ABSTRACT
The article reports the results of a study that explored users' preference for search engines in relation to other information sources. The study used qualitative and quantitative methods to examine participants' information seeking with and without access to search engines. The study identified search engine features that users find valuable, such as perception of convenience, independence and privacy, as well as specific functionality (keyword searching, autocomplete feature). The study found that inability to use search engines caused an increase in negative emotions, especially among seekers with limited information horizons; led to the decrease in use of other electronic channels and increased inquiries to other individuals and the use of print sources. Our findings suggest that seekers operate within digital and traditional information fields and do not easily switch between the fields without major disruption to their habitual pattern. The discussion about positive and negative effects of search engine preference is included.

Keywords
Information seeking behavior, search engines, information preference, information channels.

INTRODUCTION
Search engines, and particularly Google (comScore, 2011), have become such popular information retrieval tools that terms like “Google generation” and “Google addiction” have emerged to describe the heavy use of this information channel. We conducted an exploratory study to investigate the degree of users’ preferences for this popular search tool. Our study focused on investigating the following research questions:

1. How does the use of search engines compare to the use of other electronic and traditional information channels?
2. What changes in information seeking behavior and user experiences occur when search engines are unavailable?
3. What elements of search engine technology do users value the most?

In order to address the research questions, we developed an exploratory study in which we monitored participants’ routine information seeking activities as well as changes in their information seeking behavior when we restricted their use of search engines. While our exploratory findings have limited generalizability, they fall in line with previous research on habitual use of some popular information retrieval tools and suggest new directions for future research.

RELEVANT LITERATURE
In the large volume of literature written about search engines, few articles focus on users’ preferences for search engines in relation to other information-gathering tools and technologies. In this section, we review several studies that outline the factors affecting information source preferences in general, and focus on a few studies that examine the preferences for search engines in particular. We also describe the methods used in the previous studies to investigate information source preference.

The literature describes a number of factors that affect information source preference, including the cost of obtaining information, information quality, user habits, contextual variables and more. One of the most popular theories used to explain information source choices is the principle of least effort (Zipf, 1949), which stipulates that a person will expend the least amount of effort necessary to solve a problem. In the information context, this principle implies that the user will prefer the source that is most accessible (Savolainen, 2008; Fidel & Green, 2004; Gerstberger & Allen, 1968; Hertzum, 2002), convenient (Connaway et al., 2011), familiar (Fidel & Green, 2004), easy to use (Gerstberger & Allen, 1968), closest in terms of
organizational distance (Cool & Xie, 2000), and, overall, requires the least effort to use (Hardy, 1982; Hertzum & Pejtersen, 2000).

Another set of factors influencing selection of information sources is related to information quality including usefulness, trust and relevance. There is no agreement among researchers about the importance of quality compared to other criteria. Hertzum (2002), for example, argues that trust is a key factor in the information source selection, though in the author’s other publication he notes that it is less important than cost (Hertzum & Pejtersen, 2000). Davis (1989) argues that usefulness is the most important factor influencing preferences for technology, while Liao et al. (2011) show that usefulness might be less important than habit.

Other studies demonstrate the importance of habit in selection of information sources. Gefen (2003) found that habit alone could be a major predictor of the continued use of a website. The study also found that mental investment in an information technology can make it difficult to replace the technology with an alternative, and that this can create a consumer “lock-in” for such technologies (Gefen, 2003). The Liao et al. (2011) study found that both rational and irrational motivations influence the use of an information portal, and in some instances, irrational factors such as perceived playfulness and habit have more influence on technology use than its perceived usefulness.

Additional factors that have been shown to affect selection of information sources include the type of information need and information task complexity (Byström & Järvelin, 1995), context (Peterson, Balasubramanian, & Bronnenberg, 1997), and individual differences (Milewski, 2007; Clewley & Chen, 2001). For example, studies found that different types of information sources were preferred for fact-finding tasks (Gerstberger & Allen, 1968; Hertzum & Pejtersen, 2000) versus process tasks (Milewski, 2007). Savolainen (2008) showed that human and internet sources were preferred channels for addressing problem-based needs. Source preference was also found to vary depending on the stage of a project (Ellis & Haugan, 1997), and project priorities (Hertzum & Pejtersen, 2000).

Several of the reviewed studies focused primarily on users’ preference for internet sources. A recent study of the “Google generation” (Nicholas, et al., 2011) examined the heavy reliance and trust that individuals, particularly young people, place on search engines. The authors found that “digital natives”, or people born after 1993 who grew up with the internet and mobile devices, viewed fewer results pages, visited fewer websites and searched less than older generations when using search engines for information queries. At the same time, “digital natives” felt less confident in their answers compared to the other age groups (Nicholas, et al., 2011).

Connaway et al. (2011) investigated aspects of convenience, such as ease of access and use, in selection of information sources. The authors have shown that convenience is a central principle that guides the selection of information sources and makes internet sources so attractive to information seekers (especially younger users). The article discusses implications of this principle on the development of library products and services that are competing with the web.

Waller’s (2011) study of search engine use found that people often use search engines even when they know the location of information, suggesting that perhaps users treat search engines as “leisure sites”, and not always as gateways to information.

Investigation of search engine use in a professional environment found that for important information tasks, participants chose to consult peers, while for less important tasks they chose a search engine (Lu & Yuan, 2011).

The reviewed studies employed a large variety of methods to study information source preferences, including interviews (Hertzum & Pejtersen, 2000; Savolainen, 2008; Fidel & Green, 2004), journals and daily logs (Gerstberger & Allen, 1968; Fidel & Green, 2004), questionnaires (Lu et al., 2011; Nicholas, et al., 2011; Clewley and Chen, 2001), critical incident method (Fidel & Green, 2004), scenarios (Milewski, 2007), log analysis (Waller, 2011; Nicholas, et al., 2011) and observations (McDonald & Ackerman, 1998).

Our study used a combination of methods to collect data about participants’ information habits and attitudes towards various information sources. We used the experience sample method recently applied by Rieh (2010) for investigating credibility judgments in the web context. The method allows the collection of data about users’ online activities several times a day without major interruption to participants’ routines. Another method that influenced our study’s design was used in a recent study by Moeller (2011) who examined the extent of users’ preferences for information technology. Moeller’s study asked around 1000 students from ten countries not to use their electronic media for the duration of 24 hours and report on their experiences. The study found that most of the participants were unable to restrict their use of electronic devices for 24 hours and/or reported having negative experiences associated with the inability to use technology. The next section provides a detailed description of the study methods.

**METHOD**

In order to address the research questions, our exploratory study combined qualitative and quantitative techniques. The study was conducted in the fall of 2011. The study used a combination of critical case and snowballing sampling techniques to recruit participants that were either previously known to the researchers or were recommended to researchers due to their certain demographic characteristics. This particular sampling technique was chosen for the following reasons: 1) we were interested in investigating...
participants with diverse demographic characteristics since this variable was shown to influence information source preferences (Nicholas, et al., 2011); therefore, other methods, such as a commonly used convenience sampling of (under)graduate students, could not be used; 2) due to our interest in personal detailed accounts of participants’ experiences, we needed a certain degree of trust between a participant and a researcher; 3) similar to the previous studies of information behavior that used non-probability sampling, our findings could be logically generalized to a larger population (as was noted by Patton, 2002, p.237, “If it happens there, it will happen anywhere”).

Eighteen participants ranging in age from 18 to 55 years old (mean=31.5) were recruited for the study. We recruited participants from different professional fields and with various employment statuses (our sample included full-time and part-time professionals, an unemployed person, volunteers, an intern and a retiree, from the fields of business management, education, government services, engineering and others). There were seven male and eleven female participants. Participants also had varying education levels from a high school student to a PhD. One important characteristic shared by all participants was that they each frequently used search engines on the regular basis.

The study was designed in three phases. Prior to the Phase 1, participants filled out a demographic questionnaire, which collected data on participants’ usage of various hardware and software. Phase 1 was designed to understand participants’ routine information habits and determine a baseline for comparison with later modified behavior. For the first four days of the study--Friday, Saturday, Sunday, and Monday--participants were asked to record their information seeking activities three times a day, or approximately every 4-5 hours (late morning, early afternoon and late afternoon) in a structured online diary. The diary collected data about the six information sources, including four electronic channels (search engine, email, social media, and map applications), two traditional analog channels (another person and print source), and the specific functionality within these sources. The diary also collected data about duration and circumstances of information source use and emotions associated with the use of these channels. Each evening, participants had 15-30 minute phone or in-person conversations with researchers about the details of that day’s information searches.

Phase 2 was designed to determine the changes in searchers’ behavior and use of information channels when search engines are not available. During this phase, we interrupted searchers’ routine and requested that they do not use search engines and associated map applications. This behavior modification was requested in order to investigate the level of searchers’ attachment to search engines and determine which of the search engines’ features users “missed” the most. This phase took place the following Friday, Saturday, Sunday, and Monday, and followed the same online diary and interview procedure as the first phase. We chose not to enforce the restriction on search engine use (by, for example, installing monitoring software on participants’ devices and/or penalizing participants for not following the protocol). Learning about the instances when participants used search engines despite the restriction allowed us to collect additional information about the perceived value of search engines and circumstances when participants could not identify alternative information sources. Interviews that were conducted with participants during the final day of search engine restriction (Monday night) included additional questions about participants’ experiences without search engines, alternative sources used, circumstances when search engines were ‘missed’ the most, feelings associated with inability to use search engines, and, if participants confessed to cheating and using the search engine, the circumstances of use.

During Phase 3, participants were allowed to return to their routine use of search engines and associated map applications. The data collected during this phase helped us to understand the effects of search engine withdrawal on participants’ search behavior. This phase took place on Tuesday and Wednesday, immediately following the search engine withdrawal phase. Phase 3 followed the same online diary and interview procedure as the first two phases.

At the end of the study, participants received small monetary compensation for their involvement; some participants chose to participate in the study without compensation.

RESULTS

Information channels

In order to understand the use of search engines in relation to other information channels, we compared the frequencies of information channel uses on the days when search engines were available and when they were prohibited (see Table 1).

<table>
<thead>
<tr>
<th>Information channel</th>
<th>Days with search engines</th>
<th>Days without search engines</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency of use</td>
<td>Use relative to other channels</td>
</tr>
<tr>
<td>Person</td>
<td>195</td>
<td>35%</td>
</tr>
<tr>
<td>Email</td>
<td>162</td>
<td>28%</td>
</tr>
<tr>
<td>Read</td>
<td>152</td>
<td>100</td>
</tr>
<tr>
<td>Write</td>
<td>88</td>
<td>55%</td>
</tr>
<tr>
<td>Search</td>
<td>49</td>
<td>39%</td>
</tr>
<tr>
<td>No Use</td>
<td>31</td>
<td>46%</td>
</tr>
<tr>
<td>Search Engine</td>
<td>88</td>
<td>15%</td>
</tr>
<tr>
<td>No Use</td>
<td>93</td>
<td>0</td>
</tr>
<tr>
<td>Research</td>
<td>88</td>
<td>0</td>
</tr>
<tr>
<td>Known Sites</td>
<td>70</td>
<td>0</td>
</tr>
<tr>
<td>Transaction</td>
<td>18</td>
<td>0</td>
</tr>
<tr>
<td>Social Media</td>
<td>70</td>
<td>12%</td>
</tr>
<tr>
<td>No Use</td>
<td>125</td>
<td>118</td>
</tr>
</tbody>
</table>
A total of 469 online dairy entrees were collected over the course of ten days from eighteen participants. Overall, we found that the most frequently used source of information was other people, followed by email, search engines and social media sites. The least frequently consulted information sources were print media and map applications. We observed that during the days when search engines and map applications were not permitted, use of other channels did not change dramatically. We verified this finding by running the ANOVA statistical test for comparing the means of channels use on the days with and without search engines. The only statistically significant change in the usage of channel was the decrease of email readership on the days when Google was prohibited.

In addition to counting occurrences of each channel’s use, we examined the number of hours participants spent on each channel during the four days of search engine use and non-use (Table 2).

Table 1: Use of information channels

<table>
<thead>
<tr>
<th>Channel</th>
<th>Yes</th>
<th>No</th>
<th>Partially</th>
<th>Neutral</th>
<th>Negative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post Info</td>
<td>54</td>
<td>16</td>
<td>9%</td>
<td>9%</td>
<td>9%</td>
</tr>
<tr>
<td>Email</td>
<td>6%</td>
<td>9%</td>
<td>6%</td>
<td>9%</td>
<td>9%</td>
</tr>
<tr>
<td>Map Apps</td>
<td>36</td>
<td>16</td>
<td>36%</td>
<td>9%</td>
<td>9%</td>
</tr>
<tr>
<td>No Use</td>
<td>54</td>
<td>16</td>
<td>9%</td>
<td>9%</td>
<td>9%</td>
</tr>
<tr>
<td>Direction</td>
<td>20</td>
<td>16</td>
<td>10%</td>
<td>10%</td>
<td>10%</td>
</tr>
<tr>
<td>Information</td>
<td>11</td>
<td>16</td>
<td>11%</td>
<td>16%</td>
<td>16%</td>
</tr>
</tbody>
</table>

Table 2: Time spent using information channels

We found that overall participants spent the most time using email. When participants could use search engines, it was the second most popular source of information after email. However, when search engines and map applications were not accessible, participants spent more time obtaining information from other people and print sources, and spent less time using electronic sources.

Table 3: Satisfaction of information needs and emotions reported on days with and without search engines

During the search engine restriction, participants were able to resolve their information needs most of the time (Table 3). For example, one participant described his reliance on Google News aggregator, so when search engines were prohibited, he searched specific news websites (e.g. New York Times website). Participants reported the increase use of bookmarks, email, saved files and other individuals as alternative sources of work-related, school-related or leisure information they would usually seek through Google or other search engine.

While in most cases participants were able to satisfy their information needs, they reported an increase in negative feelings associated with restricted search engine use. One participant realized that she was using search engines “for everything” and it was much harder to solve her information problems without them. Another participant mentioned that she had to dig through the trash to find a phone number of a restaurant that delivered her food and check the clothing label for company information.

Participants who did not experience major difficulties without search engines provided the following categories of explanations for their experiences:

- participants did not need search engines at the time of the study (“it's been surprisingly easy not to use Google and search engines, but I'm not doing research at the moment”);
- after experiencing initial difficulties, participants re-adjusted their information seeking routine (“After the first day <without search engines>, easier than expected”);
• participants identified and/or enjoyed using alternative sources (“All urgent, needed information is in a mailbox or bookmarked websites”: “I was glad that I asked friends for information, but more so for the personal connection that the information they gave me.”)

Two participants were unable to solve their work-related information problems without search engines and gave up working on the tasks. Nine participants reported using Google or other search engines despite the study protocol. Most instances of ‘cheating’ were accidental (“I forgot that I was doing this study, succumbed to my natural instinct, and reached for the search bar.”) Three participants reported using Google up to three times over the course of the four days of restricted access. Examples of the situations when participants needed to use search engines include a) preparation for an interview at a prestigious company (the participant felt the importance of this task merited making an exception to the study protocol and researching company information online); b) need for quick reference (“to quickly find the address of the museum for my foreign friend who was in town”); and c) reference to a particular Google search result (“because someone told me specifically that there was an answer to a specific question about AmEx if I clicked the first result if I Googled “how does amex make money.”) One participant reported using Google up to 10 times over the four days of search engine’s restriction due to a medical emergency and inability to efficiently find medical (including insurance and hospital) information through alternative channels.

In order to understand why some participants experienced difficulties without search engines while others found and used alternative sources relatively easily, we examined demographic data that were collected as part of the study. We were interested in examining whether there are any relationships between participants’ age, education, occupation, technical skills or other demographic variables and levels of difficulty experienced without search engines. The only demographic variable that differentiated between participants who experienced difficulties and those who did not experience major difficulties without search engines was participants’ proficiency with information technologies and sources. Our demographic questionnaire collected data on the types and frequencies of use of various information devices (e.g., mobile phones, e-readers, laptops, etc.) and channels (e.g. search engines, blogs, podcasts, radio, libraries etc.) Participants who did not have difficulties without search engines routinely used more information devices or information channels and/or used them more frequently than other participants. Ten participants who found it hard to satisfy their information needs without search engines on average used fewer information channels or used them less frequently than other participants. This pattern suggests that participants who routinely use a wider variety of information channels are less dependent on search engines than those who use fewer channels and devices or use them less frequently. Due to the small sample size of only 18 participants, we were unable to run any statistical tests. However, the findings are consistent with the previous findings (Nicholas, et al., 2011) and can be used to inform future work.

Search engine’s perceived value
In trying to understand the features of search engines that our participants valued the most (and missed the most when use of search engines was restricted), we analyzed interview data collected during the four days without search engines. We identified several themes related to the participants’ sentiment towards search engines (Table 4). The most frequently mentioned theme was participants’ inability to find alternatives, followed by convenience associated with the use of search engines, habit of using search engines, discomfort associated with burdening others with information requests, sense of the reassurance provided by search engine results, and perceived ‘anonymity’ of search engine use. We identified eleven instances when participants reported negative feelings unrelated to the use/not use of search engines. Table 4 provides definitions and examples of the themes that emerged from participants’ responses.

<table>
<thead>
<tr>
<th>Theme (Frequency): Definition</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insufficient Alternatives (24): Alternatives that are not discovered or do not appropriately address information need.</td>
<td>“At one point I wanted to find a photo of Don King for work, but I couldn't use Google Images and could not think of how to find it otherwise...”</td>
</tr>
<tr>
<td>Convenience (16): Use of search engine is more convenient than the use of alternatives.</td>
<td>“Google is one click away, everything else is at least 2 or 3 clicks away.”</td>
</tr>
<tr>
<td>Feeling Unrelated to Search Engines (11):</td>
<td>“Stressed about school, satisfied because I was learning.”</td>
</tr>
<tr>
<td>Habit (8): Habitual use of search engines that is well integrated into other participants’ routine behaviors.</td>
<td>“It is starting to become frustrating because I have lots of ideas that I normally just open up a search engine and start working. But I cannot do that now, and I have to actively think about not using search engines, because it is so second nature. In fact I opened the search engine up, then had to stop myself.”</td>
</tr>
<tr>
<td>Sense of reassurance (5): Feelings of trust and</td>
<td>“I think using a search engine would help me feel more certain that I had everything I am looking...”</td>
</tr>
</tbody>
</table>
A number of themes in participants’ responses were related to specific search engine functionality that participants found useful and reported missing during the four days without search engines. Participants mentioned missing the following search engine functionality: 1) browsing and navigation within search results; 2) variety of search results; 3) autocomplete function for website addresses and keywords; 4) support for serendipitous discoveries, and 5) perceived quality of search results.

**DISCUSSION**

Our analysis of the use of search engines and other electronic and traditional information channels indicated that search engines are only the third most popular information source. We found that the most frequently used source of information is other people. The finding is not surprising and confirms previous findings related to the information channel preferences (Savolainen, 2008). Use of other people as information sources increased even more when search engines became unavailable. Our interview data suggests that information inquiries to other people would be even more frequent if participants were not concerned with inconveniencing others, privacy and other issues.

The second most frequently used information source in our study was email. It was also the medium where participants spent most of their time. The popularity of personal communication and email can be explained in light of the information richness theory (Daft & Lengel, 1986) that suggests that people will prefer channels that promote understanding in a timely manner. It can also be explained with the demands for credible and authoritative information (Rieh, 2010). The finding that warrants future investigation is the decrease in email use once search engines became unavailable.

We have noted that as participants could not use search engines, their use of other electronic channels dropped as well. While the use of electronic channels like email and social media sites went down during the four days without search engines (Tables 1 and 2), participants spent more time consulting print sources and other people. We interpreted this finding using the framework of information field and information pathway proposed by Johnson (2003; 2006). Information field is a concept that represents the typical arrangement of information stimuli available to individual on a regular bases; information pathway refers to a specific sequence of individual actions involved in information source selection. Our findings suggest the presence of two types of information fields available to seekers: digital (internet sources and email) and analog (print sources and other people). Within the digital field, it is easier to create paths that involve the use of various digital sources (e.g. switch between email, social media sites, search engines) to solve one or several information needs. Within this field, identifying and contacting a person or accessing a print source might be perceived as a disruptive activity. For our participants, once one major information source in the “digital” field became unavailable, they had more incentives to switch to more traditional information channels like print and other individuals. Several participants even commented on

| Table 4: Reasons for experiencing negative feelings without access to search engines |
|---|---|
| **reassurance provided by search engine results.** | for, even though my friend who works at the company is probably just as good source if not better.” |
| **Sense of independence (4): Use of search engines allows participants not to burden other individuals** | “I <…> didn’t want to put too much of a burden on people to keep searching for information to respect their time” |
| **Preference for electronic sources (3): Strong preference for electronic sources over alternative information channels** | “I don’t like having to talk to people.” “<with search engine> you can choose to get away from <print material>.” |
| **Privacy (1): Perceived “anonymity” of individual search engine searches** | “Especially with the health stuff, I only wanted to ask people I was really comfortable with to do some basic searching for me because of privacy about what I am looking for.” |
| **Themes related to the specific search engine functionality** | **Keyword search/browsing (5): Keyword search function and/or ability to browse results** |
| | “missed just Google keyword searching the entire internet” “<make internet> easy to navigate” |
| | **Variety of results (4): Ability to access variety of resources** |
| | “search engine is giving you options - <…> different ready-to-use formats of information on the searched topic (like article or ppt presentation, for example)” |
| | **Autocomplete function (2): Google autocomplete function for web addresses and search terms** |
| | “I do like predictive text as well. when typing a website I haven’t been to in a while, I like that the address bar will fill in the rest for me.” |
| | **Serendipitous discovery (2): Ability to obtain unexpected results** |
| | “<missed> the entertainment/surprise aspect of getting unexpected search results.” |
welcoming the disruption of their “digital” routine and embracing direct human-to-human interaction. Future studies should consider investigating the differences in physical dimensions, communication requirements and perceived benefits of the digital and traditional information fields. With the advancement of e-books and other digital materials it becomes especially critical to understand the differences between digital and analog information fields, and ways of connecting them in order to maximize the benefits of both fields to the user.

During the period of restricted access to search engines, participants were mostly able to solve their information needs. Even without search engines, participants were able to access web content through web browser bookmarks and mobile device applications. However, based on the interview data, it appears that participants associated the restriction with major inconveniences, regrets about inadequacies of personal libraries and/or bookmarks, and revelations about heavy dependency on a very few websites out of the entire web. Our findings are in line with the results of a recent study that examined reliance on Google search function as transactive memory tool for locating, not remembering, information (Sparrow, et al., 2011). Reliance on the internet as transactive memory aid decreases cognitive load and leads to establishment of the different information habits (e.g. reliance on search function instead of establishment and use of personal libraries/bookmarks.)

Once certain habitual heuristics for accessing content became unavailable, some participants found creative ways to resolve their information needs without search engines. In addition to using personal collections of print and electronic records, and talking to friends, some participants tried to obtain necessary information from artifacts (e.g. clothing labels and food storage containers). One participant considered using the library but confessed that it would be too time consuming and most likely not very successful. This comment, as well as lack of mentioning of libraries as information sources in other participants’ responses suggests that within our sample, use of libraries was not a routine activity. Compared to prior studies that identified barriers to the use of libraries, such as physical barriers, demographic characteristics, perception and awareness issues (Green, 1994; Harris, 1984), the most important barrier for our participants was lack of awareness of library as an information resource and, in one case, concern for inefficiency of library compared to other information channels. Considering heavy reliance of all our participants on digital information channels, future studies might examine relationships between increasing digital presence of libraries (e.g. social media sites), ways of promoting awareness and improving perception of libraries among library users and non-users.

Several participants were unable to completely abstain from search engine use. Most of these participants used the search engine accidentally. Habitual use of technology is well documented in the literature (Liao, 2011). Some of our participants of different ages and professions fell into this pattern of behavior and automatically turned to search engines for information. Such behaviors illustrate that use of search engines might have become one of the information retrieval heuristics: quick judgments and semi-automatic actions made without full assessment of information need and all appropriate sources. While such heuristics might offer time-saving and seemingly effortless techniques for acquiring information, they come with limitations (e.g., Duke and Asher (2011) report that “digital natives” experience major difficulties with every aspect of the search process.) Future studies can focus on examining advantages and disadvantages of search heuristics’ use.

Four of our participants knowingly broke the protocol and used search engines to resolve their work-related or personal information tasks. Three out of these four participants “cheated” only a few times due to perceived importance and/or urgency of the information task at hand (e.g., preparing for an important job interview). One person had a medical emergency during the four days of search engine restriction and had to use a search engine up to 10 times to locate medical and insurance related information. Two participants could not successfully identify search engines’ alternatives and stopped working on their information tasks completely.

In the described situation, inability to identify and use search engine alternatives can be explained by the type of task, its characteristics and user perceptions (Li, 2004). It can also be explained by the differences in the perceived information environments defined as sets of information sources of which seeker is aware of and used some time in the past (Savolainen & Kari, 2004). We found that participants who found it especially difficult to resolve their information needs without search engines used fewer information channels and devices on the regular basis, therefore their perceived information environments were more limited than of those participants who found it easier to find search engine alternatives. Future studies should focus on investigating the link between information source preferences (or dependencies), perceived information environments and ways of enhancing these perceived information environments. In some cases, search engines might have provided exclusive content not available through other channels (e.g. when one participant was looking for health insurance information during the weekend, insurance company’s website could have been the only available source of relevant information.)

Analysis of the interview data helped us to understand participants’ searching experiences and some of the characteristics of search engines that participants found valuable. While most of the participants were able to satisfy their information needs despite the restriction in the use of search engines, their emotional experiences with and without search engines were quite different. Participants reported significantly more negative feelings during the search engine restriction, and more than half of the
participants found it harder than they expected to give up search engines, even temporarily. A few participants reported having positive experiences associated with the absence of search engines. Those positive emotions were usually related to talking to other individuals (even when they were not ideal information sources, our participants enjoyed social interaction), and a sense of more productive use of their time (“not linger on the web like I normally do.”) Reasons for users’ reliance on search engines despite the fact that other channels can bring more ‘joy’ to their lives can be investigated in the future.

The most frequently mentioned problem associated with the absence of search engines was perceived lack of alternatives: participants were either unaware of the alternative information sources that would provide comparable content or were unhappy about inefficiency and ineffectiveness of alternatives. In fact, initially all stages of the study were planned to last for one full week. However, during participants’ recruitment, we discovered that most of them would be unable to perform their routine job-related tasks without the use of search engines, so the length of each phase was reduced. This finding points to the dependency on search engines as a unique information channel and a limiting effect of seekers’ reliance on the most frequently used and/or convenient channel. It might be interesting to examine negative and positive effects of channel dependency in the future studies. Our interview data suggests that the positive factors of search engine use include convenience, the process of serendipitous discoveries, sense of independence and privacy while major negatives are related to the heavy dependence on one application, decreased information horizons, limited awareness about alternative sources that might be better suited for the information task at hand, decreased confidence (Nicholas, et al., 2011), inability to find good sources (Duke & Asher, 2011) and other factors.

Convenience associated with search engine use was the second most popular theme in participants’ accounts. Most of the prior studies identified convenience (Connaway, et al. 2011) and accessibility (Savolainen, 2008) as primary reasons for source preference, and linked these factors to the principle of least effort (Zipf, 1949).

Closely linked to the first two themes is a theme of habitual use of search engines. Some participants mentioned that use of search engines was “second nature”, an activity so tightly integrated into their routine activities that without “browsing” capabilities of search engine some participants had to change the way they worked on tasks and generate ideas:

“I usually search for ideas for things to do and eat.”

“…can’t fire up google to find information. You actually have to think.”

This finding suggests that search engines are used not only for finding information to satisfy an existing need, but to generate ideas and activities.

Some of the more unique themes that emerged in our study were related to feelings of empowerment associated with the search engine use, specifically 1) the sense of independence and self-reliance in cases when consulting other individuals is perceived as burdensome, 2) feeling of being reassured by the search engine results, and 3) “anonymity” of search engines’ use compared to the concerns for privacy while asking other individuals for information. Since the theme of perceived empowerment was not frequently mentioned in the previous studies, we think it offers promising directions for future studies. For example, it would be interesting to investigate the levels of perceived independence, reassurance and anonymity offered by various information channels, the extent to which these features are desired by users and can be built into the information systems.

We identified a number of specific search engine functions that participants found useful and reported missing the most during the four days without search engines. Some of these functions, such as browsing (Bilal & Bachir, 2007), were previously mentioned in the literature. Value that our participants associated with the ability to discover unexpected information was also mentioned in the study that examined serendipity in the digital environment (McCay-Peet & Toms, 2011). We think that it is worth researching the perceived value of serendipity more as it might be an important component in evaluation of retrieval results (traditional relevance concept might need to include the degree of variability of results to satisfy the demand for ‘serendipitous’ discoveries.) While we did not find previous studies in which seekers “praied” the autocomplete function, there is plenty of evidence that this user preference is well known in the information retrieval industry (e.g. almost all search engines, proprietary databases, and other systems have autocomplete features as part of the keyword search option). More work needs to be done to understand the weight of specific properties that make search engines so popular since integrating these features into other systems (e.g. digital libraries) will help making search engine alternatives more attractive to information seekers. Our study helped to confirm and identify some of these properties.

**CONCLUSION**

We conducted an exploratory study to investigate users’ preferences for search engines; and specifically 1) examined how the use of search engines compares to the use of other electronic and traditional information channels; 2) investigated changes in the information seeking behavior and user experiences that occurred when search engines were unavailable; and 3) identified elements of search engine technology that users value the most. The study used questionnaires, online diaries and interviews to collect data...
about participants’ information seeking activities and experiences with and without search engines.

The study confirmed some of the previous findings and identified a number of original factors related to the preferences for information sources, and, particularly, search engines. Some of our findings that support prior research include the fact that a) the most frequently used information channel is other individuals; and b) search engines are valued for convenience, the option to quickly access a wide variety of resources, keyword search and browsing functions. Some of the study’s unique findings include the fact that when search engines were not available, use of other electronic information sources decreased, while the time spent using print and consulting other individuals increased. Our findings warrant future work on understanding digital and traditional information pathways and their relationships to users’ tasks, situational variables, information seeking habits and routine behaviors. We have also found that some participants experienced a significant increase in negative emotions due to restrictions placed on search engine use and their inability to identify alternatives. Examination of the demographic variables indicated that this “dependence” on search engines can be linked to the limitations of the seekers’ information environments. More work is needed to verify this finding, and identify specific factors related to the composition of one’s information environment and its effects on information seeking behavior. Our findings also suggest that use of search engines might be treated as an information seeking heuristic, a semi-automatic habitual response to the information need situation when minimal or no pre-search planning is done. Future work should focus on investigating information seeking heuristics related to the use of search engines and other channels, the situations when heuristics are used, their benefits and disadvantages to the user. Our study identified a number of search engine properties that seekers found valuable. Some of these properties might be important determinants of information channel preference and should be examined in future studies.

Our study had a number of limitations. Due to the high costs of conducting the study, both in terms of monetary compensation to participants and time required to collect and analyze qualitative data, the sample size of information seekers was small. This limitation prevented us from using some of the statistical tests (except for the descriptive statistics) that would make some of our findings more conclusive and generalizable. The study used a convenience sample which offered a number of benefits, including recruitment of participants with diverse demographic characteristics, and establishment of rapport that enriched qualitative data collected during the daily interviews. However, it might also have biased the data due to possible participants’ desire to please the researcher or other reasons. Our study focused on a small but demographically diverse sample of search engine users; future studies might examine and/or compare information channel preferences of more homogeneous groups (e.g., undergraduate students v working professionals). The study design also could have affected the results: while participants did not know the study details when they were recruited for the study, they were told that they might be required to give up search engines for a number of days. This knowledge by participants may have affected their searching behavior during the study phases. The data were collected using self-report measures and was largely based on trust. While we assume that participants accurately reported their information seeking routines in the online diaries and daily interviews, there is a chance that participants intentionally or unintentionally provided erroneous data. Future studies should consider capturing participants’ information interactions through logging software or other recording means in addition to using self-report measures.

The findings from our exploratory study are open to interpretation using various theories, including the information richness theory, the principle of least effort and others. Our study examined the use of various information channels, from those that provide only one particular kind of information (e.g. map applications) to the channels that are used to obtain and share information, and to communicate with others (social media sites and email). Future studies might focus on examining specific theories and/or different groups of information channels.

Despite the limitations, our study generated a number of ideas for future work and improved our understanding of the role of search engines in one’s life. One of our participants summarized his attitude to search engines in a phrase: “Google is God”. While there is plenty of evidence that search engines make one’s life richer, easier, and happier, we should not be afraid to look for the short and long-term implications of our dependency on search engines.

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