Brand and its Effect on User Perception of Search Engine Performance

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In this research we investigate the effect of search engine brand on the evaluation of searching performance. Our research is motivated by the large amount of search traffic directed to a handful of Web search engines, even though many have similar interfaces and performance. We conducted a laboratory experiment with 32 participants using a 4^2 factorial design confounded in four blocks to measure the effect of four search engine brands (Google, MSN, Yahoo!, and a locally developed search engine) while controlling for the quality and presentation of search engine results. We found brand indeed played a role in the searching process. Brand effect varied in different domains. Users seemed to place a high degree of trust in major search engine brands; however, they were more engaged in the searching process when using lesser-known search engines. It appears that branding affects overall Web search at four stages: (a) search engine selection, (b) search engine results page evaluation, (c) individual link evaluation, and (d) evaluation of the landing page. We discuss the implications for search engine marketing and the design of empirical studies measuring search engine performance.

Introduction

There has been a rapid growth in the Web search engine market since its inception. Search engines continue to attract a large number of Web searchers and consistently rank as some of the heavily visited sites in the market in terms of the number of visitors (Alexa Internet Inc., 2008). There are numerous search engines on the Web (Wikipedia, 2008); however, only a handful dominates in terms of usage (Sullivan, 2008). From a technological point, this clustering of traffic is interesting because studies report that the performance of most of the major search engines is practically the same (c.f., Eastman & Jansen, 2003). Performance is

typically defined as returning useful results and is measured by precision, which is the ratio of relevant documents to the total number of document returned at some point in the results listing. The interfaces of most search engines are also similar, namely, a text box, some verticals (i.e., tabs for searching the Web, Images, Audio, etc.), and a submit button. In studies of search engine interface usability, the results among various search engines have been similar (c.f., Wildemuth & Carter, 2002).

Given the similarity in technology and interface design, why do only a small number of search engines dominate Web traffic? Certainly maintaining Web searching infrastructures on a large scale is expensive, but several well-financed companies have been unsuccessful. Do other elements affect the evaluation of a search engine's performance? Seeking the answers to these questions motivate our research.

There could be many possible avenues to investigate. In a series of user studies concerning Web searching (Jansen, 2006; Jansen & McNeese, 2005), the participants completed pre-surveys concerning their Web searching habits. One question addressed which search engine the participant used and why. There were many expected responses, including technical features, response time, and performance. However, one response was surprising: *popularity*. Nearly 14% of the participants listed popularity as being a reason for using a search engine, making comments such as "Google, who doesn't!" and "It is the most widely known." The popularity of popularity being a major reason for search engine usage led us to investigate brand as a possible reason to explain the clustering of traffic around a handful of extremely similar Web search engines. This approach is supported by statistics that show that Google and Yahoo! are some of the most talked about brands on the Web (Boella, 2007). In this research, we measure the effect of brand on user perception of the performance of Web search engines.

In the following section, we review the concept of branding and its lack of emphasis in Web search engine design. We

then present our research questions and approaches. Next, we describe our research design. We follow this with our research results. We end with the implications of our findings for searchers, Web search engines, and content providers for Web sites.

Review of Literature

A brand is the intangible sum of an organization's attributes, which can reflect an organization's name, history, reputation, and advertisement. Searching engine interfaces contain branding elements. A brand can be recognized as the identifiable symbol, sign, name, or mark that distinguishes an organization or a product from its competitors. Therefore, good branding can result in customer loyalty and positive image of a firm's products and services. For example, a study focusing on children's perspectives of food products showed that McDonald's (a worldwide fast food company) brand made milk and carrots taste better to the participants than the identical product without MacDonald's branding (Robinson, Borzekowski, Matheson, & Kraemer, 2007).

However, the effect of branding on technology design has not been well acknowledged, with one Computer Human Interaction (CHI) 2001 conference panel on branding being an exception (Marcus, 2004). In addition, Park, Harada, and Igarashi (2006) reported that the users' perceptions of a product's brand affected the user's perceptions of mental demand. In the cognitive area, brand image has been shown to stimulate certain areas of the human brain (Born, Meindl, Poeppel, Schoenberg, & Reiser, 2006; Plassmann et al., 2006).

Although branding may be acknowledged for its importance in marketing of products and services, there has been little research investigating the brand effect on the evaluation of system performance. In the marketing area, however, researchers have conducted extensive research on brand related topics. The studies addressed many different aspects of branding, ranging from cultural (Sung & Tinkham, 2005), ethical (Dean, 2005; Palazzo & Basu, 2007), jurisdictional (George, 2006), to social (Flavián & Guinalíu, 2005; Underwood, Bond, & Baer, 2001) aspects of branding.

Branding Introduction

Brand can be understood from various perspectives, which differs across the various academic and practical disciplines. A narrow brand perspective centers on the tangible brand features, such as name, design, or symbol, while intangible features, such as values, ideas, and personality, are included in a broader brand perspective (c.f., de Chernatony & Riley, 1998; Haigh & Knowles, 2004; Stern, 2006). In our research, a broad brand perspective is adopted. Attributing the concept of brand with intangible features, we also recognize the importance of an individual or customer's brand perception.

Brand provides various functional features for different stakeholders. For a brand recipient, such as a Web search engine user, a brand may exert an identification image, a

discrimination function, a quality assurance, a prestige or a trust function (Keller, 2007). For a brand owner, such as a search engine company, preference building, customer retention and competitor discrimination are a set of functional brand properties (Keller, 2007).

The major thrust of our research is on the brand recipient because our focus is the search engine user. However, given the nearly total lack of brand discussion in the Web search and search engine area, we lay the groundwork by discussing overall brand design and management before turning towards the research trends addressing individual brand perception.

Branding From the Owners Perspective

From an organizational perspective, branding is a process involving all activities to assign a brand to an artifact. This is an extensive definition that incorporates service branding (Berry, 2000; de Chernatony, Drury, & Segal-Horn, 2003) and corporate branding (Keller & Richey, 2006). Service branding is a process of forming a brand for a product of a service provider, while corporate branding is the process of building an organizational brand. The entrepreneurial significance of the concept has led to the formation of a brand-oriented management approach (c.f., Elliott & Percy, 2007; Keller, 2007). Managerial implications of strategic branding include the design of brand architectures, the evaluation of brand extensions, and the identification of brand equity.

Numerous factors influence the design of a organization's brand including strategically assumptions, as noted by Douglas, Craig, and Nijssen (2001) and Rajagopal and Sanchez (2004), who pointed out the importance of annually reviewing the brand strategy annually and the corresponding assumptions and implications. There have been several branding studies at this level (Keller & Lehmann, 2006; Matthiesen & Phau, 2005). With the increasing influence of retailer brands (e.g., Ailawadi & Keller, 2004; Olbrich & Buhr, 2004), the area of brand imitation has attracted more and more research due to the unequal distribution of power between retailer and manufacturer (e.g., Collins-Dodd & Zaichkowsky, 1999; Morton & Zettelmeyer, 2004). Given the success of Google in the marketplace, one can see some search engines trying to mimic some aspects of Google's look and feel, perhaps for brand imitation and other reasons.

Brand extension refers to using a well-developed brand for a different artifact (Aaker & Keller, 1990), and brand extensions "represent one of the most frequently used branding strategies" .(Völckner & Sattler, 2006, p. 18). After the early work of Tauber (1981) and Aaker and Keller (1990), generalization has and still is one prime focus of brand extension research (c.f., Echambadi, Arroniz, Reinartz, & Lee, 2006; Völckner & Sattler, 2007). In addition, researchers have studied the effect of consumer information processing (Meyvis & Janiszewski, 2004), the impact of brand counter extensions (Kumar, 2005a, 2005b), and the influence of brand extensions on brand equity (Randall, Ulrich, & Reibstein, 1998; van Osselaer & Alba, 2003). Brand extension is an interesting concept for those interested in the Web search engine

market. For example, Yahoo! has an extensive host of online services, including e-mail, groups, and instant messenger. Similarly, Google also has an array of services, including e-mail, applications, and desktop search.

Brand equity refers to the concept of understanding, measuring, and creating the value of brands (Aaker, 1991; Keller, 2007). Keller and Lehmann (2006) identified three principal perspectives for researchers to study brand equity: customer-based, company-based, and financial-based. Although various definitions of brand equity exist, (Srinivasan, Park, & Chang, 2005, p. 1433) most of them share the same concept of "brand equity as the value added by the brand to the product." A major focus of brand equity research is the development of a universally accepted methodology to measure brand value. For example, Sriram, Balachander, and Kalwani (2007) utilized store-level data into the concept. Proposing and validating a survey-based logit model, Srinivasan, Park, and Chang (2005) used brand awareness, brand preference, and brand availability as a source of brand equity and accounted brand awareness as a major contributor to brand equity. Brand awareness is a main component of the brand's recipient's perspective. We address brand awareness in the next section, pointing out its importance from the individual's perspective. Although this research focuses on the recipient level of branding, from the results we can infer brand equity among the search engines used.

Branding From the Recipient Perspective

Research centering on the individual's perspective of brand has examined various impacts of brand elements. Brand effects have been studied as antecedences of online trust relating to the vendor, the Web site, and the product, as well as a means to communicate the trustworthiness of an e-vendor (for an extensive analysis, see Schultz, 2007). These brand concepts are strongly interrelated and represent various stages and aspects of an individual's brand perception and processing. Ha and Perks (2005) examined the relationship of brand experience, brand familiarity, customer satisfaction, and brand trust in the online environment. Esch and fellow researchers (2006) proposed a conceptual model to relate perceptual (brand awareness and brand image) and relationship (brand satisfaction, brand trust, and brand attachment) variables to current and future purchasing behavior. However, there is no consensus on the meaning and the correlation of these concepts.

It is apparent that brand awareness is a main contributor to brand equity (Srinivasan et al., 2005). This finding is in line with consumer research literature specifying brand awareness as the entrance level of a hierarchical model to explain the formation of consumer-based brand equity (Keller & Lehmann, 2006). Consequently, researchers have addressed the question of measuring brand awareness (Macdonald & Sharp, 2003; Wells, 2000), studying if recall or recognition is appropriate for affective advertising (Mehta & Purcis, 2006; Penn, 2006). We continue this line of branding research

in an interesting and novel way by directly measuring the effect of branding on the perception of the performance of a piece of technology.

Despite the extensive branding literature, there has been very little research on effects of brands in the online environment (Ha & Perks, 2005; Sicilia, Ruiz, & Reynolds, 2006). In a more specific setting, scholars have examined the recall effect of brand placement in online games (Winkler & Buckner, 2006). Researchers have explored aspects of searching and information retrieval systems for many years (c.f., Meister & Sullivan, 1967; Penniman, 1975; Siegfried, Bates, & Wilde, 1993). More recently, researchers have done work on search engines' effect on Web pages browsing (Cho & Roy, 2004; Frieze, Vera, & Chakrabarti, 2007; Pandey, Roy, Olston, Cho, & Chakrabarti, 2005). We extend the existing literature by investigating the effect of brands, specifically brand awareness on the process of information retrieval utilizing search engines. Preliminary results of this research were reported in two conference posters (Jansen, M. Zhang, & Y. Zhang, 2007a, 2007b).

Research Objectives

Our research aim is to examine *how branding affects overall user evaluation of results retrieved by Web search engines.* Keller and Lehmann (2006) argued that brands were one of an organization's most valuable intangible assets, and there were a variety of branding aspects including positioning, integration, growth, and management. They further commented that some potential aspects of branding research included customer, company, or finance. This research focuses primarily on the customer perspective of branding. To address this research aim, we designed a study that altered the brand of search engines for results from a set of queries while controlling for the quality and display of the results.

We conducted this study via several research questions. Our research questions and subsequent hypotheses assume that there would not be a difference among the search engines, given that the content and presentation of all the search results are the same. In our laboratory experiment, we refer to a "link" as a listing (i.e., the title, summary, and URL) on the search engine results page (SERP). We refer to a "result" as the actual Web document (i.e., landing page) referenced by a link on a SERP. A "click" is the act of initiating a visit to a Web site via a link on the SERP.

Research Objective 01: The search engine brand has no effect on the number of links examined among the SERPs of the search engines.

> Research Hypothesis 01a: There will be no difference in the number of links examined among the search engines.
> Research Hypothesis 01b: There will be no difference in the number of organic links examined among the search engines.
> Research Hypothesis 01c: There will be no difference in the number of sponsored links examined among the search engines.

For research objective 01, we used a count of the number of links that the participants examined on during the actual searching session as the response value and investigated whether there was a significant effect of the brand of the search engines. We investigated all links on the first SERP (i.e., if the participant took an action such as reformulated the query or moved to the next results page, this ended the searching session) as well as both non-sponsored (a.k.a., organic or algorithmic) links and sponsored links.

By "examined," we mean the searcher took some type of interaction with link (i.e., scanning, pursuing in detail) and verbalizing this via some utterance during the examination. An examination could (but not necessarily) result in a click on that link.

Research Objective 02: There will be no difference in the number of links clicked by rank among the search engine.

> Research Hypothesis 02a: There will be no difference in the number of links clicked among search engines.
> Research Hypothesis 02b: There will be no difference in the number of organic links clicked among search engines.
> Research Hypothesis 02c: There will be no difference in the number of sponsored links clicked among search engines.

For research objective 02, we used a count of the number of links that the participants clicked on by rank during the actual searching session as the response value and investigate whether there was a significant effect of the brand of the search engines. We investigated all links on the SERP, including both non-sponsored and sponsored links. There has been substantial research on the ranking effects of non-sponsored and sponsored (Brooks, 2004a; Brooks, 2004b) links. We wanted to investigate whether search engine brand affected click through. We are making no assumption on where more or less clicks is better in a given searching situation. Rather, in these controlled searching scenarios, we want to see if the brand causes differences in searching behavior as measured by the number of clicks.

Research Objective 03: The search engine brand has no effect on the evaluation of links on the SERP among the search engines.

> Research Hypothesis 03a: There will be no difference in the evaluation of links among search engines.
> Research Hypothesis 03b: There will be no difference in the evaluation of organic links among the search engines.
> Research Hypothesis 03c: There will be no difference in the evaluation of sponsored links during the searching session among search engines.

For research objective 03, we used the evaluation of the individual links as the response value and investigated whether there was a significant effect by the brand of the search engines. During the session, the participant evaluated each link clicked on during the session. After each participant completed all searching sessions, we asked the participant to go back and evaluate each link that she or he did not click on during the session. Again, we investigated both

non-sponsored and sponsored links. What we investigated here is whether there are search engine dependencies in these evaluations.

Research Objective 04: The search engine brand has no effect on the evaluation of SERP landing pages.

> Research Hypothesis 04a: There will be no difference in the evaluation of SERP landing pages among search engines.
> Research Hypothesis 04b: There will be no difference in the evaluation of organic landing pages among the search engines.
> Research Hypothesis 04c: There will be no difference in the evaluation of sponsored landing pages among search engines.

For the research objective 04, we used the evaluation of the individual pages as the response value and investigated whether there was a significant effect of the brand of the search engines.

Research Objective 05: What are underlying issues of branding that affect how users evaluate search engines, links, and Web pages?

During the study, the participants talked aloud as they were taking certain actions. We recorded these utterances during the search session via an application we developed to transcript utterances during laboratory experiments. We then qualitatively analyzed these utterances using an open coding method to gain deeper insight into the effect that the search engine brands were having on the participants. Appendix C contains the complete list of codes that we developed.

Research Design

To fully and effectively investigate our research objectives, we selected one-quarter fraction of a 4^2 design. Each block will have four treatment combinations. The two four-level factors are search engine brand and query type. The participants were randomly assigned to a block. The major advantage of this design is efficiency. Each participant evaluated four search engines and four queries. Each search engine will match with each query once. This design is equivalent in statistical power to a study design having four times more participants but only asking them to use one search engine and search for one query. We had 32 participants in our study. Thus, our study is equivalent to a study having 128 participants and asking each one to use one search engine and search for one query. Additionally, our helps approach control for individual differences because every participant uses every search engine and query. The 4^2 factorial design with four blocks is efficient and effective in uncovering the main factors' influence and interactions regarding the evaluation of search engine performance.

We first extracted a set of ecommerce queries from an Web search engine transaction log from 2005 with approximately 1.5 million queries using a modified snowball technique (Patton, 1990). For comparison of results across search

engines and queries, we desired that the queries be within the same domain. We selected ecommerce due to its growing importance on the Web. For the modified snowball technique, we started with some commercial key terms (buy, price, sale, purchase, etc.) as original seed terms and queried the search engine log. We reviewed the retrieved queries, adding more terms to our list of key terms. We then queried this log again, repeating the process until we had a comfortable set of ecommerce queries from which to choose. From these queries, we selected four queries representing four searching domains: *medicine*, *entertainment*, *travel*, and *housing*. We developed searching scenarios (see Appendix B) around each of the four queries. The four queries used are *laser removal*, *techno music, camping Mexico*, and *manufactured home.*

We then submitted these four queries to Google, a major U.S. search engine, using a software application that both submitted the queries and retrieved the SERP for each query exactly as it would be presented to a human user. The total time from submission to completion of result retrieval took approximately 30 seconds. We then removed all identifying logos, text, URLs, and HTML code from the Google result pages. We removed the redirects in the results, so the URLs pointed directly to the landing page. This left us with four cleaned SERPs, one for each query.

We then captured screen images of SERPs from Google, MSN Live Search, and Yahoo!, all major and well-known Web search engines, for each of the four queries. Additionally, we used an in-house search engine, AI^2RS, and captured screen images of the AI^2RS results pages for each of the queries. Throughout the remainder of the article, AI^2RS is referred to as the *No Name* search engine to denote its total lack of brand standing in the marketplace.

Using the cleaned Google results and the images from No Name, MSN Live Search, and Yahoo!, we developed four experimental SERPs for each of the four queries. To develop these queries, we cropped each SERP image using only the branding elements at the top of the SERP (i.e., logo, search box and button) and bottom (i.e., results page hyperlinks) of each image. We then built a hyperlink page structure to hold the top and bottom images. For the search engine results, we used the cleaned Google results.

At the end of this process, we had 16 experimental SERPs, four from each search engine for each of the four queries. However, regardless of the search engine branding elements, the links on the SERP were from Google. All the links appearing in the SERP from each search engine for each query were identical in both content (i.e., all links were from Google) and presentation (i.e., links were presented exactly as Google presented them). Figure 1 shows the building of an experimental SERP.

The rationale for the selection of the number of queries is radically different from the basis for query selection in traditional information retrieval system evaluation. For system evaluation, one oftentimes selects a wide variety of queries as the percentage of relevant documents in a given collection for a given query may vary. For this experiment, our selection of four queries was based on the evaluation of four

search engines. We just needed new queries for each search engine.

Our goal in this process was to be able to isolate the effect of the branding variable while controlling for the number of results, result presentation, and quality of research. We used only the first SERP for each query because most searchers only view the first results page (Jansen & Spink, 2005). We decided to use one style of results formatting (i.e., Google's) because prior work has noted that minute differences in the presentation of search engine results can affect how users interact with those results (Hotchkiss, 2005). There have been other studies of search engine performance (Vaughan, 2004; Veritest, 2003), but we wanted to control for variation in the quality of results.

Procedures During Study

Our study process is provided below.

Study Procedure

For the laboratory experiment, we recruited 32 participants from a major American university in the fall of 2006. The age range was 18 to 25 years. There were 8 females and 24 males. At the beginning of the study, the participants signed the human subject approval forms, completed a demographic questionnaire (see Appendix A), and answered questions about their Web-searching behavior, including the search engine(s) most frequently used. A moderator read a short introduction to the participant, explained that he or she would be conducting some searches using four Web search engines, and instructed the participant to think aloud during the search. We used an unrelated practice task to explain the think aloud protocol.

We then read one of the four searching scenarios to the participant (see Appendix B), informing him or her that the query had already been entered into the search engine and the results returned. All search engines used in the study followed similar interface set-up of a search box, a submit button, a list of organic results, and sponsored search results on the side. The participant would continue the search as if she or he had entered the query. The session for that query would end when the participant took some action that would remove him or her from the presented results page without returning (i.e., submit a new query, go to a new results page, go to a different search engine). There was no time limit imposed for conducting the search.

During the study, we presented all four queries to each participant, one at a time. Each participant completed one query before moving on to the next. The moderator would read the applicable scenario before moving on to the next query. We counterbalanced the order of search engines and the order of the searching scenarios to eliminate ordering effects.

The moderator instructed the participants to describe the screen content they were viewing, evaluate its relevance to the task, and explain why they moved from one item to the

FIG. 1. Example of experimental search engine results page.

next. While the participants were searching, the moderator annotated utterances and user actions using an application that the researchers designed for quantitative and qualitative data capture during Web searching experiments like ours. The moderator did not ask questions except for occasional clarifications.

After the participant had completed all four query sessions, the moderator returned the participant to the first query, and the participant evaluated all links for each query that he or she had not evaluated during the session. The participant evaluated the Web link on a 3-point scale (not relevant, somewhat relevant, and relevant) and presented a basis for the evaluation. The moderator collected these Web document evaluations again using the data collection application. Approximately 1.5 hours was required to complete the whole process for each participant.

Data Analysis

During the study, we collected the following variables from the participants for analysis:

- Examined link: whether the participant focused on a particular link during the searching process

- Clicked link: whether the participant clicked on a particular link during the searching process
- Evaluation of link: the participant's evaluation of a link on the SERP as being useful or not
- Web page evaluation: the participant's evaluation of a landing page pointed to by a link on the SERP as being useful or not
- Utterances: the utterances of the participant during the searching process
- Next searching action: the participant's next action during the searching process that would take them off the current SERP

We conducted factorial ANOVA to uncover the potential influences on perceived search engine performance, from search engine brand (Yahoo!, Google, MSN, and No Name), query type (housing, entertainment, travel, and medicine), and the interaction between brand and query type. We chose $p \leq 0.05$ as significant and $0.05 < p \leq 0.10$ as marginally significant. Marginally significant is employed to describe a p-value quite near 0.05 and it potentially becomes significant if it gets a larger sample size.

Results

We administered a pre-evaluation survey, which we have used previously (Jansen & McNeese, 2005) to collect a

TABLE 1. Basis for selection of search engine.

Reason for selecting search engine	Occurrences	Percentage (%)	Explanation of terms
Performance in terms of locating useful results	16	32	Performance: participants' perceptions of how useful or relevant the results were
Interface (i.e., ease of use)	8	16	Interface: participants' perceptions of the usability and appearance of the search engine interface
Speed (i.e., fast)	7	14	Speed: participants' perceptions of how quickly the search engine responds to a query submission
Technology (i.e., searching feature)	7	14	Technology: participants' perceptions of how advanced and helpful the search engine's additional searching features were
Popular	4	8	Popular: participants' perceptions of how widely used the search engine is
Content	2	4	Content: participants' perceptions of the size and type of the search engine's content collection
Habit/don't know	2	4	Habit: users' statements that they use a search engine because they have in the past
Little ads	2	4	Quantity of ads: participants' perceptions that a search engine results page is not cluttered by ads
Company standards	1	2	Company standards: participants' perceptions concerning a search engine company's policy that is not directly related to search
Social networking	1	2	Social networking: users' statements that a search engine was directly recommended to them by someone within their social circle
Total	50	100	

variety of demographic and other information. We asked the participants which search engines they used frequently and why they used these search engines to gauge the level of system familiarity. Concerning search engines used, 31 participants mentioned Google, 10 mentioned Yahoo!, 2 mentioned Dogpile, and one participant each mentioned AltaVista, Naver, and MSN. Participants could list more than one search engine, which is the reason why the total is more than 32.

We asked why the subjects chose the search engines that they did to understand their motivation in evaluating a Web search engine. The researchers then content analyzed the responses, assigning them to non-mutually exclusive categories. The results are displayed in Table 1.

Subjects' responses clustered into 10 categories, with Performance being the number one response, followed by Interface, Speed, and Technology. Popularity of the search engine was also cited as a basis for selection. These reasons have occurred on previous surveys conducted by the researchers. Content Collection, Habit, and Little Advertisements were also mentioned, as in prior studies. Company Standards and Social Networking were new responses that the researchers have not seen in prior surveys. Generally, though it appears that these participants' responses are inline with those from prior work.

We now address our research objectives.

Research Objective 01: The search engine brand has no effect on the number of links examined among the SERPs of the search engines.

Research Hypothesis 01a: *There will be no difference in the number of links examined among the search engines.* Factorial ANOVA test shows that there was a significant difference among the search engines ($p = 0.022$) in the number of links examined during the searching session. Tukey test indicates that Yahoo! had significantly more links examined than Google and MSN. So, this hypothesis is rejected (see Table 2).

Factorial ANOVA test also shows the query type was not a significant factor on the number of all links examined ($p = 0.154$). However, the test shows that the brand and query type interaction was significant ($p = 0.057$). The interaction plot (Figure 2) demonstrates that for the housing query, Google and Yahoo! had more links examined than MSN, and No Name had the least amount of links examined. For the entertainment query, Yahoo! had the largest amount of links examined than the other three brands, with the other three brands having almost the same number of links examined. For the medicine query, No Name had the largest amount of links examined, and Google and Yahoo! had fewer links examined than No Name, but more than MSN. For the travel-related query, Yahoo! had the most links examined, and MSN had the second most. Google and No Name had the least. Overall, except for the medicine-related query, Yahoo! had more links examined and stood out on the entertainment and travel queries. Google had the most links examined on the commerce query. MSN had less links examined than Yahoo! and Google on most queries, except for travel, where it had more links examined than Google.

Figure 3 shows the number of links examined by participants among the different search engines. Overall, the 32 participants examined 395 (21%) of 1,920 links presented during the study. Note that this is *examined* and not necessarily *clicked*. The number of links viewed by participants on Yahoo! was 25% above this average, while MSN and No Name were 11% and 15% below the average. From

TABLE 2. Analysis results on links examined.

Link type	Source of variation	*F*-value	*df*	*P*-value	Tukey HSD			
All	Brand	3.38	3,84	.022**	Yahoo!	A[a]		3.94[b]
	Query	1.79	3,84	.154	Google		B	2.72
	Brand × query	2.14	6,84	.057*	MSN		B	2.63
					No Name	A	B	3.16
Organic	Brand	2.24	3,84	.089**	Yahoo!	A		3.38
	Query	0.73	3,84	.540	Google	A	B	2.72
	Brand × query	1.24	6,84	.292	MSN	A	B	2.50
					No Name		B	2.28
Sponsored	Brand	2.80	3,84	.045**	Yahoo!	A		.56
	Query	8.09	3,84	.000**	Google	A	B	.44
	Brand × query	2.54	6,84	.026**	MSN		B	.13
					No Name	A	B	.44
					Housing	A		.84
					Entertainment		B	.38
					Medicine		B	.19
					Travel		B	.16

[a]Groups connected with same letters are not statistically different.
[b] The last column presents the mean.
*$p < 0.1$ **$p < 0.05$.
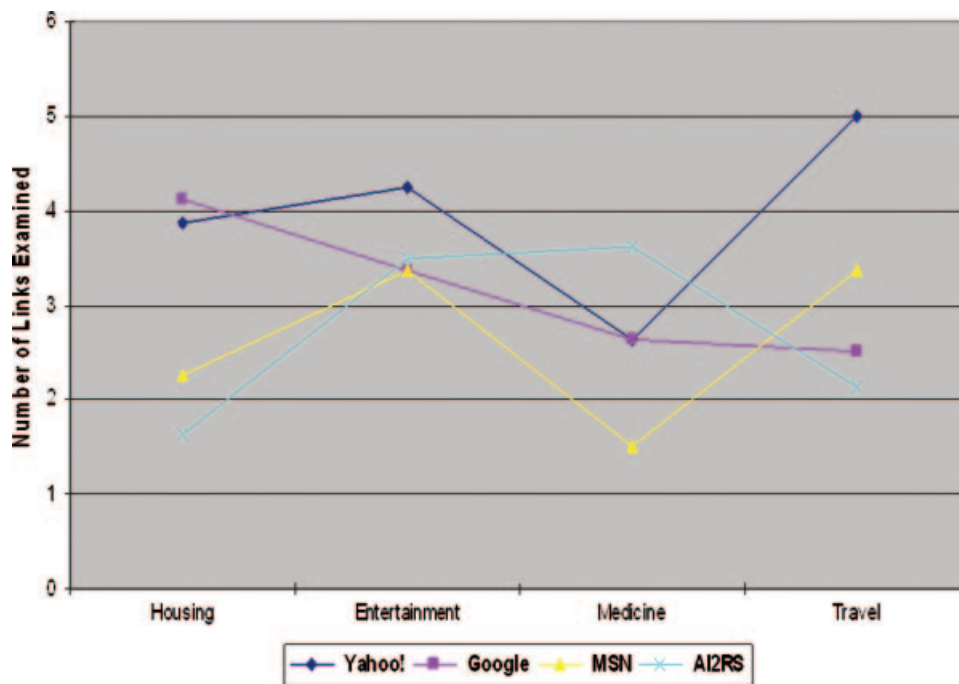
FIG. 2.   Interaction plot on number of links examined for all links.

these results, it appears that when participants were viewing links, they favored the mainstream search engines (Google by about 20% and Yahoo! by about 40%) relative to the non-mainstream search engines. This may be because the participants were more trusting towards the mainstream search engines, Google and Yahoo!.

In terms of behavior, when the participants were searching on the No Name search engine, they were generally more inclined to depart (i.e., reformulate the query, go to another results page, go to another search engine, go to a Web site) the SERP, as shown in Table 3. Again, this may come back to an element of trust.

Figure 4 shows the distribution of links examined by rank for both the non-sponsored and the sponsored links. Note that all sponsored links for this study appeared on the right-hand side of the SERP (i.e., commonly referred to as "east").
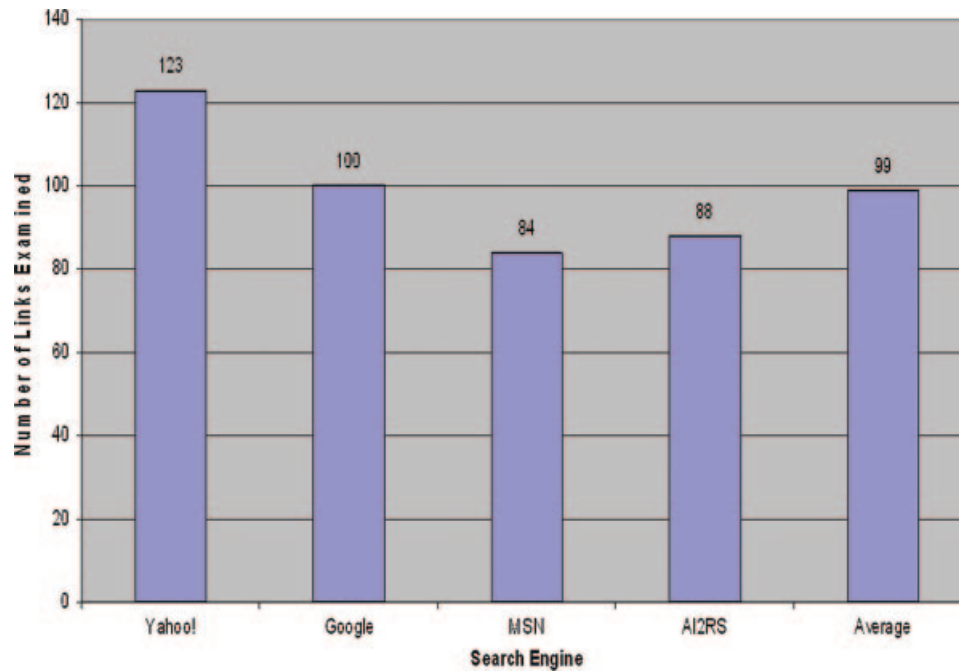
FIG. 3. Number of links examined by participants by search engine.

TABLE 3. Participant actions leading to leaving the SERP.

	No Name (%)	MSN (%)	Google (%)	Yahoo! (%)
Buy product	3	9	6	19
Quit searching	19	38	25	25
Move to another results page	6	16	16	9
Reformat query	**38**	**28**	**31**	**28**
Go to another Web site	**13**	**0**	**3**	**3**
Another search engine	**13**	**3**	**6**	**3**
Go to another info source (offline)	**6**	**6**	**9**	**6**
Other	3	0	3	6
Total	100	100	100	100

There were no sponsored links that appeared at the top of the SERP above the non-sponsored links or at the bottom of the SERP (i.e., commonly referred to as "north" and "south," respectively).

As shown in Figure 4, the distribution of examination is similar to what one typically sees as the distributaries of clicks in log studies (Brooks, 2004a; Brooks, 2004b). Fully 25% of all links examinations were on the top most ranked links. There was an 85% drop from the first to the second rank, followed by another 55% drop in examination from the second- to the third-ranked link. Obviously, these searchers placed a lot of trust in the ranking algorithms of the search engines. If the searcher believes that future links will provide no new information, the searcher might naturally not click on these links. There are a few fluctuations in the click by

rank distribution, of course. One typically sees an up tick at ranks 5 and 6, which are the links usually just above the fold (i.e., an imaginary line that is the bottom of the visible SERP without scrolling), and there is also usually an up tick at rank 9 or 10 (Brooks, 2004a; Brooks, 2004b). Figures 5a and 5b shows the breakdown of link examinations by search engine.

Figure 5 shows the percentages of link examinations by rank among the search engines. We find it interesting that the non-mainstream search engines had a substantially higher percentage of examinations at the top most rank of the non-sponsored links. It seems that there may be interplay between the perception of the search engines and a more generic perception of the search engine ranking. The mainstream search engines had more clicks further down the result listing than the non-mainstream search engines. For marketers, these findings provide interesting information on how to rank in different sponsored search programs as well as to plan their media spending.

All search engines except MSN had an increase in link examinations at the top most sponsored link. However, more than 88% of link examinations were on non-sponsored links, with 12% of link examinations on the sponsored links. We explore these differences further in the next hypotheses.

Research Hypothesis 01b: *There will be no difference in the number of non-sponsored links examined among the search engines.* Factorial ANOVA test shows that there a significantly difference ($p = 0.089$) among all search engines in the number of organic links examined. A Tukey test indicates that Yahoo! had significantly more organic links examined than No Name; Yahoo! had 24% more link examination than Google on average. Google had 9% more links
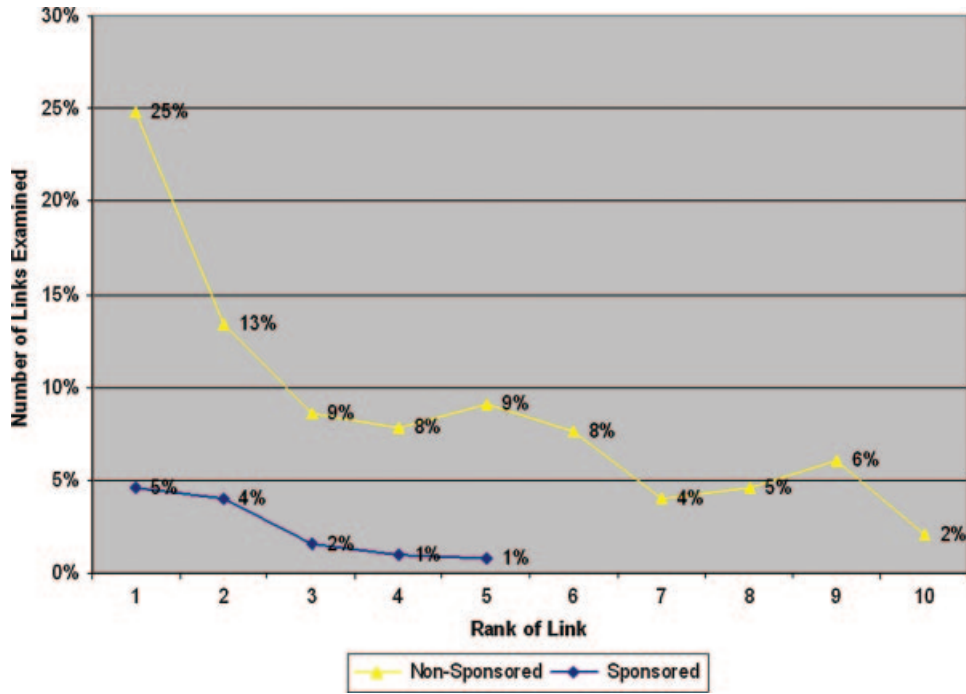
FIG. 4. Distribution of links examined by rank.

examined than MSN; MSN had 10% more links examined than No Name. So, this hypothesis is rejected.

Factorial ANOVA tests did not show any significant effect on query type and brand-query interaction. Brand was the only significant factor.

Research Hypothesis 01c: *There will be no difference in the number of sponsored links examined among the search engines*. Factorial ANOVA testing shows that there was significant differences ($p = 0.045$) among all search engines in the number of sponsored links examined. A Tukey test indicates that Yahoo! had significantly more *sponsored* links examined than MSN. So, this hypothesis is rejected.

Factorial ANOVA test shows that query type was significant factor. There were significantly more sponsored links
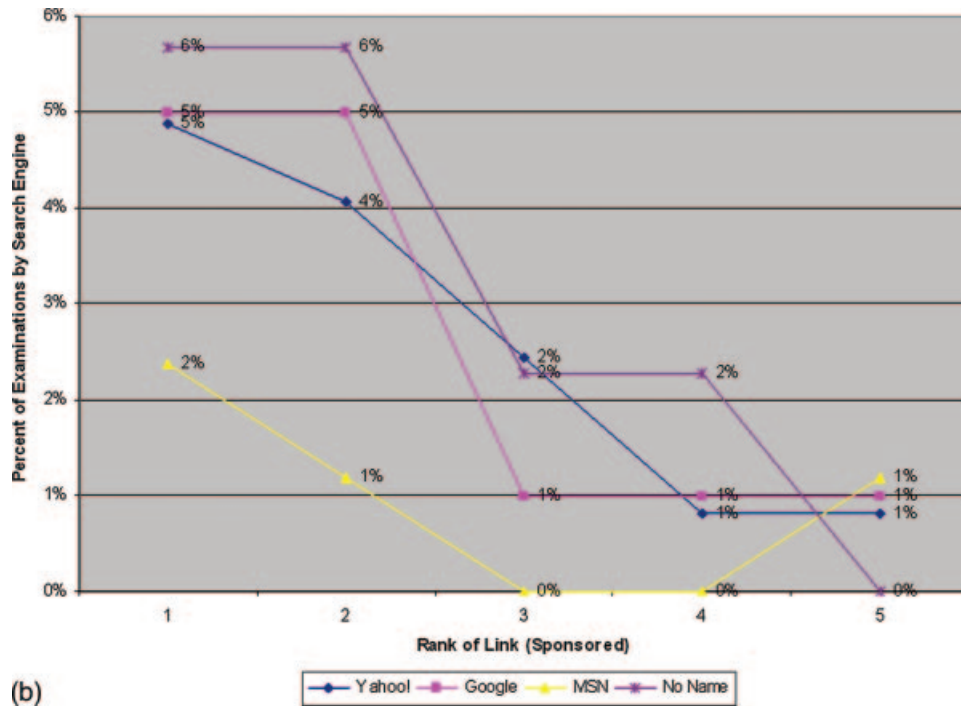

(a)
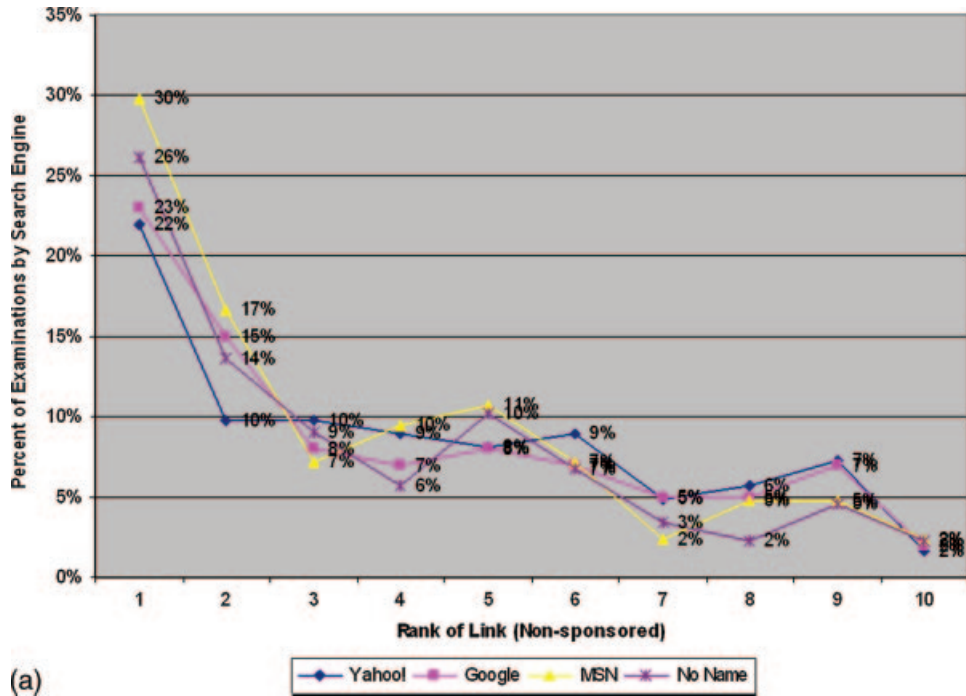
FIG. 5. *Continued*.

FIG. 5. Examination of links by rank for each search engine (non-sponsored and sponsored).
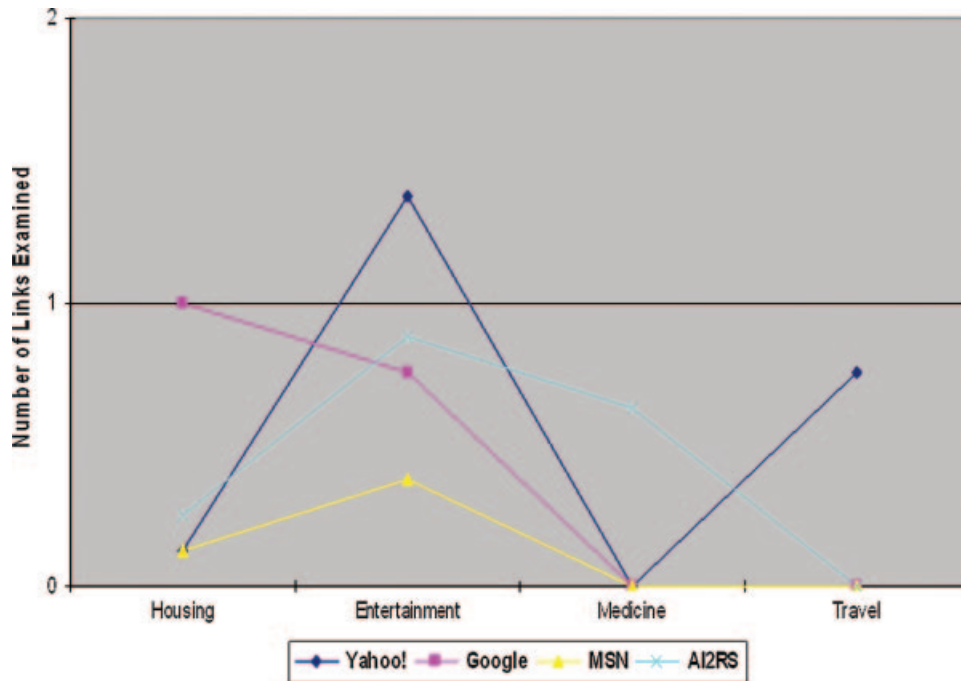

FIG. 6. Interaction plot on number of links examined for sponsored links.

examined on the housing query than the other query types. The test also indicates a significant interaction between brand and query type existed. The interaction plot (Figure 6) discloses that for the housing query, Google's sponsored links were examined more than the other three search engines. For the entertainment query, the rank based on the number of sponsored links examined is Yahoo!, No Name, Google, and MSN. For the medicine query, all the commonly know

search engines had almost 0 sponsored links examination, with only No Name having some sponsored links examined. For the travel-related query, only Yahoo! had examinations on its sponsored links. In all, Google had the most amount of sponsored links examined on the housing query. Yahoo! had the most amount of sponsored links examined on the entertainment query. MSN had the least amount of sponsored link examination on all the queries. No Name's performance
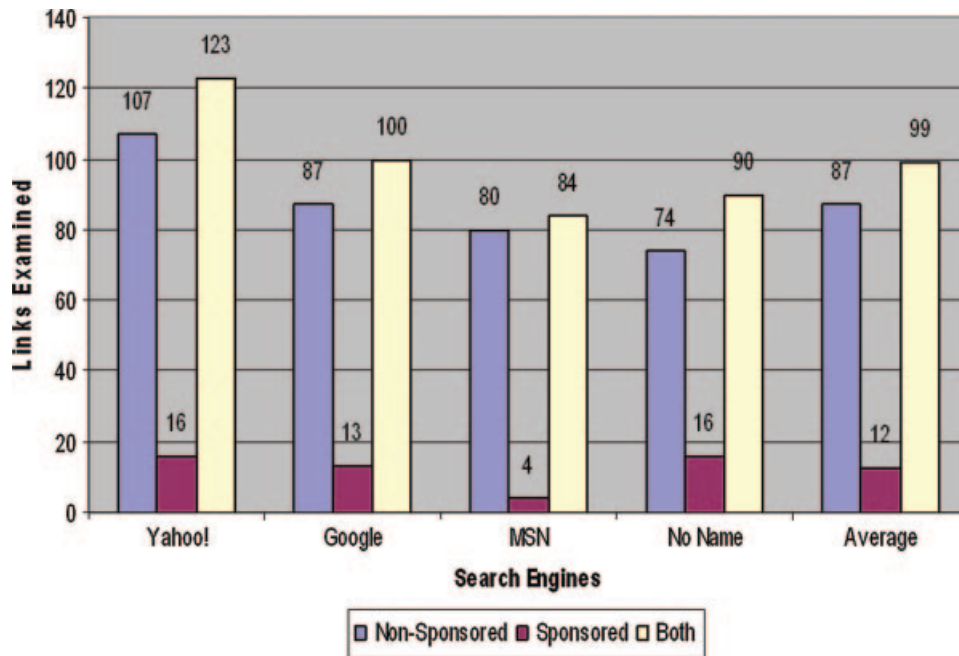
FIG. 7. Distribution of examined links by type and search engine.

TABLE 4. Analysis results on differences between links examined and link clicked.

Link	Source of variation	F-value	df	P-value
All	Brand	1.87	3, 84	0.140
	Query	1.90	3,84	0.136
	Brand × query	0.69	6,84	0.656
Organic	Brand	1.39	3,84	0.252
	Query	1.03	3,84	0.382
	Brand × query	0.33	6,84	0.919
Sponsored	Brand	1.06	3,84	0.370
	Query	1.67	3, 84	0.180
	Brand × query	0.81	6,84	0.566

TABLE 5. Links examined and links clicked by search engine.

Search engine	Links examined	Links clicked	Difference	Percentage[a]
Yahoo!	123 (26%)	85 (18%)	38	30.9
Google	100 (21%)	78 (16%)	22	22.0
MSN	84 (18%)	69 (14%)	15	17.9
No Name	88 (18%)	61 (13%)	27	30.7
Average	99	73	26	25.8

[a] Percentage of links examined and links are based 480 maximum links presented for each search engine.

swung on four queries. When it had more links examined than other brands, the difference was small.

Figure 7 shows the breakdown of non-sponsored and sponsored links examined among the search engines. The distribution of the examined number of non-sponsored links examined is varied. For the sponsored links, the distribution variance is narrower, with the exception of MSN, which had a very low number of sponsored links examined.

Research Objective 02: *There will be no difference in the number of links clicked among the search engines.* In the previous research question, we analyzed the links that the study participants examined. However, not all links examined were clicked on by the participants. Table 4 shows influences on link examination and click from brand and query type. Table 5 shows the spread among search engines between the links examined and the links clicked.

Table 4 shows there was no influence on link examination and click from factors like search engine brand, query type, and their interaction. As one sees from Table 5, there is on average 26% fewer links clicked on than examined. In all cases, when a participant clicked on a link, there was an acknowledgment that the link was either relevant or somewhat relevant.

Research Hypothesis 02a: *There will be no difference in the number of links clicked among search engines.* Factorial ANOVA test shows that brand was a significant factor for the number of links clicked ($p, = 0.045$). Post hoc analysis shows that Yahoo! had significantly more links clicked from MSN. So, this hypothesis is rejected. Referring to Table 6, we see that participants on Yahoo! clicked on 27 percentage points more links than they did on Google, 46% more than MSN and 11% more than No Name.

Factorial ANOVA test indicates that query type was a significant factor ($p = 0.013$). Housing and entertainment queries had significant more links clicked than the travel. The test also shows that brand and query interaction were significant ($p = 0.055$). The interaction plot (Figure 8) shows that

TABLE 6. Analysis results on links clicked.

Link type	Source of variation	F-value	df	P-value	Tukey HSD			
All	Brand	2.79	3,84	.045**	Yahoo!	A		2.75
	Query	3.79	3,84	.013**	Google	A	B	2.16
	Brand × query	2.16	6,84	.055*	MSN		B	1.88
					No Name	A	B	2.47
					Housing	A		2.63
					Entertainment	A		2.63
					Medicine	A	B	2.31
					Travel		B	1.69
Organic	Brand	1.82	3,84	.150				
	Query	1.51	3,84	.219				
	Brand × query	1.37	6,84	.237				
Sponsored	Brand	2.27	3,84	.087*	Yahoo!	A		.38
	Query	12.32	3,84	.000**	Google	A	B	.31
	Brand × query	3.15	6,84	.007**	MSN		B	.09
					No Name	A	B	.22
					Housing	A		.38
					Entertainment	A		.59
					Medicine		B	.00
					Travel		B	.03
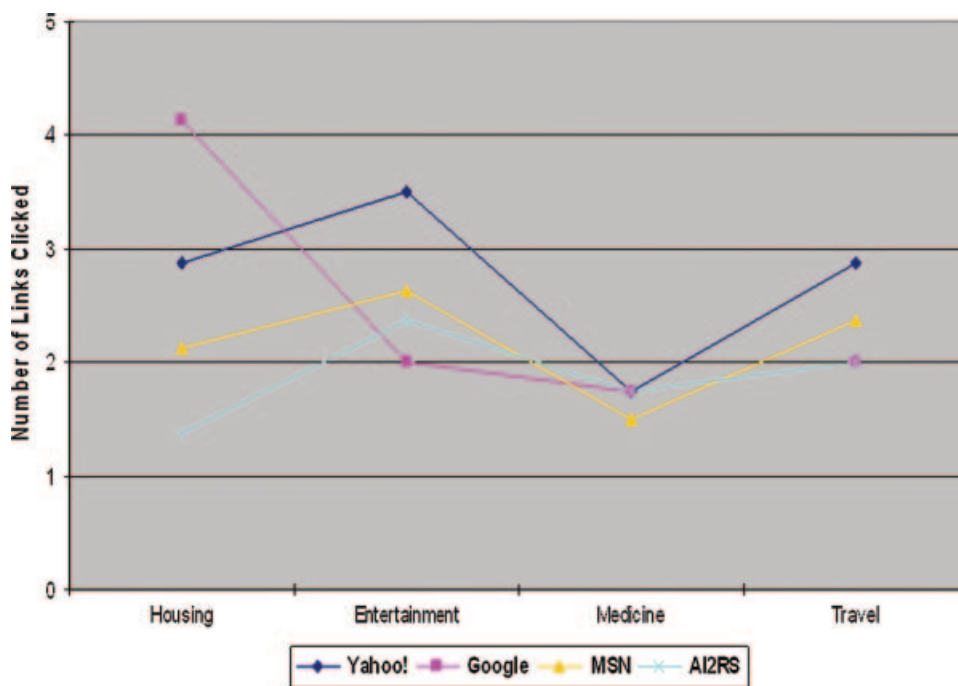
FIG. 8. Interaction plot on number of links clicked for all links.

for housing query, Google had the most links clicked of all, Yahoo! had the second most, MSN had the third most, and No Name had the least number of links clicked. For entertainment, Yahoo! had the most links clicked. Google, MSN, and No Name had similar amount of links clicked, which were less than Yahoo! For the medicine query, all the search engines had almost the same amount of links clicked. For the travel query, Yahoo! had the most clicks. MSN had the second most, and Google and No Name had the least number. However, the difference between these four brands is not big. Overall, Yahoo! had the most clicked on entertainment and travel queries. Google had much more clicks on housing query than the rest three brands. MSN and No Name usually had the least clicks on all the queries.

Research Hypothesis 02b: *There will be no difference in the number of organic links clicked among search*
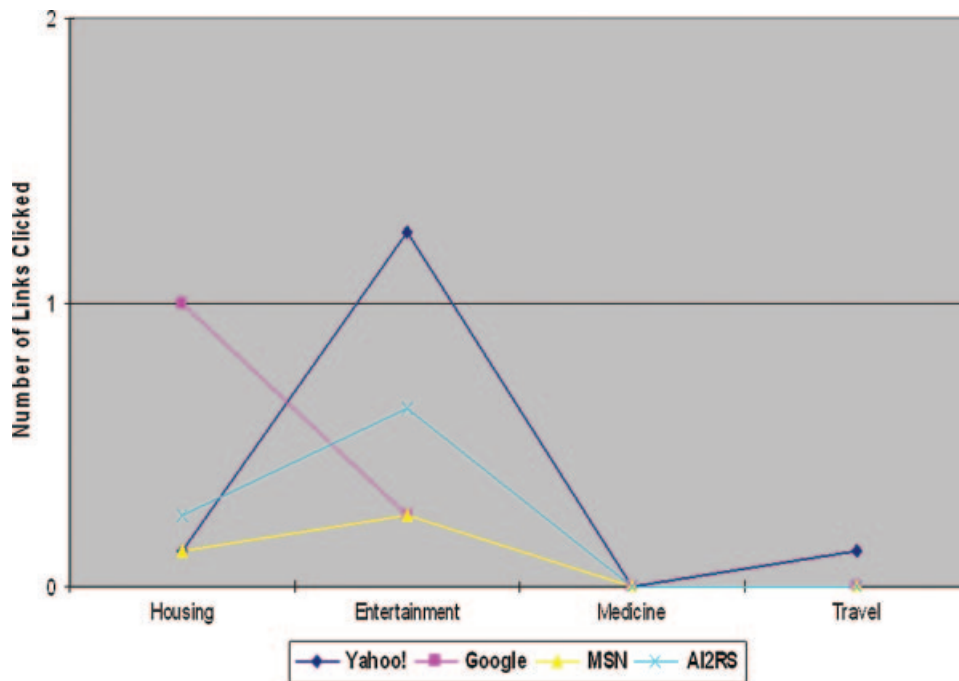
FIG. 9.   Interaction plot on number of links clicked for sponsored links.

engines. This hypothesis is supported. Factorial ANOVA test shows that no significance for main effects and their interaction on the number of organic links clicked.

Research Hypothesis 02c: *There will be no difference in the number of sponsored links clicked among search engines*. This hypothesis is rejected. Factorial ANOVA test shows that there were significant differences between brands on the amount of sponsored links clicked ($p = 0.087$). Tukey test shows that Yahoo! had more sponsored links clicked than MSN.

Factorial ANOVA test indicates that query type was a significant factor ($p = 0.000$). Housing and entertainment queries had significantly more sponsored links clicked than travel and medicine queries. The test also shows that brand and query interaction were significant ($p = 0.007$). The interaction plot (Figure 9) discloses that for the housing query, Google's sponsored links had been examined more than the other three search engines. For the entertainment query, Yahoo! had the most sponsored links clicked. The rest three brands had similar amount of sponsored links clicked, which were less than Yahoo! For medicine and travel queries, all the search engines had almost zero examination of sponsored links. In all, Google had the most amount of sponsored links clicked on the housing query. Yahoo! had the most number of sponsored links clicked on the entertainment query. MSN and No Name had the least amount of clicks on all the queries. The results indicate that different search engines might be more likely used in different contexts, although this would need to be verified with a large sample of queries in a variety of domains. Thus, advertisers need to carefully select the right search engine not only by market share but also by contextual aspects.

Figure 10 shows the distribution of non-sponsored and sponsored links clicked among the search engines. The distribution is similar to that of the examined links with more clicks on the mainstream search engines compared with the non-mainstream engines.

Research Objective 03: *The search engine brand has no effect on the evaluation of links on the SERP among the search engines.*

Research Hypothesis 03a: *There will be no difference in the evaluation of links among search engines*. This hypothesis is rejected. Factorial ANOVA shows that there were significant differences in the evaluation of links among the search engines ($p = 0.071$) (see Table 7). Post hoc analysis indicates that Google had a higher evaluation of all links on the SERP than MSN.

Factorial ANOVA shows query type and interaction between brand and query type were also significant. Housing query search had the highest evaluation. Medicine had the lowest evaluation. Evaluation of links for entertainment and travel queries were in the middle. The interaction plot (Figure 11) shows that for the housing query, Google had the highest SERP rating. Yahoo!, MSN, and No Name had similar SERP ratings, which was lower than Google. For the entertainment query, Yahoo! had the highest SERP rating and the rest three had similar but lower rating. For the medicine query, all of the search engines had similar low ratings, which were even lower than the lowest rating of the rest queries. For the travel-related query, No Name had the highest link evaluation. Google had the second highest rating. MSN and No Name had similarly lowest rating. In all, Google had the best link evaluation on the housing query among all conditions. Yahoo! had the best ratings on the entertainment query. MSN
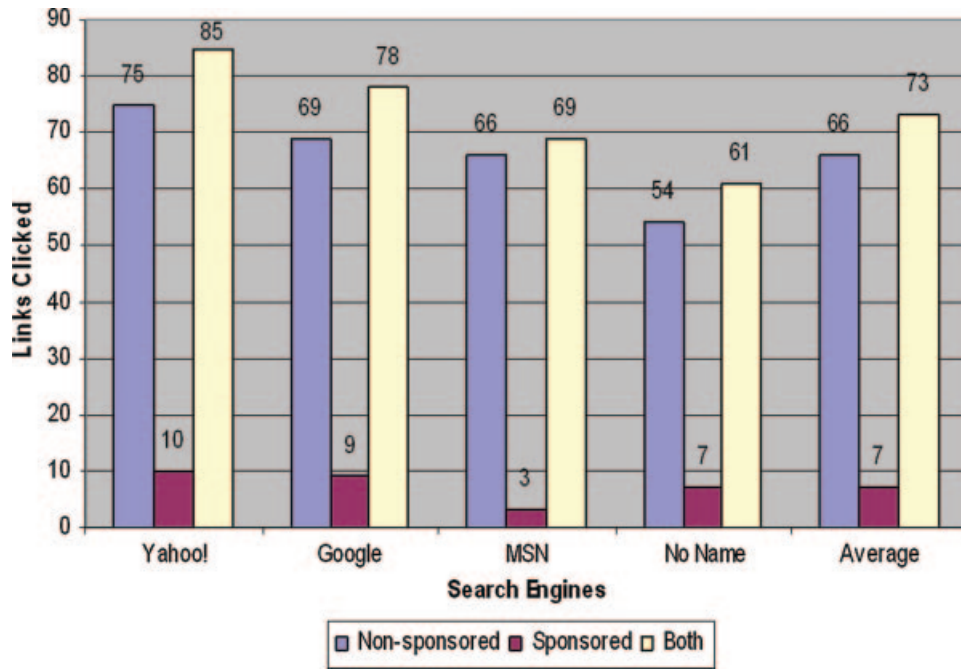
FIG. 10.   Distribution of clicked links by type and search engine.

TABLE 7.   Analysis results on links evaluation.

Link type	Source of variation	F-value	df	P-value	Tukey HSD				
All	Brand	2.428	3,84	.071*	Yahoo!	A	B		.44
	Query	44.87	3,84	.000**	Google	A			.46
	Brand × Query	2.01	6,84	.073*	MSN		B		.39
					No Name	A	B		.44
					Housing	A			.59
					Entertainment		B		.44
					Medicine			C	.25
					Travel		B		.47
Organic	Brand	1.52	3,84	.215					
	Query	31.36	3,84	.000**	Housing	A			.67
	Brand × Query	1.20	6,84	.313	Entertainment		B		.45
					Medicine			C	.35
					Travel	A			.58
Sponsored	Brand	2.49	3,84	.066*	Yahoo!	A			.33
	Query	29.80	3,84	.000**	Google	A	B		.30
	Brand × Query	1.44	6,84	.208	MSN		B		.21
					No Name	A	B		.27
					Housing	A			.42
					Entertainment	A			.42
					Medicine			C	.03
					Travel		B		.24

and No Name had the lowest ratings on all the queries, except the travel query, where MSN still had the worst evaluation, however, No Name had the best rating.

Research Hypothesis 03b: *There will be no difference in the evaluation of organic links among the search engines.* Factorial ANOVA test failed to show any significant effect of brand and brand-query type interaction (see Table 7).

So, this hypothesis is supported. The test only shows query type had significant influence on evaluations of organic links ($p = 0.000$). Housing and travel query results had the best rating. Entertainment had lower ratings. Medicine had the lowest rating.

Research Hypothesis 03c: *There will be no difference in the evaluation of sponsored links during the searching session*
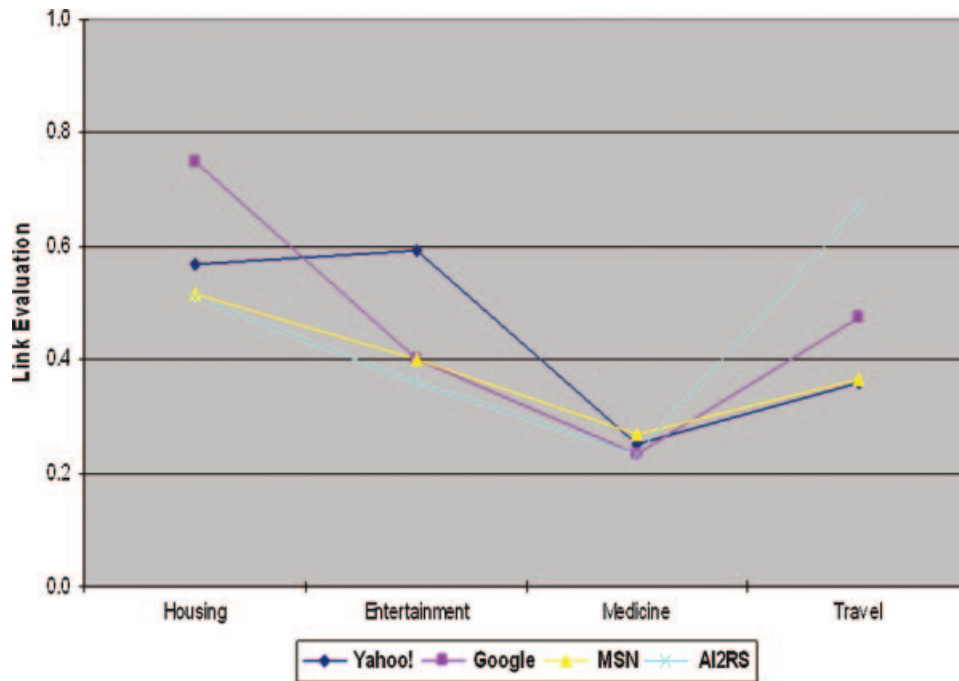
FIG. 11.   Interaction plot on link evaluation for all links.

TABLE 8.   Analysis results on Web page evaluation.

Link type	Source of variation	F-value	df	P-value	Tukey HSD			
All	Brand	.72	3,84	.541				
	Query	1.85	3,84	.144				
	Brand × query	2.47	6,84	.030**				
Organic	Brand	.78	3,84	.511				
	Query	2.81	3,84	.044**	Housing	A		.18
	Brand × query	2.71	6,84	.019**	Entertainment		B	.12
					Medicine	A	B	.15
					Travel	A	B	.16
Sponsored	Brand	.83	3,84	.479				
	Query	6.15	3,84	.001**	Housing	A	B	.04
	Brand × query	.83	6,84	.547	Entertainment	A		.08
					Medicine		B	.00
					Travel		B	.01

among search engines. This hypothesis is rejected. Factorial ANOVA (see Table 7) shows that there was significant difference among brands on sponsored link evaluation ($p = 0.066$). Post hoc analysis shows that Yahoo! had significantly higher sponsored link precision than MSN.

Factorial ANOVA shows query type was also significant ($p = 0.000$). Housing and entertainment queries search had the highest sponsored link evaluation. Medicine had the lowest rating. The evaluation of links for travel queries were in the middle.

Research Objective 04: *The search engine brand has no effect on the evaluation of Web pages linked to off the SERP.*

Research Hypothesis 04a: *There will be no difference in the evaluation of Web pages from all links among search engines.* If the participant visited a Web page during the searching session, we used the relevant score the participant assigned to that page. If the participant did not visit the Web page, we scored this page as not relevant. We failed to reject this hypothesis. Factorial ANOVA (see Table 8) shows no significant influence on the main factors. The interaction between brand and query type is significant. The interaction plot (Figure 12) shows that for housing query, Google had the highest Web page relevance rating. Yahoo! had a little lower relevance rating. MSN and No Name had the lowest Web page evaluation. For the others queries, there was no apparent difference
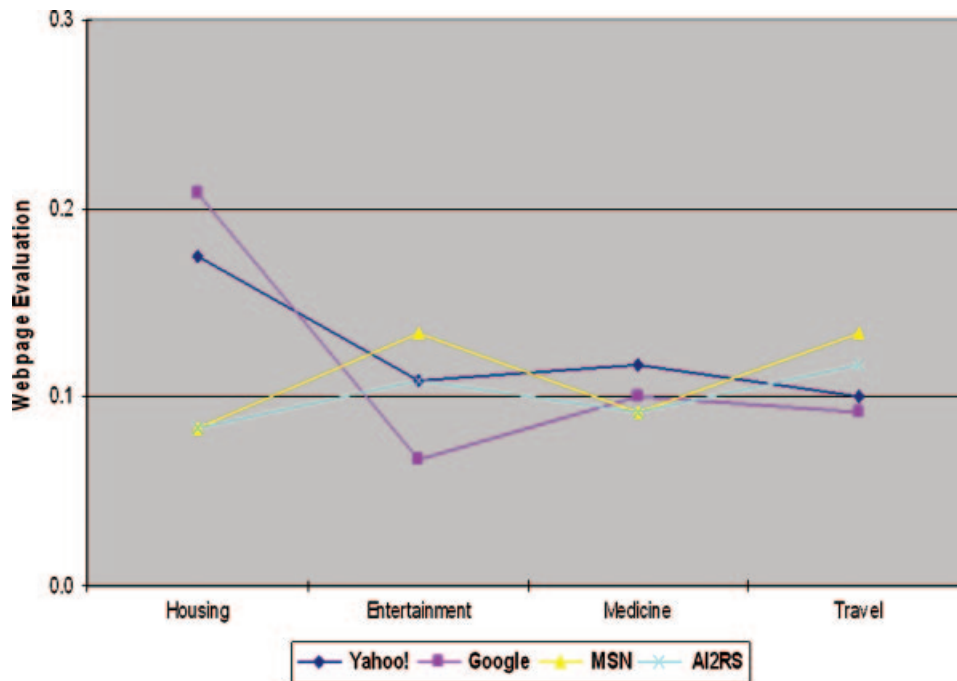
FIG. 12. Interaction plot on Web page evaluation for all links.

among search engines on Web page relevance rating. Overall, Google and Yahoo! had the best evaluation of Web pages from all links on housing query. MSN and No Name had lower Web page evaluation on this query.

Research Hypothesis 04b: *There will be no difference in the evaluation of Web pages from organic links among the search engines*. The hypothesis is supported ($p = 0.511$). Factorial ANOVA (see Table 8) shows query type had significant influence ($p = 0.044$). The Web pages off the housing query SERP were rated significantly more relevant than pages from entertainment query. The interaction between brand and query is also significant ($p = 0.019$) according to factorial ANOVA. The interaction plot (Figure 13) shows that for housing query, Google and Yahoo! had a much higher Web page relevance evaluation than MSN and No Name, both of which had the lowest evaluation rating. For entertainment, MSN had the highest Web page evaluation than the rest three brands. For medicine, all the brands had similar Web page relevance ratings. For travel, MSN and No Name had slightly better Web page relevance evaluations. In all, Google and Yahoo! had the best Web page evaluation on the housing query. MSN had the best Web page evaluation on entertainment and travel queries. No Name was among those having the lowest Web page relevance rating on all of four queries.

Research Hypothesis 04c: *There will be no difference in the evaluation of Web pages from sponsored links among search engines*. We failed to reject this hypothesis. Factorial ANOVA shows no significant influence on brand and its interaction with query type. The test shows the significant influence of query type ($p = 0.001$). The entertainment query has higher rated Web pages from the sponsored links than medicine and travel queries.

Research Objective 05: *What are underlying issues of branding that affect how users evaluate search engines, links, and Web pages?* Our qualitative analyses showed that users were sensitive to branding issues. Most of the participants had comments explicated or related with branding, although it is apparent that branding has multiple and multidimensional meanings. We have identified three underlying branding issues: (a) degree of familiarity or favorite brand, (b) trust issues, and (c) specialty of a brand.

Favorite, *familiarity*, and *popularity* denote positive branding image to users. Mike[1] tried to explain his performance expectations when switching to Google from Yahoo! during the experiment. He said "I am familiar with Google." He responded as though we had just forced him into using a very unfamiliar search engine, and when switching to his favorite one, he could not help but point out the positive position of Google in his mind. He expressed confidence that he would perform "better" by using his familiar search engine. Another participant, Bill, tried to illustrate the reason why Google was his favorite search engine: "Google is a pop culture term and [this] is why Google is so popular." Using Google was like a fashion statement for him. These two participants, and others, show that both the personal (i.e., cognitive) and the group's (i.e., social) favorite (or familiarity with one search engine) are driving forces for people to use it. Three participants clearly brought up that they had never used or heard of our locally developed search engine. Their explicit verbalization showed their concerns over its performance due to their unfamiliarity.

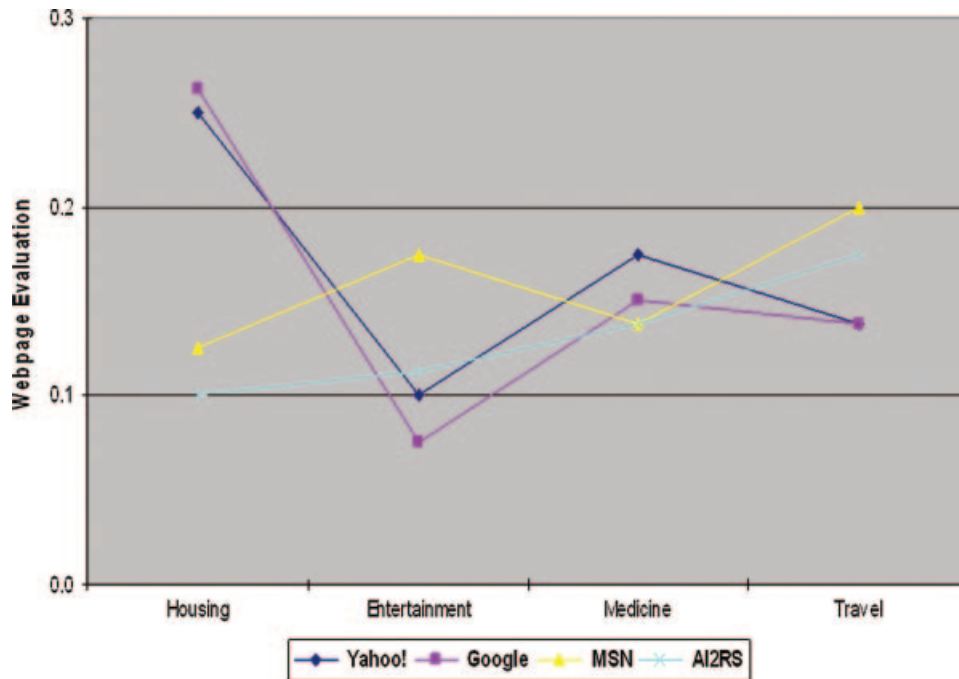[1]Names have been changed for privacy reasons.

FIG. 13.   Interaction plot on Web page evaluation for organic links.

Branding also carries the meaning of trust. When searching for the medical information, Yvonne tried to explain why she checked some links rather than the others on the SERP. She uttered, "Since this is about a health issue, I will look at the good Web sites. I would only go to a doctor or company that I have heard of and trust." The underline reasoning of her utterances is that the doctor or company Web sites that she has heard of before implies to her that the doctor is good and trustworthy. Furthermore, positive branding image means you can trust, which helps moderates any concern.

Along the same lines, most of our participants placed little credit with Amazon and eBay as being trustworthy information sources. Sang Mok said, "Amazon is trying to sell things and cannot be used for finding information." Steve said, "Amazon and eBay are not creditable." Amazon and eBay both have great branding images in the housing domain, and this viewpoint as "retailers" appears to be deeply rooted in people's mind. The negative side of this commercial branding is that people do not believe these firms provide unbiased and useful information. When our participants were searching for camping information in Mexico, there were several results from Amazon and eBay. However, the participants judged all of these results as not relevant to the query, although the links were clearly related to the query with products such as traveling books, camping tools, and such. This negative impression drove users away from these links, although the sites might provide useful or partially useful information.

In addition, branding has an inherent aspect of specialty. When talking about certain tasks, the users would immediately think about these particular Web sites that they associated with certain domains. When seeing the branding elements of these sites, they instantly "knew" what the specialty of the Web site was. Web sites like Amazon and eBay, recognized from the URLs, meant ecommerce. These sites aim to sell commodities but not to fulfill users' information need. With music, the users would immediately think about iTunes or Napster. When participants were asked to search for techno music, they either asked the moderator directly if they could go to iTunes or Napster before searching, or they stated that they planned to go one of these Web sites after searching on the generic purpose search engine. This certainly makes sense to us given that many (if not most) of the participants owned iPods, and Napster is freely available to the students by their university.

On the other hand, specialty has a negative branding image with unfavorable effects that can lead to the loss of users. Phil told us he never goes to AOL because "AOL is inferior to the others in my mind" for searching. This is an interesting comment given that (at the time of the study) AOL did not maintain their in-house search function but rather got search results from Google. So, although the results from a given query are nearly identical between Google and AOL, in the participant's mind AOL was inferior. However, the results between AOL and Google are not exact, so perhaps this difference has some effect.

Overall, the findings from our qualitative analysis supported our findings from the quantitative analysis and added additional insight. The participants had their favorite and familiar search engines, which they generally viewed in a positive manner. The search engines that the participants were less familiar with, they viewed in a negative manner. This may explain why the participants deferred the ranking of the mainstream search engines but were more discerning with the non-mainstream search engines.

Concerning Web sites and underlying Web site sponsors, the participants many times entered the searching session with a preconceived feeling of trust, namely, which Web sites they would trust and which they would not. Many times, this level of trust was expressed at the SERP based solely on the title and URL. There was also a strong view of specialty with some Web site by some of the participants. This perception of specialty affected how or if some of the participants would visit a Web site.

Discussion and Implications

In this experiment, we studied the effect of branding on how users evaluate search engine performance. Regardless of which search engine a participant used for a particular domain, the results for each query were the same. However, there were dramatic differences in how participants rated the performance of each search engine using relevance of retrieval results. Brand was found to have significant influence on number of all links examined, organic links examined, sponsored links examined, all links clicked, and sponsored links clicked. Brand also appeared to have significant effects on all links and sponsored links relevance rating. In addition, brand's effect seemed to have the trend to be significant on organic links clicked and organic links relevance evaluation, given that p values were not severely larger than 0.05. So, brands were shown to have or potentially have significant influence on our first three sets of hypothesis. Again, this significant influence was noted even though all the results were identical both in content and in presentation. The implications of these research findings give empirical weight to the notion that affective and cognitive user perceptions affect user interaction with systems. Therefore, product brand is an important usability variable in system design and evaluations of search engines.

Brand appears to be a big positive for the two mainstream search engines (Google and Yahoo!). Except for all links evaluation where Google had the highest rating, Yahoo! was perceived to have the best performance when brand types were found to be a significant factor. On the housing query, Yahoo! and Google had the best perceived performance when brand and query type interaction was significant. On the entertainment query, Yahoo! had the best perceived performance, except on the fourth set of hypothesis regarding the Web page evaluation, when brand and query type interaction was significant. Yahoo! and Google obviously have a significant marketplace advantage in service branding. We find it interesting to note that these two search engines were the top two favorites among participants. Of the 32 participants 10 were Yahoo! users and 31 users for Google.

It is easy to understand the positive brand image of Google because it is the most commonly used engine for searching. Yahoo!'s positive brand effect may be due to its benefits from brand extensions. For example, Yahoo! Mail was the most used Web-based e-mail service at the time of the study (Konrad, 2007). Yahoo! is continually ranked as one of the most trafficked sites on the Web. The search service may be benefiting from their market leadership and associated brands such as Yahoo! Groups, Yahoo! Mail, Yahoo! Maps, and their market-leading position as a source of entertainment, sports, and news information. Therefore, queries on travel and entertainment played to these strengths. This may help explain why Yahoo! has endured and prospered in a competitive marketplace where so many other search engines (e.g., Excite, Northern Light, and Infosearch) have come and gone.

It appears that lack of a brand was a detrimental factor for the unknown search engine, No Name, with an average precision of 10% below average. No Name had the least amount of organic links examination. MSN is another non-mainstream search engine. It had the least amount of all links examined, sponsored links examined, all links clicked, and sponsored links clicked. It also had the lowest all links evaluation and sponsored links evaluation. The only test in which MSN did not have the last place was on the amount of organic links examination, when brands were significant factors. It had the second to last position but only had 10% better performance than the last one, No Name. What we found very interesting, though, was the searcher behavior when using the non-mainstream search engines (MSN and No Name). Although searchers examined statistically significantly fewer links from these search engines, the results that they examined were of higher quality overall than those examined on the mainstream search engines. This finding seems to point to the fact that searchers place a great deal of trust in the major search engines, relying on the search engine to locate relevant results and trusting their ranking. The deferment to the search engine for finding relevant Web sites causes significantly more clicks off the major search engines. However, these clicked results are an overall lower quality set of Web pages, as many of the Web pages viewed are not relevant. With the non-mainstream search engines, the participants appeared to place less trust in them, thereby becoming more discriminating in selecting links to click on. However, the end result is that the set of examined Web pages is of higher quality.

There is certainly a domain effect on brand performance. The brand and query type interaction were found to be significant on 7 of the 12 hypotheses. There was almost no difference in performance on the medicine query among the brands. On travel-related query, there was almost no difference in performance among brands, except for all links examined and all links evaluation. On the housing query, Yahoo! and Google had the best performance. On the entertainment query, Yahoo! had the best perceived performance, except Web page evaluation. We found it interesting that housing and entertainment were usually the queries in which the search engines had the best performance when query type was found significant. We were not sure why brand did not have strong influence on the medicine and travel queries; maybe it was because our participants were not keen on these topics. This certainly needs to be further investigated.

Based on data from our survey, findings from the laboratory experiment, and prior published work (c.f., Hotchkiss, 2005; Jansen, 2007; Jansen & McNeese, 2005; Jansen &
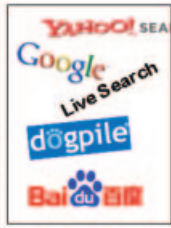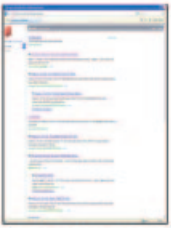
FIG. 14.   Four elements of branding during the Web searching process.

Resnick, 2006), there appears to be a multifaceted branding effect in the Web search process, as illustrated in Figure 14.

- Stage 01: Choice of Search Engine. The first element of branding is the selection of the particular search engine to use based on the user's perception of the marketplace, including the perceived performance of the particular search engine relative to other known search engines. The impact of this first element of branding is that it directs traffic to specific search engines and away from other search engines. With market buzz, habit, familiarity, and word of mouth, certain search engines develop a sizeable marketshare relative to others.
- Stage 02: Evaluation of Search Engine Results Page. The second element of branding is the user's perception of the particular search engine's aggregate SERP once the user is at that search engine. This is determined by the user's view of that particular search engine, its strengths, and shortcomings. This stage of branding affects the number of clicks that the user will make on that search engine for a given query.
- Stage 03: Selection of Individual Link. The third element of branding is the evaluation of the individual links on the SERP of a particular search engine for a given query. This is based on the user's perception of both the particular search engine and the aspects of that particular link (i.e., rank, title, summary, URL) on a given search engine for a particular query. This influences the evaluation of a given link as relevant or not relevant. There is also an element of trust in terms of whether the link is sponsored or not, as shown by (Jansen & Resnick, 2006). Koufaris and Hampton-Sosa (2004) perceived company reputation and willingness to customize products and services can significantly affect initial trust.
- Stage 04: Perception of Web page. The fourth element of branding concerns the Web page itself. Although stages one, two, and three are highly dependent on the overall view of a search engine, this fourth stage of branding appears to depend solely on the Web site itself in terms of content, trust, professional appearance, ease of use, and known brand. There appears to be very little carry over of any search engine brand on the evaluation of the Web sites once the user departs from the search engine. The impact is that once the search engine—any search engine—gets the user to the Web site, the branding of the search engine has little effect on bringing value (i.e., achieving the goal of the Web site with visitor, such as executing a transaction) to the Web site itself.

The implication for Web search engines is clear: marketplace dominance is a multi-stage issue, and it is one that will not be addressed by evolutionary, technological improvements. The brand of the major search engines carries certain worth in terms of performance evaluation, approximately 10%, relative to the marketplace average based on the results from this study. This affects the decision of the user to visit a particular search engine and the evaluation of overall effectiveness of that search engine as measured by the clicks that a user will execute before leaving the SERP. Overcoming this "brand advantage" will take either some revolutionary technological leap where the performance improvement is so apparent that the user cannot ignore it or some external factor that change user behavior.

The brand of a search engine also effects on how the user evaluates individual links. However, this is moderated somewhat by the link snippet itself. The title, the summary, and the URL all affect how users view a particular link. This appears to conform to prior work that examined aspects of the link snippet. Jansen and Resnick (2006) have shown that the title is one determinant of determining relevance, while the title and summary are the biggest determinants of non-relevance for a given link. Hotchkiss (2006) has noted that slight variations in how the individual links are displayed on the SERP can effect user evaluation. Therefore, although

the brand of a search engine may help or hinder, the manner in which the content provider titles the page, presents the URL, and summarizes the landing page also has an effect. In addition, certainly the rank of the link has a major effect. Several studies have shown that the rank at which the search engine chooses to present the link has a major effect on user evaluation of that link (Brooks, 2004a; Brooks, 2004b). This bias of trusting the search engine is apparent even when the ordering of links has been altered to place possibly less useful links higher in the results listing (Pan et al., 2007).

Finally, the implications for Web site designers and content providers are clear. It does not matter what search engine sends a Web site the traffic. Once the user leaves the search engine, the branding aspects of the Web site take over. The relevance of the content to the user's query or information need, the user's perceived professionalism of the page, the user trust in the site, along with other factors such as load time, all affect the user's positive or negative view of the Web site brand. Therefore, once the user is at the Web site, the onus is on the content providers to convert the visit into providing value.

This research has limitations. These findings are from a convenience sample, so a larger sample representative of the Web population would be a good replication of our study. However, we find it interesting that in studies with convenient samples (Hotchkiss, 2006; Jansen, 2005) and those with more rigorous sampling methods (Hargittai, 2002; Madden & Rainie, 2003), the results are similar. These similarities in findings point to overall principles or constructs of interaction at work in Web search that transcend specific demographics. Also, the study utilized a small number of queries, so a follow-up study with a larger set of even more diverse queries would be interesting in that we would have more in-depth exploration on the topical informational differences in interaction of the branding aspect among the search engines.

There are numerous strengths of the research. This is one of the first studies to investigate the effect of brand on evaluation of search engine performance. The content and the presentation of the search engine results links were rigorously controlled. The sample used was from a targeted demographic of young search engine users. Finally, the queries were from the ecommerce domain, an important area for search engine advertising. Overall, the research findings provide relevant results for several segments of the Web searching marketplace.

Conclusion

In this research, we investigated the effect of branding on the evaluation of the system performance of Web search engines. Study findings show that brands as a perception of a product have a dramatic effect on user's evaluation of system results. The brand of the major search engines has a measurable positive effect. Future research involves in-depth quantitative and qualitative analysis of experimental data, a series of experiment to tease apart the nuanced

relationship between perception of system performance and product brand, and how to incorporate branding into the system design process. We would also like to evaluate all four stages of the branding process to see the particular attributes that determine brand loyalty in Web searching. Finally, an interesting follow-up study would include exploring other query topics having an interaction effect with the search engine brand and the view of system performance. We will address this in the area of future research.

Acknowledgements

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Appendix A

Pre-Search Survey Used in User Study

Please, answer the following:

- Name
- Age
- Gender
- Are you a work-study?
- What is your experience using search engine?
- In a given day, how often do you use a search engine?
- In a given week, how often do you use a search engine?
- What do you normally search for on the Web?
- What do you sometimes search for on the Web?
- When using a search engine, how many topics do you usually search for per usage?
- Do you usually find what you are looking for?
- Why do you think this is?
- Which search engine(s) do you use most frequently?
- Why these?
- What search engine feature do you regularly use?
- What search engine feature do you sometimes use?
- What search engine do you think is best?
- Why do you think this search engine is the best?
- When searching, how many terms are in your typical query?
- How many results do you usually look at per query?
- What do you do then?
- When using a search engine and you find a document you think useful, do you normally
- Rate you skill in using a search engine (novice to expert)

Appendix B

Searching Scenarios Used in User Study

You will be doing four searching tasks using four search engines. Three are fairly well known (Google, MSN, and Yahoo!); the other one, AI2RS, is a new search engine.

Queries

Task 1: techno music

You just heard a cool new song walking downtown. A passerby told you it was techno music. You just love the stuff. You are now looking for some techno music Web sites where you can download techno songs either for free or for a minimal price.

You go to this search engine, type in techno music, and this results page appears. Continue the search.

Task 2: manufactured home

You have saved up some cash and want a house of your own. Because you don't have a lot of money, you are looking to purchase a manufactured home. You do not have any idea of the cost or the issues. So, you are looking for information for a possible later purchase.

You go to this search engine, type in manufactured home, and this results page appears. Continue the search.

Task 3: laser removal

In your younger, wild days, you got a rather large tattoo on the small of your back. Your tastes and lifestyle have changed,

so you would now like to get the tattoo removed. You're looking for information on the risks of laser removal and if the procedure is painful.

You go to this search engine, type in laser removal, and this results page appears. Continue the search.

Task 4: camping Mexico
You have been working hard and need a break. You and your special friend are planning a week-long camping trip. You are considering going to Mexico, so you want to find out about some information about camping in Mexico, such as camp ground availability, prices, safety, costs, and packing list.

You go to this search engine, type in camping mexico, and this results page appears. Continue the search.

Appendix C

Coding Sheet for Branding Study—32 Participants

1. Branding
   Branding-favorite or familiar Web site
   Branding-unknown search engine
   Branding-trust
   Branding-mistrust
   Branding-Amazon: selling
   Branding-eBay: selling
   Branding-Napster: Music
   Branding-iTune: Music
   Branding-Google
   Branding-Yahoo
   Branding-AOL
   Branding-Webophia

2. Search Engine Result Page Browsing
   Browsing technique-compare the result list and then open the link
   Browsing technique-compare the results in front of the result list and then open the link
   Browsing technique-open the link by order
   Browsing technique-randomly open the link
   Browsing technique-open the organic links and then the sponsored links
   Browsing technique-open the sponsored links and then the organic links
   Browsing technique-open the link in the new window
   Browsing technique-open the link in the same window as the result page and use "Back" to it
   Browsing technique-stop if getting the information
   Browsing technique-stop until getting certain amount of information

3. Relevance
   Relevance judgment techniques:
   Relevance judgment techniques-first page

Relevance judgment techniques-first link
Relevance judgment techniques-top organic links
Relevance judgment techniques-title
Relevance judgment techniques-snippet
Relevance judgment techniques-URL
Relevance judgment techniques-URL-from a legitimate source
Relevance judgment techniques-URL-from a specialized source
Relevance judgment techniques-search in the Web site

Relevant:
Relevant-geographically
Relevant-timely
Relevant-appearance of keywords in title
Relevant-appearance of keywords in snippet
Relevant-appearance of keywords in the Web site
Relevant-language (in English or some other known foreign language)
Relevant-words in upper case
Relevant-indented results
Relevant-granularity of information
Relevant-unbiased information
Relevant-information about contact methods of offline resources

4. Web site Exploration
   Fully explore the Web site
   Scan the Web site
   Explore the first page of the Web site

5. Next Action
   Next search engine result page
   Further search:
   Further search-query modification on the same topic
   Further search-further search on some relevant topic
   Go for offline information sources
   Information preservation:
   Information preservation-write down
   Information preservation-add to "Favorites"

6. Interface Design

7. Time Management

8. Sponsored Links
   Sponsored links-advertisement
   Sponsored links-sales Web site
   Sponsored links-need to register
   Sponsored links-cost money
   Sponsored links-quality of information-low
   Sponsored links-quality of information-high
   Sponsored links-ignorant intentionally
   Sponsored links-ignorant unintentionally
   Sponsored links-irrelevant
   Sponsored links-unfamiliar
   Sponsored links-mistrust
   Sponsored links-position on the interface
   Sponsored links-do use