



A sentiment analysis of U.S. local government tweets: The connection between tone and citizen involvement



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ABSTRACT

As social media tools become more popular at all levels of government, more research is needed to determine how the platforms can be used to create meaningful citizen–government collaboration. Many entities use the tools in one-way, push manners. The aim of this research is to determine if sentiment (tone) can positively influence citizen participation with government via social media. Using a systematic random sample of 125 U.S. cities, we found that positive sentiment is more likely to engender digital participation but this was not a perfect one-to-one relationship. Some cities that had an overall positive sentiment score and displayed a participatory style of social media use did not have positive citizen sentiment scores. We argue that positive tone is only one part of a successful social media interaction plan, and encourage social media managers to actively manage platforms to use activities that spur participation.

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1. Introduction

Scholars and practitioners agree that providing citizens with the opportunity to participate in governance practices can increase the legitimacy of the administrative state (Arnstein, 1969; King, Feltey, & Susel, 1998; Stout, 2013; Waldo, 2007) while encouraging administrators themselves to adopt a democratic-minded ethos that appreciates citizen participation despite inherent challenges (Irvin & Stansbury, 2004; Rawlings & Catlaw, 2011). Responsive governance embodies processes, politics, and partnerships that subsequently enhance administrative decision-making through transparency and citizen engagement. In contemporary times, information communication technologies (ICTs) – especially social media – are means through which administrators can increase citizens' access to government agencies and programs (Mergel, 2013a, 2013b).

Originally, static, one-way websites were platforms where people could engage in transactional relationships with governments, such as paying bills or filing forms (West, 2004). These one-way uses often are grouped together under the Web 1.0 moniker (Bryer & Zavattaro, 2011). More recently, however, social media technologies have emerged as key means through which government agencies at all levels are opening the doors of government, at least metaphorically, 24 h a day, seven days a week (Bryer & Zavattaro, 2011; Mergel, 2013a). Social media come in myriad forms but have in common capabilities such as instant information gathering and sharing, potential for networking,

knowledge co-creation, and interactivity (Bryer & Zavattaro, 2011; Mergel, 2013a, 2013b). As a result of these innovations, the opportunity exists to engage a significant number of individuals with varying interests in governmental affairs. Early government adopters, however, might not be taking full advantage of these interactional capabilities and thus are only increasing capacity for participation rather than meaningful citizen participation and engagement (Brainard & Derrick-Mills, 2011; Brainard & McNutt, 2010; Bryer, 2011; Hand & Ching, 2011; Mergel, 2013a; Rishel, 2011; Zavattaro & Sementelli, 2014).

As social media tools grow in popularity, it becomes important to understand how they can encourage meaningful citizen interaction (Brenner & Smith, 2013; Lutz, Hoffmann, & Meckel, 2014). This research builds upon the emerging literature that examines social media use at the local government level (Hand & Ching, 2011; Mossberger, Wu, & Crawford, 2014; Oliveira & Welch, 2013) by incorporating a construct within technology use: sentiment analysis (Dardenne, Dumont, Gregoire, & Sarlet, 2011; Stieglitz & Dang-Xuan, 2013). The purpose of this analysis is to determine how sentiment of local government social media posts influences citizen involvement on Twitter. To do this, Mergel's (2013b) framework for social media evaluation is coupled with machine-learning sentiment analysis.

In line with extant literature (Brainard & McNutt, 2010; Mergel, 2013a, 2013b), our results indicate that government agencies are adopting an overall neutral, informative tone via social media. We also found, however, that agencies that adopt a positive tone – and undertake activities such as retweeting information from other local agencies, responding directly to citizens on Twitter, sharing photos, and using exclamation points – are more likely to encourage citizen participation

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on Twitter than cities that simply share information in a push manner. In other words, simply using happy words or exclamation points are not enough in and of themselves to create citizen participation; a mix is necessary. Our findings show that administrators are not using the platforms to their full dialogic capabilities and are stopping short of creating what Bryer (2013) calls the empowered citizen, whereby administrators and citizens have equal chances to contribute ideas via social media. Put simply, government use of social media still has progress to make when it comes to creating meaningful collaboration, but our findings can show at least how to create environments for participation, which can bring us closer to collaboration.

2. Social media in public administration

Public administrators necessarily concern themselves with fostering meaningful and effective citizen participation and engagement (Arnstein, 1969; King et al., 1998; McGuire, 2006; Yang, 2005). Citizen participation is understood as citizen involvement with the administrative apparatus of government (Yang & Pandey, 2011), while engagement aligns with King et al.'s (1998) authentic participation, whereby there is “continuous involvement in administrative processes with the potential for all involved to have an effect on the situation” (p. 320). Often, the ideal is that online citizen involvement can create what Bryer (2013) calls an empowered citizen who is an active, equal partner in government decision making.

The focus of this research is on digital engagement through social media at the local government level, as local government managers face a number of contemporary challenges regarding how to better integrate citizen input into traditional service-delivery functions (Nalbandian, O'Neill, Wilkes, & Kaufman, 2013). Given that Mergel's (2013b) framework of social media deployment guides this analysis, her definitions of Mergel transparency, participation, and collaboration are given herein (and explained further later). For Mergel (2013b), using guidance from the White House, transparency involves the agency sharing information via social media with its followers about activities. She calls this “broadcasting government information” (p. 330). Participation is a step up from transparency on social media in that administrators will allow citizens' spaces to provide feedback on information the agency has shared (similar to participation as defined above). Finally, Mergel's (2013b) ultimate level is citizen collaboration, whereby social media platforms “can therefore be used to increase exchanges with citizens or collaboratively work with government stakeholders on innovative ideas to fulfill the mission of government” (p. 330; similar to the empowered citizen or authentic participation given above). As can be seen, there is a natural progression from full government control of information to citizens as equal partners (see also Bryer, 2013). For purposes of this research, these definitions are used to understand the manifestations of transparency, participation, and collaboration via social media.

Increasingly, citizen–government relations are turning toward co-production rather than top–down, government-led opportunities for engagement (Bryer, 2013; Clark, Brudney, & Jang, 2013; McGuire, 2006; Panagiotopoulos, Bigdeli, & Sams, 2014). This shift fits within a broader movement toward collaborative governance, which Emerson, Nabatchi, and Balogh (2012, p. 2, *emphasis in original*) define as “the processes and structures of public policy decision making and management that engage people constructively across the boundaries of public agencies, levels of government, and/or the public, private and civic spheres in order to carry out a public purpose that could not otherwise be accomplished.” Given this, social media tools are seen as means through which government agencies can achieve this co-productive call (Heintze & Bretschneider, 2000; Nograšek & Vintar, 2014). Social media “provide the opportunity to integrate information and opinions from citizens into the policy making process in innovative ways, to increase transparency by sharing information on social media channels, and collaborate

with the public to prepare decisions or create solutions for government problems” (Mergel, 2013a, p. 123).

Scholars, though, still are examining the links between online and offline citizen engagement and participation. For example, Vissers and Stolle (2014) find that online participation via Facebook does not easily translate into offline participation in political and civic activities. One exception they find is consistent with recent current events in the United States and France with people using Twitter hashtags as a means of protest or solidarity (#BlackLivesMatter, #JeSuisCharlie), then taking those forms of digital protest offline (Ferguson, Missouri, New York City, and countless other cities throughout the United State, for examples).

2.1. Why Twitter?

Some examples of contemporary social media include, but are not limited to, Facebook, Twitter, YouTube, Pinterest, LinkedIn, Instagram, blogs, wikis, and more. Interactive capabilities are not given in social media; the platforms only are as dialogic as users choose (Bryer & Zavattaro, 2011). Twitter was used for this research because the platform, as opposed to say Facebook, allows users to not only share their information with followers but also has an ability to easily “retweet” information from others, thus extending their own and others' reaches (Boiy & Moens, 2009). Twitter is one of many social networking websites that allows users to create digital webs of influence. Launched in 2006, Twitter is a microblog that allows users to share short updates of 140 characters or less called tweets. A microblog is seen as digital backchannel communication in that it is non-verbal, real-time, and non-interruptive (Ross, Terras, Warwick, and Welsh, 2011). According to the Twitter website Twitter (2014), as of this writing in early 2015, there are 288 million active monthly users, 500 million tweets are sent daily, and 80% of the users are on mobile devices. People can follow Twitter users by searching for a username, usually indicated by using the '@' sign. Exchanges via the site are searchable using hashtags, denoted by the '#' sign. “Twitter updates are seen as public conversations and are increasing not only transparency and potentially accountability, but can also – when used appropriately – lead to increased inclusion of public opinion in policy formulation through information aggregation processes” (Mergel, 2012, p. 6).

Scholars are beginning to study Twitter's efficacy in a myriad ways, including awareness of social causes (Thackery et al., 2013), corporate social responsibility (Lee, Oh, & Kim, 2013), public health information exchange (Neiger, Thackeray, Burton, Thackeray, & Reese, 2013), international political engagement Sobaci and Karkin (2013), U.S. presidential campaigns (Adams & McCorkindale, 2013; Conway, Kenski, & Wang, 2013), and disaster information sharing (Chatfield, Scholl, & Brajawidagda, 2013), to name just a handful. Oftentimes, marketing scholars and practitioners, for example, will use sentiment analysis to gauge how consumers feel about certain products (think how you use reviews on shopping or travel websites before making a purchase). Paltoglou and Thelwall (2012) move beyond this toward analyzing more informal interactions that most people on social media sites engage in regularly (updating a status, retweeting information, etc.). This kind of exploration is more in line with the research undertaken here to understand regular, everyday interactions between government agencies and citizens via social media sites.

Twitter is ripe for study because it often is used to rapidly share information with followers (Thelwall, Buckley, & Paltoglou, 2011). Thelwall et al. (2011), for example, took to Twitter to analyze the sentiment related to major current events. Studying events such as the Tiger Woods scandal, the Oscars award show, and The Bachelor television finale, the authors found that more negative sentiment was found when the events were first taking place but were largely insignificant when examined overall (Thelwall et al., 2011). They are careful to note that more important events did not trigger great sentiment changes in either direction, but that the construct still can yield insights into overall attitudes displayed via the social platform.

Even though government agencies are providing digital tools for participation, they are not inherently set up for engagement and collaboration (Zavattaro & Sementelli, 2014). Therefore, the onus to set the tone for interaction is placed upon the government agency. Increasingly, research is finding that citizens utilize social media for differing purposes, including general information, service, policy research, participation, and co-creation (Nam, 2014). The latter two uses, however, remain largely elusive in government agencies (Brainard & McNutt, 2010; Bryer, 2011; Hand & Ching, 2011; Lutz et al., 2014; Mergel, 2013b; Nam, 2014). Largely, government agencies use the tools to push information in a one-way information-provision manner (Brainard & McNutt, 2010; Mergel, 2012). As such, we offer the following proposition for this study.

Proposition 1. *Government social media managers will likely adopt a push strategy to share information in a one-way manner.*

3. Machine-learning sentiment analysis

As noted in the Introduction section, the purpose of this research is to see how, if at all, sentiment influences citizen–government involvement on social media platforms at the local government level. To do this, we couple Mergel's (2013b) framework of social media transparency, participation, and collaboration with machine-learning sentiment analysis. This section will briefly detail sentiment analysis, while Section 4 highlights Mergel's framework as a means to address the research question presented herein.

3.1. Machine-learning sentiment analysis

Sentiment analysis is better known as opinion mining (Tan et al., 2014). Sentiment analysis “represents a systematic computer-based analysis of written text or speech excerpts for extracting the attitude of the author or speaker about specific identities or topics” (Stieglitz & Dang-Xuan, 2013, p. 226). Positive and negative, as well as strong and weak, emotions often are evaluated when conducting sentiment analyses. Therefore, analyses often look at these poles – positive or negative emotions – rather than discrete, more nuanced emotions (Bae & Lee, 2012). Social media platforms are suitable areas for studying user emotional states, as language and images can be coupled to convey tone. In messages today, emoticons that display emotion (☺) are popular shorthand to help people deduce tone, which can be an admittedly tricky task via communication taking place in an asynchronous manner, such as social media, e-mail, and texting. Punctuation marks such as exclamation points also are an indicator of positive tone. Scholars still are grappling with how to study the unique dialogic properties inherent in social media, as context in addition to content is important (Madden, Ruthven, & McMenemy, 2013).

One of the most popular methods for analyzing sentiment is called machine-learning sentiment analysis. Machine-learning models often are presented with set cases assessing polarity based on an initial coding then tested upon the dataset to see if sentiment is indeed captured van Atteveldt, Kleinnijenhuis, Ruigrok, and Scholbach (2008). In other words, computers are programmed to recognize large buckets of positive and negative words (Bae & Lee, 2012). As such, human coders manually decide what words to place in what bucket (positive or negative), then the machine takes over once it “learns” what kinds of words resemble these positive and negative sentiments (Boiy & Moens, 2009). Even though humans are involved, “the selection of examples is not random,” (Boiy & Moens, 2009, p. 530), thus ensuring the integrity of the word buckets. As an example of how this process develops, the computer would code words such as happy, thrilled, fun, and neat as positive, while words such as sad, mad, angry, and letdown would be coded as negative. Machine-learning models are trained to examine unique words, so common words such as “and”, “this”, and

“they” are dropped out of the analysis. Hamouda, Marei, and Rohaim (2011) detail the process they undertook to create such a database of words based upon Amazon product reviews. Their database yielded a 71% accuracy rate for 20,000 word samples. One shortcoming of such software is the inability of the machine to determine sentiment of a tweet that contains both positive and negative language. A tweet such as “I hate Batman but love Superman” would be coded as neutral. Despite such limitations, Boiy and Moens (2009) detail some advantages of such machine-learning models: real-time information sharing, a pronounced opinion (inclinations to share information regarding experiences), and an ability to detect opinion from neutral information sharing.

While we are aware that machines cannot often pick up on the nuances of context (Murthy & Petto, 2014), machine-learning models can handle more “big” data applications given the processing abilities and long-term training (Boiy & Moens, 2009). Despite people being skeptical of machine-learning coding tools, the skepticism “[ignores] the fact that the total amount of information in the system is vastly greater than that which can be processed by an individual, and while the intuitive analysis may be better in an individual case (and certainly for an individual news report), the composite has better performance” (Schrodt & van Brackle, 2013, p. 25). As Okazaki et al. (2014) note, machine-learning sentiment analysis such as that used herein often proves more reliable than human coding because “more objective results can be obtained from precision control by machine coding” (p. 469).¹ Certainly in face-to-face interactions between humans, it is usually easy to identify the sentiment of the conversation by non-verbal and verbal cues. Someone can easily see if another individual is laughing, crying, angry or any other host of emotions.

Using sentiment analysis on social media sites can be valuable for government agencies to monitor how citizens feel in real time (Kwon, Kim & Kim, 2013). Kavanaugh et al. (2012) note that this occurrence is particularly keen in emergency management communications when speed is a necessity. Data-mining of social media sites can give officials “insights into the perceptions and mood of the community that cannot be collected through traditional methods (e.g. phone or mail surveys) due to a variety of reasons, including the prohibitive cost and limited reach of traditional methods...” (Kavanaugh et al., 2012, p. 481). Given the proclivity of government officials to maintain an authoritative role on social media (Mergel & Greeves, 2012), we offer the following proposition:

Proposition 2. *The overall sentiment of tweets from the government agency will be neutral, in line with the desire to push information.*

4. Mergel's framework of social media interaction

The final building block for this study is Mergel's framework for social media interaction (Mergel, 2013b). Mergel developed the framework based upon interviews with social media directors at the U.S. federal government level, and the logic is applied herein to municipal government use of social media. We hand-coded city Twitter feeds to determine what social media style was used, then this hand coding was coupled with the machine-learning sentiment analysis to reveal the findings presented herein.

Through her research, Mergel identified three major means through which to evaluate social media use within government agencies: transparency, participation, and collaboration. If the agency's mission is transparency, then the goal for using social media will be a one-way

¹ One author did hand code the data and found, as expected, that the database skewed more neutral, reducing the number of negative and positive tweets. We show in this paper the results of the machine-learning model because the computers are trained to measure exactly the sentiment we were inquiring about within the overall research structure. Considering the explicit nature of sentiment analysis, we preferred to present results within which we had more confidence.

communication style that pushes out information in the name of education with the end result being an increase in accountability and trust. Some metrics of success for this tactic include number of followers or “likes” to posts, agency homepage visits, time spent on webpage, and overall increase in views to web and social sites.

Participation involves two-way communication strategies that aim to pull social media visitors back to official government sites (Mergel, 2013b). For Mergel, this stage basically has the government official asking “tell us what you think” by actively seeking input into questions posted to the social sites. The end results of the participation strategy are consultation and deliberation, and metrics for measurement include click-throughs from social media sites, broad reach of possible stakeholders, and time spent on the social and web sites (increase in page views, comments to Facebook, bookmarks, etc.). It should be made clear that for Mergel, participation still is a relatively surface-level interaction between government and citizens via social media. The goal of this social media style is to have citizens give input into government-provided content.

Collaboration, her third style, serves as the highest-level use of social media, as it allows for citizen to co-create content and engage in creative conversations to spur innovations. Mergel views collaboration as a spin-off of information the government agency posted to social media platforms. Collaboration involves co-production of knowledge, so moves *beyond* a simple give-and-take on social media. Citizens should be able to see how their input has influenced policy decisions or created new opportunities for government actors based on said spin-off. According to Mergel (2013b), practitioners in her sample had little desire to embark upon this kind of reciprocal relationship. The collaboration strategy utilizes networking strategies to engage in community building and the creation of issue networks through two-way communications. Some measurements for this tactic include requests to join networks, Facebook shares, comments on social sites, and offline actions.²

Related to the sentiment literature detailed above, studies are finding that organizations that adopt a positive tone via social media sites are likely to increase engagement and information sharing (Kwak, Lee, Park, & Moon, 2010; Peters, Kashima, & Clark, 2009) as well as trust (Kim & Lee, 2012). Research from management and marketing literatures indicates that the more active an organization is on Twitter, the more likely consumers or stakeholders are to meaningfully engage with the brand, including re-tweeting information to myriad followers Zhang, Jansen, and Chowhurdy (2011), though organizations both public and private often do not take advantage of all the interactivity social networking tools allow (Brainard & Derrick-Mills, 2011; Brainard & McNutt, 2010; Hand & Ching, 2011; Mamic & Almaraz, 2013; Mergel, 2013b). Given this, we offer the following proposition:

Proposition 3. *Government agencies that adopt an overall positive tone on social media platforms are more likely to see citizen participation or collaboration as Mergel defines them.*

In general, emotions have been found to be a vital driver in information sharing and relational practices (Peters et al., 2009). “Not only is our social talk likely to form the basis of many of our social beliefs, but the emotion that it arouses is also likely to lead people to engage or disengage with the targets of social talk in positive and negative ways” (Peters et al., 2009, p. 207). Emotional states influence our desires to actively seek, process, and share information, with positive associations making us more likely to engage in these behaviors than negative emotions (Dardenne et al., 2011).

Stieglitz and Dang-Xuan (2013) translated emotional-sharing properties commonly found in face-to-face and verbal communication into an online context, specifically examining sentiment displayed on Twitter via political messaging. Their findings of tweets regarding

German politics indicate that power users, those deemed influential by their level of information sharing and number of followers, often post more emotionally charged tweets than users in the total sample. Additionally, the authors found that users tend to talk more positively about their preferred political parties and candidates and more negatively regarding competition. Finally, they found that sentiment, either positive or negative, is related to retweet speed, spreading the information more quickly through the Twitter network. Bae and Lee (2012) returned similar results when examining sentiment among popular Twitter users, including celebrities and media sites. Therefore, the following proposition is offered:

Proposition 4. *Citizens are likely to interact with government agencies that adopt an overall positive tone on social media.*

5. Methods

Results of this study come from analyzing tweets to and from U.S. local government agencies. To generate a database of cities, a systematic random sample was conducted utilizing the International City/County Management Association Municipal Yearbook 2012. Starting with a random number, every 25th city was counted until the database total reached 750. Cities are from each of the U.S. Census Bureau's geographic regions to ensure representation from a broad variety of municipalities in the sample. As such, cities varied in size, region, and economic status. Examples of cities in the database include large cities such as Chicago, Illinois, Evanston, Illinois, Lowell, Massachusetts, West Palm Beach, Florida, and Louisville, Kentucky. Considering the manner in which the database was compiled, most of the cities in the sample ended up being smaller cities, towns, and villages. Examples include Blue Springs, Missouri (population about 53,000), Auburn, Maine (population about 23,000), Conyers, Georgia (population about 10,600), Perrysburg, Ohio (population about 20,600), and Village of Gurnee, Illinois (population about 31,200). Certainly we understand that these factors (city size, budget, geographic reach, etc.) affect how social media are implemented based on resource availability; however, social media often could be seen as equalizers because the initial startup costs are small but maintaining the platforms in a dialogic manner becomes potentially difficult (Bryer, 2011).

Of the 750 cities in the database, 125 had active, official government Twitter feeds during the time of this study. Each city's Twitter handle was then put into the Mississippi State University's Social Science Research Center's Social Media Analysis and Tracking System (SMTAS). The system tracked both tweets from the agency as well as tweets to the agency for a period of five weeks beginning September 3, 2013 and ending October 12, 2013. Once data collection ended, there were more than 17,222 tweets in the dataset. When separated out, there were 4779 tweets from city agencies, while the remainder were tweets to the city entities. We removed users that appeared to represent non-municipal organizations, such as marketing agencies, particular destinations (a ski lodge, for example, was removed from the dataset), and elected officials. This was done because we wanted the focus to be expressly on local governments rather than these tangential users.

5.1. SMTAS analysis

The SMTAS system was built to expressly study the vast amount of information shared via Twitter. Once tweets were collected, the first step was to use SMTAS to determine an overall sentiment level. For the purpose, two separate sentiment analysis algorithms were used to codify the sentiment of the collected tweets in the study. The first algorithm is a sentiment classification service from a third party (www.repustate.com), which advertises an accuracy of 82–90% based on the type and complexity of the text. The second sentiment analysis

² Mergel's framework of transparency, participation, and collaboration was used to code for information-sharing styles detailed in Proposition 1.

algorithm is a machine-learning model developed for SMTAS, purposefully built for codifying short-text messages such as tweets. The model is trained on approximately 4.2 million coded tweets and has an accuracy of 81% (10 fold cross-validation with 2.1 million tweets). Both algorithms assign individual tweets (based on the text) with a value between -1.0 to $+1.0$, where -1.0 to -0.5 is codified as negative, -0.49 to $+0.49$ is neutral, and $+0.49$ to $+1.0$ is positive.

The goal of sentiment analysis, however, is to broadly understand patterns in text, so results are meant to show overall pattern. In line with the SMTAS recommendations, any tweets coded between -0.5 and $+0.5$ were neutral, so values falling on either end represented negative sentiment and positive sentiment. Table 1 shows the total positive, negative, and neutral tweets from the city government. (We will return to the citizen tweets in Proposition 4). Overall, according to the sentiment analysis, cities adopted a neutral tone (49%). Forty-one percent were considered positive and only 10% were considered negative in tone.

6. Findings

Proposition 1. *Government social media managers will likely adopt a push strategy to share information in a one-way manner.*

This first proposition aimed to examine the overall strategies public administrators were using on Twitter. Our findings confirm this proposition. To code for this, Mergel's (2013b) framework was used as detailed above. When examining the Twitter pages of all 125 cities in the database, the researchers looked for characteristics such as color scheme, language used, retweets, photos, responses to citizens, and punctuation. Push social media strategies involve sending out information in a one-way manner and are common manifestations of a transparency style of social media use (Mergel, 2013b). The goal of this style is to push out as much information as possible in the name of education. Twitter accounts were coded as transparency if there was little to no interaction on the sites, while participation was coded based upon retweets of information from other agencies, interactions, with citizen on social media, regular use of hashtags, punctuation marks (especially exclamation points), and overall look of the site (colors, photos, branding). As an example, Auburn, Maine (population about 23,000) tweeted information about public meetings, traffic alerts, construction notices, a walking tour, and a new ice arena. The look, feel, and tone of their Twitter feed is neutral and informative with no inkling of a desire for any kind of participation. Costa Mesa, California (population about 109,900) also exhibited a push style, tweeting information about office closings, city meetings, and other city events. Here, with these two examples, we see that city socio-economic status and resources have no bearing on the Twitter style used. We are careful to note that future research is needed to test the exact relationships between city resources and Twitter style utilized.

Participation coding involved seeing if the city asked for citizen feedback on issues via social media. We also coded cities as using this style if they shared information from other agencies, responded to citizens on Twitter itself, and used photos to show city happenings. Overall, we found that cities that encouraged participation utilized a more positive sentiment when compared to cities using a neutral tone and push style. As an example of a city using participation, we can

reference Lowell, Massachusetts (population about 108,800). The city often uses photos, videos, and emoticons in its tweets to indicate a proclivity toward engagement with followers. In addition to that interaction, the city is good about re-tweeting information from its local schools and even families sharing photos of their personal events.

As a recent example (July 2014), the city hosted a Folk Festival and asked followers to share what they are most excited to see when attending. Several people re-tweeted that tweet, and two followers responded. Wilmington, North Carolina (population about 112,000) also has solid participation within its twitter feed, liberally sharing photos from its own organization and re-tweeting information from other local organizations. City social media managers even created the hashtag #ilm for a city abbreviation (as of December 2014). The hashtag is now searchable for those wanting information and updates about Wilmington.

Collaboration would occur if the city administration responded directly to a citizen post on Twitter with a unique blog post or update on the site that something was done with that information that influenced policy. Collaboration as defined for purposes of this research did not manifest in the dataset, confirming extant research that highlights social media still is used primarily to push a message³ (Brainard & Derrick-Mills, 2011; Brainard & McNutt, 2010; Hand & Ching, 2011; Mergel, 2013b).

Table 2 shows the total number of cities using each style, while Table 3 gives examples of feeds and tweets coded in line with each style.

Proposition 2. *The overall sentiment of tweets from the government agency will be neutral, in line with the desire to push information.*

The sentiment analysis function of SMTAS was used to examine this proposition. This proposition also manifested in our data set data and aligns with the overall push/transparency style found. Based on the second sentiment analysis algorithm developed expressly for SMTAS, the overall sentiment level was .255, putting the results in the neutral category. Cities tend to use plain, simple language as a way to get information out, often in a redundant manner. As an example, city Twitter feeds were ripe with posts alerting followers to other posts on Facebook, usually event photos. Likely these posts are sent from a digital platform that allows for one post to be simultaneously uploaded onto multiple social media platforms.

Confirmation of this proposition is not surprising based on extant literature. Mergel and Bretschneider (2013) recommend that social media managers use plain language and remove fluff from online feeds. While our analysis confirmed tweets from local governments often exhibit a non-biased quality, it also demonstrated that a neutral tone does not encourage participation or collaboration. Most of the tweets with a neutral tone were sharing information, which does not often inspire comments or interaction. For example, the Borough of Glen Rock, New Jersey has a simple Twitter feed and was coded as transparency style, even though there are a few instances of participation. Even though the city uses exclamation points that were coded as positive ("Can't wait for summer? Neither can we!"), there is only one indication of a tweet coded as participation on the city's Twitter feed itself. The majority of the tweets from Glen Rock still are concerned with getting information out about public meetings, trash pickup, and other city happenings.

In another example, the City of Brookings, South Dakota also uses a neutral tone that does not encourage citizen engagement. The city was coded as using a transparency style of social media because there

Table 1

Overall tweet sentiment from cities.

Positive Tweets	1939	41%
Neutral Tweets	2363	49%
Negative Tweets	477	10%
Total N	4779	100%

³ We realize these terms of participation and collaboration might not align with common uses in the literature. Therefore, we reached out to Dr. Mergel for clarification via email. How we used the terms was correct, as Dr. Mergel envisions collaboration taking place on the digital site *and beyond*. For example, collaboration would include a searchable Twitter hashtag (#WhiteHouse, for example), and spur additional communications such as a blog post. Collaboration equates to knowledge co-production, while participation involves the agency actively seeking information (according to Mergel that would be a post such as "tell us what you think"). We sincerely appreciate Dr. Mergel giving us and readers this clarification.

Table 2
Overall Twitter style use.

Style	Total number of cities	Percent
Transparency	91	73%
Participation	34	27%
Collaboration	0	0%

is a focus on pushing information out rather than participation or collaboration. Although the city did tweet out information asking citizens to take official surveys or provide information, there was never a means to close that loop to tell people how their voice influenced policy – at least on Twitter.

Proposition 3. *Government agencies that adopt an overall positive tone on social media platforms are more likely to see citizen participation or collaboration as Mergel defines them.*

Delving further into the data, we found that cities that did adopt an overall positive tone were more likely to encourage participation, in line with Mergel's definition. As detailed further in the discussion, we also found that no instances of collaboration as Mergel defines it were present. With an overall positive tone, government agencies are able to indicate a certain openness to citizens that feedback was wanted. This was relatively easy to tell when coding the Twitter feeds. Those coded as transparency as above used no photos, no videos, no sharing of information, and no replying to posts. To contrast, feeds coded as participation had identifiable city branding colors and logos, photos, videos, and replies back to posts. Putting these kinds of artifacts on the Twitter feed, coupled with overall positive language, was more likely to encourage participation than the transparency style. As the next section reports, however, this openness did not necessarily increase the overall citizen sentiment, but the finding is still important of government agencies want to begin the process of conversing via social media. Table 2 above shows each city that uses transparency, participation, and collaboration. Table 4 brings it all together by showing sentiment, style used, and example tweets.

Simply put, sentiment matters for encouraging citizen participation on social media. For example, Blue Springs, Missouri has an active Twitter presence. The city regularly thanks those entities or people who retweet their information, thus spreading the city's messaging and making the response personal. As an example of turning a negative into a positive, a citizen posted to the city's Twitter page that a neighborhood was a magnet for bad drivers (negative sentiment). The city responded by telling the resident that the city has increased patrols in the area, which will hopefully help cut down on speeding (positive sentiment). In another example of maintaining a light, accessible tone (Mergel & Bretschneider, 2013), a resident responded to a city post regarding a ground breaking. In that post, the city included a photo of

Table 3
Tweet examples.

Positive Tweet examples	Old Town Clovis Farmer's market tonight! Don't miss out! Wonderful! Welcome to Jeffersonville, Indiana! Another new business coming to Jeffersonville!
Neutral Tweet examples	Perkins St railroad crossing closed until Friday Join a group of artists and guests at Artruck tomorrow night from 7 to 10 pm View the October CityView to learn about what is going on in Independence
Negative Tweet Examples	@MontgomeryOhio I mangled my knee on glass there from a break in several months ago... pleeeeeease check for broken glass! Maybe I'm paranoid. With our problems with fall/winter particulate air pollution (PM2.5–10), how does the "Color Run" get approved? @CityofClovisCA @ClearfieldCity sirens all damn night!!!!

city officials using traditional golden shovels to break ground. The citizen replied with a joke asking if a local hardware store will let the city return the gold shovels. The following was the city's response: "We don't think so ...but we borrowed most of those!" The citizen replied: "That's fiscally responsible☺" This was a positive tone that shows that the city can have a sense of humor and encourage a more open style of participation.

In another example, the City of Evanston, Illinois encourages participation on Twitter by including many photos, retweets, and exclamation points in tweets. In one instance, a citizen posted about a parking meter taking quarters but not giving them time to park. The city responded by apologizing for the lost quarters and mentioning that the situation was reported to the 311 Center. In another example, the city sent out a tweet regarding its tax rate compared to other surrounding cities. A citizen asked if she could get a PDF copy of that information, and the city responded affirmatively. The woman then wrote back asking the city to follow her so they could exchange private messages regarding e-mail addresses. The city did just that. While the tone of this exchange was neutral, it was Evanston's overall positive sentiment that encouraged that participation in the first place.

We need to be clear that further research is needed to determine what kind of positive sentiment engenders participation. All we can see from the numbers is that an overall positive tone is more likely to increase citizen participation in social media space as opposed to cities that adopt a neutral tone *coupled with* a proclivity to push information.

Proposition 4. *Citizens are likely to interact with government agencies that adopt an overall positive tone on social media.*

The final proposition offered for this study looks at the sentiment of citizen tweets, as the previous propositions examined those from the government agency. Overall, our analysis supports this proposition, but with two caveats. The first caveat is that there were not many cities in the sample that had an overall positive sentiment score, as most remained neutral (Proposition 1). Indeed, 14 cities had an overall negative sentiment, 9 had an overall positive sentiment, and the remainder were neutral. The second caveat is that this finding was not in a perfect one-to-one relationship, meaning that a positive sentiment of tweets From the city did not always mean positive citizen sentiment (tweets To the city). We can with confidence argue that an overall positive tone does indeed help spur citizen participation on the sites because of the open, welcoming tone and appearance of the Twitter feed. Further research is needed to determine exactly *how* the positive sentiment on social media influences a participatory style; all we can tell from our results is that a positive tone *does* influence a citizen's proclivity to participate with the government agency on Twitter. Table 5 shows the sentiment analysis results of tweets From and To the city.

As an example, Nampa, Idaho (population about 81,500) has an overall sentiment value of .59 related to tweets From the city, putting it into the positive category. Sentiment of tweets To the city is .709, again putting citizen tweets in the positive sentiment category. Looking at the Twitter feed, the city uses a friendly tone, shares photos and videos, and regularly interacts with citizens on the platform itself. Again, we did not see any instances of collaboration but there certainly was participation taking place. In an example of the second caveat, the City of Hesperia, California (population about 92,100) has an overall sentiment score of .51 for tweets From the city, and .43 of Tweets To the city. The city was coded as having a participatory style use for its constant information sharing, video and photo inclusion, and commenting back to posts made on the site. It is unknown why the sentiment score for citizens also is not positive, so future research is needed.

7. Discussion and conclusion

The trend toward transparency and push styles of social media use seems to be preventing government agencies from fully taking

Table 4
Twitter style examples.

City	Twitter evaluation style	Example tweets	Twitter feed style
@CityofBeaumont (California)	Transparency	Did you know: The City of Beaumont offers a "local golf club access program"	Plain colors Non-branded – city seal Mostly feeds from Facebook
@CityofLowell (Massachusetts)	Participation	Tweet from resident: @CityofLowellMA @LowellMayor You would think six months would be ample time to fix a trash bin. #lowellma pic.twitter.com/OSrLhJrr9K Tweet from city: @mo_neak @LowellMayor Please report that to See, Click, Fix Lowell:http://seeclickfix.com/lowell/ Tweet from resident: @CityofLowellMA @LowellMayor DONE! http://seeclickfix.com/issues/1205011	Blues and greens City logo City slogan Retweet other agencies Respond to citizen posts
@CityofAdaOK (Oklahoma)	Transparency	West 17th, between Broadway and Stockton, will be resurfaced next week.	City logo City slogan Blue and green colors No replies or retweets

advantage of social media's tremendous interactive abilities. In this research, we were curious to understand how tone influences citizen participation on social media. While we found that an overall positive tone does more to encourage participation than a neutral or negative tone, this was not always a perfect relationship, meaning that citizen sentiment scores were not also positive in every instance. Further research is needed to understand why citizens even follow government agencies and what kind of information they are seeking from those platforms. Understanding such will give a more complete picture that will guide managers toward developing meaningful social media presences.

By incorporating sentiment analysis, this research responds to calls to delve deeper into the power of social media use within government (Mergel, 2013b). Sentiment analysis sheds light on both the tone government agencies are adopting as well as how citizens are reacting to government policies or provisions. Even though the overall sentiment of tweets in the database was neutral, indicating a push/transparency strategy of social media use, digging deeper revealed that cities that did adopt an overall positive tone fostered increased citizen engagement and participation. A positive tone alone was not enough to encourage participation. Agencies that adopt a positive tone – and undertake activities such as retweeting information from other local agencies, responding directly to citizens on Twitter, sharing photos, and using exclamation points – are more likely to encourage citizen participation on Twitter than cities that simply share information in a push manner. Still, government has work to do regarding moving toward a collaborative use of social media (Mergel, 2013b).

7.1. Future research

No city in the sample deployed a collaboration strategy (Mergel, 2013b), meaning the local governments are missing out on a vital component of social media that can lead itself to knowledge sharing and co-creation via data mining. Further research is needed to determine if public organizations even *want* to use social media for

Table 5
City and citizen sentiment.

		From city	To city
Sentiment Algorithm 1	Average sentiment	0.099835031	0.135809595
	Number of positive	341	688
	Number of negative	66	189
	Number of neutral	5270	10,651
Sentiment Algorithm 2	Average sentiment	0.271706171	0.297926164
	Number of positive	2295	4644
	Number of negative	502	986
	Number of neutral	2880	5898

collaboration purposes. Ideally this happens, as co-production is necessary to produce innovative solutions to organizational and policy problems Vorberg, Bekkers, and Tummers (forthcoming). One place to start would be with how Voorberg and colleagues define co-creation and co-production, both parts of how Mergel envisions social media collaboration (Mergel, 2013b). According to Vorberg et al. (forthcoming), co-creation necessitates that end users of the social tools be active participants within the communicative space. The emphasis on *active* involvement moves beyond participation, which could include passive involvement (for example, re-tweeting information from the government agency).

Co-production often is used interchangeably with co-creation, as they found doing a systematic literature review of the terms. What could be extremely helpful for future research regarding citizen involvement within social media would be their findings regarding types of co-creation: citizens as co-implementer, citizens as co-designer, and citizens as initiator. A study such as this could be repeated using this framework to see how likely citizens are to engage with, or even start their own lines of conversation, the government agency. This would extend Mergel's (2013b) framework by seeing what style lends itself to what kind of citizen participation and co-creation.

Additionally, interviews with social media managers at the local government level could extend Mergel's (2013b) study of federal government social media managers. Scholars could study differences between the levels and find out further how local government managers utilize social media, why, what resources are given, and what is done with that information. Questions could be asked directly regarding the use of sentiment in tweets. Do administrators pay attention? What is done when negativity arises? Who is in charge of crafting the message? How does a formal social media policy influence the overall tone? How does the policy influence what kinds of responses are given? Prospective studies could also conduct detailed network analyses to determine who are the most influential local government social media users and followers. In other words, how does the government agency respond to certain groups or people? How does that network influence tone on social media? How might these digital networks translate into offline participation and networking?

7.2. Limitations

As with any study, limitations present themselves. First, this study did not capture every local government agency on Twitter. Adding other cities could have altered the overall findings regarding transparency and sentiment. Repeating the analysis with another set of cities is an avenue for future research. Second, tweets were collected during a one-month period. Longitudinal studies would allow researchers to determine if sentiment and tone changed through time as the social

media endeavor became richer. Finally, the machine-learning tool used only has an 80% confidence level, so there was a chance that some tweets may have been incorrectly coded. Another computer-based tool could be deployed to see if the results repeat.

The rationale for government adoption of social networking sites was to open government 24/7 to increase citizen engagement, transparency, and interactivity. Early research, however, indicates that there are costs associated with meaningful adoption of the technologies (Bryer, 2011), thus revealing that government entities often do not engage with followers in two-way dialogs but rather push information in one-way monologs (Brainard & Derrick-Mills, 2011; Hand & Ching, 2011; Mergel, 2012; Rishel, 2011). The aim of this research was to determine how local governments were utilizing Twitter, and extend this line of work by adding sentiment analysis. Sentiment analysis is binary, in that codes trend toward positive/negative mood. Anything between $-.05$ and $+.05$ was deemed a neutral tweet, showing that the overall sample utilized a neutral tone. Analyzing the tweets in the sample revealed not only the neutral tone but a proclivity toward the push and pull Twitter styles (Mergel, 2012). By examining sentiment, the results indicate the social media managers have an opportunity to change this prevailing negative image by adopting a positive, rather than neutral, tone on Twitter and other social media sites. This can be achieved by carefully utilizing exclamation points, deploying creative hashtags, retweeting positive follower content, and replying to tweets, whether positive or negative. There are cities – and other government agencies – achieving this practice, so those could be used as examples for extending a social media presence.

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