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Recommended Citation
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USING PROTOCOL ANALYSIS TO UNDERSTAND THE EFFECTS OF WEB SITE DESIGN ON CONSUMER PURCHASE BEHAVIORS

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Abstract

Research shows that poor Web site designs lead to user disorientation and cognitive process overhead that result in low user satisfaction and loss of potential sales. It is, therefore, important to understand the consumers' perception toward an effective Web site; specifically, what they are experiencing and what goes through their minds during these visits to Web storefronts. This knowledge could then be used to design e-commerce Web sites that are responsive to consumers' needs.

This research uses protocol analysis to examine the perceptual experience of the user in the context of the online purchasing activity. It allows us to study the formation process of an actual purchase decision as it progresses in the mind of the customers. Eight users were recruited to look at two Web sites (one of which was rated high, the other low) on the dimensions of content, design, navigation, business, and informational influence. Results showed that quality in these five dimensions would meet consumers' needs, positively affect their attitudes toward the Web storefront, and consequently lead to purchase intentions. Furthermore, consumers use different Web site features for different tasks; therefore, Web site designers must also use activities or scenarios in designing to ensure that the Web site features support the users in their tasks.

Keywords: Web site design, protocol analysis, consumer attitudes, online purchasing behavior

Introduction

The Internet has grown considerably during the past decade, particularly with respect to its use as a tool for commerce. In 2004, Forrester Research predicted that two-thirds of all U.S. households will shop online by the year 2007 and online sales will reach U.S. $331 billion by 2010 (Mickelson 2005). This phenomenon has significantly raised managerial attention of e-commerce practitioners in their attempts to secure a slice of the pie. For pure-play e-tailers who do not have a physical presence, the online Web site is the only interface to the customer. Given that the design of Web sites has been considered a critical factor in satisfying users and making them revisit a Web site (Nielsen 2000), it is imperative that Web sites be designed to facilitate the users in accomplishing their goals with ease and satisfaction (Abdelmessih et al. 2001).

However, in spite of the interest in improving the quality of Web sites, there still exist numerous Web sites that are difficult to use and do not meet the users' needs (Hurst and Gellady 1999; Nielsen 2000). Poor Web site designs marked by serious problems of irrelevant information, disorientation and cognitive overhead result in low user satisfaction and loss of potential sales. Furthermore, the inability to locate the Web site features to perform desired tasks lead to feelings of frustration and anger among the site users. Such users will just move on to other Web sites which are just a mouse-click away (Nielsen and Norman 2000). It is necessary to understand users' expectations and their feelings about the Web sites they use, and to address the core question of how to effectively design a Web site.

In previous studies on e-commerce, purchase intention and customer satisfaction is frequently studied from a reflective point of view. Therefore, the Web site design principles presented are geared toward optimizing Web site designs based on the users'

collection of their past experiences with the Web sites. This research looks at the perceptual[1] experience of the user in the context of the online purchasing activity. Through protocol analysis, we want to study the formation process of attitudes and intentions leading to or away from an actual purchase decision as it progresses in the mind of the customers. The theory of reasoned action (TRA) (Azjen and Fishbein 1980) is used to guide our analysis of the results. From the data collected from the protocol analysis, we hope to learn how the design of Web pages and sites affect attitudes of Internet users toward online shopping. By understanding such attitudes, businesses can better understand the factors influencing a consumer's decision to buy online, thereby enabling them to design more effective Web sites to promote e-commerce.

Background Theories

E-Commerce Web Site Design

The success of e-commerce relies heavily on the online experience provided by the e-commerce Web site to its customers (Novak and Hoffman 2000). Hence, the effective design of e-commerce Web sites becomes critical. On the practitioner side, there exist many Web sites and books that recommend good Web site design principles complete with checklists and studies (Alexander and Tate 1999; Conger and Mason 1998; Keeker 1997; Nielsen 2000). On the academic side, much research was carried out to better understand the different dimensions of Web site design. Table 1 summarizes the dimensions of Web site design with some examples. The full coverage of the Web site features in each dimension is available in Lee (2005).

Consumer Attitudes and Behavior

In marketing and consumer behavior literature, the concepts of attitudes and behavioral intentions indisputably occupy a central position in explaining consumer purchasing behavior. Attitude is defined as a learned predisposition to respond to an object or class of objects in a consistently favorable or unfavorable way (Allport 1935). Attitudes are believed to be constructed by sensory inputs from one's own direct experience and external information from others, and memory information in the form of experiences and expectations (Fazio 1986; Regan and Fazio 1977; Sanbonmatsu and Fazio 1990). While there are many variations of the attitude model, those proposed by Azjen and Fishbein (1980) have stimulated the greatest amount of research interest. The theory of reasoned action (TRA) is the most prominent model explaining consumer attitudes toward an action through behavioral intentions and has been used successfully in identifying key elements of consumer decision-making (Taylor and Todd 1995). The theory asserts that intention to perform a behavior is determined by the individual's attitude toward performing the behavior and subjective norms held by the individual. While most of the support for the theory has come from the social psychology literature, there have been successes in applying this theory to consumer decision-making (Sheppard et al. 1988). Research using the TRA has proved to be successful across a number of disciplines and was "designed to explain virtually any human behavior" (Ajzen and Fishbein 1980, p. 4). TRA can be used to explain why people want or do not want to engage in a specific behavior. In this study, TRA is used to provide the framework for developing the *a priori* coding for the protocol analysis.

Protocol Analysis

The protocol analysis or "think-aloud" methodology is recognized as a useful source of data that can provide a window for uncovering the psychological mechanisms and knowledge structures underlying human problem-solving activities with respect to specific tasks (Ericsson and Simon 1996; Newell and Simon 1972). In protocol studies, the researchers' interests lie not just in the solution to a sequence of actions, but in the processes underlying the sequence itself. Protocol analysis seeks to reveal the mental processes that take place as individuals work on problem-solving tasks. Using this technique requires subjects to verbalize their thought processes and strategies as they are tackling a specific problem-solving situation. The verbal protocols are collected, recorded, transcribed, and parsed to derive coding schemes that provide a good fit with the protocol data. This technique was applied in consumer research such as a laboratory study on consumer decision processes (Bettman and Park 1980) and a field study on supermarket behavior (Titus and Everett 1996). Both studies concluded that verbal data is helpful because it allows observers to know how users think: what they look for, how they expect to accomplish tasks, and what elements of the interface they find confusing or helpful.

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[1]The term *perceptual* refers to continuous (real time) responses of the human sensory, cognitive, and affective processing systems, restricting discussions to experience that occurs 'instant-by-instant' or 'moment-by-moment' (Lombard and Ditton 1997).

Table 1. Web Site Dimensions, Definitions, and Examples

Dimensions	Web site features (examples)
Content: (1) the characteristics of the information that the Web site provides, (2) the content of the information provided (e.g., FAQs and advertisements) (Katerattanakul and Siau 1999; Neo 2002; Palmer 2002; Ranganathan and Ganapathy 2002; P. Zhang et al. 2000a; P. Zhang et al. 2000b; X. Zhang et al. 2000)	• Information accuracy, relevance, timeliness, completeness, understandability, consistency, conciseness, reference • Relevancy of links, advertisement
Navigation: that which helps consumers move around the Web storefront and locate the information they want (Gehrke and Turban 1999; Palmer 2002; Ranganathan and Ganapathy 2002; P. Zhang et al. 2000a; P. Zhang et al. 2000b; X. Zhang et al. 2000)	• Orientation aids – site maps, breadcrumbs, appropriate headings • Speed of page loading • Presence of menus, navigation bars and icons, Web site home button • Search functions—search engines, "shop by" search tools
Design: contributes to the aesthetic experience of e-commerce Web site users (Neo 2002; Nielsen 2000; Palmer 2002; Ranganathan and Ganapathy 2002; P. Zhang et al. 2000a; P. Zhang et al. 2000b; X. Zhang et al. 2000)	• Logos, images, thumbnails • Consistency in layout, overall design, usage of colors and graphics • Clarity and legibility of text and images • Low plug-in requirements • Organization of information
Business: the business model of the Web storefront including 1. *Payment System*: The payment system affects the ease of purchasing through more types of payment methods, a simpler shopping cart and faster steps to checkout (Turban et al. 2000) 2. *Product Information*: The product information, pictures and demos helps customers in evaluating the product (Neo 2002) 3. *Marketing Focus*: The ability of the Web storefront to attract customers with promotions, incentives and price comparison features (Gehrke and Turban 1999; Lam and Lee 1999). 4. *Customer Focus*: Web storefront being able to understand customers and customizing the Web site to suit their needs (Gehrke and Turban 1999; Lam and Lee 1999; Neo 2002) 5. *Security and Privacy*: Security and privacy deals with the security features and safe transaction policies (Gehrke and Turban 1999; Lam and Lee 1999; Ranganathan and Ganapathy 2002)	• Shopping cart, checkout system, payment and shipping methods, order confirmation, shipping information • Product specs, pictures, samples, demos, price, portfolio • Promotions, product comparison tools, freebies, free gift wrap, free messages, discounts, loyalty points • Storage of customer personal info; language options, geographic-specific options; additional help for customers • Warranty, money back guarantee, • Order tracking • Customer feedback, customer hotline • Privacy assurance, security tech, external recognition of Web site
Informational Influence: relates to others' opinions about the products and services the Web storefront provides (Song and Zahedi 2001)	• Customer comments and ratings of product • Expert comments of product • Bulletin boards, online chat rooms, forums, interests/user groups

In the area of e-commerce, Benbunan-Fitch (2001) applied protocol analysis to evaluate the usability of a commercial Web site, in particular the nature of the usability problems encountered by typical users. Her study highlighted that protocol analysis has the benefit of obtaining a wealth of information that is generally not available through other methods. Furthermore, only a small sample of users were needed due to the richness of the data collected. However, the study covered only the content, navigation, and interactivity aspects of Web sites, and failed to do a comparative examination of commercial Web sites. This research will address these limitations with more comprehensive Web site features and a comparative examination of two commercial Web sites, allowing for answers to questions concerning the *how* and *why* (Todd and Benbasat 1987) instead of just the *what* of other study methods.

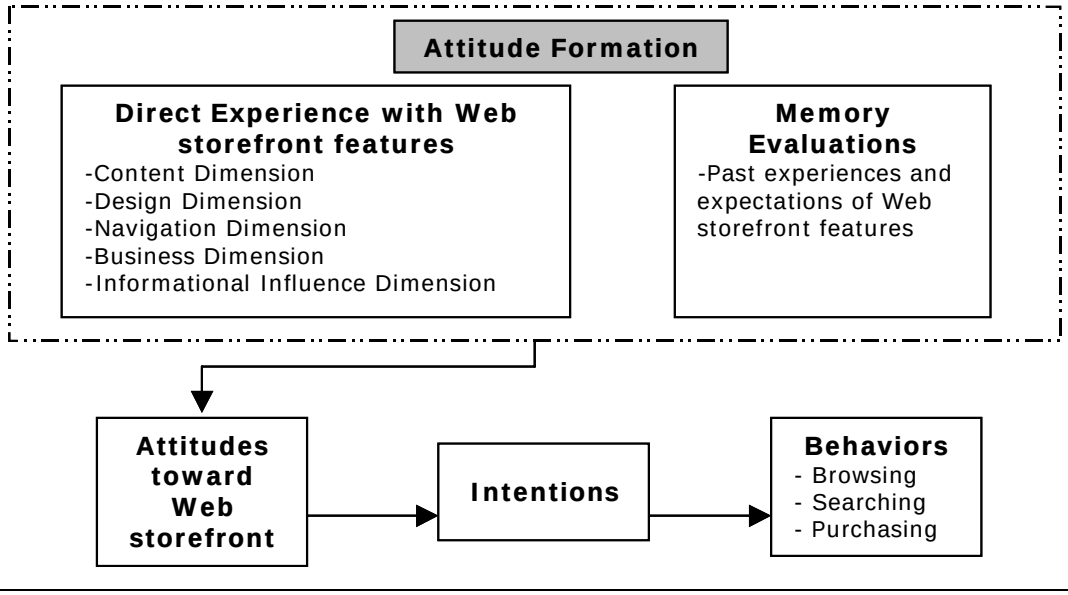

Figure 1. Research Model

Research Framework

Based on the literature review, a model for online consumer purchase behavior is developed (see Figure 1). The theory of reasoned action is applied to understand the online purchase behavior, which is determined directly by the intention and attitudes toward the Web storefront. In the research model, the belief component of the original TRA is defined as the direct experience and memory, both of which are considered main factors of attitude formation (Reed et al 2002; Sengupta and Fitzsimons 2000). Since the focus of this research is on Web site features, only the users' direct experiences with Web storefront features are examined. The subjective norms are not included because past research in e-commerce has shown that there is no particular reason why subjective norms should have a large impact on online purchasing behavior, as opposed to other behaviors where subjective norms might have more of an impact (e.g., smoking or dieting). Web use is a private affair and it is not visible to one's peers. Hence, peer pressure is unlikely to influence whether an individual chooses to purchase from a particular Web site (Davis et al.1989). Given this argument, the need to contain the scope of this research to a reasonable size, the subjective norms are excluded from this study.

Classification of the Web Site Features

The Web storefront dimensions are defined as the individual Web site features that make up an e-commerce Web site (see Table 1). These features may influence customers' purchase behavior through the reinforcement of their positive feelings or attitudes.

Formation of Attitudes

The consumer's attitude toward the Web storefront is defined as an individual's positive or negative evaluation about the Web site's features (Bagozzi 1992). Since consumers are exposed to the Web site features while shopping online, the different Web site features found in the five dimensions are defined as inputs of their direct experience for attitude formation. Consumers will also utilize their prior purchasing experiences and expectations stored in their memory, which are defined in this study as their memory evaluations (Oliver 1980; Olson and Dover 1979). The direct experience with the Web features and the memory evaluations will form the attitudes toward the Web storefront. The users' direct experience with the Web site dimensions together with their memory evaluations form their attitudes toward the Web storefront.

Effects on Attitudes, Intentions and Behaviors

In the TRA, attitudes have been proposed to influence behavioral intentions and actions. The theoretical predictions of this theory have received substantial empirical support in a variety of settings (Madden et al. 1992). In the current study, attitude is an overall evaluation of the Web storefront. Therefore, favorable attitudes are expected to ease online transactions and reduce barriers to the adoption and use of e-commerce (Jarvenpaa et al. 1999). Following the TRA, the more positive the attitudes, the higher the intention and actual behavior. On the contrary, the more negative the attitude, the lower the intentions and actual behavior (Ajzen and Fishbein 1980).

Research Methodology

As mentioned earlier, this study uses protocol analysis to study how Web site dimensions and features influence consumer attitudes and behaviors toward online purchase.

Selection of Web Site

The Web sites used in the study were Circuit City (**http://www.circuitcity.com**, accessed February 15, 2005) and Brandnamez (**http://www.brandnamez.com**, accessed February 15, 2005). Several considerations were taken in the selection process to help ensure that the differences in Web site were kept to the Web site design as far as possible. First, the product offerings on the two Web sites were similar. Second, both were American companies unfamiliar to the subjects so the brand name would not influence their attitudes toward the Web sites. Third, when benchmarked against the five Web dimensions in Table 1, circuitcity.com implemented 64 out of 80 features while Brandnamez.com implemented only 44 (Lee 2005). The quality of the stores were further confirmed by acclamations from BizRate.com, a search engine that rates e-commerce companies based on many factors such as product prices, popularity, and availability of products. BizRate.com gave excellent ratings to Circuit City and poor ratings to Brandnamez.

Subjects

A total of eight subjects were recruited for the experiment and offered monetary compensation for their participation. Four of the subjects had experiences in making online purchases while the other four were novices with no or limited shopping experience. None of the subjects had ever heard of or visited the selected Web sites.

Data Collection

The subjects were first given brief explanations of the purpose of the experiment. They were instructed to visit the two selected Web sites and accomplish three tasks: (1) open-ended browsing, (2) search for an MP3 player with a certain set of product attributes, and (3) make a purchase at the Web site (the subjects could decide not to make any purchases, but if they did, we gave them an additional USD 20. This three-stage process is based on past research, which has shown that visitors to e-commerce Web sites engage in browse tasks, search tasks, and purchase tasks (Rowley 2000).

While performing the experiment, subjects were to state, while thinking aloud, their location within the site, how they got there, their action plan, reasoning behind their decisions, their expectations, etc. When there was a lack of response from the subjects, the interviewer would prompt the subjects to keep talking. Nondirective prompting was utilized (e.g., "Keep talking") when subjects are silent for more than 10 seconds as prescribed by Someren et al. (1994) and Boren (1999). The entire session (including the subjects' and interviewer's verbalizations and real-time video capture of the monitor screen) was recorded using Camtasia Studio, a software product developed by TechSmith. After the completion of the assigned tasks, the subjects answered a postexperiment questionnaire relating to their experience in the Web sites, including their feelings and purchase intentions. This postexperiment questionnaire was important to examine any discrepancies in their attitudes toward the Web storefronts and to confirm the verbal protocols.

Data Analysis

The data analysis for the verbal protocols followed the three steps prescribed by Ericsson and Simon (1996): (1) transcribing, (2) segmenting, and (3) encoding. Todd and Benbasat (1987) also recommended developing an *a priori* coding scheme to add rigor to the research and to facilitate the efficient analysis of data. The coding scheme consists of five coding classifications based

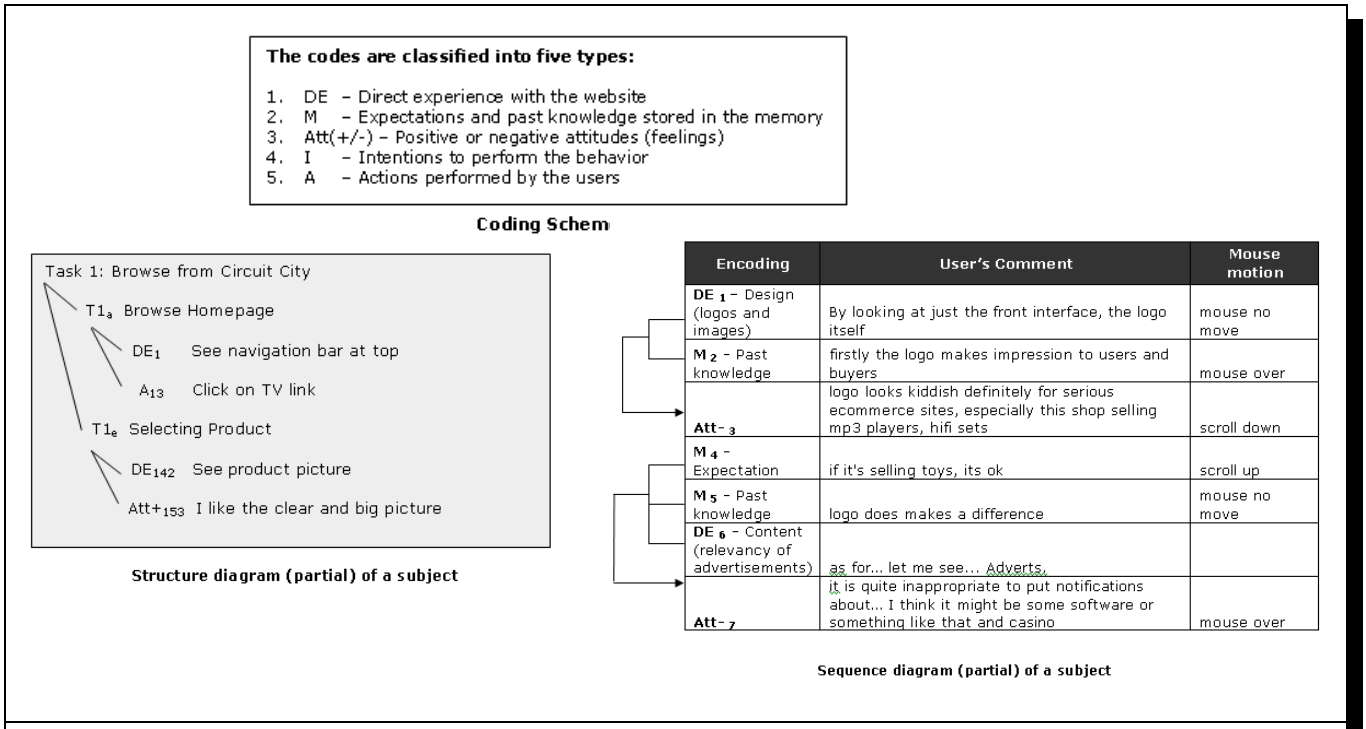

Figure 2. Excerpts of the Structure and Sequence Diagrams

on the research model. When applying the coding scheme, the protocols were scanned for anecdotal information and scoring techniques were used to tabulate the frequencies of occurrence of key items. Structure and sequence diagrams were constructed in order to reveal the decision structures and relationships between decisions and the Web site features used in both e-commerce Web sites. Excerpts of the structure and sequence diagrams are shown in Figure 2.

Intercoding reliability was performed to ensure the encodings are unbiased and more accurate (Todd and Benbasat 1987). Two coders were used, and each coder independently transcribed, segmented, encoded, and analyzed the protocol data. The intercoding reliability yielded a Kappa of 0.85, indicating a high level of agreement between the coders (Landis and Koch 1977).

Results and Analysis

The research model guided the flow of our results presentation. First, we present the task level analysis via the sequence of subtasks and Web site features employed in each of the *browse*, *search*, and *purchase* tasks. We also compare the behavior between experienced and novice users. Next, we show the attitude formation of the subjects based on their expectations of the Web site features. Finally, we present the effects of attitudes on intentions, followed by the purchasing behavior.

Task Level Analysis of Consumer Behavior

The analysis of the sequence diagrams and structure diagrams across the eight subjects revealed the common behavior and subtasks of the subjects, as well as the exact Web site design features they more frequently used.

The Browse Task

The observations in the browsing behavior for each subject were generally similar (see Table 2): (1) view homepage, (2) generate product list, (3) view product list, (4) view product page; repeat steps (2) through (4) for each product category.

Table 2. The Web Site Features Used in the Browse Subtasks

Subtasks	Frequently Used Web Site Features
1. View homepage to form initial impression of Web site)	• Colors and patterns • Relevancy of pop ups • Relevancy of information • Timeliness of information
2. Generate product list based on specific product category/attribute	• Menu • Promotion/daily special links (sometimes used) • Other categorization attributes (e.g., brand and price), if available
3. View product list to scan the product range available	• Organization of product table • Product thumbnail (if available) • Product attributes (e.g., model, price, key attributes)
4. View product page to evaluate product	• Product specifications • Product picture • Organization of information within the Web site (e.g., by topic, by date, from broad to narrow) • Product warranties • Product comparison tool (if available) • Interactive product demo (if available)

The first impression of the Web site is formed at the homepage based on the company logo, aesthetics, information presentation and layout, and broken links. A positive impression may be strengthened or reduced (or even turn negative) dependent on subsequent interaction with the Web site, but a negative impression (e.g., unprofessional or amateurish) once formed remains throughout. Organization of information is important throughout as subjects constantly praised or complained at every Web page. Subjects have strong negative reactions toward broken links and irrelevant or incorrect information. Thumbnails of products are very helpful and all subjects complained of the lack of product thumbnails at the table listing the products at Brandnamez.com.

The Search Task

The subjects follow a similar pattern in searching for specific products: broad search → narrow search → locate specific product (see Table 3). All but one subject chose the search engine as the first tool to use in the broad search, followed by other search tools such as "shop by brandname" to further narrow down the search results. Search engine effectiveness and search results organization were two main items that strongly influence subjects' attitudes. Brandnamez's search engine on keyword "mp3 player" returned several hundred entries in alphabetical order based on product name; all subjects abandoned the search results and turned to the product category menu on the homepage to accomplish their search task. Circuit City's search engine on "mp 3 player" returned results under categorized headings such as "CD players and recorders," "software," and "mp3 players" with an image of a representative product for each heading. This was very effective as subjects immediately zoomed into the correct product category, narrowed down using the "shop by" tools, and found the desired product within four mouse clicks in approximately 1.5 minutes (mean). The subjects were appreciative of the search result's organization and "shop by" tools at Circuit City. At Brandnamez.com, they spent between 8 and 15 minutes, felt disoriented and confused, and found navigation very difficult.

Table 3. The Web Site Features Used in the Search Subtask

Subtasks	Frequent Used Web Site Features
1. Broad search	• Search engine (if it works properly) • Menu • Page loading time
2. Narrow search	• Page loading time • Product sort by category, product attribute • Thumbnails

Table 4. The Web Site Features Used in the Purchase Subtasks

Subtasks	Frequent Used Web Site Features
1. Add item to shopping cart	• Guarantee policy • Shopping cart • Checkout system
2. Checkout—provide personal information	• Privacy assurance section • Safe transaction section
3. Check out—provide monetary and delivery information	• Payment methods • Shipping methods

The Purchase Task

For the purchasing task, the subjects perform the following sequence of subtasks (see Table 4): locate desired product (using steps in the browse or search task above) ➔ add to shopping cart ➔ provide personal information ➔ provide monetary and delivery information. All of the subjects checked out the shopping cart and shipping methods only during the purchasing task (one subject did observe that shipping information was available at Brandnamez.com's product page, and commented that it was "unnecessary at this stage"). Most subjects played with the shopping cart to ensure that it did add and recalculate correctly. At Brandnamez.com, most subjects commented that the purchase process was "straightforward" and "simple," but no subject wanted to make any purchase despite that it had worldwide shipping. Circuit City, unfortunately, demanded a U.S. zipcode (to calculate shipping) and did not ship outside the United States. Four of the subjects were disappointed as were ready to make a purchase there and then.

Comparison of Behavior Between Experienced and Novice Subjects

Table 5 summarizes the comparison between experienced and novice subjects' comments (both positive and negative ones), feelings of frustrations and being lost. Experienced subjects are more liberal with both praises for good implementation and complaints about bad implementation when compared to novice users. While the novice subjects focused mainly on accomplishing their tasks, the experienced subjects were far more aware of the Web site features. They were quick to notice good implementations and often offered advice on how bad implementations could be remedied. They were more easily frustrated at Brandnamez.com's navigation process but were never at a loss of how to accomplish their tasks. In contrast, novice subjects were more forgiving, but were sometimes at a loss of how to continue, even at circuitcity.com! They accepted unconventional Web site design more readily (e.g., the scrolling applet that displayed product subcategories at Brandnamez.com); one novice subject actually found it interesting and used it several times, while all the experienced subjects complained that it was "distracting" and "inconsistent." That same novice subject tried the search engine at Brandnamez.com four times with different keywords and read the search instructions; she felt that she "didn't understand." The other subjects abandoned the search engine for the menus after one attempt.

Table 5. Subjects' Comments (Positive and Negative), Feelings of Frustration, and Being Lost[a]

Task	Browse Task						Search Task						Purchase Task	
Items	Comments[b]		Frustration		Lost[c]		Comments		Frustra -tion		Lost		Comments	
Company[d]	CC	BNZ	CC	BNZ	CC	BNZ	CC	BNZ	CC	BNZ	CC	BNZ	CC	BNZ
Experienced	23(+) 0 (-)	3(+) 19(-)	0	2	0	0	5(+) 0(-)	0(+) 12(-)	0	2	0	0	5(+) 1(-)	3(+) 1(-)
Novice	9(+) 3(-)	4(+) 8(-)	0	0	1	1	3(+) 0(-)	1(+) 12(-)	0	1	0	2	3(+) 2(-)	0(+) 0(-)

Notes: a. The values are averaged across the four experienced and the four novice subjects.
b. Comments: x(+), y(-): x number of favorable comments and y number of unfavorable comments.
c. Frustration and Lost: number of times subjects felt frustrated or lost.
d. Company: CC = Circuit City; BNZ = Brandnamez

In the purchase task, some of the subjects complained that Circuit City should have made it clear upfront that it did not ship internationally. While all of subjects had no difficulty following through the purchase process at Brandnamez.com (half of them commented that it was "standard," "simple," and "straightforward"), none of them made any purchases even though Brandnamez.com supported worldwide shipping. All of the experienced subjects distrusted Brandnamez.com and were ready to purchase from Circuit City. The novice subjects did not indicate distrust nor willingness at either site. However, in the post-questionnaire survey, all eight subjects indicated their willingness to purchase from Circuit City.

Attitude Formation through Users' Expectation of the Web Site Features

The coding and analysis of the verbal protocols revealed the users' expectations in the Web site features and their attitudes. Lee (2005) showed the complete listing of Web site features and user expectations. Due to the space restrictions, only a Web feature from each Web site dimension is shown in Table 6. The shaded cells are examples taken from Circuit City's Web site while the white cells are examples taken from Brandnamez's Web site.

From the features found in both Web sites, it could be concluded that Circuit City has much better Web site features that matched the users' expectations in each dimension as compared to Brandnamez. The subjects felt likewise, as the post-interview survey results revealed that, on a scale of 1 to 7, with 7 being highest, Circuit City was ranked on an average of 6 to 7 on Web site features supporting the browsing, searching, and purchasing tasks. The subjects commented that Circuit City had "relevant and updated information," was "neat, clear, clean, consistent, and easy to read," and had "proper menus and product categorizations to guide them."

On the other hand, Brandnamez was only ranked 1 to 2 on those features. Subjects indicated that the Web storefront "lacked consistency, appeal…information [was] not up-to-date," and had "cumbersome navigational links," "poorly organized information," such that it "does not facilitate purchasing," "fails to attract attention," and gave an impression that is "very unprofessional." Hence, good acclamations were given to Circuit City, but not Brandnamez.

Effect of Attitudes on Intentions

In order to observe the effect of positive attitudes on the behavioral intentions to purchase from the Web storefronts, we examined the protocol data for the subjects' comments on their intent to purchase from Circuit City and Brandnamez. We also used the post-experiment questionnaire data where they rate their intentions to purchase from the two Web storefronts on a scale of 1 to 7 (with 7 being the highest). The results showed that all subjects have positive attitudes toward Circuit City and negative attitudes toward Brandnamez. The data compiled from the users' comments and the post-experiment questionnaire shows that all of the users have intentions to purchase from Circuit City because of their positive attitudes (see Table 7). On the contrary, none of the users intended to purchase from Brandnamez because of their negative attitudes toward it.

Discussions and Implications

This paper makes several contributions to the understanding of online shopping behavior. The proposed model incorporates a comprehensive classification of e-commerce Web site features and studies how it affects consumers' attitudes. The results show consumers favoring Web sites that rate highly along the five dimensions of content, design, navigation, business, and informational influence. Quality in these five dimensions would meet consumers' needs and positively affect their attitudes toward the Web storefront. Consequently, positive attitudes toward Web storefronts would lead to purchase intentions and purchase behavior.

This paper also highlights the use of protocol analysis and its benefits. Compared to using surveys, questionnaires, logs, and clickstream data, protocol analysis can study the consumers' detailed behaviors and examine each sub-activity leading to the eventual purchase. The verbal utterances provide insight on the expectations and preferences of the consumers while going through the purchasing process.

The comments of the subjects revealed that the presence of Web site features is not as important as the way the features are implemented. For example, both Web sites implemented search engines, and Brandnamez even had an advanced search engine whereby users could limit the price of the product. Both Web sites returned several hundred results. Circuit City organized its results into different categories with a representative product image for each category. Brandnamez simply listed the products

Table 6. User Expectation of Individual Web Site Feature

Web Site Features	Users' Expectations	Examples	How it Affects Attitude Towards Web Storefront	
(*Content dimension*) Accuracy of information	"I want accurate information to ensure that I'm making the right choice."	There is spelling error in the product specifications for Philips Portable MP3 Player.	Wrong information displayed confuses the users. Hence, they are not able to make an informed decision. It also gives an un-professional feel to the Web site and this is in turn lowers the user's trust.	(–)
		Correct product data is displayed.	Assures the users that they are getting the correct information while browsing through the Web site. This will help them to make a more accurate choice and reinforces credibility of the Web site.	(+)
Navigation dimension) Page loading time	"I want a fast page loading time so I don't have to waste my time waiting."	Page loading time is slow (more than 10 sec to load a page). A search result page takes even longer. A disclaimer on the Web site shows: "Please be patient, as it may take up to 60-Seconds for your request to process on this page."	The users have to wait for a considerable period of time and thus they get impatient during the wait.	(–)
		Fast page loading time with an average of 3 seconds.	The users are able to move from page to page quickly, hence minimizing waiting time.	(+)
(*Design dimension)* Minimal scrolling to view a page	"I like to have most of the information to be displayed at top of page so I don't have to scroll up and down to view them."	Frequent scrolling is required as product price and "add to cart" link is located at the bottom of the page.	Important information is not immediately highlighted to the users and makes it more inconvenient for the users as they have to scroll up and down frequently to read all the information. They waste time by reading through the product specifications, only to realize that the item is too expensive.	(–)
		Important information is displayed at top of the page. Limited scrolling is required to view the rest of the information.	Ensures that users can easily view the important information.	(+)
(*Business dimension – Product* Information) Product specifications	"I expect the Web site to have complete and detailed product specifications so that I can find out as much as possible about the product before I make my choice."	Provides inconsistent specifications. Some products have more specifications listed as compared to other products in the same category. No categorizing of products' specification resulting in difficulty in reading them.	Confuses the users with the inconsistency. The chunk of text without categorizing also reduces the users' willingness to read the product's specifications and find out more about the product.	(–)
		Comprehensive and detailed specifications provided.	Provides the users with details of the product, which is necessary to allow them to evaluate their choices.	(+)

Table 7. User Attitudes and Intention to Purcahse

Web Sites	Users' Comments	Post-Experiment Questionnaire	Intend to Purchase
Circuit City	1. "I would buy something from this Web site because the layout is well done. They have a lot of special features which has caught my attention." 2. "This is the only product that interests me but I am interested to find out how this checking out process is like because if they do have this product I might consider buying." 3. "I am very keen on buying from circuitcity.com because their Web site gives me a more professional feel."	Users rated the Web storefront an average of 7, indicating that they intend to purchase from the Web storefront, recommend it to their friends and purchase again in the future.	8 out of 8 users said YES
Brand-namez	1. "First of all, I'm going to declare that I'm not going to buy from this site, so I will just follow through and see how the ordering process is like. Definitely from all this information, it is very difficult for me to evaluate if this is the product that I want." 2. "I don't think I want to purchase from this site because I can't choose the best product from the list they have, so I can't be sure that I'm making the best decision. I really like to look at the other mp3 players they have but I don't seem to be able to do this easily, so I don't think I want to purchase from here." 3. "The whole feel of the Web site doesn't give a professional feeling such that it makes me trust the Web site to be able to purchase from them. So I will not be purchasing from brandnamez.com."	Users rated the Web storefront an average of 1, indicating that they do not intend to purchase from the Web storefront, will not recommend it to their friends and will never return again in the future.	8 out of 8 users said NO

in alphabetical order, making it very tedious for users to wade through the products one by one. Another example is the presentation of the product list table. Brandnamez lists the product's brand, model, price, and two or three cryptic keywords; users have to click on each product to find out its attributes. Circuit City displays the product thumbnail, key attributes (e.g., memory size, FM tuning, voice recording, etc. for mp3 players), customer rating, and availability; users could rapidly scan through the product list without going into individual product pages for quick comparisons. The bottom line is that a good implementation of a feature does one or more of the following: (1) reduces the cognitive process (e.g., after the user adds an item into the shopping cart, return to the page prior to deviation to the shopping cart); (2) reduces the manual work (i.e., scrolling and mouse-clicks) of the users; (3) is intuitive for users to use (e.g., the "shop by" tools that Circuit City uses are very easy and effective); and (4) balances information presentation such that users can rapidly scan and yet there is sufficient information to make decisions.

Limitations of the Study

There are several limitations to the study. The first is the selection of the Web site. Circuit City did not support international shipping, thus the subjects were unable to complete the purchase task. Second, the *a priori* coding scheme needs to be further refined to better explain the causal relationship between the direct experience and past knowledge and expectation to the attitudes, intention, and actions.

Implications for E-Commerce Web Site Designers

One implication for e-commerce Web designers is that they should design Web site features around activities (i.e., ensure that the Web site features support the purchasing stages and the customers' expectations). This will make customers happier and more satisfied with the Web storefront, consequently leading to greater likelihood of purchase from the Web storefront and greater sales for the company (Schoenbachler and Gordon 2002).

Another implication of our study is the evidence that users of e-commerce Web sites do have expectations on the different Web site features and that the expectations are related to their level of experience. From the subjects who participated in the experiment, experienced users have more expectations as compared to the novice users. Therefore, in order to accommodate both experienced and novice users alike, designers must adhere to the general usability principles and design guidelines in order to meet the users' expectations during their visits to e-commerce Web sites.

Third, designers should implement Web features in such a way that cognitive processing and manual work are reduced. Categorization of information, thumbnails, and inclusion of key information (e.g., key product attributes) powerfully enables users to quickly scan the information and make decisions without having to plough through many Webpages to get the information. The presentation and usage of the Web features must also be intuitive to the users.

Implications for Research

Preliminary results from this study show that the Web site dimensions and their features do affect the users' attitudes and subsequent intentions and behaviors to purchase. This is consistent with the findings of Azjen and Fishbein (1980), and has extended previous studies done by human computer interaction and marketing researchers on the area of Web site usability, e-commerce, and consumer behavior. One observation from this study is that the initial favorable attitudes may turn unfavorable later on, but once an initial unfavorable attitude is formed, it is difficult if not impossible to overcome. A future direction would be to study how the way in which the Web site features are implemented and presented affect users' attitudes.

References

Abdelmessih, N., Silverstein, M. and P. Stanger, P. *Winning the Online Consumer: The Challenge of Raised Expectations*, The Boston Consulting Group, Boston, 2001.

Ajzen, I., and Fishbein, M. *Understanding Attitudes and Predicting Social Behavior*, Prentice-Hall, Englewood Cliffs, NJ, 1980.

Alexander, J., and Tate, M. A. *Web Wisdom: How to Evaluate and Create Information Quality on the Web*, Lawrence Erlbaum Associates, Mahwah, NJ, 1999.

Allport, G. W. *Attitudes: A Handbook of Social Psychology*, Clark University Press, Worcester, MA, 1935.

Bagozzi, R. P. "The Self-Regulation of Attitudes, Intentions, and Behavior." *Social Psychology Quarterly* (55), 1992, pp. 178-204.

Benbunan-Fich, R. "Using Protocol Analysis to Evaluate the Usability of a Commercial Web Site," *Information & Management* (39:2), December 2001, pp. 151-163.

Bettman, J. R., and Park, C. W. "Effects of Prior Knowledge and Experience and Phase of the Choice Process on Consumer Decision Processes: A Protocol Analysis," *Journal of Consumer Research* (7), 1980, pp. 234-248.

Boren, M. T. *Conducting Verbal Protocols in Usability Testing: Theory and Practice*, unpublished Ph.D. Dissertation, University of Washington, Seattle, WA, 1999.

Conger, S., and Mason, R. *Planning and Designing Effective Web Sites*, Course Technology, Cambridge, MA, 1998.

Davis, F. D., Bagozzi, R. P., and Warshaw, P. R. "User Acceptance of Computer Technology: A Comparison of Two Theoretical Models," *Management Science* (35), 1989, pp. 982-1003.

Ericsson, K. A., and Simon, H. A. *Protocol Analysis: Using Verbal Reports as Data*, Oxford University Press, Cambridge, MA, 1996.

Fazio, R. H. "How Do Attitudes Guide Behavior," in *Handbook of Motivation and Cognition: Foundations of Social Behavior*, Volume 1, R. M. Sorrentino and E. T. Higgins (Eds.), Guilford Press, New York, 1986, pp. 204-233.

Gehrke, D., and Turban, E. "Determinants of Successful Website Design: Relative Importance and Recommendations for Effectiveness," in *Proceedings of the 32nd Annual Hawaii International Conference on System Sciences*, IEEE Computer Society Press, Los Alamitos, CA, 1999 (available online at **http://csdl2.computer.org/comp/proceedings/hicss/1999/0001/05/00015042.pdf**).

Hurst, M., and Gellady, E. "Build a Great Customer Experience to Develop Brand," ZDInternet.inc, 1999 (available online at **http://www.creativegood.com/creativegood-whitepaper.pdf**; accessed October 21, 2005).

Jarvenpaa, S. L., Tractinsky, N., and Vitale, M. "Consumer Trust in an Internet Store," *Information Technology and Management* (1:12), 1999, pp. 45-71.

Katerattanakul, P., and Siau, K. "Measuring Information Quality of Web Site: Development of Instrument," in *Proceedings of the 20th International Conference on Information Systems*, P. De and J. I. DeGross (Eds.), Charlotte, NC, December 1999, 12-15.

Keeker, K. "Improving Web Site Usability and Appeal: Guidelines," July 24, 1997 (available online at **http://msdn.microsoft.com/archive/default.asp?url=/archive/en-us/dnarplan/html/IMPROVINGSITEUSA.asp**; accessed October 21, 2005.

Lam, J. C., and Lee, M. K. O. "A Model of Internet Consumer Satisfaction: Focusing on the Website Design," in *Proceedings of the Fifth Americas Conference of the Association for Information Systems*, W. D. Haseman and D. L. Nazareth (Eds.), Milwaukee, WI, August 1999, pp. 526-528.

Landis, J. R., and Koch, G. G. "The Measurement of Observer Agreement for Categorical Data," *Biometrics* (33), 1977, pp. 159-174.

Lee, E. B. *Using Protocol Analysis to Understand the Effects of E-Commerce Web site Design on Consumer Attitudes, Intentions and Purchase Behaviors*, Honors Year Project Dissertation, School of Computing, National University of Singapore, 2005.

Lombard, M., and Ditton, T. "At the Heart of it All: The Concept of Presence," *Journal of Computer-Mediated Communication* (3:2), September 1997 (available online at **http://jcmc.indiana.edu/**).

Madden, T., Ellen, P., and Ajzen, I. "A Comparison of the Theory of Planned Behavior and the Theory of Reasoned Action," *Personality and Social Psychology Bulletin* (18), 1992, pp. 3-9.

Mickelson, G. "Click Tracks Lets Web-Based Small Business Gauge Customer Interest," *Santa Cruz Sentinel* May 29, 2005 (available online at **http://www.santacruzsentinel.com/archive/2005/may/29/biz/stories/01biz.htm**; accessed October 21, 2005).

Neo, H. K. *Conceptual Framework for Benchmarking Web Storefronts of Internet Retailers*, Honors Year Project Dissertation, School of Computing, National University of Singapore, 2002.

Newell, A., and Simon, H. A. *Human Problem Solving*, Prentice Hall, Englewood Cliffs, NJ, 1972.

Nielsen, J. *Designing Web Usability*, New Riders Publishing, Indianapolis, IN, 2000.

Nielsen, J., and Norman, D. A. "Usability on the Web Isn't a Luxury," *Information Week* (773), January 14, 2000, pp. 65-71 (available online at **http://www.informationweek.com/773/web.htm**; accessed October 21, 2005).

Novak, T. P., and Hoffman, D. L. *Advertising and Pricing Models for the Web*, MIT Press, Cambridge, MA, 2000.

Oliver, R. L. "A Cognitive Model of the Antecedents and Consequences of Satisfaction Decisions," *Journal of Marketing Research* (17), 1980, pp. 460-469.

Olson, J. C., and Dover, P. A. "Disconfirmation of Consumer Expectations through Product Trial," *Journal of Applied Psychology* (64:2), 1979, pp. 179-189.

Palmer, J. "Website Usability, Design, and Performance Metrics," *Information Systems Research* (13:2), 2002, pp. 151-167.

Ranganathan, C., and Ganapathy, S. "Key Dimensions of Business-to-Consumer Web Sites," *Information & Management* (39:6), 2002, pp. 457-465.

Reed, A., Wooten, D. B., and Bolton, L. E. "The Temporary Construction of Consumer Attitudes," *Journal of Consumer Psychology* (12:4), 2002, pp. 375-388.

Regan, D. T., and Fazio, R. H. "On the Consistency between Attitudes and Behavior: Look to the Method of Attitude Formation," *Journal of Experimental Social Psychology* (13), 1977, pp. 28-45.

Rowley, J. "Product Search in e-Shopping: A Review and Research Propositions," *Journal of Consumer Marketing* (17:1), 2000, pp. 20-35.

Sanbonmatsu, D., and Fazio, R. "The Role of Attitudes in Memory-Based Decision Making," *Journal of Personality and Social Psychology* (59:4), 1990,pp. 614-622.

Schoenbachler, D. D., and Gordon, G. L. "Multi-Channel Shopping: Understanding What Drives Channel Choice," *Journal of Consumer Marketing* (19:1), 2002, pp. 42-53.

Sengupta, J., and Fitzsimons, G. J. "The Effects of Analyzing Reasons for Brand Preferences: Disruption or Reinforcement," *Journal of Marketing Research* (37:3), 2000, pp. 318-330.

Sheppard, B. H., Hartwick, J., and Warshaw, P. R. "The Theory of Reasoned Action: A Meta-Analysis of Past Research with Recommendations for Modifications and Future Research," *Journal of Consumer Research* (15), December 1988, pp. 325-343.

Someren, M. W., Barnard, Y. F., and Sandberg, J. A. C. *The Think Aloud Protocol: A Practical Guide to Modeling Cognitive Processes*, Academic Press, San Diego, CA,1994.

Song, J., and Zahedi, F. "Web Design in E-Commerce: A Theory and Empirical Analysis," in *Proceedings of the 22nd International Conference on Information Systems*, V. Storey, S. Sarkar, and J. I. DeGross (Eds.), New Orleans, LA, December 2001, pp. 205-220

Taylor, S., and Todd, P. "Decomposition and Crossover Effects in the Theory of Planned Behavior: A Study of Consumer Adoption Intentions," *International Journal of Research in Marketing* (12), 1995, pp. 137-155.

Titus, P. A., and Everett, P. B. "Consumer Wayfinding Tasks, Strategies, and Errors: An Exploratory Field Study," *Psychology and Marketing* (13), 1996, pp. 265-290.

Todd, P., and Benbasat, I. "Process Tracing Methods in Decision Support Systems: Exploring the Black Box," *MIS Quarterly* (11:4), 1987, pp. 493-512.

Turban, E., King, D., Viehland, D., and Lee, J. *Electronic Commerce: A Managerial Perspective*, Pearson Prentice Hall, Upper Saddle River, NJ, 2000.

Zhang, P., von Dran, G., Blake, P., and Pipithsuksunt, V. "A Comparison of the Most Important Web site Features in Different Domains: An Empirical Study of User Perceptions," in *Proceedings of the Sixth Americas Conference on Information Systems*, H. M. Chung (Ed.), Long Beach, CA, August 10-13, 2000a, pp. 1367-1372.

Zhang, P., von Dran, G., Small, R., and Barcellos, S. "A Two-Factor Theory for Website Design," in *Proceedings of the 33rd Hawaii International Conference on Systems Science*, Maui, Hawaii, January 2000b (available online at **http://csdl2.computer.org/comp/proceedings/hicss/2000/0493/06/04936026.pdf**).

Zhang, X., Keeling, K., and Pavur, R. "Information Quality of Commercial Web Site Home Pages: An Explorative Analysis," in *Proceedings of the 21st International Conference on Information Systems*, W. J. Orlikowski, S. Ang, P. Weill, H. C. Krcmar, and J. I. DeGross (Eds), Brisbane, Australia, December 2000, pp. 164-175.