L@@K! MINING EBAY: A THREE-PART INTEGRATED PROJECT FOR UNDERGRADUATE CIS STUDENTS

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ABSTRACT

Industry often criticizes Computer Information Systems (CIS) courses for failing to help students see the "large picture." CIS students may not always make the connection between an information system's design and how design impacts users and consumers in the larger e-commerce marketplace. A three-part integrated project utilized eBay and allowed students to explore online auction system functionality, with emphasis on the search function and how keyword variation, photos, text descriptions and additional graphics impact sellers and buyers in the marketplace. Student evaluations of the various activities and recommendations for their refinement are included.

Keywords: E-Commerce, Search Engines, Search Strategies, Online Auctions

INTRODUCTION

Industry often criticizes Computer Information Systems (CIS) courses for failing to help students see the "large picture." It is true, many teachers, due to time constraints, often rely heavily on textbook examples and short reinforcement exercises. The result may be a lack of understanding by CIS students as to how an information system's design impacts users and consumers in the larger e-commerce marketplace. This paper focuses on a teaching strategy implementing a three-part CIS project, using eBay, a popular auction site. The project was implemented at a regional, comprehensive university with two CIS classes with 40 total students, during the spring of 2006. The purpose of this three-part integrated project was to use eBay, a popular online auction site, to achieve the following objectives:

1. To introduce students to the system functions of online auction databases.

2. To allow students to explore search strategies, and the effects of keyword variation on buyers and sellers.

3. To provide students an opportunity to examine additional eBay system features, at the seller's disposal including text, photos, color, and additional layout and design elements.

4. To reinforce how search engines function and how language variation and system features impact buyers in online auction settings.

5. To assess student interest levels in the integrated, three-part project.

INTEGRATED PROJECT

During the spring of 2006, a three-part, integrated project was introduced to two introductory level computer information systems classes. The three parts of the integrated project were as follows: the query process and language variation; basic system features and consumer response; and a final integrative reinforcing exercise to compare and discuss results of system features for consumers and sellers in an online auction site. This project was used to meet course objectives dealing with evaluation of systems design and user applications. This paper includes background on the search process as well as rationale for and activities and discussion of each of the three parts of the project. Student ratings of their perceptions of the project and researcher recommendations are also included.

Background on the Search Process

Users employ three major ways of finding information on the Internet. First, users can directly type the uniform resource locator (url) in the address bar; second, they can use categorical structures set up by the search engine, such as Yahoo's category directory; and third, they can type keywords, or queries, in a search bar or box. Researchers have hypothesized that the methods searchers employ is not haphazard, but that factors such as the type of question and whether its answer is predictable or not contribute to the search method used [6]. For example, in a study that involved several search tasks across a variety of contexts, keyword queries in search engines were used most frequently, followed by direct typing of urls, followed by the use of categorical directories [6].

In auction sites like eBay, there is no opportunity for a user to directly type a url. However, although url searches are not applicable, there is ample opportunity for using both keyword queries and categorical directories.

The number of categories and subcategories in eBay's directory has grown dramatically in recent years—from over 3000 categories in 1999 [2] to over 25,000 categories in 2006 [1] .

PART ONE:
QUERIES AND SEARCH ENGINES

The first part of the integrated project allowed students to examine both query length and language variation within queries using eBay's search engine. Query length has been investigated in several research projects using Web-based search engines [5]. Results of these studies, which included over a million queries of Excite.com show that users enter an average of 2.4 words per query [5]. Little is known about query length in the context of an auction site like eBay.

Interestingly, there is also very little research describing language variation in keyword searches. One previous study [4], however, demonstrated that terms used by information system designers and users varied in much the same way that terms varied between document authors and searchers. The mismatch between two parties is called the vocabulary problem [4].

In-Class Activities with Students

For the first assignment, students were given images of 15 products found on eBay (see Figure 1). The black and white images students received were approximately one-inch square; a color version was also made available. Students were asked to search for each item on eBay and record the following data:
1. search term(s) used;
2. number of items found; and
3. other notes concerning their search strategies for that product.

Discussion of Activity Results

Students favored the keyword search strategy over eBay's categorical directory structure. Though the majority of students used the keyword search strategy, some started with keywords and then switched to the categorical directory structure to refine their searches by excluding unwanted categories that included the same keyword. The 15

products used in the initial search task appear in Figure 1.

1) dresser (15) 2) chester drawers (2)	1) rain jacket (7) 2) pull over wind breaker (1)	1) coat rack (10) 2) hat and coat stand (1)
1) love seat (8) 2) antique wood couch (1)	1) hub cap (12) 2) 5 lug wheel factory (1)	1) crock pot (4) 2) glass top pot (1)
1) frying pan (14) 2) french skillet (1)	1) brief case (7) 2) black leather carryon (1)	1) bicycle wheel (11) 2) spoke bike wheel (1)
1) desk (7) 2) letter writing desk (1)	1) toboggan (8) 2) skully (1)	1) coozie (10) 2) can cozy (1)
1) china cabinet (10) 2) dark curio cabinet (1)	1) tea pot cover (8) 2) tea pot warmer (1)	1) coffee table (7) 2) wooden hall table (1)

Figure 1. Images of eBay Products Used for Initial Search Task with Frequency Counts for Most Popular and Less Popular Keyword Search Terms (N = 36)

Data from the search activity for the 15 products activity show that searches of eBay's database using

its search engine averaged 2.11 words per query. These results are quite similar to the average of 2.4 words per query expected from Web searches [5].

In terms of language variation in keyword searches, students used a variety of terms to search for the 15 products. For example, when searching for the piece of furniture in Figure 2, 15 different terms were used by 36 students.

Keyword Search Term Entered	# of Sellers (hits)
drawer	6610
dresser	3612
dresser drawers	439
dresser drawer	422
chest of drawers	298
wooden chest	296
wood dresser	189
oak dresser	168
brown bedroom furniture	88
wooden dresser	88
brown dresser	15
drawer double dresser	11
7 drawer dresser	8
blonde dresser	5
chester drawers	2

Figure 2. Terms Used and # of Hits for the Image

For example, while the popular term *dresser* produced over 3500 sellers' products, the term *chester drawers* produced just two sellers. Figure 1 provides the search term used most often (1) and the search term used least often (2). Additionally, for each of the 15 products for which students searched, they used an average of 19.4 different words or phrases. This data helped students see immediately the impact of language variation in the marketplace. In this study, the ratio (calculated by dividing the number of items found for the most popular term used by the number of items found for the least frequently used term) was over 27000:1. This ratio indicates the keywords students used produced very different sets of items, in terms of size and composition, which in turn impacts consumer purchase options.

PART TWO: BASIC SYSTEM FEATURES AND CONSUMER BUYING BEHAVIOR

An examination of basic system features affecting consumer buying behavior marked the second part of eBay's e-commerce activities. To select a product for classroom study required an item with little inherent gender bias. The online auction system implemented by eBay provides sellers with a variety of options to enhance their ability to sell their products. A central element is the textual title and description sellers enter to be used by buyers using eBay's search function.

In-Class Activity with Students

For Part 2 assignments, students were asked to perform four major tasks that occurred in successive class periods:

1. list products that both males and female students would be likely to purchase; and
2. use results from first activity to select a single product in order to rank text only descriptions based on students' likelihood of purchase;
3. rank the same set of products on likelihood of purchase using the captured Web pages, including text with original eBay fonts, images and layout; and
4. analyze rankings and the web/text correlation in class to better understand customer buying behavior and its relationship with system features.

Discussion

In order to determine an appropriate product for this project, students were asked to list products both males and females were likely to purchase. A variety of items were reported. Movies, CDs and cell phones were frequently mentioned, but were not selected for the study due to minimal product descriptions available on eBay sites. Exercise equipment, however, did offer a variety of products with greater variation of product descriptions. Used exercise equipment descriptions provided greater variation in text description than did text describing new products. Often new products contained identical text, chiefly because it appeared to have been copied directly from a manufacturer's Web site or copied from Web sites of other sellers. Researchers for the
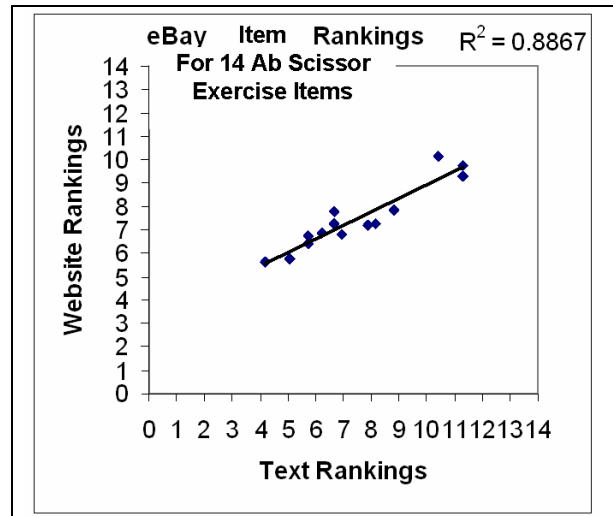
study selected an ab exerciser machine, as numerous used products were listed for sale on eBay. The ab scissors was under $200 and was an item likely to be purchased by college students. Fourteen ab scissor eBay Web sites were collected for the integrated project. Two versions of the fourteen product descriptions were created. A text-only version was created by stripping out the title and text from the Web page description. The formatted version included each captured Web page uploaded to a local Web server.

During a class session, students were given the 14 text-only descriptions and asked to rank the products according to their likelihood to purchase. They ranked each text-only description from 1 (most likely to buy), to 14 (least likely to buy). Rankings were submitted to the instructor and entered into a spreadsheet.

In addition to the text titles and descriptions, sellers can use a variety of other system features such as photos, graphics, color and fonts to promote their products. Therefore, in the class period following the ranking of the text-only descriptions, students re-ranked the same 14 ab exercisers based on the actual Web page as it appeared on eBay with photos and formatting.

The comparison of the two separate ranking activities was presented in the class period following the Web page rankings. An in-class discussion followed to demonstrate how students could use the same methods to analyze data from customers (i.e., which company Web site they preferred). Two methods were used to compute rankings: a voting-tally method, and an average ranking method. Using the voting method, the number of student votes was tallied for products most likely to be purchased if they received rankings of 1, 2, or 3. The average ranking method was used to determine the average rank. The same two methods were used for the products least likely to be purchased, except that votes were tallied if the product received rankings of 12, 13 or 14. Both methods produced similar results, so the final ranking was based on the average rank method with ties broken using the results from the voting method.

Figure 3 illustrates the correlation of the two separate ranking activities: text only and full Web site versions of the 14 ab exercise items. The correlation between the text rankings and the formatted ranking was significant at .88.

Figure 3. Correlation Between Text Rankings and Web site Rankings for the 14 Ab Scissor Items

The similarity of the results of the two ranking activities may emphasize the power of text to influence buyers.

PART THREE: REINFORCEMENT

On auction sites, in addition to text, titles, and other graphics, other system-provided features are designed to enhance the marketability of seller's products. For example, in the late '90s, system designers for eBay implemented a feedback reputation system designed to encourage trust in the marketplace. Having examined selected features in two prior sets of activities, an assignment was created to examine the possible effects of other system-provided features, such as bidding history data.

Class Activity with Students

For Part 3, students were asked to gather and analyze eBay data and to prepare for in-class discussion of eBay system design features by completing the following tasks:

1. students were asked to collect (out of class) the following data for three pairs of assigned keywords (from Figure 1) using the **completed** listings on eBay: highest and lowest selling price, number of total bids, number of unique bidders, number of photos, number of words in text, number of language variants used in the title, and percentage rating for seller feedback; and

2. students were asked to enter their data on spreadsheets, compare the collected data and to project which design features they felt had the greatest effect on potential buyers and to be prepared to explain their reasons. Students were also asked to make recommendations for improving the system design.

Discussion

In order to collect data from completed listings, students needed either their own registered accounts with eBay or an instructor-provided account.

In general, students reported a comparison of lower priced items to higher priced items for each keyword and found that higher priced items were associated with higher numbers of total bids, more unique bidders, longer descriptions, more photos and lower shipping costs. Some factors, such as the percent of positive feedback did not seem to differentiate high and low priced items. From class discussion, it appeared that not all students were able to discern these relationships.

Students found the search function most in need of improvement. For example, searching for *toboggan* in the active listings for eBay brought up a list of related search terms for *sled*, *wooden sled*, *snow sled* and *sleigh*, but none for *hat*, a common referent for toboggan in several southeastern states. Related searches for *bureau* include *dresser*, but those for *dresser* do not include *bureau*.

RESULTS: EFFECTIVENESS OF eBAY E-COMMERCE ACTIVITIES

Results of an anonymous student survey are presented in Table 1. The survey allowed students to rate their interest in the project, to indicate whether the project should be refined and continued, and to rate the effectiveness of the homework. T-tests were used to analyze the data.

Students were asked to rate their interest level in the eBay assignments using a 5-point Likert scale from 1 (not interesting) to 5 (very interesting). While students found the assignments interesting, men's interest in the project was higher than that of women, though results did not reach significance. All students agreed that the project should be refined and continued, having rated it on a 5-point Likert scale from 1 (highly disagree) to 5 (highly agree). However, again, men agreed that the project should continue to be refined and used more than women, though results did not reach significance. Lastly,

students rated the effectiveness of the homework using a 5 point Likert scale from 1 (not effective) to 5 (highly effective). Students found the homework connected to the project to be effective with no significant difference between women and men.

Table 1. Correlation Between Text Rankings And Web site Rankings For The 14 Ab Scissor Items
*significant at < .001

	N	M	SD	P	t
Interesting Assignment	40	3.60	1.08	<.001*	t(39) 1.68
Females	15	3.26	.88	=.109	t(36)
Males	25	3.80	1.15		2.02
Refine and Continue Assignment	37	3.70	1.68	<.001*	t(36) 1.68
Women	15	3.33	.97	.069	t(29)
Men	25	3.95	.99		2.44
Effective Homework	40	2.25	.74	<.001	t(39) 1.68
Women	15	3.73	.70	.912	t(32)
Men	25	3.76	.78		.111

CONCLUSIONS AND RECOMMENDATIONS

Several conclusions can be drawn from this pedagogical strategy. First, students use a variety of search terms when selecting common items found on eBay. Second, students are as likely to rank-order descriptions based on the text alone as much as other seller-provided photos or manufacturers' "canned" descriptions. Third, students, when given an assignment to find language variants for a common item, recognize the relationship of marketing, keyword search, and search engine design. Fourth, eBay provides an effective teaching tool for the classroom study of search engine design and consumer/buyer behavior. And fifth, students' self-reported satisfaction with the eBay project is approximately equal to similar non-eBay assignments.

Based on the conclusions, the researchers offer the following recommendations:

1. When selecting a product, select one with more potential for text and photo variation.
2. Provide a longer interval between ranking of text and ranking of Web sites to avoid the possibility that students will rank both text and web results similarly, only to reduce feelings of cognitive dissonance. (The theory of cognitive dissonance [3] essentially posits that people try to reduce

feelings of dissonance between, for example, behaviors and attitudes.) In this study, there is a possibility that students who ranked the text descriptions in a particular way will rank the fully formatted versions the same way only a day later so as to agree with their earlier rankings.

3. Because some students appeared to have difficulty analyzing spreadsheet data for the completed listings (the third activity), allow additional time for students to create charts to illustrate relationships between system design and consumer behavior.

4. Based on high student interest and availability of data, continue to develop projects using eBay that integrate both technical aspects of information systems and their impact in the marketplace.

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