# Effects of Anonymity, Ephemerality, and System Routing on Cost in Social Question Asking

HAIWEI MA, University of Minnesota, USA
HAO-FEI CHENG, University of Minnesota, USA
BOWEN YU, University of Minnesota, USA
HAIYI ZHU, Carnegie Mellon University, USA

Online platforms provide new channels for people in need to seek help from friends and strangers. However, individuals often encounter psychological barriers that deter them from asking for help. For example, people might have different concerns about asking for help, including acknowledging incompetence, bothering others, and accruing social debt. These perceived social costs limit the potential benefits of help solicitations. In this study, we attempt to investigate whether anonymity (posting a question anonymously), ephemerality (allowing questions to be visible for only a short period), and system routing (having the system handle the question routing) could reduce social costs in a typical online help-seeking behavior—question asking. We built a platform to support these three features and conducted a controlled within-subjects experiment to test their effects on the social costs of posting questions. Results suggest that the presence of anonymity, ephemerality, and system routing reduce social costs. Further, we find that employing anonymity and system routing features did not lower the quality and quantity of answers to the questions in our system.

CCS Concepts: • **Human-centered computing** → **Empirical studies in HCI**; **Empirical studies in collaborative and social computing**.

Additional Key Words and Phrases: Social Cost, Q&A Site, Ephemerality, Anonymity

## 1 INTRODUCTION

Social question answering (social Q&A), which refers to question answering behaviors occurring on social networking sites, like Twitter and Facebook; or social network based Q&A sites, like Quora, has received great attention from academia [40, 42, 58, 64, 67–69, 75, 88]. In 2018, Quora reported that it reached 300 million monthly active users [1]. A previous survey study also found that over 50% of respondents have used their status messages to ask a question on Twitter or Facebook [58]. Questions posted on these social Q&A sites not only provide important knowledge resources when answered, but also reinforce social interaction and social connection [6, 57, 58, 64].

Despite this great potential of social Q&A, researchers find that it entails "social cost" due to its nature of interpersonal interaction, which inhibits people from posting questions [16, 47, 48, 75]. Social cost is evident in social networks. For example, previous study found that blind users do not see social networks as an appropriate venue for asking visual questions due to high social cost [16]. Another research found that a portion of users sacrifice the bonus rewards in experiment to avoid posting questions on social medias [75]. Social cost is also observed when people seek professional help or ask for help informally from non-professional helpers, such as asking strangers for directions or asking confederates for assistance in experimental tasks [23, 47, 79, 92]. Previous research in social Q&A have studied what factors affect efficiencies (including speed, quantity, and quality) of answers to questions posted on social networking sites or social network based Q&A sites [68, 88, 100]. However, to the best of our knowledge, no research has been done to investigate what affordances of social networking systems affect social cost of posting questions. In this paper, we aim to look at how anonymity of users, ephemerality of questions, and routing mechanisms to selected audience, affect social cost of posting questions on social networking sites. We choose these three affordances because previous studies showed that different social computing systems make drastically different choices regarding each of the three affordances, which greatly influences user experience and user behaviors [10, 19, 26, 43, 55, 70, 72, 82, 83, 85, 89, 95]. This forms our research questions:

- *How does anonymity affect the perception of social costs in question asking?*
- *How does ephemerality affect the perception of social costs in question asking?*
- *How does system routing affect the perception of social costs in question asking?*

In order to manipulate these affordances to answer the research questions, we build our own social Q&A platform, *Mobilyzr*, on top of Facebook. We have to build the platform for the study as we cannot directly manipulate the three affordances (anonymity, ephemerality, and system routing) of existing social networking sites. Thirty-one participants log onto the platform using their Facebook accounts and grant our system access to their Facebook profiles and social networks. Users' profiles and the friendship connections on Facebook are transferred into this Q&A platform to simulate a real social network. We then conduct a controlled within-subjects experiment in which their questions are assigned to different conditions with different combinations of whether real names or pseudonyms of question askers are shown, whether questions are displayed for a long period of time or a short period of time, and whether routing to potential question answerers is decided by user tagging or a random selection algorithm. We collect user responses to four questions regarding social cost and compute the statistics of answers received for each posted question. We run quantitative analysis to evaluate the effects of anonymity, ephemerality, and system routing on social cost as well as the efficiencies of answers received (e.g., the number of answers received, the average length of answers, and the time it takes to get the first answer). We find that anonymity, ephemerality, and system routing can each reduce social costs. We also find that only ephemerality significantly reduces the number of answers received.

## 2 THEORY AND HYPOTHESES

### 2.1 Social Q&A

As previous studies found, people often post questions to their social networks for help [33, 58]. To understand this emerging phenomenon of social Q&A, researchers conduct interviews with users to find why they choose to post questions to social networks. The results show that, compared to search engines and traditional Q&A sites, social networks are perceived to be more trustworthy, more suitable for subjective questions, and more socially engaging [58, 64]. Quantitative analysis of question types posted in social networks supports these findings, with recommendations, opinions,

rhetorical questions, and requests/ favors being the most popular information needs that are sent to social networks [37, 58, 64]. These questions become important knowledge resources when answered and fortify social interaction and social connection [6, 57, 58, 64].

However, some studies indicated that people are not willing to utilize social networks to answer their questions due to social cost [16, 75]. The study of VizWiz Social app that lets blind users to post questions either to social networks for free or to crowd workers for some monetary cost finds blind users are extremely reluctant to post questions to social networks because of high social cost [16]. A similar phenomenon is observed for general users, where a portion of them are willing to sacrifice bonus rewards in experiments to avoid posting questions to social networks [75]. A closer examination on how to reduce social cost of posting questions to social networks will facilitate users to post questions and get their important needs fulfilled. Our work serves as the first step in this direction. Through literature review, we identify the concerns people have are associated with social cost of seeking help (section 2.2) and the affordances that may reduce social cost (section 2.3, section 2.4, and section 2.5).

## 2.2 Social Cost

Posting questions to social networks entails social cost due to its nature of interpersonal interaction [16, 47, 48, 75]. Social cost hinders people from posting questions or seeking help in other forms. To the best of our knowledge, there is no comprehensive study of this complex construct, social cost, in both psychology and HCI fields. Therefore, there is no consensus regarding the definition and understanding of social cost. Previous studies try to understand social cost by directly asking people why they are reluctant to seek help. These findings suggest that social cost may be associated with different concerns [15, 16, 24, 25, 29, 32, 47, 79, 84, 87, 93]. People are not willing to ask for help if it may incur obligation to reciprocate [84], disclose personal information [16, 87], make others think less of them [24, 29, 32, 47, 48, 93], or bother others [16, 25]. These are summarized as follows:

- *Indebtedness: the cost of being obligated to reciprocate*
- *Privacy: the cost of disclosing personal information*
- *Social image: the cost of harming social image*
- *Bother: the cost of bothering others*

There is no consensus regarding the measurement of social cost either. Prior research propose different methods to measure social cost. Some researchers observe participants' actual help seeking behaviors as proxies for social cost, with the assumption that higher social cost leads to fewer help seeking behaviors [25, 48]. Some researchers measure social cost by measuring how much bonus rewards participants choose to sacrifice to avoid posting questions to social networks [75]. Since participants' behaviors are complicated by their motivation and perception of benefits of seeking help, these two methods are actually measuring the blended results of cost-benefit analysis. We can directly measure social cost by survey questions, but there is no validated questionnaire so far. Two previous works create their own questions measuring social cost associated with different concerns [5, 48]. Adapted from prior literature, we ask participants questions to measure social cost associated with four concerns listed above. Details of these questions will be described in section 3.1.

## 2.3 Anonymity

Anonymity in online communities allows users to perform actions without leaving identifiable traces. Anonymity is not a binary construct. Different degrees of anonymity can be achieved by using fake names, pseudonyms, throwaway accounts or more. In this study, we choose to compare

social cost in two conditions of anonymity: showing the real names of the users who post the questions and hiding the real names of the questioners.

Psychology studies have found that people care less about social image in anonymous conditions than non-anonymous ones [7, 18]. For example, tax fraudsters are more willing to pay taxes when there is a risk of being publicly recognized as a dishonest person than when they are anonymous [18]. In the dictator game, people acting as dictators are more likely to voluntarily cede exactly half to another individual under non-anonymous conditions than anonymous ones to maintain a favorable social image [7]. Similar findings are also found in online contexts. People report lower social anxiety and social desirability when they are anonymous than when they are non-anonymous [45]. Interviewees from various cultures explicitly choose to be anonymous to avoid harming their public or self-image [46]. Yelp reviewers who disclose identifiable information and construct a profile are more motivated than anonymous reviewers to write high-quality reviews and to be productive thanks to social image incentives [90]. As discussed early in section 2.2, when people are seeking help online, they might be concerned about their social image [25, 44, 48, 75]. In particular, they might be worried that others might think less of them [24, 29, 32, 47, 93]. Being anonymous may reduce such concerns about harming social image when posting questions. Therefore, we propose the first hypothesis regarding anonymity: **H1a. Anonymity will reduce the social cost associated with concerns of harming social image.**

Researchers also find that anonymity can facilitate posting personal and sensitive content. Members in online health community for recovery from substance use disorders report anonymity to be important for their communication [74]. Reddit users are more likely to use throwaway accounts, which provide greater anonymity, than identified accounts when posting or seeking support in stigmatized contexts like sexual abuse [4]. Other studies also find that people are more willing to share personal information, opinions, and feelings on anonymous sites [14, 54, 78]. Interviewees in another study explicitly mention that one of the reasons to seek anonymity is to have control over personal information disclosure [46]. On the other hand, authenticity causes context collapse and privacy concerns [30, 38, 41]. For example, people are not comfortable talking about their health-related needs on real name social networking sites like Facebook [60]. This indicates anonymity may reduce people's privacy concerns when posting questions. Therefore, we propose the second hypothesis regarding anonymity: **H1b. Anonymity will reduce the social cost associated with privacy concerns.**

Lastly, previous research shows that anonymity motivates lurkers' lurking behaviors. Lurkers are people who often read the content produced by others but seldom repay to the community [62, 63, 71]. Qualitative studies of lurkers using survey and interview find that several top reasons why they lurk include "Didn't need to post", "Just reading/ browsing is enough", "No requirement to post", and "Had no intention of posting" [71]. Interviewees from various cultural backgrounds also explicitly list one advantage of anonymity to be avoiding commitment to the community [46]. Interestingly, research on what lurkers and contributors think of each other shows that lurkers have less respect for contributors than contributors themselves and few contributors express resentment towards lurkers [63]. Another study finds that people who help strangers with advice and ideas in an anonymous discussion forum do not expect reciprocity from others [91]. This implies anonymity may loosen the social norm of reciprocity and reduce people's obligation to reciprocate when posting questions. Therefore, we propose the third hypothesis regarding anonymity: **H1c. Anonymity will reduce the social cost associated with indebtedness.**

## 2.4 Ephemerality

Ephemerality means that the content is transitory, lasting for a short time. Some content like Snapchat photos only exist for one day, whereas other content like Instragram photos can last

for years. Ephemerality is not a binary construct. It can range from content lasting for hours to content lasting for years; from all functions associated with the content being inaccessible after a certain time, to some functions being inaccessible after a certain time, and to all functions still being accessible for a long time. Due to the constraints of time and data privacy, we choose to compare social cost in two conditions of ephemerality: questions persisting for only one day and questions persisting for seven days.

Ephemerality is found to reduce self-consiousness and encourage playful interactions. Users of Snapchat, a popular ephemeral mobile platform for social networking, report that they have less long-term exhibition concerns and are comfortable lowering their guard to send ugly and silly faces [95]. A different qualitative study echoes this finding and suggests that the affordance of ephemerality may reduce self-presentational concerns and encourage more authentic and less filtered exchanges [11]. Increased deviant behaviors such as sexting or flirting on Snapchat are also found to be associated with ephemerality [19, 70, 85]. Persistent content, on the one hand, is found to serve as long-term exhibition of self to others [98], but on the other hand, makes concerns about self-presentation salient [13]. This suggests ephemerality may reduce people's concerns about harming social image when posting questions. Therefore, we propose the first hypothesis regarding ephemerality: **H2a. Ephemerality will reduce the social cost associated with concerns of harming social image.**

Researchers also find that the affordance of ephemerality promotes personal communication among users. Research on Snapchat shows that ephemerality facilitates frequent informal and personal communication with friends [95]. Another study replicates this finding, demonstrating that users regard Snapchat as a more personal communication tool than Facebook [86]. Besides, on Snapchat, users are encouraged to create pictures and videos first before considering with whom they will share the content with and some users even decide whether to save these content themselves by first posting it to Snapchat story and then reflecting on it [55]. This implies that ephemerality may help manage the self-disclosure in questions posted due to its short-time visibility and reduce people's privacy concerns when posting questions. Therefore, we propose the second hypothesis regarding ephemerality: **H2b. Ephemerality will reduce the social cost associated with privacy concerns.**

## 2.5 System Routing

System routing refers to the process of directing content to certain audience via automated algorithms. System routing is not a binary construct. It can range from completely relying on user tagging, to algorithm-assisted tagging, and to fully relying on automated algorithms. Most social networking systems support both user tagging and automated algorithm, with some content directed to audience by posters and some by automated algorithm. In this study, we choose to compare social cost in two conditions for system routing: picking potential question answerers by user tagging and picking potential question answerers by random algorithm.

Studies of user tagging show that posters worry about whether the post will be of interest to targeted audience or it will bother them when they tag others [65, 76]. This suggests users try to avoid wasting time of targeted audience on undesired content. When it comes to algorithmic decisions of finding targeted audience, posters may be less concerned because the automated algorithm (and developers behind it) may be seen as accountable for the decisions made [27, 49]. It is also easier for potential helpers to ignore a system-generated request compared to a personal request [20]. This implies system routing may reduce people's concerns of bothering others. Therefore, we propose the hypothesis regarding system routing: **H3. System routing will reduce the social cost associated with concerns of bothering others.**

## 3 METHOD

### 3.1 Questionnaire Design

In section 2.2, we have reviewed previous research findings on social cost that try to explain why people feel reluctant to seek help. Previous research suggests social cost associated with four concerns: indebtedness, privacy, social image, and bother. We create a survey adapted from prior literature to study social cost of posting questions.

The perception of the cost related to social image is defined as "concerns when an individual's utility depends on the posterior expectations of his/her type held by others, conditional on observing his/ her behavior" [17] and "judgements and reactions of others—family, friends, colleagues, employers" [12]. Thus, we ask participants to what extent they agree with the statement *"I feel that it will incur negative judgments from others"* to measure cost related to social image. Prior research finds that people feel more uncomfortable about asking for help that will be costly to the potential helper or will interrupt them. This suggests concerns of bothering others when seeking help [16, 25]. We follow their work and ask participants to what extent they agree with the statement *"I feel that it will bother others in a way I don't want"* to measure the cost of bothering helpers. The feelings of indebtedness and reciprocity are closely related. Prior work describes reciprocity as a general moral norm [36], and indebtedness as the obliged feeling to reciprocate and provide benefits to their social network after receiving social support [84]. Thus we ask participants to what extent they agree with the statement *"It makes me feel that I need to reciprocate to the answerers"* to measure the cost of indebtedness for the question askers. Lastly, privacy concern is the perceived risks that one discloses private information online [56], and is a factor for a person to decide whether to seek help or not [87]. Therefore we ask participants to what extent they agree with the statement *I feel that it discloses important information that I don't want others to know* to measure the cost related to privacy disclosure of question-asking.

After several rounds of pilot testing, we finalize the phrasing for each item. The final questionnaire includes four statements, each of which utilizes a 5-point Likert scale (5 = strongly agree and 1 = strongly disagree). Participants choose different points to indicate how much they agree with each statement.

### 3.2 Study Platform

To answer our research questions and test our hypotheses, we run a controlled within-subjects experiment on *Mobilyzr*, a question asking platform built for this research. People have to log into the platform using their Facebook accounts and grant our system access to their Facebook profiles and social networks. Users' profiles and friendship relations on Facebook are transferred into our platform to simulate real social networks. People can post questions to others (Figure 1). Questions are distributed to other participants according to the experiment condition. Participants tagged by question askers or selected to answer the questions by the algorithm will receive both email and system notifications with the link to the questions so they can easily find the questions. Questions asked by the users appear in the "My Questions" panel, with description of the experiment condition shown next to the questions (Figure 2). People can freely view questions from other users and answer them. *Mobilyzr* allows researchers to randomly assign each question into different conditions (i.e., anonymous or not, ephemeral or not, and system routing or user tagging). We evaluated effects of the three features (anonymity, ephemerality, and system routing) on users' perceived social cost.

With anonymity, questions are distributed anonymously. Otherwise, questions include question askers' real names. With system routing, questions are distributed to two randomly selected users. The question askers do not know who would be selected prior to posting the question. Without

system routing, question askers have to manually tag at least two users to answer the question. Both friends and strangers may be tagged by users or picked by the random algorithm. We do not implement a complex routing algorithm because: 1) The condition we want to test is a condition where the algorithm is fully in control of the routing decision instead of working as assistant to user tagging by recommending appropriate audience. In this condition, participants do not know who are picked by the automated algorithm when they post. A complex algorithm or a simple algorithm does not make a difference in the user experience of question posting. 2) Prior literature indicates that users will hold algorithms accountable for its routing decisions and be less concerned about bothering others (see section 2.5 for details of hypothesis H3). Both complex algorithm and simple algorithm should reduce the social cost related to bothering others. With ephemerality, questions are only displayed for 1 day on the platform before they disappear. Without ephemerality, questions are displayed for 7 days, a much longer period of time. We choose 7 days to prevent some questions lasting longer than others before the experiment ends, which might influence both users' perception of social cost and on the answers received. Seven days has also been adopted by other researchers as the time window to study Q&A [39].

Our platform sends emails to notify those users who are either tagged by question askers or picked by the algorithm about the question, as well as system notifications after they log in, so that they could notice the new questions as soon as possible. Screenshots of *Mobilyzr* are shown in Figure 1 and Figure 2.



Fig. 1. Interface for asking a question.

## 3.3 Participants Recruitment

We simulate an environment similar to social network based Q&A sites such as Quora, where a mix of friends and strangers are present in the community. Previous studies found that posting questions to friends-only network is limited in benefits, and suggest extending the social Q&A
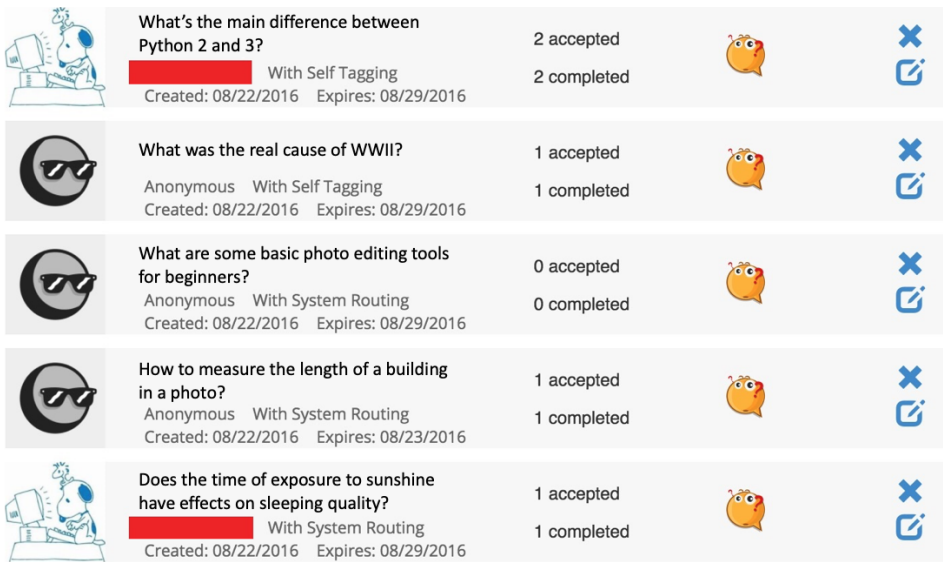
Fig. 2. Interface of the Q&A platform. The description of the assigned experiment condition is shown next to each question.

network to include strangers for much more potential [42, 58, 61, 64, 100]. Indeed, knowledge sharing in a broader social network like Quora can gain larger benefits by reaching a larger audience [2, 61, 66, 97]. Therefore, in this work we explore a social network with both friends and strangers.

We used the snowball sampling method to recruit participants with pre-existing connections in order to simulate a natural, engaging, and interactive social Q&A network with a mix of friends and strangers [8, 9, 35, 50]. This recruiting method is also used in other research work in social computing (e.g., [59, 94, 96]). The authors posted recruitment messages on their own social networks. Participants were encouraged to invite their friends to join our study. Participants were told that the study was about testing a novel social Q&A platform.

The demographic information of the participants is shown in Table 1. We plotted Figure 3 to visualize the social network among the participants. Each node in the figure represents a participant and each link represents a friendship relation between those participants. Larger nodes denote participants with higher number of friends and brighter colors denote participants with higher centrality in the network. On average, each participant had three friends. Twenty eight out of thirty-one participants had at least one friend. The network structure is consistent with our intention: creating a social Q&A site with both friends and strangers.

We conducted a power analysis to determine the number of participants required to detect significant differences between conditions. We computed the power analysis using a medium effect size of 0.5, power of 0.8, and alpha level of 0.05 [21], indicating that the minimum number of participants required to detect significant main effects in our experiment design is 10. We recruited 41 participants for the experiment, but 10 participants dropped out during the one-month long experiment and did not complete all steps. This left us with 31 participants for the analysis.

Participants were required to post at least eight questions and complete a social-cost questionnaire for each question they have posted. Participants could see to which condition a question was assigned to after the question was posted, and before they filled out the questionnaire (Figure 2). Thus the effects of different conditions on social cost can be precisely reflected. All questions were

| Demographic Factors | Ranges | Number | Percentage (%) |
|---|---|---|---|
| Age | 18-22 | 8 | 26 |
| | 23-27 | 23 | 74 |
| Gender | Male | 23 | 74 |
| | Female | 8 | 26 |
| Cultural Origins | United States | 4 | 13 |
| | India | 2 | 6 |
| | China | 25 | 81 |
| Occupation | Undergraduate student | 5 | 16 |
| | Master student | 13 | 42 |
| | Doctorate student | 9 | 29 |
| | Non-student | 4 | 13 |
| Major | Computer Science (CS) | 17 | 55 |
| | Non-CS | 14 | 45 |

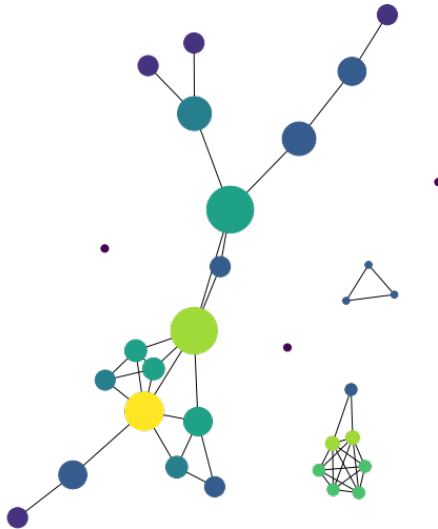Table 1. Demographic profiles of participants



Fig. 3. Social network structure of the participants. Larger nodes denote participants with higher degrees; brighter colors denote participants with with higher betweenness centrality.

only routed to and answered by other participants in this study. Among the 31 participants, one participant only asked 6 questions while others asked at least 8 questions. We collected their first 8 questions if participants asked more than 8 questions. Additionally we excluded 2 questions with missing data. We ended up with 244 questions and 244 social-cost questionnaires.

## 3.4 Experiment Design

We used a within-subject design in our experiment, which has greater statistical power than a between-subjects design. In other words, we can find significant differences with fewer participants

compared to between-subject design [34]. Since there were 8 experimental ($2 \times 2 \times 2$) conditions in our study (with anonymity or not, with ephemerality or not, and with system routing or not), each of the 31 participants was exposed to the 8 conditions (i.e., each participant asked eight questions). However, there was one participant that only asked six questions and another two asked seven questions. This resulted in 244 observations for each type of social cost in the analysis. Another reason why within-subject design is sensitive to capture differences is that having the same participant examined under multiple conditions allows them to serve as their own control. We ran fixed-effect regression analyses to estimate the effects of anonymity, ephemerality and system routing on participants, which controls for individual differences [3]. The disadvantage of within subject design is carryover effects and fatigue, which were alleviated since our study is a four-week long field experiment.

Immediately after a participant asks a question, that question is assigned to one of the eight conditions. Assigning conditions after questions were posted ensures that the difference of perceived social cost is attributed to the manipulations rather than the questions themselves. Otherwise, participants might adjust the type of the questions they would ask if they know which condition they are in (e.g., anonymous or not, ephemeral or not, and system routing or not). For example, participants might choose to post difficult and sensitive questions in anonymous conditions and post easy and impersonal questions in non-anonymous conditions, which can change people's perceptions of social cost and confound the results [16, 25, 48, 52, 58]. In our study, participants do not know which experiment condition their question will be assigned into until the question has been posted, so they cannot tailor their question to different conditions.

## 3.5 Procedure

First, participants were introduced to the study and its procedure. They were told that they were participating in a study to evaluate the usability of a social Q&A website. After the participants signed the consent forms, the authors helped them create an account on *Mobilyzr* by logging in with their Facebook accounts and granting our system access to their Facebook profile and friends information. Participants then completed the questionnaire of basic demographic information adapted from [73, 80]. Participants were given one month to post eight questions and seek answers from others. We did not impose any requirements on the question type or time and location to post because we wanted to simulate a natural environment. Immediately after the participant posted a question, she would receive a notification to remind her to fill out the social cost questionnaire about the question she had just asked. Users tagged by the question asker or selected by the algorithm would also receive email notifications to answer the questions. Users could also freely view others' questions after logging into the system. We recorded information about whether the potential helpers responded or not. If they responded, we recorded how long it took them to respond and the content of the response. Regardless if a question received responses or not, the question became inaccessible after the expiration date. Finally, participants were then debriefed and compensated with a $20 Amazon Gift Card for participating in the study. The study was approved by the University of Minnesota's Institutional Review Board .

## 3.6 Measurement

To test our hypotheses, we had participants fill out a social cost questionnaire immediately after posting each question. For each question, we calculated the following measurements:

### 3.6.1 Dependent Variable.

- **Social Cost.** We have four variables directly measured from the questionnaire: *indebtedness*, *social image*, *bother*, and *privacy*. The variables are in a 5-point Likert scale, measuring social

| Question Type | Percent | Examples |
|---|---|---|
| Informational help seeking | 96.7% | What's the relationship between alpacas and sheep? Why is Fortran widely used in computational science? How does epistemology guide research process? |
| Emotional help seeking | 3.3% | Always feel lacking of motivation, what to do? Why is it so hard to lose weight? How to break up with someone you love? |

Table 2. Question types and examples on *Mobilyzr*

cost related to the specific concern. Responses ranges from 1 = Strongly Disagree to 5 = Strongly Agree.

- **Efficiencies.** We also measure the efficiencies of the Q&A platform. These measures include number of answered received by each question, the time taken for a question to receive the first answer, and the average character length of the answers. These three variables can be regarded as proxies to capture the quantity, speed, and quality of answers received, respectively.

### 3.6.2 Independent Variable.

- **Anonymity, Ephemerality, and System Routing.** We have three variables to indicate whether the question is distributed with anonymity or with real identity; whether the question would be inaccessible for one day, a very short period, or for seven days, a longer period; and whether the question is distributed via system routing or user tagging. A value of 1 indicates that anonymity, ephemerality, or system routing is on, while a 0 indicates that it is off.

### 3.7 Data

We looked at what questions participants posted on our system and categorized the questions into two types proposed by prior work: informational help seeking and emotional help seeking [22]. Informational help seeking requests information on a certain topic while emotional help seeking requests emotional support. Table 2 shows the distribution of 244 questions over two categories and lists some example questions posted by our participants. Note that majority of the questions belong to the category of information seeking, which echoes the prior research that information needs are the biggest motivation for social Q&A [58, 64].

## 4 RESULTS

The mean and standard deviation of each type of social cost are shown in Table 3. The average mean is 2.18 on a 5-point Likert scale. The average standard deviation is 1.25, which is consistent with prior literature [48]. On average, users were most concerned about indebtedness and were least concerned about privacy in our study. Figure 4 shows the distribution of social costs. Participants generally ask questions of relatively low social cost on our platform. There might be several explanations for this: 1) They avoid asking high-cost questions because they are not sure which experiment condition the question will be assigned into. 2) They avoid asking high-cost questions because they are all newcomers to this platform and do not know what is appropriate to ask.

### 4.1 Effects of Anonymity, System Routing and Ephemerality on Social Cost

In the study, we tested three possible methods to reduce social cost: posting questions anonymously rather than with a real identity, posting questions to system picked users rather than manually tagged users, and allowing the question to be visible for a short period of time (24 hours) rather than

|  | Overview of the Perceived Social Cost | | | |
|---|---|---|---|---|
|  | Indebtedness | Social image | Bother | Privacy |
| Means (S.D.) | 2.36 (1.35) | 2.12 (1.21) | 2.30 (1.26) | 1.94 (1.17) |
| Median (IQR) | 2 (3) | 2 (2) | 2 (2) | 1 (2) |

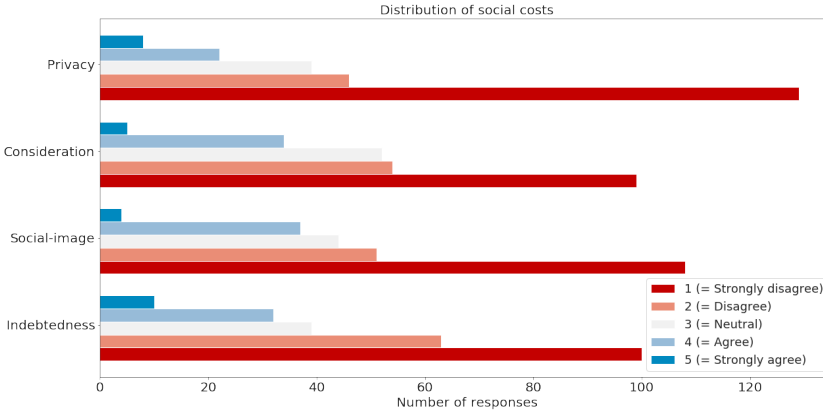Table 3. Mean and standard deviation of social costs associated with four types of concerns.



Fig. 4. The distribution of participants' responses to social costs associated with four types of concerns.

|  | Social Cost | | | | | | | |
|---|---|---|---|---|---|---|---|---|
|  | Indebtedness | | Social image | | Bother | | Privacy | |
|  | Coef. | P | Coef. | P | Coef. | P | Coef. | P |
| Intercept | 2.522 | *** | 2.418 | *** | 2.466 | *** | 2.206 | *** |
| Anonymity | -0.227 | **0.022***  | -0.206 | 0.062 | 0.061 | 0.583 | -0.057 | 0.622 |
| System Routing | -0.096 | 0.332 | -0.083 | 0.450 | -0.269 | **0.016***  | -0.141 | 0.225 |
| Ephemerality | 0.003 | 0.973 | -0.306 | **0.006**** | -0.117 | 0.292 | -0.335 | **0.004**** |

Table 4. Effects of anonymity, system routing, and ephemerality on social cost associated with four types of concerns. For p-value, * means <0.05; ** means <0.01; *** means <0.001. Only p values that remain significant after Benjamini-Hochberg correction are bolded.

a long period of time (7 days). The first analysis tested the effects of the three methods on reducing social cost. We hypothesized that anonymity would reduce social cost associated with social image concerns, privacy concerns, and indebtedness concerns; that ephemerality would reduce social cost associated with social image concerns and privacy concerns; and that system routing would reduce social cost associated with concerns of bothering others based on prior literature. We ran fixed-effect regression analyses to estimate the effects of anonymity, ephemerality and system routing on participants, which controls for individual differences [3]. We did not find interaction effects among the three affordance factors.

Table 4 shows the results of four linear regression models between three independent variables (anonymity, system routing, and ephemerality) and four dependent variables (indebtedness, social image, bother and privacy). We only show main effects of anonymity, system routing, and ephemerality without an interaction term because none of the interaction terms have significant effects. The fact that we were considering these analyses simultaneously might introduce a multiple comparison

problem. We addressed the issue by performing p-value adjustment using the Benjamini-Hochberg approach (we did not use Bonferroni correction because it has a high false negative rate. Another issue with Bonferroni correction is that it assume the tests are in the same family, which is not true in our case.). We set the false discovery rate to 0.2 as recommended by McDonald [53]. After adjusting the p-value, the relevant results remained significant.

*4.1.1 Effects of Anonymity.* Anonymity seemed to reduce the social cost associated with social image concerns by 8.5% (-0.206/2.418=-8.5%), but the effect was not statistically significant (p=0.062). Our hypothesis H1a that anonymity mitigates concerns about harming social image was not supported. We also found that anonymity could reduce the privacy concerns by 2.6% and this effect of anonymity on privacy was also not significant (p=0.622). This result did not support our Hypothesis H1b that anonymity will reduce the social cost associated with privacy concerns. However, anonymity had significant effects (p=0.022) on reducing the social cost associated with indebtedness by 9.0%. This supported our hypothesis H1c that anonymity will reduce the social cost associated with indebtedness.

By allowing users to post the questions anonymously, the answerers do not see the identity of the person they are providing answers for. This anonymity makes people feel less obligated to reciprocate the help, as the answerers do not know their identities. Interestingly, anonymity did not have the same effect in mitigating the concerns related to the privacy and social image. First, since the experiments were conducted with snowball recruitment, the identities of the participants were not completely anonymous. Participants may know the other participants in the network. We speculate that since participants were aware of each other's participation, the participants were still watchful about their image and privacy in the social network. For instance, while posting questions anonymously does not associate users from the questions, any sensitive information disclosed in the question is still made available to other users of the network. Second, the vast majority of the questions asked belong to informational help seeking in the study (see Table 2). While prior work suggests that under the protection of anonymity, users would be less guarded about emotions [78], the informational questions involved in the study were less likely to involve emotional or sensitive content and could have obscured some effects of anonymity on reducing social cost. Indeed, table 3 suggests questions asked on the platform are generally low-cost questions.

*4.1.2 Effects of Ephemerality.* Ephemerality significantly reduced the social cost associated with social image concerns by 12.7% (p=0.006) . This supports our hypothesis H2a that ephemerality mitigates concerns about social image. Ephemerality allows questions to be visible only for a short duration of time and prevents other individuals from looking up the past questions asked by the same person. Users have a lower perceived cost related to social image if they will not receive judgement based on their previous questions and answers. This is consistent with prior work which finds users to be less conscious of their social image if the shared content will disappear shortly [95].

Ephemerality also significantly (p=0.004) reduced the social cost of privacy concerns by 15.2%. This evidence supported our hypothesis H2b that ephemerality would reduce concerns of privacy. By only showing the questions for a short duration of time, ephemerality reduces the exposure of sensitive information shown to other users in the platform. As the information only stays on the platform for a short period of time, it reduces users' need for self-censorship [85]. It is interesting that the effect size of ephemerality on social image and privacy is larger than anonymity in our study.

*4.1.3 Effects of System Routing.* We see that system routing significantly (p=0.016) reduced the social cost related to concerns of bothering others by 12.5%. That means, when the system selects

|  | Efficiencies | | | | | |
|  | Number | | Time Elapsed | | Average Length | |
|  | Coef. | P | Coef. | P | Coef. | P |
|---|---|---|---|---|---|---|
| Intercept | 0.638 | *** | 26.192 | *** | 59.207 | *** |
| Anonymity | 0.034 | 0.687 | 1.835 | 0.566 | -9.707 | 0.402 |
| System Routing | 0.112 | 0.185 | -0.496 | 0.884 | -8.907 | 0.457 |
| Ephemerality | -0.284 | **0.001**** | -0.399 | 0.904 | 0.566 | 0.963 |

Table 5. Effects of anonymity, system routing, and ephemerality on number of answers received, average length of answers (in characters), and time elapsed to get the first answer. For p-value, * means <0.05; ** means <0.01; *** means <0.001. Only p values that remain significant after Benjamini-Hochberg correction are bolded.

other users in the network to help with the questions, the askers feel less concerned about bothering the helpers compared to manually choosing whom to request the answers from. We speculate that the perception of having the system acts as the "middle-man" of requesting help can reduce social cost compared to having to make the request personally. This supports our hypothesis H3 that system routing reduces the concerns of bothering others.

Overall, the results support Hypothesis H1c (**anonymity reduces privacy concerns**), H2a (**empherality reduces social image concerns**), H2b (**empherality reduces privacy concerns**), and H3 (**system routing reduces concerns of bothering others**).

## 4.2 Effects of Anonymity, System Routing, and Ephemerality on Efficiencies

In the post-study questionnaires where participants give open-ended responses about their thoughts and feelings towards these three affordances, our participants expressed concerns that although these anonymity, system routing and ephemerality features can reduce social cost, they might also reduce the response rate and response quality as a side effect. For example, one participant said ephemerality might reduce the chance of being seen by the potential helpers. Sometimes, she wants her questions to be visible for a longer time in order to get more and better responses.

We used simple metrics to measure the efficiencies, such as number of answers received, average length of answers (in characters), and time elapsed to get the first answer to study effects of three features on responses. We applied fixed effects linear regression models to predict the effects of three features on response rate, quality, and speed.

Table 5 shows results of the model. Only ephemerality significantly reduced the number of responses received (p=0.001). As there are no significant differences in the time elapsed to receive the first answer, the decrease in the number of received responses is likely due to the lack of exposure, as the questions are only available for a short period of time. Interestingly, anonymity does not decrease the number of responses, reduce the quality of responses, or slow down the response speed. Although one might predict that people, especially friends, would pay more attention to those questions with real identity attached, we did not observe that in the study. Also we did not observe any significant effect of system routing on the number, quality, and speed of responses.

## 5 DISCUSSION

Through a randomized controlled experiment, we examined the effects of anonymity, system routing, and ephemerality on social cost of asking questions as well as efficiencies of answers received. We found that anonymity reduced the social cost related to indebtedness, system routing reduced the social cost associated with bothering others, and ephemerality reduced the social costs regarding privacy and social image concerns. Our research extends the prior psychological

theories on social costs to online environments, and evaluates effects of three novel techniques on alleviating the social cost. The results provide direct design implications to build more effective online help seeking systems. For example, when designing a novel Q&A platform for a specific user population, one might want to first identify what concerns people most and implement corresponding alleviation strategies. Furthermore, when introducing the social cost reduction functionalities into the community, one need to consider both benefits and costs that may be brought by these affordances.

## 5.1 Anonymity in Online Communities

Our findings suggest that anonymity can reduce the social cost related to indebtedness in social Q&A, which supports our hypothesis H1c. However, we do not find evidence suggesting anonymity reduces social costs related to social image or privacy concerns. Therefore, H1a and H1b are not supported by our study. Moreover, anonymity does not impact the number of answers received, the average length of answers, or the time it takes to get the first answer.

One possible explanation why H1a and H1b are not supported is that we did not achieve true anonymity in our study. Participants might believe that their friends would still be able to recognize them even though their identities are not associated with the questions they asked. It is also possible that the effects of anonymity on social cost will be larger on more sensitive and personal topics. People may not mind posting impersonal content with real names, but they will turn to anonymous communities for personal issues, as indicated by prior work [60].

Anonymity can benefit users in reducing the social costs of social Q&A. However, anonymity may also lead to negative consequences. Although we do not observe any hateful or trolling questions in our study, prior research found that anonymity might reduce accountability and increase deviant behaviors from users in online communities and social networking sites [28, 81]. Designers in social Q&A systems need to bear in mind that anonymity is a complex affordance. On the one hand, anonymity can reduce social costs associated with asking questions; on the other hand, anonymity might also reduce accountability and increase undesired behaviors.

## 5.2 Ephemerality for Q&A sites

Our findings suggest that ephemerality can reduce the social costs related to social image and privacy concerns. This supports our hypotheses H2a and H2b. We also find that ephemerality reduces the number of answers received.

Ephemerality has been implemented on many social media applications such as Snapchat [11, 95], 4chan [14], and Yik Yak [77]. In addition to reducing social costs, ephemerality can also facilitate playful and mundane interactions (e.g., [11, 95]) and create a selection mechanism by requiring content the community wants to see to be repeatedly reposted or saved [14, 55]. However, these benefits may come at a price. In the context of online Q&A, we found that ephemerality decreased the number of answers received. Although ephemerality can potentially encourage people to post more questions, the number of answers might decrease.

Another potential drawback of emphemerality is that emphemerality makes it difficult to curate and store knowledge, which is an important function for a lot of Q&A systems [88]. As one of the participant in our study said, *"As for some knowledge related question, having those questions last longer will allow more users to answer and help me to collect better ideas. At the same time, it allows users to gather answers and make improvement on previous answers."* One possible solution is to combine ephemerality and anonymity. Instead of removing a question completely from social Q&A sites after a certain period of time, the system can anonymize the question and unlink it from the question asker. By doing so, the knowledge in the questions and answers can be retained, and at the same time social cost is still reduced.

### 5.3   System routing

Our findings indicate that system routing can reduce the social cost related to concerns about bothering others. This supports our hypothesis H3. Furthermore, system routing does not impact the number of answers received, the average length of answers, or the time it takes to get the first answer.

System routing algorithms can not only help users find appropriate answerers in Q&A [51, 99], but also reduce social cost of posting questions. However, algorithms may have unexpected psychological and social consequences. For example, previous research suggests that more than half of Facebook users were not aware of existence of the News Feed curation algorithm, and their initial reactions were surprise and anger [31]. Furthermore, people often attributed missing stories to their friends' decisions to exclude them rather than to Facebook's News Feed algorithm [31]. When designers implement algorithmic routing, it is important to consider an algorithm's social factors, such as transparency, understandability and explainability, in addition to its accuracy and performance.

### 5.4   Limitation and future research

We used the snowball sampling method to recruit participants with pre-existing connections in order to create a natural, engaging, and interactive social network with a mix of friends and strangers (Figure 3). Nonetheless, the limitation of this approach is that the participants are not completely representative. Our sample is biased towards people who are male, graduate students, study computer science, and come from China. Future research could extend this work by replicating the work on a more representative sample. In future research, we also want to examine how participants' demographics impact the effects of anonymity, ephemerality, and system routing on social costs in online Q&A sites.

Our experimental design ensures that the difference of perceived social cost is attributed to the manipulation rather than other factors such as question type, sensitivity, and context. However, because the condition of questions is randomly assigned, users might only post generic (i.e., not sensitive or personal) and "low-cost" questions because this is the safest choice under the randomized experiment. To examine whether the features can reduce social costs of asking more sensitive questions and encourage users to post more sensitive questions, we plan to conduct a field study and deploy the system among a group of real users with sensitive needs and observe their spontaneous behavior. We expect to see more sensitive and "high-cost" questions when anonymous, system routing, and ephemeral features were turned on. Just as one participant stated, *"The type of questions you can ask anonymously is way more different than what you would ask with your real username. When asking questions anonymously you can ask stupid questions and not feel embarrassed."* Additionally, we acknowledge that there is no way to capture all of the relational and contextual aspects of help seeking in a single study (whether in the lab or in the field). To advance future work in this field, one of the contributions of this study is providing a platform that can be adapted by other investigators to study help seeking in different contexts, with different communities, and with different feature constraints.

In future work, we want to further explore the topic on social cost and ways to reduce them. First, we treated anonymity, system routing, and ephemerality only as simple binary conditions in this study, but there are nuances in how to implement these features. For example, users could have different levels of anonymity with different amount of information disclosed. We could have more advanced system routing algorithms like Aardvark [42]. Second, we only looked at simple metrics about the answers, but we could use more sophisticated metrics for answer quantity and quality to evaluate influences of the three features. It is also interesting to extend the study of social

cost from question answering to other types of help requests, on everyday tasks such as moving. Although the requests are posted online, the actual help has to happen in the offline world. This might change the social cost dynamics. Moreover, we might want to study this from the perspective of help givers. How much social capital do they feel they gain in different conditions? Does it match the social cost from the view of help requesters? How would the interpersonal relationship change after the help solicitation process to both help requesters and givers? Finally, it is not clear how social cost will in turn affect actual behaviors. We want to see whether reduced social cost can actually facilitate their help seeking when help is needed and available. All of these remain further exploration.

## 6 CONCLUSION

In this paper, we report on a controlled experiment asking participants to post questions utilizing *Mobilyzr*, a novel Question and Answer platform. Each question was assigned to one of eight different combinations of three treatments (anonymity, system routing, and ephemerality) in a random order. The results show that anonymity, system routing, and ephemerality could reduce social cost. In addition, we find that ephemerality reduces the number of responses as well. We hope our work could offer the first step to investigate how different affordances of online communities influence social cost.

## ACKNOWLEDGMENTS

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