Neighborhood Community Well-being and Social Media

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ABSTRACT
In the following study we adopt a multi-method approach to examine whether the growing use of social media as a channel for hyper-local conversation may provide meaningful insights into the well-being of neighborhood communities. First, through interviews and a questionnaire with 174 residents of 26 neighborhoods we explore what are indicators of neighborhood level well-being, and what are current communication practices around the use of social media to support community well-being. Second, through an analysis of neighborhood-level Twitter messages we examine the extent to which mood and social interactivity in Twitter correspond with our neighborhood well-being indicators. Overall, we found self-reported usage of social media positively correlated with community well-being. However, while smaller neighborhood communities had higher community well-being, they were lower in usage of social media for interacting with neighbors. Only in larger, more urban centers characterized by younger professionals, did Twitter message mood and social interactivity correlate with well-being.

Author Keywords
Twitter; social media; community well-being; hyper-local; third place; networked publics; neighborhoods

ACM Classification Keywords
H.5.3 [Group and Organization Interfaces]: Web-based Interaction.

General Terms
Human Factors; Measurement.

INTRODUCTION

Social media play a central role in people's personal and professional lives, from friends and families connecting in Facebook [8], to colleagues connecting on LinkedIn and Yammer. In the past decade, social media are also increasingly playing an important role in more public spheres, providing new ways in which people are connected and mobilized [1, 9, 30], positively impacting civic engagement [3, 58]. However, social media use for hyper-local communities is not fully examined. In this paper we examine social media as a potential networked *third place* – that is, a place outside the home and outside of the work place where local communities may meet and converse [47].

In particular, we investigate how Twitter conversations may correspond to neighborhood community well-being. Social media generates persistent data traces, which has led researchers to explore the exciting potential of social media to serve as social sensors signaling attitudes on a societal scale [43]. More cautionary voices have raised concerns with the new infatuation with "big data" and social media [7]. While it is easy to collect and analyze social media data, it remains an unanswered question whether social media tools such as Twitter can meaningfully signal the well-being of real-world, neighborhood communities.

Our contributions are twofold. First, through interviews and a questionnaire with 174 residents of 26 neighborhoods we explore indicators of neighborhood level well-being, and current communication practices around the use of social media to support neighborhoods. Second, through an analysis of neighborhood-level Twitter messages we examine the extent to which conversations in Twitter correspond with the well-being indicators of neighborhood communities.

BACKGROUND

Social Media as Third Places Fostering Community Well-being

Societies are increasingly recognizing that well-being should be assessed not simply in terms of financial success, but also in terms of quality of life [51]. An important condition of individual well-being is membership in a thriving community that effectively collaborates both to have fun and to solve its collective problems. As argued by Oldenburg [47], *third places*, such as coffee shops, bars, and libraries, play an essential role in helping thriving communities form, by providing a safe public place where

people can develop relationships through frequent serendipitous interactions and ongoing discourse around common interests. Thus, third places can play an important role in fostering community well-being, where members a) know and interact with each other, b) have a feeling of belonging and affection toward the community that motivates their sense of responsibility, and c) can work together effectively toward common goals [47, 49].

Much like brick and mortar third places, communication systems may also play a central role in helping local communities grow by providing channels for serendipitous interaction, discourse, and collaboration with a wider and more asynchronous reach than found in purely face-to-face environments [40, 49].

Related Work with Community Technologies

Experimental community technologies designed specifically to support neighborhood communities first emerged in the 1970s (see [12], for review), with many new experimental approaches over the years as new technologies emerged, including email and mailing lists [13, 28, 34], web and blogging services [21, 26], social networking tools [33, 40] and most recently mobile social technologies [14, 24, 29]. While research consistently shows that these technologies may positively impact desirable social outcomes such as the size of local neighborhood networks [28, 65], place attachment [23], social capitol [11, 34, 49], and civic engagement [21, 22], in the real world people have been slow to adopt new technologies for local communities [12]. Anecdotal evidence suggests more complex neighborhood interactions occur largely in email and mailing lists, which are not optimal as third places because they tend to be private with moderated memberships. Most recently a few promising new social networking technologies were developed such as Patch.com and Everyblock.com, only to be closed. The jury is still out on Nextdoor.com [46], another neighborhood-specific social networking service, but by all indications adoption has been slow.

Prominent Social Media Tools and Neighborhood Community Engagement

At the same time, social networking services such as Facebook and Twitter have achieved broad adoption [27], providing a venue for civic discourse [39, 53], and are meaningfully transforming both theory and practice in how people achieve social goods. Large scale participation in these networked publics enable more emergent, fluid, bottoms-up social movements, rather than the more traditional collective action arising from social coordination by formal organizations [2, 48]. Online applications such as Twitter in particular have been heralded for bringing in a new hey-day of participatory civic culture [31, 56] through the rapid proliferation of information to people no matter what their location, rallying immediate, large scale responses to natural disasters [55, 59], war crimes [42], political protests [56, 60], or more playful flash mobs [52].

Bimber [4], in reconceptualizing collective action theory to account for personal participation outside the bounds of formal organizations, argues that an important condition for collective action in the new media world is the transition from expressing oneself in private to expressing oneself in the public sphere. Bennett and Segerberg [2] similarly argue that the new Internet-enabled, participatory model of citizenship largely emerges through personalized content sharing and storytelling in public places, which they characterize as *connective* action. Research has shown positive correlations between communication technologies and civic activities [16, 27, 37, 53, 58, 45, 50], and that in particular this form of personal sharing in networked publics leads to increased civic engagement [21, 34, 35], especially if people also identify with their local community [15, 22, 40].

At the hyper-local level recent work suggests neighborhood conversations do exist in these more prominent communication channels [29, 41]. Hu et al. [29] found latent neighborhood communities already exist in Twitter, and Cranshaw et al. [18] found that Foursquare check-ins meaningful corresponded with socially constructed neighborhood regions. Twitter in particular has unique affordances suggesting it would be an appropriate third place for hyper-local communities. First, Twitter is public. Second, it does not require that people use their real names should they have privacy concerns in reaching out to strangers in their neighborhoods. Third, it is optimized for mobile notifications about what is happening here and now, which is of great value for hyper-local community activities which are often very place-based.

Twitter Conversations as Signals of Community Well-being.

Historically governmental agencies have measured the well-being of neighborhoods in terms such as crime rates, home ownership, and the income of its residents. Only recently has there has been an effort (as exemplified by [20, 25, and 44]) to develop measures of community well-being that incorporate more subjective evaluations of quality of life and community engagement. While a few such measures have been developed [17, 36, 51, 64], they nonetheless tend to focus on aggregating individual assessments of life satisfaction and personal engagement rather than asking for evaluations of the success of the community as a whole. One such community-level assessment tool was developed by Carroll et al. [15], for which respondents rated the collective efficacy of the community – that is the perceived capacity of a community to work together to achieve its goals.

More importantly, traditional self-report measures of community well-being are quite resource-intensive to collect. As such, researchers have already explored whether active conversation in prominent public networks around local topics could be a signal of well-being. Schwartz et al. [57] found that the topical content of Twitter messages corresponded with measures of personal life satisfaction

aggregated at the regional level. A sentiment analysis of Twitter posts has been used to analyze aggregated well-being of a community, city and nation, showing corresponding fluctuations in social and economic indicators of the same period [6]. Other research shows that monitoring the topical content of Tweets in combination with census data offers insights into community well-being and deprivation -- showing that deprived communities seem happier in Twitter messages than less deprived [50].

While this past research is provocative, there remains a need to validate Twitter-based measures of community attitudes or well-being against other measures. Schwartz et al. [57] found significant relationships between self-reported *personal* life satisfaction measures, Twitter affect, and census data. We extend this work to focus on *community* level well-being, assuming people may be happy as individuals even though their local communities are low in well-being.

Twitter Conversations Biased by Age or Lifestyle

As both a vehicle for community conversation and a tool for measuring community attitudes and well-being, Twitter also presents many problems. While its public nature and large scale data collection capabilities make it easier to study a community, these same features might systematically inhibit participation from certain subgroups or for certain types of conversation. Past work has found that Twitter is used by younger populations [27], and that more personal, important, or complex topics occur in other communication channels [22]. Thus the signals of community well-being we may gain from the public traces in social media may be systematically biased.

Multi-method Approach

Given our desire to understand the relationship between the use of social media and neighborhood community well-being, we adopted a multi-method approach, triangulating on a rich picture of 26 neighborhood communities from methodological extremes. Although labor intensive, this approach provides a much deeper understanding of the power and limitations of using social media to gain insights into local communities.

We first assessed real world indicators of community well-being through a combination of questionnaire measures, qualitative interviews asking residents to discuss the determinants of their neighborhood communities' well-being, and census data such as crime rate, resident incomes, and home values. We then performed an analysis of neighborhood-level Twitter data generated by querying the Twitter fire hose for mentions of our selected neighborhoods. First we examined if the content of our sample of messages corresponded with self-reported indicators of neighborhood well-being, then we assessed if measures of affect and interactivity predicted neighborhood well-being.

METHODS

To select the neighborhoods to include in the study we first developed a comprehensive list of 221 potential King County small cities, towns, or neighborhoods through a review of both municipal and real estate web sites. We then randomly selected 30 neighborhoods that were mentioned at least 10 times on Twitter over the course of one month of Twitter data collection. During our interview process, we further reduced the list to 26 by increasing our criteria to at least 20 Twitter messages when we found it prohibitively difficult to find residents on the street who identified with a neighborhood name that had fewer than 10 Twitter messages.[1]

Semi-Structured Field Interviews

We recruited a total of 174 participants, 162 by approaching people in the center of the neighborhoods, in cafes, businesses, grocery stores, public parks and on the street. 12 more participants were recruited via a targeted craigslist ad where on-street recruitment proved difficult. These participants were not interviewed, they responded to all of the questions using an on-line questionnaire. All participants were recruited based on having lived in the specified neighborhood for more than one year. Participants received a $5 gift card for their participation. The interviews began with a 20 minute semi-structured interview, followed by a questionnaire. In the interviews, we asked participants (1) about their existing communication practices with neighborhoods versus friends and family, (2) what meaningful activities they did with their neighborhood community and finally, (3) what they believed were indicators of community well-being in their neighborhoods. For example, participants were asked: *"What does this community have that indicates to you that it is healthy or unhealthy (that is, high or low in community well-being, as opposed to physical health)."*

We recorded handwritten notes for all interviews and photo-documented each interview location. We then performed a thematic analysis on all the interview data to establish meaningful patterns [10]. Three researchers independently reviewed the notes, familiarized themselves with the data, and generated the initial codes. We then collaboratively searched for themes among the codes, reviewed themes, defined and named them, and produced the final report.

Questionnaire

Participants completed a brief, 15 minute questionnaire following the interview. We first asked for basic demographic and Internet experience information. Participants were then asked to indicate on a scale of 1 to 7

[1] This indicated that if a neighborhood had members who identified as residents, its community members would generate at least a few Twitter messages over a month.

the importance of various communication technologies for communicating, sharing, and keeping up-to-date with a) their friends and family, and b) members of their local neighborhood community. Participants then completed the following items designed to measure local community engagement and well-being. All items were rated on seven-point Likert scales, ranging from strongly disagree to strongly agree, or not at all to extremely so, depending on the question.

Neighborhood safety was assessed with three questions, *"I feel safe walking alone in my neighborhood after dark", "I have been a victim of crime in my neighborhood in the last 12 months",* and "*People feel safe in this neighborhood"*.

Neighborhood network was measured with one question *"I belong to an informal network of friends or acquaintances in the neighborhood, with whom I have contact on a regular basis."*

Civic engagement was measured using items from the Civic Engagement Questionnaire, asking respondents to indicate how often they engaged in various neighborhood community activities [32, 36], including, *"Spending time participating in any neighborhood community service or volunteer activity," "Working together with others to solve a problem in the neighborhood where I live,"* and "*Joining neighborhood community or political groups".*

Collective efficacy, or the belief that one's community has the ability to work to solve its own problems, was measuring using items from the Community Collective Efficacy Scale [15], including *"I am convinced we can improve the quality of life in the neighborhood, even when resources are limited or become scarce",* and *"Our neighborhood can cooperate in the face of difficulties to improve the quality of neighborhood facilities".*

Psychological sense of community, or feeling of connection, belonging and loyalty to the neighborhood was measured with items adapted from the Psychological Sense of Community Scale [64], including *"I feel loyal to the people in my neighborhood," I really care about the fate of my neighborhood,"* and *"I feel I belong in my neighborhood".*

Community well-being was measured through a series of questions adapted from a review of community well-being measures [17] including *"People care about each other," "There is no sense of community in this neighborhood"* (reversed item), *"People in this neighborhood have a feeling of belonging",* and *"My neighborhood has a healthy community".*

Neighborhood Demographics and Lifestyle Data

Neighborhood demographic and lifestyle characteristics were measured using data provided by a third-party location-based data service, Locations, Inc. [38]. Locations, Inc., is a well-respected geographic research and data mining company that integrates census data with proprietary lifestyle and living conditions data, most often used in real estate websites. Given the variety of neighborhood characteristics provided by location data services that might indicate well-being, the challenge was in reducing them to a meaningful set. We first selected those measures that corresponded with indicators of well-being used by government assessment tools [51], and then performed a factor analysis on these measures (principle components with varimax rotation) across *all* neighborhoods in King County, Washington, USA. Three factors emerged across measures, which we labeled **Urban Lifestyle** (42.4% of variance), with high factor loadings (.6 or higher) for measures of young professionals living in urban areas with high crime rates, and inversely for measures of family home-owners in quiet towns; **Socio-economic Status** (16.5%), with high factor loadings for education level, wealth, home values, and inversely racial diversity, and then **Older Population** (9.6%), indicating the percent of population over 44 and inversely under 29. Factor scores were saved as variables and used in subsequent analysis. We later find **population size** and **age diversity**, while not loading onto these three factors, prove to be meaningful variables and are also included in subsequent analysis.

Twitter Analytics

Data collection

We initially collected public Twitter messages about neighborhoods over a one month time span (Nov 11, 2012 to Dec 11, 2012) using methods developed by Hu et al. [28]. We acquired Twitter messages from the Twitter fire hose that explicitly and uniquely mentioned one of 222 neighborhoods using common variants of the city and neighborhood names (e.g. Capitol Hill might be either *"capitol hill"*, *"capitolhill"*, or *"caphill"*), filtered to include only authors who explicitly stated being from one of the 43 cities within King County and whose messages came from the Pacific Time Zone. This generated a set of 97195 messages authored by 17300 people, an estimated .8% of the total population, and 6% of the population using Twitter in the Pacific Northwest. For our 26 selected neighborhoods, we collected an additional five months of Twitter data for increased stability in our social network interactivity metrics.

Twitter Message Topical Content

To validate our sampled messages were about the neighborhoods and explore neighborhood level topical content, we used manual coding of randomly sampled messages adapting the schema developed by Hu et al. [28]. Three coders were trained on the same initial set of 300 messages. The remaining messages were then coded by two individuals each (achieving inter-coder reliabilities over .8). Coders rated if each message was about the neighborhood mentioned, the topical content of the message, and then whether it referred to an event (a time-based activity). A total of 2095 messages were coded, an average of 80 messages for each of the 26 selected neighborhoods.

Twitter Message Affect

Neighborhood level affect was measured using methods developed by De Choudhury et al. [19], to assess message valence and activation. The analysis tool provided 7 scores ranging from -1 to 1 for each affective state for each message, and one overall positivity score. See Table 1.

Measure	Example
Positivity	Happy #Thanksgiving from all your friends here at Bear Creek Country Club!
Joviality	Win FREE TICKETS to the "Grandaddy of all holiday shows!" December 8 - 9: Salty's on Alki Beach…
Fatigue	Is there a Belltown soup delivery service? Cuz I need soup served to me in bed.
Hostility	I'm so annoyed with this gondola crap. Deal with the problem: cars, Denny, and surrounding streets. No excuses. @seattledot
Sadness	Depression has taken over me...Costas Opa in Fremont is closed FOR GOOD. R.I.P. Avgolemono soup...I will miss you.
Serenity	Tea, music on a cold winter night walking at the pier waterfront of Seattle ..the best
Fear	Either the rapture just happened or there was a rolling blackout in my neighorhood. Witnessed it while driving... scary. #WestSeattle
Guilt	I am embarassed beyond belief that Seattle's downtown Christmas tree is made of plastic. #shame

Table 1. Example Twitter neighborhood messages scoring high on specific affective measures.

Social Interactivity

An important condition for neighborhood community well-being is that people know each other and interact with each other. As such, we expect in neighborhoods with a thriving neighborhood community, that Twitter users within the neighborhood would frequently mention each other. To assess this, we draw from traditional measures in social network analysis, including **mention network reciprocity**, indicating the proportion of active network connections that are reciprocal, and **mention network density**, indicating what proportion of all possible interactions that actually exist [63]. Finally, we also look at the **degree centralization** in the network, which indicates the extent to which mentions are spread equally across the network, versus concentrated on few individuals.

RESULTS

Participants

174 people completed the interview and questionnaire. On average, participants were 42 years of age (ranging from 15 to 84), with 48% male and 52% female. 73% were Caucasian, 6% Asian, 6% African-American, 2% Hispanic, 1% Hawaiian/Pacific Islander, and 2% American Indian. 5% indicated mixed heritage. We recruited participants who had lived in their neighborhood for a year or more, and found 93% reported living in the neighborhood for more than year, with 35% living in the neighborhood for 1-5 years, 19% for 11-20 years, and 16% for 21 or more years. 54% reported owning (or family owns) their home, with 42% renting their home. 52% were employed full-time, 19% part-time, 6% students, 7% were homemakers, 5% unemployed, and 16% retired. (Note the numbers add up to more than 100% because we allowed for multiple responses.) Participants were fairly well-educated on average, with 21% having a graduate degree, 36.5% an undergraduate degree, 18% a 2 year community college or associate's degree, 9% a technical certification, and 12% a high school diploma or equivalent. Given our recruiting method of approaching people on the street to participate, we were concerned our sample would be biased toward underemployed or retired individuals. However, a comparison against demographic information about King County neighborhoods [61] indicates the sample is fairly representative, with 27% of our sample versus 34% of all of King County being a minority, 41% versus 37% over 45 years of age, 57% versus 46% with bachelor's degree or higher, 5% versus 7% unemployed, 16% versus 12% retired, and 54% versus 58% homeowners. Overall, our participants were fairly Internet-savvy, reporting high levels of Internet Experience, with 91% reporting intermediate or higher levels of experience (35% advanced, and 19% expert).

Existing Neighborhood Communication Practices

We asked participants how they communicate, share, or keep up-to-date with members of their neighborhood, and for comparison how they communicate with friends and family. As can be seen in Figure 1, compared to when talking to friends and family, our participants largely relied on face-to-face interactions to communicate with their neighbors, followed far behind by cell phones (voice and text), and emails. Social networking sites were used even less so, and Twitter hardly at all.

During our interviews we further asked: *"If you wanted to communicate, share or keep up-to-date with members of your neighborhood, how would you go about doing so?"* When examining frequency data in the qualitative results, we similarly found their primary reported methods of communication with *friends and family* were cell phone, voice (72%), email (61%), Facebook (51%) and text messaging (40%), whereas with members of the *neighborhood*, face-to-face (52%) was by far the most frequently mentioned method, followed by email (22%), cell phone, voice (18%) and Facebook (16%).

> *"When it gets sunny, everybody goes outside. That is when you see them. Go over to them, knock on their door." (Wallingford)*

Notably, and what was highlighted as a result of our qualitative interviews was that 10% of participants mentioned that they did not communicate or had no method of communicating with members of their neighborhood. Participants indicated that technologies related to neighborhood communications either did not exist or were hard to find.

> *"I rarely communicate with my neighbors. Most of the time I'm on my stairs and just saying 'hi'." (Bothell)*

"There is no way. Other than the coffee house. In person with people closely surrounding our house — there is no way to get in touch with others - that is the problem." (Phinney Ridge)

Other social technologies were rarely used, especially compared to how people communicate with friends and family. Those participants that did report using social technologies to connect to their neighborhoods used email, email lists serves, Facebook, and neighborhood blogs to keep up-to-date on their neighborhoods.

"There is a group of parents that communicate by email a lot. Facebook pages. I might join someone's page for an event, community group mailing" (Wallingford)

"I use the capitol Hill blog, Facebook sites, yelp reviews." (Capitol Hill)

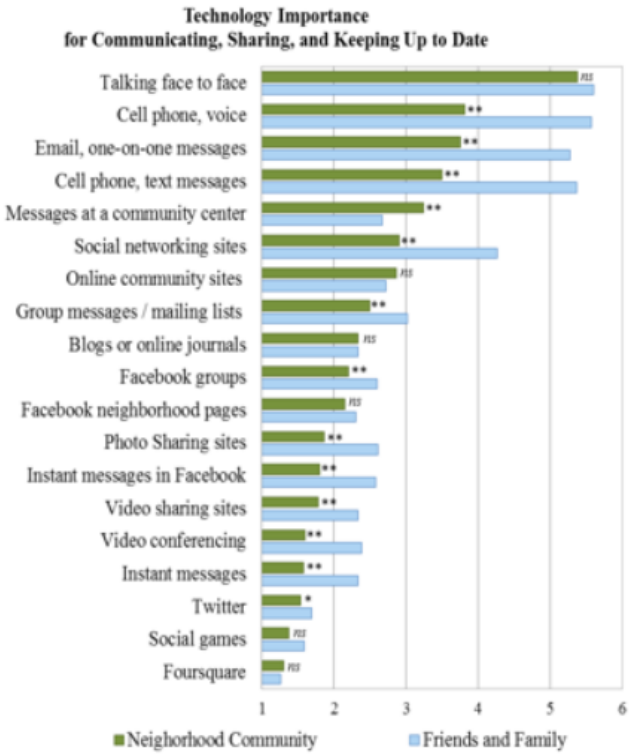

Figure 1. Face-to-face interactions were rated as most important for communicating with neighbors (where 1 = not at all, and 7 = extremely so). Asterisks indicate significant differences with ** = p <.005, and * = p < .05.

Mailing lists were particularly used as a trusted way to distribute information, and neighborhood blogs provided a centralized place to find community information that could be moderated.

"There is a list-serve, we use it to stay informed. Hear about break-ins in the neighborhood. We used to be more open, now we want more control of our information." (Mount Baker)

At one technological extreme, the Wallingford neighborhood had the popular 'Wallyhood' blog, Facebook site, and a number of private mailing lists for moms, nanny referrals, crime watch, and classified ads — however, the mailing lists could only be joined through invitation with strict arrays of social governance rules.

"It is a closed forum… you can't post on it every day. Some are gently reprimanded if you sell stuff too often. We have built a network of efficiency, trust and economics." (Wallingford)

Consequently, if members of the neighborhood did not happen to get invited, then they did not have access to the mailing lists. Asking one resident how she gets information about the Wallingford neighborhood, she replied: *"There are no technological outlets to keep in touch with my neighborhood. No blogs that I know about."* These results highlight the tension between needing accessibility to the public forums, and desire for trust that arrives from bounded, moderated group.

To extract the significant components of neighborhood level communication for subsequent analysis, we performed a factor analysis (principle components with varimax rotation) on our measures. Five factors emerged: **real-time, interactive media** (42.2% variance) such as video chat and instant messaging, **social networking sites** (10.8%) primarily via Facebook usage, **broadcast, public media** (9.1%)**,** such as blogs and online community sites, **personal messaging** (7.2%) such as email and text messaging, and **mobile social network king** (5.9%) such as Twitter and Foursquare. Factor scores were saved as variables and used in subsequent analysis. An examination of these factors and demographic variables shows that older participants had lower ratings on the real-time, interactive media factor (r = -.28, p < .05) and the social networking sites factor (r = -.29, p < .05), and minorities had higher ratings on the real-time interactive media factor (r = .37, p < .05).

Technology Usage and Neighborhood Community Well-being

As can be seen from Table 2, we found that the use of social technologies to communicate and share with neighbors generally correlated positively with measures of neighborhood level well-being. Personal messaging tools in particular had higher correlations with the size of participants' networks, civic engagement, sense of community, and community well-being. More broadcast, public media tools correlated more highly with civic engagement, which is consistent with Farnham et al.'s [22] finding that interaction in the public sphere is particularly important for civic engagement.

Neighborhood Characteristics and Communication Practices

Across our communication technology factors, we generally found that participants in neighborhoods with higher lower socio-economic status were less likely to use real-time

interactive media for interacting with their neighbors, which also corresponded with population size and age diversity. See Table 3. We found a marginal effect with those in higher socio-economic status neighborhoods sending fewer personal or mobile social networking messages, and neighborhoods with higher age diversity sending more personal messages. The larger the population, the more people used social networking sites and Twitter.

	Safe	Neigh. Net.	Civic Eng.	Psych. Sense Comm.	Coll. Eff.	Comm. Well-being
Real-time interactive media	-.10	**-.17**	.13	**-.17**	-.05	-.11
Video chat	-.03	-.02	**.28**	.06	.10	.07
Photo sharing sites	.02	.05	**.30**	.09	.13	.08
IM in Facebook	.09	.03	**.26**	.11	**.18**	**.16**
Video sharing sites	-.10	-.02	**.28**	.00	.10	-.02
Instant messages	.04	.00	**.30**	.08	.16	.05
Social networking sites	.09	.11	**.15**	**.21**	**.24**	**.19**
Facebook neighb. pages	.11	.15	**.30**	**.31**	**.33**	**.24**
Facebook groups	.08	**.17**	**.31**	**.23**	**.27**	**.18**
Social networking sites	.09	.12	**.27**	**.20**	**.24**	**.16**
Broadcast, public media	.08	**.25**	**.47**	**.30**	**.29**	.14
Online community sites	.12	**.21**	**.46**	**.29**	**.29**	**.22**
Messages at a center	.06	**.28**	**.47**	**.35**	**.34**	**.15**
Blogs or online journals	.09	.11	**.39**	**.22**	**.22**	.13
Group messages / lists	.07	**.26**	**.37**	**.29**	**.23**	**.22**
Personal messaging	.05	**.44**	**.35**	**.39**	**.28**	**.32**
Cell phone, voice	.06	**.30**	**.29**	**.22**	**.23**	**.19**
Cell phone, text messages	.06	**.34**	**.36**	**.29**	**.20**	**.26**
Email, one-on-one	.07	**.44**	**.45**	**.43**	**.35**	**.35**
Mobile social networking	.10	.04	**.18**	.13	.09	.08
Foursquare	.13	.10	**.33**	**.20**	**.19**	.14
Social games	.13	.13	**.30**	**.23**	**.16**	**.21**
Twitter	.07	.01	**.26**	.09	**.15**	.06

Table 2. Intercorrelations between self-reported measures of technology importance for communicating with neighbors and measures of neighborhood community engagement and well-being. (N = 174, bolded items are $p < .05$.)

Neighborhood Characteristics and Well-being

An examination of the correlations between neighborhood metrics and our participant's ratings of community well-being show some notable relationships. We find neighborhoods that are smaller and more quiet have higher community well-being ratings (*r*s = .41 and .40, *ps* < .05, respectively). We also found those in neighborhoods with higher family friendly scores and more homeowners also reported higher community well-being (*r*s = .36 and .35, respectively, $p < .06$ (2-tailed)). See Table 4.

	Urban lifestyle	Socio-econ. status	Older Pop.	Pop Size	Age Div.
Real-time interactive media	.19	***-.36***	-.15	**.39**	.29
Social networking	-.02	.14	-.21	.10	-.03
Broadcast, public media	**.49**	.03	-.01	-.20	-.19
Personal messaging	-.27	**-.42**	-.10	-.01	**.43**
Mobile social networking	-.14	***-.37***	.00	.07	.12
Social networking sites	-.16	-.24	***-.35***	**.40**	.19
One on one emails	-.18	-.05	-.11	.01	.01
Twitter	.05	-.24	-.23	**.39**	.06
Face to face	-.26	-.15	.01	.13	.20
Blog or online journal	**.38**	.18	.11	.06	-.12

Table 3. Intercorrelations between participants' types of technology use for communicating with neighbors and neighborhood characteristics. (Measures conservatively aggregated to the neighborhood level with N = 26. Bolded items are p < .05, and bolded italic items are marginally significant at p < .07, 2-tailed.)

It may on the surface seem surprising that larger neighborhood communities reported lower community well-being, however when we examine these more populated areas, we are also finding participants report having fewer people in their personal neighborhood networks ($r = -.41$, $p < .05$). That is, despite the large population – or because of it -- they know fewer people. The related finding that participants reported using Twitter and Facebook to communicate with neighbors more often in these populated areas suggests they may be using Twitter and Facebook to compensate for lack of connection, because it is difficult to meaningfully connect with others in urban environments.

Another notable pattern is that while neighborhoods with higher home values were rated as being more safe by our study participants ($r = .55$, $p < .05$), home values were negatively correlated with their ratings of local civic engagement ($r = -.40$, $p < .05$). We further observed neighborhoods with more age diversity had higher levels of civic engagement ($r = .44$, $p < .05$).

Qualitative Indicators of Neighborhood Well-being

In order to better understand the constituents of neighborhood well-being, we performed a qualitative deep dive into the indicators of what creates a healthy neighborhood. We wanted to understand what was meaningful and important to people with respect to their neighborhood community. In the qualitative interviews, participants were asked: *"What does this community have*

that indicates to you that it is healthy or unhealthy (that is, high or low in community well- being as opposed to physical health)."

	Safe	Neigh. Net.	Civic Eng.	Psych Sense Comm.	Coll. Eff.	Comm. Well-being
Urban Lifestyle	-.11	-.08	-.05	-.02	.11	-.15
Hipster score	-.02	-.01	-.08	-.02	.11	-.05
Percent homeowners	.29	.24	.05	.14	-.02	***.35***
Percent families	.25	.12	-.04	.09	-.08	.30
Family friendly index	***.37***	.17	-.03	.12	-.05	***.36***
Walkability score	-.08	.04	-.04	.07	.10	.01
Young professionals	.20	-.22	-.28	-.25	-.07	-.27
Crime density	-.20	.02	.08	.23	.13	.04
Crime rate	**-.42**	.02	.23	.19	.23	-.11
Quite score	**.39**	.29	-.03	.15	.05	**.40**
Socio-economic status	**.57**	.01	***-.36***	-.14	-.07	.11
Education level index	**.41**	.01	-.25	-.09	.06	.03
High culture index	**.49**	.24	-.17	.07	.03	.29
Schools quality index	**.55**	.05	-.32	-.10	-.03	.18
Wealth index	**.55**	.04	-.30	-.12	-.17	.19
Low income index	**-.55**	-.04	.30	.12	.17	-.19
Race diversity (% minority)	**-.67**	-.11	.22	.11	.10	-.19
Home values	**.55**	.01	**-.40**	-.03	.03	.23
Age	-.01	.27	.15	.26	.22	.33
% older (> 44)	-.06	.18	.16	.17	.16	.26
% younger (< 29)	-.14	-.17	.09	-.16	-.15	-.29
Age diversity score	-.24	.19	**.44**	.24	.21	.15
Population size	**-.47**	**-.41**	-.04	-.22	-.12	**-.41**

Table 4: Intercorrelations between neighborhood characteristics and self-report measures of community engagement and well-being (Bold indicates p < .05, bold italics p < .07. Note these are aggregated at the neighborhood level so N = 26, with more conservative p-values).

As can been seen from Table 5, the most frequently mentioned indicators (47%) contributing to community well-being were the presence of thriving local businesses and organizations (33%), followed by safety (33%), and community events (25%). Some of these indicators are more surprising than others, and are explained in greater detail below based on the interviews. We further found that several themes emerged through our analysis of the qualitative interviews, beyond those indicators provided explicitly by the participants. These emerging themes are also discussed below: the importance of community hubs, and diversity and segmentation.

Importance of Local Businesses

Local businesses served two major functions in contributing to community well-being. Local businesses were 1) an entity participants developed a strong relationship with and 2) served as the quintessential third places where community members connect. Participants showed strong loyalty and friendship with local businesses. Instead of being a source of unwanted advertising or spam, businesses played a critical role as an important member of the community.

"I think there is a strong acknowledgement of each other being from the same community … I know all the baristas, know the bar tenders. All the businesses here know that I live here." (Capitol Hill)

"Strong friendships between businesses and people." (West Seattle)

The presence of local businesses served as a vehicle to inspire interaction that might not otherwise occur. People had a primary reason to go to local coffee shops, book stores, yoga studios, but while they were there they could serendipitously run into and get to know their neighbors.

"They have groups that come here on a regular basis- gay men's running club, UW med students. You can feel the zeitgeist." (Wallingford)

"Have a place like this (Bindlestick café) where all the locals come and talk is really amazing." (Snoqualmie)

Indicators of Neighborhood Well-being	**Percent Mentions**
Thriving local businesses	47%
Safe, low crime	33%
Community events	25%
Community resources	25%
Friendly	25%
Walkability	25%
Gathering places	24%
Social support	20%
Well-maintained	19%
Other health: mental, economic, physical	19%
People know each other	14%
Diversity (race, SES, age, families)	12%
Vibrancy -- people out and about	11%
People interact/communicate	11%
Civic engagement	10%
Environmental/geographical assets	10%
Growth - embracing change	10%

Table 5. Indicators of well-being mentioned during qualitative interviews.

Neighborhoods that lacked the presence of walkable local businesses, displayed lower overall community well-being.

> *"There is no community focus. If there were among all these buildings more social venues - bars, coffee, shops, etc., it would prevent me from going to other neighborhoods." (South Lake Union)*

Safety and Trusted Network

As expected, safety and trust contributed highly to a sense of well-being. Communities where there was a high level of trust exhibited behaviors such as key exchanges, assisting in fix-it projects, and random acts of kindness, consequently leading to higher levels of community well-being.

> *"I have done a lot to help my neighbors … lots of lost animals, know where they need to go -- I take my quad and bring them home." (Duvall)*

> *"People take care of each other … this guy didn't want me to wait for the roadside assistance - he jumped my car for me … there is a willingness to be open to people." (Capitol Hill)*

Community Events

The next most important indicators were the presence of community events and community resources. These served as anchors for community growth and development.

> *"I think this is a healthy community as evidenced by volunteer opportunities, attendance at city-sponsored events (music in the park, Riverfest, etc.) events held by local sports leagues, and participation in local government to name a few." (Bothell)*

We further asked participants to describe *"Are there things you do with people in your neighborhood that are meaningful to you?"* We found that participants frequently mentioned events like BBQs, playing music, gardening, walking dogs, potlucks, connecting with people, bike rides, and so forth. This really highlighted the importance of personally connecting with people and relationship-building centered around social and civic activities.

> *"The creek is a huge deal to me, volunteered there for the last 15 years. In May I will work every day with Salmon in the Classroom." (West Seattle)*

> *"We spend every holiday together. We make time for BBQs, pot lucks together, sit around and have tea together at least once a week. That is meaningful to me—quality time with my neighbors. Hanging out on the patio with them in the summer time." - (Snoqualmie)*

Community Hubs

The presence of a community hub, or curator of information, emerged from the qualitative interviews as being vital to community well-being. This trusted person was described as collecting neighbors' phone numbers, emails, sometimes has copies of neighbors' keys, and generally knew what was going on. Moreover, in some communities this person served as the curator for neighborhood information online and provided a filter for the relevant quality neighborhood information.

> *"[Community blogger], She really knows what she is doing… tell her what is going on… as soon as something happens in the neighborhood… she shows up there."(Fauntleroy)*

It was not enough for the community hub to simply be the broadcaster of information. An emerging theme from the interviews was the importance of two way interaction.

> *"The other business are not super effective—they don't get the interaction piece - they run [their FB page] like an ad. I think of Facebook like a cocktail party—you are circling the room, you need to introduce new things, you want it to be a two way conversation." (Auburn)*

One participant from Duvall ran her successful community site 'Duvall 360' by providing daily community opportunities for engagement and highlighting members of the neighborhood that were civically engaged:

> *"[It's] like a conversation. I spotlight local merchants on Merchant Monday, Wednesday is 'Where in the Valley' where I take a picture of somewhere in the neighborhood and everyone has to figure out where it is. Thursday is 'Random acts of kindness'... there is a gal named Helen who drives around in a white Lexus picking up garbage … I have 558 followers" (Duvall)*

The Complexity of Diversity

Diversity in neighborhoods was a complicated topic as it related to community well-being: it was positive in some cases, and in others, considered quite negative. Age diversity was considered a positive aspect of neighborhoods where they felt it provided the community with a sense of history and meaning. In contrast, while many reported valuing socio-economic diversity, neighborhoods with more poverty and homelessness felt less safe.

In general, participants wanted to find others like them in their neighborhoods. A similarity in life stage, and in particular having children, significantly oriented a lot of interactions. In some cases, within neighborhoods, people isolated themselves from the neighborhood as a whole. For example, a retirement community had its own activities within condominiums that were divorced from engaging with the broader community on the street.

> *"We have quite a strong community in the building, but I don't really communicate with the neighborhood" (First Hill)*

This "stranger fear", or fear of people who might be too different, inhibited a lot of potential social interactions, which was further alienated by new technologies.

> *"So fractured and different from one another, separated by class and money – socio-economic. Technology has further alienated us because we don't need to see or be*

with one another. We are more fearful of one another." (International District)

Interestingly, we observed that the more affluent the neighborhood, the less people seemed engaged. This is consistent with our questionnaire results. Neighborhoods that had a little adversity, or a cause to gather around, reported higher levels of community well-being. For example, a West Seattle couple reported having a Methamphetamine lab on their block and that catalyzed email exchanges, regular meetings and consequently a feeling of bonding.

Neighborhood Twitter Analytics

Having developed a rich picture of 26 neighborhoods and indicators of their well-being through a questionnaire, qualitative interviews, and census data, we then asked to what extent is there a corresponding picture of these neighborhood's well-being in Twitter. First we examine the activity metrics of neighborhood Twitter messages, and then we explored whether they were correlated with our measures of neighborhood well-being.

Twitter Activity Metrics

Across all 222 neighborhoods (excluding the city of Seattle itself which is an extremely outlier), we found a mean number of 99 messages over the span of a month from 69 unique people. Many neighborhoods were quite small with little conversation on Twitter. Out of the original 213 neighborhoods that were mentioned at least once, 49% were inactive with 20 or less messages, 25% had 21-100 messages, and 26% had > 100 messages. Within the 26 neighborhoods of our study, we found 212 messages on average, with 146 active contributors. Please see Table 6 for metrics of social activity within our neighborhood sample.

Content of Twitter Neighborhood Messages

An analysis of the content of a subset of our sampled messages indicates 88% were about the neighborhood mentioned. Of the 2095 messages we coded, 3.8 % were erroneously assigned as being about the neighborhood. Of the remaining, 7.8 % were personal in nature, and 31.5% were generated automatically by a service, such as check-ins from Foursquare or activity reports from the police department (see Table 7). The remaining 60.7% were sent by individual persons and were about the neighborhood. We found when examining the content of these messages, that general news and then local business were the most common topics, followed by links to photos or videos, descriptions of the area labeled local "flavor", and local sports. See Table 7. Across these messages, independent of topical content, we also rated whether they were about an event, and found 29% were about a current event or happening. These findings show that the content of neighborhood Twitter messages overlaps a fair amount with what people reported caring the most about as indicators of community well-being, such as local businesses and community events.

Measure	Mean	Min	Max	*SD*
Number of messages	212.1	9.0	1253.0	294.18
Number of active contributors	146.3	4.0	1062.0	244.42
Messages per active contributor	1.8	1.1	2.9	0.48
Proportion of neigh. pop. contributing	0.007	0.000	0.035	0.009
Followers per contributor	1359.4	241.7	3539.4	1019.00
Following per contributor	647.7	189.9	1415.0	311.43
Retweets	23.6	0.0	159.4	38.08
Mentions	321.7	5.0	2741.0	615.34
Asymmetrical mentions per contributor	0.882	0.000	2.615	0.8646
Mutual mentions per contributor	0.121	0.000	0.476	0.1270
Mention network degree centralization	0.070	0.000	0.290	0.0640
Mention network reciprocity	0.160	0.000	0.364	0.1196
Mention network density	0.005	0.000	0.046	0.0098

Table 6. Descriptive statistics for Twitter neighborhood networks, aggregated at the neighborhood level.

Messages from individuals.		Messages from services.	
News	15.2%	Foursquare	29.1%
Local businesses	12.1%	News	22.8%
Multi-media links	11.7%	Police Department	19.8%
Local "flavor"	7.4%	Classifieds	12.6%
Sports	7.2%	Weather report	8.5%
Emergency	6.7%	Fire	4.9%
Arts	5.8%	Photo sharing	0.8%
Classifieds	5.4%	Job board	0.6%
Checkins	4.8%	Events	0.5%
Nature	4.3%	Yelp	0.2%
Civic activity	3.7%	Transportion	0.1%
Educational	3.6%	Deals	0.1%
Social events	3.5%		
Social "grooming"	3.2%		
Deals	2.8%		
Festivals/parades	2.7%		

Table 7. Topical content of neighborhood messages.

Community Wellbeing and Twitter Activity

We next examine if measures of affect and social activity in neighborhood Twitter measures corresponds with neighborhood well-being. Examining the overall pattern of correlations we see Twitter affect and social activity levels do *not* generally correlate with well-being measures. Rather, we find much stronger correlations with measures of neighborhood characteristics. See Table 8.

In neighborhoods with a more urban lifestyle, a larger percent of the population is Tweeting, has more followers, are mentioning each other more, with more prominent individuals in the network (as indicated by degree

centralization). The more the age diversity, the less people are tweeting, the less they are mentioned, and the less mutual the mention networks. These results indicate that overall Twitter usage and content has more to do with the age and demographic characteristics of the neighborhood than the community's well-being. Within the measures of well-being, we do find one exception to this pattern, which is the more the number of people who are tweeting, and the more people are mentioning others, the higher the sense of psychological community.

A closer examination of the particular neighborhoods suggests we are not observing a relationship between Twitter metrics of well-being and community well-being because there are small, family-oriented towns that report very high levels of community well-being but have low levels of Twitter activity. We also observe urban centers known as shopping or business districts where few people actually live – consequently they are high in Twitter activity, but low in community well-being. This suggests there may be an interaction effect, where if we control for whether the neighborhood actively uses Twitter messages, we might find the expected relationship between affect, social activity, and self-reported well-being. To test for this interaction effect, we performed a repeated measures generalized linear model with participant assessment of community well-being as the repeated dependent measure, and life style, the number of Twitter messages, and mention network reciprocity as independent variables. We found as predicted when controlling for the number of messages and life style, the mention network reciprocity significantly predicted community well-being ($\beta = .01$, CI [.001, .021], $p = .03$) and significantly interacted with the level of neighborhood Twitter activity and lifestyle ($\beta = .00007$, CI [.0000, .0001], $p = .07$). As illustrated in Figure 2, when neighborhoods are using Twitter, the size of the mention network correlated community well-being ($r^2 = .07$). There was no main effect, but a similar interaction effect for degree centralization with lifestyle, such that those more urban neighborhoods with lower degree centralization had higher community well-being ($\beta = .004$, CI [.001, .007], $p = .02$), indicating that having more equal participation in online conversations corresponds with well-being. Interestingly, we found these same neighborhoods that had less centralized Twitter networks had the particularly strong offline community hubs that were called out by our interviews, many of whom also have prominent Twitter accounts. This suggest the community hubs may have a role in increasing the overall interactivity of the mention networks. With message positivity, we found no main effect but a stronger interaction effect, ($\beta = .054$, CI [.036, .072], $p < .000$), with positivity correlating with community well-being only in neighborhoods with high Twitter activity ($r^2 = .14$). See Figure 3. A similar pattern emerged for joviality, and with other measures of well-being as the dependent measure including civic engagement and psychological sense of community.

	Urban Lifestyle	Socio-econ. Status	Older Pop.	Pop. Size	Age Div.	Safe	Neigh. Net.	Civic Eng.	Psych Sense Comm.	Coll. Eff.	Comm. Well-being
Joviality	**.44**	.30	-.21	-.07	-.33	**-.05**	.01	.10	.01	.23	.02
Fatigue	**-.38**	.12	.17	-.15	.19	**.32**	.28	.04	.05	-.18	.15
Hostility	**-.45**	-.20	.19	-.02	.34	**.11**	.07	.03	-.04	-.17	-.03
Sadness	.01	-.23	.10	**.49**	**.39**	**-.34**	-.21	.27	.04	.24	-.29
Serenity	-.18	**.35**	-.23	-.12	**-.47**	.27	.03	-.16	-.17	-.26	-.13
Fear	-.11	-.23	.09	-.27	.00	.23	.09	-.18	.11	-.13	.23
Guilt	-.30	-.31	.10	.44	.32	**-.44**	-.31	-.16	-.22	-.22	-.30
Positivity	***.35***	-.03	-.16	-.11	-.11	**-.47**	-.01	.18	.27	.31	.02
Number of messages	.22	.25	-.12	**.38**	-.28	-.03	-.02	.06	.32	.20	.01
Number of active contributors	.27	.27	-.06	**.28**	-.28	.01	.02	.07	***.37***	.27	.08
Messages per active contributor	**-.70**	***-.35***	-.01	**.58**	.26	-.08	.14	.27	.13	.04	.06
Proportion of neigh. pop. contributing	**.51**	**.46**	-.21	-.16	**-.50**	.17	-.03	-.06	.11	-.03	-.04
Followers per contributor	**.55**	.15	.00	-.18	**-.41**	.03	.05	-.12	-.07	.00	.01
Following per contributor	.33	.30	.20	-.17	-.32	.24	.04	-.15	-.13	.04	-.03
Retweets	.30	.27	-.07	.25	-.30	-.05	-.01	.06	.31	.25	.02
Mentions	.26	.22	-.06	.26	-.23	-.01	.06	.09	**.40**	.26	.08
Asymmetrical mentions per contributor	**.77**	.29	-.22	-.23	**-.53**	-.01	-.07	.05	.10	.12	-.16
Mutual mentions per contributor	**.81**	.11	-.18	-.30	**-.45**	-.01	-.06	-.06	.05	.02	-.09
Mention network degree centralization	**.55**	.02	.20	**-.40**	-.18	.03	.12	-.07	-.07	-.08	.08
Mention network reciprocity	**.63**	.12	.03	-.09	-.17	-.12	-.21	-.26	-.24	-.19	-.18
Mention network density	.26	.01	.24	-.27	.08	.08	.20	-.03	-.11	-.06	.14

Table 8. Correlations between metrics of neighborhood activity in Twitter, neighborhood characteristics, and self-reported neighborhood community well-being. Bold indicates p < .05, bold italics p < .07, 2-tailed, with N = 26.

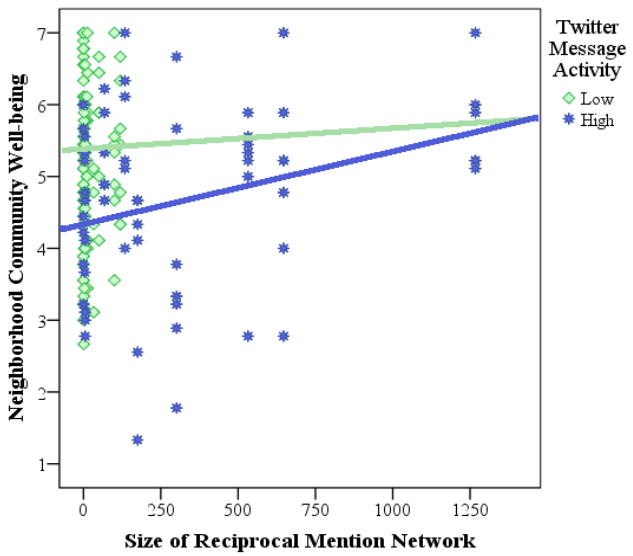

Figure 2. In Neighborhoods with high Twitter activity, the size of the reciprocal mention networks correlates with self-reported community well-being.

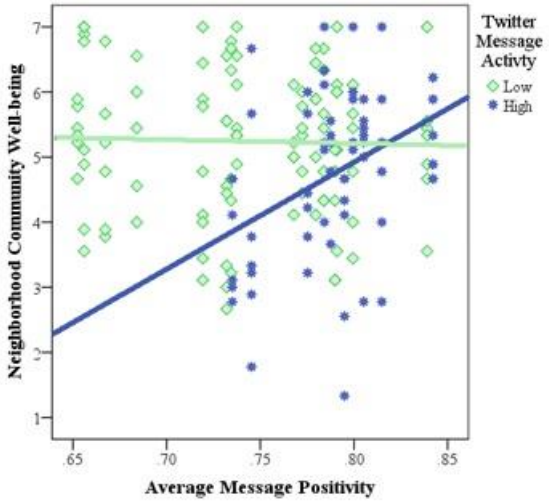

Figure 3. In Neighborhoods with high Twitter activity, message positivity correlated with self-reported community well-being.

DISCUSSION

In this study we used a multi-method approach to examine whether the growing use of Twitter as a third place for hyper-local, neighborhood community conversation may provide meaningful insights into the well-being of that community. We found people largely still rely on face-to-face interactions to interact with their neighbors, especially in smaller, more family-oriented areas, with little public conversation online. This is consistent with recent research [40, 53] finding that people in small towns are more likely to use traditional forms of media to get local news. That said, the self-reported use of communication technologies meaningfully correlated with neighborhood community civic engagement and well-being.

In exploring the use of Twitter as a signal for neighborhood community well-being, we found that there are latent neighborhood communities using Twitter that talk about their neighborhoods. In addition, the content of neighborhood Twitter messages overlaps with what people reported caring about as indicators of community well-being, such as local businesses and community events. However, we did not find that overall its use correlated with our well-being measures. Rather, our metrics of message mood and social activity tended to correspond much more with neighborhood characteristic such as urban lifestyle and age diversity. Many smaller, suburban, family-oriented neighborhood communities have high levels of civic engagement and community well-being, but are *not* using Twitter. Furthermore, although urban environments were less safe, messages about those areas were more positive.

Perhaps the most important implication from our study is that overall neighborhood Twitter message affect and social activity should *not* be used as a signal of neighborhood community well-being, *unless there is a lot of neighborhood Twitter activity.* In larger urban areas populated by younger professionals, people do use Twitter to talk about their neighborhoods, and the more positive their mood and the larger the mention network, the higher their community well-being. These results suggest Twitter *is* being used to help people connect, however if anything to help compensate for the *lack* of a healthy community. In more populated areas people knew fewer neighbors, and the neighborhoods showed lower levels of community well-being, while at the same time they reported using social networks and Twitter more to communicate with neighbors.

From our interviews, it was clear that fear of strangers across economic, lifestyle, or racial divides may be an important factor in *inhibiting* neighborhood community interactions (offline and online) and well-being in more populated areas. In many cases, the most successful tools were moderated groups that limited public access, but consequently had higher levels of trust. This suggests if we want to leverage social media to increase community engagement, we need tools to help people find similar others in their neighborhoods, while at the same time providing controls that address stranger fear and safety concerns.

We found age diversity on one hand was an important factor in predicting civic engagement, and that neighbors reported appreciating when their young could interact with the more elderly in the neighborhood. On the other hand, we found neighborhoods with a higher percentage of elderly people are less likely to be using social networks or Twitter, which is consistent with Bloch & Bruce [5] who found the elderly exhibit little awareness of an online participatory culture. Thus designing tools that enable people to bridge these age-based communication silos is another important challenge if

we seek to leverage social media as a third place for improved community engagement.

Local businesses emerged as surprisingly important for community well-being, and as such should be included not only as *members* of any technology-mediated neighborhood community tools, but possibly also as an important *vehicle* for helping people develop trusting relationships through frequent, serendipitous exposure to each other in a trusted third place. We similarly found that community hubs played an important role in curating both topical content and people memberships. As such we recommend focusing on such individuals or business entities as vehicles not only for community content, but also centers for developing trust.

Study Limitations. It should be noted we reported a sizeable number of correlations without adjusting for the number of correlations reported. Qualitatively an N of 174 people across 26 neighborhoods is very high, however we recognize quantitatively this is considered a low number. That said, our correlations are conservative and fairly stable because we aggregated to the neighborhood level. Nonetheless, we assume there is some error and advise our readers to attend more to the larger pattern of correlations rather than any specific one.

Another study limitation is that while our manual Twitter message coding showed we effectively sampled messages about the neighborhood, there are likely many neighborhood messages that were not found by our search for variants of the neighborhood name. Thus neighborhood Twitter message are probably underrepresented in volume.

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