

The Comparative Effectiveness of Sponsored and Nonsponsored Links for Web E-commerce Queries

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The predominant business model for Web search engines is sponsored search, which generates billions in yearly revenue. But are sponsored links providing online consumers with relevant choices for products and services? We address this and related issues by investigating the relevance of sponsored and nonsponsored links for e-commerce queries on the major search engines. The results show that average relevance ratings for sponsored and nonsponsored links are practically the same, although the relevance ratings for sponsored links are statistically higher. We used 108 e-commerce queries and 8,256 retrieved links for these queries from three major Web search engines: Yahoo!, Google, and MSN. In addition to relevance measures, we qualitatively analyzed the e-commerce queries, deriving five categorizations of underlying information needs. Product-specific queries are the most prevalent (48%). Title (62%) and summary (33%) are the primary basis for evaluating sponsored links with URL a distant third (2%). To gauge the effectiveness of sponsored search campaigns, we analyzed the sponsored links from various viewpoints. It appears that links from organizations with large sponsored search campaigns are more relevant than the average sponsored link. We discuss the implications for Web search engines and sponsored search as a long-term business model and as a mechanism for finding relevant information for searchers.

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General Terms: Design, Experimentation, Human Factors

Additional Key Words and Phrases: Web search engines, sponsored search, sponsored results, sponsored links, e-commerce searching, Web searching

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1. INTRODUCTION

Many people use the Web as a primary source of information and shopping. Certainly, shopping online offers numerous advantages such as lower search

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cost, speedy comparisons of products, and personalization .[Turban et al. 2004]. Online shopping also saves time for Web consumers [Bellman et al. 1999]. However, the success of online shopping is dependent on customers actually finding relevant sites [Spiteri 2000].

Search engines are the major portals for people as they seek online information. Several sources report that more than 80% of Web visitors use a search engine as a starting point [Cole et al. 2003; Sullivan 2003]. SearchEngineWatch.com reports that the top ten search engines execute well over a half-billion searches per day for U.S. traffic alone. Search engines generally offer two types of links in response to user queries, nonsponsored and sponsored. Nonsponsored links are links returned based on the proprietary indexing and ranking algorithms of the particular search engine. Sponsored links are links returned based on the outcomes of proprietary online auctions where content providers/advertisers bid on query terms. Sponsored links are the primary business model for Web search engines, providing profit for the search engine companies and financing access to Web content for millions of users worldwide. But are sponsored links providing relevant results to Web searchers?

Without a doubt, sponsored links are one of the most influential innovations in Web search. In 2005, sponsored search was a \$12-billion industry for the four largest search engines. Businesses consider sponsored links a reliable marketing and profit avenue, and search engines certainly consider sponsored search a workable business model. To be a viable long-term revenue stream, however, sponsored links must be effective at providing relevant information for Web searchers. In this research, we investigate how relevant sponsored links are in response to Web e-commerce queries.

2. RELATED RESEARCH

The major Web search engines are commercial entities requiring continual revenue to support the free information access provided every day to millions of searchers. The primary business model for these search engines is sponsored links, or those links for which sponsors (i.e., commercial corporations, small businesses, individuals, along with some other entities) pay the search engines to include on results pages when searchers enter certain key phrases as queries. Therefore, sponsored search plays a critical role in financing the free search and the nonsponsored links provided by search engines that have rapidly become essential to so many Web users.

There are several sponsored search systems on the Web today. However, the two that dominate as of 2006 are Google Adwords and Yahoo! Search Marketing Services. These two sponsored search systems provide the majority of sponsored links to not only Google and Yahoo!, respectively, but also to numerous other search engines via third-party agreements. In addition to Google and Yahoo!, Microsoft has entered the sponsored search market, and there are some smaller players in the field such as Snap.com, FindWhat, and Kanoodle. Figure 1 shows a typical search engine results page (SERP) with both sponsored and nonsponsored links.

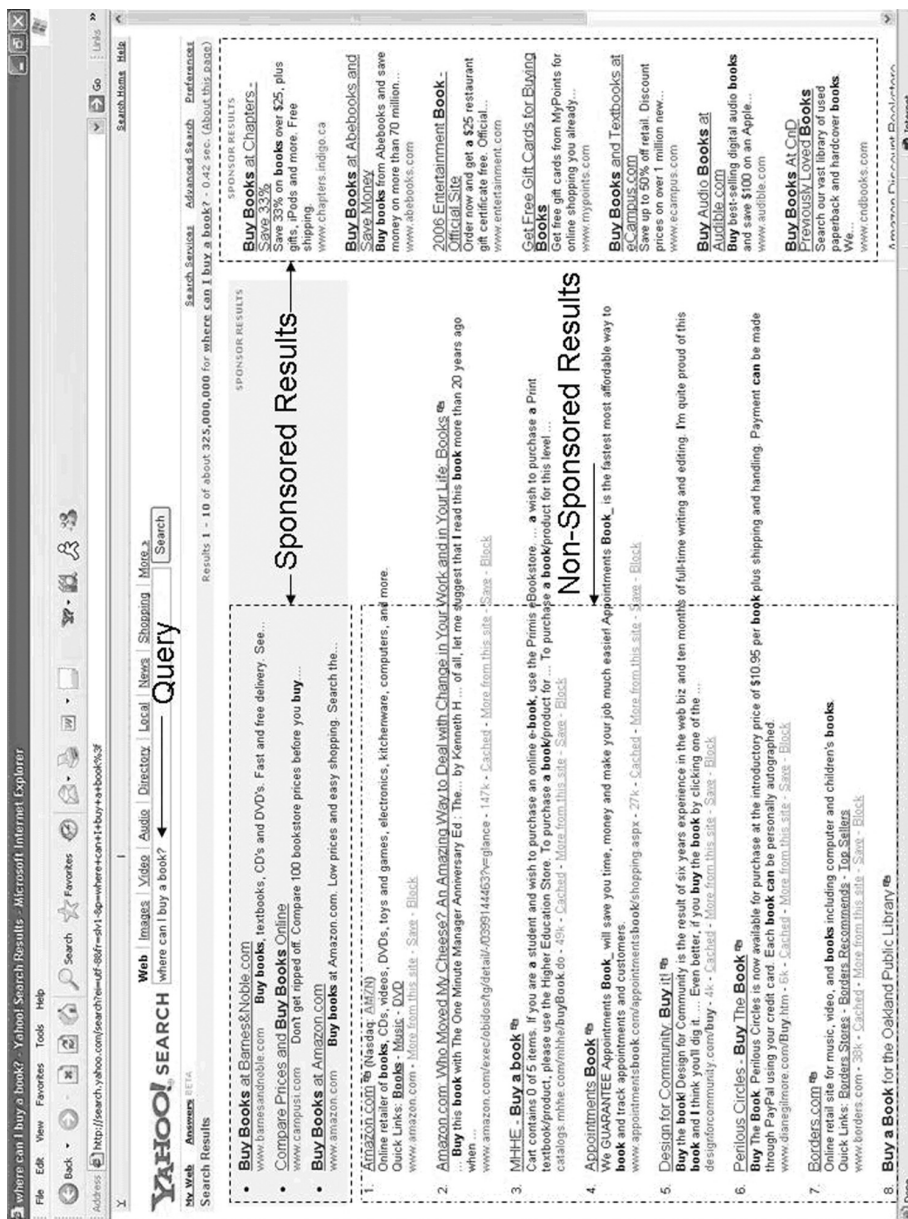


Fig. 1. Yahoo! SERP with both Sponsored and nonsponsored Links.

From Figure 1, in response to a query, the search engine responds by presenting two types of links, nonsponsored and sponsored. The nonsponsored links ranking is based on the proprietary ranking algorithm of the search engine. Additionally, the search engine also presents sponsored links. The amount that a content provider is willing to bid on selected key words is the primary basis for the ranking of the links, along with click through and other data. An online auction controls the bidding process. The highest bidder gets the number one rank, the second-highest bidder gets the second ranked position, etc. Premium bidders get the top-listed sponsored links, just above the nonsponsored links. Search engines provide a measure of quality control to ensure that the sponsored Web site is associated with the query. Search engines also sometimes rerank sponsored links based on historical click-through data (i.e., the sponsored link with the best click-through rate will move up in the list). See Jansen [2006a, 2006b] for a more in-depth overview of sponsored search, and Fain and Pedersen [2006] for a history of sponsored search.

The economic impact of sponsored search is immense. In 2005, Web search engines displayed approximately 13 billion sponsored links in a given week, according to Nielsen/NetRatings. In 2004, sponsored search was an \$8-billion industry and vital to the success of most major search engines. Google received 99% of its \$3.1-billion revenue from sponsored search in 2004; Yahoo! received 84% of its \$3 billion; and AOL received 12% of its \$1 billion, according to Tim McCarty of Time magazine. The investment firm Piper Jaffray estimates that online advertising will exceed \$55 billion globally by 2010. Certainly, sponsored search is now and for the near future, will be the primary business model for Web search engines.

Somewhat surprisingly, there has been limited research into the relevance of sponsored links for Web queries. Jansen and Resnick [2006] report searchers are biased against sponsored links, but that sponsored links (i.e., the Web page pointed to by the link) are just as relevant as organic (i.e., nonsponsored) links. In this study, the researchers used six e-commerce queries and 56 participants in a lab study. The researchers controlled for content of the organic and sponsored links, reporting that the participants have a significant bias against the sponsored links, clicking on the organics links 70% of the time. However, after reviewing both nonsponsored and sponsored links, the participants rated Web pages pointed to by sponsored links just as relevant as those Web pages identified from organic links. Jansen and Resnick [2006] used only six queries and did not compare sponsored and nonsponsored links.

Jansen and Molina [2006] evaluated the effectiveness of different types of Web search engines in providing relevant content from Web e-commerce queries. The researchers examined the most popular search engines—general purpose, paid for inclusion, directory, e-commerce, and metasearch engines—and submitted Web e-commerce queries to each. The researchers collected the results, conducted relevance evaluations, and reported little difference among the five search engine types in relevance of either nonsponsored or sponsored links. They also reported nonsponsored links as more relevant than sponsored links. However, neither of these studies did an in-depth examination of sponsored links from the major search engines.

Nicholson et al. [2006] examined how much of a SERP's real estate was devoted to sponsored links. The researchers reported that for, major search engines, on average 56% of the real estate of the first screen (i.e., the SERP that first appears on the page without scrolling; also referred to as above-the-fold) is devoted to sponsored links, while 82% of the first SERP is devoted to nonsponsored links. Again, this study did not investigate the relevance of the sponsored and nonsponsored links. Dai et al. [2006] attempt to classify Web queries as e-commerce or not by drawing on the results pages returned by the search engine in response to the searcher's query. Jansen [2006c] discusses the issues of click fraud with sponsored search.

In this research, we examine several thousand sponsored and nonsponsored links from the three major search engines in response to more than 100 e-commerce queries. Our major finding is that sponsored links are more relevant than nonsponsored links in response to e-commerce queries. This is surprising given the negative bias toward sponsored links that prior research (i.e., Jansen and Resnick [2006] and Marable [2003]) has reported from Web searchers. We begin with the research questions and methodology. We then present the results, followed by a discussion of implications. We end with conclusions and directions for future research.

3. RESEARCH QUESTIONS

Sponsored search is the predominant business model for Web search engines, generating billions in yearly revenue. But are sponsored links providing online consumers with relevant choices for products and services? Are sponsored links more relevant than nonsponsored links for Web e-commerce queries? What factors influence the determination of relevance for online consumers? These questions motivated the research. We address these issues by investigating the following hypotheses and research questions.

H01. *Sponsored links are more relevant than nonsponsored links for Web e-commerce queries.* Given that sponsored search is primarily a process for commercial entities, it would seem reasonable that sponsored links should be more relevant than nonsponsored links for e-commerce queries. In fact, for sponsored search to be a workable long-term business model, it is critical that the relevance be competitive with nonsponsored links.

H02. *Side-listed sponsored links are more relevant than nonsponsored links for Web e-commerce queries.*

H03. *Top-listed sponsored links are more relevant than nonsponsored links for Web e-commerce queries.*

H04. *Top-listed sponsored links are more relevant than side-listed sponsored links for Web e-commerce queries.* Given that content providers pay for positioning on the sponsored results listings, we would assume that side-listed and top-listed sponsored links would be more relevant than nonsponsored links. It would also make sense that the top-listed sponsored links would be more relevant than the side-listed links since sponsors pay a premium to be top-listed. It

is important that advertisers realize or at least have a reasonable probability of a return on their investment.

H05 *The rank of top-sponsored links is correlated with the relevance of sponsored links.*

H06 *The rank of side-sponsored links is correlated with the relevance of sponsored links.*

H07 *The rank of nonsponsored links is correlated with the relevance of nonsponsored links.* Ranking is a critical metric for users of any search engine. It would seem reasonable that the top-most ranked links for both sponsored and nonsponsored links would be more relevant than links ranked farther down the results listing. However, given the unique nature of sponsored links, this has not been investigated. We do know that the higher in the sponsored results listing, the more clicks and conversions that link receives [Brooks 2004a; Brooks 2004b].

Related to these hypotheses, we are interested in understanding the nature of e-commerce queries and trends in sponsored links so as to shed light on methods to make sponsored search more effective for Web searchers and commercial content providers. Therefore, we investigate the following research questions.

RQ02: *What is the nature of e-commerce queries?* For this research question, we qualitatively analyzed each of the e-commerce queries used in this study, classifying each query into e-commerce categories. For search engines and content providers that rely on sponsored search traffic, an understanding of the nature of e-commerce queries would be helpful in many respects, including campaign targeting.

RQ03 *Are there trends in the nature of sponsored links that shed light on their effectiveness in response to e-commerce queries?* For this research question, we analyzed a subset of sponsored links to determine characteristics on their effectiveness in responding to e-commerce queries. This will assist search engines and content providers in understanding which campaigns are effective.

4. RESEARCH METHODOLOGY

Using top e-commerce-related query terms from WordTracker, we extracted queries from an AltaVista search transaction log that consisted of about 1 million queries. The terms selected from WordTracker were popular e-commerce-related terms and terms related to these. Using these commercial key terms as original seed terms and employing a modified snowball technique [Patton 1990], we extracted from this large set of queries a focused e-commerce set of queries that expressed a commerce information need. From this list, the researchers selected 108 queries that represented a broad range of e-commerce queries. Examples include *buying Diesel shoes online*, *finding wholesale car prices*, *buying digital cameras* and *discount Broadway tickets*. While the AltaVista transaction log was from 2001, the use of terms from WordTracker provided a temporal relationship to current e-commerce queries. In addition, queries were culled for current product and services. Finally, prior research has shown that

Web searching is generally stable as measured by sessions, queries, and topics [Jansen and Spink 2005; Jansen et al. 2005b; Jansen et al. 2000].

4.1 E-commerce Web Results

We submitted the 108 ecommerce queries using the WebPosition Gold software application to the three major search engines (i.e., Google, MSN Search, and Yahoo!) and retrieved the results. We first captured two SERPs, which generally accounts for 80% of Web searchers' results page-viewing [Jansen et al. 2000; Silverstein et al. 1999] for each query on each search engine. The default SERP typically includes 10 or less nonsponsored links and a number of sponsored links.

The process of submission and retrieval of results for Google and MSN took approximately 4 minutes. The process took approximately 50 minutes for Yahoo! since Yahoo! places a limit on the number of queries it will process from a single Internet Protocol (IP) address within a 30-minute period. This short period of retrieval ensured that the list was a consistent snapshot among all three search engines, lessening the possibility of bias due to changes in search engine database algorithms that could have occurred with a list retrieved during a longer duration of time [Selberg and Etzioni 2000].

The total number of search links returned from all three search engines was 8,256. The average links per-query was 25.5 links, including both sponsored and nonsponsored links. The least number of links per-query was 10, and the maximum number of links was 110 (i.e., total for all three search engines for a given query).

Given the variety of e-commerce queries and the large number of search engine results, both nonsponsored and sponsored, we believe that this is a fair sample in order to evaluate the differences between these two types of links. Naturally, given the highly changeable nature of the sponsored search campaigns, they may not reflect all possible circumstances. Identifying and evaluating the effect of possible changes in sponsored search campaigns may be an area for future research.

We imported all of the search results into a relational database management system, aligning the results into records containing the following categorical information: Query, Search Engine, Rank, Title, Description, Uniform Resource Locator (URL), and Type of Result (whether or not the search result returned was a sponsored result), and Location (if the result was sponsored, its location is either top or side). We also assigned each record a unique identifier.

4.2 Preparation for User Evaluation

We then prepared the data for analysis by removing the Search Engine, Sponsored, Location, and Rank fields. We did not want the knowledge of the search engine, type of result, or the result rank to bias the evaluator's rating of the result. With our unique identifier, we could later repopulate this data.

We also removed all duplicate links for each query because we did not want the evaluators to review the same URL more than once for a particular query in order to ensure consistency among evaluations. We considered a record to be

a duplicate if the URL, title, and description were all identical. For example, if all five search engines retrieved the same URL for the same query, we removed four of the URL occurrences. Similarly, if the same search engine retrieved a URL multiple times for the same query, we removed the duplicate URLs. With duplicates removed, we had 6,162 unique records containing the fields of Query, Title, Summary, and URL. We wanted to further break up the ordering of the queries so we sorted the dataset by query and link title as shown in Figure 2.

We then designed an application to present each result to each evaluator, one result at a time. Figure 3 shows the application interface used by the evaluators.

As Figure 3 indicates, the application displayed each result individually with the corresponding query. We ordered the database so that all URLs from a particular query were presented together, followed by all results from the next query, etc. The application form would open and a dialog box would appear (see Figure 3) at start-up, setting the scenario for the session. The dialog box told the evaluator that he/she had just entered the query in a search engine, and he/she was now evaluating the result returned. The evaluators based their judgments on their interpretation of the query and the scenario.

Once the evaluator clicked OK on the dialog box, the evaluation form was now in front of him/her. The form displayed the Query, along with the result's Title, Summary, and URL. The form also had fields for the evaluators to enter their ratings of the result (1 for relevant, 2 for somewhat relevant, and 3 for not relevant). In order to help interpret the basis for the evaluators' evaluation, the evaluator selected the reason for their evaluation for a subset of results.

4.3 User Evaluation of Results

Three evaluators participated in this study. The evaluators were all college students between the ages of 19 and 21. Two evaluators were males and one was female. The evaluators were students currently enrolled in an information technology program at a major US university. They were familiar with Web search engines at the user-level but had limited education on the internal workings of search engines. They were provided no training or presentation on sponsored search.

The evaluations were not performed at a specified location but in natural conditions. We presented the evaluators with their materials individually. Each evaluator completed the evaluations at his/her individual pace. We did this to reduce the effects of fatigue on the users, given that they were evaluating more than 6,000 search results. We also wanted the evaluators to make independent evaluations of the results.

We instructed the evaluators on the process for completing the study. The instructions indicated to the evaluators that their objective was to evaluate Web search engine results in terms of their relevancy to the original e-commerce query. We also briefed the evaluators on the following scenario (which also appeared whenever the evaluators opened the software application):

You have entered a query in a search engine, looking for information on a possible purchase. You are now examining the results returned

Identifier	Type	Local Search	Query	Title	Rank	Summary	Result Reference	
3305	Organic	MSN	+Genie garage door opener +price	genie garage door opener Click to Learn More	10	Find genie garage door opener now genie-g: http://genie-garage-door-opener.linkster.org		
129	Organic	Yahoo	+Genie garage door opener +price	A Click Away Remotes	5	offering brand-name garage door opener rerr http://www.clickawayremotes.com		
3313	Organic	MSN	+Genie garage door opener +price	CONNECTICS & DOOR, CADZ, GENE, SCREW, genie garage door - DRIVE	19	... Free mini transmitter with Genie http://www.5-genes.us/door_garage_genie_6.h		
3317	Organic	MSN	+Genie garage door opener +price	Door Opener Webbing Read reviews on Garage Opener here	17	door opener, genie garage door opener, gar: http://www.door-opener.com/genie-garage-opener.htm		
151	Organic	Yahoo	+Genie garage door opener +price	eBay Store: Garage Door Superstore, Liftmaster-Craftsman-Sears, Genie, Marantec	27	Time: newly listedPrice: lowest firstPrice: http://stores.ebay.com/Garage-Door-Superstore		
144	Organic	Yahoo	+Genie garage door opener +price	EZ Garage Door	20	... View More: Genie Garage Door Opener C: http://www.ezgaragedoor.com		
3320	Sponsored	Site	MSN	+Genie garage door opener +price	Find Garage Accessories at JC Whitney	25	Find parking and garage accessories at JC: http://www.jcwhitney.com	
3322	Sponsored	Site	MSN	+Genie garage door opener +price	Garage Door Opener - Cheap Prices	27	Before you buy, compare prices at Calbox: http://www.calbox.com	
131	Organic	Yahoo	+Genie garage door opener +price	Garage Door Opener StanleyOpener Garage Door Remote Control	9	Liftmaster garage door opener. Competit: http://www.stanleyopeners.com		
3303	Organic	MSN	+Genie garage door opener +price	Garage Door Opener StanleyOpener Garage Door Remote Control	9	Operator \$310.00 Liftmaster Garage door http://www.stanleyopeners.com/index.html		
3306	Organic	MSN	+Genie garage door opener +price	Garage Door Opener StanleyOpener Garage Door Remote Control	8	Operator \$310.00 Liftmaster Garage door http://www.stanleyopeners.com		
3310	Organic	MSN	+Genie garage door opener +price	Garage Door Opener StanleyOpener Garage Door Remote Control	15	Adjacent to the garage. Related terms in: http://www.garagedoorparts.com/garage_door_		
3309	Organic	Site	MSN	+Genie garage door opener +price	Garage Door Opener Prices, Carriage Price	13	Adjusted price per garage door opener: http://www.clickawayremotes.com	
3321	Sponsored	Site	MSN	+Genie garage door opener +price	Garage Door Opener Prices, Carriage Price	13	Adjusted price per garage door opener: http://www.clickawayremotes.com	
3301	Organic	MSN	+Genie garage door opener +price	Garage Door Opener Prices, Carriage Price	6	Garage door opener, garage door opener: http://www.clickawayremotes.com		
3305	Organic	MSN	+Genie garage door opener +price	Garage Door Opener, Genie garage door opener, Liftmaster garage door...	1	keychain remote Genie Garage Door Op: http://www.stanleyopeners.com		
137	Organic	Yahoo	+Genie garage door opener +price	Garage Door Opener, Genie Garage Door Opener, Stanley Garage Door Opener, Chant	3	systems for all brands - low price quasar: http://www.shopping.com		
147	Organic	Site	MSN	+Genie garage door opener +price	Garage Door Opener, Genie Garage Door Opener, Stanley Garage Door Opener, Chant	12	Find, compare and buy tools and hardware: http://www.stanleyopeners.com/keysads	
3302	Organic	Yahoo	+Genie garage door opener +price	Garage Door Opener, Garage Remote Controls, Home Security Systems, Gate Opene	23	For installation call: (877) 738-4455 or C: http://www.stanleyopeners.com/keysads.html		
143	Sponsored	Top	Yahoo	+Genie garage door opener +price	Garage Door Opener Parts Fix It Yourself	7	Genie door opener parts. Huge inventory, in: http://www.garagedooropeners.net	
125	Sponsored	Top	Yahoo	+Genie garage door opener +price	Genie Garage Door Opener Parts Fix It Yourself	11	Genie door opener parts. Huge inventory, in: http://www.remoteshop.com	
3306	Sponsored	Site	MSN	+Genie garage door opener +price	Genie Garage Door Opener	1	Genie door opener parts. Huge inventory, in: http://www.garagedooropeners.net	
3397	Organic	Site	MSN	+Genie garage door opener +price	Genie Garage Door Opener	19	Genie door opener parts. Huge inventory, in: http://www.remoteshop.com	
126	Organic	Yahoo	+Genie garage door opener +price	Genie Garage Door Opener	2	... with Genie Intellicode and Overhead Door: http://www.genie-garage-opener.com		
140	Sponsored	Site	Yahoo	+Genie garage door opener +price	Genie Garage Door Opener - Alliance, ProMax, BlueMax, Stealth...	2	... with Genie Intellicode and Overhead Door: http://www.genie-garage-opener.com	
150	Sponsored	Site	Yahoo	+Genie garage door opener +price	Genie Garage Door Opener - Alliance, ProMax, BlueMax, Stealth...	16	Find low prices on name brand home and g: http://www.hairstag.com	
3309	Organic	Site	MSN	+Genie garage door opener +price	Genie Garage Door Opener - Find Prices	34	Find low prices on name brand home and g: http://www.hairstag.com	
3300	Organic	MSN	+Genie garage door opener +price	Genie Garage Door Opener - Information on Genie Garage Door Opener	14	Genie Garage Door Opener Genie Garage C: http://shop.slingfling.com/genie_garage_door_		
143	Organic	Yahoo	+Genie garage door opener +price	Genie garage door opener accessories	8	Genie Garage Door Opener Accessories: http://shop.slingfling.com/genie_garage_door_		
146	Organic	Yahoo	+Genie garage door opener +price	Genie Garage Door Opener Button on eBay	22	eBay offers great deals on items related to: http://search-desc.ebay.com/search/all		
3299	Organic	MSN	+Genie garage door opener +price	Genie Garage Door Opener Carriage - Part # 20432R	4	Genie Chain Guide openers with a stands: http://www.genieonlineparts.com/gen20432R.h		
159	Sponsored	Site	Yahoo	+Genie garage door opener +price	Genie Garage Door Opener Carriage - Part # 20432R	5	Carriage - Part # 20432R - Genie garage: http://www.genieonlineparts.com/gen20432R.h	
3315	Organic	Site	MSN	+Genie garage door opener +price	Genie Garage Door Opener Items - Price	35	Before you buy, compare prices at Calbox: http://www.calbox.com	
3298	Organic	MSN	+Genie garage door opener +price	genie garage door opener part	20	Every product from every store means yo: http://newssearch.com/genie-garage-door-op		
153	Organic	Yahoo	+Genie garage door opener +price	Genie Garage Door Opener Safety Beam Sensors part number 34094R	3	Beam Availability: Usually ships the sam: http://www.genie-garage-opener.com/gen2456		
150	Organic	Yahoo	+Genie garage door opener +price	Genie Garage Door Opener Trac Drive Replacement Parts	29	Genie Garage Door Opener Safety Beam: http://www.genie-garage-opener.com/gen2456		
136	Organic	Yahoo	+Genie garage door opener +price	Genie Garage Door Opener Universal Conversion Kit	26	Genie Intellicode Universal. Conversion Kit: http://store.yahoo.com/genie-garage-opener/		
180	Sponsored	Site	Yahoo	+Genie garage door opener +price	Genie Garage Door Opener Wireless Keyless Entry Systems & Wired Keypads	11	Search, compare and save. Visit Yahoo!Sh: http://shopping.yahoo.com	
154	Sponsored	Site	Yahoo	+Genie garage door opener +price	Genie Garage Door Opener	30	Find, compare and buy products in category: http://www.shopping.com	
142	Sponsored	Site	Yahoo	+Genie garage door opener +price	Genie Garage Door Opener	18	Search, compare and buy products in category: http://www.shopping.com	
138	Sponsored	Site	Yahoo	+Genie garage door opener +price	Genie Garage Door Opener	14	Find, compare and buy products in category: http://www.shopping.com	
136	Sponsored	Site	Yahoo	+Genie garage door opener +price	Genie Garage Door Opener	12	Find, compare and buy products in category: http://www.shopping.com	
128	Organic	Site	Yahoo	+Genie garage door opener +price	Raymor Garage Doors Parts Service Installation	13	Discounts on Genie garage door openers p: http://www.geniedoor.com	
137	Sponsored	Site	Yahoo	+Genie garage door opener +price	Genie Garage Door Opener Superstore	31	Discounts on Genie garage door openers p: http://www.geniedoor.com	
156	Sponsored	Site	Yahoo	+Genie garage door opener +price	Genie Garage Door Opener Superstore	31	Discounts on Genie garage door openers p: http://www.geniedoor.com	
127	Sponsored	Site	Yahoo	+Genie garage door opener +price	Genie Garage Door Opener Superstore	30	Discounts on Genie garage door openers p: http://www.geniedoor.com	
129	Sponsored	Site	Yahoo	+Genie garage door opener +price	Genie Garage Door Opener Superstore	30	Discounts on Genie garage door openers p: http://www.geniedoor.com	

Fig. 2. Layout of Web Search Results after Processing.

Scenario: Review the following queries and, by looking at the Title, Summary, Hyperlink of each query, determine if you would click on the URL (i.e., based on the query the result seems pertinent). Rate each result as (1) would definitely click on it, (2) might click on it, or (3) wouldn't click on it.

This is the query

Assign a rating of 1 (indicating that you would click on the URL and view the Web page), 2 (indicating that you might click on the URL and view the Web page), or 3 (indicating that you would not click on the URL). Then select the primary basis for your evaluation. You may select from the dropdown or type in an item.

Rating

Basis for Evaluation

To move to the next record-->

This is the result

Title	<input type="text" value="Classic Cars - Classic Car Pricing"/>
Summary	<input type="text" value="Classic Car Auto Insurance ... Classic Cars Sale, Nopar Muscle Cars, Vintage Vans, Camaros, Classic Car Prices, Classic Cars Sales, Classic Project Cars, Classic Mercedes, Malibu, Classic Car ..."/>
Hyperlink	<input type="text" value="http://classiccars.search4buzz.com/classiccarpricing"/>

To move to the next record, click the arrow pointing to the right (->). To go back a record, click the arrow pointing left (-<).

Record: of 6163

Form View

Fig. 3. Application used in evaluation of search engine results.

by the search engine. Base your evaluation of the result on your interpretation of the query.

Participants did not have a deadline for completing the study and could conduct the evaluations in pieces if they experienced fatigue. We explicitly gave these latter instructions to the participants to make certain that each user carefully evaluated each individual search result.

We emphasized to each participant that the primary task was to assign a rating on a scale of 1, 2, or 3 based on whether, for the given query, the result is relevant (1), somewhat relevant (2), or nonrelevant (3). The instructions stated the need for users to rate each result by looking at its Title, Summary, or Hyperlink. The evaluators could visit a result's corresponding Web page by simply clicking on its displayed hyperlink. This is an approach used in a variety of other studies (see Jansen and Molina [2007] and Vaughan [2004]) and is similar to the approach used in the Text Retrieval Conference (TREC) where a binary score of 0 or 1 is used to denote nonrelevant or relevant. Additionally, the evaluators were not the actual users who originally submitted the query. However, based on their independent judgment of the query terms, the evaluators could make a reasonable estimate of what a relevant result would be. This link of content to query terms is known as *topical relevance* [Huang and Soergel 2004].

$$\alpha = \frac{N - \bar{r}}{1 + (N - 1) \cdot \bar{r}}$$

Fig. 4. Formula for Cronbach's alpha.

When the three users had evaluated all of the search results, we combined and averaged the ratings for each of the search results. In order to make the means more intuitive, we transposed the evaluation results for relevant and nonrelevant links (i.e., a rating of (1) relevant was recoded to a (3) relevant, and a rating of (3) not relevant was recoded to a (1) not relevant). With this recoding, the higher mean score indicates a more relevant set of results. Cronbach's alpha [Cronbach 1951] was 0.61. Cronbach's alpha is a lower boundary for the reliability of survey responses. It mathematically defines reliability as the proportion of the variability which is the result of differences in the respondents. The computation of Cronbach's alpha uses the number of items on the survey and the ratio of the average interitem covariance to the average item variance. The formula for Cronbach's alpha is shown in Figure 4.

From Figure 4, N is the number of items measured and \bar{r} is the average interitem correlation among these items. Generally, a Cronbach's alpha of .70 is acceptable. Given the large number of items, the three-point relevance rating scale, and three evaluators, we believe that 0.61 is a reasonable alpha. One way to intuitively view this is to examine the range of options among the three evaluations on any given link. With three evaluators each evaluating a link on a three-item scale, there are 27 possible combinations, with 3 combinations representing agreement across all three evaluators (11%), eighteen combination representing agreement across two evaluators (67%), and 6 combinations representing no agreement among the three evaluators (22%). For our evaluators, there was agreement among all three evaluators for 2,077 links (25%), agreement among two evaluators on 4,826 links (58%). Given the wide personal variations that can occur with rating documents as relevant or not, we see this agreement as quite high.

For each record, we reintegrated the Search Engine, Rank, Type, and Location with the judges' evaluations. For the nonunique results, we reintroduced these records and automatically assigned the corresponding average evaluation. Once we had completed this, we had an evaluation between 1 and 3 for each of the 8,256 results. We exported this tabulation from our database to a spreadsheet and then imported the data into SPSS 12.0 for the statistical analysis.

In the next section, we discuss our statistical analysis and results.

5. RESULTS

Table I shows the distribution of queries by search engine, result type, and location (top or side) for sponsored results. Of the 8,256 total results, Yahoo! returned 39.1%, Google 36.5%, and MSN 24.3%. From Table I, we see that Yahoo! and Google each returned nearly twice as many sponsored results as MSN. In terms of percentages, MSN had a higher percentage of its results

Table I. Distribution of Sponsored and Nonsponsored Links

Search Engine	Type	Location	Count	Percentage
Yahoo	Non-sponsored		2,087	64.6%
	Sponsored	Top	161	14.1%
		Side	981	85.9%
	Sponsored Total		1,142	35.4%
	Total		3,229	100.0%
Google	Non-sponsored		2,069	68.6%
	Sponsored	Top	244	25.7%
		Side	704	74.3%
	Sponsored Total		948	31.4%
	Total		3,017	100.0%
MSN	Non-sponsored		1,483	73.8%
	Sponsored	Top	126	23.9%
		Side	401	76.1%
	Sponsored Total		527	26.2%
	Total		2,010	100.0%
All	Non-sponsored		5,639	68.3%
	Sponsored		2,617	31.7%
	Total		8,256	100.0%

Table II. ANOVA Descriptives for Hypothesis 01

	N	Mean	Std. Deviation	Std. Error	Minimum	Maximum
Non-sponsored	5,639	1.69	.47	.006	1.0	3.0
Sponsored	2,617	1.93	.57	.011	1.0	3.0
Total	8,256	1.77	.52	.006	1.0	3.0

(5–10%) that were nonsponsored as did Yahoo! or Google. Google and MSN had about twice as many top-listed sponsored results as did Yahoo!. MSN used the Yahoo!-sponsored search program at the time of the study so one would expect the numbers to be similar, all else being equal. These differences may reflect differing policy concerning the use of SERP screen space rather than the size of the sponsored search program. We now examine the results of each hypothesis test.

H01. *Sponsored links are more relevant than nonsponsored links for Web e-commerce queries.* In order to evaluate H01, we performed a statistical evaluation to determine if there is a difference of means (relevancy means) among the two types of Web links (nonsponsored and sponsored) tested. We used a one-way ANOVA statistical analysis to compare means and variance between the groups. The ANOVA analysis tests the null hypothesis that group means do or do not differ.

The results indicate that there is a significant difference among the groups ($F(1) = 413.77$, $p < 0.01$; the critical value of $F = 2.37$). This indicates significant effects among the group, and the group means differ more than would be expected by chance (experimental error) alone.

From Table II, we see that the average relevance rating of the nonsponsored links (1.693) was statistically significantly lower than that for the sponsored

Table III. ANOVA Descriptives for Average Relevance by Search Engine

Search Engine	Type of Links	Mean	Std. Deviation	N
Google	Non-Sponsored	1.70	.46	2,069
	Sponsored	1.96	.58	948
	Total	1.78	.52	3,017
MSN	Non-Sponsored	1.69	.46	1,483
	Sponsored	1.97	.57	527
	Total	1.76	.51	2,010
Yahoo!	Non-Sponsored	1.68	.48	2,087
	Sponsored	1.89	.60	1,142
	Total	1.75	.52	3,229
Total	Non-Sponsored	1.69	.47	5,639
	Sponsored	1.93	.57	2,617
	Total	1.77	.51	8,256

Table IV. ANOVA Descriptives for Hypothesis 02

	N	Mean	Std. Deviation	Std. Error	Minimum	Maximum
NonSponsored	5,639	1.69	.47	.006	1.0	3.0
Side-Sponsored	6,258	1.91	.57	.013	1.0	3.0

links (1.93). Therefore, we accept Hypothesis 01 that sponsored links are more relevant than nonsponsored links for Web e-commerce queries.

We also investigated the effect of the three search engines on the difference in the relevance of type of links. Using a multiple variable ANOVA analysis, we determined that there was an effect due to the search engine and type of link ($F(5) = 86.01$, $p < 0.01$; the critical value of $F = 3.14$). The particular search engine was significant, but marginally ($F(2) = 6.84$, $p < 0.01$; the critical value of $F = 4.79$). We see the means of nonsponsored and sponsored links for each search engine shown in Table III.

It appears that the three search engines are generally equal in performance, with the average relevance of sponsored links being than that of nonsponsored links on all search engines.

H02. *Side-listed sponsored links are more relevant than nonsponsored links for Web e-commerce queries.* The results indicate that there is a significant difference among the groups ($t(7723) = 17.46$, $p < 0.01$). This indicates significant effects between the groups, and the group means differ more than would be expected by chance (experimental error) alone. Therefore, we accept Hypothesis 02 that sponsored links are more relevant than nonsponsored links for Web e-commerce queries.

H03. *Top-listed sponsored links are more relevant than nonsponsored links for Web e-commerce queries.* The results indicate that there is a significant difference among the groups ($t(6168) = 14.65$, $p < 0.01$). This indicates significant effects between the groups, and the group means differ more than would be expected by chance (experimental error) alone. Therefore, we accept Hypothesis 03 that top-sponsored links are more relevant than nonsponsored links for Web e-commerce queries.

Table V. ANOVA Descriptives for Hypothesis 03

Location of Result	N	Mean	Std. Deviation	Std. Error	Minimum	Maximum
NonSponsored	5,639	1.69	.47	.006	1.0	3.0
Top-Sponsored	1,062	2.04	.56	.024	1.0	3.0

Table VI. ANOVA Descriptives for Hypothesis 04

Location of Result	N	Mean	Std. Deviation	Std. Error	Minimum	Maximum
Top-Sponsored	1,062	2.04	.56	.02	1.0	3.0
Side-Sponsored	6,258	1.91	.57	.01	1.0	3.0

Table VII. Multiple Comparisons of Means Among NonSponsored, Top-Sponsored and Side-Sponsored Links

(I) Link Type	(J) Link Type	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
NonSponsored	Top-Sponsored	-.31753(*)	.02286	.000	-.3711	-.2639
NonSponsored	Side-Sponsored	-.22335(*)	.01290	.000	-.2536	-.1931
Top-Sponsored	Non-Sponsored	.31753(*)	.02286	.000	.2639	.3711
Top-Sponsored	Side-Sponsored	.09418(*)	.02447	.000	.0368	.1515
Side-Sponsored	NonSponsored	.22335(*)	.01290	.000	.1931	.2536
Side-Sponsored	Top-Sponsored	-.09418(*)	.02447	.000	-.1515	-.0368

*The mean difference is significant at the .01 level.

H04. *Top-listed sponsored links are more relevant than side-listed sponsored links for Web e-commerce queries.* The results indicate that there is a significant difference among the groups ($t(2615) = 3.89$, $p < 0.01$), and the group means differ more than would be expected by chance (experimental error) alone (see Table VI). Therefore, we accept hypothesis 04. It appears that top-sponsored links are more relevant than side-sponsored links for Web e-commerce queries.

We conducted an ANOVA analysis of all three types of links with mean comparisons displayed in Table VII. In confirmation of the previous analysis, all mean differences were significant ($F(2) = 214.63$, $p < 0.01$; the critical value of $F = 4.79$).

H05 *The rank of top sponsored links is correlated with the relevance of sponsored links.*

To investigate the correlation between the rank of a result and relevance rating, we use a linear regression test, which models the value of a dependent variable based on its linear relationship to an independent variable. The results of a regression analysis indicate that there is not a significant correlation between the rank of a top-sponsored link and its relevance rating. Therefore, we reject Hypothesis 05. It appears that the rank of top-sponsored links is not correlated with the relevance of sponsored links. Figure 5 provides a graphical comparison of the mean.

H06. *The rank of side-sponsored links is correlated with the relevance of sponsored links.* We again used a regression analysis. The results of a regression analysis indicate that there is not a significant correlation between the rank of a top-sponsored link and its relevance rating. Therefore, we reject Hypothesis 06. It appears that the rank of side-sponsored links is not correlated with the relevance of sponsored links.

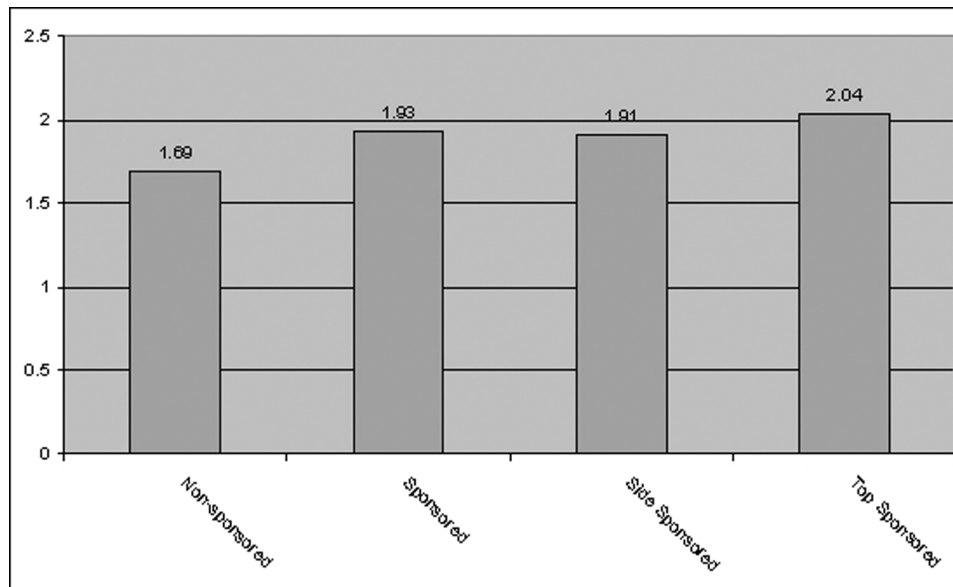


Fig. 5. Means of each category of search engine link.

Table VIII. Regression Analysis Results for Hypothesis 07

	Sum of Squares	df	Mean Square	F	Sig.	R	R Square
Regression	13.75	1	13.746	63.32	.000	.105	.011
Residual	1223.77	5637	.217				
Total	1237.52	5638					

H07. *The rank of nonsponsored links is correlated with the relevance of nonsponsored links.* Using a regression analysis, with the results displayed in Table VIII, there is a statistically significant correlation between the rank of a side-sponsored result and its average relevant rating ($F(1) = 63.32$, $p < 0.01$). Therefore, we fail to reject Hypothesis 07, and there is a correlation between result rank and relevance for nonsponsored links. However, the small regression sum of the squares ($SS = 13.75$) rank explains little of the relevance variation. This observation is further supported by the small multiple correlation coefficient ($R = 0.105$) which is the linear correlation between the observed and model-predicted values of the dependent variable. A small value indicates a weak relationship. Further, the small *R Square* ($R^2 = 0.011$) shows that only a small part of the variation in relevance is explained by rank.

In the Table IX, we show the average relevance rating for nonsponsored, top-sponsored, and side-sponsored links by rank. We see from Table IX that, for nonsponsored links, there appears to be a linear correlation between rank and average relevancy rating. As the links appear lower in the results listing, average relevance rating decreases. The same correlation does not hold for sponsored links. In fact, the average relevancy ratings appear to hold fairly constant for sponsored links, regardless of rank.

Table IX. Average Relevance Rating for Type of Link by Rank

Rank	NonSponsored	Top-Sponsored	Side-Sponsored
1	1.91	1.97	1.97
2	1.81	2.09	2.09
3	1.81	2.02	2.02
4	1.79	2.00	2.00
5	1.76	2.00	2.00
6	1.75		
7	1.71		
8	1.75		
9	1.70		
10	1.67		

RQ02. *What is the nature of e-commerce queries?* For this research question, we qualitatively analyzed these e-commerce queries, plus an additional 25 e-commerce queries obtained from a search engine marketing firm. We used the NVivo application for the qualitative analysis. NVivo [1] is a qualitative data analysis tool from QSR designed for researchers who need to combine subtle coding with qualitative linking, shaping, and modeling. As analyzer software, NVivo integrates the processes of interpretation and focused questioning. Using NVivo to analyze and mine associations between queries enabled us to take qualitative inquiry beyond simple coding since the use of NVivo supported fluid interpretation and emergence of relationships between data. These were essential in efficiently mining relationships among queries.

To code the sets of queries, we used five categorizations (or nodes in NVivo) developed a posteriori.

- Intent to buy* denoted by terms such as buy, buying, or purchase
- Product-specific* denoted by specific product or brand term
- Location-specific* denoted by a location/geographical terms
- Company* denoted by the term of company name
- General information* denoted by terms such as reviews, cheap, or prices

There is a possibility that our original query selection methods biased the results by favoring these 5 categories. However, given that these original terms came from WordTracker and that they represent popular e-commerce searching terms, and that the resulting queries came from a search engine transaction log, we believe that these categories represent valid e-commerce need classifications.

During the coding process, we went through each query, located the identifying terms (i.e., buy, price, review, etc.), and then coded each to its particular node. The results are shown in Table X. In this analysis, we allowed each query to have more than one association which is why the total of Passages Coded is 211 instead of 130.

Figure 6 shows a bar chart of the composition of coded queries and the number for each categorization. From Figure 6, we can see that a large number of queries fell into the product-specific category (48.34%). This would indicate that most of the queries are for products. While Information and Intent to Buy

Table X. Results of NVivo Analysis

Node:	Characters Coded:	Paragraphs Coded:	Passages Coded:	Percentages:
Intent to Buy	986	44	44	20.85%
Product-Specific	2,243	104	102	48.34%
Location-Specific	205	7	7	3.32%
Company	24	1	1	0.47%
Information	1,510	57	57	27.01%
Totals	4,968	213	211	100.00%

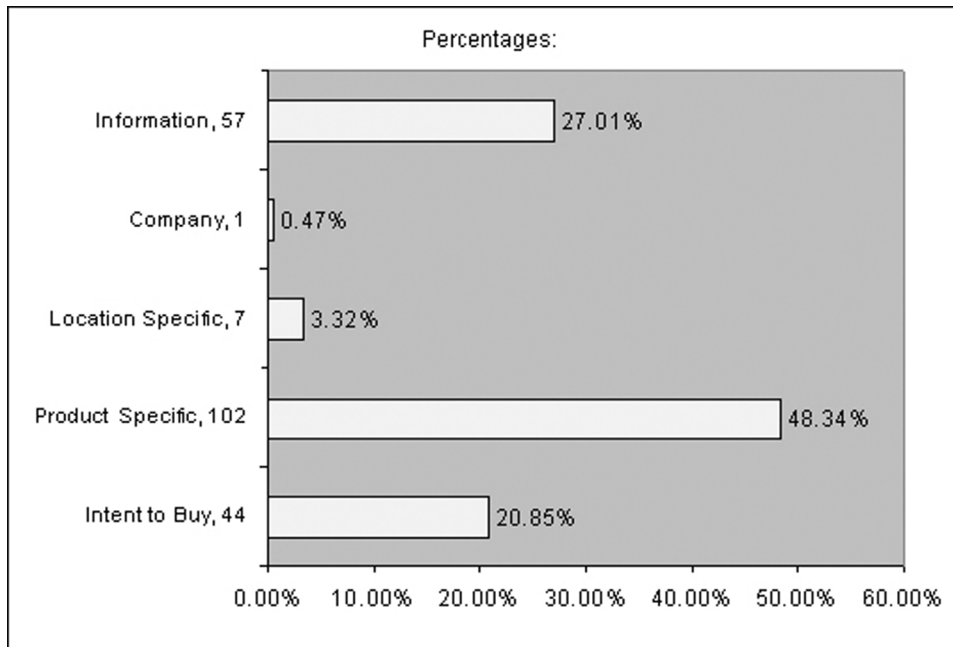


Fig. 6. Results of NVivo analysis.

only make up about half of the total queries analyzed, we can also see that only a very small percentage focuses on Companies and Location. We see that 3.32% are for Locations. Most of these are searches for real estate or buying houses in certain areas of the country. While only half a percent were queries for specific companies (one query for a Best Buy in N.H.). With this category, we see the only overlap is with Location, (e.g., ... in N.H.). This would indicate that searchers approach e-commerce searching from two major perspectives, one to locate information and the other to look for a specific product.

However, many queries belonged to more than one category so there was a significant degree of overlap within each group. The degree of overlap among these categories was especially telling in terms of the intent of the searcher. We first analyzed the Product-Specific queries, which were the most popular query type. Figure 7 illustrates the results. Within this category, the queries are composed of at least 39.22% Information, 30.39% Intent to Buy as well as 29.41% “pure” Product queries (i.e., Product queries that were not also in

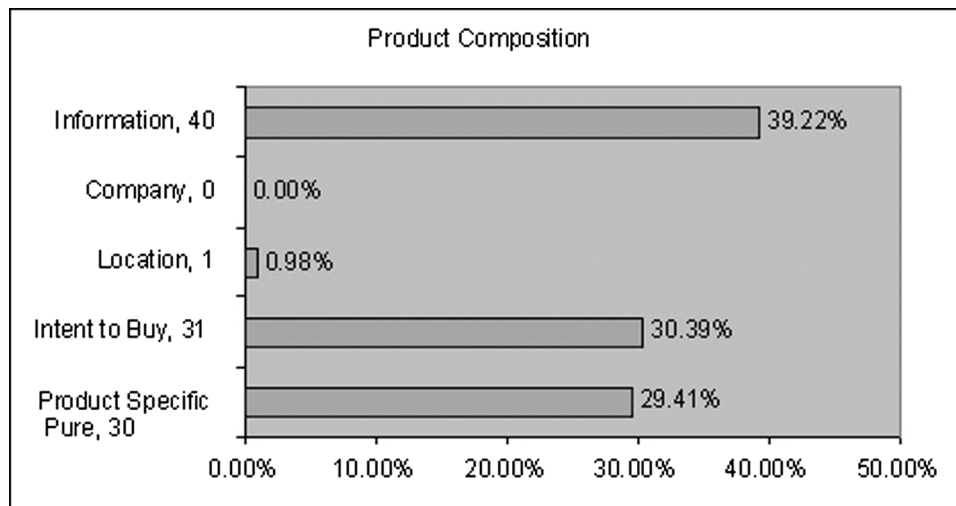


Fig. 7. Results of NVivo analysis for product-specific queries.

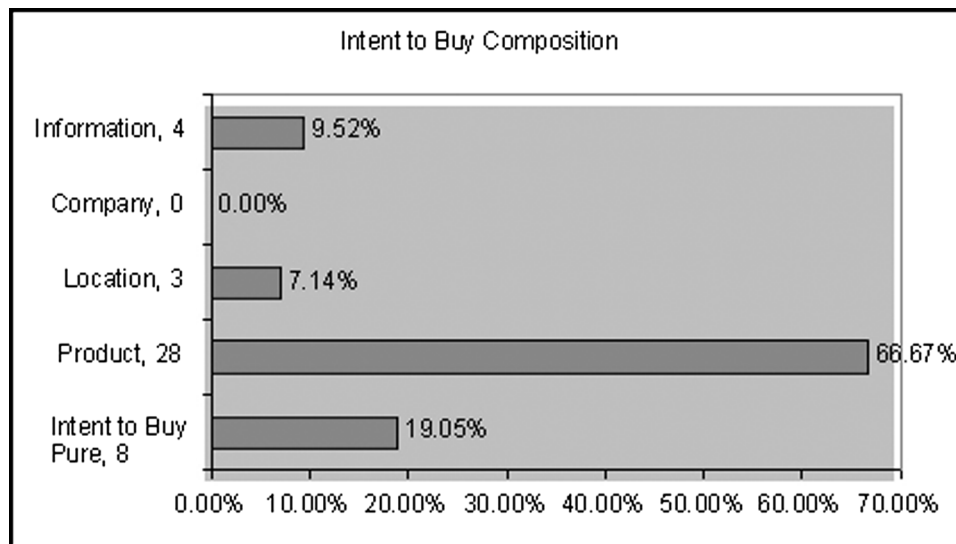


Fig. 8. Results of NVivo analysis for Intent to Buy specific queries.

another category). We note that Location and Company have very few overlaps in Product queries. The next most common overlapped query category was for Information. One would expect this since the primary goal of a search engine is to locate pertinent information. From the data composition shown in Figure 7, we see that the majority of these queries are made up of the Product-Specific classification (78.85%). Location and Intent to buy play much smaller roles.

In the Intent to Buy category, we see from Figure 8 that a majority of the overlaps are with the Product queries (66.67%). We also see from the composition percentages that about a fifth of these queries (19.05%) are

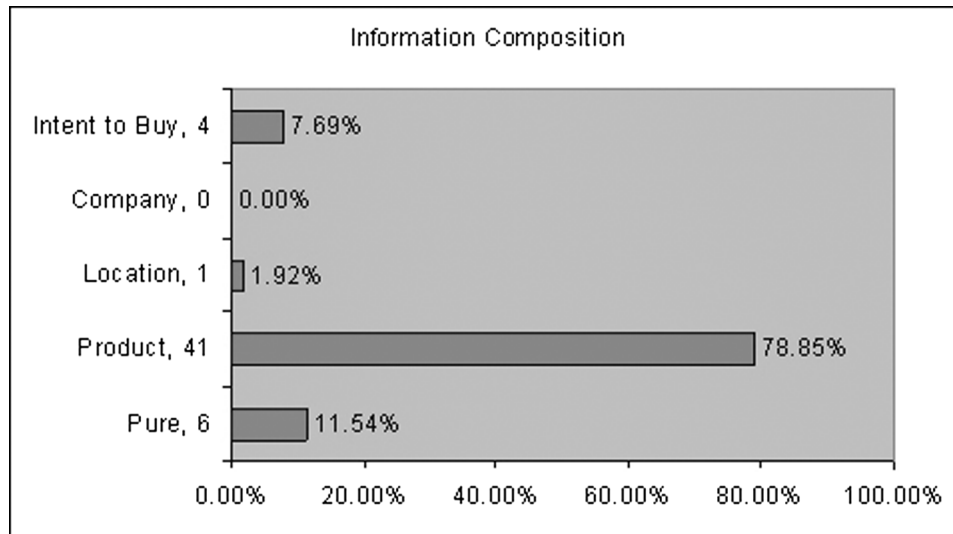


Fig. 9. Results of NVivo Analysis for Information-Specific queries.

Intent to Buy-specific. The next largest overlap is General Information, making up about 10% of the total queries. This is also expected as a search for General Information is closely linked with purchasing. Location plays a small role in Intent to Buy, with approximately 7%. Queries for houses or real estate in certain areas make up this percentage. Companies have no commonalities with Intent to Buy.

In the Information category, Figure 9 shows that a majority of the overlaps are again with the Product queries (78.85%). The next largest group is the “pure” Information category making up about 12% of the total queries. Intent to Buy follows with just under 8%

From the results of these query analyses, the bulk of these e-commerce queries are for products, while purchasing and information make up the other components of online searches. Searches for companies and specific locations are not very common, only about 4% in the whole set of data. This shows us that the intent of e-commerce searching is for product information, while the secondary use is to locate relevant purchasing (Intent to Buy) information.

RQ03. Are there trends in the nature of sponsored links that shed light on their effectiveness in response to e-commerce queries? The results of the ANOVA analysis were surprising to us in that we expected sponsored links to be as relevant, if not more relevant, than the nonsponsored links. Therefore, we analyzed the data set of sponsored results to determine if there was some pattern that would shed light on why these results were not more effective in satisfying or meeting the needs of e-commerce searchers.

We first examined the most commonly occurring domains in the set of sponsored results. These results are shown in Table XI. In Table XII, these 26 domains were the top occurring URLs. Although only 2% of the unique sponsored links, they account for 26.7% of all sponsored links occurrences with 698

Table XI. Top 26 Occurring URLs in the Data Set

	URL	Occurrences	Average Relevance Rating
1	http://www.nextag.com	90	2.02
2	http://www.ebay.com	81	1.94
3	http://www.shopping.com	67	2.97
4	http://www.bizrate.com	61	2.60
5	http://www.shopzilla.com	46	1.67
6	www.eBay.com	39	2.62
7	http://www.calibex.com	39	3.00
8	BizRate.com	35	2.48
9	www.Shopping.com	21	2.67
10	http://shopping.yahoo.com	20	1.60
11	http://www.overstock.com	20	2.08
12	http://www.pricegrabber.com	17	1.94
13	http://www.orbitz.com	16	2.00
14	Yahoo.com	15	1.67
15	http://www.edmunds.com	14	2.43
16	http://www.shop.com	12	1.56
17	http://www.fingerhut.com	12	2.44
18	http://www.pricerunner.com	11	1.88
19	Shopzilla.com	11	2.10
20	http://www.cheaptickets.com	11	2.54
21	http://www.americawest.com	10	1.07
22	www.carsdirect.com	10	1.33
23	http://shopper.cnet.com	10	1.77
24	http://www.amazon.com	10	1.93
25	http://www.target.com	10	2.33
26	ebay.com	10	2.57
		698	2.12

total occurrences. Obviously, the e-commerce organizations represented by these URLs are actively engaged in sponsored search advertising, and they bid on multiple query terms and phrases. It would seem reasonable that that these domains would have a major impact on the aggregate rating of sponsored links.

Our results show that this set of links had an average relevance rating of 2.12 compared to 1.93 for the set of nontop occurring sponsored URLs. An ANOVA analysis of relevance ratings showed a significant difference ($F(1) = 12.56$, $p < 0.01$, critical value of $F = 6.85$) between this set of 26 e-commerce URLs and the remaining set of sponsored links which had an average relevance rating of 1.80. Therefore, it appears that these high-volume sponsored links have a significant effect on the relevance of sponsored search.

We then examined the average relevance rating for each category of URL occurrences, with results shown in Table XII. In Table XII, the first column is the category of URL based on occurrences. The second column is the occurrences of that count. The third column is the total number of URL appearances, followed by the average relevance rating. Row 14 is the midway point. In the Average Relevance Rating column, we bolded those categories with above average relevance ratings. The average relevance rating across the entire data

Table XII. Occurrences of Sponsored Links in the Data Set

URL Count	Occurrences	Number of URL Occurrences	Average Relevance Rating
1	578	578	1.76
2	207	414	1.81
3	76	228	1.86
4	79	316	1.88
5	30	150	1.90
6	16	96	1.87
7	8	56	1.82
8	9	72	1.87
9	1	9	1.33
10	6	60	1.83
11	3	33	2.17
12	2	24	2.00
14	1	14	2.43
15	1	15	1.67
16	1	16	2.00
17	1	17	1.94
20	2	40	1.84
21	1	21	2.67
35	1	35	2.48
39	2	78	2.81
46	1	46	1.67
61	1	61	2.60
67	1	67	2.97
81	1	81	1.93
Total	1030	2617	
Average			1.93

set was 1.93. From Table XII, we see that the majority of categories with above average ratings were in the group of URLs that occurred most frequently. An ANOVA analysis indicated a statistically significant difference ($F(1) = 13.61$, $p < 0.01$, critical value of $F = 6.85$) between the URLs that occurred more frequently (mean = 2.24) relative to those URLs that occurred less frequently (1.79). Again, these results indicate that those advertisers most involved in the sponsored search program provide the most relevant results.

For a substantial portion of the results, we asked the evaluators to provide a basis for their evaluation, with the results shown in Table XIII. As shown in Table XIII, it appears that Title and URL are significant elements that searchers use to judge the relevance of search engine links in a positive manner, while Trust and Professionalism were major factors in a negative assessment. This result would highlight the importance that advertisers should place on the link title and description in order to attract potential customers.

We examined this for just the sponsored links, with the results shown in Table XIV. From Table XIV, we see similar results for the sponsored links and the data set as a whole, Title and URL are significant factors concerning positive relevance assessments, while Trust and Page Content are significant factors for negative assessment.

Table XIII. Basis for Evaluation of Search Engine Links

Basis	Occurrences	%	Average Relevance Rating
Trust	193	0.95%	1.51
Title and Summary	188	0.92%	1.77
Professionalism of Page	12	0.06%	1.92
Summary	6,813	33.48%	2.16
Content on Page	10	0.05%	2.20
Title and Hyperlink	3	0.01%	2.33
Title	12,712	62.47%	2.36
URL	418	2.05%	2.59
	20,349	100.00%	

Table XIV. Basis for Evaluation of Search Engine Sponsored Links

Basis	Occurrences	%	Average Relevance Rating
Content on Page	3	0.06%	1.33
Title and Summary	66	1.27%	1.62
Trust	115	2.22%	1.63
Professionalism of Page	6	0.12%	2.00
Summary	1726	33.25%	2.19
Title	3145	60.59%	2.23
URL	130	2.50%	2.28
	5191	100.00%	

6. DISCUSSION

Our results show that, statistically, sponsored links are more relevant than nonsponsored links, based on user evaluation of SERP snippets composed of Title, Summary, and URL. We found this somewhat surprising given the negative bias that Web searchers appear to have concerning sponsored links [Jansen and Resnick 2006; Marable 2003]. This is a good sign for the long-term success of sponsored search as a viable business model. With only about 30% of searchers presently interacting with sponsored links [Jansen and Resnick 2006], there is potential for substantial growth given that these sponsored links appear to be providing relevant content. However, our sample of queries was e-commerce-related, and sponsored search is designed with this domain in mind. It would be interesting to see if this comparison held in other domains outside of e-commerce.

The average rating, while significant statistically, may not be significant in practical terms for a single search session. Nonsponsored links had an average relevance rating of 1.69 compared to 1.93 for sponsored links, a 14% improvement. However, over several searching episodes, 14% improvement in each session could be a noticeable improvement. Given that many Web searchers appear to do multiple sessions per day (see Jansen et al. [2005a]; Jansen and McNeese [2005]; and Jansen and Spink [2003]), there is the potential for rapid pay-off of this small improvement in relevance.

It is important to note that this analysis was based on an evaluation of links off of the SERP. Based on prior work [Jansen and Resnick 2006], the relevance of the actual Web pages from these sponsored and nonsponsored links might be quite similar. Therefore, the difference may have more to do with the proper

or improper selection of the SERP snippet Titles and Summaries. This would point to a couple of improvements to the sponsored search mechanism, namely, improved campaigns by content providers in designing better snippet titles and summaries that are linked to targeted queries. In addition, perhaps there is a need for some sponsored search applications to automatically generate more appropriate titles and summaries based on the user's query. Maybe these titles and summaries could be generated on the fly based on the specific wording or word order of the query. Regardless, it appears that sponsored links are just as relevant to those Web searchers interested in the e-commerce domain.

In terms of ranking, there was a significant correlation between the rank of a nonsponsored link and its average relevance ranking. This correlation was not true of sponsored links. Therefore, it appears that the online auction process of the sponsored search process is having the effect of negating the ranking process. The results from this research show that the average relevance ranking for sponsored links was not significantly different, regardless of the link's rank. However, it is also interesting that the overall effect of rank on the relevance evaluation is relatively small even for the nonsponsored links.

However, we know from several studies that users favor links higher in the results listing than those lower in the results listing [Brooks 2004a, 2004b; Jansen and Spink 2003]. Based on the results from this study, the higher click-through rate is not supported by the higher ranking. This finding reinforces issues raised in prior work that the ranking of search engines may cause a bias against sites that are just as relevant but that appear lower in the nonsponsored or sponsored results listing (see Introna and Nissenbaum [2000]). However, with the inclusion of sponsored links, these sites can buy their way onto the first SERP of higher links. Therefore, sponsored search offers an insurance policy against this inherent bias of a search engines' algorithmic approach.

In classifying the queries, most of the queries involved looking for a specific product, followed by queries expressing intent to buy, and queries looking for information about products or buying products. There was also a great deal of overlap with many queries falling into more than one category. Researchers have investigated the online shopping process reporting that searchers often search several times before making a purchase [Brooks 2006]. From the results of this study and prior work, it would appear that participants in sponsored search campaigns would do well to target a population of searchers from broad informational queries and more specific product and intent to buy queries. Perhaps, this can be done with multiple campaigns based on user intent as expressed by the query.

It appears the more distinguishing a sponsored link campaign is, the better. The top 26 occurring URLs (2% of unique sponsored links) account for 26.7% of all sponsored links occurrences. The average relevance rating of these link was 2.24, well above the remaining sponsored links, a statistically significant difference. It appears that these frequently occurring URLs may be more targeted specifically to user queries. This again points to the need to take more care in constructing titles and summaries for sponsored links.

Certainly, there are limitations that one should highlight from this type of relevance comparison. In this research, each search engine link was evaluated

in isolation from the other links that would have appeared on the SERP. In practice, search engine results are typically presented as a ranked set. Therefore, searchers have to take into account other factors in evaluations such as position on the page and relevance relative to results viewed on that page. This would be an interesting area for future research.

7. CONCLUSION

Sponsored links are the predominant business for Web searching, financing most of the free searching that has become a central aspect for information searching. However, for sponsored links to be a viable long-term business model, they must be at least as relevant as nonsponsored links. This research addresses this fundamental issue.

We examined, whether sponsored links are providing relevant information to Web searchers. We used 108 e-commerce queries, submitted these queries to three major search engines, and collected 8,256 SERP results. For the retrieved links, 68% were nonsponsored and 32% were sponsored. The results show that average relevance ratings for sponsored and nonsponsored links are practically the same, although the sponsored links relevance ratings are statistically higher. However, the difference is slight (1.93 to 1.69). The findings have implications for Web search engines and implementation of the sponsored search model. It appears that sponsored search is an effective method for providing relevant information to Web searchers, nearly as effective as algorithm methods. Our results show this for the e-commerce area. Future research is needed to determine if this applies to other domains as well. It would be beneficial to obtain actual click-through data from a commercial search engine company in order to investigate the click-through data as a measure of perceived relevance. As a long-term business model, content providers must improve their methods for display titles and summary in response to user queries. Future research will focus on algorithms to automatically generate these in response to user input.

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