

E-Shopping Behavior and User-Web Interaction for Developing a Useful Green Website

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Abstract. In recent years there has been an increasing respect for green issues. It has been addressed in various products/services as well. There is still no web-site to support green customers' decision process on electronic commerce (EC). The aim of this study is to understand user EC needs and expectations in order to elicit the design requirements of a useful interface. A questionnaire and an experiment were conducted to get users' green knowledge and to detect user external behaviors interacting with computer when e-shopping. The study is centered on electric green products, including computers, communication devices, and consumer electronics. The results are used to produce the online-shopping process flowchart and several suggestions for improving e-shopping. The suggestions including information search, information display, and web site features have been addressed. From this, further research will focus on the design of web sites supplying consumers with green product information.

Keywords: User-centered design, User-Web Interaction, Green product, E-commerce.

1 Introduction

In recent years there has been an increasing respect for green issues. It has been addressed in various products/services as well. In the information-rich world of today, the internet is simply an alternative mechanism for accomplishing certain communication-related functions. The internet provides the capability of inexpensively storing vast amounts of information in different virtual locations and supporting and facilitating several forms of interaction, including one-to-one, one-to-many, many-to-one, and many-to-many interactions [1] and [2]. The electronic commerce (EC) Web site design has allowed companies to provide customers with a large amount of information and more options to enhance consumers' online experience. More and more companies and government organizations are developing web sites to convey green information in

establishing an international image and reinforcing people's environmental values i.e. conservation, preservation, world of beauty. However, there has been a tremendous increase in the number of web sites and most of them have been designed without respect to the user's cognitive thinking leading to a frustrating and disappointing experience for searching information. In addition, rarely can one find a web site catering to the needs of consumers searching for green products. This study is designed to observe how users search for specified product information and then making a purchase decision online. This project is an initial phase focusing on obtaining consumers' needs of green information for guiding their buying behavior towards being more environmentally friendly. Therefore, consumers' information seeking processes and needs have to be considered during the interface design. An experiment has been developed to understand users' needs and interaction with Web resources in order to elicit the design requirements of a useful interface for dealing with information overload and usability problems. Here, the study is centered on electronic products, including computers, communication devices and consumer electronics. The aims of this study are: (1) to acquire target consumers' preferences, purchase intention, and acceptance level of electronic green products (EGP) by using a questionnaire; (2) to develop an experiment for studying user-web interaction and information searching process from the e-purchase behavior; and (3) to provide several suggestions for developing an EGP Web site with user-centered interfaces in an EC environment from the results of the questionnaire and the e-purchase behavioral experiment.

2 Relevant Literatures

Green information is very important to people in protecting our environment. The speed at which electronic technology is improving has shortened the life cycle of products contributing to increased pollution. The internet has already become a powerful tool for people to search information, evaluate alternatives, and make decisions before making purchases. Developing a web site for green products is not easy but important. Effective website design is necessary for improved customer satisfaction and enhanced consumer experience. Electronic commerce (EC) may exchange large amounts of product information between users and sites. Given the large amounts of information available at the site, user interaction with web sites becomes an effort. To improve user's operations in EC requires understanding their behavior online. The user's external behavior is important to understand because they may correlate with their cognitive need. What the user considers success can be seen from their behavior when interacting with the interface design. The user-centered interface design on web-based systems may assist the user in receiving the right information in the right way and in an acceptable time before making any purchases. Also, it may support user knowledge in a specific domain, minimize of the cost of interaction, and provide less information load. There is an increasing number of consumers making purchases online, however currently there is no model for EC purchasing decision-making. For traditional offline shopping there exists multiple proposed models, one of the most popular is the EBM model for purchasing decision-making process. It was abstracted

from the EKB model. The consumer purchasing decision-making process can be divided into five stages: need recognition, information search, alternative evaluation, purchase, and after purchase evaluation [3]. This study aims to develop a flowchart of e-shopping process for users in the web environment from the real shopping process, including information seeking and decision making from the e-shopping behavior. The focus will be on the information search and alternative evaluation stages from the EBM model.

Information is an important tool for the growing public support for environmental issues and also developing environmentally responsible behavior in many ways. With the right kind of information it is possible to influence consumers' value priorities, and to persuade them to change their priorities [4]. Information is accessible in various forms, and nowadays people find it easier to search for information online. The internet is being searched both when a consumer's objective is specific product or service information in anticipation of a purchase as well as when the objective is to obtain general information about a brand or product or service category [1]. There are two types of internet-based consumer information search behavior using six dimensions [5]. Specific information search was characterized as being extrinsically motivated, having an instrumental orientation, reflecting situational involvement, seeking utilitarian benefits, consisting of directed search, and focusing on goal-directed choices. General information search was characterized as being intrinsically motivated, having a ritualized orientation, reflecting enduring involvement, seeking hedonic benefits, consisting of non-directed search, and focusing on navigational choices. The complexity of consumer information search behavior is inherent. In order to develop a user-centered web-based system, anticipated needs, requirements, and expectations from the EC will need to be identified. To build effective and efficient human-centered electronic information systems, developers need to ground systems in a comprehensive understanding of the information-foraging process in context [6] and [7]. Collecting quantitative data on thoughts and feelings from user-web interactions besides physical movements is important to developing a user-centered web-based system. User-web interaction can be seen as (1) communication consisting of a series of transactions between the user and the web, and (2) information processing and problem-solving in which the user makes decisions based on the interpretation of information presented to him/her via an interface [8].

The store front for an EC transaction is the web site and online retailers invest in its design improvements. The usability of a website has been a focused upon in determining its success or failure according to human-computer interaction (HCI) literature. In the standard ISO-9241 Part 11, usability has been defined as 'the extent to which a system can be used by specified users to achieve a specified goal with effectiveness, efficiency and satisfaction in a specified context of use'. The usability or HCI criteria are important in making the customer's interaction with the website a satisfying one through the web site interface. An interface is the layer between the user and the system that facilitates human-computer communication [8]. This study researches e-shopping behaviors for improving user-web interaction via the web site interface design.

3 Method

According to the latest report from Taiwan Network Information Center (See the TWNIC at <http://www.twmic.net.tw/>) up to January 31, 2008, the population ages 12 to 35 accounted for about 90% of the internet usage. In particular, the percentage of internet users in age group 16 to 20 rises to 96.95%. It can be seen that the major part of internet user in Taiwan is young adults especially in age 16 to 20. This age group has the highest percentage online presence and will be the next generation of online consumers. Here, an initial questionnaire and an experiment were conducted to investigate the user needs, captured by consumers' external and mental patterns, to apply it on the interface design.

3.1 Collection and Analysis of Questionnaire Data

To elicit responses from consumers in Taiwan, a questionnaire has been designed With survey questions concerning the preference and purchase intention of green products. Most questions provided multiple-choice items and allowed selecting multiple answers. Using the questionnaire method, a total of 291 (97%) questionnaires retrieved, including active Web males ($n = 197$) and females ($n = 94$) students ages 18 to 21 at Oriental Institution of Technology (OIT) in Taiwan, were analyzed using descriptive statistics. The results indicated that 73.5% students had some form of knowledge about electric green products, and only 1.3% students have bought related goods. In addition, if 291 students are willing to buy green products, 60.9% students will choose computers, 45.7% of them will choose electric appliances, and 43.6% students will choose communication devices. The reasons of buying green products for students were protecting environment (78%), marketing (40.1%), and friend's recommendations (31.4%). The reasons of not purchase green products were having no idea about the products (49.3%), price (49%), and limited selections of products (38.6%).

3.2 Experiment

The subsequent experiment has been designed based on the results of the initial questionnaire and was conducted to detect users' external behaviors interacting with web sites when e-shopping and to collect users' mental pattern from experimental questionnaires.

Participants. Forty undergraduate students at OIT in Taiwan, 20 males and 20 females in age 18 to 21 years, were paid to participate in the experiment. All had online shopping experience for an average of 30.83 (SD 20.4) months.

Apparatus. A computer with internet capabilities provided for online information search and shopping. Input devices available included a keyboard and a mouse. Output device available was 15 inch liquid crystal display (LCD) screen.

Procedure. An experimenter introduced a task, which is searching for laptop computer product information on the Web and deciding which to buy. All the participants used the same computer and were given the same task. After filling out a pre-experiment questionnaire each participant was instructed to find the item that they would most

likely purchase online in any way that they preferred. During the experiment, the participant was video taped to analyze their user-web interaction, user e-shopping process, and time spent shopping from the online behaviors. After the participant completed the task of making the purchase decision, he/she had to fill out a post-experiment questionnaire.

Measurements. The following sections for the measurements are pre-experiment questionnaire, user-web interaction, online shopping process, and post-experiment questionnaire.

Pre-experiment questionnaire. It is designed with nine questions to obtain participants' background, online experience, and anticipated features for buying a laptop, which was to be completed before the start of the experiment.

User-web interaction. It is analyzed by objective measure in this study. A quantitatively-based measure has been developed by simple frequency counts to describe the nature of the interaction between user and World Wide Web. The interactions are captured by observers at an intermediate level of detail that incorporates behavior and quantitative aspects of the interaction. During the run of an experiment, the observer watched the interactions in real time, and used a specially designed form to capture the source, the recipient, and the type of the interactions between the user and the web sites. After the experiment, the results of interaction were double checked from the video tapes.

Online shopping process. It is presented by a simply flowchart constructed from the participants' e-shopping behavior. The flowchart is hypothesized to facilitate researchers understanding users' cognitive style and habitual behavior for dealing with the current Web environment.

Post-experiment questionnaire. It is designed with fifteen open-ended questions to get information such as what kind of laptop the participant wanted, where to buy, and why and to elicit their intentions, experiences, decision-making, information load and suggestions for online shopping process.

4 Results

4.1 Pre-experiment Questionnaire

In this experiment, the average experience of participants' interaction with World Wide Web resources is 102.45 (SD 19.85) months and the online purchase is 30.825 (SD 20.35) months. About 55% of the participants have had the experiences of buying clothes, 43% of buying accessories, and 40% of buying books online. Before execute searching information online, the anticipated features of laptop product are that 63% of the participants value tech specs 58% design, 55% usefulness, and 53% size and weight.

4.2 User-Web Interaction

The results is shown in Table 1, one can see that the participants visited the mean number of 34.63Web pages and of 9.13 (SD 8.05) Websites by using keyword/hierarchical/others search functions for mean number of 20.85 (SD 13.59) times

in 71.81 (SD 22.32) minutes. This demonstrates that the users visited many web sites and web pages before having sufficient information to make their decisions. The user-web interaction data is analyzed by interaction ratios. In search anticipation ratios, the ratios for females (ratios=1.38), for males (ratios=1.67), and for all participants (ratios=1.5) are larger than 1.0 indicating that users using the search functions are able to locate more relevant information than non-relevant information. The ratios <1 mean that users using the search function are less likely to be able to find relevant information. The information ratio is 1:0.75, meaning text and image information are both important for users.

Table 1. Summary of results for user-web interaction

		Used search functions			Visited		data format	
		Keyword	Hierarchical	others	Web pages	Web sites	text	Image
Interaction types	F	7.7 (4.93)	12 (7.04)	7.46 (6.19)	37.5 (18.27)	10.75 (9.3)	15.7 (7.95)	9.95 (2.96)
	M	5.6 (4.6)	8.8 (6.26)	4.58 (4.48)	31.75 (15.4)	7.5 (6.4)	15.9 (8.63)	13.8 (6.94)
	Total	6.65 (4.83)	10.4 (6.77)	6.08 (5.52)	34.63 (16.9)	9.13 (8.05)	15.8 (8.19)	11.88 (5.62)
Interaction ratios	F	Search anticipation = 1.38			Information anticipation =			
	M	Search anticipation = 1.67			1: 0.63			
	Total	Search anticipation = 1.5			1: 0.87			
					1: 0.75			

4.3 Online Shopping Process

The online shopping process from the experiment has been simply drawn as a flow-chart (please refer to Figure 1). About 85% of participants use Yahoo.com as their web portal and use the keyword, hierarchical, or other search functions to get wanted information based on their preferences for a laptop computer including tech specs, design, usefulness, size and weight, and/or price. Then, they will narrow down the choices of which to buy. At that time, they will need the information to compare about the tech specs, price, consumers' rating, and/or user reviews to aid in their decision making. Here one can see that the consumer has to make a decision on whether or not to make a purchase. If the consumer does not make a decision to purchase, then they will have to repeat the searching process again from the mean number 9.13 (SD 8.05) of web sites until a suitable product is chosen for purchase. After the experiment, a few participants may want to see the real product in the offline store before deciding where to make their purchase.

4.4 Post-experiment Questionnaire

In addition, the results revealed that about 70% of participants were satisfied about the online shopping process and was due to a large amount of information (40%), the information easy to be obtained and understood (40%), and convenient (12%). The remaining 30% of participants were unsatisfied with the online shopping process because of difficulty in obtaining more specific information (69%), insufficient information (15%), and information overload (15%). During the experiment, every

participant came across unnecessary information or visited wrong web pages/ web sites sometimes because 21% of users reached unrelated information, 29% users using the hierarchical search do not get right information because the classification model is not match their mental thinking, 29% users could not find wanted information online with the resources available to them. Users can buy the laptop computer online for the following reasons; 53% value high seller reputation, 50% value deliver service, and 25% value better price. Keeping track of information that has been retrieved can be a difficult process. The two main methods are searching the browsing history of the browser and keeping multiple browsing windows or tabs open. However 78% of users still have difficulty in relocating information that they have previously found. With so much information to process, some users may face information overload. How does one deal with this problem. 95% of consumers felt overloaded with information. After the experiment, the participants provided the following suggestions to improve the online shopping experience: 30% prefer more online security, 30% prefer a well designed interface, 28% prefer real and relevant information, 18% prefer information to be concise, 15% prefer improved speed of web site, and 13% prefer the use of product placement advertisement to introduce new products. In addition most of the users agreed that having the ability to do a side by side comparison of products from different vendors from a single website would greatly assist in making their purchase decision easier and quicker.

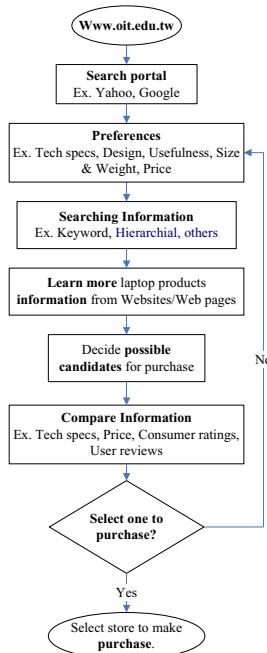


Fig. 1. Online shopping process flowchart

5 Discussion

The following discussion topics follow from the results: information search, information display, and web site features.

- Information search: Users search information by product preferences or requirements from their online experiences and knowledge about the product (please refer to Figure 1) via keyword or hierarchical search which plays an important role in the first step in finding the right information. The way the search behaves has to match the user's mental model or cognitive style in order to avoid unnecessary information overload from visiting a lot of unnecessary web pages thus improving interaction performance by using less search functions to get right information from less web pages.
- Information display: This also plays an important role in helping people have the right knowledge about green products (please refer to Figure 1). Availability of green information may affect their shopping decision from traditional to green products. With green information 78% surveyed from the questionnaire would buy green products for protecting our environment. However, 49.3% of persons questioned have no prior experience with real green information. Green information from marketing (40%) and recommendation from others (31%) are very important in this case. Availability of green information on websites would enhance people's environmental values. The laptop information that online users request most are: tech specs, design, reviews (negative and positive), computer accessories, comparison information (price, consumers' rating, etc), new product information, and clear and definite information. The way to display the information would be using text and images in the ratio of 1:0.75, with comparison information integrated in one table allowing easier reading and comprehension.
- Web site features: These play an important role in attracting visitors including (1) site reputation and services provided; (2) real information via social network that allow users to share their reviews; (3) automatic record tool to record the important information for the user including past searches and provide recommendations; and (4) comparison tool to compare specific criteria i.e. price or tech specs for specific items.

6 Conclusion

Provided with more green information, consumers would be more willing to purchase green products. Consumers have grown accustomed to using the internet to search for their information needs. This study is aimed towards researching consumers' online shopping behavior to obtain users' needs and expectations on web-based system for improving users' ability to gather information during their online shopping. For user-centered design on web-based system, user e-shopping behavior has been investigated producing the online-shopping process flowchart and several suggestions for improving e-shopping. The suggestions about information search, information display, and web site features have been addressed. Results from this study will be applied in the design of future web sites focuses on supplying consumers with green product information.

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