statistics for NCRC

Effect	DF	X^2	p
ISM	1	2.68	.1016
IP	1	1.04	.3077
ISM*IP	1	.00	.9763

Table 6-39 Wald Statistics for NALC

Effect	DF	X^2	p
ISM	1	4.62	.0317
IP	1	1.31	.2531
ISM*IP	1	2.48	.1156

Table 6-40 Estimate Means for NALC

Effect	ISM	IP	L.S. Mean	Calc. Resp. Mean	Std Err	X2	p	Lower C.L.	Upper C.L.
ISM	Browse		0.233	1.262	0.166	1.970	0.160	<.001	0.558
ISM	Search		<.001	0.729	0.194	2.646	0.104	<.001	0.065
IP		Lean	0.104	1.110	0.168	0.384	0.535	<.001	0.434
IP		Rich	<.001	0.829	0.192	0.953	0.329	<.001	0.189
ISM*IP	Browse	Lean	0.178	1.194	0.226	0.616	0.433	<.001	0.622
ISM*IP	Browse	Rich	0.288	1.333	0.242	1.412	0.235	<.001	0.762
ISM*IP	Search	Lean	0.031	1.031	0.249	0.015	0.902	<.001	0.518
ISM*IP	Search	Rich	<.001	0.515	0.299	4.922	0.027	<.001	<.001

*df=1, α=.05

Table 6-41 Difference in NALC Least Square Mean Due to ISM*

	Effect	Ref-ISM	Co-ISM	Diff.	Std Err	X^2	p	Lower C.L.	Upper C.L.
ISM		Browse	Search	0.549	0.256	4.616	0.032	0.048	1.050

*df=1, α=.05

Table 6-42 Difference in NALC Least Square Mean Due to IP*

Effect	Ref-IP	Co-IP	Diff.	Std Err	X^2	p	Lower C.L.	Upper C.L.
IP	Lean	Rich	0.292	0.256	1.306	0.253	<.001	0.793

*df=1, α=.05

Table 6-43 Difference in NALC Least Square Means Due to ISM*IP Interaction*

Effect	Reference	Comparison	Diff.	Std Err	X^2	p	Adj. p	Lower C.L.	Upper C.L.
ISM*IP	Browse-Lean	Browse-Rich	<.001	0.332	0.110	0.740	0.886	<.001	0.540
ISM*IP	Browse-Lean	Search-Lean	0.147	0.336	0.191	0.662	0.886	<.001	0.806
ISM*IP	Browse-Lean	Search-Rich	0.841	0.375	5.028	0.025	0.162	0.106	1.576
ISM*IP	Browse-Rich	Search-Lean	0.257	0.347	0.548	0.459	0.842	<.001	0.937
ISM*IP	Browse-Rich	Search-Rich	0.951	0.385	6.110	0.013	0.103	0.197	1.705
ISM*IP	Search-Lean	Search-Rich	0.694	0.389	3.186	0.074	0.320	<.001	1.456

*df=1, α=.05

Table 6-44 summarizes the results for the behavioral hypotheses.

Table 6-44 Summary of Behavioral Hypotheses Results

Hypothesis	Statistical Test	Result	Significance
H4a: Searchers view more product-specific pages than browsers	GZLM	Not Supported	.032
H4b: Searchers view fewer category-level pages than browsers	GZLM	Supported	<.001
H5a: Searchers spend more time viewing product-specific pages than browsers	M-W U	Not Supported	.613
H5b: Searchers spend more time viewing category-levl pages than browsers	M-W U	Supported	.003
H6a: Searchers view product features more than browsers	GZLM	Not Supported	.128
H6b: Search view product reviews more than browsers	GZLM	Not Supported	.102
H6c: Searchers follow hyper-links to related product less than browsers	GZLM	Supported	.032
H7a: Test subjects view a higher total number of pages for a rich IP than for a lean IP	GZLM	Not Supported	.348
H7b: Test subjects have a longer total session time for a rich IP than for a lean IP	M-W U	Not Supported	.179

6.7.5 Searching and Browsing Behavior

Proposition 1 predicts that two distinct patterns of behavior will be apparent, arising from the test subjects receiving instructions to either search or browse. The proposition in effect states that it should be possible to predict a test subject's membership in one of two groups (searchers or browsers) on the basis of a set of predictor variables (behavioral metrics). While the categorical nature of this analysis suggests Discriminant Analysis as an appropriate statistical technique, discriminant analysis assumes a multivariate normal distribution of the predictor variables. The non-normality of the behavioral metrics means that Logistic Regression is the preferred technique (Press and Wilson 1978).

Appendix A lists the behavioral metrics available for consideration, with the metrics suggested by Moe (2002; 2003) tagged. Given the large number of predictor variables and a sample size of 131 cases, it is apparent that the risk of overfitting the regression model is high (Babyak 2004). Following the recommendation of Peduzzi et al. (1996) that 10 cases per variable or more are required, a maximum of 13 variables was considered in any one logistic regression analysis.

Validation of a predictive model, that is, a determination of the model's performance on a data set other than the training data set is an important statistic. To a large extent, the basis of the proposition is from the work of Moe. To be able to extend her findings requires that the behavioral metrics she identified (Moe 2002; Moe, Chipman et al. 2003) be used in the logistic regression analysis. Ideally, in addition to having identified the variables, if Moe had knowledge of the information seeking mode, and had run the logistic

regression and made the parameters available, this study would form an external validation. Lacking this prior information, the analysis described below is restricted to an internal validation.

Split sample, with and without cross validation, jack-knife and bootstrapping (Efron and Tibshirani 1997) have all been proposed for internal validation, with bootstrapping being the recommended technique (Steyerberg, Harrell et al. 2001). To evaluate the performance of the logistic regression predictions, receiver operating characteristic (ROC) curves were used. With the logistic regression bootstrapped, the area under the ROC was calculated for each iteration of the bootstrapping procedure.

Bootstrapping of logistic regression is not a built-in function of SPSS 15. An example bootstrapping syntax script is supplied with SPSS for linear regression. The supplied script required extensive modification for use with logistic regression, so that it could include the ability to capture goodness of fit statistics, and ROC calculations (See Appendix E). The script selects at random with replacement as many cases as the sample size and performs the logistic regression on those cases; the cases not selected are used to test the resulting regression. The predictions are saved to a separate data file, which is used by the ROC procedure. The complete sequence is repeated 100 times, followed by the generation of summary statistics. The use of the script only requires the specification of the independent variables to be regressed against information seeking mode.

Appendix A shows 15 variables previously identified by Moe, which exceeds the maximum allowed by the recommendation above. Furthermore, from the literature reviewed and theory developed in this study, additional metrics were identified as being useful predictors of searching and browsing behavior. As a consequence, three separate logistic regression analyses were performed. One considered only those variables proposed by Moe, the remaining two examined page type counts and times respectively. To reduce the number of variables in the first analysis to 13, TNPV and ATP were analyzed in the second and third analyses. One hundred iterations of the bootstrapping procedure were run in all instances. Higher numbers of iterations were tested, but the results were not noticeably different from one hundred iterations.

A logistic regression was performed with PNPP, PNCP, PNTSP, PNINFP, PNHP, NUP, NUC, NPR, NCR, PPPU, PPCU, UPCP, and MREPP as predictor variables. As this is hypothesis testing, the enter method was used. The mean percentage correct for searchers was 73.87% (95%CI=54.14-90.75), browsers was 77.06% (95%CI=61.76-90.13), and overall was 75.95% (95%CI=65.29-85.5). Hosmer-Lemshow χ^2 was insignificant for 72 out of 100 iterations, indicating that for most iterations a good fit was obtained. The mean area under the ROC curve was 0.845 (95%CI=.772-.915) indicating a reasonable discrimination ability.

Note that the individual contributions of the predictor variables and the resultant equations are not reported since the proposition is only concerned with whether a viable model exists. Furthermore, the bootstrapping technique would produce 100 sets of results causing difficulties in interpretation.

The theory developed in this study suggests that the type of page viewed is impacted by the test subject's information seeking mode. This leads to a logistic regression with TNPV, NPP, NCATP, NMCAT, NBSP, NASP, NSRP, NSP, NCTSP, NCOMP, NCSP, NCARP, and NHP as predictor variables. Again, the enter method was used. The mean percentage correct for searchers was 77.90 (95%CI=58.77-89.71), for browsers was 72.4 (95%CI=57.21-84.47) and overall 75.51% (95%CI=65.65-83.57). Hosmer-Lemeshow χ^2 was insignificant for 64 out of 100 iterations, indicating that for most iterations a good fit was obtained. The mean area under the ROC curve was 0.844 (95%CI=.754-.902), indicating a reasonable discrimination ability.

The third logistic regression was similar to the second, but with time as the principal dimension. A logistic regression was run with TST, TPP, TNMCAT, TCATP, TBSP, TASP, TSRP, TSP, TCTSP, TCOMP, TCARP, THP, and ATP as predictor variables using the enter method. The mean percentage correct for searchers was 73.645% (95% CI=50.85-86.61), and browsers were 70.27% (95% CI=53.528-86.51), with overall at 72.44% (95% CI=64.12-82.81). Hosmer-Lemeshow χ^2 was insignificant for 61 out of 100 iterations, indicating that for most iterations a good fit was obtained. The mean area under the ROC curve was 0.806 (95% CI=.725-.886) indicating a reasonable discrimination ability.

The results from all three logistic regressions are consistent with each other and support Proposition 1, that searchers and browsers can be differentiated on the basis of behavioral metrics.

The next section will discuss the results in terms of the objectives of this study.

7 DISCUSSION & CONCLUSION

7.1 Introduction

The findings presented in the previous section offer detailed insight into how certain Web atmospheric variables (information presentation and information focus) in an experimental retail shopping Web site affect product information seeking (browse and search) behavior.

To understand these findings better, this section synthesizes the results found and provides answers to the study's research hypotheses and proposition. This is followed by a discussion of the major contributions of the study, identification of limitations, as well as plans for future research in this area.

7.2 Answers to Research Hypotheses

7.2.1 Perceived Value Hypotheses

The perceived value hypotheses are recapped prior to discussion of the experimental results.

H1: On-line consumers that are in a search information seeking mode and use a retail Web site with a lean information presentation, compared to those who use a site with a rich information presentation, will report:

H1a: higher levels of perceived hedonic value;

H1b: higher levels of perceived utilitarian value.

H2: On-line consumers that are in a browse information seeking mode and use a retail Web site with a rich information presentation, compared to those who use a site that with lean information presentation, will report:

H2a: higher levels of perceived hedonic value;

H2b: higher levels of perceived utilitarian value.

H3: On-line consumers will rate a rich Web site, compared to a lean Web site higher in hedonic value.

Hypotheses H1 and H2 predict the impact that varying the level of information presentation will have on the perceived value of searchers and browsers. With the potential of covariates affecting the results, an ANCOVA was run, with no support for the hypotheses shown between levels of information presentation for either searchers or browsers (see sections 6.6.1.1 and 6.6.1.2).

However interesting results were seen for utilitarian value, where searchers reported higher utilitarian value than browsers. This may indicate that browsers were unable to utilize the experimental Web site in the manner they desired. That is, the Web site may not have met the functional requirements of browsers, but did meet the functional requirements of searchers. This would suggest that a future study should include an even richer level of information presentation than that used in this study to determine if these results hold.

An ANCOVA was run pooling searchers and browsers in order to test for a main effect for hedonic value due to information presentation. A main effect was found for the covariate of online product searching, but a main effect was not found for information presentation (see section 6.6.1.1).

In summary, support was not found for any of the perceived value hypotheses (H1, H2, H3). The significance of this result is unclear, since possible causes may be due to faulty hypotheses, insufficient experimental manipulation, no real effect, or measurement failure. Discussion is deferred to the next section after the behavioral hypotheses have been discussed.

7.2.2 Behavioral hypotheses

The behavioral hypotheses are recapped prior to discussion of the results.

H4:On-line consumers that are in a search information seeking mode, compared to consumers in a browse information seeking mode, will view:

H4a: a higher number of product-specific pages;

H4b: a lower number of category-level pages;

H5: On-line consumers that are in a search information seeking mode, compared to consumers in a browse information seeking mode, will spend:

H5a: a longer amount of time viewing product-specific pages;

H5b: a shorter amount of time viewing category-level pages.

H6: Consumers that are searching, compared to consumers that are browsing, will:

H6a: view the features of a specific product with increased frequency;

H6b: view product reviews of a specific product with increased frequency;

H6c: follow hyper-links to related products with decreased frequency.

Proposition 1: Consumers that are searching will exhibit a distinct behavior that is different from consumers that are browsing.

H7: Consumers that are exposed to a rich, compared to a lean Web site will:

H7a: view a higher number of pages,

H7b: have a longer total session time.

Hypotheses H4, H5, H6, H7, and the proposition all have behavioral metrics as their respective outcomes. H4 and H5 predict that searchers and browsers will differentially choose to view Web pages that have an information focus consistent with their respective information seeking modes.

The results showed that browsers viewed significantly more product pages, category pages and a higher number of pages in total than searchers (see section 6.7.1), supporting H4b, but not H4a. In terms of the amount of time spent viewing Web pages, browsers spent significantly more time viewing category-level pages than searchers, supporting H5b but not H5a. There was no difference in the amount of time viewing product pages, or the total time viewing the Web site.

Hypotheses H6a, H6b, and H6c predict that searchers and browsers will differentially click links on a product detail page that are consistent with their respective information focus. The results indicate that there is not a difference in the number of times searchers and browsers click links to view product detail, or view a product review (see section 6.7.4). However, browsers do click links to view related products significantly more than searchers, giving support to H6c, but no support for H6a and H6b.

Proposition 1 asserts that the behavior of searchers and browsers is sufficiently different that it would allow categorization of test subjects into their assigned information seeking mode based on the measured behavior. The results obtained show that the information seeking mode can be successfully predicted with a reasonable discrimination ability using three different sets of metrics: number of page views by type, proportion of page views by type, and the time viewing each page type (see section 6.7.5), giving support for proposition 1.

Hypothesis 7, similar to H3, predicts that a main effect on behavior will be seen due to information presentation. The results do not provide any support for H7 (see section 6.7.3). An explanation for this result may be found in recent research into searching behavior in a Web shopping environment that reported that the inclusion of product pictures helps users navigate more efficiently

(Mochel 2006), suggesting that a rich information presentation may reduce the number of pages viewed. An additional implication of this finding is that increasing levels of information presentation would not induce browsing behavior.

The lack of support for H1, H2, H3 and H7 might lead to the conclusion that information presentation does not have an effect on perceptions of the Web site or on behavior. However, a finer-grained examination of the results demonstrates that this is not the case. As noted in section 6.7.1, changes in the level of information presentation result in a differential impact on the number of search pages viewed by searchers and browsers. Comparing rich information presentation to lean information presentation, browsers increased the number of search pages viewed while searchers decreased the number of search pages viewed. This finding is important since it demonstrates that information presentation does have an impact, and that this impact is moderated by the information seeking mode of the test subject.

Following the above, discussion can now return to the examination of potential reasons for the lack of results for H1, H2, H3 and H7. Before commenting on the reasonableness of the hypotheses, the experimental effect and method of measurement require examination. The manipulation check for information presentation provides evidence that the test subjects perceived a difference in the levels of information presentation as experimental treatments. The preceding paragraph has strong support for information presentation impacting behavior, but is only suggestive that it has an impact on the perceived value scales. It can therefore be concluded that the experimental manipulation of information presentation was perceived by the test subjects, and did have an impact on behavior. However as was seen in the case of viewing search pages, changes in levels of information presentation had a differential effect on searchers and browsers, which could lead to the lack of results for H7. In other words, online consumer behavior is more complex than a main effect due to information presentation, implying that H7a and H7b were not reasonable hypotheses.

The method of measurement for H1, H2, and H3 were the perceived value scales which had been used successfully by others, and were validated in this study for use in the context of the internet. However with the exception of Section 6.6.1.2, which did show that changes in the level of ISM did impact utilitarian value, and was suggestive of an interaction effect between ISM and information presentation, the scales did not appear to be sensitive to changes in perceived value. If it is assumed that the experimental manipulation of information presentation (as discussed above) was sufficiently strong, then the possible conclusions that the perceived value scales were not an appropriate outcome measure given the experimental manipulations of this study, or that perceived value was not a sufficiently sensitive construct must be considered.

7.3 Major Contributions of the Study

Recall the objectives of this study:

1) to address the gap in research on the design of retail Web sites that support both product searching and product browsing;
2) to conduct a theoretically-based research investigation of information seeking and Web atmospherics that is of high relevance to practitioners; and
3) to develop a research tool that allows researchers to conduct experiments concerning consumer interactions with retail Web sites.

In this respect, all three objectives of the study were met.

First, a research investigation was conducted that filled a gap in the literature exploring how Web atmospherics of information presentation and information focus affect consumer product information seeking behavior.

- The activity-channel lens was shown to be a viable theoretical framework that facilitated the development of testable hypotheses.
- This study demonstrated that searchers and browsers are differentiable and actionable segments. Recall that only the criteria of differentiable and actionable remained to be shown so that searchers and browsers could be considered viable market segments. With the support shown for proposition 1, where using metrics that had been previously identified from commercial Web sites, it was possible to predict which of the two information seeking modes the test subject had been assigned to. The ability to discriminate between information seeking modes based on behavior leads to the conclusion that the two information seeking modes are differentiable. This was evident in the study's findings. Searchers and browsers reacted differently to changes in information presentation. In addition, searchers and browsers had a different information focus from each other (refer to section 6.7.4 where it was shown that browsers preferentially clicked on links to see related products, and to section 6.7.1 where differing preferences for types of pages by information focus varied). Since the modifications to the Web pages and design elements used in this study are reasonable changes to make on most Web servers, it can be said that the segments are actionable.
- Experimental results showed support of the moderating effect of Web atmospheric variables (information presentation) on the influence of product information seeking mode (browse or search) on end-user shopping behavior. "Moderation" in this sense occurs when a moderator variable affects the strength and direction of the relationship between the independent and the outcome variables (Carte and Russell 2003). Examples of this moderating effect were seen in section 6.7.1, where

depending on whether the test subject was a searcher or a browser, changes in the level of information presentation had a differential effect on the number of search pages viewed. That is, information seeking mode moderated the effect of information presentation on behavior.

Second, outcomes of the research are of clear interest to theory and practice.

In terms of theory, researchers now have a cause and effect model of on-line consumer information seeking behavior that would be suitable as the basis for further research, as well as a set of behavioral measures (based on information focus) that have been confirmed in an experimental context.

In terms of practice, this study has shown that design elements of a retail Web site can be manipulated so that consumers have a differential response dependent upon the shopping activity they are performing. Experimental results demonstrated that searchers and browsers behave differently when seeking out product-related information on e-retailing sites. Practitioners now have evidence that browsers and searchers are differentiable and actionable market segments and should be treated differently. As such:

- Practitioners now have a basis on which to design Web pages that are tailored to the information seeking mode of the consumer. This would be in contrast to the less effective strategy of designing Web pages to support both modes simultaneously. Web pages could be designed with navigation aids that permit the consumer to self-select the pages they prefer. For example, a common design feature on Web sites are navigation links to pages for extended search or browsing by category. The search page should have minimal graphics or images, the formatting of text should highlight the search function, and when product information is provided, it should be detailed and in depth. A category browse page should include examples of products in each category with images of the products, include suggestions and recommendations of alternate or complementary products, with product information kept to a minimum.
- Practitioners now have evidence that on-line consumers can be segmented on the basis of their on-line information seeking behavior. Web sites can be designed to track consumer behavior and have adaptive Web pages that are tailored to the observed behavior. Web sites should be designed to track individual consumer behavior through monitoring the types of pages viewed and navigation patterns. This would allow customization of the overall look and feel of a Web site to match a consumer's behavior.

Third, a research tool was developed that allowed for experimental manipulation and testing of a simulated eShopping Web site.

This Web-based tool (coined Sparky's) simulates a real-life retail shopping site and allows for easy manipulation of characteristics on the Web interface and

shopping instructions. The tool was shown to be viable through its provision of a reasonable online catalog, its integrated measurement systems (perceptual and behavioral), and its facility for manipulation of interface variables of interest to practitioners and researchers. The manipulation checks demonstrated that meaningful experimental manipulations were achieved. The research tool is able to implement meaningful treatments, as shown by its ability to simultaneously manipulate information presentation and information seeking mode. The tool only requires minor configuration changes to test the impact the inclusion or exclusion of design elements on a detail page. The research tool integrates a control system that facilitates implementation of the experimental procedure, consent and post-test questionnaires, and a behavioral measurement system. Through this study's use of the tool, the research tool was shown to be relatively robust, without any lost sessions. The cause of the spoiled sessions exhibited in this study's data collection phase was easily rectified with minor changes to the control system.

7.4 Limitations

The major limitation of this study is that generalization beyond the conditions tested in the study is not possible. This is due to the fixed effects experimental design used in this study. For example, the results could not be applied to another product category such as clothing. This limitation forms the major threat to external validity of this study. However, this study has demonstrated the usefulness of the experimental Web site as an experimental apparatus. Thus, it is now possible to develop a more extensive research program that will address external validity by testing a broader range of Web atmospherics and shopping activities, or by using random effects models.

7.5 Plans for Future Research

The theoretical model developed in this study has potential for application in the investigation of other shopping activities, such as evaluation of alternatives, purchase decision, and some aspects of post purchase behavior;

This study described, but did not test, a number of Web design elements that could impact information presentation and information focus. Further research should experimentally test these design elements in either a fixed effects or random effects model. These new studies would be able to identify the relative impact of each factor, and if optimal levels of each factor can be determined.

A critical examination of the research design of this study could suggest alternate designs that may provide stronger results. It could be argued for example that the rich information presentation used was an appropriate base

level, and the second level of information presentation to be investigated should be richer rather than leaner.

An alternate perspective into the study of information seeking could take the form of an investigation of information seeking strategies. Are there core strategies that are largely maintained irrespective of changes in Web atmospherics, and are there adaptive strategies that are reactive to changes in Web atmospherics?

7.6 Conclusion

This research study investigated ways of designing the Web atmospherics of retail shopping sites to better support consumers in their product information seeking. A review of the literature yielded a theoretical model incorporating constructs of product information seeking (product browsing and product searching) and two specific types of Web atmospherics (information presentation and information focus). Research hypotheses were derived from this theoretical model that explored various perceived value and behavioral hypotheses.

A randomized experiment was designed which placed subjects into either a browsing or searching mode, and manipulated information presentation within a simulated Web shopping environment. Measured outcomes in terms of perceived hedonic and utilitarian values were used to determine interactions between information seeking mode and information presentation. An analysis of test subjects' on-line behavior in the form of click-stream data when using the experimental Web site was conducted to assess: i) how information presentation and information seeking mode impacted test subjects' choices of Web pages and Web page design elements of different information focus granularities; and ii) the extent to which analysis of the click-stream data yielded distinctive patterns of on-line behavior.

Findings from the experiment did provide support for two distinct behavioral patterns corresponding to searching and browsing information seeking modes: i) searchers and browsers chose to view Web pages and Web page design elements consistent with their information focus; and ii) the on-line behavior was moderated by varying the level of information presentation. Specifically, browsing was associated with a more diffuse information focus than was searching; and as predicted, browsers viewed more pages and clicked on hyper-links that were of a more diffuse information focus (category-level pages, view related products) than did searchers. Further the moderating role of information presentation was seen in the number of search pages viewed by searchers and browsers at each level of information presentation. Specifically browsers viewed more search pages in a rich information presentation than in a lean information presentation, and searchers showed the opposite response by viewing fewer search pages in a rich information presentation than in a lean information presentation. However, the results indicate that perceived hedonic

and utilitarian value scales were likely not sufficiently sensitive to measure the experimental manipulations in this experiment

In addition to the running of an experiment, a key deliverable of this research was the development of a research tool that simulated a real-life shopping environment where consumers browse and search for product-related information. Future research investigations are planned with this tool.

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APPENDIX A BEHAVIORAL METRICS

Metric Name	Description	Measured/ Calculated	Where used
NPP	Number of product pages viewed	Measured	calculation
NCATP	Number of category pages viewed	Measured	calculation
NMCAT	Number of explore more category pages	Measured	
TNCATP	Total number of category pages viewed	NCATP+NMCAT	
NBSP	Number of basic searches	Measured	
NASP	Number of advanced searches	Measured	
NSRP	Number of scans of search pages	Measured	calculation
NSP	Number of advanced search request pages viewed	Measured	calculation
TNSP	Sum of all search pages	NBSP+NASP +NSRP+NSP	calculation
NCTSP	Number of customer support pages viewed	Measured	calculation
NCOMP	Number of compare pages viewed	Measured	calculation
NCSP	Number of compare summary pages viewed	Measured	calculation
NCARP	Number of cart pages viewed	Measured	calculation
NINFP	Number of information pages viewed	NCTSP+NCOMP +CNSP+NCARP	calculation
NHP	Number of home pages viewed	Measured	
TNPV*	Total number of pages viewed	NPP+TCATP+TNSP +NINFP+NHP	H7, H6
PNPP*	Proportion pages viewed: product	NPP/TNPV	H4, H6
PNCATP	Proportion pages viewed: category	NCATP/TNPV	
PNMCP	Proportion pages viewed: explore more category	NMCAT/TNPV	
PNCP*	Proportion pages viewed: all category	NCATP/TNPV	H4, H6
PNBSP	Proportion pages viewed: basic search	NBSP/TNPV	
PNASP	Proportion pages viewed: advanced search	NASP/TNPV	
PNSR*	Proportion pages viewed: scan search	NSRP/TNPV	H6
PNSP	Proportion pages viewed: advanced search request	NSP/TNPV	
PNTSP	Proportion pages viewed: all search	TNSP/TNPV	
PNINFP*	Proportion pages viewed: information	NINFP/TNPV	H6
PNHP*	Proportion pages viewed: home	NHP/TNPV	H6
NUP	Number of unique products viewed	Measured	calculation
NUC	Number of unique categories viewed	Measured	calculation
NPR*	Number of products that are repeat viewed	Measured	H6
NCR*	Number of categories that are repeat viewed	Measured	H6
PPPU *	Proportion of product pages that are unique	NUP/NPP	H6
PPCU*	Proportion of category pages that are unique	NUC/NCATP	H6
UPCP*	Ratio of unique products to unique categories	NUP/NUC	H6
MREPP*	Maximum number of times any one product viewed	Measured	H6
TPP	Time viewing: product pages	Measured	calculation
TNMCAT	Time viewing: explore more category pages	Measured	
TCATP	Time viewing: category pages	Measured	calculation
TBSP	Time viewing: basic search pages	Measured	

Metric Name	Description	Measured/ Calculated	Where used
TASP	Time viewing: advanced search pages	Measured	
TSRP	Time viewing: search request pages	Measured	calculation
TSP	Time viewing: search results	Measured	calculation
TCTSP	Time viewing: customer support pages	Measured	calculation
TCOMP	Time viewing: compare pages	Measured	calculation
TCARP	Time viewing: cart pages	Measured	calculation
TINFP	Time viewing: informational pages	TCOMP+TCARP +TCTSP	calculation
THP	Time viewing: home pages	Measured	calculation
TST	Total session time	Measured	H7, H6
ATP*	Average time spent per page	TNPV/TST	H6
PTPP	Proportion time viewing: product pages	TPP/TST	H4, H6
PTCP	Proportion time viewing: category pages	TCATP/TST	H4, H6
PTSR	Proportion time viewing: search pages	(TSP+TSRP)/TST	H6
PTINFP	Proportion time viewing: informational pages	TINFP/TST	H6
PTHP	Proportion time viewing: home pages	THP/TST	H6
NDFC	Number of detail Features clicks	Measured	H5, H6
NALC	Number of Also Looked At clicks	Measured	H5, H6
NACC	Number of Accessory clicks	Measured	H5, H6
NCRC	Number of Customer Review clicks	Measured	H5, H6
NLIC	Number of large image clicks	Measured	H6
NACAC	Number of Add To Cart clicks	Measured	H6
NACOC	Number of Add To Compare clicks	Measured	H6

* From Moe (2002; 2003), with metric names modified.

APPENDIX B - EXPERIMENTAL WEB SITE VARIANTS

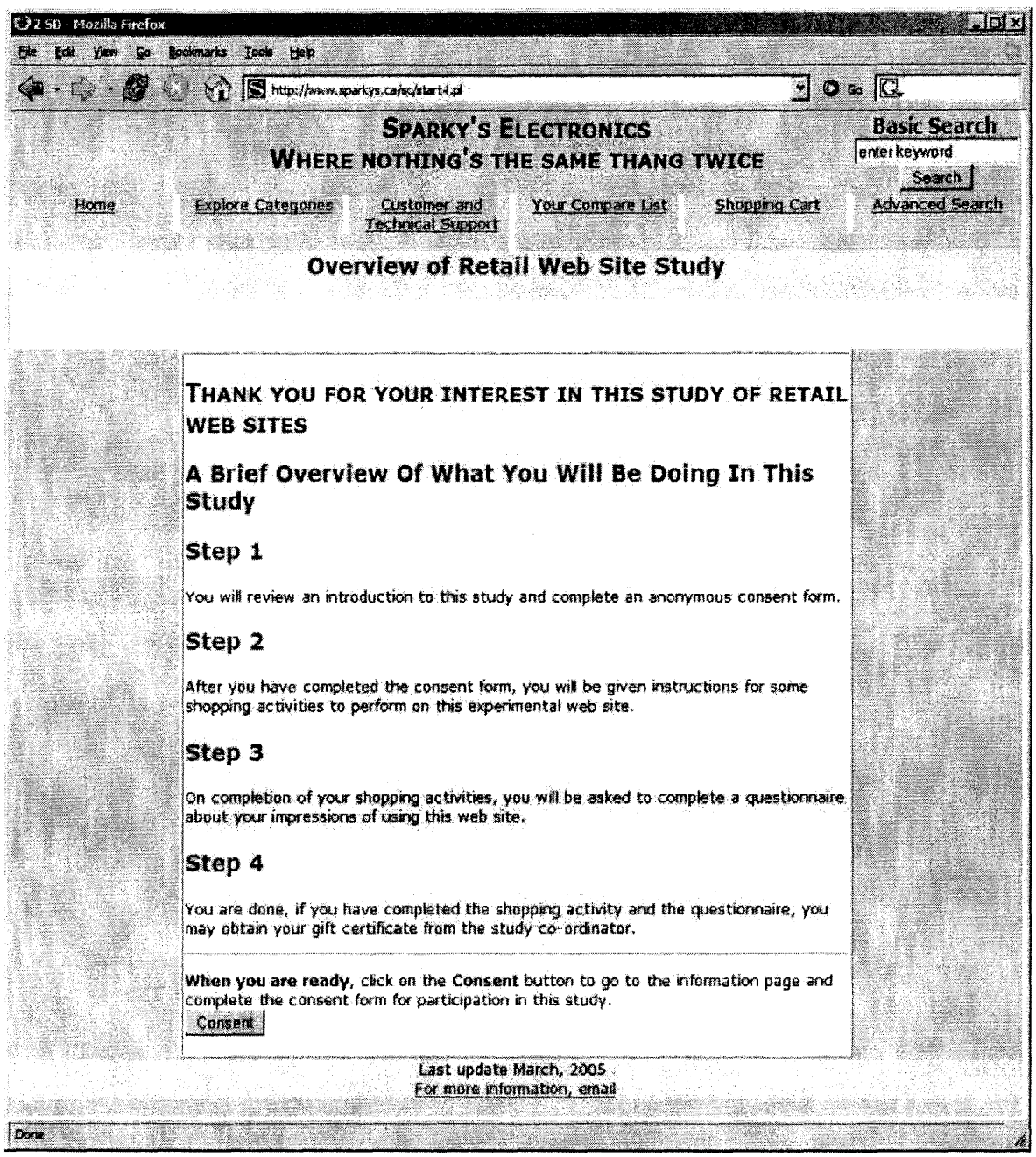

Figure 1 Start Page – Rich information presentation

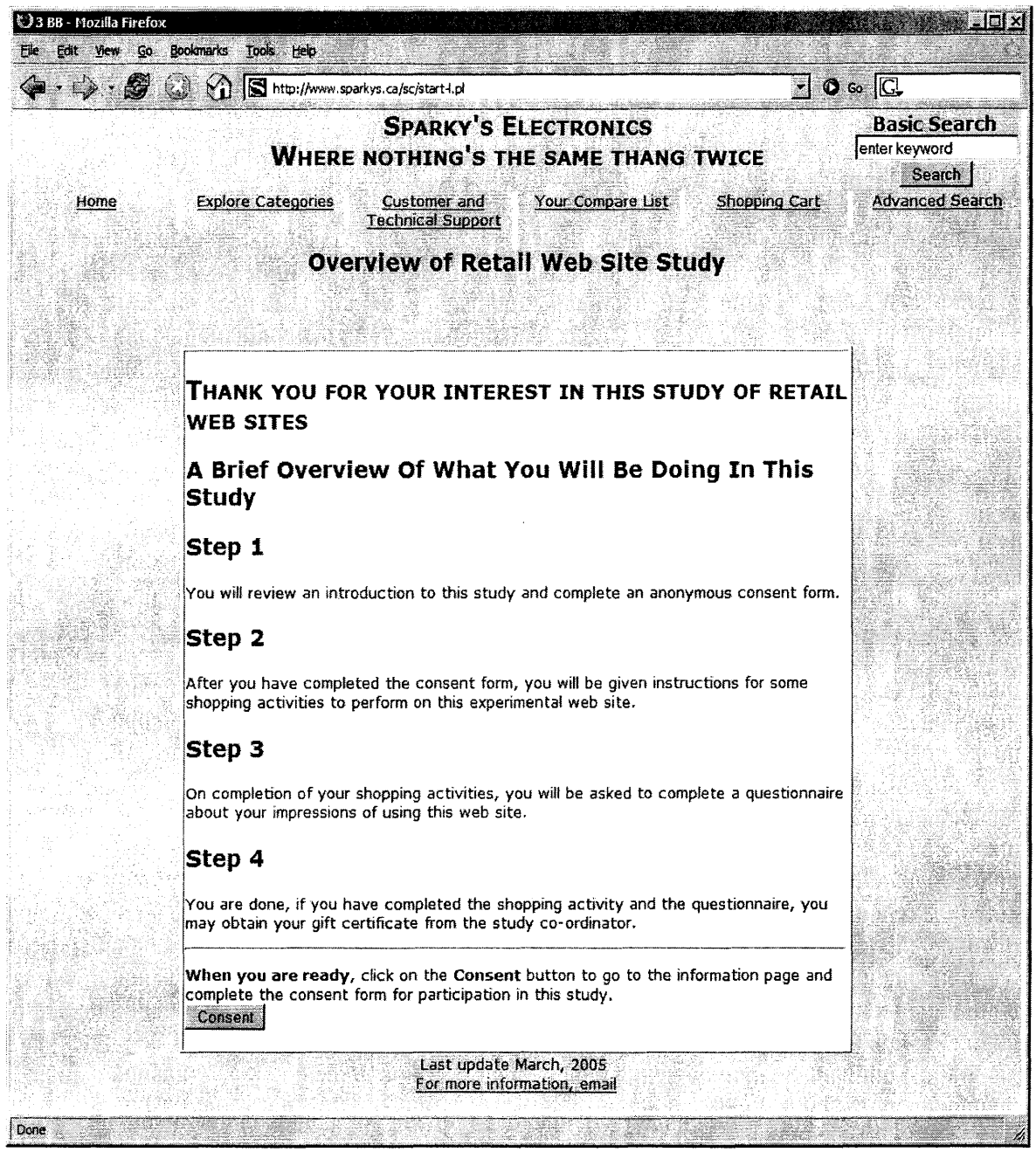

Figure 2 Start Page – Lean information presentation

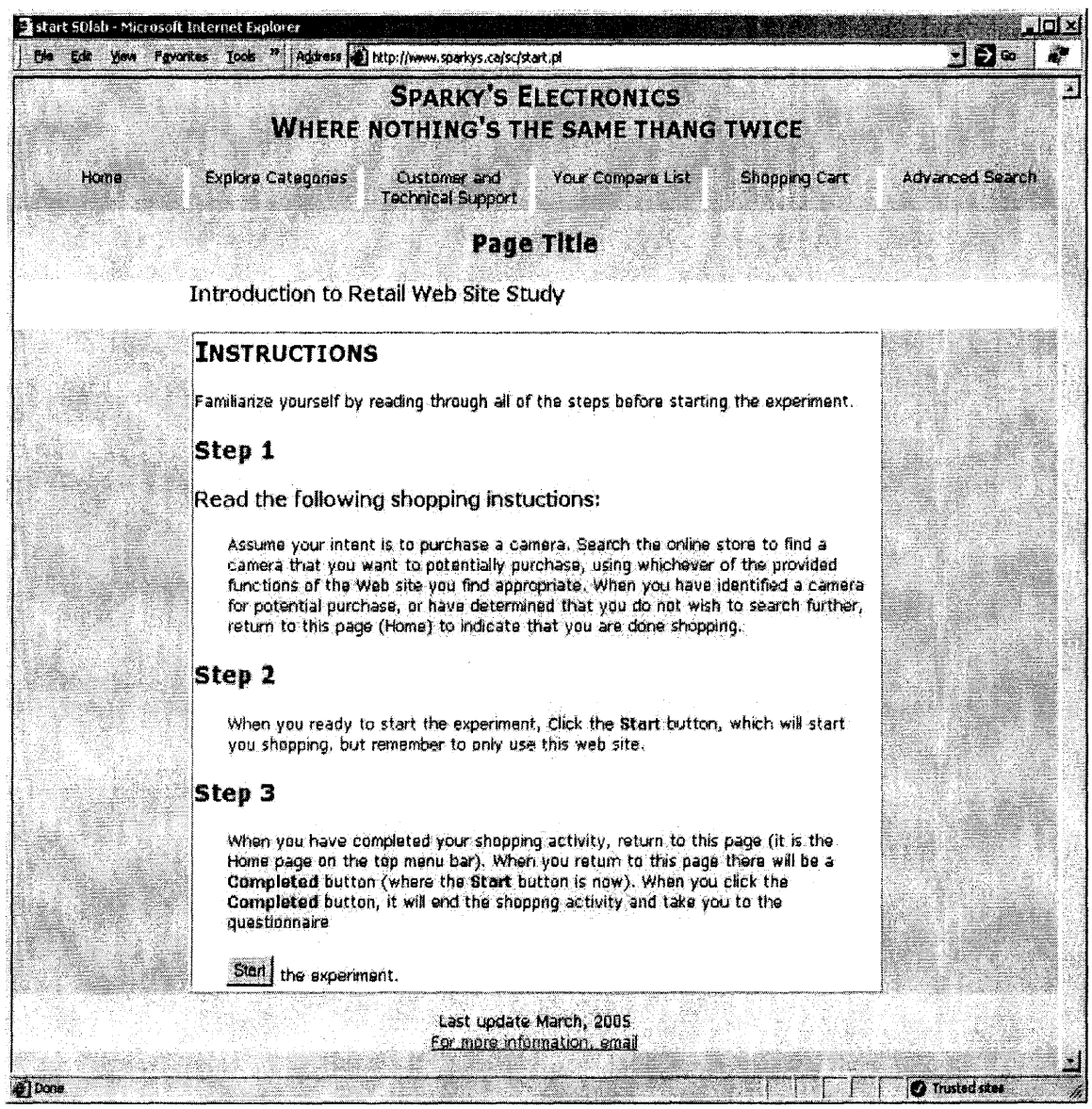

Figure 3 Introduction Page – Rich information presentation, search information seeking mode

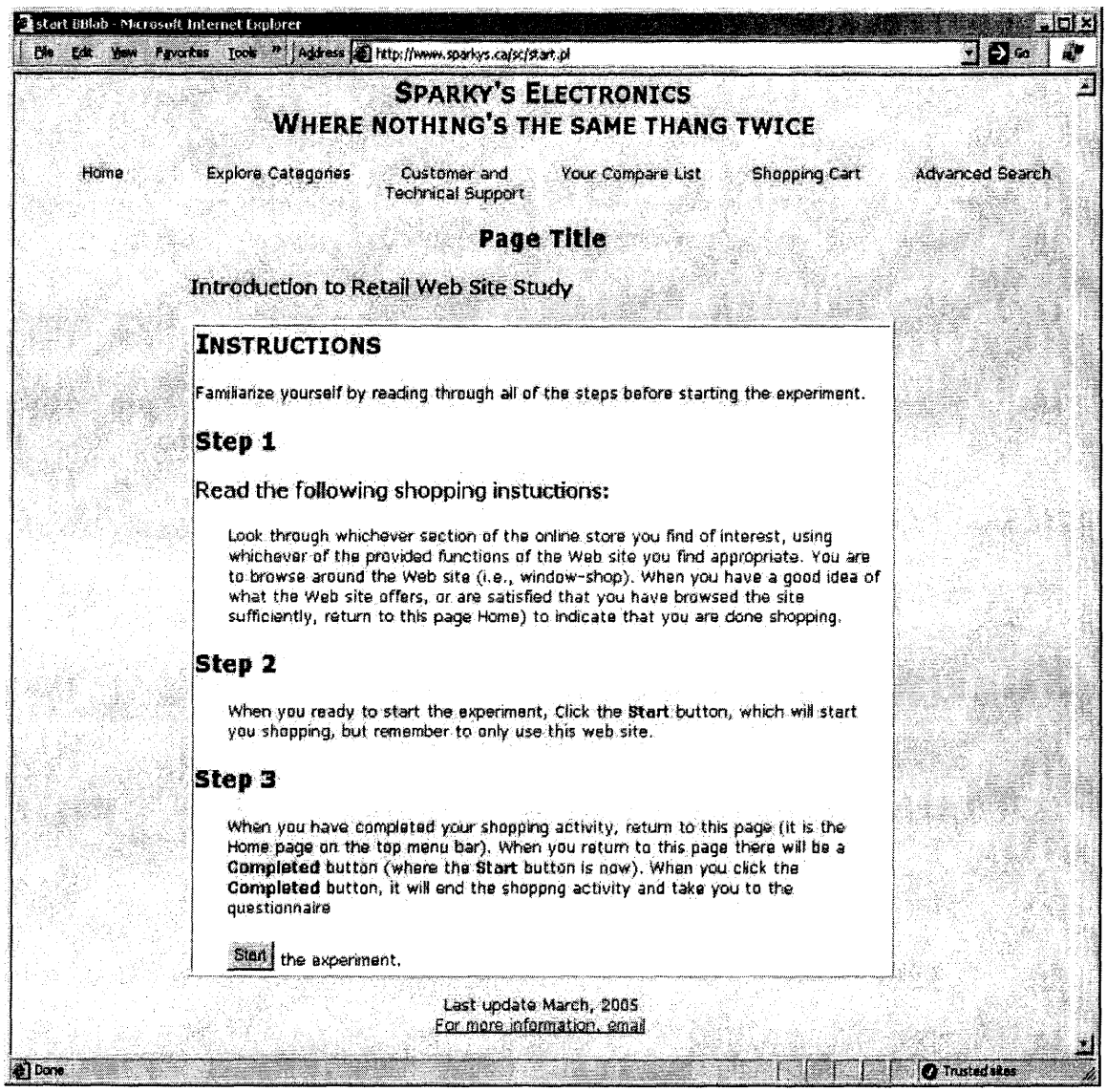

Figure 4 Introduction Page – Lean information presentation, browse information seeking mode

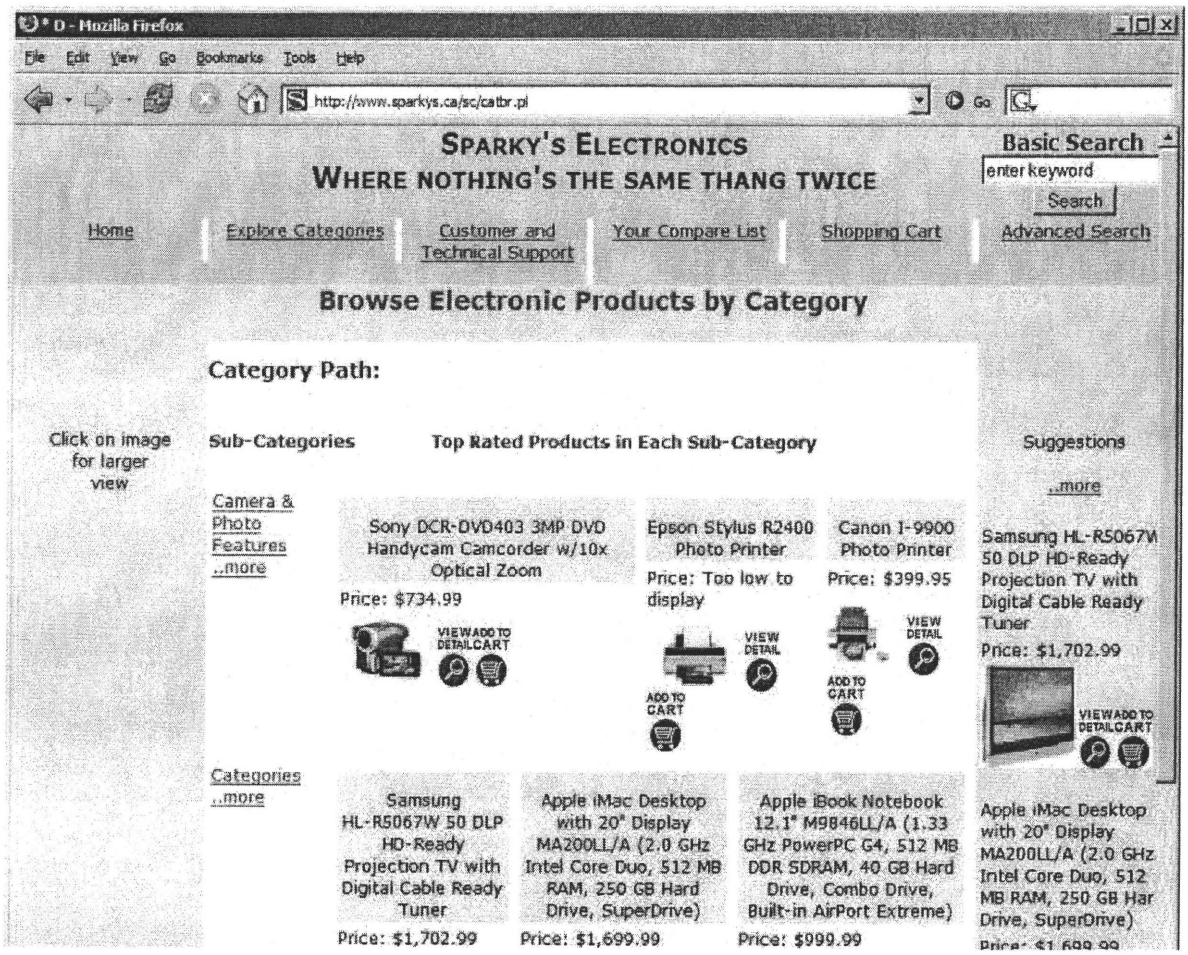

Figure 5 Explore Categories – Rich information presentation

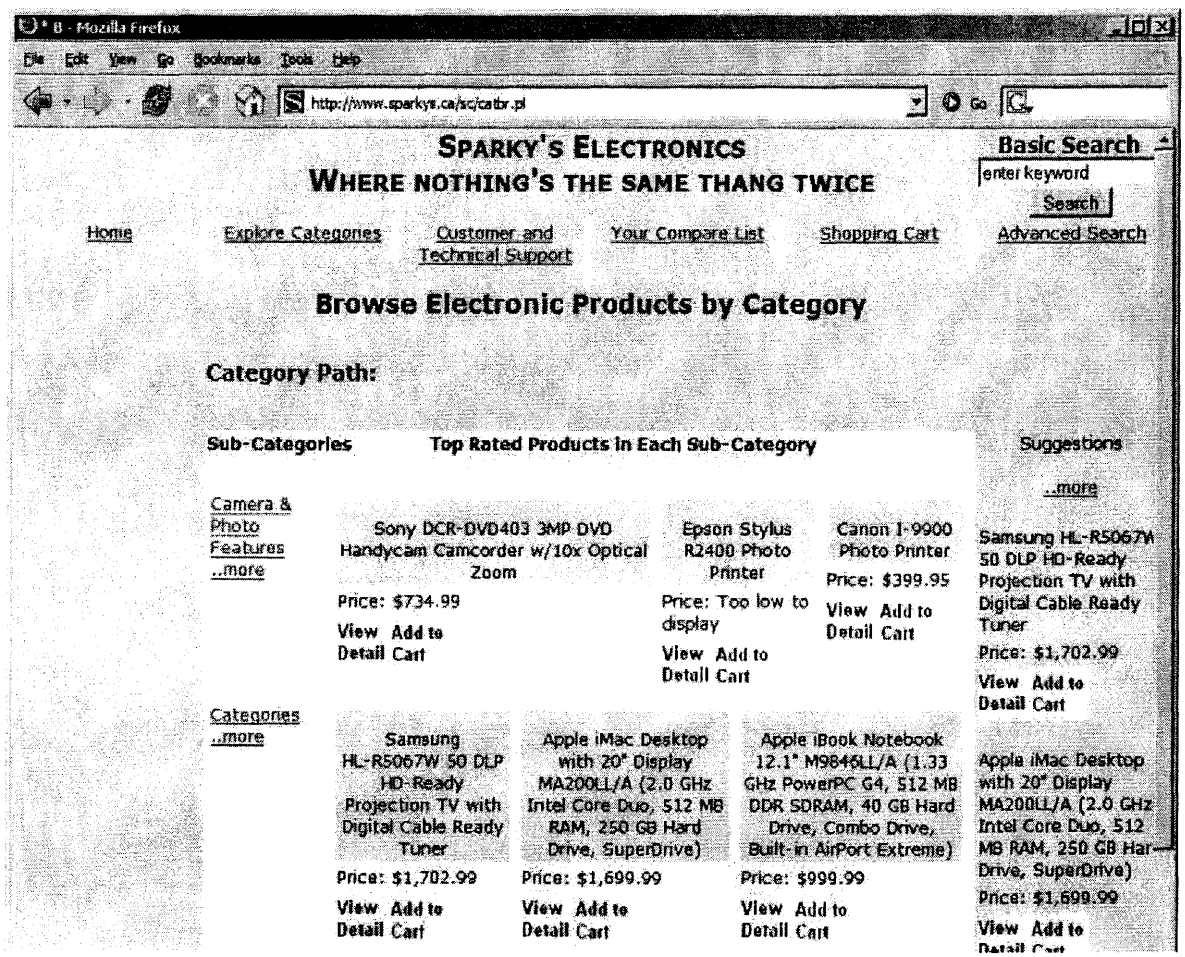

Figure 6 Explore Categories – Lean information presentation

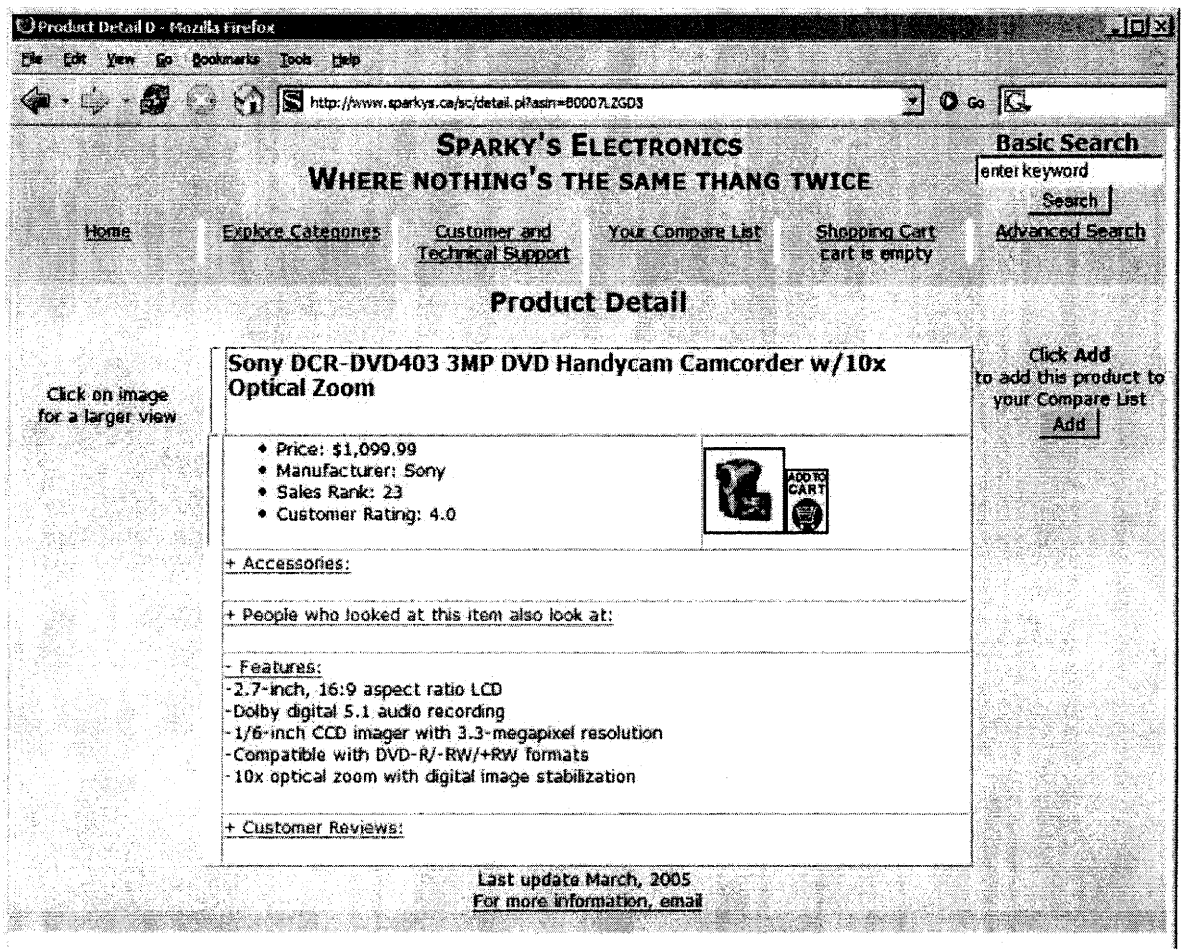

Figure 7 Product Detail – Rich information presentation

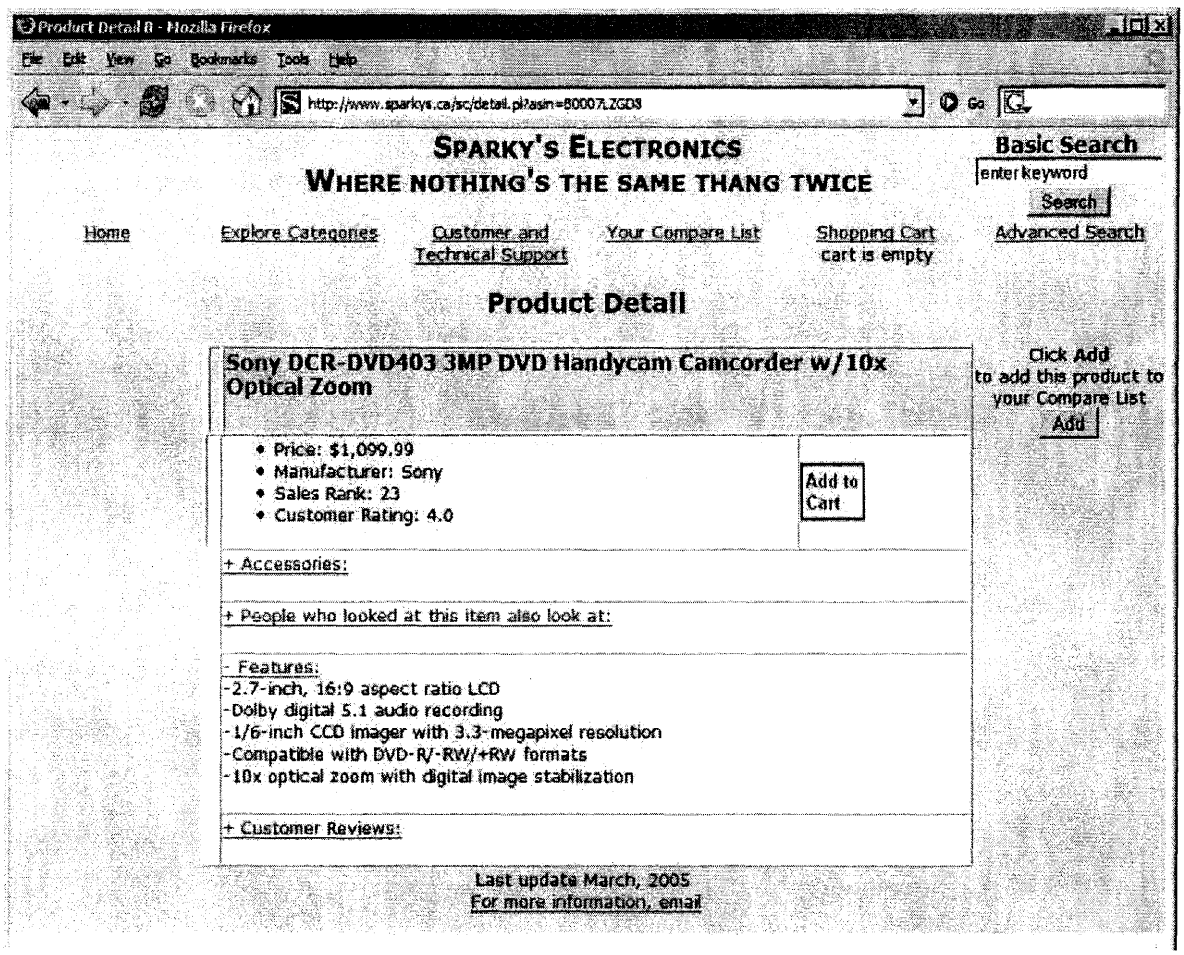

Figure 8 Product Detail – Lean information presentation

APPENDIX C: POST-TEST QUESTIONNAIRE

Perceived Value Survey Questionnaire
All items use a 7 point Likert type scale.

Strongly Disagree	No Opinion	Strongly Agree

Hedonic Shopping Value Adapted[1] from Babin, Darden and Griffen (1994)
Hed-1: This shopping experience was truly a joy.

Hed-2: I continued to shop, not because I had to, but because I wanted to.

Hed-3: This shopping experience truly felt like an escape.

Hed-4: Compared to other things I could have done, the time spend shopping was truly enjoyable.

Hed-5: I enjoyed being immersed in exciting new products.

Hed-6: I enjoyed this shopping experience for its own sake, not just for the items I may have purchased.

Hed-7: I had a good time because I was able to act on the "spur of the moment".

Hed-8: During this shopping experience, I felt the excitement of the hunt.

Hed-9: While shopping, I was able to forget my problems.

Hed-10: While shopping, I felt a sense of adventure.

Hed-11: This shopping experience was not a very nice time out.

Utilitarian Shopping Value Adapted[1] from Babin, Darden and Griffen (1994)
Util-1: I accomplished just what I wanted to on this shopping experience.

Util-2: I couldn't buy what I really needed.

[1] The adaptation consisted of replacing all occurrences of "trip" with experience, and "store" with Web site. Also the scale was expanded from 5 to 7 point.

Util-3: While shopping, I found just the item(s) I was looking for.

Util-4: I was disappointed because I would have had to go to another Web site to complete my shopping.

Open Ended Questions

Please describe any features of the Web site that you found useful, and in what way they were useful.

Please describe any features of the Web site that you thought could be improved, and what you would recommend to improve them.

Please describe any features of the Web site that you found made your use of the Web site difficult, and in what way they made it difficult.

Please describe any features of the Web site that you found made your use of the Web site enjoyable, and in what way they made it enjoyable.

Manipulation Check Questions

All items use a 7 point Likert type scale.

ISM-1: When I started shopping, I was searching for a particular type of product, such as a camera.

ISM-2: When I started shopping, I was just looking around and browsing.

ISM-3: I felt as though I was shopping for fun or pleasure.

ISM-4: When I started shopping, I only had a general idea of what I was looking for.

ISM-5: I did not intend to make a purchase when I started shopping.

ISM-6: I wanted this shopping experience to be as efficient as possible.

ISM-7: When I started shopping I knew exactly what I was looking for.

ISM-8: While I was shopping I wanted to be able to explore different products.

IP-1: If we define a **Lean** Web site as one with limited use of fonts, font sizes, colors, and graphics, and a **Rich** site as one that makes extensive use of fonts, font sizes, colors and graphics, then MSN.ca would be considered an example of a Rich site and Google.ca would be considered an example of a Lean site. Using the above definition, how would you rate this study's Web site on a scale of Lean to Rich?

IP-2: I felt that the Web site used only a limited amount of fonts and font sizes and only had a small amount of color and graphics.

IP-3: I felt that the Web Site made extensive use of text formatting, used different fonts and font colors and had a large amount of graphics and images.

Demographic Questions

Your Sex

- Female
- Male
- Prefer not to say

Your Age

- Under 18 years
- 18 -29 years
- 30-49 years
- 50-64 years
- 65 and over
- Prefer not to say

How long have you been using the internet?

- less than 6 months
- 6 months to 1 year
- 2 - 3 years
- More than 3 years
- Prefer not to say

How many purchases have you made online in the past year?

- 0
- 1
- 2
- 3 or more
- Prefer not to say

On average how frequently do you search for any type of information on the internet?

- at least daily
- at least once per week
- at least once per month
- at least once per year

- Prefer not to say

On average how frequently do you search for information about products or services on the internet?

- at least daily
- at least once per week
- at least once per month
- at least once per year
- Prefer not to say

The following two items use a 7 point Likert type scale.

I am familiar with cameras and have an understanding of the difference between conventional and digital cameras

I am familiar with consumer electronic devices, such as DVD players, MP3 players

APPENDIX D: POST-TEST QUESTIONNAIRE LEAN AND RICH WEB SITE EXAMPLES

Figure 1 Example - Lean Information Presentation

Figure 2 Example – Rich Information Presentation

Appendix E SPSS Script – Bootstrapping of Logistic Regression and ROC Calculations

```
***bs_multi.sps***.
*** Set up variables and datasets ***
PRESERVE.
SET TVARS NAMES.

OMS /DESTINATION VIEWER=NO /TAG='suppressall'.

DATASET DECLARE log_bs.
OMS /SELECT TABLES
   /IF COMMANDS=['Logistic Regression']
       SUBTYPES=['Classification Table']
       INSTANCES = [2]
   /DESTINATION FORMAT=SAV OUTFILE='log_bs'
   /COLUMNS DIMNAMES=['Predicted' 'Step' 'Observed']
   /TAG='reg_coeff'.

DATASET DECLARE roc_bs.
OMS /SELECT TABLES
 /IF COMMANDS = ["ROC Curve"]
     SUBTYPES = ["Area Under the Curve"]
 /DESTINATION FORMAT = SAV  OUTFILE = 'roc_bs'
/COLUMNS DIMNAMES=['Statistics' 'Area']
/TAG='roc'.

DATASET DECLARE bs_hos_lem.
OMS /SELECT TABLES
   /IF COMMANDS=['Logistic Regression']
       SUBTYPES=['Classification Table' 'Hosmer and Lemeshow Test']
       INSTANCES = [2]
   /DESTINATION FORMAT=SAV OUTFILE='bs_hos_lem'
   /COLUMNS DIMNAMES=['Step' 'Statistics']
   /TAG='hos_lem'.

***This is a macro to perform the bootstrap***.
DEFINE regression_bootstrap (samples=!TOKENS(1)
                        /depvar=!TOKENS(1)
                               /indvars=!CMDEND)
SET SEED=20061023.
COMPUTE dummyvar=1.
AGGREGATE
  /OUTFILE = * MODE = ADDVARIABLES
  /BREAK=dummyvar
  /filesize=N.

!DO !other=1 !TO !samples
WEIGHT OFF.
FILTER OFF.
DO IF $casenum=1.
- COMPUTE #samplesize=filesize.
- COMPUTE #filesize=filesize.
END IF.
DO IF (#samplesize>0 and #filesize>0).
- COMPUTE sampleWeight=rv.binom(#samplesize, 1/#filesize).
- COMPUTE #samplesize=#samplesize-sampleWeight.
- COMPUTE #filesize=#filesize-1.
ELSE.
```

```
- COMPUTE sampleweight=0.
END IF.
WEIGHT BY sampleweight.
FILTER BY sampleweight.

LOGISTIC REGRESSION  !depvar
  /METHOD = ENTER !indvars
 /PRINT=GOODFIT
 /SAVE= PRED (predict)
  /CRITERIA = PIN(.05) POUT(.10) ITERATE(20) CUT(.5) .

ROC predict BY MODEN (2)
 /PLOT = CURVE(REFERENCE)
 /PRINT = SE
 /CRITERIA = CUTOFF(INCLUDE) TESTPOS(LARGE) DISTRIBUTION(FREE) CI(95)
  /MISSING = EXCLUDE.

DELETE VARIABLES predict.
!DOEND
!ENDDEFINE.

***Data file containing behavioral data***.
GET FILE='\\192.168.2.93\usr\phd\results\spss\results\chkbehav-
edtd.sav'.

***Call the macro, and specify number of samples***.
regression_bootstrap
      samples=100
      depvar=MODEN
      indvars=PNPP PNCP PNTSP PNINFP PNHP NUP NUC NPR NCR PPPU
              PPCU UPCP MREPP.

OMSEND .
***Produce some frequency tables for inspection***
DATASET ACTIVATE log_bs.
FREQUENCIES
  VARIABLES=PercentageCorrect_Step1_1 PercentageCorrect_Step1_2
PercentageCorrect_Step1_OverallPercentage
  /FORMAT NOTABLE
  /STATISTICS=MEAN
  /PERCENTILES= 2.5 97.5
  /HISTOGRAM NORMAL.

DATASET ACTIVATE bs_hos_lem.
FREQUENCIES
  VARIABLES=@1_Sig @1_Chisquare
  /FORMAT NOTABLE
  /STATISTICS=MEAN
  /PERCENTILES= 2.5 97.5
  /HISTOGRAM NORMAL.

DATASET ACTIVATE roc_bs.
FREQUENCIES
  VARIABLES=Area LowerBound UpperBound
  /FORMAT NOTABLE
  /STATISTICS=MEAN
  /PERCENTILES= 2.5 97.5
  /HISTOGRAM NORMAL.

RESTORE.
```