Local News Chatter: Augmenting Community News by Aggregating Hyperlocal Microblog Content in a Tag Cloud

Kyungsik Han[a], Patrick C. Shih[a] & John M. Carroll[a]

[a] College of Information Sciences and Technology, Pennsylvania State University, University Park, Pennsylvania, USA

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Being aware of local community information is critical to maintaining civic engagement and participation. The use of online news and microblog content to create and disseminate community information has long been studied. However, interactions in the online spaces dedicated to local communities tend to only garner very limited usage, and people often do not consider microblog content as a meaningful source of local community information. Local News Chatter (LNC) was designed to address these challenges by augmenting local news feeds with microblog content and presenting them in a tag cloud that displays news topics of varying popularity with different tag sizes. Our study with 30 local residents highlights that LNC increases the visibility of hyperlocal community news information and successfully utilizes microblog as an additional information layer. LNC also increases one's community awareness and shows the potential for leveraging community knowledge as a deliberation platform for local topics.

1. INTRODUCTION

Accessing local newspapers and media has been regarded as an indicator of community awareness and engagement and of the vitality of community because they define and reflect the perspectives of community members and their activities (Putnam, 2000; Shah, Mcleod, & Yoon, 2001). For a long time, local residents have utilized them as the primary sources of everyday local community news, events, or activities (Tezon, 2003). More recently, local community news and events are made accessible in an online environment through digital platforms such as computers and portable devices (Kohut, Doherty, Dimock, & Keeter, 2012).

Local residents are also interacting with community news through various methods. For example, sometimes they have a face-to-face conversation with others (e.g., local family members, friends, coworkers, or strangers) about the local news topics. Sometimes they use the Internet to e-mail local news information to themselves or others, or read comments and add their own to local news articles or discussion forums. More

recently, social media and microblogs (e.g., Twitter, Facebook, Tumblr, etc.) have been playing a significant role in creating and disseminating local community news content for local residents and communities—they have gained a large amount of attention, because they provide an additional channel for people to interact with local news information (Bollen, Pepe, & Mao, 2009; Kwak, Lee, Park, & Moon, 2010; Lerman & Ghosh, 2010).

Essentially, the *consumption* and *interaction* with local news are two main elements of how people consume local news information. In particular, Web 2.0 technologies are capable of integrating these two elements closely as we can observe a number of local news media, organizations, and groups now take advantage of websites to provide local information as well as allowing people to contribute their own inputs (Carroll et al., 2011; Paulussen & Ugille, 2008). This integration of consuming and interacting with local news information creates an interactive and dynamic environment for local residents with respect to creating and disseminating local news information within a community (Mason & Rennie, 2007).

Theoretically, this perspective leads to fulfilling the notion of *hyperlocality*, which refers to providing geographically bounded information and interaction that are most relevant to local community members (Farhi, 1991; Hu, Farnham, & Hernandez, 2013). However, there exist challenges from the practical and empirical perspectives. When we examined local news websites more closely, the activities of consuming and interacting with local news seemed artificially separated. A number of local residents use online sources to consume local news (Miller, Purcell, & Rosenstiel, 2012), but these local online news spaces tend to garner only very limited usage. For example, there tends to be only few comments and resulting conversations (frequently not at all) on the local news articles that cover even the most popular news topics. This in part because of the fact that local information is accessed primarily, or perhaps exclusively, by local people who are already connected to those sources. The separation and failure of realizing a critical mass of users in a local discussion space create a barrier of participation and discourage local residents from engaging in online conversations about local news topics.

Our design approach leverages microblogs as a source of local community information because a lot of people use microblogs everyday as a way of expressing their own thoughts, feelings, and experiences, and many research studies have demonstrated the effective communication method of microblogging (Ehrlich & Shami, 2010; Forte, Melissa, & Park, 2012; Kwak et al., 2010). However, microblogs have also received a lot of criticisms regarding the usefulness of their content. For example, Andre, Bernstein, and Luther (2012) investigated various types of users' reactions to microblog content and found that people tend to consider the majority of microblog content as noise or junk (only 36% were reported as being *worth reading*) because they do not believe the content is informative or relevant to themselves. To effectively utilize microblog content, we need to address more nuanced questions such as if/why/how the content reflects local community news, events, and activities, and if the content is informative and worth reading. With the right filter, tweets have the potential of representing voices of the community members scattered throughout the cyberspace.

In this article, we introduce the Local News Chatter (LNC) application that has been designed to address the aforementioned challenges with the following design goals.

- Making various (including less popular) hyperlocal community information more visible.
- Making microblog content a meaningful and useful form of hyperlocal community information.
- Increasing civic awareness and participation as well as facilitating deliberation of community issues.

Based on these intentions, we sought to empirically understand user experience and explore design implications by conducting a user study with 30 local residents.

2. RELATED WORK

2.1. Community Research Efforts

Investigating how technologies contribute to the strengthening of community identity, enhancement of residents' awareness, and promotion of participation in activities in the community environment has become an essential element of the research of community networks. Such examples include understanding the contribution of Internet connectivity in public spaces with respect to social interaction and participation (Hampton, Livio, & Goulet, 2010) and investigating the benefits of ubiquitous computing in community infrastructures, service supports, education, culture, and recreation (Carroll & Rosson, 2008).

Along with these theoretical insights, much research has been done on the development of systems that harness the benefits of supplementing community activities with technologies. One of the main goals of community-oriented system development is to make community information more visible to community members, which also leads them to be more aware of their community and promote participation. For example, *CiVicinity* is a web-based feed aggregation tool that presents a diverse picture of the news, activities, and events of a local community from local organizations, government bodies, blogs, and media outlets (Hoffman, Robinson, Han, & Carroll, 2012). *What's happening* is a community awareness tool that is designed to easily convey community information and interact with other members with minimal efforts by integrating simple interfaces such as a communication bar and a screen saver (Q. A. Zhao & Stasko, 2002). *AwareNews* is the application that employs the notion of context awareness to present organizational community news information and to promote knowledge sharing among people (Decurtins, Norrie, Reuss, & Weibel, 2008). *Viewpoint* is a simple yet effective polling tool to increase civic awareness of and participation in local issues of different stakeholders by allowing local citizens to vote. (Taylor et al., 2012). *Discussion in Space* is a feedback platform utilizing large screens to advertise community relevant questions and issues to the public and encouraging people to add their thoughts about them via their mobile devices (Schroeter, 2012). In summary, our work is aligned with the goal of these research projects but furthermore employs a socio-technical approach to understand how our civic application will make people more aware of their community information and encourage them to partake in local community issues and articulate any technical, social, or societal implications and issues (Hochheiser & Lazar, 2007).

2.2. Microblog and Community

Microblogging has gained much attention as an additional communication method. It creates new affordances for disseminating diverse types of information, ranging from presidential elections (Tumasjan, Sprenger, Sandner, & Welpe, 2010) to major incidents or disasters (Vieweg, Hughes, Starbird, & Palen, 2010; Yardi & boyd, 2010), as well as contributing to forming and maintaining social interactions and personal networks (Gruzd, Wellman, & Takhteyev, 2011). However, most of these studies focus on a large scale of national events, and we found significantly less attention has been given to everyday community news or smaller events.

There have been a number of research efforts on designing a tool by utilizing tweets to deliver community-related information in distinctive ways. For example, *Twitterspace* presents tweets created on large screens in a physical community center of the university to deliver events and member activities to a broad audience (Ryan, Hazlewood, & Makice, 2008). *Whoo.ly* is a web-based service that filters meaningful content from tweets, such as various types of community-relevant information, including recent tweets, active events, top topics, popular places, and active local people (Hu et al., 2013). Similar to these tools, LNC leverages tweets for providing community information. However, one outstanding distinction between these tools and LNC is that LNC has been designed to link local tweets to the keyword tags extracted from local news articles, which contain local community news and events, whereas both Twitterspace and Whoo.ly present local community information

exclusively from tweets. Thus far, little has focused on detailing users' motivations and expectations of obtaining local community information and exploring users' empirical perceptions and attitudes to microblog content with respect to consuming community information.

3. OVERVIEW OF LOCAL NEWS CHATTER

Figure 1 represents an overview of the LNC, an application that aggregates local news articles and tweets and presents the integrated information in a tag cloud. Regarding the local news sites, our assumption is twofold. First, local news sites are the most active community news providers when compared to those from other organizations and national news media. Second, if several local news media cover the same news topic, or if multiple news articles about the same topic are published, that topic can be considered to be a trendy local topic and is more visible across different local news sources. With this rationale, LNC collects RSS news article feeds from five local news sites and stores them in a database on our server on an hourly basis. Although it is possible that globally interesting news can appear on local news websites, the information processed and displayed in LNC is mostly related to the local community. The community described in this article is a college town of about 45,000 students and 45,000 local residents living in neighborhoods that span approximately 10 square miles, embedded in a rural and agricultural region. In this community, there are five online local news sites, and we leverage the specific URL (ending with ". . . /local") that provides only locally relevant news content (no news articles at the national/international level). Thus, LNC is able to retrieve locally relevant news articles directly. We also verified that only local news were provided and displayed in the LNC application during the study. Each news item contains a set of metadata, including a title, description, source URL, and created date and time.

After a typical preprocessing step in Natural Language Process (such as stop word removal), word tags are extracted from news titles and descriptions, and their Term Frequency-Inverse Document Frequency (TF-IDF) scores are calculated. The TF-IDF score is a standard metric in Information Retrieval to measure the "importance" of a tag. The TF-IDF value of a tag w in an article a is positively correlated with the frequency of w within a but is negatively correlated with the frequency of w in the entire article collection (Salton & Buckley, 1988). We have designed the system to handle tags up to three words (tri-gram).

At the end, top-k tags with the highest TF-IDF scores are used as a parameter, along with a geo-coordinate and a radius (we used 3 miles because it is enough for covering this community), and submitted to a Twitter search API. Twitter returns a set of tweets that are pertinent to the provided tag and location, and the results are stored in the local server database. Because all reactions to the topics are retrieved from Twitter, users of LNC do not need to formally declare membership or interests before they can engage in a discussion on any given local topics.

The news article collection cycle occurs on an hourly basis. Because the data from local news media and tweets are already connected by the "tags," we are able to present this information together in an integrated fashion using a tag cloud. As depicted in Figure 2, the first page of the application shows a tag cloud (Figure 2, left). We employed a tag cloud in LNC because it supports searching, browsing, and capturing main topics of information in a coherent view (Rivadeneira, Gruen, Muller, & Millen, 2007). Each tag in the tag cloud corresponds to a word tag identified by the aforementioned Natural Language Process algorithm, and the size of the tag in the tag cloud represents the frequency of articles mentioning the tag. Because each news article contains the creation timestamp information, tag cloud can also be regenerated by different time variances in any given day, week, or month period.

The current LNC implementation has been designed to display a tag cloud generated from local news feeds. By default, the tag cloud includes local news articles published within the last 48 hr, but this can be changed to cover other time frames, such as a day or a week, depending on user preference. The tag cloud displays four different tag sizes. A tag is larger if it has been mentioned by several local news articles from different local news sources, which could be considered as more popular local news articles, whereas a smaller tag means that fewer, mostly only one, news article(s) published (exclusively) from one local news source, which could be considered as less popular local news articles. With LNC, we hope to allow local residents to be exposed to more diverse local community news because they might have different motivations and expectations when reading or searching online local news articles.

When one of the tags is clicked, the corresponding news article(s) and the tweets by local residents will be shown (Figure 2, middle). The news article is displayed at the top of the page, and tweets are displayed below the article. Because there can be multiple articles that mention the same tag w, one design issue is to decide which article should be displayed when w is clicked (e.g., oldest vs. latest article). By default, we show the news
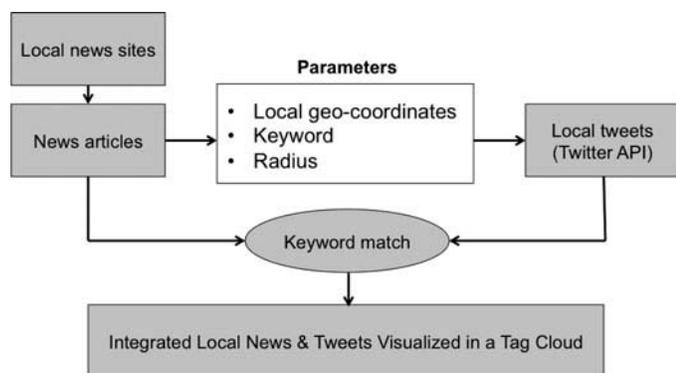

FIG. 1. Overview of the Local News Chatter application. *Note.* Local News Chatter aggregates locally relevant news articles and tweets and presents them in an integrated fashion.
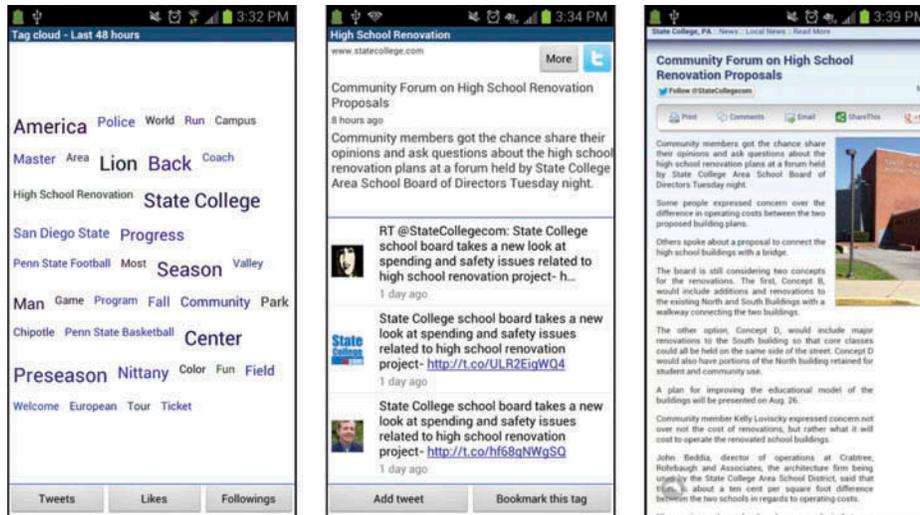
FIG. 2.   Screenshots of Local News Chatter. *Note.* Tag cloud presented with different tag sizes (left), combined view of news items and tweets (middle), and corresponding local news article (right).

article that has the highest TF-IDF score for the selected tag, and the user can horizontally scroll through the news articles associated with the same tag in order of descending TF-IDF scores. Users can also read the full story of a news article by accessing the web page of it (Figure 2, right).

In summary, our design approach shows a unique way to represent and deliver hyperlocal community information. LNC utilizes only news content that is relevant to a local community and strives to combine local news articles and tweets based on the tags to present richer and more dynamic local community information to local residents.

4. USER STUDY

Our main focus was to evaluate LNC through the lens of participants' expectations from browsing local news information by choosing a tag from a tag cloud and their perceptions and attitudes toward the corresponding news articles and tweets. We also aimed at exploring design implications and other potential research questions that would guide future design and research directions.

4.1. Procedure

We recruited 30 local residents via mailing list, university research website, and word of mouth. Each participant was asked to schedule a 1-hr appointment to complete the survey study in our research lab. Before using LNC, participants answered 5-point Likert scale questions from 1 (*never*) to 5 (*every day*) about their current practices of online local news consumption. The participants were then provided with a mobile device installed with LNC. A researcher provided a short tutorial of the functions and the interface of LNC and answered any questions that the participants had. As the last step of the tutorial, the participants were asked to click on two

different preset tags and read corresponding local news content so that they could get a sense of the type of information that LNC provides before the actual study.

For the purpose of control, all participants accessed the same tag cloud during the study. The tag cloud contained 50 different tags with 25 smaller and 25 larger tags. After completing the tutorial, participants were asked to follow study instructions displayed on a lab computer screen and answered survey questions at the three stages throughout the study.

Figure 3 shows the procedure of the user study, which consists of three stages. First stage was to investigate how participants utilized the tag cloud to consume local news. After the participants had chosen the tag, but prior to clicking on it (so that they did not know what would be shown), they were asked to answer the following set of questions: (a) why they picked that tag (*motivation*), and (b) what they expected to see from the news articles and tweets (*expectation*). Then they were asked to click the tag and read the associated local news articles and the tweets.

The second stage was to evaluate the microblog content from the participants' experiences. After they read all the associated local news articles and the tweets, the participants answered the following set of questions: (c) whether the contents of the tweets were relevant to the associated local news topics (*relevance*), (d) whether they learned something useful from news articles or tweets (*learning experience*), (e) whether they had shared interests or opinions from tweets (*shared interests or opinions*), and (f) whether they were willing to provide own inputs to LNC (*tweeting or retweeting*). The first and the second stages were repeated five times for a total of five tags.

The last stage was pertinent to understanding the overall outcomes of LNC use. After having read the associated local news articles and tweets and answering the survey questions for all five tags, we asked the participant to answer general
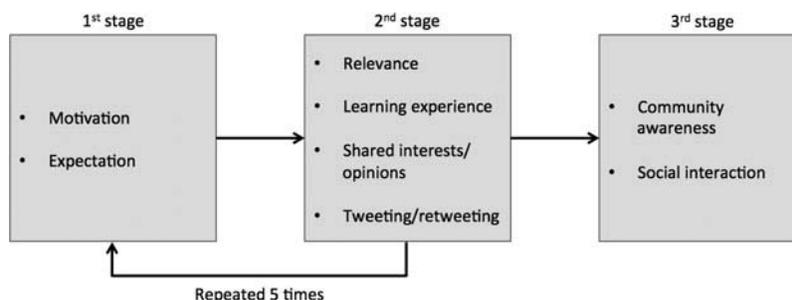
FIG. 3. The procedure of the user study with three stages. *Note.* We aimed at investigating different perspectives in each stage.

questions about their experiences, including (g) whether LNC would contribute to their awareness of a local community news, events, or activities (*community awareness*) and (h) whether they would be interested in having more interactions with others who have similar interests if they use LNC on a daily basis (*social interaction*).

All survey responses were inductively coded by the first author, and then discussed in groups including all authors to iteratively generate and refine the codes until a sense of closure was reached. No data were discarded or refined.

4.2. Participants

All 30 participants mentioned that they were generally interested in local community news information. Sixteen of them were in their 20s, 11 of them were in their 30s, and three of them were in 40s or 50s. Some participants also indicated that their current practices involve using both online local news sites as well as social media, such as Twitter or Facebook, to receive local community news information.

5. RESULTS

We describe the study results in three subsections with respect to the usability and feasibility of LNC as well as potential opportunities and benefits of LNC when used by local citizens: (a) understanding participants' motivations and expectations of choosing a tag with different popularity and accessing local community news content using a tag cloud, (b) articulating their interpretations and evaluations of the tweets that were associated with the corresponding local news articles, and (c) exploring their motivations of creating and sharing local community information with others.

5.1. Making Less Popular Local Issues More Visible

One of the challenges in accessing local community online information is that most digital news websites are not well designed for providing diverse types of local community information. Similar to what is shown in other national media websites (e.g., cnn.com, nytimes.com), most local community websites provide headlines or popular news articles within the

community on the front page. This could undermine the chance of discovering relatively less popular news articles, unless the readers intentionally search for them. Especially in the context of a local community, less popular news articles should not be overlooked because they may pertain to news or events that are relevant to some local citizens or smaller special interest groups in the community. Local community citizens may also be more interested in learning and discovering interesting local news rather than reading stories that are already widely covered by many other mass news media.

One of the initial goals in designing LNC was to provide diverse community information. By providing different sizes of locally relevant tags in a tag cloud, LNC provides the opportunity for readers to determine how best to access the local news articles. Participants liked the idea of presenting community news in that interface because it grabbed their attention quickly, for example, "It helped me become more aware by graphically showing me what is happening, even if I just open the app and glance at the homepage of it" (P6) and "I think it helped keep me much better informed about local news, particularly about current "hot topics" in the area" (P19). They also indicated that they felt presenting local community information in a tag cloud helped them stay in the know about what is going on and reported that LNC increased their local community awareness of local news, events, or activities by making it easy to get all the recent local information in one place. Some participants mentioned "It allowed me to easily stay up to date on a lot of information about the local community" (P15), and "Pointed me to news stories or insights about the local area which I might not know (and therefore be interested in) otherwise" (P22).

Furthermore, we explored possible motivations and expectations for picking a tag and how that would pertain to consuming local community news information. We first coded the participants' responses to the questions about their motivations and expectations and identified one core element, *awareness*, which refers to the fact that being aware of a tag involves having heard of or been previously exposed to the local topic referred to by the tag on a general level. We then investigated the relationship between one's awareness of the topics and tag size.

TABLE 1
The Relationship Between Awareness and Tag Size

Awareness	Tag Size (Count)		
	Smaller (25)	Larger (25)	Total
I was aware of any local topic referred to by the tag	18	39	57
I was *not* aware of any local topic referred to by the tag	67	26	93
Total	85	65	150

Table 1 summarizes participants' responses regarding awareness and the number of selections by tag size. A chi-square test shows a significant difference between awareness of local topics and tag size, $\chi^2(1, N = 150) = 23.9$, $p < .001$, indicating that participants tended to pick the smaller tags if they were not aware of the local topics (72.0%), whereas they were more likely to pick the larger tags if they already knew about the local topic from the tag (68.4%). Some of their responses gave us more detailed explanation of their motivations and expectations in using the tag cloud. On one hand, because larger tags represent popular local news information, by picking them, participants wanted to obtain updated news or read tweets from other people, or local groups or organizations in order to broaden their knowledge toward the corresponding local topics. "I knew this tag would show continuing sanctions and lawsuits and wanted to see people's reactions and local perspectives about this topic from tweets" (P22). On the other hand, participants tended to pick smaller tags because they were less aware of a tag itself or the local news associated with the tag. They wanted to know what the tag meant and what kind of the locally relevant news articles and tweets would be shown. "It was a small tag that I was not aware of, so I wanted to see how it would look" (P2) and "It is a small tag. I have a daughter in college and I thought this would probably tell me tuition rates and what increases were happening all over" (P25).

In summary, these results seemed to verify one of our design motivations of LNC. Although the existing news aggregators only display the most mentioned news topics across news sources by design, by providing both popular local news topics (larger tags) less visible news topics (smaller tags) together in a tag cloud, we are able to present more diverse local community news information and supports users' different motivations and expectations of local news consumption.

5.2. Making Hyperlocal Microblog Content More Meaningful

The content from the tweets tends to have some degree of variations, which has been already identified by prior research. As mentioned previously, Andre et al. (2012) found that users
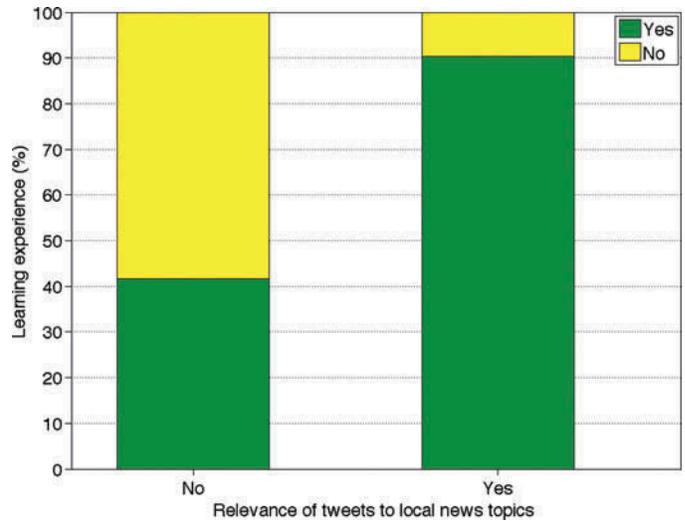

FIG. 4. The relationship between relevance of tweets to local news topics and learning experience from tweets.

believed only 36% of tweets were worth reading and did not want to read others' conversations, mood, activities, and presence maintenance mainly because most of them were boring. Rather, users seem to like the tweets that are informative and have fun or happy sentiments. In this study, we seek to empirically understand and evaluate how participants perceived the tweets from LNC, leading us to articulating system design that could enhance their experiences.

Overall, participants answered that the tweets from 79% (118 of 150) tags are well associated with the local news topics, showing the high relevance of the tweets. Next we analyzed participants' evaluation on tweets in terms of learning experience and shared interests or opinions.

Learning Experience. Participants mentioned that they learned something useful about their local community from the tweets in 74% (112 of 150) of the tags that they had selected. As illustrated in Figure 4, participants learned more useful information when the tweets were relevant to local news topics, $\chi^2(1, N = 150) = 34.25$, $p < .001$. Based on the participants comments, we identified the two main reasons for that finding, including the cases in which the content of the tweets (a) had additional information that news articles did not contain or (b) referred to people's opinions or thoughts (both positive or negative) toward the news articles or the tag. The followings are the participants' comments for each reason.

a. "I learned about recent safety and crime events in this area as well as some from the surrounding communities. None of these events I was previously aware of, so I appreciated being educated on this platform" (P22; Figure 5, left)

b. "I could see people's interests and eager for support the apartment residents. People retweeted the way how to donate, the motivation of fire, and so forth" (P29; Figure 5, right)
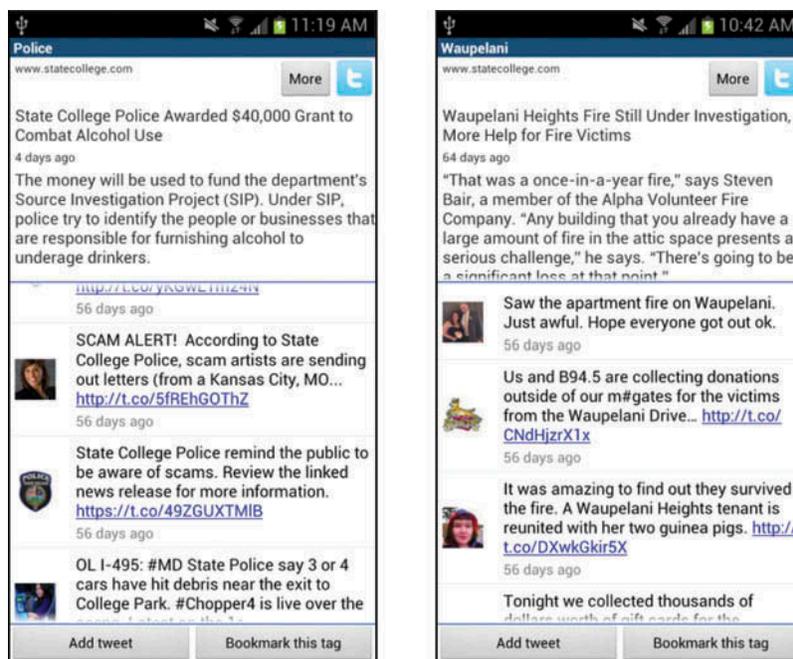
FIG. 5. News articles and tweets displayed in Local News Chatter presented during the user study. *Note.* The left screenshot shows the news about police investigation and the right screenshot depicts the fire incident.

Both reasons point to extending and enhancing participants' knowledge or perspectives of local news information or local sentiment. These results are consistent with some of the motivations of consuming online news comments presented in Andre et al. (2012), indicating that participants found the tweets presented in LNC meaningful and relevant. Such examples with the corresponding reason are illustrated in Figure 5. The left screenshot shows the news about police investigation, and the right screenshot depicts the fire incident both from formal news articles and user tweets.

It is worth noting that sometimes the news articles and tweets did not match up quite well, mainly because those two sources are connected through the tag, not necessarily by content. This might raise a question about the inconsistency of local news articles and tweets, which could lead to undermining user experience or expectation. However, we found that, even if the tweets did not match the local news articles very well, some participants still seemed to consider them to be useful and informative as additional local community information, because those tweets were obtained based on the locally relevant tags. Figure 4 also supports this perspective, as we found that some participants still considered some tweets to be informative even if they were not well relevant to the associated local news topics (i.e., they answered they learned something useful from 41.6% of tweets that were not relevant to local news topics), which resonates well with some of their comments: "These tweets were more helpful to me than the news articles were. If the tag were not cars but rather wrecks, they would still have been about as informative on the subject, but I am still relatively pleased to see

that the twitter aspect of the program could cast a light on the subjects that I was hoping to see" (P7) and "A lot of interesting studies at Penn State were highlighted not from the articles but from the tweets" (P30).

Similarly, according to some participants, another positive reaction toward the tweets is that the tweets sometimes contained more meaningful or informative content than the news articles. This aspect in part supports one of our design motivations of utilizing tweets into local community news context with respect to providing additional locally relevant information that may not be easily accessed (or not available at all) through online local news sites. For example, some participants indicated, "These [tweets] were what I had hoped to learn on the entering the thread. I feel that sometimes Twitter was a better medium than the local news" (P12) and "I found the tweets to have a lot more useful information than I thought, more interesting to read them than the news articles" (P25). An additional interesting finding here is that the design rationale of LNC seemed to positively influence some participants' perception toward Twitter itself or its content, indicating that tweets could be utilized as a great resource if managed appropriately. "I have tried to avoid Twitter like the plague, but I think I would start appreciating it more, particularly truly 'newsworthy' tweets. The tweets are good ways to learn key words and ideas circulating in local news" (P19).

However, we found that not all tweets were perceived as informative local content. Some participants complained that some of the tweets (a) contained similar or just the same information that the news articles provided and (b) lacked people's

expressions or opinions, which both did not seem to impact participants' sense of learning from the tweets. For example,

a. "They pretty much just summed up what was in the news article. I didn't learn anything from this" (P24)
b. "Most of the tweets were just providing links to news articles about the issue. Very little opinion on the issue. I already learned from the articles everything that I wanted. Nothing new from the tweets" (P8)

Shared Interests or Opinions. Participants answered that they found shared interests or opinions from the tweets from almost half of the tags (51%; 76 of 150). Considering the example of the recent fire incident depicted in Figure 5 (right), one reason of having shared interests or opinions seem to be extended from learning experience if the content of the tweets is reasonably aligned with one's personal interests or opinions. "Definitely, I was very interested in how to help and what I can do to help them" (P29; Figure 5, right). The other reason is the sharing of personal experiences with some local events that they attended or participated. It seems that participants felt great about reading the similar excitement, effort, or motivation from the tweets. "Yes, I enjoyed the festival tremendously. It's good to realize that almost everyone feels the same way" (P18; Figure 5, right).

Conversely, we found that the reasons for not identifying with the tweets included (a) misalignment with one's own interests or opinions, (b) a lack of interests or personal indifference to the topic, and (c) unrelated or less informative content. This result implies that learning experience does not seem to necessarily affect one's shared interests or opinions (and statistically, there was no significant difference) because the former refers to extending one's knowledge or perspective, whereas the latter is more pertinent to individual preferences or situations. Next are participants' comments that support each reason.

a. "I did not have shared opinions because they were all bashing our school on twitter" (P3)
b. "I do not care one bit about football, so I did not have shared interests with those who tweeted" (P19)
c. "I did not share opinions because these tweets were mostly unbiased and objective reports of news stories" (P22; Figure 5, left)

Overall, the analysis based on these two perspectives (i.e., learning experience and shared interests or opinions) shows that participants perceived the tweets presented in LNC were quite informative and useful with respect to accessing and consuming local community information. Simply presenting the tweets themselves without connecting them to local topics could possibly make tweets noisy streams or spam. Our method, which is to anchor tweets to the tag extracted from local community news articles, leads not only to complementing formal local news sources but also to making tweets more meaningful and informative content to local people.

We argue that another salient benefit of LNC is that it utilizes users' existing Twitter practices instead of requiring them to adopt a new technology platform completely. LNC users are able to access community discourse for current local news, events, or activities without much effort, because it utilizes the content that already exists in local news media and Twitter.

5.3. Leveraging Local Knowledge for Community Discourse

Much research has reported that the motivations for tweeting or retweeting on traditional social media are highly individual oriented such as broadcasting personal updates or some random thoughts, maintaining informal communications or conversations, or sharing information to their followers or one-time visitors (boyd, Golder, & Lotan, 2009; D. Zhao & Rosson, 2009). One outstanding difference between LNC and Twitter (and other third-party Twitter-based applications) is that LNC connects local people through hyperlocal news topics that are relevant to the local community.

Increasing social interactions and connections among local residents is one of our main design rationales; thus, our intention here is to understand the motivations of creating or sharing community information as well as exploring the reasons why participants were reluctant to engage in those activities. Although we did not ask participants to provide their own tweets or retweets during the study we asked them whether they would be willing to retweet existing posts or tweet new posts if they use LNC on a daily basis. Participants answered that the tweet content from 38% of the tags (57 of 150) would impact their willingness to take actions on tweeting or retweeting.

As shown in Figure 6, the chi-square test showed that LNC users tended to tweet or retweet more when they were interested in the local news associated with the tag, $\chi^2(1, N = 150)$
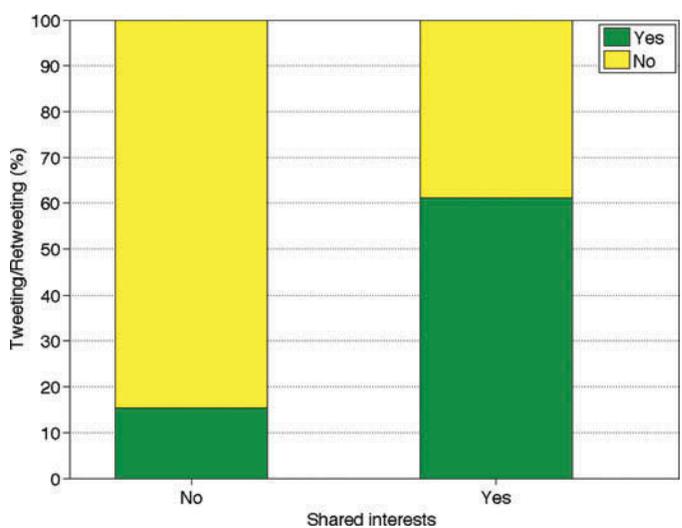

FIG. 6. The relationship between having shared interests from tweets and tweeting/retweeting.

$= 35.01$, $p < .001$. Although surprisingly, participants shared more details on their motivation to add to the already abundant tweets on the topics of interest. In terms of the creation of new tweets, there were two reasons. On one hand, some participants wanted to add additional and nonrepetitive meaningful information or personal opinions that had not been provided by the existing tweets. For example, "I felt I needed to tweet something to share a different side on the basketball program and how it will take hard work and smart calls next year and how even once and a while the top dog can be beaten by a rising team" (P6) and "I am interested in how people are still feeling. I was surprised that people aren't stating too much about Penn State paying all the money and how it may affect the university financially. So I would add a tweet" (P18). Apparently, those participants did not have any shared interests from the tweets but mentioned they would like to add a new one to express their personal thoughts or opinions expecting that other users might see it.

On the other hand, some participants indicated that they wanted to join existing discussions or conversations that matched their interests or were willing to start a discussion as well. Examples include "I would be more willing to participate if someone that attended the event initiated some discussion" (P15), and "I think that if I would have tweeted about the money, it would have opened up a lot more chatter" (P18). Similarly, regarding retweeting activities, in most cases, we identified the combined motivation of one's agreement and intention to spread the opinions to other people as follows. "[I] would retweet because I saw that others on tweeter were talking about it" (P11) and "I would certainly retweet a message about an interesting noon event in this community or somewhere else I know" (P21).

It seemed that those participants who were generally positive about tweeting new or retweeting existing community information wanted to take advantage of utilizing LNC as a way of reaching a larger audience and potentially creating a constructive online discussion and conversation space for local topics. "I would hope that my opinions were not taken out of context. I assume that most of my tweets only reach my followers and do not expect many people to look at aggregated tweets. This is a practical application of aggregated tweets and might anticipate my tweets to be seen more often here" (P18).

Along with these positive reactions, however, some participants were reluctant to create or share content. We identified four reasons for this: (a) They did not want to provide redundant content, (b) they did not have specific thoughts or opinions about the topic, (c) they did not want to reveal their identity, and (d) there was a general preference toward Twitter. For example,

a. "I felt no motivation to share or retweet something many people have already tweeted multiple times" (P3)
b. "I wouldn't retweet since this is a controversial topic that I don't know enough about to share an opinion, or someone else's opinion, for that matter" (P26)
c. "I would be hesitant that my opinion about a single event would be connected to my identity. This is particularly worrisome for people who do not know me in real life and what kind of opinion they might form about me" (P23)
d. "I do not like twitter. Once again I am utilizing it as a means to an end. I am glad to see the rest of the people using it for its intended purpose and it is benefiting me a lot, but I would not tweet unless I absolutely had to" (P14)

In particular, regarding the third point, previous research has reported that people tend to create or retweet content based on their perceived audience (Marwick & boyd, 2011). It is possible that some of our study participants did not perceive their audience on social media as local, but LNC has influenced their perception of using Twitter at a local level to some extent. Perhaps this lack of individual anonymity in a hyperlocal environment might affect some participants' willingness to tweet or retweet content because that can be accessed and reevaluated by other local residents and their identity could be revealed.

Of interest, this perspective seems to affect the way of posting and sharing local community information more carefully and thoughtfully. Some participants mentioned, "I would make a conscious decision to make my Twitter public; no problem with my tweets showing up here" (P13), and "I would adjust the content shared accordingly to protect my own safety and privacy" (P22). These results in general indicate that having shared interests or opinions is a prerequisite to be engaged in tweeting and retweeting activities. Although it would be difficult to generalize the application of shared interests or opinions because it varies a lot by users, one salient aspect of tweeting and retweeting activities is that they contribute not only to the diversity of content but also to the increase of awareness to the corresponding topics.

Our last investigation was to broadly understand potential communications and social interactions through LNC use because the aforementioned results were constrained to the tweets presented during the study. We found that 21 of 30 participants (70%) stated that they would be interested in having more interactions with others who have similar interests as revealed through tweet content using LNC. This shows a possible utilization of LNC as an information sharing and social tool among motivated and engaged local residents. One participant indicated, "I would find it easier to tweet back and forth with locals who share similar opinions. The Twitter Universe is so vast that I never feel connected with anyone because they feel too far away from me. I think knowing that I was communicating with local folks would increase my interests" (P24).

In summary, participants showed different motivations or intentions to be involved in social communications and interactions compared to what regular Twitter users generally possess. They wanted to share content that will be meaningful to their local community and people, such as added knowledge or personal opinions about the local issues. This perspective is different from what was reported in (Naaman, Boase, & Lai, 2010), where people mostly use Twitter for personal updates.

The hyperlocal content provided by LNC provides similar usage as reported in Forte et al. (2012), where teachers use Twitter in more meaningful ways such as maintaining professional ties with different educational communities, sharing resources, and making connections with students. By leveraging scattered local knowledge and opinions, LNC shows the potential for creating a space to discuss and share information about local topics and providing a social channel to interact with other local members and their community.

6. DISCUSSIONS AND DESIGN OPPORTUNITIES

In this article, we identified two challenges of leveraging online local news and microblog content, including sparseness of local online interactions and unwelcomeness of microblog content by people. We investigated the ways of increasing local community online interactions and of using socially generated informal content in the context of a local community. We introduced the civic application, LNC, which has been designed to aggregate locally relevant news topics and people's opinions and interests shared on Twitter. We conducted a design research study with 30 local residents, providing critical evaluations of LNC and identifying future design and research directions. Overall, the contribution of this study is threefold.

First, LNC aggregates locally relevant news and makes less popular local community information visible using a tag cloud that displays news topics of varying visibility with different tag sizes, increasing the diversity of news provision and satisfying different user motivations and expectations in news consumption. We found that participants tended to pick smaller tags because they were unfamiliar with or unaware of the local topics associated with the tags and pick larger tags to read more updates on the local topics.

Overall, participants in the study seemed to consume both more and less popular local news information. They also highly appreciated the ability to access diverse community information through a tag cloud. As a design implication, this emphasizes that a community-oriented tool should make local news topics visible regardless of its popularity, because different community members might have different motivations or expectations when accessing them. Some promising future enhancements to the system include allowing users to customize topics based on their interests, organize topics by some higher level categories (e.g., sports, entertainment, etc.), or search for specific local topics for flexible management or leveraging other local information resources such as from local nonprofit organizations or social groups for content diversity.

Second, LNC utilizes microblog content as useful or meaningful local information by anchoring it to the tags extracted from local news articles. By connecting online formal new services and informal news tweets, LNC provides richer and more dynamic local community information and enhances user experiences. Another salient aspect of LNC is that it leverages existing content because tweets already posted in Twitter and news articles are already published. This would be very helpful in real-world tool adoption, especially for social interactive application, than just a novel news chatter tool with no content to start.

Microblog content might have potential for allowing people to share values and common interests; however, research has found it difficult to consume in the most general context. By aggregating the scattered voices of the individuals from local tweets with local news topics, LNC demonstrates that tweets can be leveraged to support community awareness to local news, events, or activities. We found that participants liked "diverse," "meaningful," or "news-worthy" local community information presented by LNC. It would be difficult to design the system to meet every user's expectations to the content of tweets, because each one has different personal preferences and interests. However, some design changes, such as allowing users to bookmark interesting local news topics so that they can be notified of any updates of the bookmarked news topics and tweets would increase a chance to access tweets that they look for. Moreover, providing an option to see how the local thread of news and discussions might compare to that of national news might be useful and meaningful for some users, because it could show the topics of interest of people beyond the local community.

Last, LNC shows the potential of increasing people's community awareness to local news, events, or activities by leveraging scattered community knowledge to create a discussion and communication space for local topics and for creating and strengthening social interaction among local residents.

Participants showed great interests in using LNC as a way of creating new community information (tweet) or sharing existing ones (retweet) to other people. This indicates that LNC has the potential of facilitating online interactions among local residents. Some participants expressed privacy concerns with the disclosure of one's identity through LNC because their tweets will be presented and accessed by other members in the local community. Conversely, this could lead to creating a better environment with respect to information quality because users would post more meaningful messages. This insight complies with the recent trend where a number of national news organizations have begun to adopt social media platforms (e.g., Facebook, Twitter, Linkedin, etc.) to help civilize the online comments and improve the discourse quality. Linkages to social media services would also provide the means for effective dissemination of local information, and LNC shows one way of answering how to untap the power of hyperlocal microblog of supporting community activities.

7. LIMITATIONS AND FUTURE WORK

Our lab study was conducted to validate the effects of representing local news topic in a tag cloud and combining local news articles with local tweets along with the dimensions outlined in the survey questions. A field study would be one immediate extension to fully demonstrate the effects of LNC with respect to community awareness, participation, and social interactions.

As we acknowledge these limitations, we are planning to conduct a field study in which participants will use LNC in the wild for a longer period and employ both quantitative and qualitative methods to not only measure the use of LNC but also articulate its impacts and consequences (e.g., community awareness, participation, connection, a sense of community, self and collective efficacy, etc.), encountered challenges, and design implications.

We are also interested in exploring the formation of community connections among participants from using LNC on a daily basis. As mentioned previously, more than two thirds of the participants (21 of 30, 70%) answered that they would be interested in interacting with other community members more. Prior research found that social awareness and social presence influence social connectedness in online social networks (Riedl, Köbler, Goswami, & Kcrmar, 2013), and we believe this is a promising and interesting research direction and would like to investigate users' motivations, expectations, and outcomes of having or maintaining online social interactions with others through LNC (e.g., following others and retweeting, liking, replying others' tweets, etc.) and articulate how LNC facilitates those online or even possibly offline social connections or interactions. As LNC has been designed as a smartphone application and much research has reported that mobile users tend to spend much time on reading online news reports and articles (Lee, Kim, & Kim, 2005), we expect that people will use LNC as an additional channel to read local news articles. We also plan to investigate the influence of smartphone affordances (such as mobility and connectivity; Zhang & Adipat, 2005) on reading, creating, and sharing local news information and understand people's expectations for such technologies to keep them stay up to date and in touch with local news, events, and activities.

In summary, we observed that many participants still read newspapers, whether via print or the web, to become aware of their local community news, events, and activities. As more people will come to utilize digital platforms to consume local community information, there should be a systematic support to make various types of hyperlocal community content more visible and easily accessible with less effort that could result in the increase of civic engagement. By connecting our online activities to where we live, we hope to increase social interactions and individuals' awareness of other community members and local topics. Along with traditional or existing online news media, LNC is another community-oriented tool that leverages technology benefits yet aims to increase the diversity and visibility of local community information, to facilitate social connection and interaction, and to strengthen the sense of community of local residents.

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ABOUT THE AUTHORS

Kyungsik Han is a Ph.D. candidate in Information Sciences and Technology at Penn State University. He is interested in studying mobile & ubiquitous computing in a local community context. He received his B.S. in Computer Science from Kyungpook National University (2009), and M.S. in Computer Science from UCLA (2011).

Patrick C. Shih received his B.S. in Computer Science and Engineering from UCLA (2003), M.S. in Information Networking from Carnegie Mellon (2005), and Ph.D. in Information and Computer Science from UC Irvine (2011). In 2012, he joined the College of Information Sciences and Technology at Penn State as a Research Associate.

John M. Carroll is Distinguished Professor of Information Sciences and Technology. Recent books include *The Neighborhood in the Internet* and *Creativity and Rationale*. He is editor of *Synthesis Lectures on Human-Centered Informatics*. Carroll received the Rigo Award and CHI Lifetime Achievement Award from ACM and the Goldsmith Award from IEEE.