To Search or to Ask: The Routing of Information Needs Between Traditional Search Engines and Social Networks

Anne Oeldorf-Hirsch[1], Brent Hecht[2], Meredith Ringel Morris[3], Jaime Teevan[3], Darren Gergle[4]

[1]University of Connecticut
Storrs, CT
anneo@uconn.edu

[2]University of Minnesota
Minneapolis, MN
bhecht@cs.umn.edu

[3]Microsoft Research
Redmond, WA
{merrie,teevan}
@microsoft.com

[4]Northwestern University
Evanston, IL
dgergle@northwestern.edu

ABSTRACT

In status message question asking (SMQA), members of social networking sites make use of status messages to express information needs to friends and contacts. We present findings from a laboratory study that examined 82 participants' SMQA behaviors in the broader context of online information seeking. When given the option of using a search engine and/or a social network, participants leveraged SMQA for 20% of their information needs, most often posing a question to their network in addition to issuing a query. We show the important roles played by the specificity of the information need and the perceived audience of a given network on routing decisions. We then demonstrate that routing decisions have varied effects on participants' satisfaction, information value, and trust of outcomes. In addition to highlighting the complementary advantages and disadvantages of search and SMQA, our findings suggest that search engines can better address a meaningful portion of people's information needs by integrating SMQA capabilities into their systems.

Author Keywords

Social media question asking; information seeking; social networks; Web search; social search.

ACM Classification Keywords

H.5.m [Information Interfaces and Presentation]: Miscellaneous

General Terms

Human Factors

INTRODUCTION

A new information seeking approach that has received attention from both researchers and practitioners is *status message question asking* (SMQA) [1, 12, 20, 23, 24, 31, 32, 37]. In SMQA, users of social networking sites like Facebook and Twitter co-opt the status message field to pose questions to their friends and contacts [24]. While researchers are beginning to develop an understanding of SMQA behavior in isolation, little is known about how this behavior fits into people's broader online information seeking strategies. For instance, although we have some understanding of users' motivations when they ask status message questions (e.g., [20, 24, 37]), the same cannot be said for when they purposely eschew their networks (e.g., by self-censoring Facebook posts [7, 30]) and instead route an information need to search engines. Similarly, while status message questions in Facebook and Twitter have been examined separately (e.g., [24, 26]), the process by which question askers choose a network to express a given information need has not been investigated. In addition, the relationship of these routing decisions to the type of information need is not well understood.

Developing a clear picture of the routing of information needs between traditional search engines and social networks has implications not only for our understanding of SMQA behavior but also for the design of systems that integrate the two, such as Bing's "Social Sidebar" [5], Google's "Search, plus Your World" [29], and research systems like SearchBuddies [15] and MSR Answers [17]. Because search engines and SMQA each bring unique benefits and costs for different types of information needs [4, 8, 23], a deeper knowledge of routing behavior has the potential to guide further development of such technologies.

In this paper, we present findings from a laboratory study designed to answer three questions about participants' SMQA behaviors in the broader context of online information seeking: 1) Which needs go where? 2) Why (and why not)? and 3) What was successful?

By asking, "*Which needs go where?*" we engage in the first examination of how people route information needs to search engines and social networks. When given the option of using a search engine or SMQA, our participants preferred to use a search engine, although they used SMQA for a meaningful portion of their needs (20%). The overall preference for search engines still exists for types of information needs that have been shown to be most prevalent in status message questions (e.g., recommendations), but it is weaker. We also found that when status message questions were asked, it was more often as a complement to issuing a query to a search engine than as a replacement. These results suggest that search

CSCW'14, February 15 - 19 2014, Baltimore, MD, USA

http://dx.doi.org/10.1145/2531602.2531706

engines may be able to better address a portion of information needs by integrating SMQA capabilities.

By exploring the question, "*Why (and why not)?*" with regard to routing decisions, we uncover new motivations for searching and asking. We show that the specificity of the information need and the perceived audience in a given network play an important role in participants' choices. Our findings suggest that these factors not only guided decisions with regard to searching and asking, but also figured into selecting the correct social network to ask.

Finally, in addition to examining routing decisions, we also look at the outcomes of these decisions by asking, "*What was successful?*" We show that no one strategy received universally better responses than another. Instead, each strategy had complementary advantages and disadvantages. Our findings show that overall, greater trust and value was placed on search engines as an information source than on social networks. However, ratings of individual responses received from SMQA were more trusted and satisfying than those received from search results. Although SMQA occurs less often than search engine use, there are clear benefits to the behavior that are worth understanding and supporting.

RELATED WORK

Since Morris et al. [24] identified that as many as 50% of Facebook and Twitter users engage in SMQA behavior, SMQA has become the focus of an increasing number of studies [1, 12, 20, 23, 24, 31, 32, 37]. Follow up work [22] has confirmed that 50% of Facebook users have tried SMQA, with lower numbers turning to other social networks (33% of Twitter users, 25% of Google+ and LinkedIn users). We extend this research by placing SMQA into a broader framework of online information seeking that includes both SMQA (on multiple networks) and search engine use.

In addition to establishing the popularity of SMQA, Morris et al. [24] found that the most popular information needs sent to social networks are requests for recommendations and opinions, primarily due to greater trust in friends' opinions, need for subjective information, and the belief that a search engine would not work well in such cases. Additional SMQA studies have built on this typology. In an exploration of 420 information-seeking status updates on Facebook, Gray et al. [12] identified similar question types but in very different proportions. Rhetorical questions were most common, followed by requests/favors and opinion/polls. When studying SMQA on Twitter, Paul et al. [26] found that rhetorical questions, requests for factual knowledge, and polls were particularly prevalent.

Researchers have examined the answers to status message questions, primarily by scoring friends' and contacts' responses on various measures of quality (e.g., [11, 12, 24, 26, 31]). Morris et al. [24] rated responses to information needs routed to social networks by whether or not they were helpful and if a response came as quickly as expected. Paul et al. [26] coded responses to question tweets as related or unrelated. Gray et al. [12] developed a more elaborate measure that examined both the satisfaction and usefulness of responses. In an assessment of the effects of tie strength on answer quality, Panovich et al. [25] developed a multi-faceted measure of answers including various informational and trust aspects of the information and the source. Building on this work, our experimental design enables us to assess the quality of an answer on various dimensions, depending on information need and routing decision.

The literature on answer quality in SMQA also contains the only other studies that simultaneously considered search and SMQA [11, 23]. In Morris, et al. [23], 12 information needs were issued as queries and status message questions, and the responses were compared for speed and quality. Evans et al. [11] compared usefulness of responses to specific information requests for problem-solving tasks in traditional search to several social search approaches to assess differences in learning scores. Our work, on the other hand, is focused on how people route information needs across SMQA and search, as well as on the entire question and answer pipeline.

Recent work has also started to consider the social costs of using one's network as an informational resource. Ellison et al. [8] categorized requests posted on Facebook into cost levels, finding that individuals use up more social capital with requests that require more effort from their friends. Other work has begun to examine instances in which users choose not to post information to their online social networks [7, 30], or to post only to a select audience within those networks [18, 21]. Our work complements such studies by examining the circumstances under which users prefer to route information needs to search engines rather than social sources, or combine these methods.

Evans and Chi [10] presented a model of social search in which a user interacted with others before, during, and/or after search engine use. Their model, developed before social networks achieved mass penetration, did not account for alternative social information seeking approaches, such as SMQA. Nor did it explore how users chose to route specific types of information needs to either social or non-social sources. Our work expands the "during search" phase of the Evans and Chi model, enriching our understanding of users' reasoning regarding social interaction while seeking information.

METHOD

We conducted a laboratory study to assess when people with information needs turn to a search engine versus when they ask their social networks. We examined what types of needs were directed to which services and why, and assessed how the participants felt about the answers and results they received in response. Participants considered both self-directed information needs and a set of prompted needs based on common status message question and query types identified in the literature [16, 19, 24, 28, 35].

Participants completed the study over two sessions one to five days apart to allow time for responses from social networks. In the first session, they used a custom designed web application to attempt to fulfill the prompted and unprompted information needs and completed questionnaires regarding their information seeking strategies. In the second session, participants rated the search engine results and answers to the questions that were posted to their social networks. Participants completed a pre-questionnaire that asked if they were familiar with and how often they used a variety of websites and apps – including the four used in the study (Google, Bing, Facebook and Twitter) – and others such as Wikipedia, YouTube, Instagram, and Quora (1 = *No, have never used it* to 5 = *Yes, currently use it often*). The questionnaire also contained Hargittai and Hsieh's 10-item web use skill measure [13]. At the conclusion of the first session they completed a post-questionnaire that measured how often they used each of the same services to ask for information (1 = *Never* to 6 = *Several Times a Day*). Demographic information was also collected in this survey and our study software collected numbers of Facebook friends and Twitter followers.

Participants

Participants (N = 82) were recruited from the geographic area surrounding a mid-sized Midwestern university. They were required to be regular users of the Internet and social media (self-defined) and have at least a Facebook account. The sample ranged in age from 18 to 64 (M = 24, SD = 10.10) and was 64% female. The majority of the participants (84%) were students. Fifty-one percent were Caucasian/White, 28% Asian/Pacific Islander, 11% African American/Black, and 10% multi-racial.

Participants were moderately skilled in their web use [13] (M = 3.53, SD = .82) and all but two participants stated they were familiar with all four of the services used in the study. All participants indicated that they seek information online daily, with issuing queries to Google being the most popular strategy. Facebook was used to seek information at least a few times per month by 67% of participants and Twitter by 33%. Participants' Facebook networks ranged widely in size from just one friend to 1,645 (*Median* = 511, SD = 394). For those who used Twitter in the study (24%), their number of followers ranged from 7 to 1,007 (*Median* = 122, SD = 214).

Procedure

The web application (Figure 1) allows users to type in a query or question and send it to (up to) two search engines (Google and Bing) and (up to) two social networks (Facebook and Twitter), by pressing each button separately. The layout order of these four service buttons was randomized. After selecting one service, the query remains in the textbox so that another service can be selected for the same text or the text can be modified or removed for another query. The first page of query results was displayed in a frame below the question box. Participants were informed that questions routed to Facebook and Twitter were recorded but not posted, and that only one would be randomly selected for each service at the end of the study and posted to their Facebook Timeline or Twitter news feed. This was done to prevent concerns about spamming one's network with too many questions in quick, unnatural succession [38] from interfering with participants' routing decisions. This allowed participants to send questions for which they would most want to use Facebook or Twitter to those services, rather than turning to search engines only to avoid the cost of asking their networks many artificial questions. In this study our goal was to understand routing decisions outside of cost constraints, as discussed in more detail below. The web application logged all questions, search results (including post-query interactions), and answers to Facebook and Twitter questions.

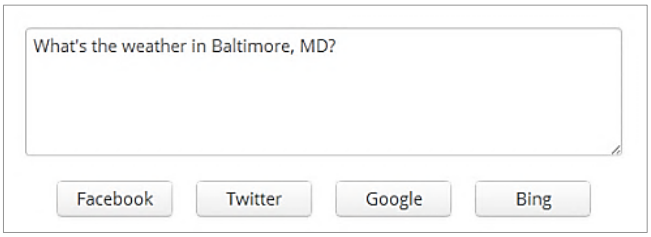

Figure 1. The primary interface to the web application used in the study.

Information Seeking Phase

The information seeking phase of the study began by giving participants five minutes to write down "anything you've been meaning to ask someone, information you have been seeking, anything you want to know more about, or want to understand better." Afterward, participants were instructed on how to use the web application and given 10 minutes to explore their own information needs. During this stage, they were allowed to enter as many questions or queries as they wanted using any of the available services.

Participants were then instructed to consider a number of prompted information needs (Table 1). Each participant saw 10 of the 30 prompted needs created for the study – one from each of the types discussed in the section that follows – selected and displayed in random order. Participants were required to use at least one service to investigate a prompted information need before they could move on to the next one. They had 20 minutes to complete this process. While the prompted approach is less natural than intrinsically motivated questions, it ensures coverage over a wide range of information need types.

At the conclusion of the *information seeking phase*, participants were shown each of their routing choices and were asked to complete the following open-ended items: "Why did you choose to use [service] to ask this question?" and "What [answers/results] were you expecting from [service]?"

Participants then completed a final questionnaire indicating how often they use each of the four services for seeking information on a six-point scale ranging from *Never* to *Several Times a Day*. At the end of this session, participants were partially compensated and instructed not to delete or edit any status message questions or any responses before their follow-up session.

Response Assessment Phase

Participants returned for a second session one to five days after the information seeking phase to rate the responses to their information needs. This allowed time for responses to SMQA information needs to be posted. In this response assessment phase of the study, participants were shown each of their previous information needs along with the results/answers they received. For search queries, they were shown the same results they had previously received, with those they had clicked highlighted in gray. If the question was posted to Facebook or Twitter and received any answers, that question was displayed with accompanying responses. Participants were instructed to select which result/answer they thought was best, which loaded a questionnaire about that answer, and then they rated it on dimensions of satisfaction, information value, and trust [25]. Upon finishing the answer-rating questionnaires, they were compensated for their second session.

Prompt Development

The prompted types used in the information seeking phase are presented in Table 1 and were based on typologies from the social media question asking and information retrieval literatures. The objective was to capture a wide range of query and question types and examine how they were routed between search engines and social networking sites. The bulk of the prompted types were based on the schema from Morris et al. [24] that includes eight types of questions: recommendation, opinion, factual knowledge, rhetorical, invitation, favor, social connection, and offer. However, due to our broader scope, it was also necessary to consider types of information needs not typically seen in SMQA but common in traditional search. In doing so, we identified two additional need types not captured by Morris et al.'s schema: 1) navigational information needs [16, 28], which are typically expressed by queries such as "cscw 2014" and "gmail", and 2) exploratory information needs [19, 35], which are defined by their open-ended and multifaceted nature. Taxonomies of traditional web search queries typically include information need types in addition to navigational and exploratory (e.g., transactional [6] and casual-leisure [9, 36]), but these have extensive overlap with Morris et al.'s question types.

Three prompts were written for each of the ten types. Wording was constructed so as not to bias participants toward any particular service. For example, the word "find" was used consistently across all prompts rather than the words "ask" or "search," and the use of the word "network" was avoided.

Recommendation
Find a good place to get food right after this study.
Find a good birthday present that you could buy online now for a specific relative.
Imagine a trip you'd like to take in the future and find out what others recommend as the best sights to see.
Opinion
Think of a certain place you are interested in seeing and find out whether it's worth traveling there.
Think of the next tech product you'd like to buy and find out what people think of it.
Think of a TV show that you plan to watch during your next free hour and find out what others think of the show.
Factual Knowledge
Find out what might be causing symptoms you have been having recently.
Find out what traffic will be like for your commute to your next destination after this study.
Find out what the weather is like outside right now.
Rhetorical
Contemplate something that's always confused you. See what others think.
Think of something that's frustrating you right now. See what others think.
Think of a strong opinion you have about a current issue. See what others think.
Invitation
Plan an activity you would like to do this weekend and find out who is interested in joining you.
Find out if someone in the area is interested in meeting up for your next meal.
Think of something you would like to do after this study and find out if anyone else would be interested too.
Favor
Think of a project you'd like to do or a task you need to finish for which you don't have the right tool or gadget. Find someone local who has this particular item you can borrow.
Think of a task at home you could use help with today, and find someone who would be willing and available to help.
Think of an errand that needs to get done today. Find someone else who can take care of it right now.
Social Connection
Find someone who can help you learn more about a new hobby you'd like to take up.
Find someone who would be a good person to know for finding a job in [local city] for you or someone else.
Find someone to teach you a new skill while you're online right now.
Offer
Think of a skill or particular area of knowledge you have. Find someone who could benefit from this skill/knowledge.
Think of an item you have at home that you no longer use. Find someone else who could use it.
Think of something you can offer to do in your next free hour that would be useful within your group of friends or local community.
Navigational
Find the website for the main gym at your university or alma mater.
Find Nike's website.
Find [local library] website.
Undirected / Exploratory
Find a current event you are interested in keeping up with (one you aren't already keeping up with).
Find an idea for a new hobby (a hobby you haven't considered before).
Find a new activity to do this week.

Table 1. Prompt by prompt type.

Data Preparation

Participants initially submitted a total of 1,728 information needs. Exact duplicates within each service were removed. Similarly, fixed typos and rephrasing strategies within the same service (i.e., query reformulation) were collapsed into a single information need (e.g., "Breaking Bad next season date" and "Breaking Bad season date 2013"). For prompted information needs, those that did not address the prompt were marked and excluded from further analyses. This left a total of 1,397 valid information needs, of which 584 (42%) were the participants' own needs (user-defined) and 813 (58%) were prompted.

All unprompted information needs were coded using our typology developed for prompts (Table 1). There were no unprompted needs expressed for two of the types (offer and social connection) and an additional type was added – polls – to capture needs that did not fit into our initial schema. This coding process was performed by two independent coders. Initial inter-rater agreement was low (Cohen's Kappa = .67, $p < .001$) due to conflicts in the categorization of navigational needs. The navigational type definition was clarified, questions were recoded, and acceptable inter-rater agreement was reached (Kappa = .81, $p < .001$).

WHICH NEEDS GO WHERE?: ROUTING DECISIONS

Because little is known about how people route their information needs between status message questions and search engines, our first series of analyses addresses the question of "which needs go where?"

A clear theme emerges from our participants' routing decisions: when given the option of issuing a query to a search engine or posing a question to their social networks, information seekers prefer search engines but utilize SMQA for a meaningful portion of their needs. Overall, 80% of unprompted information needs and 76% of prompted information needs were routed exclusively to search engines (Table 2).

Focusing on the more naturalistic distribution of information needs from the unprompted dataset, we found that when status message questions were asked, they were more often accompanied by a query to a search engine than not. While 7% of all unprompted information needs were expressed solely through status message question asking, 13% were expressed in combination with a search query (Table 2).

As discussed above, recent work has established that status message questions reflect a unique distribution of information needs. Requests for recommendations, opinions, and factual knowledge are the most common. Our unprompted and prompted results show that even for these types of information needs, search engines remain dominant, although to a somewhat lesser degree. Figure 2 depicts participants' routing decisions by type of information need. Fifty-six percent of unprompted opinion needs went only to search engines, with the analogous numbers for recommendations and factual knowledge being 77% and 81%, respectively. The results for prompted information needs were similar, with a trend towards a higher percentage of search engine queries. Moreover, as with the results for the entire dataset, status message questions were accompanied by queries a majority of the time. For instance, only 3% of unprompted recommendation information needs were routed solely to social networks and 20% went to both.

We also found that the two types of information needs drawn from the information retrieval literature and not yet considered in the context of SMQA – navigational needs and exploratory needs – were routed almost exclusively to search engines. The navigational result is to be expected as search engines are known to excel at navigational queries

Type	Search	SMQA	Both
Unprompted Needs	80% (344)	7% (27)	13% (54)
Prompted Needs	76% (522)	20% (134)	4% (30)

Table 2: The final routing choices for unique prompted and unprompted information needs.

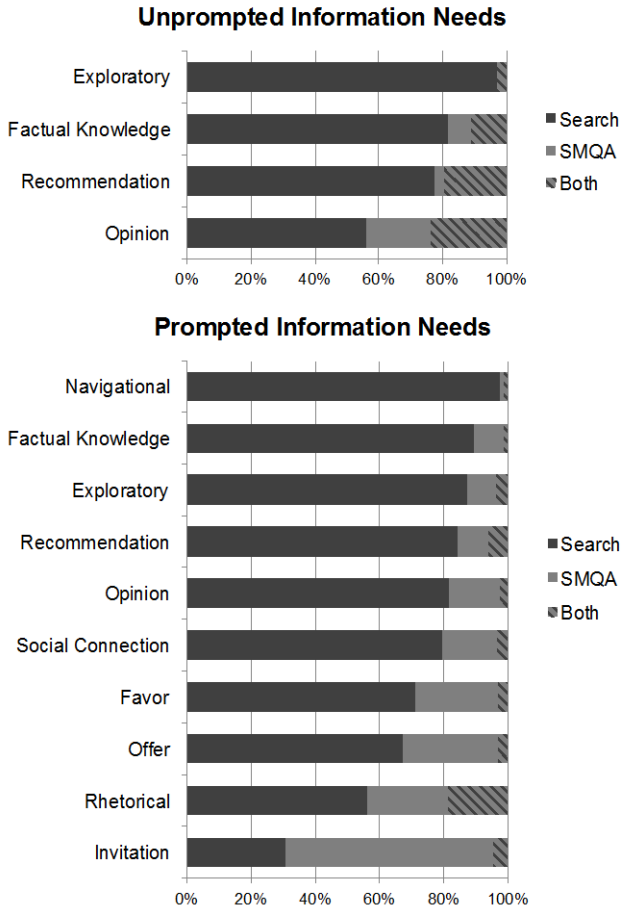

Figure 2: The routing decisions of participants by type of information need. Only types with 10 or more expressed information needs are shown.

[35]. The same is not true of exploratory queries, however, which are widely recognized as a weakness of modern search technology [34, 35]. Moreover, the rich conversational environment in which SMQA takes place would seem well-suited to exploratory information needs, which are open-ended, multifaceted, and typically fulfilled iteratively [35]. We address participants' motivations for routing exploratory needs away from their social networks and the implications of this finding for the development of new exploratory search technologies later in the paper.

WHY (AND WHY NOT?): MOTIVATIONS

For each information need, participants were asked to explain why they chose the service they did and what they were expecting. These open-ended responses were gathered for 1,195 of the expressed information needs and were analyzed for themes that compare and contrast the use of the two available service types: search and social. Participants' quotes are presented in their original wording.

Why SMQA?

Participants turned to social networks for their information needs for reasons that were largely consistent with previous findings [24]. We found that participants routed information needs to Facebook because they trusted their friends' opinions, were asking for subjective information, were seeking a specific audience, or hoped for better personalization and contextualization. That said, some previously documented reasons for routing needs to social networks were not observed in this study. Notably, participants rarely mentioned turning to Facebook because of a belief that a search engine would not work for the information need, although this was a common motivation in earlier work [24]. Connecting socially is another motivator missing in the present study. Participants may have routed some information needs to Facebook for this reason, but it was not explicitly expressed. Answer speed (social networks being *faster*), failed previous search, and social networks as an easier option were also common motivations in past literature not mentioned by participants in the present study. Conversely, we found that speed and ease sometimes drove participants to search.

Differentiating Use of Twitter and Facebook

Past research has focused either on social networks as an undifferentiated category or on a single network at a time, but the ability to choose between networks or use more than one in this study allowed for a comparison of differential routing behavior among networks. Gathering opinions from friends was a commonly cited motivation for asking a question on Twitter, as it had been for Facebook. However, Twitter users also took advantage of the site's broader network in different ways than they did of their more personal Facebook networks. Information needs often went to Twitter when they required a more personal audience, but were deemed inappropriate for Facebook. For instance, one participant used Twitter to ask what she felt was a very personal question, but one that she did not want her Facebook friends to know:

"I think the people in the Twitter could be a little bit smart and there isn't too many real-world friend in the Twitter, and interest in bible is a very personal thing, I don't want my friend know it."

Similarly, another participant wanted to gather a subset of friends for an event, but did not want to include all of his friends in the area:

"I know some people in [town] on Twitter and I would be curious to see if they'd be interested (a friend who is also on Twitter and in [town] had brought up the idea of going). I didn't post this to Facebook because I have a different set of [local] friends there and I didn't want them to see this post."

Twitter was also used for questions deemed too controversial for Facebook, such as political discussions:

"It is a platform that I generally use (and I know is commonly used) to follow political and social issues, as well as to interact with the opinions of my friends. I tend [not] to post political content on Facebook at all."

Twitter users were also aware of the potential for broader network audiences. One participant was frustrated about a local situation and was seeking others in the area that might have similar opinions:

"[Information about new campus construction] is something that a search engine probably won't be able to answer because it's a more under-the-wraps issue. I'm also looking more for people who feel the same way about me and to instigate a discussion."

Twitter's public network was described by one participant as having a benefit over other venues for gathering opinions specifically because of its potentially broader audience:

"Not only to get my question answered, I like that the fact someone replied to my answer pops up both on my page and the other person's page. The conversation becomes public therefore can engage other people in."

These examples show that social networks cannot be compared unilaterally to search engines; each service provides unique benefits. Specifically, it appears that Twitter serves as a unique middle ground between search at one end of the information-seeking spectrum and Facebook at the other. Participants can use the service to get subjective information not accessible from search engines, but with fewer social costs and a broader audience than routing information needs to Facebook.

Why Not SMQA?

While motivations for routing information needs to SMQA largely confirmed previous work [24], the structure of our experiment allowed us to examine for the first time motivations for routing information needs *away* from SMQA. We found that the three most common of these motivations were (1) information needs being either too specific or not specific enough for SMQA, (2) concerns

about the limited information available in one's social networks, and (3) hesitation about disrupting one's networks.

Needs Were Too Specific, Or Not Specific Enough

Search engines were utilized most often when individuals had a very specific information need or when they had one that was quite abstract. The first indication of this U-shaped relationship between the specificity of an information need and search engine use came with our quantitative observation that navigational (very specific) and exploratory (very unspecific) needs are almost always sent to search engines. Participants also provided support for this relationship when discussing the motivations behind their routing decisions.

At the narrow end of the specificity spectrum, Bing and Google were most often chosen when users felt they were asking a "simple" or "straightforward" question to which they could quickly and easily find an answer. In the words of one participant, *"[The search engine] has a straightforward answer and would give me the fastest results."* On the other hand, when faced with very unspecific information needs, participants turned to a search engine because "it seemed like a good place to start" or because they were unsure what to ask their network. One participant explained, *"I felt that Google would help me direct my search through the results I'd get from this initial search, especially since I wasn't sure exactly what I was hoping to find."* Similarly, another participant stated, *"Since I wasn't sure exactly how to phrase the question, perhaps Google's results would help me do that."*

Limited Information in Networks

A common motivation for eschewing SMQA in favor of search was a belief by participants that the people in their networks would not have sufficient knowledge about the topic to answer their question. For instance, in seeking opinions on a new smartphone, a participant wrote, "*don't know anyone who has it yet, but I know it is being released soon and I imagined tech reviewers may already have their hands on it."*

Although we (and others, e.g., [24]) found that participants often routed needs to SMQA because they believed their friends had a greater knowledge of the relevant context, we also saw the inverse occur. That is, some participants avoided using SMQA because they thought their friends and contacts knew very little about the relevant context. For instance, referring to a search for a new restaurant, one participant wrote, "*I did not want to use Facebook to ask this because people on Facebook do not know my specific taste in food. Instead I would like to use a search engine to check out menus and possibly see pictures*."

Even for highly personal types of needs like invitations, there were a moderate number of cases in which participants searched for Meetup groups for a specific activity because they did not have the right group of friends for that activity. One participant wanted to start doing martial arts in her community, but her network was limited: *"I don't know of anyone in my networks that does this and lives in this area, so Google would be best for a primary search."*

In many cases, participants believed that searching for opinions and recommendations gave them a much wider variety of information than their friends could. To find tips for exploring the large city in which he currently resides, one participant routed his information need to search rather than his network "*because a lot of more people worldwide may have already done this before*." Likewise, another participant decided that while her audience had some expertise, she wanted a different audience: "*As much as I know some friends have traveled extensively, I was more curious to see what cultural Francophiles had to say about the overrated tourist spots*."

Disruptive to Network

Participants actively avoided SMQA for information when they were afraid of disrupting their networks. This was particularly true for controversial topics for which opinions were desired, but for which the social cost of posting to Facebook or Twitter was believed to be too high. One participant specifically sought a discussion about gun control from the comments in response to an opinion piece, stating, *"I know that using Facebook to discuss strong political issues can be a very tricky thing that can invite heated unpleasant arguments."* Similarly, another participant wrote, "*I would NOT use Facebook for this question because I already know my friends' opinions, and even if I didn't I'd be wary of asking political questions on Facebook*."

A different form of disruption avoidance occurred when participants wanted to keep their activities out of the networks so as not to cause tension between contacts, such as when using search to find information related to an exclusive event: "*I'm going to a party there on Saturday. Thought I could get dinner before hand. didn't want to announce the party to everyone on Facebook or Twitter because I know people who are not invited*."

Avoiding SMQA Completely

Twenty-two (27%) participants did not send any questions to Facebook or Twitter, despite all participants having social media accounts. While most did not mention purposely avoiding their networks, a few participants indicated that they did not want anything posted to their Facebook Timeline, a finding that is consistent with results that show that many Facebook users carefully curate their account [38]. More specific motivations matched those described above for routing information needs away from social networks. The majority of these 22 participants indicated that they were most comfortable using search engines for information or felt that a search was adequate or most relevant. As one participant who sent all her information needs to search indicated: "*I thought it would*

be unnecessary to wait for a response from Facebook friends when I could easily search it."

Merging SMQA and Search

Eighty-four information needs were sent to both SMQA and search engines. Two broad motivations emerged for this behavior: complementing friends' opinions with search and using social responses to interpret search results. With regard to the former, one participant asked his network for their "*passionate responses*" and then sent the question to search engines, doing so because "*a search engine would be better than asking my friends through Facebook where everyone ...has biased opinions*." Similarly, one participant first asked her network because "*i want to know what all my smart friends are using to study [for the GRE],"* but then issued a query to Google because "*I thought google would give me less biased answers than my friends*."

In contrast, sometimes friends' knowledge was expected to help clarify factual information found via search engines. For instance, one participant wanted to learn about a topic both on Wikipedia and then on Facebook because "*My friends might be able to summarize the answer to this question in a way that would be easier for me to understand.*"

WHAT WAS SUCCESSFUL?: RESPONSE OUTCOMES

Of the 1,397 information needs studied, 1,142 (82%) received responses. Thirty-nine percent of information needs posted to social networks received responses, ranging from one to ten in number, with a median of three. The median response time for the first response on social networks was five hours and 55 minutes, with the fastest response coming in one hour and 34 minutes after the information need was posted. All search queries received at least ten results in our study.

Participants selected the best response received for each information need and rated it on three dimensions using 7-point Likert-type scales: information value, satisfaction, and trust. These ratings were received for 1,036 (91%) of responses. Information value was measured using three items, which asked participants to rate to what extent the response contributed to existing knowledge, provided new information, and verified information already known. One item was used to measure their satisfaction with the response. Trust in the response was assessed in terms of their trust in the answer itself, trust in the source (e.g., the specific friend on Facebook or website from Google that provided the answer), and trust in the service (e.g., Bing or Twitter).

We used a mixed-effects regression model to analyze the information value, satisfaction, and trust scores. The independent variables include participants' web skill, age, gender, question type (categorical), and search (vs. SMQA). Because observations were not independent, participant was modeled as a random effect. Full results of these models can be found in Appendix 1.

Search vs. SMQA

Response ratings were compared for information needs routed to search engines and SMQA on the dimensions of information value, satisfaction, and trust.

Information Value

Overall, responses from search engines provide greater information value than those from social networks. Information needs routed to search engines were rated significantly higher for contributing to knowledge (M = 4.85) than those routed to social networks (M = 3.73), $F(1, 950.1) = 9.49$, $p < .01$. Search engine responses were also rated higher for providing new information (M = 4.78) than social media responses (M = 2.94), $F(1, 952.9) = 24.51$, $p < .001$. It is likely that responses from search engines more directly answer the question, while those from social networks may offer other content not necessarily relevant to the information need.

Satisfaction

While participants felt that information from search engines contributed more new knowledge than social networks, they were marginally more satisfied with responses to questions posted to social networks. The effect of routing on satisfaction shows a trending effect, with responses to information needs routed to social media rated as more satisfactory (M = 5.86) than those routed to search engines (M = 5.2), $F(1, 968.4) = 3.06$, $p = .08$. This indicates that satisfaction has a social component; users may rate responses that do not answer the question as satisfactory because of other factors (e.g., humor and tie building).

Trust

Trust varied significantly by routing decision. Participants trusted search engines (M = 5.78) more than social networks (M = 3.78) as a general resource for information, $F(1, 939.8) = 86.51$, $p < .001$. However, when rating the specific source of the information (a particular friend in the case of social networks or a specific website linked to by a search engine), participants placed greater trust in responses from social sources (M = 6.19) than search sources (M = 5.27), $F(1, 952.2) = 11.39$, $p < .001$. These results present an interesting contradiction whereby individuals generally perceive search engines as more trustworthy sources of information, but end up placing greater trust in the information provided by their friends.

Question Type

Ratings of responses in terms of information value, satisfaction, and trustworthiness also varied significantly by question type.

Information Value

Question types had a significant effect on contributing to knowledge, $F(10, 950.1) = 6.54$, $p < .001$, and on providing new information, $F(10, 953.4) = 5.52$, $p < .001$. For both outcomes, responses were rated highest for factual knowledge and exploratory information needs. In contrast, responses were rated significantly higher in verifying existing information for navigational needs, which are

targeted and easily fulfilled, than for factual knowledge, social connections, invitations, favors, and offers ($F(10, 944.2) = 5.76$, $p < .001$).

Satisfaction

Question type also had a significant effect on satisfaction with responses, $F(10, 968.8) = 11.28$, $p < .001$. Navigational, recommendation, and factual knowledge information needs lead to the most satisfying results, while offers, favors, and invitations garner the least satisfactory result.

Trust

Finally, question type had a significant effect on trust in the source of the response, $F(10, 953.2) = 11.11$, $p < .001$, and trust in the content of the response, $F(10, 953) = 12.10$, $p < .001$. For both, responses to navigational needs are rated highest, whereas favors, offers, rhetorical questions and polls are rated lowest.

DISCUSSION

The results above contribute to our understanding of SMQA behavior and can inform the design of the growing number of technologies that seek to bridge traditional search and social networks. This section discusses both of these topics and also covers our work's limitations.

SMQA Behavior

Our findings related to the question "Which needs go where?" highlight both the potential of SMQA and its limitations. With regard to SMQA's potential, the fact that participants entirely ignored search engines in favor of SMQA for 7% of unprompted information needs means that SMQA can serve as a search engine alternative in special cases. Moreover, SMQA's utility as a complement to web search was highlighted by the 13% of information needs that went to both search and SMQA.

On the other hand, we also saw that search engines were used exclusively for a large majority of information needs, even those that are decidedly social (offers, favors, and social connections). It is possible that these needs are being routed to search engines to avoid the costs of asking one's social network for information [8], such as expectations of reciprocity [33, 37] or a desire to portray a highly curated persona [38]. Users may also route information needs away from their social networks despite the potential for more satisfactory answers in order to respect norms and etiquette surrounding social networks as personal spaces rather than as resources for information-seeking [8]. Overall, our findings suggest that SMQA has an important role to play as both an alternative and complement to web search, but that this role is somewhat constrained.

The trade-offs between search and social are captured in the motivations, which show not only when to route to, but also when to route away from or merge with SMQA. While motivations for turning to SMQA were consistent with previous work (e.g., [24]), our findings shed light on information seeking strategies for actively avoiding SMQA. We introduce the U-shaped curve of specificity, indicating that SMQA is deemed appropriate within a spectrum bound by needs that are believed to be too exploratory to be successful in SMQA and too specific to be necessary in SMQA. A desire to merge SMQA and search is evident in the various ways users employ both in their information routing needs: comparing both for a wider variety of information, using search to verify friends' opinions, and turning to friends to clarify search results.

Finally, when examining "what was successful?", we found a nuanced answer in which search and SMQA act differentially on various facets of success. In line with our findings about the large percentage of information needs that are sent to search engines, we discover that information seekers perceive search to provide more valuable information than SMQA. However, SMQA provides more satisfying answers, indicating that success goes beyond informational content, and information seeking potentially fulfills a more holistic, partly social need. That information-seekers place greater trust in search engines as a whole for information, but greater trust in their friends than web results found in search, corroborates the complementary roles that can be played by search and SMQA.

Implications for Design

At a high level, our results add to the growing body of work advocating for technologies that merge the searching and asking experience. Twenty percent of unprompted information needs in our study were routed to social networks, suggesting that search engines can better address a meaningful portion of information needs by integrating SMQA capabilities into their systems. Social networks, on the other hand, could increase the information value of asking a status message question by incorporating search engine technology into the conversations around status message questions.

Our work also presents the possibility of developing technologies that automatically route information needs to the appropriate service. We saw above that distinct patterns exist in people's routing choices and the motivations behind those choices. Using these patterns, a model could be developed that would allow, for instance, a search engine to know when to suggest posting a status message question in addition to – or instead of – continuing with a search. Working towards this model is a direction of future work.

Another important implication for design arises from our finding that exploratory information needs are almost always are routed to search engines, at least in part due to a tendency to avoid posing open-ended questions to one's social networks. Exploratory information needs are a well-known weakness of current search engines and are, accordingly, an active area of research (e.g., [3, 14]). Our research suggests that despite the conversations around status message questions having many properties conducive to the open-ended, multifaceted, and iterative process that is exploratory search [35], use of SMQA for exploratory

search is not common. One interpretation of this finding is that SMQA has little value for exploratory search; an alternative interpretation is that further research is needed to develop novel approaches to make SMQA more amenable to exploratory information needs.

Limitations

Although this paper is the first to examine the routing of information needs across SMQA and search engines, we did not consider the effect of other social search strategies such as IM, email, SMS, and face-to-face discussion, whose relationships with traditional search has been a subject of several studies (e.g., [10, 27]). We also do not analyze the influence of network properties, such as size, which likely have an effect on the success of SMQA. Understanding routing in this more diverse ecology is a subject of future work.

Our research is also limited by potential sampling biases. Although the distribution of web skills among our participants was not abnormal, our sample had an overrepresentation of women and students. Participants also had a substantially higher median number of friends on Facebook than active Facebook users overall [2]. By recruiting those who consider themselves regular Facebook users, we may have also biased the sample toward Facebook use rather than regular use of Twitter or other social media. The sample was also relatively young, which does not allow us to assess the potential systematic effects of age on social media use for question asking. Additionally, our sample was drawn from a specific geographic area and an urban setting. Query sampling biases may also exist, and certain type of queries (e.g., navigational), may be under-sampled in this study.

Another issue not addressed here is the potential saturation effect present in SMQA, in terms of social capital costs [8]. In order to understand routing behavior at the information need level, we necessarily restricted the number of status message questions that would actually be posted to participants' networks. Our current work involves taking a longitudinal perspective in order to shed light on the relationship between the number of status message questions posted in a given timeframe and the likelihood of asking another question.

Finally, there is a possibility that our results related to prompted information needs are biased towards search engines due to participants being reluctant to post artificial information needs to their friends and contacts. While very few participants indicated that this was a concern in their questionnaires, this effect may still exist. This bias could exist more generally for information needs due to the experimental setting, in which the costs of posing questions to one's social network become more salient. Throughout the paper, we have attempted to mitigate this bias by using only the unprompted information needs or presenting the results separately when this issue could have affected our conclusions.

CONCLUSION

In this paper, we presented the results of an 82-participant laboratory study on SMQA, a form of information seeking in which social network users pose questions to their friends and contacts. We placed SMQA behavior in the context of more traditional search engines by identifying what types of information needs go to SMQA instead of, or in addition to, search engines. We also investigated why users are motivated to route information needs to or away from social networks and which routing decisions are most successful in terms of information value, levels of trust, and satisfaction. This work presents evidence that users combine routing strategies, providing support for new technologies that aim to merge search and social information seeking approaches.

ACKNOWLEDGEMENTS

This research was supported by a grant from Microsoft Research and completed while the first author was a Postdoctoral Fellow at Northwestern University. We thank Khalid Aziz and Irsal Alsanea for building the application used by participants in this study, Alison Ho and Jennifer Suh for helping with data collection, and members of the CollabLab for their insightful feedback.

REFERENCES

[1] Ackerman, M., Adamic, L., Ellison, N., Gergle, D., Hecht, B., Lampe, C., Morris, M.R. and Teevan, J. 2013. Social media question asking workshop. *Proc. of CSCW 2013*, ACM Press, 297-298.

[2] Backstrom, L. 2011. Anatomy of Facebook. *Facebook Blog*. http://www.facebook.com/notes/facebook-data-team/anatomy-of-facebook/10150388519243859

[3] Bozzon, A., Brambilla, M., Ceri, S. and Fraternali, P. 2010. Liquid query: Multi-domain exploratory search on the web. *Proc. of WWW 2010*, ACM Press, 161-170.

[4] Brady, E.L., Zhong, Y., Morris, M.R. and Bigham, J.P. 2013. Investigating the appropriateness of social network question asking as a resource for blind users. *Proc. of CSCW 2013*, ACM Press, 1225-1236.

[5] Bringing your friends to Bing: Search now more social. 2010. *Facebook Blog.* http://www.facebook.com/notes/facebook-data-team/anatomy-of-facebook/10150388519243859

[6] Broder, A. 2002. A taxonomy of web search. *ACM SIGIR Forum*, 3-10.

[7] Das, S. and Kramer, A. 2013. Self-censorship on Facebook. *Proc. of ICWSM 2013*, 120-127.

[8] Ellison, N.B., Gray, R., Vitak, J., Lampe, C. and Fiore, A.T. 2013. Calling all Facebook friends: Exploring requests for help on Facebook. *Proc. of ICWSM 2013*, 155-164.

[9] Elsweiler, D., Wilson, M.L. and Harvey, M. 2012. Searching for fun: Casual-leisure search. *ECIR 2012 Workshop Proposals*.

[10] Evans, B.M. and Chi, E.H. 2008. Towards a model of understanding social search. *Proc. of CSCW 2008*, ACM Press, 485-494.

[11] Evans, B.M., Kairam, S. and Pirolli, P. 2010. Do your friends make you smarter?: An analysis of social strategies in online information seeking. *Information Processing & Management, 46*, 6, 679-692.

[12] Gray, R., Ellison, N.B., Vitak, J. and Lampe, C. 2013. Who wants to know?: Question-asking and answering practices among Facebook users. *Proc. of CSCW 2013*, ACM Press, 1213-1224.

[13] Hargittai, E. and Hsieh, Y.P. 2012. Succinct survey measures of web-use skills. *Social Science Computer Review, 30*, 1, 95-107.

[14] Hecht, B., Carton, S., Quaderi, M., Schöning, J., Raubal, M., Gergle, D. and Downey, D. 2012. Explanatory semantic relatedness and explicit spatialization for exploratory search. *Proc. of SIGIR 2012*, ACM Press, 415-424.

[15] Hecht, B., Teevan, J., Morris, M.R. and Liebling, D. 2012. SearchBuddies: Bringing search engines into the conversation. *Proc. of ICWSM 2012*, 138-145.

[16] Jansen, B.J., Booth, D.L. and Spink, A. 2008. Determining the informational, navigational, and transactional intent of Web queries. *Information Processing & Management, 44*, 3, 1251-1266.

[17] Jeong, J.-W., Morris, M.R., Teevan, J. and Liebling, D. 2013. A crowd-powered socially embedded search engine. *Proc. of ICWSM 2013*, 263-272.

[18] Kairam, S., Brzozowski, M., Huffaker, D. and Chi, E. 2012. Talking in circles: Selective sharing in Google+. *Proc. of CHI 2012*, ACM Press, 1065-1074.

[19] Kules, B. and Capra, R. 2008. Creating exploratory tasks for a faceted search interface. *Proc. of HCIR 2008*, 18-21.

[20] Lampe, C., Vitak, J., Gray, R. and Ellison, N.B. 2012. Perceptions of Facebook's value as an information source. *Proc. of CHI 2012*, ACM Press, 3195-3204.

[21] Marwick, A.E. and boyd, d. 2011. I tweet honestly, I tweet passionately: Twitter users, context collapse, and the imagined audience. *New Media & Society, 13*, 1, 114-133.

[22] Morris, M.R. 2013. Collaborative search revisited. *Proc. of CSCW 2013*, 1181-1192.

[23] Morris, M.R., Teevan, J. and Panovich, K. 2010. A comparison of information seeking using search engines and social networks. *Proc. of ICSWM 2010*, 291-294.

[24] Morris, M.R., Teevan, J. and Panovich, K. 2010. What do people ask their social networks, and why?: A survey study of status message Q&A behavior. *Proc. of CHI 2010*, ACM Press, 1739-1748.

[25] Panovich, K., Miller, R. and Karger, D. 2012. Tie strength in question & answer on social network sites. *Proc. of CSCW 2012*, ACM Press, 1057-1066.

[26] Paul, S., Hong, L. and Chi, E. 2011. Is Twitter a good place for asking questions? A characterization study. *Proc. of ICWSM 2011*, 578-581.

[27] Paul, S.A. and Reddy, M.C. 2010. Understanding together: Sensemaking in collaborative information seeking. *Proc. of CSCW 2010*, ACM Press, 321-330.

[28] Rose, D.E. and Levinson, D. 2004. Understanding user goals in web search. *Proc. of WWW 2004*, ACM Press, 13-19.

[29] Singhal, A. 2012. Search, plus Your World. *Google Inside Search Blog*. http://googleblog.blogspot.com/2012/01/search-plus-your-world.html

[30] Sleeper, M., Balebako, R., Das, S., McConahy, A.L., Wiese, J. and Cranor, L.F. 2013. The post that wasn't: exploring self-censorship on Facebook. *Proc. of CSCW 2013*, ACM Press, 793-802.

[31] Teevan, J., Ringel Morris, M. and Panovich, K. 2011. Factors affecting response quantity, quality, and speed for questions asked via social network status messages. *Proc. of ICWSM 2011*, 630-633.

[32] Thom-Santelli, J., Helsey, S.Y., Matthews, T.L., Daly, E.M. and Millen, D.R. 2011. What are you working on? Status message Q&A in an enterprise SNS. *Proc. of ECSCW 2011*, 313-332.

[33] Uehara, E.S. 1995. Reciprocity reconsidered: Gouldner's "moral norm of reciprocity" and social support. *Journal of Social and Personal Relationships, 12*, 4, 483-502.

[34] White, R., Muresan, G. and Marchionini, G. 2006. Evaluating exploratory search systems. *SIGIR 2006 Workshop on Evaluating Exploratory Search*.

[35] White, R. and Roth, R. 2009. *Exploratory search: beyond the query-response paradigm*. Morgan & Claypool.

[36] Wilson, M. and Elsweiler, D. 2010. Casual-leisure searching: The exploratory search scenarios that break our current models. *Proc. of HCIR 2010*, 8-31.

[37] Yang, J., Morris, M.R., Teevan, J., Adamic, L.A. and Ackerman, M.S. 2011. Culture matters: A survey Study of social Q&A behavior. *Proc. of ICWSM 2011*, 409-419.

[38] Zhao, X., Salehi, N., Naranjit, S., Alwaalan, S., Voida, S. and Cosley, D. 2013. The many faces of Facebook: Experiencing social media as performance, exhibition, and personal archive. *Proc. of CHI 2013*, ACM Press, 1-10.

APPENDIX 1.

	Satisfaction	Contribute Knowledge	Provide Information	Verify Information	Trust Answer	Trust Service	Trust Source
	Estimate (SE)	*Estimate (SE)*	*Estimate (SE)*	*Estimate (SE)*	*Estimate (SE)*	*Estimate (SE)*	*Estimate (SE)*
Age	.0070	.0160	.0091	.0181	.0069	.0135	.0069
	(.0076)	(.0108)	(.0106)	(.0124)	(.0076)	(.0082)	(.0075)
Female	-.0042	-.0329	-.0430	.0312	-.0285	.0711	.01780
	(.0898)	(.1284)	(.1259)	(.1478)	(.0908)	(.0975)	(.0892)
Web Skill	-.0504	-.1679	-.0870	.1626	.1027	.0262	.1400
	(.1030)	(.1463)	(.1434)	(.1680)	(.1035)	(.1108)	(.1016)
Search	-.3304 #	.5621 **	.9200 ***	-.1538	-.1942	1.003 ***	-.4612 ***
(vs. social)	(.1890)	(.1825)	(.1858)	(.1708)	(.1398)	(.1078)	(.1367)
Question Types							
(vs. avg. others)							
Exploratory	.3124 #	.6073 ***	.5743 ***	.2216	.3567 **	.0596	.2756 *
	(.1632)	(.1576)	(.1604)	(.1474)	(.1205)	(.0932)	(.1178)
Factual Knowledge	.6593 ***	.5445 ***	.5986 ***	.2153 #	.5190 ***	-.0421	.4649 ***
	(.1343)	(.1301)	(.1324)	(.1222)	(.0997)	(.0772)	(.0976)
Favor	-.5127 *	-.7857 ***	-.3214	-.5337 **	-.1713	-.2549 *	-.2106
	(.2242)	(.2180)	(.2204)	(.2025)	(.1659)	(.1288)	(.1621)
Invitation	-.9318 **	-.2608	-.1614	-.3670	-.0584	-.3520 #	.0191
	(.3187)	(.3083)	(.3140)	(.2889)	(.2362)	(.1859)	(.2309)
Navigational	1.458 ***	-.0748	-.3927 *	.8572 ***	1.343 ***	.1689	1.249 ***
	(.1911)	(.1840)	(.1874)	(.1722)	(.1411)	(.1087)	(.1379)
Offer	-.5022 *	-.4804 *	.0860	-.6517 **	-.2292	-.1001	-.2663
	(.2361)	(.2273)	(.2316)	(.2126)	(.1743)	(.1342)	(.1703)
Opinion	.3480 #	.4224 *	.5216 **	.3324 #	.0474	-.0956	.0834
	(.1914)	(.1846)	(.1880)	(.1727)	(.1415)	(.1090)	(.1383)
Poll	-1.269	-1.083	-1.697 *	-.9006	-2.094 ***	.5256	-2.042 **
	(.8526)	(.8230)	(.8381)	(.7712)	(.6313)	(.4865)	(.6170)
Recommendation	.7248 ***	.5846 ***	.4858 **	.2410 #	.4790 ***	-.0011	.4899 ***
	(.1575)	(.1521)	(.1551)	(.1427)	(.1166)	(.0901)	(.1141)
Rhetorical	-.4343 #	.2724	-.2233	.6045 **	-.3309 #	-.0354	-.2664
	(.2467)	(.2364)	(.2407)	(.2214)	(.1853)	(.1397)	(.1770)
Adj-R^2	.192	.302	.294	.384	.302	.430	.302
	n = 1,006	n = 1,008	n = 1,008	n = 1,009	n = 1,007	n = 1,007	n = 1,008

*Notes: Significance levels are the following: #p < .10; *p < .05; **p < .01; *** p < .001.*
For ease of exposition only fixed effects are reported in this table.