

Expressing Social Relationships on the Blog through Links and Comments

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Abstract

Blogs, regularly updated online journals, allow people to quickly and easily create and share online content. Most bloggers write about their everyday lives and generally have a small audience of regular readers. Readers interact with bloggers by contributing comments in response to specific blog posts. Moreover, readers of blogs are often bloggers themselves and acknowledge their favorite blogs by adding them to their blogrolls or linking to them in their posts. This paper presents a study of bloggers' online and real life relationships in three blog communities: Kuwait Blogs, Dallas/Fort Worth Blogs, and United Arab Emirates Blogs. Through a comparative analysis of the social network structures created by blogrolls and blog comments, we find different characteristics for different kinds of links. Our online survey of the three communities reveals that few of the blogging interactions reflect close offline relationships, and moreover that many online relationships were formed through blogging.

1. Introduction

During the past several years, blogging, the keeping of a regularly updated online journal interspersed with hyperlinks and photographs, has emerged as a trendy yet powerful form of computer-mediated communication (CMC). Blogs enable individuals and organizations to quickly and easily share information and links with a large set of readers. It is estimated that 7% of U.S. adult Internet users, approximately eight million people, have created a blog or online journal and 27%, or 32 million people, read blogs [1]. Far from being a phenomenon concentrated in the United States, blogs are popular across the globe [2-4].

Despite the large number of potential blog readers, only a small fraction of blogs, known as the A-list blogs, command a large portion of site traffic [5].

Most bloggers write about their everyday lives and generally have a small audience of regular readers. Some of these readers interact with bloggers by contributing comments in response to specific blog posts. Moreover, readers are often bloggers themselves. They may list the blogs they read in their blogrolls - lists of links to other blogs placed in the sidebars of their own blogs. They can also create links to other blogs and websites in their posts; we refer to these links as citations. Citations within a blog post are usually used to point out content on another blog or to refer to another blogger. Receiving blogroll links, citations, and blog comments is a sign of the blogger's popularity. Rather than being a one-sided expression of interest, the relationships that bloggers have with one another are often mutual. Moreover, bloggers tend to frequent the same blogs and build relationships with blogs that share similar interests [6]. These cliques are often referred to as blogospheres, sets of highly linked and intertwined blogs.

In examining the social structures created by blogrolls and blog comments, it is unclear how these relationships and social networks were formed. Did blog networks emerge due to blogging or are these blogospheres merely representations of real life social networks? In other words, do blogs help facilitate the formation of new friendships or do they help preserve existing relationships in the real world? Furthermore, do blog comments and blogroll links represent different levels of relationship intimacy? Understanding the answers to these questions will offer a more complete picture of the social dynamics of blogging and how individuals manage their virtual and real life relationships. In addition, these insights may have implications for increasing participation in online communities and computer-supported cooperative work (CSCW) systems.

While previous studies have evaluated the impact of the Internet on social behavior and examined the social network structures of the blogosphere, here we draw a connection between blogging and real life social networks. In order to do so, we survey three

blog communities who identify themselves with three different geographical locations: Kuwait, Dallas/Fort Worth, and the United Arab Emirates. We find that blogging relationships do not reflect close real-world ties. Within each community, social networks corresponding to different kinds of linking behavior - blogrolls, citations, and comments - reflect different kinds of interaction. We also observe differences across the communities in measures of cohesion: reciprocity, density, and degree of interaction with blogs outside of the community. Finally, we examine the link structure of comments and topical content of blog posts spanning a two week period in Kuwait blogs and find both strong themes and different roles played by bloggers in the community.

2. Related work

2.1. Computer-mediated communication and relationship formation

The effect of the Internet on its users' real world social interactions and involvement has been a subject of debate. Kraut et al. (1998) found that as participants used the Internet more frequently, they communicated with family members less frequently and experienced more instances of depression and loneliness [7]. Moreover, the study found that the size of the participants' social networks decreased with prolonged Internet use. Additionally, Cummings et al. (2002) argued that online relationships were not as intimate as face-to-face or telephone communication [8]. In reviewing email and Listserv communication, they observed that "social places on the Internet where close personal relationships are formed and maintained are rare."

On the other hand, an overwhelming number of studies have shown that Internet use can help individuals in developing and sustaining relationships. In a follow-up study, Kraut et al. (2001) found that Internet use had a positive impact on communication and social involvement [9]. Wellman (2001) points out that the Internet enables individuals to maintain existing social ties and develop new social ties with others sharing similar interests [10]. He also argues that "the more contact people have online, the greater the impression they make on each other." McKenna et al. (2002) conducted surveys of online newsgroup posters that showed that some close online relationships naturally progress to face-to-face interactions and that a majority of those surveyed experienced an increase in their social networks due to

online interactions, regardless of the size of their social networks [11].

Based on these previous results, we hypothesize that blogging should enable people to develop new relationships online and sustain and strengthen existing relationships in real life. Indeed, preliminary ethnographic research of bloggers has shown that blogging is a highly social activity. Nardi et al. (2004) found that many people start blogging at the urging of friends and continue to blog to avoid disappointing their readers [12]. Of the motivations for keeping a blog, they found that three of them ("update others on activities and whereabouts[,] express opinions to influence others[, and] seek others' opinions and feedback") involved communicating with others. They also found that communication sometimes extends to other media, including email, instant messaging, and face-to-face conversation, which is a trend we will follow up on in our study.

2.2. Blogs as social networks

Social network analysis is the quantitative study of the relationships between individuals or organizations [13]. Social network analysts represent relationships in graphs where individuals or organizations are portrayed as nodes (also referred to as actors or vertices) and their connections to one another as edges (also referred to as ties or links) [13]. By quantifying social structures, social network analysts can determine the most important nodes in the network [13].

Applying social network analysis methods to the blogosphere has revealed interesting findings about how individuals share information and interact socially online. For example, the linking patterns of blogs can be used to predict paths of information flow through the blogosphere [14, 15]. Adamic and Glance (2005) looked at the network structure of political blogs during the 2004 U.S. Presidential election and found that the linking patterns between conservative and liberal blogs formed two fairly separate communities [16]. Moreover, Herring et al. (2005) found that blogs that link to each other and are part of the same community have a tendency to mention one another in blog posts and to communicate with one another through comments [6]. These citations between blog pairs occurred "on multiple occasions, suggesting the existence of a relationship between them, not just a one-time exchange." Several studies proposed different measures of network structure to identify and extract such communities [17-19], and it is these structural measures that we turn to in the next section.

3. Community structure

Our study focuses on three blog communities, each with a central site containing a curated listing of blogs. We now use network analysis to determine to what extent each set of blogs actually forms a community by engaging in reciprocal, group interaction. But first we examine the different forms of interaction that can take place.

3.1. Blog ties: blogrolls, citations, and comments

Social relationships can be expressed online as different forms of blog ties:

Blogroll links are usually located in the blog’s sidebar and point to other blogs that the author may read or simply want to always include on her main page. Blogrolls are typically updated infrequently.

Citation links are made by bloggers within their own posts and can reference an entire blog or just a particular post on that blog. By their nature, they occur at a fixed time point, but may be repeated. Repeated citations can serve as a weight for the tie – with more frequent citations indicating a greater interest of one blog for another.

Comment links are not necessarily hyperlinks per se, but an interaction that occurs when one person, possibly a blogger, adds a comment to another blogger’s post.

For both blogrolls and citations, the communication is indirect. It occurs on the blog with the blogroll or citing blog post, but may be noticed by the blog being referenced through blog search engines, server logs, or through TrackBacks. Trackbacks allow the citing blog to notify the blog receiving the citation that their post has been discussed [20]. The receiving blog will typically display the TrackBack, along with summary text of the citing post. Readers are then able to follow conversations across several blogs by traversing TrackBacks.

Most of the blog research to date has focused on blogrolls and citation links [6, 14, 16, 18]. We find, however, that much of the interesting interaction occurs in comments left by bloggers directly on a post of another blog. This kind of communication is more interactive and conversational, and we observe that bloggers receiving many comments will comment on their own post in reply to others’ comments.

3.1.1. Data collection. For all three communities, we gathered the blogroll links by hand at a single time point. For better coverage, post citations were

collected using two search engines, BlogPulse [21] and Technorati [22], and the data spanned April 2005 to March 2006 for Technorati and November 2005 to April 2006 for BlogPulse. Comments were gathered manually over a two week period just for the Kuwait blog community. A more detailed analysis of the comment network and contents of the posts will be presented in Sections 5 and 6.

3.1.2. Link type overlap. Although one might expect that bloggers cite and leave comments on the blogs that are in their blogrolls, we found that overlap between the different kinds of ties, while significant, is not complete. As shown in Figure 1, a majority of both comment ties and citation links are not present in the blogroll network.

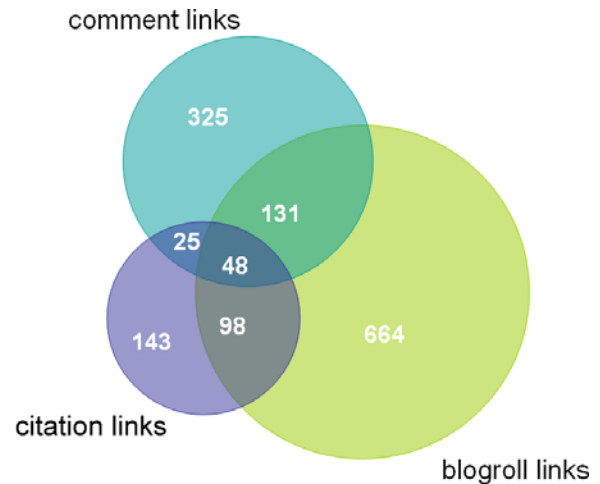


Figure 1. Venn diagram illustrating the overlap in different types of blog ties (comments, blogrolls, and citations) for Kuwait Blogs.

3.2. Density and centralization

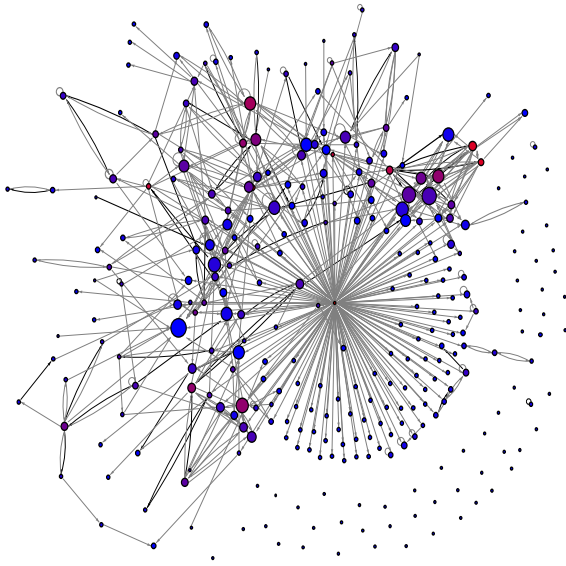
The first measure of community we consider is the density of links between blogs within that community. The greater blogosphere is vast, and the chance of a link falling randomly within one of these small communities is negligible. We find, however, that blogs link on average to one or more other blogs within the community, with the Kuwait network being most dense, and the DFW network most sparse. Overall, blogroll links are more numerous than post citations.

	Kuwait	UAE	DFW
citation	2.08	1.37	0.37

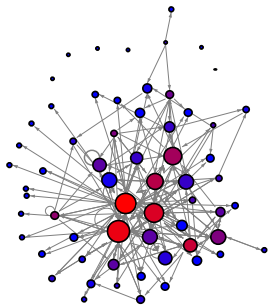
blogroll	6.25	2.65	1.79
comment	5.10		
centralization of the combined blogroll and post citations network			
indegree centralization	0.18	0.30	0.04
outdegree centralization	0.30	0.67	0.55

(c)

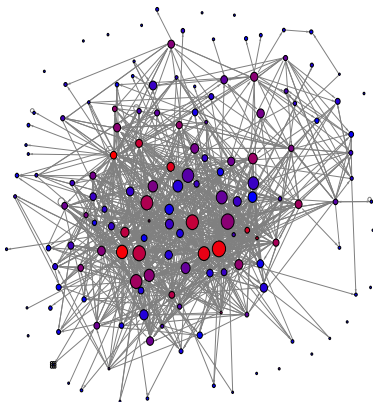
Figure 2. Within-community blogroll and post citation links for (a) DFW, (b) UAE, and (c) Kuwait. Nodes are colored by outdegree: red – high, blue – low, and sized by their indegree.



(a)



(b)



The communities differ not only in the density of links, but also in the distribution of those links. Centralization measures the equality of allocation of links. In all communities, there is greater centralization of outdegree – meaning that a few blogs have very long blogrolls and/or cite other blogs often, while many list few or no other community blogs in their blogrolls.

Figure 2 shows a visualization of the links between blogs within the three communities. It is immediately apparent that there is one DFW blog listing many others. But this blog, like most others, has very low indegree. The absence of hubs attracting large numbers of links corresponds to a low indegree centralization. On the other hand, there are several hubs among the UAE blogs that both give and receive many links. We will see how this contributes to community cohesion in Section 3.1.5. Finally, the Kuwait community is the most dense, with several high degree blogs, but not as much centralization as there is in the UAE community.

3.3. Reciprocity

As we saw in the example of the DFW community, it is possible for one blog to link to many others, but not receive links in kind. Similarly, a blog may be very popular but not reciprocate the attention it is receiving. If there is true interaction and relationship formation within the community, the ties will be reciprocal [23], which we found true for all three communities. Reciprocal blogroll links indicate possibly only a mutual awareness, whereas reciprocal post citations imply that both blogs actively discussed or linked to one another in their posts – a less likely event given that post citations are fewer in number. It is therefore unsurprising to find that a greater fraction of blogroll links are reciprocated than are post citations. In general, bloggers do tend to reciprocate blogroll links merely as a courtesy. Finally, it is interesting to observe that for the Kuwait blogs, it is the comments that are most often reciprocated, making commenting the most conversational and mutual activity.

Table 2. Percentage of links that are

reciprocated			
	Kuwait	UAE	DFW
post citations	19%	16%	26%
blogroll links	32%	43%	27%
comments	43%		

3.4. Community structure

Often times communities themselves contain subcommunities. Modularity measures how pronounced this subcommunity structure is [24]. A modularity of 0 means that there is no natural way to subdivide the network into groups while minimizing the number of links between the groups, and a high modularity means that one can easily subdivide the network. For all three blog networks, we find relatively high modularity, but it is highest for DFW, which is the sparsest and most easily broken up network. In contrast, Kuwait and UAE, while displaying a degree of local interaction between subgroups of blogs, have a tighter cohesion overall.

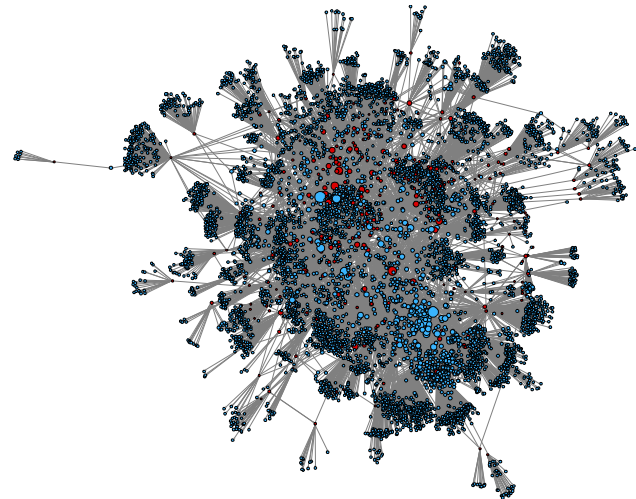
	Kuwait	UAE	DFW
maximum modularity	0.24	0.22	0.53
number of communities at maximum modularity	7	6	10

3.5. Community boundaries

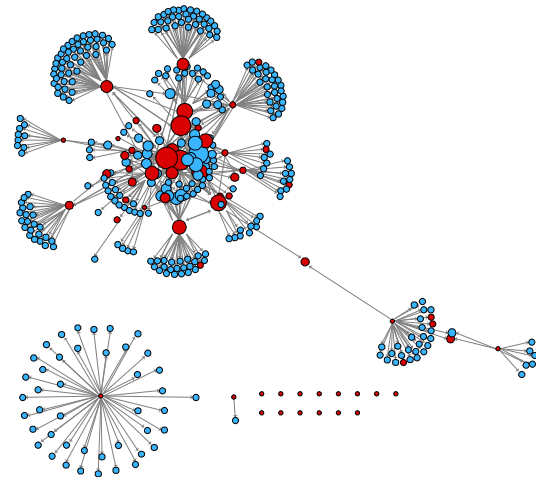
Specific blogs were included in this study because they were listed on a central webpage for one of the three communities. There is a question of how self-contained those communities are: how much interaction there is across the community boundaries and whether some popular Kuwait, UAE, and DFW blogs were omitted from the sites. To answer this question we look at the relative fraction of internal and external interaction and the characteristics of the most cited blogs outside the community.

Overall, we see a country-level affinity of the blogs. The 5 most blogrolled blogs for all three communities are blogs from the respective countries. But for the DFW blogs, 4 of the top 5 blogs are A-list blogs in the United States that are outside of Dallas/Fort Worth. DFW blogs also have the highest percentage of blogroll links to blogs outside of their community (91%), while Kuwait has the lowest (53%). These community statistics are reflected in Figure 3, showing blogroll networks including external blogs linked to by blogs from within the community.

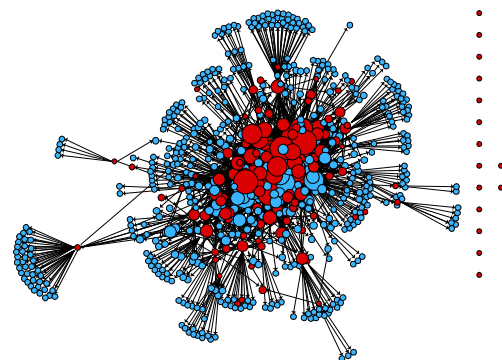
The same trend is valid for citations received by the bloggers from other blog posts. As is shown in Table 4, an overwhelming majority of citations in Kuwait originate from within the community (79%), which is not the case for UAE and DFW. Finally, nearly half of the comments posted on Kuwait blogs are made by the Kuwait bloggers themselves.



(a)



(b)



(c)

Figure 3. Blogroll and citation links for (a) DFW, (b) UAE, (c) Kuwait. Nodes are colored red if they are in the community and are sized by indegree.

	Kuwait	UAE	DFW
internal post citations received	79%	24%	16%
internal blogroll links given	47%	22%	9%
non-anonymous comments received from bloggers within community	42%		

Since a fair fraction of blogroll links do fall outside of the communities, a valid question to pose is whether some of the most blogrolled blogs should be considered as belonging to the community, even though they were omitted from the central websites. For UAE and Kuwait, we find that one or two of the top 10 most blogrolled blogs did identify themselves as UAE or Kuwait blogs, but were not listed on the community websites. For DFW, even though many of the most popular blogs were outside of the community, none in the top 10 are in DFW.

Porous community boundaries aside, the high concentration of links within communities and their significant reciprocity, as well as cohesion in the overall link structures, all indicate that these groups of blogs do indeed interact as communities.

4. Online and offline-relationships

In carrying out this study, we were concerned with how blogs impacted people's relationships online and in real life. Do blogs help facilitate new relationship formation or do they help maintain relationships that already exist in real life? To answer this question, we surveyed the three communities, asking bloggers about their motivations to keep a blog, their commenting behaviors, their relationship with those who leave comments on their blog, their relationship to blogs on their blogroll, and their basic demographic information. The survey was completed by 85 bloggers in Kuwait, 38 bloggers in the UAE, and 67 bloggers in DFW, yielding survey response rates of 63%, 68%, and 23% for each community respectively.

When asked about the comments that are left on their blogs, a majority of survey respondents (79% of Kuwait bloggers, 81% of UAE bloggers, and 66% of DFW bloggers) reported that few or none of the comments they receive are left by individuals whom they know offline. Moreover, bloggers were also asked about the comments that they leave on others' blogs. 94% of UAE bloggers, 74% of Kuwait

bloggers, and 65% of DFW bloggers reported that few or none of the comments that they write are on the blogs of individuals whom they know offline. For all three communities, bloggers are interacting with new people whom they do not know in real life.

Along with online relationship formation, we were also interested in understanding if blogs can help sustain real life relationships. 99% of Kuwait bloggers, 94% of UAE bloggers, and 79% of DFW bloggers reported that few or none of the comments they received were made by people who do not blog but whom they know offline. It appears that blogs do not necessarily help individuals maintain their real life relationships. This finding may not necessarily signify a weakness of blogging as a communication medium. It may be merely a function of blogging being a fairly new technology, whereby a minority of one's real life social network actually blogs. Moreover, there is a possibility that non-blogging real life friends and contacts do read blogs but do not leave comments. Furthermore, in the case of Kuwait and UAE bloggers, most of those bloggers blog anonymously by using a pseudonym so by definition, they are keeping their real life contacts away from their blogs.

Survey respondents were also asked about how their blogroll relationships pertained to their real life relationships. When asked how many of the bloggers on their blogrolls have they met in person, bloggers in Kuwait and DFW cited an average of 9 others, while bloggers in the UAE cited an average of 4. The mode for the Kuwait and UAE communities was one other blogger and two other bloggers for the DFW community. These results signal that bloggers do meet each other offline but they appear to be reserved in doing so. Nonetheless, bloggers' hesitancy to meet bloggers listed on their blogrolls may be reflective of the casualness of blogroll links. Bloggers do appear to be more willing to communicate with other bloggers listed on their blogrolls through email (citing an average of 9 bloggers in Kuwait and UAE and 20 bloggers in DFW), but less likely to communicate through the telephone or instant messaging (for telephone conversations, citing an average of 5 bloggers in Kuwait and DFW and 2 bloggers in UAE; for instant messaging, citing an average of 8 bloggers in Kuwait, 4 bloggers in UAE, and 6 bloggers in DFW). When asked to estimate the number of bloggers listed on their blogrolls whom they initially met through blogging but whom they now communicate with in person, by phone, email, or instant messaging, the Kuwait and UAE bloggers listed an average of 6 other bloggers (approximately 20% of their blogroll), while the DFW bloggers listed an

average of 13 other bloggers (approximately 25% of their blogroll).

Along with the quantitative evidence, there is qualitative evidence that blogging does enable new relationship formation. In this regard, one Kuwait Blogs survey respondent stated:

Most of the Kuwaiti bloggers know one another, either directly (friends/relatives) or indirectly (friends of friends, friend's relatives, etc.). If they don't know one another, then they don't remain strangers for long. [...] I know of several people who used their blogs to make new friends in Kuwait.

A survey respondent in the Dallas/Fort Worth community shared a similar experience:

The DFW Blogs community was an incredible social network for me. I had recently moved back to the Dallas area when the group began. Through that group I was able to meet highly intelligent, talented, motivated, and creative people. We all had a common interest - blogs - but we were all so diverse. The group was amazing and I'm so thankful I was apart of it for so many years.

Another blogger from Dallas/Fort Worth offers some insights into how blogging enables new relationship formation:

I wish everybody would blog. It's such an easy way of knowing what's up in someone's life and what thoughts are on their mind, important or not. People often think, 'Oh, nobody'd want to read about /my/ boring life,' but really, sometimes just seeing the world from someone else's point of view can be fascinating.

5. Social roles in blog comments

When people leave comments regarding a blog post, they are indicating that they read the blog post and have some feedback to offer the blogger. Since they are more direct and often represent continued interaction, the interactions that bloggers have with one another through comments may be more indicative of the depth of their relationship than other blog ties. Along with tracking the blogroll and citation networks for the three communities, we also examined the comments network of the Kuwait community during a two week period in January 2006. The comments

dataset includes 3943 comments left on 468 blog posts from 89 blogs. The mean number of comments per blog post is 8.425, the median is 6, and the mode is 0.

As we examined the interactions in the comments network, we observed several central hubs receiving the majority of the blog comments in the network and a few of the bloggers in the community posting a disproportionate number of comments. Bloggers with the highest outdegree (the bloggers who left the most comments), however, are not always the most central in terms of indegree (see Figure 5). The most central node in the dataset received 346 comments from 100 different authors, 24 of whom were from the community. This blogger also left 89 comments, but only 12 of those were on other blogs. The blogger with the highest outdegree left comments on 26 other blogs in the community, but only received comments from 8.

Earlier research uncovered several social roles in newsgroup participation [25]. Similarly, we believe that two distinct social roles exist in the Kuwaiti blogosphere: conversation-starters, those who create high-level content, and conversation-supporters, those who contribute to it and keep the conversation going (see Figure 4). Both roles are important. The blogosphere needs the conversation-starters to spread ideas and share news that is of importance to the community. The conversation-supporters offer the community's reactions and their level of participation in a blog post indicates its importance to the community.

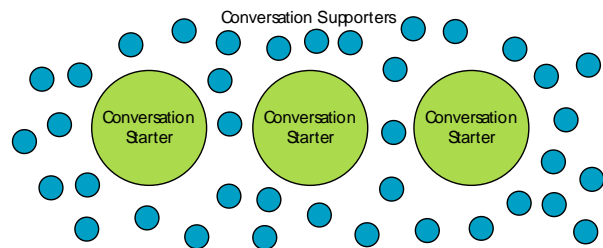


Figure 4. Social roles in the Kuwaiti blogosphere: conversation-starters and conversation-supporters.

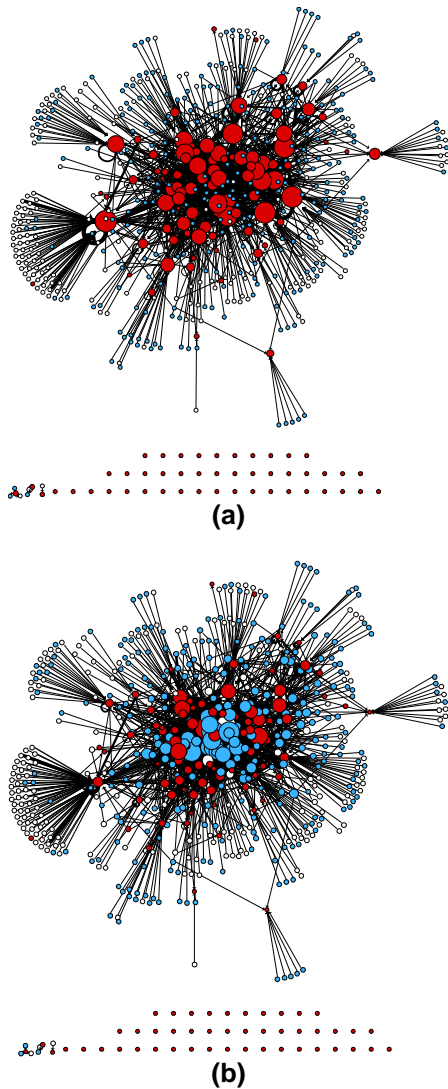


Figure 5. The network of comments in Kuwait blogs. Nodes are sized by (a) how many people commented on their posts (indegree) and (b) how many posts they left comments on (outdegree). The color of the nodes corresponds to their status in the community: Kuwait Blogs are red, other blogs are blue, and anonymous authors or non-bloggers are white.

6. Blogs and decentralized information sharing

Along with analyzing the Kuwait comments network, we also tagged the blog posts in this network during the same two week period. We selected this period since Kuwait’s ruling emir (prince) of nearly thirty years, Sheikh Jaber Al-Ahmed Al-Sabah, passed

away on January 15, 2006 [26]. The Emir’s death was a major political and historical event in the country. Along with being credited as the father of modern Kuwait, the late emir had been symbolized as a father-like figure. Schoolchildren in Kuwait were even taught to refer to him as “Baba Jaber,” baba meaning father in Arabic. For many Kuwaitis and expatriates in their twenties and thirties, Emir Jaber was the only ruler they had ever known. In mourning his loss on their blogs, many still referred to him as Baba Jaber. Similarly, the greatest number of comments in the dataset was left on the day of his death (see Figure 6). Along with shock and grief, the Emir’s death brought about a succession crisis [27]. The crown prince, Sheikh Saad Al-Abdullah Al-Salim Al-Sabah (also referred to as “Baba Saad”), automatically became the Emir but was only in power for ten days due to being extremely ill [27]. There were sharp divisions amongst members of the royal family and the Kuwaiti Parliament about who would rule the country [27].

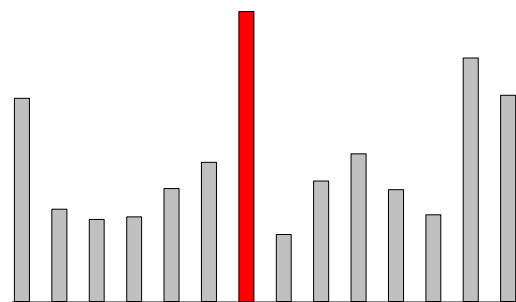


Figure 6. Distribution of total comments based on blog post date. 575 comments were left on January 15, 2006, the day that the Emir of Kuwait passed away.

To understand the impact that the Emir’s death had on the Kuwaiti bloggers, we tagged each blog post left during this period with a one or two-word descriptor. As illustrated in Figure 7, we then visualized these descriptors (known as tags) using a tag cloud, a list that displays tags in differing sizes, where the size of the tag indicates its popularity [28]. The cloud reveals a number of themes prevalent in the blog posts during this time period. Along with their initial grief and shock, Kuwaitis were concerned about who would succeed the late Emir and the stability of the new government. Moreover, certain events that were unlikely to receive mass media coverage were highlighted in depth in the Kuwaiti blogosphere. For instance, following the Emir’s death, a campaign of text messages of a political nature (spreading rumors

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