

# A Day without a Search Engine: An Experimental Study of Online and Offline Searches\*

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## Abstract

With the advent of the Web and search engines, online searching has become a common method for obtaining information. Given this popularity, the question arises as to how much time people save by using search engines for their information needs, and the extent to which online search affects search experiences and outcomes. Using a random sample of queries from a major search engine and a sample of reference questions from the Internet Public Library (IPL), we conduct a real-effort experiment to compare online and offline search experiences and outcomes. We find that participants are significantly more likely to find an answer on the Web, compared to offline searching. Restricting to the set of questions in which participants find answers in both treatments, a Web search takes on average 7 (9) minutes, whereas the corresponding offline search takes 22 (19) minutes for a search-engine (IPL) question. While library sources are judged to be significantly more trustworthy and authoritative than the corresponding Web sources, Web sources are judged to be significantly more relevant. Balancing all factors, the overall source quality is not significantly different between the two treatments for search-engine questions. However, for IPL questions, non-Web sources are judged to have significantly higher overall quality than the corresponding Web sources. Lastly, post-search questionnaires reveal that participants find online searching more enjoyable than offline searching.

Keywords: search, productivity, experiment

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# 1 Introduction

People search for information on a daily basis, for various purposes: for help with job-related tasks or schoolwork, to gather information for making purchasing decisions, or just for fun. Searching is the second most common online activity after email. On a typical day 49% percent of Internet users are searching the Internet using a search engine (Fallows 2008). In December 2010 alone, Americans conducted 18.2 billion searches (comScore 2011). Web searching is an easy and convenient way to find information. However, one concern is the quality of the information obtained by those searches. Web searches provide searchers with almost instantaneous access to millions of search results, but the quality of the information linked to by these search results is uneven. Some of this information may be inaccurate, or come from untrustworthy sources. While a searcher may save time by searching online, this time-saving may come at the expense of information quality.

Researchers in information science and communication have examined the interplay of accessibility and quality when examining information source selection. Accessibility refers to “the ease with which information seekers can reach an information source to acquire information” (Yuan and Lu 2011), while quality refers to the accuracy, relevance, and credibility of information. In their summary of the research on information source selection, Yuan and Lu (2011) find a mixed picture. Some researchers found that accessibility was favored over quality, while others found the opposite.

To address this issue of quality versus convenience, we explore two related questions: (1) how much time is saved by searching online? and (2) is time saved at the expense of quality? Time-saving ability has been identified as one aspect of accessibility (Hardy 1982), but the time-saving from using one information source instead of another has not been quantified. The second research question examines whether there is a tradeoff of time saving and information quality. That is, does choosing a more accessible (i.e., time-saving) way to find information necessarily result in a loss of information quality?

In this paper, we present a real effort experiment which compares the processes and outcomes of Web searches in comparison with more traditional information searches using non-Web resources. Our search queries and questions come from two different sources. First, we obtain a random sample of queries from a major search engine, which reflects the spectrum of information users seek online. As these queries might be biased towards searches more suitable for the Web, we also use a set of real reference questions users sent to librarians in the Internet Public Library (<http://www.ipl.org>). Founded in 1995 at the University of Michigan School of Information, the main mission of the Internet Public Library (IPL) was to bridge the digital divide, i.e., to serve populations not proficient in information technology and lacking good local libraries.<sup>1</sup> Towards this end, the IPL provides two major services: a subject-classified and annotated collection of materials and links on a wide range of topics, and question-answering reference service by live reference experts. Thus, we expect that the IPL questions came from users who could not find answers from online searches. Compared to queries from the major search engine, we expect the IPL questions to be biased in favor of offline searches. In sum, a combination of queries from the major search engine and IPL questions enables us to obtain a more balanced picture comparing Web and non-Web search technologies.

Using queries from the search engine and questions from the IPL, we evaluate the amount of time participants spend when they use a search engine versus when they use an academic library

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<sup>1</sup>Dozens of articles have been written about the IPL (McCrea 2004). Additionally, the IPL has received many awards, including the 2010 Best Free Reference Web Sites award from the Reference and User Services Association.

without access to Web resources; differences in information quality across the two resources and differences in affective experiences between online and offline searches. In our study, we include two treatments, a Web and a non-Web treatment. In the Web treatment, participants can use search engines and other Web resources to search for the answers. In the non-Web treatment, participants use the library without access to the Web. We then measure and compare the search time, source quality and affective experience in each of the treatments.

While this paper employs a real effort task, which has become increasingly popular in experimental economics (Carpenter, Matthews and Schirm 2010), our main contributions are twofold. First, we present an alternative method to measure the effects of different search technologies on individual search productivity in everyday life. Our experimental method complements the empirical IO approach using census and observational data (Baily, Hulten and Campbell 1992). Furthermore, our study complements previous findings on the impact of IT on productivity. While previous studies have examined the impact of IT on worker productivity (Grohowski, McGoff, Vogel, Martz and Nunamaker 1990) or on the productivity of the firm as a whole (Brynjolfsson and Hitt 1996) in specific domain areas or industries, our study presents the first evaluation of productivity change in general online searches. As such, our results are used to assess the value of search technologies in a recent McKinsey Quarterly Report (Bughin *et al.* 2011). Second, we introduce experimental techniques from the field of interactive information retrieval (IIR) in the design of search experiments and the evaluation of text data, both of which are expected to play an increasingly important role in experimental economics (Brandts and Cooper 2007, Chen, Ho and Kim 2010).

## 2 Experimental Design

Our experimental design draws from methods in both interactive information retrieval and experimental economics. Our experiment consists of four stages. First, search queries obtained from a major search engine are classified into four categories by trained raters. This process enables us to eliminate queries which locate a website or ask for web-specific resources, which are not suitable for comparisons between online and offline searches. We also eliminate non-English language queries or queries locating adult material. Similarly, IPL questions are classified into four categories by trained raters. Second, we ask the raters to convert the remaining queries into questions and provide an answer rubric for each question. As IPL questions do not need conversion, we ask the raters to provide answer rubrics for each classified question. In the third stage, using the questions generated in the second stage, a total of 332 subjects participate in either the Web or non-Web treatment, randomly assigned as a searcher or an observer in each experimental session. Each searcher is assigned five questions, with incentivized payment based on search results. Lastly, answer quality is determined by trained raters, again using incentivized payment schemes. We next explain each of the four stages.

### 2.1 Query and Question Classification

To directly compare online and offline search outcomes and experiences, we need a set of search tasks that apply to both online and offline searches. To achieve this goal, we obtained queries and questions from two different sources.

Our first source is a random sample of 2515 queries from a major search engine, pulled from

the United States on May 6, 2009. As each query is equally likely to be chosen, popular search terms are more likely to be selected. This implies that searches more suitable for a Web search are more likely to be in our sample. After eliminating duplicates, we ended up with a total number of 600 unique queries to be classified. Query classification was completed by three raters, who were two graduate students of the School of Information (SI), majoring in Information Science and one undergraduate student, all from the University of Michigan.<sup>2</sup> In particular, the two graduate students were recruited from the pool of students who took either SI 665 (Online Searching and Databases) or SI 666 (Organization of Information Resources), each of which offers students a variety of skills and knowledge regarding information searches. In SI 665, students are exposed to and learn how to search in a number of subscription databases such as LexisNexis and Dialog. In SI 666, students learn how to classify and categorize various types of information resources according to existing information organization schemas, including Library of Congress Subject Headings and metadata standards for electronic data. In both courses, the relationship between search query terms and the information sought through those query terms is a key underlying concept, reinforced through course materials and assignments. Thus, we consider the students trained in these courses as semi-professionals.

These 600 unique queries were placed into four query categories by the three trained raters: Factual (105), Source (251), Web (200), and Other (44). Query categories were based on taxonomies of web queries proposed in the information retrieval literature (Broder 2002, Rose and Levinson 2004). The intent of a Factual query is to obtain a brief factual answer to a question, e.g., “airports serving sonoma,” while the intent of a Source query is to obtain a list of sources that can help answer the question, e.g., “alexander graham bell.” The Source category also includes searching to find out more information on a topic, such as subject searching. The intent of a Web query is to locate a particular website, or obtain a resource on the Web, such as downloading a file. Specifically, this category includes navigational searching (searches for a particular website, including one the searcher believes exists), e.g., “facebook,” and transactional searching (searches to locate a website with the goal of carrying out transactions on that site, such as purchasing a product, executing an online application, or downloading files), e.g., “yahoo mail.” Lastly, a query for which the intent does not match any of the three categories mentioned above, or cannot be ascertained, is classified as Other. Examples include “test.” Queries in languages other than English, and queries for adult material, are also placed in this category.

The query classification was conducted in two steps. First, we provided each rater with instructions and 600 queries, which each rater classified independently based on the given criteria. A facilitator compiled all the classified queries and reviewed the classification results. In reviewing the classification results, the facilitator used a majority rule to decide the classification of queries when all the raters failed to reach a consensus. After the review, we had 536 queries which were completely classified and 65 queries which all the raters classified differently. In the second step, the raters and the facilitator gathered to discuss the classification results of the 65 queries which showed disagreement among the three raters. The facilitator was present to promote their discussion. For each query, the three raters exchanged their opinions regarding the rationale for their classification, and arrived at a consensus classification by agreeing together or using the majority rule if necessary.

After completing the classification of 600 queries, we removed the queries which were classi-

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<sup>2</sup>The use of three raters follows the evaluation methodology from the Text REtrieval Conference (TREC), a workshop hosted by the U.S. National Institute of Standards and Technology that has been a source of evaluation methods and protocols for researchers in interactive information retrieval (Voorhees and Harman 2005).

fied as either Web (200) or Other (44), as they were considered inappropriate for conversion into search questions for use in both Web and Non-Web conditions. Consequently, the total number of queries which could be converted into search questions was 356,<sup>3</sup> with 105 being Factual and 251 being Source.

To address the potential sample selection bias from queries obtained from the major search engine, we use 110 real reference questions obtained from the Internet Public Library question-answering database. These questions were sent to the IPL between 2003 and 2008, many of which came from reference librarians, who handled patron questions in local libraries.<sup>4</sup> From this sample, we select questions which were answered within an hour by IPL volunteers. These questions came from users who could not find answers from simple online searches or who did not have access to the Internet, so they sent their questions to a librarian working for a local library who forwarded them to the IPL, or sent their questions directly to the IPL. Thus, these questions should be biased in favor of offline search. Combining the two sources of questions should lead to less biased results.

Again, question classification was completed by three raters, who were graduate students of the School of Information, majoring in Information Science. Following a similar two-step procedure as in query classifications, the raters had 108 questions completely classified and two questions which all the raters classified differently.<sup>5</sup>

In the second step, the raters and the facilitator gathered to discuss the classification results of the two questions which showed disagreement among the three raters and questions that the raters indicated a need for edits. For each question which showed disagreement among the raters, the three raters exchanged their opinions regarding the rationale for their classification, and arrived at a consensus classification or a classification based on majority rule if necessary. For each question which required edits, the three raters exchanged their opinions regarding how to edit it, and arrived at a consensus rephrasing. Then, the facilitator recorded the rephrased question. As a result, 48 questions were rephrased. Questions were rephrased if they include effort-related words, IPL-related words, redundant or unnecessary words, Web or online-specific words, outdated information, or ambiguous words. Consequently, 110 questions were classified into 47 Factual questions and 63 Source questions. A complete list of the questions are provided in Appendix F.

## 2.2 Question and Answer Rubric Generation

We next converted the 356 queries from the search engine into questions for use in our experiment. An important aspect of IIR experiments with human searchers is the provision of realistic search tasks (Borlund and Ingwersen 1997). Thus, the goal of question generation was to generate realistic search tasks that could be used in both of the experiment treatments, Web and non-Web search. Three SI graduate students were responsible for this task. All of the raters were selected among students who had taken either SI 665 (Online Searching and Database) or SI 666 (Organization of Information Resources). For each query, we asked the raters to generate a question and an answer rubric to evaluate the quality of answers provided by our subjects. We provided the raters with

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<sup>3</sup>The 356 unique queries correspond to 1420 if we include duplicates.

<sup>4</sup>We thank Maurita Holland for giving us access to the Internet Public Library database. The IPL maintains a complete data archive of the questions and answers provided. From Fall 2003 on, each volunteer was asked to write down the actual amount of time it took to answer a question, which was the main reason we select our questions from the database from Fall 2003 onwards. We do not have access to the questions sent to the IPL after 2009.

<sup>5</sup>Note that, while 200 out of 600 queries from the search engine are classified as Web, only 1 out of the 108 IPL questions is classified as Web.

instructions for question generation, as well as examples for additional clarification. To make sure that our instructions made sense to all the raters and were interpreted consistently, we first asked each rater to generate a sample of ten questions and answers, which were reviewed by one of the authors who provided a feedback summary to all raters. Then, each rater was assigned a similar number of queries for generating question and answer rubrics.

For example, the question “What are some features of the Zurn Z86500 faucet?” is generated from the query “zurn faucet Z86500.” In another example, from the query “Wolverine Movie Quotes Wade,” we generate the question “What are some quotes from the movie Wolverine that can be attributed to Wade Wilson?”

During the question generation process, we emphasized to the raters to include both Web and non-Web options in developing the answer rubric, and to make clear from the question wording whether it was a Factual or Source type question. After compiling the questions generated by the three raters, an undergraduate research assistant reviewed the questions to make sure that each question was intelligible, and one of the authors reviewed the answer rubrics. In reviewing question and answer rubrics, reviewers could correct typos, as well as change the original classification of a query, if necessary. During the review process, the following types of questions were discarded: questions about obtaining computer game cheat codes, software registration or activation codes, uploading/downloading files, and seeking information about individuals who are not public figures. Questions with no answer and questions generated from undecipherable queries were also removed from our question pool. As a result, we had a set of 330 questions to be used for our online and offline search treatments. Of these, 25 queries were used for pilot sessions to test the experimental instructions and protocols, while 305 were used for the formal experimental treatments.

For each of the 110 IPL questions, we follow a similar process to generate answer rubrics. Raters who classified the questions were asked to generate answer rubrics. Each rater was assigned a similar number of questions for generating answer rubrics. Questions were assigned such that each question had two answers generated by two different raters.

## 2.3 Experimental Procedure

In our experiment, we use a two-treatment between-subject design, including a Web search treatment and a non-Web search treatment. Each subject participates in only one session. Each search session has a maximum of three hours to avoid potential fatigue. Subjects in each session first complete a pre-experiment survey (Appendix A), participate in the search experiment, and then finish with a post-experiment survey (Appendix D). A total of 332 subjects participated in our experiment.

The non-Web sessions were conducted at the Hatcher Graduate Library at the University of Michigan. Each session consists of 10-18 subjects, half of whom are randomly assigned as searchers and the other half as observers. Subjects are paired into searcher-observer pairs. After experimental instructions are read aloud, each observer in the searcher-observer pair receives five questions and observation forms. The observer then hands the searcher one question. Each searcher-observer pair proceeds to the reference room or library stacks to search for answers to these questions. A searcher logs his or her own search, including call numbers and information in the materials examined, while an observer logs observations of the searcher’s actions. After the completion of each search, the searcher completes a post-search questionnaire (Appendix C)<sup>6</sup> on

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<sup>6</sup>Questions on the affective aspects of the search process are derived from White, Jose and Ruthven (2003).

specific aspects of her search. The observer hands the searcher the next question when this is completed. A searcher can consult the reference librarian up to two times during a session. Instructions for the non-Web treatment is included in Appendix B-1.

The Web search sessions were conducted at the Behavioral and Experimental Economics Lab at the University of Michigan. Each experimental session consists of 8-20 participants, again randomly matched into searcher-observer pairs. Each searcher is assigned five questions, and can use search engines or other resources on the Web to search for answers. Observers again log the time and search activities. However, unlike the non-Web treatment, we use Morae to record the precise mouse movements and clicks of each searcher. Even though observers are technically not needed, we include them so that the process is comparable across the two treatments. The Morae data also enable us to evaluate the accuracy of the observer logs. Instructions for the Web treatment are included in Appendix B-2.

After completing the search tasks, all subjects record their search results and process on a computer, and fill out a demographics and post-experiment survey.

Both searchers and observers receive \$5 for showing up. Additionally, a searcher receives one point for each question answered, and one point for the quality of the answer, for a total of up to two points for each answer. An experimenter evaluates answers based on the rubric provided by our research assistants during the question generation process. The conversion rate is 1 point = \$2. An observer receives a flat fee of \$10 per hour. The average payment is \$22.42 for searchers (\$22.15 for non-Web and \$22.69 for Web treatments), and \$25.85 for observers (\$31.51 for non-Web and \$20.29 for Web treatments).

## 2.4 Rating Procedure for Answer Quality

Out of 305 (110) questions from the search engine (IPL) used for the formal experimental treatments, 275 (96) questions received answers in both the non-Web and Web treatments. To evaluate the source quality of these answers, we use 18 raters, masters students in the School of Information specializing in Library and Information Services (LIS), who have taken either SI 647 (Information Resources and Services) or SI 665 (Online Searching and Databases)<sup>7</sup> in the past two years. Specifically, a total of 550 (192) search engine (IPL) question-answer pairs are randomly divided into four (two) sets, each consisting of approximately 137-138 (96) question-answer pairs. We divide these question-answer pairs into six sets to avoid rater fatigue. Three raters are assigned to each set. Thus, each question-answer pair is rated by three independent raters, and we use the median rating for each answer in our analysis. The first rating sessions uncover that sources are not recorded in 60 of the non-Web questions. However, the original hardcopies of search records indicate recorded sources for 49 out of the 60 answers. These 49 questions form question set 5 and each is rated by three independent raters. In sum, search-engine question sets 1-4 have a mixture of Web and Non-Web answers, and each rater group rates 110 to 115 question-answer pairs, after excluding answers originally marked as having no source, whereas search-engine question set 5 consists of the 49 recovered Non-Web question-answer pairs. In comparison, IPL question sets 1 and 2 each consists of 96 question-answer pairs.

Six common evaluation criteria for source quality are applied to each question-answer pair: trustworthiness, authoritativeness, relevance, accuracy, amount of information, and overall source

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<sup>7</sup>Both courses prepare students for reference services in settings such as libraries or other information centers, requiring students to work with actual reference questions. In both courses, students gain expertise in searching, evaluating information resources, and answering questions submitted online.

quality. In addition, different evaluation criteria are applied to the factual and source questions respectively. For example, answer correctness is evaluated for the factual questions, but not the source questions, which often require evaluation and synthesis of multiple information sources without necessarily providing a definitive correct answer. Rater Instructions are included in Appendix E.

Raters are paid using a combination of a fixed base rate and a bonus for being the median of the raters. For a rating session, each rater is paid \$15 per hour. In addition to this base rate, a rater receives a bonus of \$1 per question-answer, for up to 50 randomly selected question-answer pairs, if her rating for the overall source quality for a question-answer pair is at the median for that pair. Such a payment scheme is based on similar considerations to the coordination game developed to classify messages in Houser and Xiao (2011), which outperforms a fixed payment scheme.

Table 1: Inter-rater reliability using intraclass correlation coefficient: ICC[3,3]

Query/Question Source: Q-A Pair Set:	Search Engine					IPL	
	Set 1	Set 2	Set 3	Set 4	Set 5	Set 6	Set 7
Q1. Question difficulty	0.695	0.643	0.720	0.726	0.786	0.672	0.482
Q2a. Source trustworthiness	0.717	0.816	0.609	0.692	0.523	0.767	0.644
Q2b. Source authoritativeness	0.698	0.789	0.659	0.697	0.575	0.745	0.652
Q2c. Source relevance	0.698	0.691	0.519	0.62	0.522	0.660	0.681
Q2d. Information accuracy	0.538	0.769	0.536	0.441	0.370	0.623	0.512
Q2e. Information sufficiency	0.663	0.72	0.714	0.636	0.514	0.695	0.627
Q3. Overall source quality	0.645	0.774	0.640	0.699	0.320	0.685	0.514

Table 1 reports the intraclass correlation coefficient (ICC[3,3]) as a measure of inter-rater reliability.<sup>8</sup> In general, values above 0.75 represent excellent reliability, values between 0.40 and 0.75 represent fair to good reliability, and values below 0.40 represent poor reliability. Good to excellent reliability is observed for all but two of our ratings, each of which relates to Question Set 5.

### 3 Results

In this section, we first formulate our alternative hypotheses based on prior empirical research and our own experience. We then present our results related to each hypothesis. Our general null hypothesis is that the outcome does not differ between the two treatments. In our analysis, we use a 5% statistical significance level as our threshold to establish the significance of an effect.

We first compare the likelihood that searchers find an answer in the two treatments.

**Hypothesis 1.** *Searchers are more likely to find an answer using a Web search.*

<sup>8</sup>There are six main cases of intraclass correlation coefficients (ICC), distinguished by the numbers in parentheses following the letters ICC. The first number indicates the statistical model assumed. Case 3 assumes that judges are fixed and not drawn from a random population. The second number indicates the number of raters. More details on ICC computation can be found in Shrout and Fleiss (1979).



While Hypothesis 1 *per se* might not be surprising, we aim to identify how much more likely a searcher is able to find answers using the Web.

**Result 1** (Likelihood of Success). *Searchers are significantly more likely to find an answer using a Web search. Of the 305 search-engine (110 IPL) questions, 99.7% (100%) are answered in the Web treatment, while 90.2% (87.3%) are answered in the non-Web treatment.*

**Support.** *Paired t-tests of the null hypothesis of equal likelihood against Hypothesis 1 each yield  $p < 0.01$  (one-sided) for the search-engine and the IPL questions.*

By Result 1, we reject the null in favor of Hypothesis 1 that searchers are more likely to find an answer using the Web. Despite the elimination of questions which ask for Web-specific resources, we find a roughly 10% margin in the likelihood of finding an answer, using two very different samples of questions.

We next compare the search outcome for the 275 search-engine (96 IPL) questions for which searchers in both treatments find answers. We are interested in two outcome measures. The first measure is the time it takes to search for an answer. The second measure is the quality of the information source.

**Hypothesis 2.** *A Web search will take less time than a non-Web search.*

Again, while Hypothesis 2 is not surprising, our study estimates the time it takes to find an answer for a randomly selected sample of real searches people send to the search engine or the IPL, and thus provides an answer to how much time a Web search saves on average for searches conducted in everyday life.

**Result 2** (Search Time). *An online search takes significantly less time than an offline search. In our study, using the search-engine (IPL) questions, an online search takes on average 7 (9) minutes, whereas the corresponding offline search takes 22 (19) minutes.*

**Support.** *Paired t-tests of the null hypothesis of equal time against Hypothesis 2 each yield  $p < 0.01$  (one-sided) for the search-engine and the IPL questions.*

For the 275 search-engine questions with answers in both treatments, the average search time to find an answer is 22 minutes ( $\sigma = 14.0$ ) in the non-Web treatment, and 7 minutes ( $\sigma = 4.7$ ) in the Web treatment. In comparison, for the 96 IPL questions, the average search time is 19 minutes ( $\sigma = 11.0$ ) in the non-Web treatment, and 9 minutes ( $\sigma = 5.1$ ) in the Web treatment. For both sources of questions, the difference is highly significant. By Result 2, we reject the null in favor of Hypothesis 2 that a Web search takes less time than a non-Web search. On average, a Web search saves 15 (10) minutes compared to an offline search for search-engine (IPL) questions. This result also reflects the potential sample selection bias in each of our two samples. Questions generated from search-engine queries lead to more time saved using the Web, whereas IPL questions generate a smaller margin in terms of time saved.

Comparing the two sets of questions, we also note that the questions generated from search queries are significantly shorter than IPL questions ( $p < 0.01$ , t-test). The average word count for search-engine (IPL) questions is 12.72 (30.28). While a longer question results in more queries typed into the browser ( $\rho = 0.19$ ,  $p < 0.01$ ) which might lengthen online search time, it might help shorten the time for offline searching as it provides more contexts. Table 2 presents eight OLS specifications investigating factors affecting search time. The dependent variable is the time

it takes to search online (columns 1-4) or offline (columns 5-8). The independent variables (with omitted variable in parentheses) include the following: IPL (search-engine) questions, question difficulty, question length, number of search queries used for online searches, and whether a searcher consulted a librarian in the non-Web treatment.

While IPL questions take on average 2.3 minutes longer than the search-engine questions for online searches (column 1), they take on average 2.8 minutes shorter for an offline search (column 5). Furthermore, this comparison is robust to controlling for question difficulty (columns 2 and 6). To explore question and search characteristics on search time, specifications (3) and (4) each explore whether question length and the number of search queries used are correlated with online search time, respectively, while controlling for question difficulty. Both variables are positive and significant. Specifically, each additional query typed into a search engine increases search time by almost one minute. Similarly, specifications (7) and (8) explore whether question length and consulting a librarian affect offline search time, respectively. We find that question length decreases search time, and significantly so in (8), thus providing some evidence for our conjecture that longer questions might provide more context for offline searches, making it easier to find answers. Lastly, in column (8), we find that consulting a librarian during an offline search increases search time by 8 minutes. These analyses use question and search characteristics to account for the differential magnitude of time saved from the two sources of questions.

We next examine source quantity and quality based on the evaluation of the independent raters. To determine source quantity for the non-Web treatment, we ask raters to review a searcher's answer and a corresponding observer's log, and record the following for each question-answer pair: (1) sources a searcher consults, and order consulted, (2) whether a searcher consults a reference librarian, (3) total number of sources a searcher consults, (4) number of source(s) actually used by a searcher in her answer, and (5) the reasons a searcher fails to answer a question, as inferred from the observation log. We also ask raters to describe any noticeable characteristics or search patterns for each searcher. The raters were given an initial list of ten source categories for use, including Mirlyn (UM online catalog), reference librarian, ready reference, books, journals, magazines/newspaper, government documents, telephone directory, people, and other.

In comparison, for the Web condition, we ask raters to review Morae files<sup>9</sup> of each searcher and record the following for each question-answer pair: (1) queries a searcher types in, (2) whether a searcher uses advanced search features, (3) position of each link clicked on the first search results page, (4) type of each link clicked from the first search results page (e.g., organic, sponsored, or other), (5) number of links a searcher clicks from the first search results page, (6) whether a searcher goes beyond the first search results page, (7) number of links a searcher clicks from other search result pages, (8) whether a searcher returns to the previous search results page, (9) whether a searcher's typed query is the same as the original query, (10) whether a searcher reformulates the query or enters a new query, (11) the total number of queries a searcher types in, (12) whether a searcher changes search engines, (13) total number of links a searcher clicks, and (14) number of links actually used by a searcher in her answer. We also ask our raters to describe any noticeable characteristics or search pattern for each searcher. As it is less costly to consult more sources on the Web, we expect that searchers will use more sources under the Web treatment.

**Hypothesis 3.** *Searchers under the Web condition will look at and use more sources than those under the non-Web condition.*

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<sup>9</sup>Recall Morae records on-screen activities and keyboard/mouse inputs.

Table 2: Search Time, Questions Characteristics and Search Process: OLS Regressions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Online Search Time (minutes)				Offline Search Time (minutes)			
IPL	2.297*** (0.535)	2.097*** (0.523)			-2.825*** (1.419)	-2.903*** (1.418)		
Question Difficulty		1.028*** (0.213)	0.989*** (0.215)	0.320* (0.173)		0.853 (0.580)	0.924 (0.583)	0.464 (0.559)
Question Length			0.066*** (0.017)				-0.084* (0.047)	-0.111*** (0.045)
No. of Search Queries				0.914*** (0.056)				
Consult Librarian								8.395*** (1.326)
Constant	7.039*** (0.276)	4.043*** (0.678)	3.574*** (0.706)	3.631*** (0.535)	21.409*** (0.723)	18.928*** (1.834)	19.397*** (1.909)	18.798*** (1.818)
Observations	414	414	414	406	370	370	370	370
R-squared	0.04	0.09	0.09	0.43	0.01	0.02	0.01	0.11

Notes:

1. Standard errors are included in parentheses.
2. \* Significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.
3. Specification (4) has 406 observations because the remaining participants either went directly to a website rather than typing queries into search engines, or, in one case, a Morae file for a subject was corrupt.

**Result 3 (Source Quantity).** *Searchers under the Web condition look at and use significantly more sources than those under the non-Web condition.*

**Support.** *For questions generated from search queries (IPL), on average, a searcher under the Web condition clicks 3.9 (5.2) links during a search to answer a given question, and actually uses 1.6 (2.0) sources in her answer, while a searcher under the non-Web condition looks at 3.1 (2.2) sources and uses 1.3 (1.3) sources in her answer. The difference in the total number of sources looked at and total number of sources actually used between non-Web and Web conditions are each statistically significant for the search-engine and IPL questions ( $p < 0.01$ , one-sided signed rank tests).*

By Result 3, we reject the null in favor of Hypothesis 3. We now explore the type of sources searchers use in each treatment. The top three sources a searcher under the non-Web condition first looks at are Mirlyn (72%), ready reference (13%), and the telephone directory (9%). Additionally, 70% of non-Web searchers seek help from reference librarians.

By contrast, searchers under the Web condition access 438 unique URLs. Figure 1 presents the frequency distribution of the URLs. To increase readability, we combine the 379 URLs accessed only once into one category as “URLs cited once.” Similarly, we combine the 40 URLs accessed twice into a category as “URLs cited twice.” URLs accessed at least three times are individually listed on the horizontal axis in decreasing frequency. In our sample, the ten most frequently used online sources (in decreasing frequency) include Wikipedia, Google, Amazon, ehow, Google Maps, IMBD, Wiki Answers, ask.com, the New York Times, and Bing. Three of these sites, Wikipedia, Google, and Amazon, are also among the top ten most visited websites in the world.<sup>10</sup> For both sets of questions, Wikipedia is the most often visited website by our searchers.<sup>11</sup> Furthermore, we note that, on average, a searcher types in three queries to answer a question. They type in the same query as the original one in 22% of their searches.

As we are not aware of a comprehensive rating of source quality for online and offline information sources, we use trained raters for quality rating. For source quality, recall each answer is independently rated by three MSI students. Using the intraclass correlation coefficient to measure inter-rater reliability, we find that that our raters achieve good to excellent levels of inter-rater reliability (Table 1). We thus use the median rating of the three raters for our analysis of source quality. The issue of source quality is largely unresolved when comparing Web and non-Web searches. Thus, we do not have a strong prior belief about the alternative hypothesis.

**Hypothesis 4.** *Source quality is different between the two treatments.*

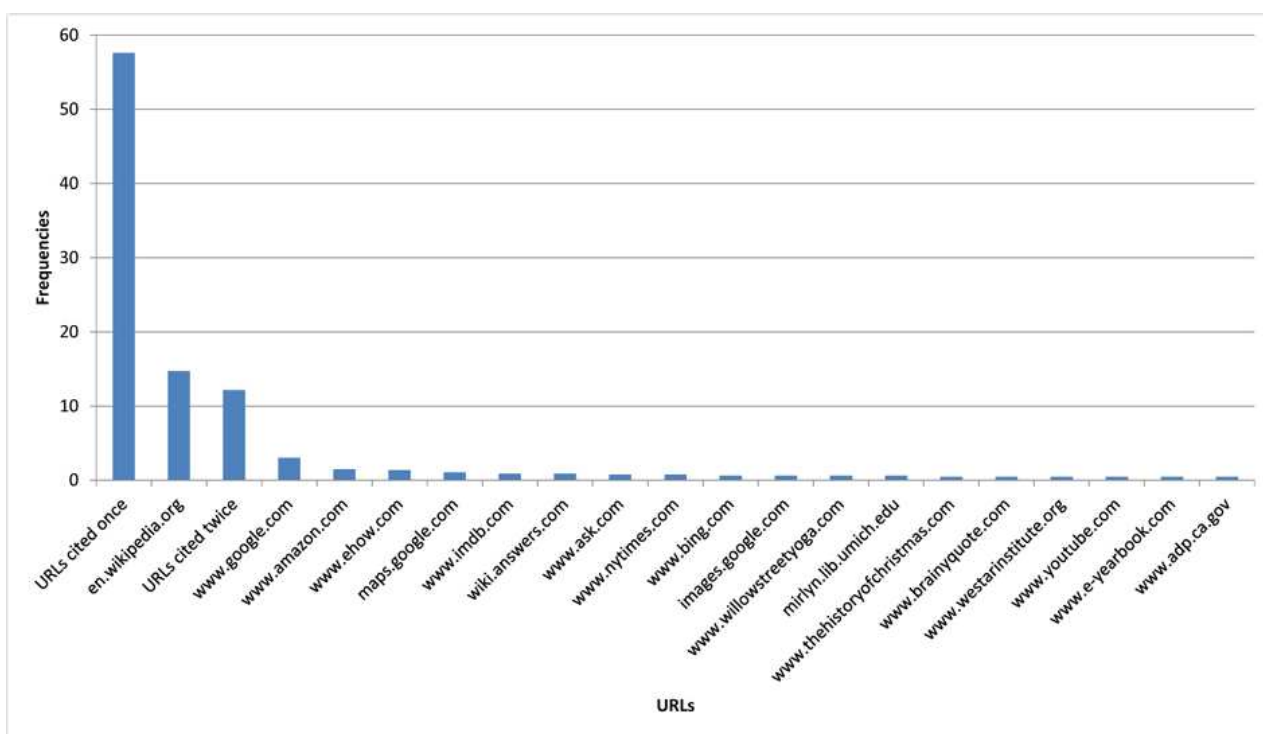
**Result 4 (Source Quality).** *For both sets of questions, while non-Web sources are judged to be significantly more trustworthy and authoritative than the corresponding Web sources, Web sources are judged to be significantly more relevant. Balancing all factors, while the overall source quality is not significantly different across the two venues for search-engine questions, the overall quality*

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<sup>10</sup>The top ten most visited websites in the world include (in decreasing traffic) Google, Facebook, YouTube, Yahoo!, Baidu (*Chinese*), Wikipedia, Windows Live, Twitter, QQ (*Chinese*), and Amazon, retrieved from <http://www.alexa.com/topsites> on June 1, 2012.

<sup>11</sup>The quality of Wikipedia has been controversial. For example, Giles (2005) reports that a selection of its science entries contains comparable number of errors as the corresponding entries from Encyclopedia Britannica. In response, Britannica published an open letter disputing the findings (Encyclopaedia Britannica, Inc. 2006). *Nature* subsequently responded with a point-by-point rebuttal of the Britannica open letter, which can be accessed from the same page as Giles (2005).

Figure 1: Frequencies of URLs Used for the Web Search Treatment



of non-Web sources is judged to be significantly higher than that of the corresponding Web sources for the IPL questions.

**Support.** For search-engine questions, Wilcoxon signed-rank tests yield the following results: (1) trustworthiness:  $p < 0.01$  (one-sided); (2) authoritativeness:  $p < 0.01$  (one-sided); (3) relevance:  $p < 0.01$  (one-sided); (4) accuracy:  $p = 0.824$  (two-sided); (5) information sufficiency:  $p < 0.01$  (two-sided); and (6) overall quality:  $p = 0.618$  (two-sided).

For the IPL questions, Wilcoxon signed-rank tests yield the following results: (1) trustworthiness:  $p < 0.01$  (one-sided); (2) authoritativeness:  $p < 0.01$  (one-sided); (3) relevance:  $p = 0.042$  (one-sided); (4) accuracy:  $p < 0.01$  (two-sided); (5) information sufficiency:  $p = 0.344$  (two-sided); and (6) overall quality:  $p < 0.01$  (two-sided).

By Result 4, we fail to reject (reject) the null in favor of Hypothesis 4 for search-engine (IPL) questions. Therefore, unlike search-engine questions, IPL questions generate search results more favorable to offline resources.

Lastly, we examine the affective experience of the different search treatments using post-search questionnaires. The questionnaire and the summary statistics are included in Appendix C. We first note that searcher self-evaluation of familiarity with the question topic is not different across the two treatments ( $p = 0.16$ , two-sided Wilcoxon signed-rank test for matched samples). This indicates that searchers in the two treatments are equally familiar with the background required to answer the questions. Thus, any difference in affective experience should come from the experimental treatments. Again, we do not have a strong prior belief about which venue is more enjoyable.

**Hypothesis 5.** *A Web search yields different affective experiences from a non-Web search.*

**Result 5 (Affect).** *A Web search yields significantly more positive affective experiences than a non-Web search.*

**Support.** *Each two-sided Wilcoxon signed-rank test for matched samples yields  $p < 0.01$ .*

After searching for answers for each question, searchers in the Web treatment find the question significantly more interesting, the process of finding information significantly less difficult, the materials found during the search process significantly more useful, and the search process itself significantly less stressful, more enjoyable, and less tiring compared to their non-Web counterparts. Finally, searchers using the Web search are significantly more confident that their answers are correct. By Result 5, we reject the null in favor of Hypothesis 5 that a Web search yields different affective experiences. Furthermore, it is more positive.

## 4 Conclusions

With the advent of the Web and search engines, online searching has become a common method of obtaining information. With this method, the question arises as to how much time people save by using search engines for their information needs, and the extent to which online searching affects search experiences and outcomes.

Using a random sample of queries from a major search engine and a sample of real reference questions from the Internet Public Library, we conduct an experiment to compare online and offline search experiences and outcomes. Overall, our results indicate that online searching yields a higher likelihood of search success, saves on average 10-15 minutes compared to the corresponding offline search, and is more enjoyable. However, our results on source quality are more nuanced. While library sources are judged to be significantly more trustworthy and authoritative than the corresponding Web sources, Web sources are judged to be significantly more relevant. Balancing all factors, the overall source quality is not significantly different between the two treatments for search-engine questions. However, for IPL questions, non-Web sources are judged to have significantly higher overall quality than the corresponding Web sources. This indicates that while credibility is a problem with online information, there are other aspects of information quality that compensate for its relatively lower credibility, especially when the questions are generated from the search engine queries.

Our results on time saved and source quality point to the importance of using questions generated from different sources. While searching information to answer questions generated from search engine queries tends to bias the results in favor of online searching, IPL questions produce results more favorable to offline sources. Thus, having two different sets of questions generates a more balanced set of results. A caveat to our results on time saved is the fact that the time it takes to travel to a library is not taken into account. Therefore, our estimates on time saved should be taken as a lower bound. Finally, as online search technologies evolve over time, online search time might shorten even more. In comparison, we expect that our results on offline search to remain fairly stable. Overall, our study provides a benchmark for the evaluation of search experiences and outcomes in everyday life in the early twenty-first century.

Searching for information is an important day-to-day activity for many online users, just as it was before the prevalence of the Web. The shift to online search changes search productivity,

source quantity and quality, as well as affective experiences. Our study evaluates these measures in a controlled real-effort experiment for the Web and non-Web searches. In addition to time saved, perhaps the most surprising finding is that the overall Web source quality is not significantly different from that of non-Web sources when questions come from search-engine queries. For IPL questions, non-Web sources are judged to be of significantly higher quality. Overall, this stream of research contributes to the evaluation of search technology on search outcome and productivity in everyday life. Our paper also introduces experimental techniques from interactive information retrieval to experimental economics.

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## Appendix A. Pre-Experiment Survey

*(Summary statistics in italics)*

Please answer the following questions. Your answers will be used for this study only. Individual data will not be exposed.

1. Please enter today's date.
2. Please enter your Participant ID.
3. How often do you search for information for the following purposes? Please check all that apply.

	Everyday	3-4 times per week	1-2 times per week	Less than 1 time per week	Never
Work	<i>20%</i>	<i>11%</i>	<i>20%</i>	<i>24%</i>	<i>25%</i>
School	<i>58%</i>	<i>26%</i>	<i>9%</i>	<i>6%</i>	<i>1%</i>
Personal	<i>71%</i>	<i>17%</i>	<i>9%</i>	<i>3%</i>	<i>0%</i>
Other	<i>33%</i>	<i>18%</i>	<i>21%</i>	<i>15%</i>	<i>13%</i>

4. How often do you use search engines to help you find information on the Web?

- Everyday (*88%*)
- 3-4 times per week (*10%*)
- 1-2 times per week (*2%*)
- Less than 1 time per week (*0%*)
- Never (*0%*)

5. Which search engines have you used? Please check all that apply.

- Ask.com (*38%*)
- Bing (formerly MSN Search) (*41%*)
- Google (*100%*)
- Yahoo! (*63%*)
- Other, please specify. (*7%*)

6. Please indicate which search engine you use most often.

- Ask.com (*0%*)
- Bing (formerly MSN Search) (*1%*)
- Google (*95%*)
- Yahoo! (*4%*)
- Other, please specify. (*0%*)

7. Please rate your ability to find information using a search engine (1: Poor, ... 5: Excellent).  
(*Min: 2, Max: 5, Median: 4*)

8. How often do you use libraries to find information?

- Everyday (2%)
- 3-4 times per week (4%)
- 1-2 times per week (12%)
- Less than 1 time per week (63%)
- Never (19%)

9. Which libraries have you visited? Please check all that apply.

- Ann Arbor District Library (41%)
- Art, Architecture & Engineering Library (30%)
- Harlan Hatcher Graduate Library (75%)
- Shapiro Undergraduate Library (96%)
- Other, please specify. (20%)

10. Please indicate which library you use most often.

- Ann Arbor District Library (5%)
- Art, Architecture & Engineering Library (12%)
- Harlan Hatcher Graduate Library (17%)
- Shapiro Undergraduate Library (60%)
- Other, please specify. (6%)

11. Please rate your ability to find information using a library. (1: Poor, . . . 5: Excellent).  
(*Min: 1, Max: 5, Median: 3*)

## **Appendix B-1. Experimental Instructions: Non-Web Treatment**

### **Participant instructions**

This experiment studies how people look for information when they do not have access to information resources on the Web. Participants are divided into two groups, which are “Searcher” and “Observer”. In this experiment, those of you sitting in the first row are Searchers. Those of you in the second row are Observers. Each Searcher is paired with an Observer, and vice versa - the person sitting directly behind a Searcher is their assigned Observer, and the person sitting directly in front of an Observer is their assigned Searcher. Please confirm who is your Searcher or Observer now.

### **Searcher**

The Searcher is expected to answer five questions, using print resources in the library. Searchers are not allowed to use search engines such as Google or other Internet resources. Imagine you are trying to answer your questions in the days before the Web. The resources you are allowed to use are Mirlyn (the library’s online catalog), and materials in the stacks. You can consult a reference librarian for only two of your five questions. To help you, we have included guides to the Hatcher Graduate Library. We will also provide you with a brief instruction on using Hatcher.

First, here is the procedure you, the Searcher, will follow in this experiment:

1. You have received a clipboard labeled “Searcher”. Please check it has all of the following: participant instructions, map of Hatcher 2nd floor, map of call numbers, list of allowed resources, payment form, and a Participant ID.
2. You will complete a pre-survey after we finish going over these instructions.
3. After completing the pre-survey, you will be guided to the library by one of the experimenters.
4. The experimenter will provide a brief overview of resources available in the library.
5. Once the experimenter instructs you to start, the Observer will hand you a question and answer form.
6. Please answer this question to the best of your ability, using the allowed resources.
7. The Observer will be logging your start and end times for the task, as well as the actions you take to answer the assigned question.
8. When you have answered the question on the answer form, please complete a post-search questionnaire which is stapled to the answer form, and return it to your Observer.
9. You will receive the next question and answer form from the Observer. Please follow the same procedure you followed for the first question for the remaining four questions.
10. When you have answered all the questions and returned your last question and answer form to the Observer, please return with your Observer to the 2nd Floor Hatcher computer area.
11. The Observer will give you all the answer forms you completed.

12. Please take a seat and log on to a computer with your username, and open a browser and go to the following link and type in your answer to each question with Question ID and submit it. <http://tinyurl.com/lxwr6f>
13. Once you have submitted your answers, please go to the following link and complete the post-survey. <http://tinyurl.com/nlkqbx>
14. Please go to the waiting table and fill out the subject payment form.
15. Please wait until your ID number is called to receive your earnings. Return the completed subject payment form and your clipboard to the experimenter at this time.
16. After receiving payment, you may leave the study session.

Your payment will be based on the number of questions you answer and the quality of the answers you provide. If you determine you cannot answer a question, you may move on to the next one. Once you move on to the next question, you cannot return to a question you worked on previously.

### **Observer**

The Observer is expected to follow their assigned Searcher and observe and record their observations of the Searcher's activities. The Observer also has to perform a number of additional tasks.

Here is the procedure you, the Observer, will follow in this experiment:

1. You have received a clipboard labeled "Observer." Please check it has all of the following: participant instructions, map of the 2nd floor, map of call numbers, list of allowed resources, 5 sets of questions and answer forms and post-search questionnaires, 5 log sheets, a payment form, and a Participant ID.
2. You will complete a pre-survey after we finish going over these instructions.
3. After completing the pre-survey, you will be guided to the library by one of the experimenters.
4. The experimenter will provide a brief overview of resources available in the library.
5. Once in the library, write down the Question ID of the first question on your log sheet and hand your Searcher the first question and answer form. Log on the log sheet the time this was handed out.
6. As the Searcher attempts to answer the question, log their activities on the log sheet (e.g. searching on Mirlyn, speaking with a reference librarian).
7. When the Searcher returns the question and answer form and post-search questionnaire, please log this time as the end time for this search on the log sheet. Please check the Searcher has written their Participant ID and Question ID in the answer form.
8. Hand the Searcher the next question and answer form. Please follow the same procedure you followed for the first question for the remaining four questions.

9. When the Searcher has completed answering all questions and returned the last question and answer form and post-search questionnaire, please return to the 2nd Floor Hatcher computer area with your Searcher.
10. Please return all the answer forms you received from the Searcher back to him or her.
11. Please take a seat and log on to a computer with your unique name, and open a browser and go to the following link and type in your log for each search task with Question ID and submit it. <http://tinyurl.com/mkby5a>
12. Once you have submitted your logs, please go to the following link and complete the post-survey. <http://tinyurl.com/nlkqbx>
13. After completing the post-survey, please go to the waiting table and fill out the subject payment form.
14. Please wait until your ID number is called to receive your earnings. Return the completed subject payment form and your clipboard to the experimenter at this time.
15. After receiving payment, you may leave the study session.

## **Payment**

As mentioned earlier, participants are assigned to the role of either a Searcher or Observer. There are two different payment schemes for each group. Both Searchers and Observers receive \$5 for showing up. A searcher receives 1 point for each question answered, and 1 point for the quality of the answer, for a total of up to two points for each answer to a question. There is an answer rubric for the questions, and an experimenter will evaluate answers based on the rubric. Points will be converted into a dollar-value based on our conversion rate. The conversion rate for this experiment is 1 pt = \$2. The Observer will receive a flat fee of \$10 per hour. An individual Observer's actual earnings will depend on the actual time it takes to participate in the experiment. Each participant's earnings will be calculated based on these two schemes. Please note that payoff of Searcher and payoff of Observer will be determined independently. Payment will be made individually in the order of completion of assigned tasks.

Are there any questions? Please make sure that your cell phone is on silent mode. Keep in mind that you are not allowed to communicate with other study participants during the experiment, other than with your assigned Searcher or Observer and only for handoff of forms. You may not help each other in the searches. If there are no further questions, let's begin with the pre-survey. Please log on to a computer with your uniqueness, open a browser and complete the pre-survey at this URL: <http://tinyurl.com/ksaojw>

Once you have finished the pre-survey, please log out and wait to be guided to the Graduate Library.

## Appendix B-2. Experimental Instructions: Web Treatment

This experiment studies how people look for information on the Web. Participants are divided into two groups, which are “Searcher” and “Observer”. A Searcher and an Observer are randomly assigned and paired.

### Searcher

The Searcher is expected to answer five questions via a Web search. The Searcher’s entire search process will be recorded by Morae, a software program.

First, here is the procedure you, the Searcher, will follow in this experiment:

1. You have received a clipboard labeled ”Searcher”. Please check it has all of the following: participant instructions, a payment form, and a Participant ID.
2. You will complete a pre-survey after we finish going over these instructions.
3. After completing the pre-survey, please go to the following link to open an answer form. You will see the answer form to fill out when answering a question. Please keep this window open throughout the session. <http://tinyurl.com/meky7b>
4. Please raise your hand and let an experimenter know you opened the answer form. The experimenter will start Morae on your computer.
5. The Observer will hand you a question sheet.
6. Please answer this question to the best of your ability, using a Web search.
7. The Observer will be logging your start and end times for the task, as well as the actions you take to answer the assigned question.
8. Once you have answered the question on the answer form, please complete a post-search questionnaire which is stapled to the question sheet, and return it to your Observer.
9. You will receive the next question sheet from the Observer. Please follow the same procedure you followed for the first question for the remaining four questions.
10. Once you have answered your last question, please click the ”Submit” button on the answer form.
11. Please complete the last post-search questionnaire and return it to the Observer.
12. Please wait until the experimenter stops the Morae recording, as the Observer let the experimenter know you are done by raising his or her hand.
13. Please go to the following link and complete the post-survey. <http://tinyurl.com/ya542hp>
14. After completing the post-survey, please fill out the subject payment form.
15. Please wait until your ID number is called to receive your earnings. Return the completed subject payment form and your clipboard to the experimenter at this time.

16. After receiving payment, you may leave the study session.

Your payment will be based on the number of questions you answer and the quality of the answers you provide. If you determine you cannot answer a question, you may move on to the next one. Once you move on to the next question, you cannot return to a question you worked on previously.

### **Observer**

The Observer is expected to observe and record their observations of the Searcher's activities during his or her search process. The Observer also has to perform a number of additional tasks.

Here is the procedure you, the Observer, will follow in this experiment:

1. You have received a clipboard labeled "Observer". Please check it has all of the following: participant instructions, 5 sets of question sheets and post-search questionnaires, 5 log sheets, a payment form, and a Participant ID.
2. You will complete a pre-survey after we finish going over these instructions.
3. After completing the pre-survey, please move your chair to the position where you can observe your Searcher's search process.
4. Please wait until your Searcher opens an answer form on his or her computer, and an experimenter starts Morae on your Searcher's computer.
5. After Morae is started, please write down the Question ID of the first question on your log sheet and hand your Searcher the first question sheet. Log on the log sheet the time this was handed out.
6. As the Searcher works on the question, log your observations of their search process on the log sheet (e.g. time, browser used, search engine used, queries typed in).
7. When the Searcher returns the question sheet and post-search questionnaire, please log this time as the end time for this search on the log sheet.
8. Please write down the Question ID of the next question and hand the Searcher the next question sheet. Please follow the same procedure you followed for the first question for the remaining four questions.
9. When the Searcher has completed answering all questions and returned the last question sheet and post-search questionnaire, log the time as the end time and raise your hand to let the experimenter know the Searcher is done.
10. The experimenter will stop the Morae recording.
11. Please return to the computer you used for a pre-survey and take a seat.
12. Please open a browser and go to the following link, and type in your log for each search task with Question ID and submit it. <http://tinyurl.com/kprfjy>
13. Once you have submitted your log, please go to the following link and complete the post-survey. <http://tinyurl.com/ya542hp>

14. After completing the post-survey, please fill out the subject payment form.
15. Please wait until your ID number is called to receive your earnings. Return the completed subject payment form and your clipboard to the experimenter at this time.
16. After receiving payment, you may leave the study session.

### **Payment**

As mentioned earlier, participants are assigned to the role of either a Searcher or Observer. There are two different payment schemes for each group. Both Searchers and Observers receive \$5 for showing up. A searcher receives 1 point for each question answered, and 1 point for the quality of the answer, for a total of up to two points for each answer to a question. There is an answer rubric for the questions, and an experimenter will evaluate answers based on the rubric. Points will be converted into a dollar-value based on our conversion rate. The conversion rate for this experiment is 1 pt = \$2. The Observer receives a flat fee of \$10 per hour. An individual Observer's actual earnings will depend on the actual time it takes to participate in the experiment. Each participant's earnings will be calculated based on these two schemes. Please note that payoff of Searcher and payoff of Observer will be determined independently. Payment will be made individually in the order of completion of assigned tasks.

Are there any questions? Please make sure that your cell phone is on silent mode. Keep in mind that you are not allowed to communicate with other study participants during the experiment, other than with your assigned Searcher or Observer, and only for handoff of forms. You may not help each other in the searches. If there are no further questions, let's begin the pre-survey. Please open a browser and go to the following link, and complete the pre-survey. <http://tinyurl.com/yelu74j>

Once you have finished the pre-survey, Searcher should open the answer form (please refer to Searcher procedure #3) and Observer should wait until Searcher opens the answer form (please refer to Observer procedure #3). You may start the search and records the search process after the experimenter starts Morae on your computer.



## Appendix C. Post-Search Questionnaire

(Mean and standard deviation of responses for each treatment is included in italics.)

1. Please rate how familiar you are with the question topic. (1: not at all familiar)  
*Non-Web:  $\mu = 1.88, \sigma = 1.32$ ;*  
*Web:  $\mu = 2.06, \sigma = 1.29$ .*
2. Please rate how interesting you found this search question. (1: not at all interesting)  
*Non-Web:  $\mu = 2.11, \sigma = 1.36$ ;*  
*Web:  $\mu = 2.69, \sigma = 1.29$ .*
3. Please rate how difficult it was to find information in answering the question. (1: not at all difficult)  
*Non-Web:  $\mu = 2.96, \sigma = 1.62$ ;*  
*Web:  $\mu = 2.29, \sigma = 1.31$ .*
4. Please rate how useful the materials were that you found during the search for answering the question. (1: not at all useful)  
*Non-Web:  $\mu = 2.92, \sigma = 1.58$ ;*  
*Web:  $\mu = 3.79, \sigma = 1.17$ .*
5. The search process to answer the question was
  - (a) stressful (1: stressful, 5: relaxing)  
*Non-Web:  $\mu = 2.419, \sigma = 1.277$ ;*  
*Web:  $\mu = 3.347, \sigma = 1.07$ .*
  - (b) unenjoyable (1: unenjoyable, 5: enjoyable)  
*Non-Web:  $\mu = 2.20, \sigma = 1.24$ ;*  
*Web:  $\mu = 3.10, \sigma = 1.17$ .*
  - (c) tiring (1: tiring, 5: restful)  
*Non-Web:  $\mu = 2.42, \sigma = 1.28$ ;*  
*Web:  $\mu = 3.35, \sigma = 1.07$ .*
6. Please rate your confidence in your answer to the question. (1: not at all confident)  
*Non-Web:  $\mu = 3.23, \sigma = 1.66$ ;*  
*Web:  $\mu = 4.03, \sigma = 1.09$ .*

## Appendix D. Post-Experiment Survey

*(Summary statistics in italics.)*

Please answer the following questions. Your answers will be used for this study only. Individual data will not be exposed.

1. Please enter today's date.
2. Please enter your Participant ID.
3. What is your age? (*Min: 18, Max: 36: Median: 21*)
4. What is your gender?
  - Female (*45%*)
  - Male (*55%*)
5. Please indicate your race/ethnicity.
  - American Indian/ Alaska Native (*1%*)
  - Asian/ Pacific Islander (*35%*)
  - Black (*13%*)
  - Hispanic (*2%*)
  - White (*40%*)
  - Other, please specify. (*6%*)
  - I do not wish to disclose it. (*3%*)
6. What is your major at the University of Michigan?
7. What year are you in your program?
  - Freshman (*1%*)
  - Sophomore (*18%*)
  - Junior (*26%*)
  - Senior (*41%*)
  - Other, please specify. (*14%*)
8. Before today, have you ever used the following advanced features of search engines? Please check all that apply.
  - Phrase search by putting quotes around a set of words (*84%*)
  - Search within a specific web site (*87%*)
  - Include all of the words you typed in the search box by inserting "AND" or "+" (*61%*)
  - Searches for results that match either one or more of the words by inserting "OR" (*46%*)

- Exclude words from your search by inserting “NOT” or “-” (29%)
  - Fill in the blanks by using “\*” (15%)
  - Restrict your search to sites with specific domain suffix (20%)
  - Restrict your search by a specific file type (38%)
  - Limit your results to sites that have been updated within a certain amount of time period (25%)
  - None of the above (5%)
9. Please rate your ability to find information using a search engine. (1: Poor, . . . 5: Excellent).  
(*Min: 1, Max: 5, Median: 4*)
10. Before today, have you ever used the following resources available at a library? Please check all that apply.
- Document center for government information (8%)
  - Mirlyn (91%)
  - Reference librarian (59%)
  - Serial services (e.g. periodicals, newspapers, microforms) (32%)
  - Special collections (18%)
  - Subject specialist (8%)
  - None of the above (7%)
11. Please rate your ability to find information using a library. (1: Poor, . . . 5: Excellent).  
(*Min: 1, Max: 5, Median: 3*)
12. Where do you have Internet access? Please check all that apply.
- At home (98%)
  - At school (98%)
  - At work (59%)
  - At a coffee shop/ fast-food restaurant/ bookstore (72%)
  - Other places, please specify (2%)
13. How much do you pay for Internet access at Home? Please check all that apply.
- I pay \$ \_\_ per month. (45%)
  - It’s free. (16%)
  - My parents pay for it. (29%)
  - I don’t know. (14%)
  - Other places, please specify. (5%)
14. If your answer to the previous question (Question 13) is “I pay \$\_\_ per month.”, please enter how much you pay per month. If not, please enter “0”. (*Min: 3, Max: 100, Median: 20*)

15. Hypothetically, if you do not have Internet access and you would like to search for information such as what you searched for today. How much would you be willing to pay for one day (24 hours) of Internet access? (*Min: \$0, Max: \$500, Median: \$5*)
16. Hypothetically, if you have Internet access and we paid you to give up Internet access, how much money would we have to pay you to give up Internet access for one day?  
(*Min: \$0, Max: \$1,000,000, Median: \$20*)

## Appendix E. Rater Training Session Instructions

You are now taking part in a study that compares online and offline search experiences and outcomes. Your participation will take the form of rating questions and corresponding answer source(s) on several factors. There are two types of questions: Factual questions and Source questions. The intent of a Factual question is to obtain a brief factual answer to a question. The intent of a Source question is to obtain a list of sources that can help answer the question or to find out more information on a topic.

You will initially take part in an in-person training session. After the training session, you will rate question-answer pairs using a web-based system, over the following two weeks. We ask you not to discuss your rating activities with others during the course of the two weeks. Should you have any questions during the course of rating, please email us at [yjeon@umich.edu](mailto:yjeon@umich.edu).

The purpose of this training session is to familiarize you with the rating procedure, and to ensure a common understanding of the rating factors. We are interested in eliciting objective ratings from impartial raters. We ask you to think how a trained information professional would rate these question-answer pairs when following the rating procedure.

In this training session, you will be asked to rate two question-answer pairs, one with a Factual question, the other a Source question. You will also be asked to fill out a Background Questionnaire at the end of this training session. For each question-answer pair, you will be asked for the ratings shown below:

1. Please rate the difficulty of the question. (1 = very easy . . . 5 = very difficult)
2. Please rate the answer source(s) for the following factors  
(1=strongly disagree . . . 5 = strongly agree)
  - (a) The source is trustworthy.
  - (b) The source is authoritative.
  - (c) The information in the source is relevant to the question.
  - (d) The information in the source is accurate.
  - (e) There is enough information in the source to answer the question.
3. Please rate the overall quality of the answer source  
(1=very low quality ... 5=very high quality)
4. If a question is factual, please rate the followings:
  - (a) Is the answer correct?
    - i. Yes
    - ii. No
    - iii. Don't know
  - (b) Please rate your confidence about your judgment (1=not confident at all ... 5=very confident):

The procedure in the training session is as follows:

1. You will each receive two rating sheets, a Background Questionnaire, and your rater ID.
2. You will rate the first question-answer pair, working individually. Please write your rater ID on the rating sheet for Question 1, and enter your ratings on the rating sheet.
3. Please let us know when you have finished rating the first question-answer pair. We will wait until all the raters have completed rating. Do not proceed to the second pair.
4. When all raters have completed rating the first question-answer pair, there will be a brief discussion, no longer than 10 minutes, regarding the rating activity. We will go over each rating, asking all of you for your ratings. You may ask us questions at any time.
5. When all questions have been addressed, we will move on to the second question-answer pair, and repeat the procedure used for the first pair.
6. Please fill out the Background Questionnaire given to you.
7. Please return the completed rating sheets and questionnaire to us.
8. After everyone has returned the completed rating sheets to us, we will use the remaining time to go to the Web interface and start the formal rating sessions. This way, if you have any questions, you can ask us.

Are there any questions? We would like to ask you to please take the time to read each question and answer pair carefully when rating.

### **Rating Session Instructions**

The actual ratings will be done using a web-based system. The system has been programmed to show you a predefined number of question-answer pairs for rating per login session. You will rate between 20 - 25 question-answer pairs per session. Once you have rated a predefined number of pairs you will be automatically logged out. If you have to quit your session before rating all the pairs, simply close the browser window.

For a rating session, you will get paid at the rate of \$15 per hour. In addition to this base rate, you will receive a bonus of \$1 per question-answer, for up to 50 randomly selected question-answer pairs, if the following condition is met: for each question-answer pair in the set of 50, if your rating for overall source quality for a question-answer pair is at the median for that question-answer pair, you will receive a bonus of \$1.

### **Instructions for rating on the Web:**

To start your rating session, please go to the following web page: <http://yjeon.people.si.umich.edu/login.php>

We recommend using the Firefox browser, as Internet Explorer does not display in a consistent format.

Now follow these steps:

1. Login using the name (Rater ID) and password given to you.
2. Provide the ratings requested for the question-answer pair.
3. When you are done, click 'Submit' - note that you will not be permitted to continue until you have entered all nine ratings.

4. The next question-answer pair will be presented.
5. When you have finished rating the session limit, you will be shown a 'That is all your questions for this session. Thank you.' Screen.
6. Close the browser.

## **Appendix F. Questions from Search Engine Queries and from the IPL**

### **F1. Questions Converted from Search Engine Queries**

1. What are some features of the Zurn Z86500 faucet?
2. What is the history of Mexico's Yucatan Peninsula?
3. Where can I go to get high quality woven shirts at a good price?
4. World leaders of which countries attended the G8 summit in 2009?
5. What are some quotes from the movie Wolverine that can be attributed to Wade Wilson?
6. Where can I go to find the lyrics for Motley Crue's song "Without You"?
7. How can I install or purchase WindowSeal from Polyguard Products?
8. I would like use the open source Mono framework to develop Windows software. How much does Mono interact with the Windows registry?
9. What ways did the characters of Willy and Biff Loman perceive and experience the American Dream differently in the play "Death of a Salesman" by Arthur Miller?
10. I need information to help me decide whether to take classes at Willow Street Yoga in Takoma Park, Maryland, such as the type of yoga and the quality of the instructors.
11. How can I find basic information on the white peacock?
12. Is there a map where I can see where swine flu has been diagnosed?
13. When should a breastfeeding mother start pumping breastmilk?
14. What are some of the functions of my iPod Touch?
15. What instruments are used in Mariachi music?
16. What is the purpose of the "Consent to Request Consumer Report & Investigative Consumer Report Information" form?
17. What is the most endangered animal in the world?
18. What are Blik decals?
19. What is the definition of the word "derived"?
20. What home treatments are available to ease diarrhea and vomiting in dogs?
21. How can I find basic information on the habits and habitats of whales?
22. Where can I find contact information and reviews for the Westport Coffee House in Kansas City, MO?
23. What is the history of the Weimar Republic?



24. What scholarships are offered in the state of Washington?
25. What companies sell electric floor heating systems?
26. What are common characteristics of popular songs about war in various periods?
27. Where can I find maintenance and product information on the VW 1.6L diesel engine?
28. Who are some famous villains in history and literature?
29. How can I find out more about risks associated with taking Vagifem for treatment of breast cancer?
30. I need to find a tutorial on how to write a web application for the iPhone
31. How can I check my own heart rate with my hand when exercising?
32. What is involved in fugitive investigation training for U.S. Marshalls?
33. Where can I find out the maximum length for the various environment variables I can set using the UNIX setenv command?
34. Where can I find information on causes of unexplained bruises?
35. What is the book “Traditions and Encounters: A Brief Global History” about? What are some of the topics covered?
36. Where can I find a chart showing health problems caused by tobacco use?
37. What theaters are close to my home, and what are they showing?
38. Where can I find collections of various legends across the world?
39. Where can I find out more information about The Killers, such as the band history and the albums they have released?
40. Where can I find reviews of the Nine Inch Nail’s Downward Spiral album?
41. What is the current temperature in Phoenix, AZ?
42. Where can I find listings and reviews of temporary employment agencies in San Diego, California?
43. What song has the lyric “So tell me why in the hell you just strollin’ in?”
44. Where can I find out how much a telescoping poster tube will cost me?
45. Where can I find diagrams on the linkage system in Tecumseh lawn mower engines?
46. Where can I find transcripts of former talks and speeches?
47. Where can I find out about home meal delivery programs in Northern Kentucky for elderly or sick people?

48. Have there been any instances of human feces being found in Taco Bell refried beans?
49. What is the definition of the word “synonym”?
50. What are the location, leadership and activities of the Swara Laya Fine Arts Society in Australia?
51. Where can I find information about Susan Boyle and how she’s been dealing with the media attention she’s been getting?
52. What are the parking ratios, only counting surface parking, in major American cities?
53. What is the recent value and performance of Stratex Networks, Inc. stock?
54. What is the definition of stubbornness?
55. Where can I learn more about design patterns in software design and how structured they should be?
56. Where can I find out more about the guitars made by Steinberger Guitar?
57. Where can I find reviews and retailers of Steyr handguns?
58. What sound effects were commonly added to Steve Kilbey’s vocal tracks? He is the lead singer of The Church.
59. What are common methods for performing statistical analysis on a data set?
60. Where can I find Star Trek Voyager fan fiction?
61. Where can I find team rosters and game schedules for lacrosse teams in this area?
62. What are the recent actions of the school board of the St. Johns County schools in St. John’s, FL.
63. What companies offer spray tanning services in Hamilton, OH?
64. What are the ways in which sports have shaped American culture?
65. Where can I find contact information and reviews for the South Shore Animal Hospital near Boston?
66. What is the definition of “soft news”?
67. What are the major ways that society pressures its members towards monogamous relationships?
68. What is the process for replacing a social security card?
69. What are some sources for learning more about social class in the United States?
70. What is the habitat of the snapping turtle?

71. I need to find full side profile pictures of American crocodiles with their mouths open.
72. Is the “CD-quality upgrade” on Sirius worth the money?
73. Where can I buy a “sippy cup” for adults?
74. What are the side effects of fatty acid intake?
75. Where can I find examples of shower invitations?
76. Where can I find reviews and retailers of shower benches for elderly and handicapped persons?
77. Where can I find a list of sunken ships?
78. Where can I find maintenance and product information on the fuel injection barrel valve tuning process in the SESCO midget race engine?
79. What is the average salary for a Senior Web Developer?
80. Where can I find information on hiring security staff in Orlando, Florida?
81. I need to find out more about Scott Pickens, the baseball player, to help me decide whether to include him in my fantasy baseball team.
82. How many school closures have occurred in the U.S. due to Swine Flu this year?
83. Where can I find contact information and reviews for restaurants in Schererville, Indiana?
84. Where can I find a cast list for the movie “Scarface”?
85. Where can I find team rosters, rankings and game schedules for the San Jose State University basketball team?
86. What information is available about Safeway’s Health Care program?
87. Where are the nearest Ruth’s Chris Steakhouses located?
88. Where can I find out which cities have Russell Reynolds offices?
89. What are some good sources for biographical information about Rosa Parks?
90. What was Robert Fratta’s alleged crime and what is the status of his trial? This was a famous murder case in the 1990s.
91. Where can I find contact information and reviews for Riverside Marine Boat Equipment and Supplies in Tennessee?
92. Where can I find benefit information for Rite-Aid employees?
93. What were the circumstances of Rick Ankiel’s diving catch of a baseball?
94. What are possible side effects of the antioxidant resveratrol, found in red wine?

95. What medical purpose does Restatis serve?
96. What private homes are available for rent in my area of interest?
97. What are the details and history of the Reno v. Condon case?
98. Where can I find contact information and reviews for Red Fish Blue Fish Photography in Seattle?
99. I want to find some case studies on recruiting practices in small and medium-sized companies.
100. Where can I find out what Ray Manzarek has been doing after Jim Morrison died?
101. How can I implement non-blocking read on stdin in Python? Where can I find some examples of code for this?
102. What words are synonyms for “puck”?
103. What research has been done into the psychological uses of heroin?
104. What are the lyrics to the song “Proud To Be A Stoner”?
105. What literary analysis and criticism has been done on Jane Austen’s *Pride and Prejudice*?
106. What different methods can be used to prevent pregnancy?
107. Where can I find reviews and retailers of the Porsche 928?
108. Who do I contact if I would like to submit my invention to the show Pitchmen?
109. What is the connection between pigs at public zoos and the spread of swine flu?
110. Where can I find information about Pig Wiggin Private School in Lanoka Harbor, NJ?
111. Where can I find pictures of Bart Simpson?
112. Where can I find reviews for the Philips 37 PFL 9903 TV?
113. Where can I find information on growing petunias?
114. How can I find basic information on the country and peoples of Peru?
115. Where can I find information on the actors and plots of the Perry Mason television show?
116. Where can I find information on Patrick Swayze’s personal life and career?
117. Where can I find materials for the Parallel Alternative Strategies for Students (PASS) program?
118. Where can I find a list of reviews and retailers of the Palm Pre?
119. What is an oxygen enhancement ratio?

120. Where can I get curtains at factory outlet price?
121. How can I set up and host an outdoor concert?
122. What information is available on Oprah Winfrey and her career?
123. Where can I find information on Oliver North's career?
124. How can I perform a partition alignment on my OCZ brand SSD drive?
125. How do I create a new reference to a file using the System.IO.FileInfo method in .NET?
126. How do I find out what level of pronation control is offered by the design of New Balance cross trainers?
127. What are the classes of substances that are banned by the NCAA?
128. Where can I find information on the history of the National Basketball Association and its members?
129. Where can I find information on the history of the Nevada State University baseball team?
130. What are the effects of an underdeveloped or narrow chest on Morgan Horses?
131. Where can I find lists and reviews of music stores in Lyon, France?
132. I would like to find out what Moscato wines are available from Sutter Home Winery's Family Vineyards.
133. Where can I find retailers of seeds for morning glory plants?
134. Where can I find sheet music or recordings of Larsen's "Missa Gaia"?
135. Where can I find information about how to qualify for the Miss America pageant?
136. How do I properly apply Miracle Gro in my garden?
137. What are the current gas prices around town in Milwaukee, WI?
138. Where can I find a place to get a military ring engraved?
139. Where can I find pictures and factual information on the plant milfoil?
140. How can I find out what game console I can play Midnight Club LA on?
141. Where can I find information on Middle School curriculum in my state?
142. What medical purpose does Microgestin FE serve?
143. What is the location and history of the Merrimac River?
144. What are common characteristics and what is the cultural background of merengue music and dance?

145. Where can I find reviews and retailers of Mercedes Benz vehicles?
146. Where can I find out if I qualify for Medicaid?
147. Where can I find information about the Ultralounge in Maine?
148. What are some good histories of McCarthyism?
149. Where can I find quotes by Maya Angelou?
150. What are possible causes of the strange/excessive noises coming from my Maxtor disk drive?
151. Where can I find pricing and review information on Martinez Painting Company in Ypsilanti?
152. What is the history of the Manchester Park neighborhood in Omaha, NE?
153. How can I make a NetBSD system look and feel like Mac OS?
154. Can I make phone calls for free using my PSP?
155. Where can I find out what kinds of animals live in the Madagascar rainforest?
156. Does the band Little Jackie have a song with “20 bottles” in the lyrics?
157. Where can I find information on training to be a Licensed Vocational Nurse in San Diego, California?
158. What is the first verse of “The loudest sound” by The Cure?
159. Where can I find out what the game schedule is for the Linn Mar High School basketball team in Iowa?
160. Where can I find reviews for Lily Allen’s albums?
161. Where can I find analyses of the collapse of Lehman Brothers and acquisition by other financial institutions?
162. What kind of information on Lebanon does the CIA Factbook have?
163. Who are some famous people who have dealt with learning disabilities?
164. Where can I find listings of vacation rental homes in Las Vegas, Nevada, that include pool access?
165. Which cell phone company has the largest network?
166. Where can I find reviews and stats on the Lamborghini Gallardo?
167. Where can I find the biography and voting record of Representative Lacy Clay of Missouri?
168. What information is available on obesity and health in Louisiana?
169. What are the guitar chords for the song “Kingpin” by Wilco?

170. How can I learn the various moves required to practice karate?
171. Who was the June Havoc of the June Havoc Theater in New York?
172. Where can I find information about jeep tops?
173. Where can I find maintenance and product information on the Jeep Cherokee transmission control module?
174. Who is Jason Segel, the actor from Forgetting Sarah Marshall, and what other movies has he been in?
175. I would like to find examples of the use of jaguars in Pre-Columbian tribal art.
176. What are some sources for finding out about hotels in Jackson, Mississippi?
177. How can I sync my iPod touch to MediaMonkey, instead of iTunes?
178. What happened to the aircraft carrier USS Intrepid after it was decommissioned?
179. What is the role of “internal validity” in developing a research project?
180. Is Inkheart a good movie for fathers to take their kids to see?
181. What are some synonyms of the word “infuriate”?
182. What is the history of the Peace Corps?
183. What is the definition of the word “indignant”?
184. Where can I find more information on implementing an in-memory repository for testing? Any object-oriented programming language is fine.
185. Can high doses of Lactimal have side effects such as the feeling you are “in a fog”?
186. Where can I find images of 19th century textile mill owners in Lowell, Massachusetts?
187. Where can I find a diagram of how to wire a 100 amp sub panel to a garage?
188. How do I take out duplicate songs from my iTunes library?
189. How do I make a fresh fenugreek paste?
190. How can I make a child-size tutu at home?
191. What are some ways to lower one’s resting heart rate?
192. How can I install pitch or instrument applications on my computer or mobile device?
193. How much does racing gas cost? I heard the gasoline used for automobile racing is different from regular gasoline I use in my car.
194. How common is clinical depression?

195. I would like to learn about sign-language, what pictures would help?
196. What private homes are available to rent in Camden County?
197. What companies sell hot tub covers in Seattle, WA?
198. What information was published in the Honolulu Advertiser on Hydrogen bomb testing?
199. Where can I find information on the cost and steps required to take a vacation on the French Riviera?
200. How can I determine what company HIG stands for?
201. I would like to find some good sources on the portrayal of Hermes in Greek mythology.
202. Where can I find episode and broadcast information about the show Here Comes the Brides?
203. I would like to compare and contrast the customs of the Heian court of Japan to the customs of the Samurai. What are some of the main differences?
204. What information is available on incidents of hazing on college campuses?
205. What are some places that sell the Harry Potter edition of Trivial Pursuit?
206. Where can I find a list of business information for local hardware distributors?
207. Where can I find reviews and retailers of Hart Truck Tycoon for my PC?
208. Where can I find recipes for the GT 101 Express cooker?
209. Where can I find recipes for ground meat?
210. What companies sell greeting cards?
211. Where can I find out more about styles of architecture for Greek houses in various eras?
212. What architectural principles are exemplified in the Great Ziggurat of Ur?
213. What companies sell and install granite countertops in New Jersey?
214. What is the language of origin for the word “gesticulate”?
215. What German Shepherd breeders are selling dogs in Illinois?
216. What are the major gender roles in our society and how have these roles been ascribed varying statuses?
217. I am thinking of buying a GPS, and would like to know more about the Garmin Nuvi 260w. Where can I find information that will help me make this decision?
218. How is the elephant-headed god Ganesh portrayed in images?
219. What are some U.S. states that have game warden academies?



220. Where can I find out more about Fruit of Islam martial art schools, such as who are they and what are their origins?
221. What companies sell freightliner trucks?
222. Where can I purchase a copy of Frank Raczynski's "Twilight Somewhere"?
223. How much can a forklift truck operator make per year?
224. Where is Foote Street in Washington, DC?
225. What information is available on the tradition of fire-eating in Hawaii?
226. What is the Field Artillery Association Award and who gives/receives it?
227. Where can I find biographical information about famous female athletes?
228. What is a recipe for fudge that will not take much time to prepare?
229. Where can I find biographical information about famous scientists?
230. How can I go about researching my family's geneology?
231. Where can I find out more about the TV show "Family Guy", such as who are the writers and the voice talent?
232. What research is available on how families in the U.S. practice their beliefs and religions?
233. What is the recent value and performance of Ev Innovations, Inc. stock?
234. Where can I find tips for throwing an evening wedding reception?
235. How can I learn the histories of select words?
236. What were the effects of the Black Death in the Middle Ages?
237. How can I find out if Eddie Bauer Holdings, Inc. stock price is going to rise?
238. What are some sources for finding easy jobs that pay well?
239. What program and athletics are offered by East Carolina University?
240. What is the history of Earl Grey tea?
241. Where can I go to take a practice driving test in the state of Michigan?
242. Does eyebrow threading hurt?
243. How can I find out more about the song "The District Sleeps Alone Tonight", such as who sings it and the lyrics?
244. What does the "diskette drive 0 seek failure" error message on my Dell computer mean?

245. Where can I find health information on the identification, prevention and treatment of diabetic seizures?
246. What activities were planned for the 50th Anniversary of Motown in Detroit?
247. What is the role of decomposition in an ecosystem?
248. What were the main historical events of the 1970s?
249. I want to find out more about the current situation of refugees in Darfur. What are some good sources to look up this information?
250. What are common uses of the Digital Aeronautical Flight Information Files (DAFIF)?
251. Where can I find some cute pictures?
252. What is the phone number for the Courtyard Marriot near Jefferson Avenue in Detroit?
253. What kind of cabinet handles are available for a cottage I am currently remodeling?
254. Where can I find images and facts regarding the Arenal volcano in Costa Rica?
255. Where can I get directions to the Copa Room in Kansas City, MO?
256. Where can I find reviews and retailers of Cambray skin care products?
257. What is the history of color film, and what colors were used in various formats?
258. Where can I find reviews and retailers of Cole Haan Air Kailey books from Nike?
259. Where can I learn more about the benefits and risks of closed rhinoplasty procedures?
260. Where can I find reviews of the Cloer electric kettle?
261. How can I find out more about the brand Clauss Products?
262. What were the major events, players and results of the Civil Rights Movement?
263. What is the recent value and performance of Chesapeake Energy Corporation stock?
264. Where can I find a chiropractor or physical therapist who specializes in neck, shoulder and back pain near New York City?
265. Where can I learn more about the origins of cheerleading in the U.S.?
266. Where is there a Chase ATM near zip code 44107?
267. How can I find basic information on the country and peoples of Chania, Crete?
268. What is the purpose of the design of the champagne flute?
269. Does oatmeal fit into the restrictions of the South Beach Diet?
270. Do the HARP refinancing loans carry a 1-point fee?

271. What is the calorie content of an average beer?
272. How can I visit Disney's California Adventure park?
273. Where can I find more about the California Department of Alcohol and Drug Programs, such as its budget and the programs offered?
274. Is there a Byron Street in Mount Laurel, NJ?
275. How can I find basic information on the the habits and habitat of the bull shark?
276. What are some travel books published by British companies? *Frommer's* is American and *Lonely Planet* was originally Australian - I was wondering if there were any travel book series originating from the U.K.
277. Where can I find information about the history of Brindisi, Italy?
278. Where can I find more information about Brad Vinson, an entomologist, including some of his publications?
279. Where can I find trustworthy reviews of the book *One Thousand White Women*?
280. What has Bono said on the subject of grace?
281. What is the routing number for Bank of America for checking accounts?
282. What are common characteristics of and who are some famous Blues music artists?
283. What is the game schedule for the Portland Trail Blazers' 2010 season?
284. I would like to learn more about black Spiritualist churches of the early 20th century.
285. What are some highlights of Bill Cosby's personal life and career? Where can I find out more about him?
286. Where can I find copies of images of Barbie to color?
287. What is the recent value and performance of Bank of America Corporation stock?
288. Where can I find some projects that are dedicated to helping sea turtles conservation?
289. What is the former location and history of the Auschwitz concentration camp?
290. Where can I find episode and broadcast information about the children's show Arthur?
291. What does "anaerobic" mean?
292. What did they believe about human nature in Ancient Rome?
293. How many total acres of land in the U.S. are taken up by houses?
294. What internships are available through Allegacy Investment Group, what is the rate of pay and how can I apply?

295. Who is Alexander Graham Bell?
296. What airports serve Sonoma, California?
297. What kinds of crops were grown in ancient Egypt?
298. What are some of the uses of agave nectar and its effects?
299. What are some of the topics researched by Professor Michael Selig in the Department of Aerospace Engineering at the University of Illinois Urbana-Champaign?
300. What is the address for Inglewood Associates, LLC?
301. I am considering buying a used 1989 Mustang LX Hatchback and would like to find out more about the car.
302. What retailers sell the ZR 520 ProRacer autpmobile wheel made by 5Zigen?
303. Was the minimum wage in California in 2008 \$8.50?
304. Where can I find reviews and retailers of the 2005 GTO Sport Appearance Package?
305. What is the history of Tux, the Linux penguin?

## **F2. Questions from the Internet Public Library**

1. I need the names of at least five scientists from the Caribbean who are inventors.
2. I am in library school and I need to do a project on seniors and technology in the public library. I just started school and I have no idea where to begin. Mostly I need help finding statistics and stuff about seniors using technology. (Like how many own computers, how many use the Internet?) I have some articles from public librarians about their work in this area, but I have no data to support my assertion that this is a good idea. Where could I even look for this?
3. I need to write about following information on Ohio's Native American Heritage: I need four tribes. For each tribe, I need a location and a description of them and their jobs like what they did for a living/to survive. It doesn't have to be long 'cause I only have one page I need to write so maybe a paragraph for each tribe. Where can I look for this?
4. I'm looking information about a John Corcoran who was English teacher who was illiterate. There was an article written about him in the Esquire Magazine called "Teacher who couldn't read." The article citation would be great, but anything about him is fine.
5. In need a really good critique of Robert Moss' book, *Dreamgates* - something that debunks the New Age bias and unbridled personal subjectivism of his ideas on lucid dreaming.
6. I would like to get biography information on A. S Otis or R. T. Lennon. They were authors of a standardized school test called "Otis-Lennon Scholastic Aptitude Test." I would also like to find out when test was first devised and why they created it, and what was their motivation.
7. I am a teacher and I need some resources that help create lesson plans and other activities. I am really busy so I'd like to find some good sources where I can see examples of lesson plans, etc. that I can just modify for my own class. I teach 3rd grade and I need resources that will address a variety of subject areas. How can I search for such things?
8. I am volunteering to do research for a community group of parents and other volunteers who want to read stories to K-6 students about grandparents. We are interested in books that relate to grandparents who are parenting; death of a grandparent; physical/memory impairment of grandparents; having fun with grandparents, all sorts of topics. I would appreciate a list of possible titles/authors/subjects.
9. How do I obtain my deceased husband's social security number? This information is needed to obtain his Death Certificate in Arizona.
10. I would like to know the best educational resources available for students in grades 3-6 about Black History.
11. Is the Jesus Group (I don't think I have the name quite right-Jesus Scholars?) still meeting? They are the group of scholars who are deciding which words in the Bible Jesus really said and which were added in the first several hundred years after Jesus's death. If they are still active, I would like to know if they have published any findings lately and, if so, where I can find them.

12. What is the source of, or reason for, the use of the word “blue” in “blue laws.” I know what a blue law is (limits commerce on Sundays) but why “blue”?
13. What were Welsh towns like in the 19th century?
14. I live in East Quadrangle, a dormitory at the UM, in Ann Arbor. In the dorm is a library, the Charles H. Benzinger library. A plaque above the entrance says the library is in honor of the man for who it is named, for his service in conceiving and planning “Operation Ransom” and gives his dates as 1930-1954. The library was dedicated in 1955. My question is, who is Charles Benzinger and what was the operation?
15. I am looking for information on public camping facilities in Germany.
16. What is the name of a small Greek island that is also the name of a city/town/village in Florida?
17. When did colleges begin to award specific degrees? I remember hearing that Thomas Jefferson did not receive a BA from William & Mary since there was no such thing at the time.
18. Did Mark Twain ever really say “Patriotism means being loyal to your country all the time and to its government when it deserves it”? This quote has been circulating around the Internet since 9/11/01. I don’t trust the sites on which it is reported. I came across the closest quote, “My kind of loyalty was loyalty to one’s country, not to its institutions or its office-holders”, from “A Connecticut Yankee in King Arthur’s Court.”
19. I read somewhere that most of the companies that sell textbooks to the US public school system are owned by France or The Netherlands or some other country. I am referring to Steck Vaughn, McDougal Little, Prentice Hall, etc. Is this true?
20. Was Giorgi Eliava, a Russian scientist in the Stalin era, killed because he was a Jew and therefore an enemy of the state?
21. In making cookies, does the use of butter or margarine affect the size of the cookie?
22. I need some sources to compare and contrast the basic element of theme and style of two particular writers, Stephen King and Edgar Allen Poe.
23. We want to generate reading lists from which to choose books for adult low level learners. These could also be books that would be good choices to read to their children. Reason: We need reading lists specifically aimed at low level adult readers. We plan to purchase new books if the state’s grant is awarded. Publisher and cost information would also be appreciated.
24. How do I create ceramic material from the waste products of coal incineration, through the use of microwaves?
25. What are the origins and reasons for the animosity between Arabs and Jews?
26. I am interested in learning to type and need some sources for free typing tutorial. Can you recommend some resources?

27. What products are exported out of and what products are imported into New York State?
28. I remember that Paul Harvey reported that “University of California” had done research on whether or not the tendency to homosexuality was nature or nurture, and that research found sexual choice “hard-wired into 54 human genes.” I need to find that published research. Other of the same genre would be most helpful.
29. How is Amazon doing as a company these days? I remember that there was time when there was so much talk about how they were barely getting by and might not be able to sustain themselves. I don’t want indepth financial analysis, just something about how they are doing as a company.
30. How can I find out many ways in which Ancient Greece had an impact on Today’s world?
31. Often money market reporters refered to Alan Greenspan while using “Humphrey/Hawk” references. They used to refer to Mr. Greenspan as being “Hawkish.” Evidently Humphrey and Hawk had a debate of some kind and I would like to know what Humphrey and Hawk is about.
32. I think that there was an Atchison who served as interim President for one day while waiting for the elected President to be inaugurated. Can you tell if this was so and who was the Atchison and President elect?
33. Can I get recent information for the reasons that women stay in abusive relationships and the solution to this problem?
34. I am doing a project on Michigan. I need to know lots. I need to know things like population, state flower, major crops, first governor, what happened there before it was state. Can you give me information about Michigan?
35. I have no idea where to look to find information on making an outline. I want to know HOW to make an outline.
36. I would like to know how Christmas is celebrated in Germany and in England. I want to know any specific customs, foods, gifts etc.
37. At what time in a child’s development is the best time to introduce another language to a child (for the child to become bilingual)?
38. How quickly do different metals conduct heat?
39. Halen is credited with the quote “Two souls and one thought, two hearts and one pulse.” Who is Halen?
40. I want to eventually get a job overseas, but I don’t know where to start. I would like to find some lists (comprehensive if possible) of companies that do business in France or Belgium. I would also like to find out what French/Belgium companies might do business in the Chicago area.
41. How did the District of Columbia get its name?

42. Can you find me some articles and information regarding the pledge of allegiance's use of the words "One nation under God" and the controversy concerning both sides (To leave them in or take them out)?
43. What is PVA glue? Is this adhesive the best choice for attaching canvas to a wood panel as a support for an oil painting?
44. What did the naval act of 1910 do for Canada and what did it mean to Britain?
45. I am looking for information on a career in law enforcement (police officer) for an oral presentation. I need information such as job description, salary, growth potential, working for local or state and federal government.
46. How did Mark Twain portray white and black people in his books?
47. What is a router? How does it act as a firewall? How effective is it in stopping viruses?
48. What are the rules or methods of art criticism?
49. I am doing a presentation on Mozart for my high school class. I watched the movie Amadeus and it said that he had a son. I was wondering if he really did have a son. Did he have any other children? Does he have any direct descendants?
50. How can mine tailings containing arsenic and cyanide be revegetated?
51. What actually happens when a person gets the "wind knocked out" of them?
52. How do smoke detectors work?
53. How the American biker gangs such as the Hell's Angels get their start? I've heard that they were founded by returning veterans after WWII, but need sources to confirm or deny this story.
54. I want to know if the amount of hours you sleep at night affect your mood. Like if you get 4 hours of sleep, are you cranky all of the time, or if you sleep 10 hours are you calm and happy the whole day?
55. What is the Bermuda Triangle?
56. I am looking for recent (since 1990) sources on Frederick W. Taylor, Taylorism. I even heard of somethings called neo-Taylorism and anti-Taylorism. Are these all related?
57. I would like to know function of a piston and a cam.
58. What are the supporting ideas that would help me understand the poem "a valediction: forbidding mourning" by John Donne, and what are the metaphores used in the poem?
59. I'm trying to source a quote attributed to Woodrow Wilson. It has to do with a supposed deathbed quote about his signing of legislation for the creation of the Federal Reserve. Some have said that he lamented that he had allowed the Federal Reserve to be foisted upon the American public. Could you help me pin down if it really happened or is it just one of those urban legends that is generally accepted as fact ?



60. I would like some leads on researching disinformation and disingenuousness on the part of the federal government at times of political election in this country, showing through quotes and example, that it has been always thus, that only the details change but the context remains fairly steady.
61. I remember I saw an editorial of a newspaper using the English language phrase FOOT IN MOUTH while commenting on a statement of a Minister. This was not used regarding the disease of the animals. I want to know the meaning of this phrase.
62. I want to write a paper about how divorce and a child born out of wed lock effects a child, and or adolescent. I witnessed both first hand and can't seem to put into words what I actually seen different about these kids, but there is something different about them.
63. I am interested in looking at children's books that have been banned. I know about the ALA site with the top 100 challenged books of the 1990's but would like to find similar lists for previous decades.
64. I would like to know articles/journals/researches on the use of chat abbreviations in emails. My thesis title is "the use of chat abbreviations in online social communication: why, what and when."
65. I am seeking information about antique cut glass such as pattern identification and prices.
66. Who changed the capital of India from Lahore to Delhi in sultanate?
67. I am seeking information about a major investment in internet infrastructure which occurred in South Korea. I am seeking support for such investment in Canada and would appreciate the background on the sources of funding a nature of the build.
68. What exactly is Library and Information Science? What are their applications (both academic and business)? Which schools/programs should I explore if I am interested in this field?
69. I've read references in several books (most recently, Daniel Quinn's *Ishmael*) to the "fact" that ancient hunter-gatherers only worked three hours a day and had abundant leisure time. I'm wondering: 1) What is the basis of these claims? 2) Is that 3 hours spent gathering food, or 3 hours doing all the things necessary for survival? 3) What is meant by "leisure" in this context? 4) If this is based on a study, does the study have any scientific credibility according to today's anthropologists?
70. I need to know the problems that were created by the arrival of many immigrants to Canada West after confederation.
71. I am looking for a list of all companies from around the world (primarily the US, but world-wide would be best) who have drinking water in cans (not bottles - it has to be cans only). It can be both regular water (w/o bubbles) and sparkling water (with bubbles).
72. I read that, in the late middle ages, some lords moved out of castles and into manor houses. I would like some more information about why this happened.

73. I am a student of computer science, currently working on project of “face recognition and detection”. I need some information about my project topic.
74. Who are P.W.G. (public war group) and how did they come into existence?
75. I need current information on attempts that are being made to organize or catalog the internet to improve better information access.
76. I need to find that population for the state of Georgia during the 1600’s.
77. Where can I find more information on a Mongolian genealogy?
78. Where can i find information on torture, crime, and punishment in England in the Elizabethan Era? I also want to know exactly when the Elizabethan Era was.
79. Where do I find information on the Political Influence of American Movies on the American Culture from 1930-1970. I need references and good sources to read.
80. I would like a list of all the major candidates for the U.S. presidency, their political parties, and what those parties evolved into from Washington to Obama.
81. I am working in a high school with students with severe learning disabilities. I am trying to locate books with limited vocabulary which they would like to read or have read to them.
82. I am looking for criticism of either the FDA Model Food Code or the Connecticut Food Protection Program.
83. I need a list of business magazines published in the Caribbean. I need to contact them and maybe advertise there.
84. I would like to know the most comprehensive resource for the history of great oration, speeches that have changed our world.
85. I would like to know the origin of the expression “to a T”.
86. When was the first time an Asian person was used in an ad that wasn’t targeted to an Asian audience?
87. I was watching the movie Waking Life, and want to know if anyone ever conducted an experiment to prove that people do better on day-old crosswords? In the movie, a couple characters talk about a study that proved that people did better on crossword puzzles that other people had already solved before them. The theory was that the knowledge was accessible to humanitys collective mind once people had solved it. I want to know more about this theory and if anyone has proven it. I’m especially interested in finding an article about the original study. I think they used the New York Times Crossword.
88. Who was John Playford? I heard he invented a kind of dancing. Does anybody still do it?
89. Where did the phrase “practical joke” come from?
90. What if any, is the relationship between how a word is presented, either visually or in audio to how well the person remembers it? What is the evidence of this?

91. What caused child labor to start and stop in the USA?
92. Is there one woman who has posed for several statues in New York City? This was a puzzle presented to me by a relative. They claim a famous woman has posed for several statues, and is also the model shown on the coins in other countries as well. She is supposed to have been fairly well known, but not necessarily as a model. She did however pose nude for some artists.
93. I need information to analyze the current development and status of the O'Neill extreme sport brand.
94. Why did periodicals (magazines and journals) start using volumes as a numbering system? What is the origin/history of the use of volume numbers as opposed to other possible numbering systems?
95. Where can I find peer reviewed journal articles about the digital divide that consider the social-economic dimensions? I need to find at least twelve articles.
96. I'm trying to find published information in magazines, newspapers, etc. regarding self-esteem that claims self-esteem is in fact harmful instead of healthy. I would like to know what is being said in the mainstream public media, not in scientific academic journals or papers (popular literature vs. scientific/academic literature). Is there a database or any other means by which I can search by keywords (such as self esteem) to find articles written in magazines and newspapers regarding that topic?
97. I would like a short history of Susan B. Anthony and Sacagawa (the Indian girl who guided Lewis & Clark). I have both coins to give to a grand niece for Easter and need background material.
98. What do I need to know about starting a church in Michigan? Are there state government requirements or anything else I need to know?
99. I would like to know how ip addresses work.
100. I am looking for the list of native American book publishers to publish my manuscripts.
101. I am thinking about buying Earth shoes and looking for some reviews on Earth shoes.
102. I would like to know how Wall Street got started.
103. A person is found dead and only their bones are recovered. How can you tell if it is male or female?
104. I would like to know how to start a personal chef business.
105. "Do what you can with what you have where you are." is attributed to Theodore Roosevelt, but no source can be identified. Can you help me finding its source?
106. I am looking for stain charts that list the stains and say how you should get them out. I want one or two comprehensive sources.

107. We need to find out how asphalt roofing is made, with what materials, and how the black roofing would become hotter, faster vs. white asphalt which would reflect the sun.
108. How does sleep deprivation affect the way students work at school and their achievement?
109. What are the major characteristics of the Scandinavian literature? Are these characteristics applicable to all the Scandinavian countries, or is there a difference between them?
110. Should Alan Greenspan have been reappointed to the Federal Reserve Chairman in 2006? What were prevailing opinions against his reappointment?