

# Tie Strength in Question & Answer on Social Network Sites

Katrina Panovich, Robert C. Miller, David R. Karger

MIT CSAIL

{kp, rcm, karger}@mit.edu

## ABSTRACT

Asking friends, colleagues, or other trusted people to help answer a question or find information is a familiar and tried-and-true concept. Widespread use of online social networks has made social information seeking easier, and has provided researchers with opportunities to better observe this process. In this paper, we relate question answering to tie strength, a metric drawn from sociology describing how close a friendship is.

We present a study evaluating the role of tie strength in question answers. We used previous research on tie strength in social media to generate tie strength information between participants and their answering friends, and asked them for feedback about the value of answers across several dimensions. While sociological studies have indicated that weak ties are able to provide better information, our findings are significant in that weak ties do *not* have this effect, and stronger ties (close friends) provide a subtle increase in information that contributes more to participants' overall knowledge, and is less likely to have been seen before.

## Author Keywords

Social search, Social networks, Q&A, Social Network Q&A.

## ACM Classification Keywords

H5.3. Information interfaces and presentation (e.g., HCI): Hypertext/Hypermedia: Collaborative computing.

## General Terms

Human Factors, Design

## INTRODUCTION

We all have information needs—How's the weather? Who's the actor in this movie? Where can I find the best latte in Seattle?—and we have long found a variety of ways to satisfy these needs. Some questions are easily satisfied by a trip to the library, some by a phone call to a knowledgeable friend, and many are now best handled by

using the internet. The internet has become a fully



Figure 1. Question from study with some of the answers.

integrated utility in many people's lives, and *the* place to find an answer to many questions. Besides the obvious, and most common [9], option of using a search engine, one might post to a Q&A (question and answer) site, where community members help find answers. Some people use the internet to contact specific friends, using IM or email. One option that's gaining traction is using a social network site, such as Facebook, MySpace, LinkedIn, or Twitter [22]. In this case, people ask *all* of their friends or followers at once—they have no need to direct questions at specific people, or even to specific lists of people, they just simply broadcast their question.

Using social networks for information seeking long predates current research. In this work, we are particularly interested in Granovetter's "The Strength of Weak Ties" [11]. This influential paper defined tie strength as the strength of a friendship—close friends are strong ties, and acquaintances are weak ties. He observed job finding practices, and saw that the job opportunities his participants found were largely through word-of-mouth communication with weak ties—this very useful information came from acquaintances who traveled in different circles and so had

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access to different information, not from strong ties or close friends.

Do our friends *offline* travel in the same circles *online* as us? Do they frequent the same places and sources of information online? In the broadcast question-asking mechanism concerning us here, one's entire network of friends has the ability to answer questions, and so both *who* answers questions (strong ties? weak ties?) and *how* they answer them (does one type of tie tend to provide more useful information, as in Granovetter's work?) are important to understanding the practices of social network-based information seeking.

We build off of tie strength work by Gilbert and Karahalios [10], who constructed a model of tie strength on Facebook using profile characteristics. We employ their techniques in our paper.

In this paper, we argue that tie strength *does not* have the same effect in question answering as would be predicted. In fact, there seems to be a subtle increase in answer quality from strong ties, rather than weak ties.

Some previous work, discussed in more detail below, has looked at who answers questions. For instance, popular question answering service Aardvark [15] found friends-of-friends to be more effective than strangers in answering questions. Morris et al [21] found that, in a small study, many participants' questions were answered by friends they rated as close. Granovetter's work suggests that perhaps the most useful answers would *not* come from close friends, but from acquaintances instead. Work by Morris et al [22] saw that closeness of a friendship was a motivator to answer questions, though many also responded to friends who weren't yet close, in an effort to improve the friendship, suggesting that friends of all strengths would respond to questions.

We have these research questions: we ask *if tie strength has the same 'strength of weak ties' effect in SNS Q&A*, and *how the relation between tie strength and answer quality plays out*. We found that it does *not* have the same effect, and strong ties may actually contribute slightly more to the overall knowledge gained by participants, and share less information the participant already knew. To do this, we conducted a lab study attempting to correlate tie strength with various measures of answer quality. In this paper, we first discuss related work, then our methodology for the study, followed by our results and a discussion, and potential design implications.

## RELATED WORK

This research is beholden to several different areas of research: online question and answer tools, social search, social networking systems, and tie strength, a sociological principle spawned from interest in information exchange.

### Online Q&A Tools

Electronic bulletin boards, newsgroups, and question-answering sites enable users to post questions targeted

either at a particular community or to the world at large. We refer to sites where users post questions to be answered by people not known personally as *Q&A sites*. Question asking and answering behavior on Q&A sites has been well studied (e.g., Harper et al. [14]; Hsieh and Counts [16]; Liu et al. [19]; Mamykina et al. [20]). For example, Harper et al. [14] identified two categories of questions posted to Q&A sites: conversational questions, which are intended to spark discussion, and informational questions, which solicit specific facts. They found informational questions have higher archival value.

Other question asking opportunities include third-party applications that Facebook users can install designed specifically for Q&A purposes (e.g., "My Questions" [slide.com]). Facebook also has a feature called Facebook Questions [7]. We did not collect data on use of this application and we are unaware of any research focusing on its use. We focus on the use of status messages for question asking, which does not require the installation of additional applications and thus has a lower barrier to entry, as well as for its unique role in repurposing social network tools.

Some researchers have explored the factors affecting answer quality on Q&A sites. Raban and Harper [25] point out that a mixture of both intrinsic factors (e.g., perceived ownership of information, gratitude) and extrinsic factors (e.g., reputation systems, monetary payments) motivate Q&A site users to answer questions. These questions come from complete strangers or near-strangers using the same system, as opposed to friends or followers online. Ackerman and Palen [1] and Beenan et al. [2] confirmed that intrinsic motivations, such as visibility of expertise and the feeling of making a unique contribution, influence participation in such systems. Results regarding extrinsic motivators have been more mixed; Hsieh and Counts [16] found market-based incentives did not increase answer speed or high-quality answers, but did decrease the number of low-quality responses, but Harper et al. [14] found fee-based sites produced higher quality answers than free sites. In this work, we look at answers from social networks, rather than Q&A sites — there are no extrinsic motivators besides social ones. Harper et al [13] also looked at questions on Q&A sites to determine the difference between informational and conversational questions — objective and subjective questions — and included "non-questions". These "non-questions" are of particular interest as many status message questions are not in typical question form. We incorporate their precedent and include information seeking sentences like these (often prefaced with "I wonder...") in the same group as general questions. These sentences are information seeking, and can be reframed in the form of a question, so can be considered questions.

Question-and-answer systems (Q&A systems) are of commercial interest as well. One commercial system of note is Aardvark [15], a site which routes questions through an instant messaging bot to an appropriate user in one's

extended network, comprised of friends-of-friends and strangers. Aardvark prioritizes friends-of-friends for responses, and in fact, this appears to be a good way to increase the quality of the response. When asked for feedback about the answer the user received, 76% of the answers from within the user's extended network were rated 'good', and only 68% of answers from outside the user's network were rated 'good.' We hypothesize that extended network effects here mirror the effects of weak ties or acquaintances providing novel information.

### **Social Search**

Broadcasting a question to one's social network, as in status message questioning, is one way to find information online; other common methods include using a search engine or emailing a question to a particular person. The term *social search* refers broadly to the process of finding information online with the assistance of social resources, such as by asking friends, reference librarians, or unknown persons online for assistance. Some researchers have built special tools to integrate social information with search engine use, such as HeyStaks [27].

Some researchers have proposed formal models to describe the interplay of online information seeking with the use of social resources. For example, Pirolli [24] developed a model of social information foraging, and Evans and Chi [5] described the various stages in the search process when users engaged with other people.

To compare social search with more traditional search, Evans *et al.* [6] conducted a study in which eight participants completed two search tasks. For one task, participants used only non-social, online resources (*e.g.*, search engines); while in the other they used only social resources (*e.g.*, calls or emails to friends, and social network or Q&A sites). Evans *et al.* found that in the social condition targeting questions to specific friends versus asking a social network had similar outcomes in terms of task performance; questions posed to the social network received more answers, but those targeted to individuals received in-depth answers.

### **Social Network Site Q&A**

Our work draws directly from previous work on social network question answering (SNS Q&A). Morris *et al* [22] provide a survey of this behavior, including the types and topics of questions asked. The most popular type was recommendation, and the most popular topic was technology; our study capitalizes on these trends and uses them as the basis for questions in our study. They also addressed motivation for asking, the biggest factor of which was trust of friends, and motivations for answering. The most popular motivation was altruism ("being friendly"), though over 35% of participants cited the nature of the relationship, connecting socially, and creating social capital. Morris *et al* [21] also looked at searching, vs. asking questions, and saw similar motivations in trust, as well as the additional benefit of personalization from friends. Participants in their study also stated that they knew

the friends who answered their question quite well. This serves as an interesting counterpoint to Granovetter's and others' work (discussed below).

### **Social Network Sites**

While we position our work in the space of social search and question asking, and specifically SNS Q&A, the fact that it happens on social networks is non-trivial. Social network sites enable users to specify other users that they are connected to. Examples of popular social networking services include Facebook, Twitter, and MySpace. A December 2008 survey by the Pew Internet Project [18] found 35% of adult internet users in the U.S. have a profile on a social network, as do 65% of U.S. teens. We focus on work conducted on Facebook, as opposed to sites like Twitter, where "social network" has a different meaning.

The popularity of these social network sites (SNSs) is a big part of the reason this research is interesting: there are many users and their use is only increasing. Addressing unmet information needs in such a well-used medium means that more people are able to participate, as opposed to installing a tool or signing up for another service. This low barrier to entry is similar to simply searching on a search engine.

Researchers have explored many aspects of how social networking services are used. Lampe *et al.* looked at how university students' perceptions and use of Facebook changed over time [17]. In particular, Lampe *et al* found that the number of participants who used Facebook "to get useful information" increased from 2006 to 2008, pointing toward potential social information seeking behaviors, though it's unknown if this "useful information" consisted primarily of social awareness information or if it also included content gleaned from practices such as question asking.

Others have looked more specifically at expertise finding on social networks. Bernstein *et al* [3] generated a body of informational tags for users from their friends using a social game, and then were able to leverage that information for a system suggesting who might be able to answer a question.

### **Tie Strength**

In our introduction, we discussed Granovetter's work looking at tie strength. His seminal paper "The Strength of Weak Ties" [11,12] discussed the value of weak ties (acquaintances). The primary idea behind tie strength is that, amongst our network of friends (online or offline), we have friends with whom we are close (*strong ties*) and friends who are less close, acquaintances or *weak ties*. Granovetter identified this after observing friendships in an offline social network, and pointed toward the idea that one's weak ties might be an effective information source because they traveled in separate social circles, and so could better transmit new information. Constant *et al.* [4] looked specifically at the role of weak ties in seeking technical advice, rather than job finding, in an enterprise setting. They found that, in cases where strong ties lacked the knowledge to answer questions, weak ties were able to

provide good answers, given motivation. Recent work by Gilbert and Karahalios [10] looked at Granovetter's denotation of strong and weak ties within real-life offline social networks and found a series of features (number of mutual friends, number of words exchanged, and so on) that can effectively predict tie strength between friends in an online social network. Granovetter highlighted the role of tie strength in information exchange between people, and as such, models of tie strength online can help us to understand the exchange of information through questions and answers online. We build upon their algorithm in our work looking at what kinds of friends provide valuable answers to questions on SNS.

## METHODOLOGY

In this study, we analyzed responses to status message questions - questions that were asked through the status message feature of the popular SNS Facebook. Note that this is distinct from questions asked in directed messages to friends, public or not, or using systems built specifically for question asking, such as Facebook Questions [7].

In an effort to assess how tie strength between friends affected answer quality, we collected information to determine tie strength and asked for feedback about responses participants received to questions they had asked. In this section, we detail the process of generating a tie strength value for participants, the feedback we requested from participants, and general information about our participants.

### Participants

We had 19 participants complete the study. Participants were recruited through mailing lists to engineering students at a northeastern university; recipients were also invited to forward the information to friends. Most participants were from the university. Of these participants, 31.58% were female. While this is not proportionate to the Facebook population, it is a better percentage than some previous work in the field [22]. The mean age was 25.8 (median 25). Participants were largely seasoned users of Facebook, with a mean length of time with profiles on the site being 5.26 years (median 6), and with an average number of friends at 607.42 (median 505). This is far above the average of 130 friends of the general Facebook population [8], but is largely explained by the length of time participants have been members of the site, and could be considered a way to forecast use of Facebook as more and more participants reach this duration of time as members. Our findings should be interpreted in light of the generalizability of this population. As with many such studies, future work is needed to fully understand the generalizability of these findings.

### Generating Tie Strength

Our process for generating tie strength is drawn directly from Gilbert and Karahalios [10]. In their method, they predicted tie strength using features and content from Facebook. They listed their top 15 predictive variables and

Our Predictive Variables	$\beta$
Days since last communication	-0.76
Days since first communication	0.755
Words exchanged	0.299
Mean tie strength of mutual friends	0.257
Positive emotion words	0.135
Intimacy words	0.111

**Table 1. Our predictive variables and their associated beta coefficients. Beta values are drawn directly from Gilbert and Karahalios**

their corresponding beta coefficients; we have used a subset of those for our model.

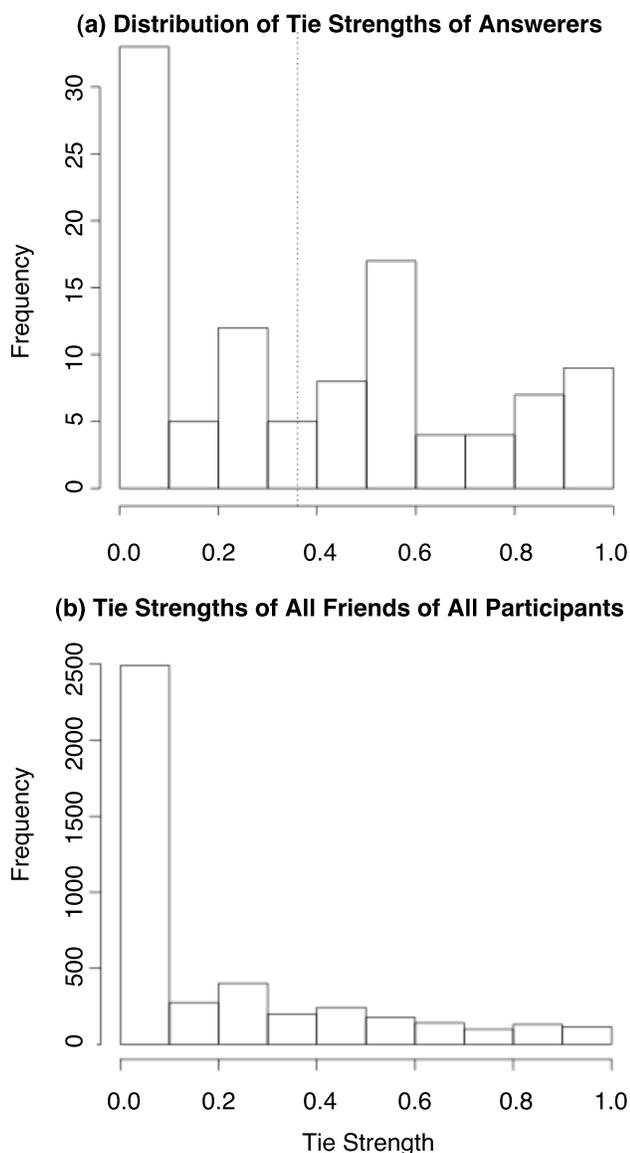
We list our variables in Table 1. We used the same beta coefficients as Gilbert and Karahalios for all variables. The variables we omitted were Intimacy  $\times$  Structural, Educational difference, Structural  $\times$  Structural, Reciprocal Serv.  $\times$  Reciprocal Serv., Participant-initiated wall posts, Inbox thread depth, Social Distance  $\times$  Structural, and Participant's number of apps.

The variables not used were omitted because of the increased difficulty in obtaining the information. For instance, educational difference: at the time of the study, the Facebook API call for education did not return meaningful information. Asking each participant about each of their friends would not have been feasible, and so we omitted it from our study.

Since we used a simplified version of Gilbert's model, we attempted to calibrate our results by asking participants a question in the survey portion about how much they valued information from each of the answerers in general. The correlation was statistically significant. Several months after the initial study, we asked participants to rate the tie strength of a selection of their friends as well. The correlation was strong.

The data required for generating tie strength was gained primarily from Facebook's Download Your Data feature [29]. This allowed us to capture all of the communication between the participant and her friends. Participants were asked to download their data before the study and before asking a question for our study, so that participation in the study would not affect generated tie strengths.

We parsed this information to get our necessary numbers: the days since first and last communication, quantity of words exchanged, intimacy words, and positive emotion words. Communication between each friend was parsed with LIWC to label words as positive emotion or intimacy words. LIWC, Linguistic Inquiry Word Count, is a tool for text analysis developed by social psychologists [23]; Gilbert and Karahalios used this tool to generate the same data in their study. We also gathered the mutual friends



**Figure 2. Distribution of tie strengths of (a) answers of questions during the study and of (b) all friends of all participants. The dotted line in (a) represents the median: 0.36, indicating that more weak ties answered questions than strong ties. The median in (b) was 0.01, a very weak tie.**

between each participant and their friends to generate the mean tie strength of mutual friends.

We chose to calculate tie strength from a trained model instead of asking about it outright because of potential biases that would be introduced. Participants would be more likely to rate the closeness of a friend highly when presented with an example that they had just helped them; using this model to generate tie strength was an effort to remove this bias.

We saw confirmation of this effect in our study. Several participants had friends that answered their question multiple times. Two of our questions (detailed below) were about the friend in general, such as how much they valued

input from this friend, and some participants increased the score for those friends on subsequent times we asked.

After several months had elapsed, potentially negating this bias, we asked participants to rate the strength of their friendship with some of their friends, as detailed in the Followup Surveys section. We found a strong correlation between our generated tie strength and their responses.

The distribution of generated tie strength between answerers of questions and our study participants is shown in Figure 2(a). The distribution of all of tie strengths for all of the friends of our participants is in Figure 2(b). As in Gilbert and Karahalios, the range is normalized to between 0 and 1 for each participant, where 0 is the weakest tie strength of a friend, and 1 is the strongest.

### Answer Quality Survey

To determine the quality of responses from friends, 24 hours before the study, we asked each participant to ask a recommendation question about technology, such as “Can anyone recommend some places to get good information on cameras?” Participants were asked to use the question to address an existing information need.

While this is more specific in scope than the entire spectrum of questions typically asked on Facebook, previous work by Morris et al. points to recommendations being the most popular form of questions asked, and technology being the most popular topic.

Each participant asked a question, and in some cases, we reviewed other questions the participant may have asked if the participant wished to do so. An example question, drawn (with permission) from a participant in our study, is in Figure 1.

Questions included the following examples (somewhat altered to preserve anonymity):

- recommendations please: what are your must-have smartphone apps?
- does anyone have a good camera to recommend? Size-wise, I’m looking for something between a giant DSLR and a tiny point-and-shoot
- anyone got a website they use to track relevant new academic papers?
- Anyone flown Delta? Good? Bad?

Our 19 participants received a total of 104 responses, with a median response rate of 3 answers (not counting any clarification or comments by the participant) (average 5.47 responses, minimum 1 answer, maximum 19). All of the questions covered in our study were answered.

We asked participants nine questions about each answer they received. Questions were either about the *person* answering the question or about the *specific answer*. The questions and the distribution of answers are in Figure 3. Each participant was asked to give a response on a 7-point scale, with 1 being the least and 7 being the most. The

questions we asked, along with clarification given, are as follows:

- How on topic is this answer? (where 1 is not at all related, 7 is 100% only about what was asked)
- What value do you place on answers from this person in general? (1-7)
- How knowledgeable or trustworthy is this person about this topic? (1 is not at all, 7 is expert level)
- How supportive is this answer? (1 is not at all, 7 is completely) *with example provided, see below*
- How interesting is this answer? (1-7)
- How much does this answer contribute to your overall knowledge? (1-7)
- How much does this answer provide information you haven't seen before, that's novel? (1-7)
- How much does this answer verify information you already knew? (1-7)
- How much do you trust this answer? (1 is not at all, 7 is don't need to verify anywhere, complete trust)

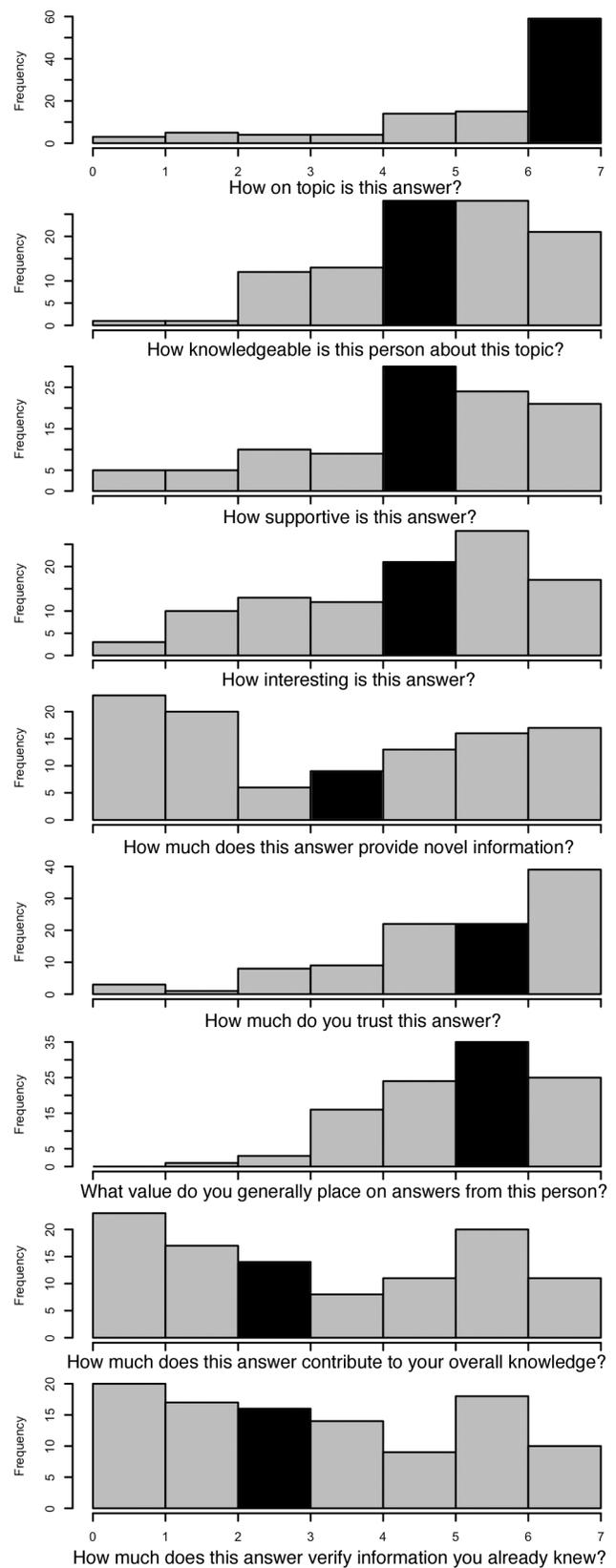
Three of the questions (how much the answer contributes to overall knowledge, how much is novel information, how much you already knew) address knowledge gained from the answer. We asked this general question in three specific ways in an effort to tease out any subtleties. Two of the questions (value placed on answers from this friend, how knowledgeable/trustworthy about the topic the friend is) asked about the friend in general. This was an effort to understand if answer quality was simply related to qualities (not necessarily tie strength related) of the answerer.

We conducted the data collection and survey portion of the study in the lab for several reasons. The main reason was that we conducted unstructured interviews with participants after the survey.

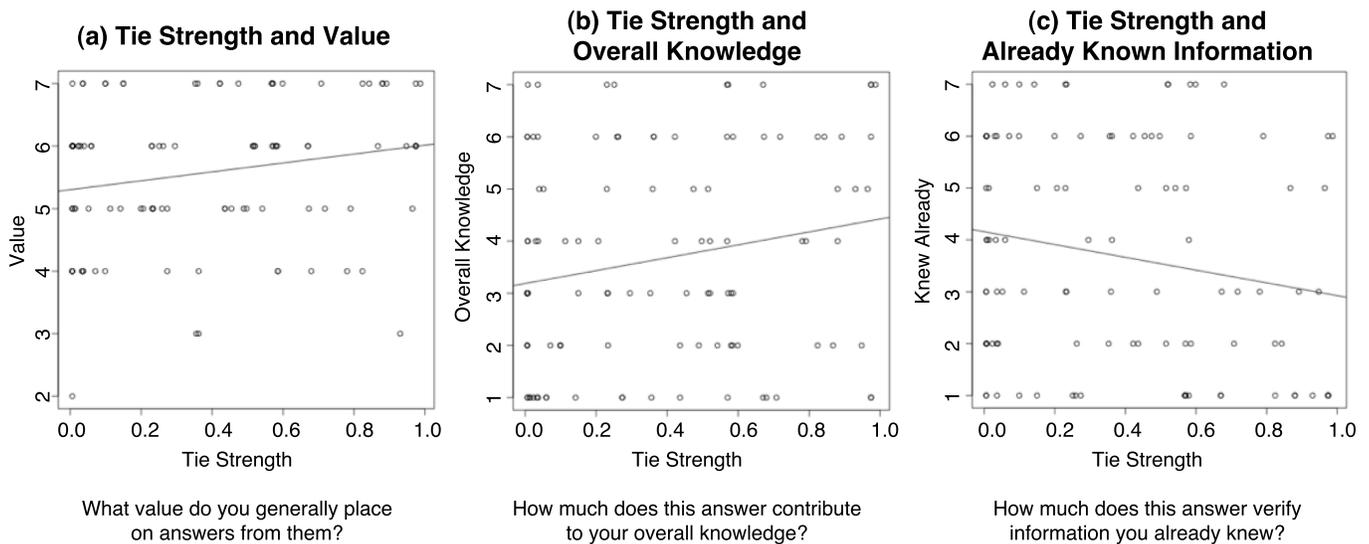
Participants could also qualify answers and give general impressions. We also had participants come into the lab in an effort to mitigate privacy concerns about sharing their downloaded Facebook data. Participants seemed more comfortable sharing their data when they were able to observe the investigator generating the tie strength metrics without actually reading messages.

We also conducted the study face-to-face in an effort to help participants calibrate answers; when asking about how supportive an answer was, for instance, we gave this example of an unsupportive answer: "Don't buy a new camera! What a waste of money!"

Previous work often simply discusses evaluating answer quality by having independent coders rate answers. The questions we asked participants were based largely on interviews with participants from a pilot study and others who self-identified as question-askers. Our nine questions are an attempt to unpack what constitutes answer quality in social questions.



**Figure 3. Questions asked of participants and their distributions. Medians are highlighted.**



**Figure 4. Tie strength and (a) value of answers in general, (b) overall knowledge gained from each answer, and (c) information already known by the participant.**

We chose not to use an independent rater because of the inherently social nature of the site. For instance, friends could exchange an inside joke that was on topic, even if it didn't appear so to outside raters.

We asked how interesting the answer was to capture answers that may be good in a non-traditional sense. Someone answering with a pun, for instance, may not be very helpful, but it may be interesting. We also asked if participants would trust the answer, in the sense that they wouldn't feel the need to verify it at all. A trusted answer, for instance, would be an answer a participant would repeat to another friend, if she asked a similar question.

For questions that were directly about the answer, rather than the answerer, we followed up with participants several months later, in attempt to reduce bias or memory of the answers, and asked them to rate their answers without being able to see who provided them. More details are below.

#### Followup Surveys

Several months after the initial study, we contacted our participants for two more surveys. In the first, participants were asked to rate the strength of their friendship with some of their friends. We specifically asked participants to "adjust [a] slider to represent how strong your relationship is with [each] person", for a set of friends comprised of the friends that answered their question, the friends we found to be the highest and lowest tie strength with our generated metric, and random friends, totaling 15 friends. We received participation on this portion from all but one participant. We measured the correlation between the tie strengths we generated and the tie strengths our participants provided and found a Pearson's coefficient of 0.50, indicating a strong correlation.

We also asked participants to re-rate the answers that they had received to their questions. We used the same questions as above, focusing only on questions that are about the answer, rather than the person who provided it. After they

had responded to those questions, we asked them to rate how much each answer had contributed to any decision they made for their question, and how they made that decision. We also asked if participants remembered who provided the answers.

Fifteen of 19 participants completed this survey. These 15 participants had a total of 101 answers, of which participants remembered the author 56% of the time. We discuss the differences in rating in the following section.

#### RESULTS

In this section, we discuss the results from our survey and tie strength metrics, as well as our followup work. To do this we calculated a correlational analysis between tie strength and each of our survey questions, as well as between other variables, when noted below.

Our analysis did not control for the number of answers a participant had received. Our analysis also does not include any analyses of likelihood of getting a response or of getting a high quality response. This information was impossible to obtain, given the data available. Further discussion of this appears in the Limitations section.

Surprisingly, the bulk of our results were not statistically significant. We initially found no significant correlation between tie strength and how on topic an answer was, how knowledgeable a friend was about the topic, how supportive the friend was perceived to be, how interesting an answer was, how novel the information was, or how much the answer was trusted. However, the correlations between the value placed on a friend's feedback, the overall knowledge gained from an answer, and whether or not the answer verified already known information were statistically significant. We discuss these results in more detail below. In some cases our followup survey or the tie strength numbers provided by our participants conflicted with our initial findings; these are noted when this is the case.

	On topic	What value for friend in general	How knowledgeable	How supportive	How interesting	How much added to overall knowl.	How much already known	How novel	How trusted was response
How on topic was this answer?		not sig	0.51***	0.60***	0.32***	0.32***	0.16*	0.21**	0.48***
What value do you generally place on answers from this friend?	not sig		0.32***	not sig	0.20**	0.17**	not sig	0.11*	not sig
How knowledgeable/trustworthy is this friend about this topic?	0.35***	0.44***		0.43***	0.32***	0.30***	not sig	0.17**	0.31***

**Table 2. Correlations with beta coefficients between survey variables and how on topic a question was, what value participants generally placed on answers from that friend, and how knowledgeable/trustworthy on this topic they are.**

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

We also discuss a subset of significant correlations between survey questions. We focus on the things that were predicted by qualities about the answerer, the friends of the participant – the value placed on answers from that friend, and the perceived knowledge and trustworthiness of the friend on the topic of the question. These qualities of the answerer can help us understand factors that *do* predict answer quality, if tie strength does not.

#### How on topic is this answer?

While initial ratings and generated tie strengths showed no statistically significant correlation, the tie strengths from participants *did* correlate negatively with the ratings from our followup survey ( $R^2 = 0.049$ ,  $\beta = -0.040$ ,  $p < 0.05$ ). This effect size is minimal.

#### What value do you generally place on answers from this person?

The value placed on answers is correlated positively with tie strength ( $R^2 = 0.065$ ,  $\beta = 0.071$ ,  $p < 0.05$ ).  $R^2$  indicates that about 4% of value is predicted by tie strength; the low  $p$  value indicates that it is a statistically significant fit.  $\beta$  indicates that, as ties become stronger, value increases, though not greatly. Figure 4(a) shows a plot of tie strength and value, with the line of best fit. When correlated with participants' ratings of tie strength, we saw a similar correlation with a slightly larger effect size ( $R^2 = 0.020$ ,  $\beta = 0.114$ ,  $p < 0.001$ ).

We also compare the value placed on answers with other measures of the answers. Those results are in Table 2. Value is correlated significantly with how knowledgeable the friend is, how interesting the answer is, how much the answer contributes to the participant's overall knowledge, and how novel the answer was.

#### How much does this answer contribute to your overall knowledge?

The overall knowledge gained by answers is correlated positively with tie strength ( $R^2 = 0.036$ ,  $\beta = 0.031$ ,  $p < 0.05$ ). About 4% of knowledge gained is predicted by tie

strength; Figure 4(b) shows a plot of tie strength and knowledge gained, with the line of best fit.

#### How much does this answer verify information you already knew?

How much answers verify known information is correlated negatively with tie strength ( $R^2 = 0.062$ ,  $\beta = -0.038$ ,  $p < 0.01$ ).  $R^2$  indicates that about 6% of how much of the answer is known is predicted by tie strength; the  $p$  value indicates that the fit is nearly statistically significant.  $\beta$  indicates that, as ties become stronger, answers are less likely to have already been known. Figure 4(c) shows a plot of tie strength and how much the answer was known, with the line of best fit.

#### How knowledgeable/trustworthy is this person about this topic?

Specific numbers are in Table 2. Knowledge on the topic is correlated significantly with how on topic the answer is, the value placed on answers by that friend in general, how supportive the answer is, how interesting it is, how much it contributed to overall knowledge, how novel the answer was, and how much the participant trusted the response. It was not, however, correlated with tie strength.

#### How much do you trust this answer?

How much participants trust specific answers is correlated positively with tie strength, only when participants *do not remember* who provided the answer in the followup survey ( $R^2 = 0.092$ ,  $\beta = 0.058$ ,  $p < 0.05$ ). There was no initial correlation. In a followup survey, which took place months later, we asked this question again. Fifteen of 19 participants completed this portion, and a combined total of 44 of 101 answerers were forgotten.

#### How much did this answer contribute to your decision?

We asked participants how much each answer contributed to their ultimate decision regarding their question. Fifteen of 19 participants completed this portion, and there was no statistically significant correlation between tie strength and the decision.

## DISCUSSION

In this section, we discuss the meaning behind our results and possible explanations for them.

Our research question asks *if tie strength has the same 'strength of weak ties' effect in SNS Q&A, and how the relation between tie strength and answer quality plays out.* In our introduction and related work we detailed some of the places where tie strength and the transmission of information have been studied. While job finding may be different from question asking, at its crux, it is still about solving an information need. In these cases, research pointed toward *the strength of weak ties*, where weak ties provided better information than strong ties.

Surprisingly, our data show no correlation in this direction. Participants in our study even rated answers from strong ties as having a slightly stronger contribution to their overall knowledge. Weaker ties were more likely to answer with information that the participant had already seen, and participants valued answers from closer friends more in general. Both strong and weak ties provided decision making information, though no correlation between the two was found.

We asked participants how much they valued answers from each of their friends in general, and saw a statistically significant positive correlation with tie strength. Though the beta is low, we see this as evidence that our implementation of Gilbert and Karahalios's model is valid. Several months later, we surveyed participants and found that their reported tie strengths were strongly correlated with our initial values.

There are several potential explanations for why our contrary findings may be the case. We saw that strong ties were slightly more likely to contribute more to a participant's overall knowledge, and that weak ties were more likely to share information the participant already knew. One potential, though unlikely, explanation is that information diets, even between close friends, are varied and diverse. As such, question askers might gain benefits like personalization without losing breadth in information known by their close friends.

The ability for friends to personalize information when answering questions alone may also help explain our findings. Strong ties' increased knowledge of the participant may have enabled them to direct their answer, despite their overlapping knowledge bases. Even when participants could not remember who provided an answer, they rated answers from strong ties more trustworthy than those from weak ties. Future work is needed to unpack these interactions and to verify these results.

Perhaps topical knowledge matters more. There was no statistically significant correlation between how knowledgeable/trustworthy a friend was and tie strength, but the correlation between how much the answer contributed to participants' overall knowledge and how

trustworthy/knowledgeable the answer was significant, and predicted 66% of the overall knowledge gained.

Many participants confirmed this and said that the answers they liked best were answers that seemed reliable, and came from a reliable source. One participant said, *"I look for answers where people didn't just recommend a product but gave reasons from their experience or pointed to reviews online. So I guess I want citations."*

Others echoed this remark: *"I guess a lot of evaluating is my estimation of the source reliability (the person)."* One of our questions asked how much participants trusted their friend about the particular topic – this had no statistically significant correlation with tie strength, though it seems to be a big factor in determining answer quality for many participants.

Another said, *"[It's] just kind of a personal experience with products that I'm looking for. For example, I know [friend with tie strength 0.006] does a lot of camera work, and [tie strength 0.718] is a professional photographer, so I value their answers more."* In this case, the best answers were from friends with wildly different tie strengths.

One interesting anomaly in our study is that very few things seem to be correlated with how much the answer verified information that was already known. Part of the reason we asked several questions about knowledge was to allow for survey questions that may have been perceived as confusing or unclear.

## IMPLICATIONS FOR DESIGN

Perhaps most significantly, designers should consider drawing on close friends more strongly within the question-asking process. Systems such as Aardvark [15] bypass all friends, including close friends, for friends-of-friends and strangers. While some questions may be better suited for strangers, due to an embarrassing nature, or extremely localized knowledge, other questions may do better when routed to close friends. For instance, a participant may want to ask *any* close friend for advice about something, but selecting a specific friend is unimportant. Were one to have access to a social network at a higher level, it would make a great amount of sense to route questions that were posted to strong friends first.

## LIMITATIONS

This paper suffers from several limitations. One is that work on Facebook must acknowledge unknowns about the Newsfeed algorithm. This algorithm, at time of writing, selectively displays posts to participants, instead of displaying all recent posts. This means that we cannot make any claims as to who saw posts or make any useful statements about percentages of answers from strong or weak ties; it also means that the weak ties that answered questions in our study may have been a poor subsection of the population. We are also unable to predict the likelihood of getting a high quality response to a question for this reason.

Our participants may likewise not be a generalizable population, though it is possible that the length of time our participants have been on the site can help us predict what longer term use looks like.

We also did not completely replicate the tie strength model proposed by Gilbert and Karahalios. While we argue that the parts of the model we used were the most significant parts, there may be subtleties we are missing.

## CONCLUSION

In this paper, we presented a study relating tie strength to answer quality for questions asked as status messages on social network sites. We found that there was no statistically significant correlation between tie strength and these values, contrary to previous literature on tie strength.

In our study, 19 participants asked technology recommendation questions of their social network. We compared participant-rated answers to a tie strength metric drawn from Gilbert and Karahalios [10]. We saw that, instead of weaker ties providing better answers, there was minimal correlation at best, and in fact, for some measures of answer quality, stronger ties actually provided better answers.

We also saw that friends who were rated as more knowledgeable and trustworthy about the given topic provided answers that were better (more interesting, supportive, contributed more to overall knowledge).

Social network system Q&A lies at the intersection of several different areas. We hope that our effort to better understand some of the social mechanisms in play can also translate to other areas. It is important to understand this process – it has been happening for a long time, and will continue into the future for a long time as well.

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