

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.

Keywords

blogs, social networks, information visualization

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 [23]. Far from being a phenomenon concentrated in the United States, blogs are popular across the globe [1, 2, 17].

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 [14]. Most bloggers write about their everyday lives and generally have a small audience of regular readers [18]. 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 bloggers that share similar interests [13]. 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.

2. Related work

2.1 Computer-mediated communication and relationship formation

An overwhelming number of studies have shown that Internet use can help individuals in developing and sustaining relationships. Kraut et al. found that Internet use had a positive impact on communication and social involvement [15]. Wellman points out that the Internet enables individuals to maintain existing social ties and develop new social ties with others sharing similar interests [25]. He also argues that "the more contact people have online, the greater the impression they make on each other."

McKenna et al. 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 [21].

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. found that many people start blogging at the urging of friends and continue to blog to avoid disappointing their readers [22]. 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.

Most similar to our current study, Marlow[20] conducted a large scale survey of over 35,000 blogs, gathering their demographic information, motivations for blogging, and communication frequency with individuals they linked to. Unlike our present study, Marlow did not identify or compare different communities, but he did extensively employ social network analysis to characterize the linking patterns of hundreds of thousands of blogs.

2.2 Blogs as social networks

Social network analysis is the quantitative study of the relationships between individuals or organizations [24]. 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) [24]. By quantifying social structures, social network analysts can determine the most important nodes in the network [24].

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 [6, 12]. Adamic and Glance 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 [5]. Moreover, Herring et al. 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 [13]. 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 [11, 16, 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. For simplicity, we define membership in a community simply by whether a blog was listed on one of the three sites. The Kuwait and DFW communities were selected because of the contrast in culture they represent. UAE blogs were included so that we could compare the features of the Kuwait community with another small Middle Eastern nation. The sets of blogs were of different sizes, with 65 UAE blogs listed on a central site, compared to 152 for Kuwait, and 365 for Dallas/Fort Worth. These different sizes only loosely correspond to the populations of the geographical areas, which are a bit under 3 million for both UAE and Kuwait, and over 5 million for DFW. We 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.

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 [4]. 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 [5, 6, 13, 16]. 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 [3] and Technorati [8], 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.

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.

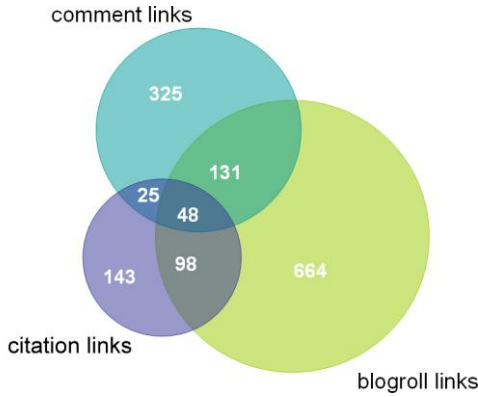


Fig. 1: Venn diagram illustrating the overlap in different types of blog ties (comments, blogrolls, and citations) for Kuwait Blogs

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 (see Table 1). Overall, blogroll links are more numerous than post citations.

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.

	Kuwait	UAE	DFW
citation	2.08	1.37	0.37
blogroll	6.25	2.65	1.79
comment	5.10	N/A	N/A
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

Table 1: Average number of links per blog

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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 3.5. 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 [7]. Table 2 shows a high degree of reciprocity in all three communities, but the level varied by the type of link.

	Kuwait	UAE	DFW
post citations	19%	16%	26%
blogroll links	32%	43%	27%
comments	43%	N/A	N/A

Table 2: Percentage of links that are reciprocated

In all three communities a greater fraction of blogroll links are reciprocated than are post citations, possibly because blogroll links are more numerous in our data set and because bloggers sometimes reciprocate blogroll links merely as a courtesy. Furthermore, reciprocal blogroll links indicate possibly only a mutual awareness, whereas reciprocal post citations imply a greater level of interaction: both blogs actively discussing or linking to one another in their posts rather than one blog simply finding another’s post interesting enough to cite. 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 in that community.

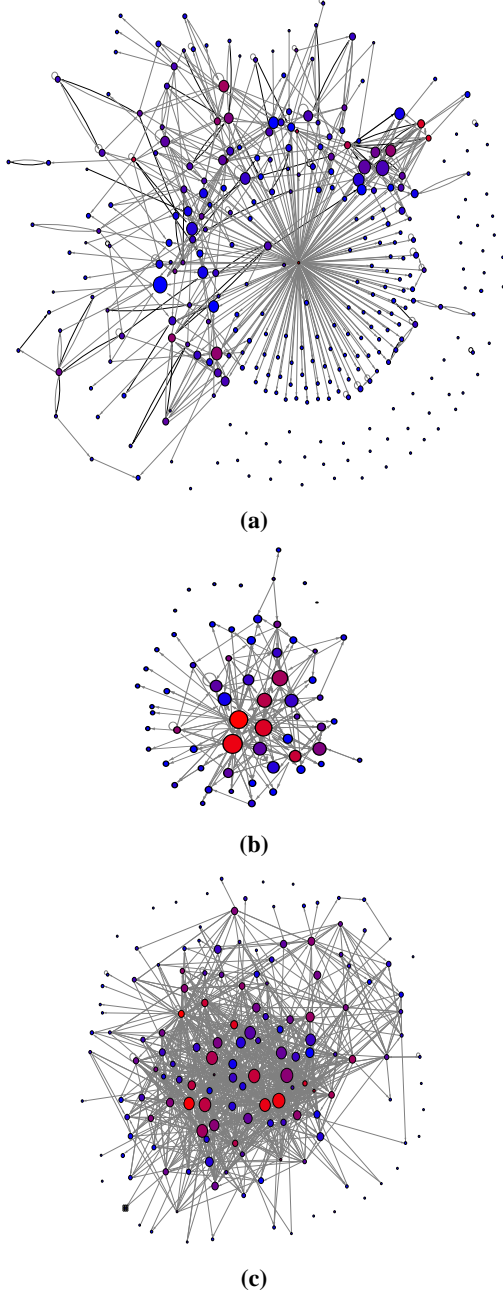


Fig. 2: Within-community blogroll and post citation links for (a) DFW, (b) UAE, and (c) Kuwait. Nodes are colored by outdegree: red – high, blue – low, and sized by their indegree

3.4 Community structure

Often times communities themselves contain subcommunities. Modularity measures how pronounced this subcommunity structure is. We use a fast community finding algorithm [10], that subdivides the nodes into groups in order to maximize the proportion of edges within groups compared to a random subdivision. A modularity of 0 means that there is no natural way to subdivide the network into groups, and a high modularity means that one can easily subdivide the network (maximum modularity is 1). As is shown in Table 3, 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

Table 3: Modularity

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 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, all (dooce.com, michellemalkin.com, powerlineblog.com, captainsquartersblog.com) but the last 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.

	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%	N/A	N/A

Table 4: Porosity of community boundaries

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. The Kuwait

Blogs community emerges as the most cohesive according to most network measures, having the greatest number and most evenly distributed within-community links per blog, having a majority of citations fall within the community, and not showing much subcommunity structure.

4. Online and offline relationships

Having shown that there is substantial community interaction within each group of blogs, we were further interested in how these interactions 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 bloggers listed on their blogroll, and their basic demographic information.

4.1 Survey procedures

The majority of bloggers were contacted regarding the online survey via email: 135 in Kuwait, 56 in the United Arab Emirates, and 288 in the Dallas/Fort Worth area, with a reminder email sent to non-responders after 5 days. Bloggers who did not list their email addresses on their blogs were notified of the survey by leaving one comment on their individual blogs. In addition, the Kuwait Blogs and UAE Blogs communities encouraged participation by blogging about the survey.

4.2 Survey participants

The survey was completed by 85 bloggers from the Kuwait community, 38 bloggers from the UAE, and 67 bloggers in DFW, yielding survey response rates of 63%, 68%, and 23% for each community respectively. The demographics of the communities leaned toward the young and highly educated. 68%, 66%, and 85% of the bloggers in DFW, Kuwait, and UAE, respectively, held undergraduate degrees or higher. Kuwait had a slightly lower number of masters and advanced degrees due to their younger demographic: 45% of respondents were in the 18-24 age group, compared to 21% in UAE and just 8% in DFW. Interestingly, the residence and citizenship of each community varied in their uniformity. 98% of Dallas/Ft. Worth bloggers were living in the United States, 95% were US citizens, and 74% identified themselves as either white or Caucasian. In contrast, only 73% of the Kuwait bloggers resided in Kuwait, with a full 22% being Kuwaiti citizens but residing in the United States at least part time. Finally, 82% of UAE bloggers resided in the United Arab Emirates, but fully 84% of them were non-nationals. This is even in excess of the overall UAE demographics where 73% of adults are non-nationals [9]. Based on the survey results, the three communities are alike in some regards, namely their high level of education, but different in how diverse their nationalities and geographical locations are within the communities.

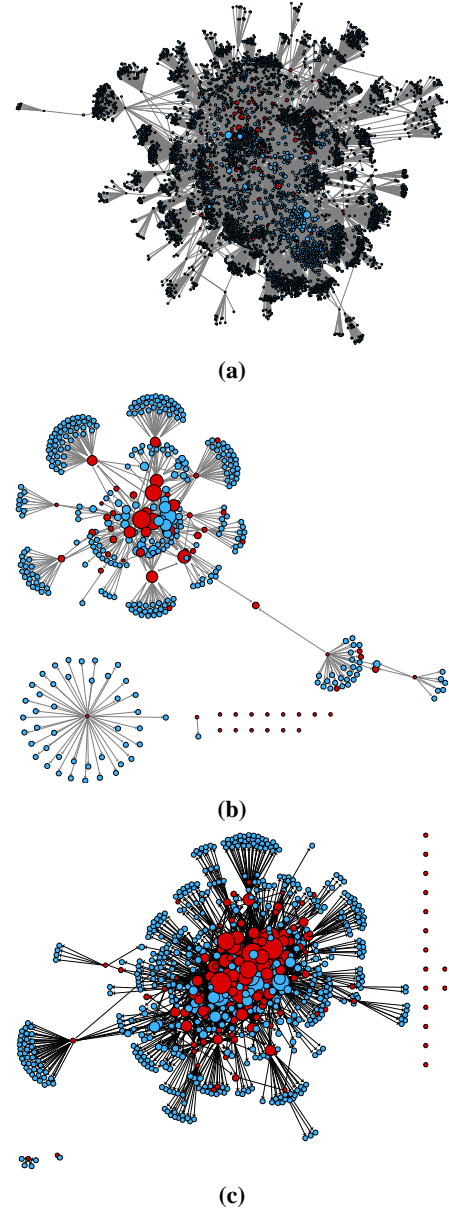


Fig. 3: Blogroll and citation links for (a) DFW, (b) UAE, (c) Kuwait. Nodes are colored red if they are in the community and are sized by indegree

4.3 Motivation behind blogging

The first survey question regarding blogging behavior asked why the respondent had started to blog, with the respondent being able to select all applicable reasons. One reason 'finding new friends' corresponds to bloggers' desire to expand their social networks, and another 'sharing news with friends and family' corresponds to a desire to enrich and maintain existing offline relationships. Unsurprisingly, the most popular choice across communities actually had to do with neither – it was the simple desire to express oneself through blogging.

Figure 4 shows several interesting and significant differences; 26% of Kuwait bloggers were motivated by finding

new friends, while 12% of UAE and only 3% of DFW bloggers listed this as a reason ($p < 0.001$, Fisher's exact test). Interestingly enough, a respondent who did not select finding new friends as a motivation for blogging later on in the survey reported having met her spouse through blogging. This would seem to indicate that new relationships develop even when people do not set out to create them. While DFW bloggers may have been less motivated to find new friends, they were twice as likely to be interested in maintaining existing relationships with friends and family through blogging (46%), than either the Kuwait (26%) or UAE bloggers (23%) ($p < 0.05$). One blogger from Dallas/Fort Worth shared her enthusiasm for keeping in touch through blogs:

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.

Even though many bloggers started blogging to express themselves, they have certainly become aware of blogs' social nature, as we will see in the next section.

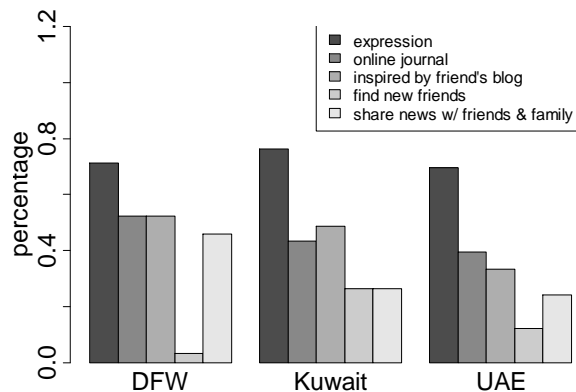


Fig. 4: Main motivations for blogging

4.4 Intersection of blogging and offline relationships

Since at least some of the bloggers are motivated by a desire to share news with friends and family, we were also interested in quantifying the intersection of bloggers' blogging and offline lives. We did so by focusing on the interactive medium of comments, which were enabled by nearly all bloggers, and by asking about the relative proportion of comments the bloggers receive from people they know offline. Across communities, 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.

4.5 Using blogs to sustain real-life relationships with non-bloggers

As small as the overlap is between commenting interaction and offline interaction, it is even smaller if the offline relationship is with a non blogger. 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 help individuals maintain their real life relationships to non-bloggers. 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, many blog anonymously by using a pseudonym, and so are potentially able to keep their real-world and blogging interactions separate. This also correlates with our earlier mentioned finding that UAE and Kuwait bloggers were less interested in blogging to share news with friends and family.

4.6 Using blogs to maintain and form relationships

Along with blogging's role in maintaining existing offline relationships, we were interested in its ability to facilitate new relationship formation. When asked how many of the bloggers on their blogrolls they had met in person, bloggers in Kuwait and DFW cited a median of 5 others, while bloggers in the UAE cited a median of 2. Here we use the median or the middle value rather than the mean because the distribution is highly skewed. Bloggers in all three communities had most often reported meeting just 1 or 2 others in person, while some responded that they had met dozens. 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 a median of 5 bloggers in Kuwait, 10 in UAE and 12 bloggers in DFW), but less likely to communicate through the telephone or instant messaging (for telephone conversations, citing a median of 3 bloggers in DFW and 2 bloggers in Kuwait and UAE; for instant messaging, citing a median of 6 bloggers in Kuwait, 2.5 bloggers in UAE, and 2 bloggers in DFW).

Finally, we wanted to know not just whether a blogging relationship coincided with other forms of communication, but whether blogging was the cause for the relationship to form in the first place. 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 bloggers listed a median of 5, the UAE bloggers listed a median of 4 other bloggers (approximately 20% of their blogroll), while the DFW bloggers listed a median of just 3 other bloggers, although two DFW bloggers mentioned having met upwards of 100 people through blogging.

Along with the quantitative evidence, there is qualitative support 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.

The above questionnaire revealed that blogging relationships tend to predominantly form online with few of them being existing offline ties. At the same time they tend to stay online, usually at most extending to email communication. However, some new offline relationships did form – showing that online community formation can translate to real world connections.

5. Conclusion and future work

In this paper we examined three blog communities in different geographical locations, both by analyzing the network structure of their blogrolls, citations, and comments, and by surveying the bloggers directly. In all three communities, there is strong evidence that blogs do enable relationship formation, with some of those new relationships later extending to other communication media and offline meetings. On the other hand, blogs do not play a large role in helping bloggers sustain their real life relationships; nonetheless, this finding may be due to blogging's relatively young age. In general, all three communities show high degrees of reciprocity and cohesion. But we find that bloggers in DFW tend to more heavily link to A-list blogs outside their community, while Kuwait and UAE bloggers link more inwardly. In future work, we would like to compare the strength of the tie specified by the survey respondents (friend, acquaintance, etc), with the frequency and type of blog interaction.

Acknowledgments

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